

## Storm List Appendix F

This appendix contains all the storm data used to adjust each storm in-place. Information is provided for each storm including the SPAS analyzed data, the information used to locate the storm representative dew point/SST location, and other pertinent information regarding the in-place storm representative dew point/SST, and rainfall. The adjustments applied to each storm to each grid point to calculate the MTF, GTF, and TAF over the entire project domain are contained in the PMP Tool database as described in the calculation.

In this appendix, daily synoptic weather maps are provided for a period starting a few days before each storm and continuing to a few days after each storm. Daily weather maps covering the period from 1871 through 2002 are from the U.S. Daily Weather Maps Archive, [NOAA Climate Database Modernization Program \(CDMP\)](#), National Climatic Data Center, Asheville, NC, and the NOAA Central Library Data Imaging Project. Daily synoptic weather maps from 2002 through 2019 are from the NOAA Weather Prediction Center Daily Weather Maps web page, <http://www.hpc.ncep.noaa.gov/dailywxmap/index.html>.

For all storms which had a USACE Storm Studies analysis completed, those pertinent data sheet pages are included. These data came from the USACE Storm Rainfall in the United States, Depth-Area-Duration Data files. In addition, there are several storms which include a hand drawn transposition limit map complete by the NWS. These are included for reference to give context of various transposition limits assigned by the NWS. These maps were recovered from the Hydrometeorological Design Studies Center office in Silver Spring, MD and are archived on AWA's server.

**Table F.1 Short storm list used for PMP Development-general storms. Max\_PPT is the location with the largest rainfall accumulation for the total storm duration.**

SPAS_ID	STORM_NAME	STATE	LAT	LON	YEAR	MONTH	DAY	MAX_PPT	PMP_TYPE
SPAS_1614_2	LAKE MORAINÉ	CO	38.804	-104.946	1894	5	30	8.91	GENERAL
SPAS_1305_1	ELBA	AL	31.363	-86.121	1929	3	12	29.73	GENERAL
SPAS_1587_1	PRAIRIEVIEW	NM	33.138	-103.079	1941	5	20	11.08	GENERAL
SPAS_1486_1	MCCOLLEUM RANCH	NM	32.146	-104.746	1941	9	20	21.81	GENERAL
SPAS_1431_1	WARNER	OK	35.479	-95.329	1943	5	6	25.24	GENERAL
SPAS_1433_1	COLLINSVILLE	IL	38.672	-89.980	1946	8	12	18.70	GENERAL
SPAS_1583_1	COUNCIL GROVE	KS	38.646	-96.621	1951	7	9	18.56	GENERAL
SPAS_1251_1	LAKE MALOYA	NM	37.009	-104.341	1955	5	19	14.82	GENERAL
SPAS_1183_1	EDGERTON	MO	40.413	-95.513	1965	7	18	20.76	GENERAL
SPAS_1253_1	BIG ELK MEADOW	CO	40.267	-105.417	1969	5	4	20.01	GENERAL
SPAS_1219_1	BIG FORK	AR	35.871	-92.121	1982	12	1	15.92	GENERAL
SPAS_1719_1	NECAISE	LA	30.565	-89.495	1995	5	8	28.51	GENERAL
SPAS_1286_1	AURORA COLLEGE	IL	41.458	-88.070	1996	7	16	18.13	GENERAL
SPAS_1242_1	ALLEY SPRING	MO	37.160	-91.450	2008	3	17	15.10	GENERAL
SPAS_1218_1	DOUGLASVILLE	GA	33.870	-84.760	2009	9	19	25.37	GENERAL
SPAS_1208_1	WARNER PARK	TN	36.061	-86.906	2010	5	1	19.71	GENERAL
SPAS_1530_1	GUADALUPE PASS	TX	32.035	-104.555	2013	9	10	18.34	GENERAL

**Table F.2 Short storm list used for PMP Development-local storms. Max\_PPT is the location with the largest rainfall accumulation for the total storm duration.**

SPAS_ID	STORM_NAME	STATE	LAT	LON	YEAR	MONTH	DAY	MAX_PPT	PMP_TYPE
SPAS_1426_1	COOPER	MI	42.376	-85.610	1914	8	31	12.60	LOCAL
SPAS_1427_1	BOYDEN	IA	43.190	-96.010	1926	9	17	24.00	LOCAL
SPAS_1494_1	MOUNTAIN HOME	TX	30.171	-99.379	1932	6	30	35.56	LOCAL
SPAS_1495_1	CHEYENNE	OK	35.621	-99.679	1934	4	3	23.01	LOCAL
SPAS_1295_1	ELBERT CHERRY CREEK	CO	39.238	-104.488	1935	5	30	24.00	LOCAL
SPAS_1295_2	GENOA	CO	39.329	-103.538	1935	5	30	12.65	LOCAL
SPAS_1295_3	HALE	CO	39.613	-102.263	1935	5	30	18.00	LOCAL
SPAS_1485_1	LAS CRUCES	NM	32.304	-106.796	1935	8	30	10.03	LOCAL
SPAS_1496_1	WOODWARD RANCH	TX	29.479	-99.388	1935	5	31	21.93	LOCAL
SPAS_1429_2	HALLETT	OK	36.246	-96.613	1940	9	2	24.00	LOCAL
SPAS_1432_1	MOUNDS	OK	35.846	-96.071	1943	5	16	19.27	LOCAL
SPAS_1434_1	HOLT	MO	39.453	-94.342	1947	6	18	17.60	LOCAL
SPAS_1613_1	GOLDEN	CO	39.788	-105.288	1948	6	7	6.00	LOCAL
SPAS_1602_1	VIC PIERCE	TX	30.404	-101.438	1954	6	23	35.79	LOCAL
SPAS_1226_1	COLLEGE HILL	OH	40.085	-81.648	1963	6	3	19.39	LOCAL
SPAS_1030_1	DAVID CITY	NE	41.213	-97.071	1963	6	24	15.98	LOCAL
SPAS_1293_1	HOLLY	CO	37.713	-102.404	1965	6	16	19.18	LOCAL
SPAS_1034_1	ENID	OK	36.381	-97.868	1973	10	10	19.45	LOCAL
SPAS_1247_1	FRIJOLE CREEK	CO	37.096	-104.379	1981	7	3	16.33	LOCAL
SPAS_1185_1	CORRIGAN	TX	30.260	-94.890	1994	10	16	23.31	LOCAL
SPAS_1036_1	PAWNEE CREEK	CO	40.775	-103.625	1997	7	29	13.58	LOCAL
SPAS_1662_1	SAGUACHE	CO	38.215	-106.295	1999	7	25	6.68	LOCAL
SPAS_1220_1	DUBUQUE	IA	42.440	-90.750	2011	7	27	15.14	LOCAL
SPAS_1590_1	DAWSON	TX	31.895	-96.645	2015	10	23	32.92	LOCAL

**Table F.3 Short storm list used for PMP Development-tropical storms. Max\_PPT is the location with the largest rainfall accumulation for the total storm duration.**

SPAS_ID	STORM_NAME	STATE	LAT	LON	YEAR	MONTH	DAY	MAX_PPT	PMP_TYPE
SPAS_1591_1	HEARNE	TX	30.840	-96.570	1899	6	27	34.50	TROPICAL
SPAS_1582_1	BROOME	TX	31.788	-100.854	1936	9	13	30.34	TROPICAL
SPAS_1596_1	MILLER ISLAND	LA	29.854	-92.246	1940	8	6	37.85	TROPICAL
SPAS_1519_1	YANKEETOWN	FL	29.029	-82.721	1950	9	3	45.18	TROPICAL
SPAS_1601_1	SOMBRERETILLO	MX	26.279	-99.921	1967	9	19	35.87	TROPICAL
SPAS_1601_2	DINERO	MX	28.254	-97.904	1967	9	19	35.01	TROPICAL
SPAS_1179_1	ALBANY	TX	32.726	-99.350	1978	8	3	32.50	TROPICAL
SPAS_1463_1	ALVIN	TX	29.429	-95.271	1979	7	25	45.49	TROPICAL
SPAS_1184_1	CLYDE	TX	32.479	-99.479	1981	10	10	23.23	TROPICAL
SPAS_1317_1	AMERICUS	GA	32.096	-84.229	1994	7	4	28.09	TROPICAL
SPAS_1569_1	DAUPHIN ISLAND	AL	30.315	-88.035	1997	7	19	45.27	TROPICAL
SPAS_1593_1	MUNSON	FL	30.855	-87.725	1998	9	24	24.92	TROPICAL
SPAS_1464_1	HOUSTON	TX	29.755	-95.275	2001	6	5	40.97	TROPICAL
SPAS_1631_1	WATSON	LA	30.555	-90.965	2016	8	10	34.65	TROPICAL
SPAS_1631_2	LAFAYETTE	LA	30.145	-92.085	2016	8	10	28.74	TROPICAL
SPAS_1667_1	HARVEY	TX	29.965	-93.915	2017	8	28	61.11	TROPICAL

**Table F.4 Short storm list used for PMP Development-hybrid storms. Max\_PPT is the location with the largest rainfall accumulation for the total storm duration.**

SPAS_ID	STORM_NAME	STATE	LAT	LON	YEAR	MONTH	DAY	MAX_PPT	PMP_TYPE
SPAS_1294_1	PENROSE	CO	38.464	-105.070	1921	6	2	12.20	HYBRID (G/L)
SPAS_1294_2	ADELAIDE	CO	38.564	-105.071	1921	6	2	10.14	HYBRID (G/L)
SPAS_1592_1	THRALL	TX	30.629	-97.388	1921	9	9	39.90	HYBRID (T/L)
SPAS_1560_1	CONWAY	TX	35.221	-101.396	1951	5	13	15.21	HYBRID (G/L)
SPAS_1293_3	ELBERT	CO	39.188	-104.296	1965	6	16	16.28	HYBRID (G/L)
SPAS_1568_1	CARLSBAD	NM	32.254	-104.613	1966	8	22	17.35	HYBRID (G/L)

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## **General Storms**

## Storm Precipitation Analysis System (SPAS) For Storm #1614\_2

**General Storm Location:** Ward District and Lake Moraine Colorado

**Storm Dates:** May 29 - June 1, 1894

**Event:** Synoptic

**DAD Zone 2**

**Latitude:** 38.8042

**Longitude:** -104.9458

**Max. Grid Rainfall Amount:** 8.91”

**Max. Observed Rainfall Amount:** 7.50” (Lake Moraine, CO)

**Number of Stations:** 43

**SPAS Version:** 10.0

**Basemap:** USACE Isohyetal Map

**Spatial resolution:** 0.2568

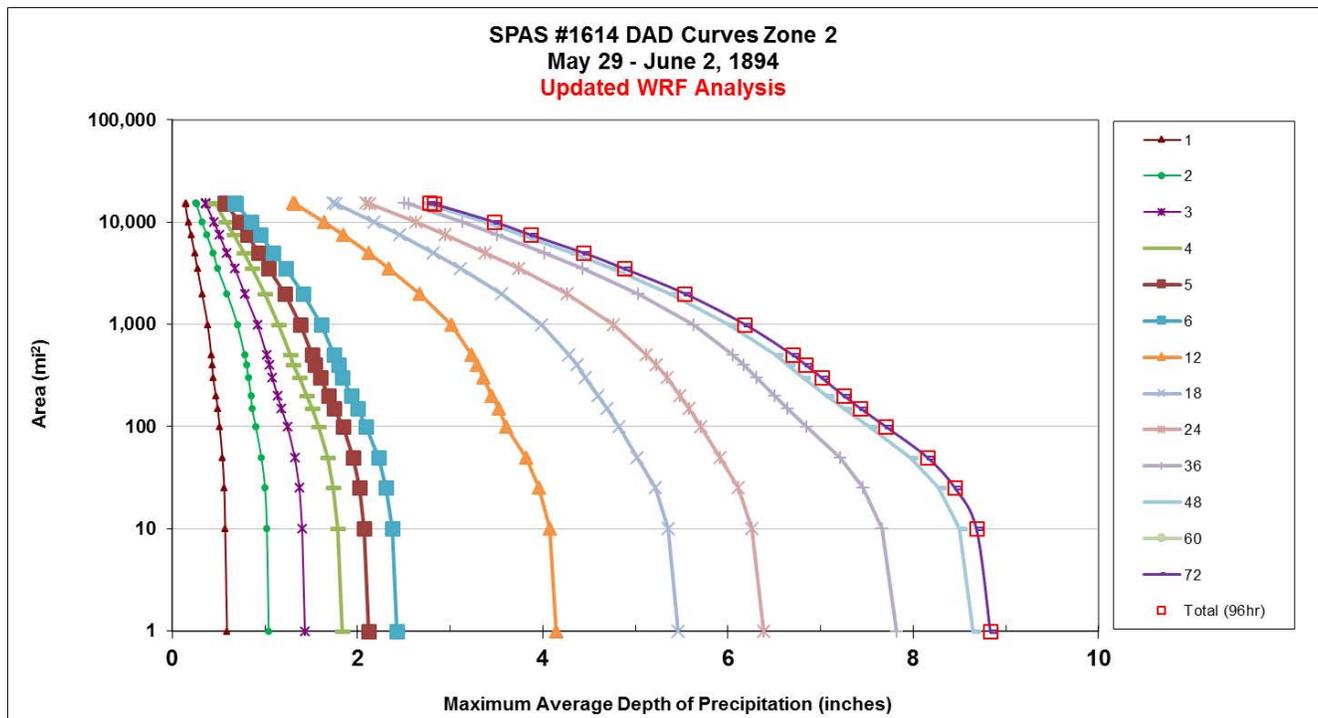
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

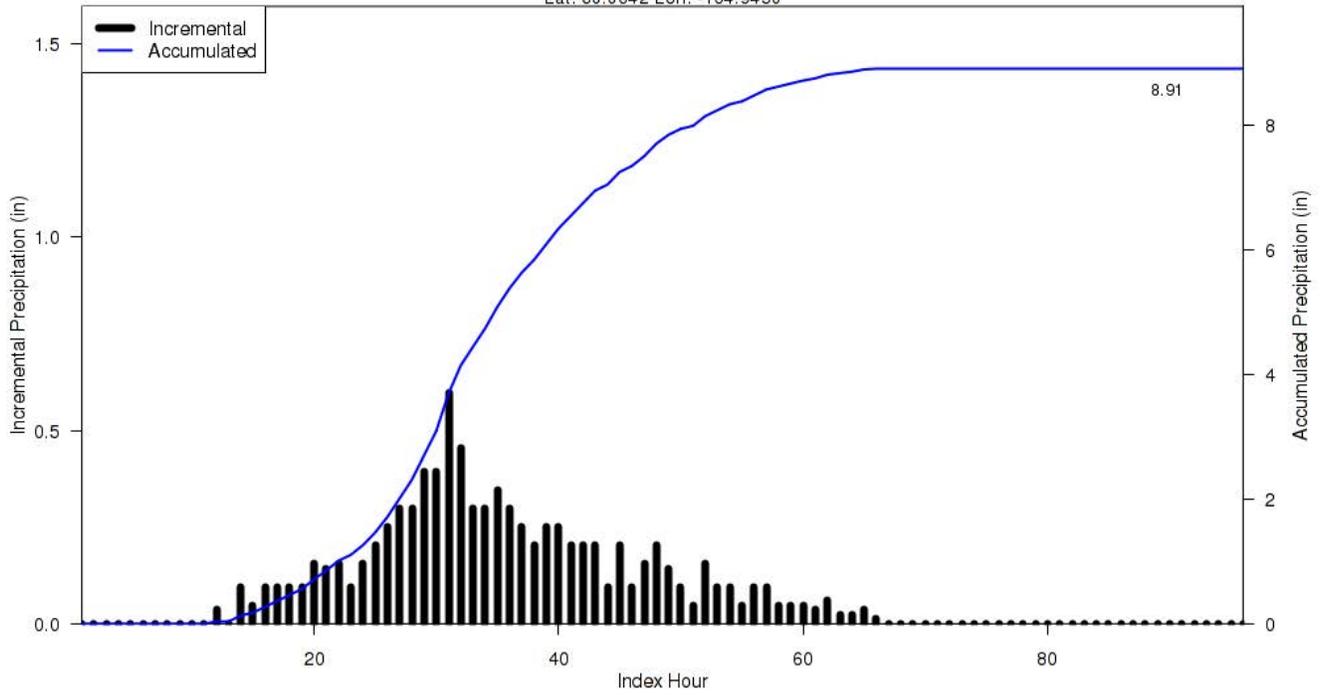
**Reliability of results:** This analysis was based on 43 hourly stations, daily data, and supplemental station data. We have a good degree of confidence for the station based storm total results. The spatial pattern is dependent heavily on the basemap created from the USACE MR 6-14 Isohyetal image. Timing is based on the hourly pseudo stations near the storm center (based on USACE MR 6-14). Several daily stations were moved to supplemental stations due to timing issues and to ensure data consistency.

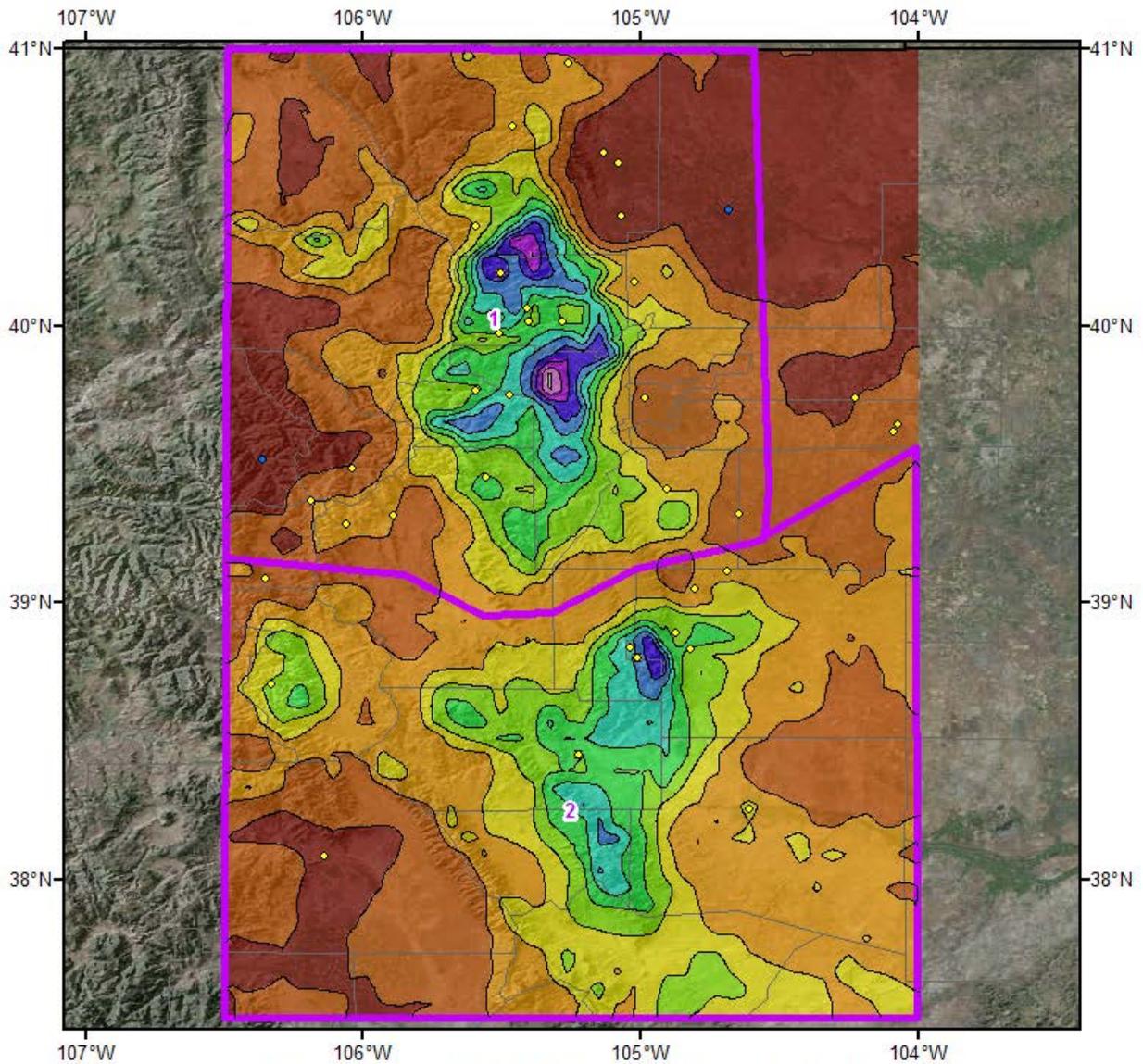
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1614_2	-104.946	38.804	10,380	10,500	66.00	1.86	1.34	54	0.520	77.41	77.5	3.22	2.08	77	1.135	1.500

Storm 1614 Zone 2 - May 29 (0800 UTC) - June 2 (0700 UTC), 1894														
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES) Updated WRF Analysis														
areasqmi	Duration (hours)													
	1	2	3	4	5	6	12	18	24	36	48	60	72	Total (96hr)
0.4	0.60	1.05	1.44	1.84	2.13	2.43	4.16	5.49	6.42	7.87	8.69		8.88	8.88
1	0.59	1.04	1.43	1.83	2.12	2.42	4.14	5.46	6.38	7.82	8.64		8.83	8.83
10	0.57	1.02	1.40	1.78	2.07	2.37	4.07	5.35	6.26	7.66	8.50		8.68	8.68
25	0.56	1.00	1.37	1.74	2.02	2.31	3.96	5.21	6.11	7.46	8.27		8.45	8.45
50	0.54	0.96	1.32	1.68	1.95	2.23	3.82	5.02	5.91	7.21	7.97		8.15	8.15
100	0.51	0.90	1.24	1.58	1.84	2.09	3.60	4.82	5.71	6.85	7.52		7.70	7.7
150	0.49	0.86	1.18	1.51	1.75	2.00	3.52	4.69	5.58	6.64	7.25		7.43	7.43
200	0.47	0.85	1.14	1.45	1.69	1.93	3.45	4.60	5.48	6.50	7.06		7.25	7.25
300	0.44	0.82	1.08	1.37	1.60	1.83	3.36	4.46	5.34	6.31	6.81		7.01	7.01
400	0.43	0.80	1.05	1.30	1.54	1.79	3.29	4.37	5.22	6.17	6.64		6.84	6.84
500	0.42	0.78	1.02	1.27	1.51	1.75	3.23	4.28	5.12	6.05	6.51		6.70	6.7
1,000	0.38	0.70	0.92	1.15	1.38	1.61	3.01	3.99	4.76	5.63	6.01		6.18	6.18
2,000	0.32	0.59	0.78	1.00	1.21	1.41	2.67	3.55	4.26	5.03	5.37		5.53	5.53
3,500	0.27	0.49	0.67	0.86	1.04	1.22	2.34	3.11	3.74	4.43	4.74		4.88	4.88
5,000	0.24	0.44	0.59	0.77	0.93	1.09	2.12	2.82	3.38	4.02	4.31		4.44	4.44
7,500	0.20	0.37	0.51	0.66	0.81	0.95	1.84	2.45	2.94	3.50	3.76		3.87	3.87
10,000	0.17	0.32	0.45	0.58	0.72	0.85	1.64	2.18	2.63	3.13	3.38		3.48	3.48
15,000	0.14	0.26	0.36	0.47	0.58	0.68	1.32	1.77	2.13	2.55	2.75		2.83	2.83
15,417	0.14	0.25	0.36	0.46	0.57	0.67	1.30	1.74	2.09	2.50	2.70		2.78	2.78



SPAS 1614 Storm Center Mass Curve Zone 2  
May 29 (0800UTC) to June 2 (0700UTC), 1894  
Lat: 38.8042 Lon: -104.9458

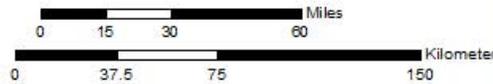




**Total Storm (96-hr) Precipitation (inches)**  
**5/29/1894 0800 UTC - 6/2/1894 0700 UTC**  
**SPAS #1614**  
**WRF Re-Analysis**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Pseudo
- ◆ Supplemental



**Precipitation (inches)**

■ 0.11 - 1.00	■ 3.01 - 4.00	■ 6.01 - 7.00	■ 9.01 - 10.00
■ 1.01 - 2.00	■ 4.01 - 5.00	■ 7.01 - 8.00	■ 10.01 - 11.00
■ 2.01 - 3.00	■ 5.01 - 6.00	■ 8.01 - 9.00	■ 11.01 - 12.00



02/26/2018

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 29 May - 31 May 1894  
 Assignment MR 6-14  
 Location Central Colorado  
 Study Prepared by:  
 Missouri River Division  
 Denver District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 9/12/47  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 6/14/49  
 Remarks: Center at Ward  
 District, Colorado  
 Dewpt. 62°-Ref. Pt. 325 SE  
 Grid B-20

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1: 500,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	4
Form 5001-B (24-hour " " " " ).....	6
Form 5001-D ( " " " " " " ).....	8
Misc. precip. records, meteorological data, etc.....	16
Form 5002 (Mass rainfall curves).....	9

**PART II**

Final isohyetal maps, in 1 sheet, scale 1: 500,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	2
Form S-11 (Depth-area data from isohyetal map).....	1
Form S-12 (Maximum depth-duration data).....	12
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	1

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

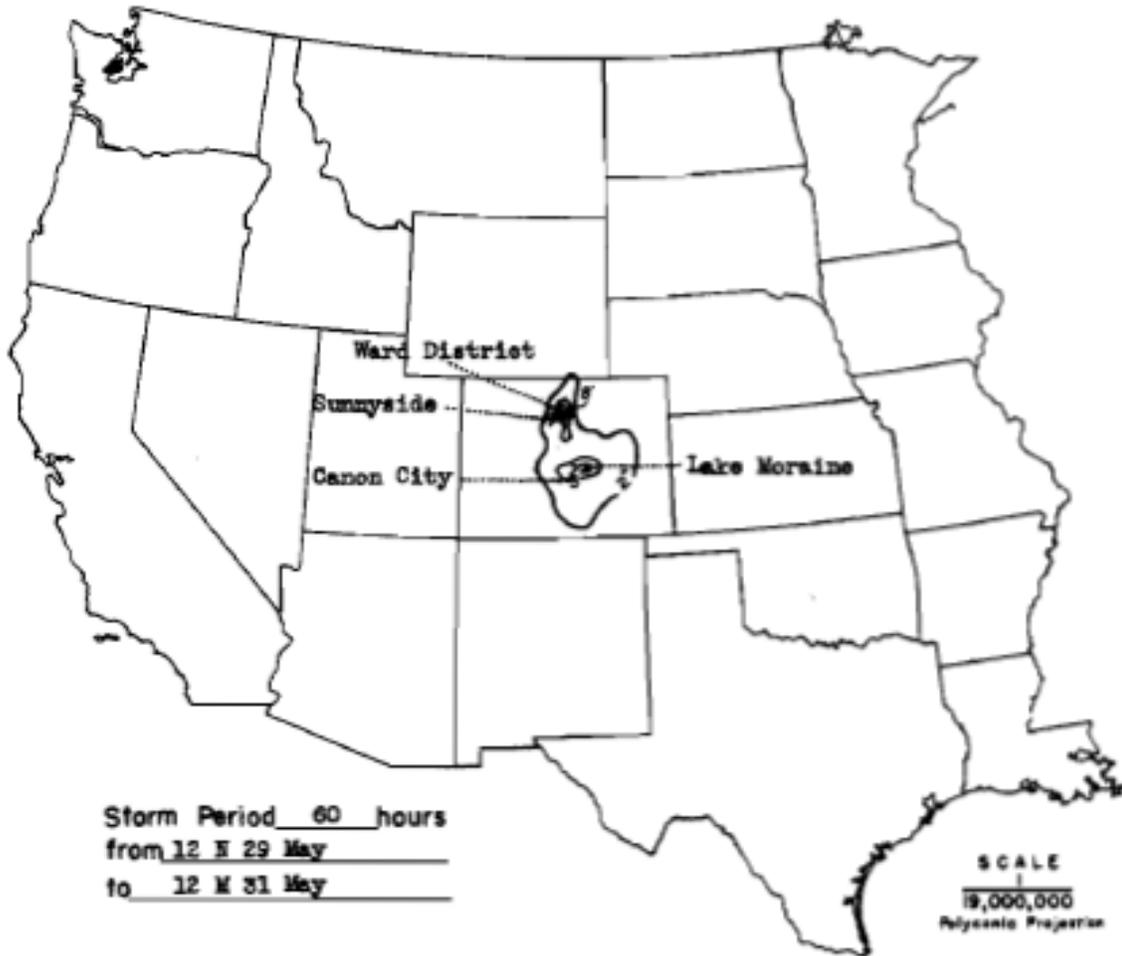
Area in Sq. Mi.	Duration of Rainfall in Hours							
	6	12	18	24	30	36	48	60
10	1.7	3.3	4.7	5.6	6.6	7.3	8.2	8.5
100	1.7	3.2	4.3	5.2	6.0	6.5	7.3	7.5
200	1.7	3.1	4.2	5.0	5.8	6.3	7.0	7.2
500	1.7	3.0	4.0	4.8	5.5	5.9	6.6	6.8
1,000	1.6	2.9	3.8	4.6	5.3	5.7	6.3	6.5
2,000	1.6	2.7	3.6	4.4	5.0	5.3	5.9	6.1
5,000	1.5	2.5	3.2	3.9	4.5	4.7	5.3	5.5
10,000	1.3	2.2	2.8	3.5	4.0	4.3	4.7	4.9
20,000	1.0	1.8	2.3	2.8	3.2	3.5	3.8	4.0
25,300	0.9	1.5	2.1	2.5	2.9	3.1	3.4	3.6

DEPARTMENT OF THE ARMY

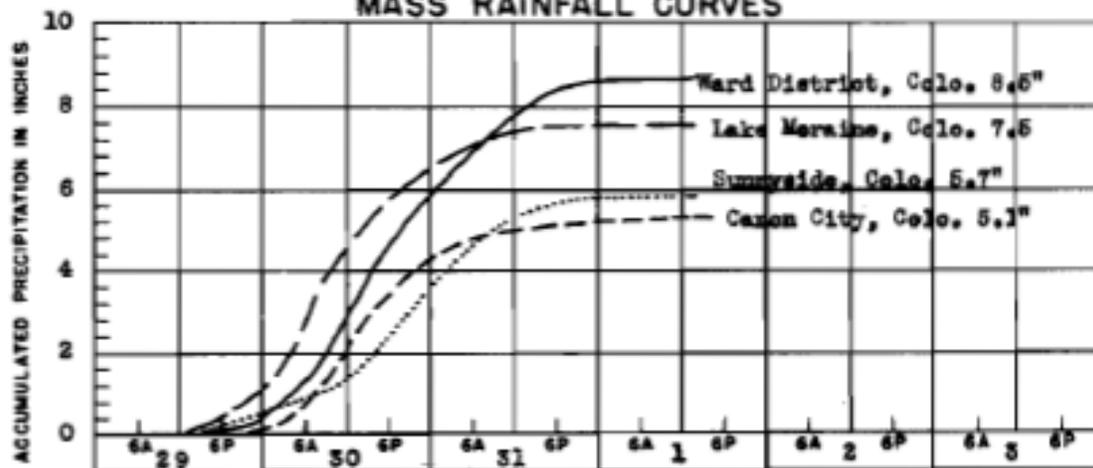
CORPS OF ENGINEERS

**STORM STUDIES - ISOHYETAL MAP**

Storm of 29 May - 31 May 1894 Assignment MR 8-14  
 Study Prepared by: Denver, Colo. District  
Missouri River Division



**MASS RAINFALL CURVES**



FORM 8-3W





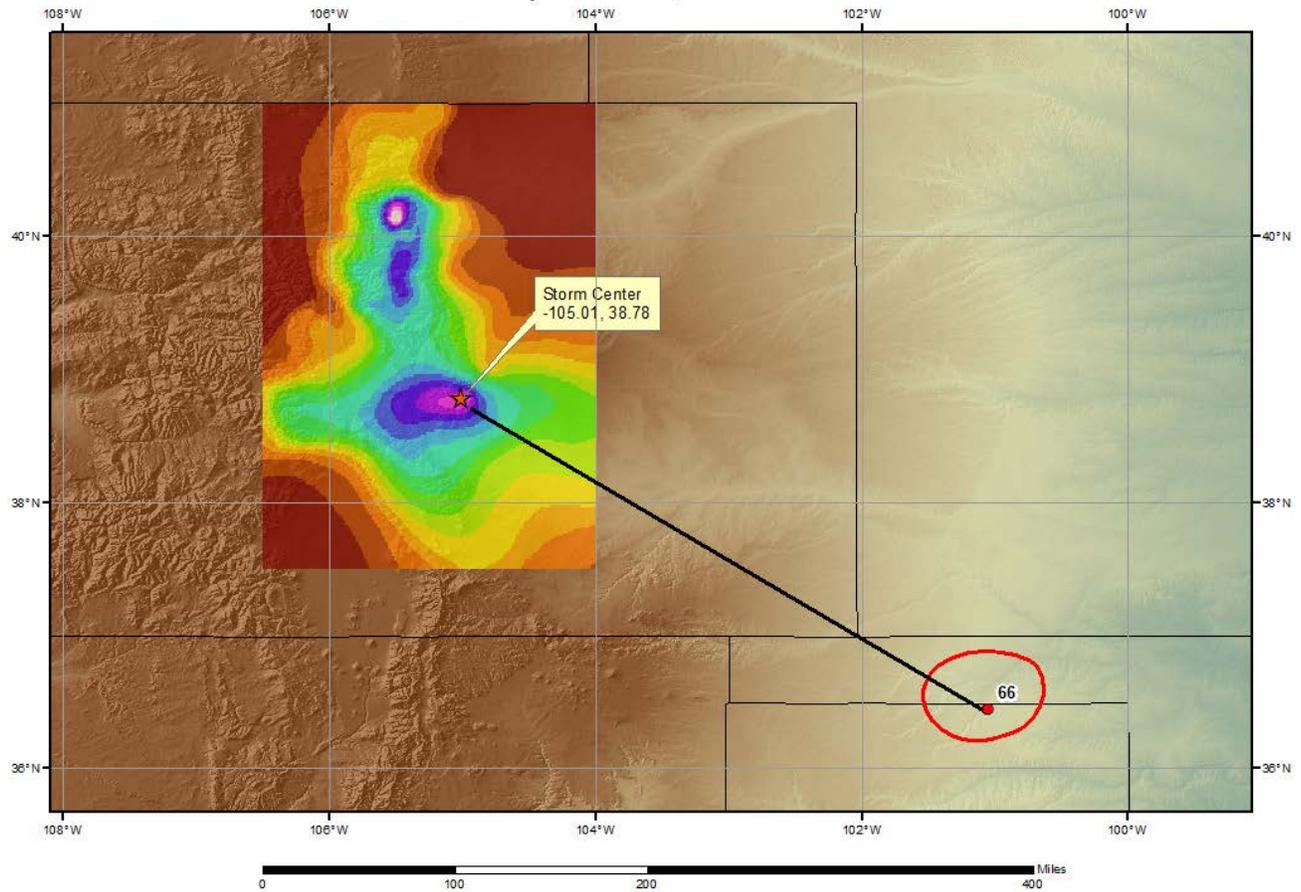


6.

Storm Date	Assignment Number	Representative Storm Dewpoint	Reference Point
<u>1890</u>			
Jul 1-5	GL 1-2	69	250 SW of Constableville, N. Y.
Sep 8-13	GL 4-1	70	330 SSE of S.Canistota, N. Y.
<u>1891</u>			
Jun 23-28	MR 4-2	72	200 S of Larrabee, Iowa.
Dec 13-15	GL 2-7	55	410 SSE of Lincoln, Wis.
<u>1892</u>			
Jul 24-28	UMW 1-1	72	200 S of Minneapolis, Minn.
Aug 24-27	GL 1-3	70	270 S of North Hammond, N. Y.
<u>1893</u>			
Aug 24-29	GL 1-4	72	220 S of Lowville, N. Y.
Aug 26-28	SA 2-1	75	80 E of Manning, S. C.
Sep 6-10	LMW 3-2	71	100 E of Franklin, La.
<u>1894</u>			
Mar 17-20	LMW 1-1	67	120 SSE of Washington, Ark.
May 17-22	NA 1-4	64	50 W of Bridgton, N. J.
May 29-Jun 1	MR 6-14	62	325 SE of Lake Moraine, Colo.
Sep 18-20	SA 1-13	67	250 SSW of Smith's Corner, Pa.
<u>1895</u>			
Oct 11-15	NA 1-5	60	100 ESE of Grosvonordale, Conn.
Dec 16-20	MR 1-1	59	260 S of Phillipsburg, Mo.
Dec 16-21	GL 2-8	51	350 SW of Three Rivers, Mich.
<u>1896</u>			
Jun 4-5	MR 4-3	68	250 SSE of Greeley Center, Nebr.
Sep 27-30	SA 1-19	71	240 SE of Bloomery, W. Va.
Dec 31-Jan 3	UMW 2-1	61	125 S of Pine Bluff, Ark.

### SPAS 1614 Ward District, CO Storm Analysis Zone 2

May 29 - June 1, 1894



## Storm Precipitation Analysis System (SPAS) For Storm #1305\_1

**General Storm Location:** Southern Alabama (Elba, AL)

**Storm Dates:** Mar 11-16, 1929

**Event:** Stalled Front

### DAD Zone 1

**Latitude:** 31.3625

**Longitude:** -86.12083

**Max. Grid Rainfall Amount:** 29.73" (29.6" at Elba, AL)

**Number of Stations:** 118 (includes 3 omitted stations)

**SPAS Version:** 9.5

**Base Map Used:** NWS-MetStat Blended Isohyetal Map

**Spatial resolution:** 30 seconds

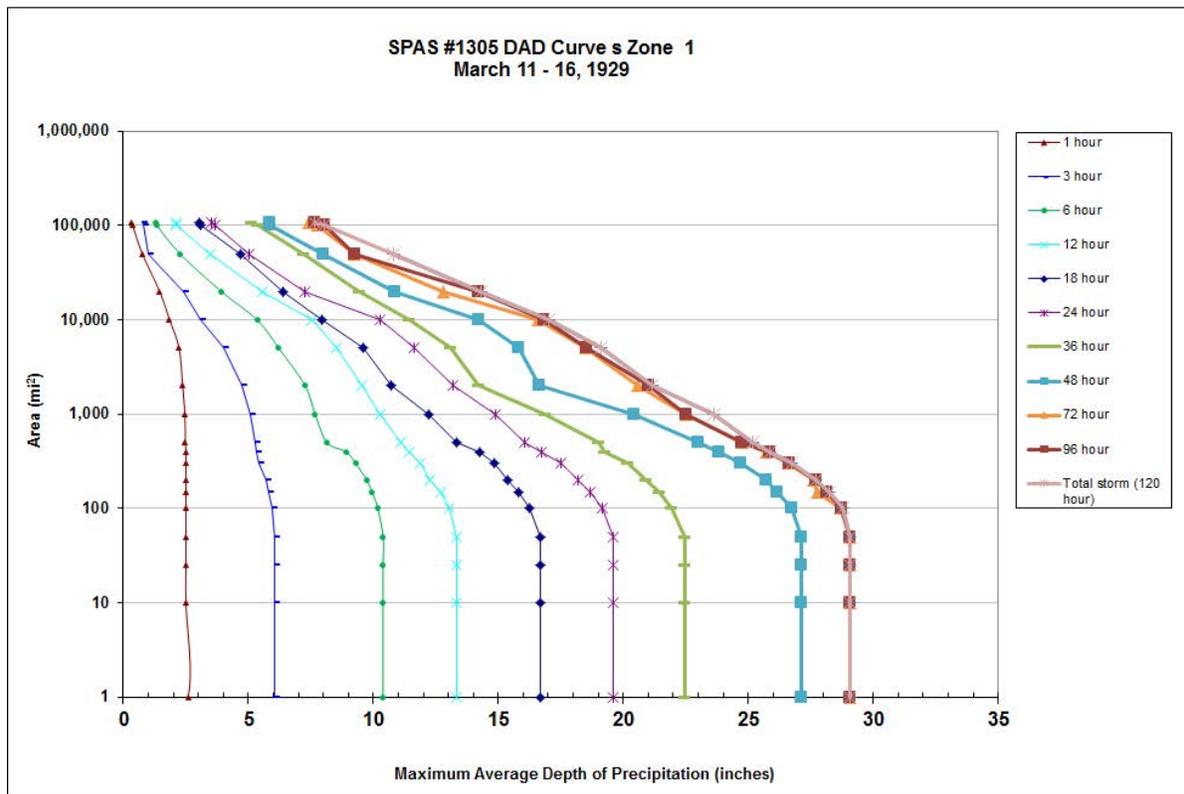
**Radar Included:** No

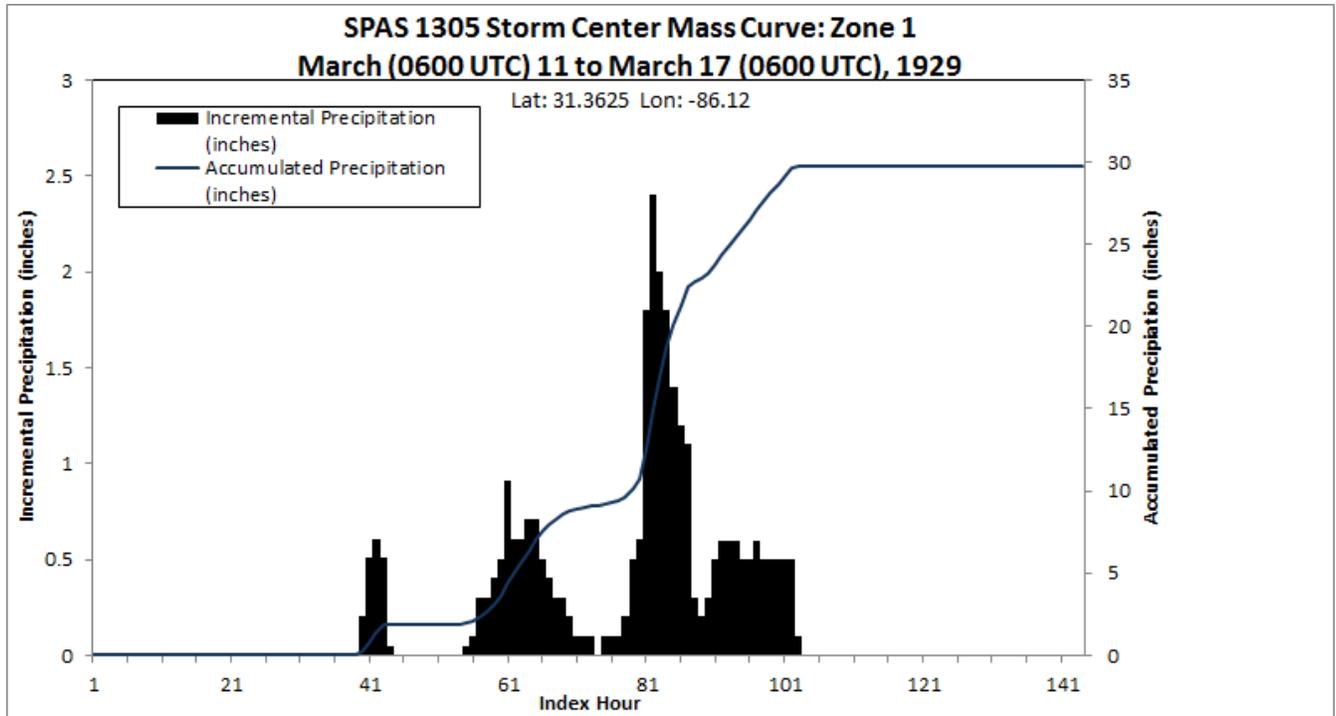
**Depth-Area-Duration (DAD) analysis:** Yes

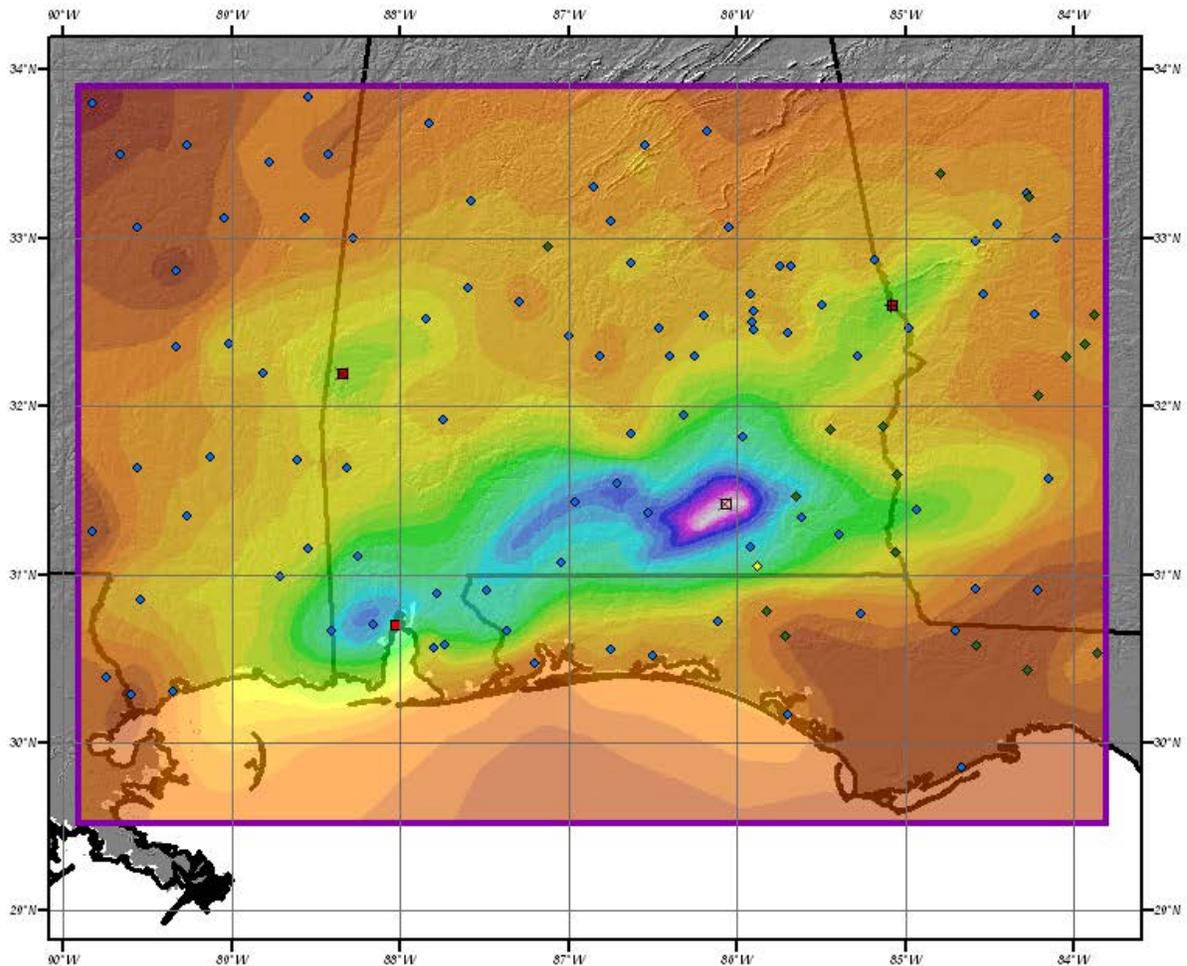
**Reliability of Results:** Given the lack of hourly data (only 4 stations), there is limited confidence in the timing across much of the region. The timing of the storm center is tied entirely to the estimated hourly data from the USACE storm report. The extent and magnitude of the rainfall is moderately reliable given the surprising large number of daily rain gauges available. The exception to this is the precipitation exists across southern Mississippi where very little rain gauge data was available; We followed the trends of the NWS isohyetal pattern in this area.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1305_1	-86.121	31.363	304	300	69.00	2.14	0.06	60	2.080	72.87	73.0	2.60	0.07	68	2.530	1.216

Storm 1305- March 11-16, 1929												
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)												
area (mi sq )	Duration (hours)											
	1	3	6	12	18	24	36	48	72	96	120	Total
0.3	2.58	6.22	10.64	13.65	17.07	20.08	22.99	27.81	29.72	29.73	29.73	29.73
1	2.5	6.07	10.39	13.33	16.67	19.6	22.44	27.13	29.07	29.07	29.07	29.07
10	2.5	6.07	10.39	13.33	16.67	19.6	22.44	27.13	29.07	29.07	29.07	29.07
25	2.5	6.07	10.39	13.33	16.67	19.6	22.44	27.13	29.07	29.07	29.07	29.07
50	2.5	6.07	10.39	13.33	16.67	19.6	22.44	27.13	29.07	29.07	29.07	29.07
100	2.5	5.96	10.18	13.02	16.23	19.14	21.95	26.73	28.66	28.71	28.77	28.77
150	2.5	5.82	9.95	12.7	15.82	18.68	21.42	26.17	27.76	28.16	28.24	28.24
200	2.5	5.69	9.73	12.25	15.39	18.2	20.92	25.71	27.63	27.71	27.72	27.72
300	2.5	5.44	9.3	11.86	14.85	17.51	20.16	24.69	26.6	26.64	26.73	26.73
400	2.48	5.33	8.91	11.42	14.27	16.73	19.24	23.82	25.72	25.85	25.87	25.87
500	2.46	5.26	8.14	11.1	13.35	16.07	19.03	23.02	24.77	24.77	25.2	25.2
1000	2.37	5.07	7.67	10.26	12.21	14.87	16.87	20.41	22.5	22.5	23.61	23.61
2000	2.23	4.75	7.27	9.53	10.7	13.2	14.19	16.62	20.55	20.99	21.16	21.16
5000	1.85	4	6.22	8.51	9.58	11.63	13.07	15.82	18.5	18.52	19.1	19.1
10000	1.45	3.1	5.35	7.54	7.93	10.29	11.44	14.22	16.59	16.84	17.02	17.02
20000	0.76	2.42	3.92	5.56	6.38	7.26	9.47	10.86	12.8	14.2	14.3	14.3
50000	0.37	1.01	2.27	3.49	4.67	5.04	7.22	8.01	9.25	9.25	10.82	10.82
100000	0.3	0.82	1.35	2.14	3.09	3.66	5.39	5.87	7.77	8.04	8.04	8.04

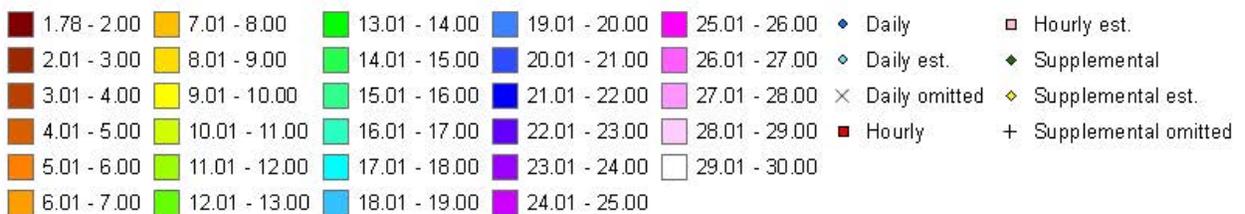






**Total 6-day Precipitation (inches)**  
**Mar 11-16, 1929**  
**Elba, AL Storm**  
**SPAS #1305**

**Inches**





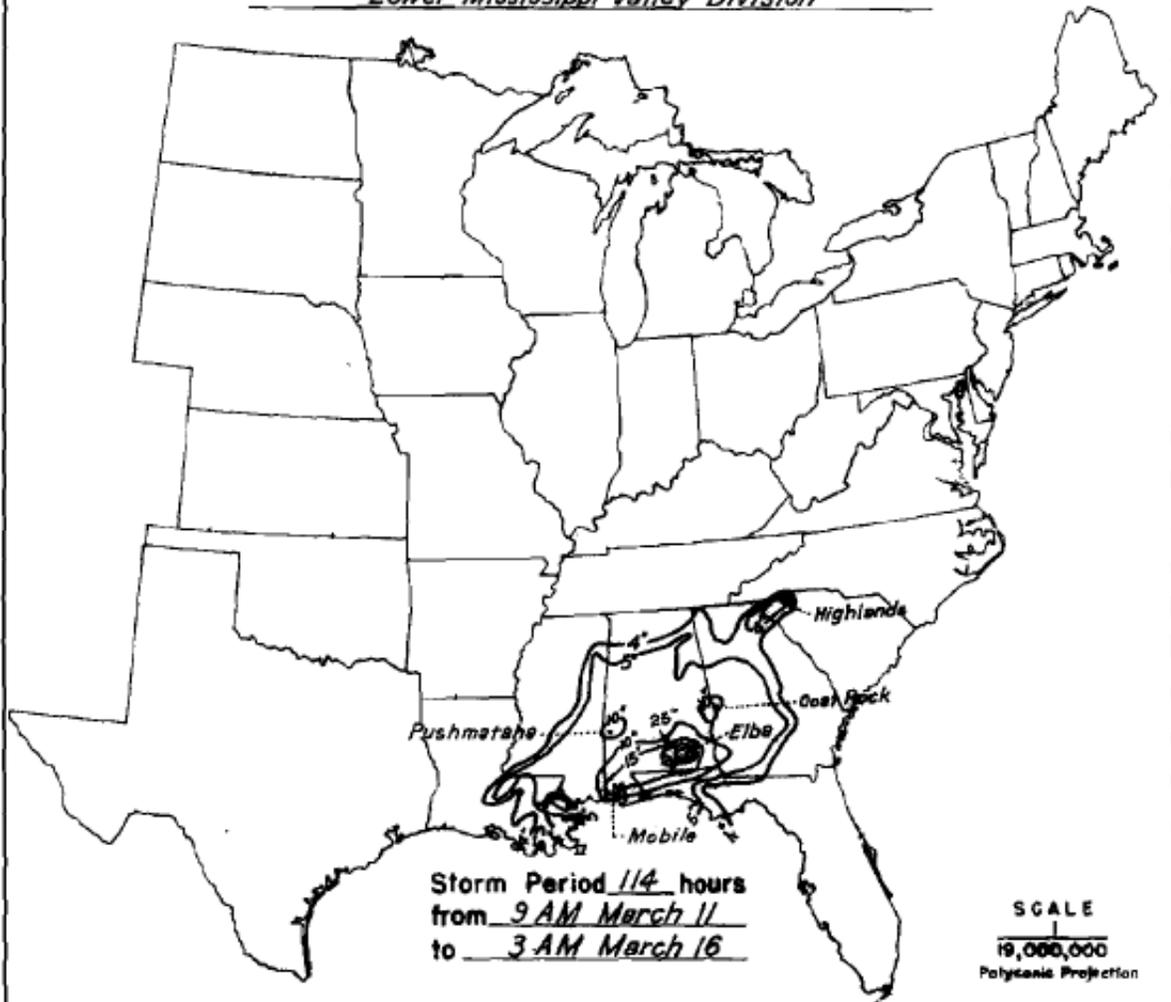
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

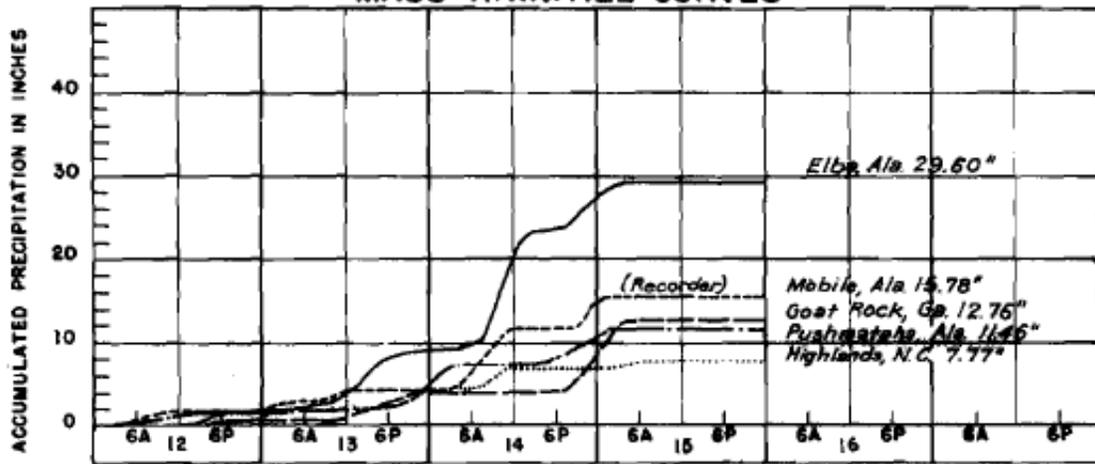
**STORM STUDIES - ISOHYETAL MAP**

Storm of March 11-16, 1929 Assignment LMV 2-20

Study Prepared by: Vicksburg, Miss. District  
Lower Mississippi Valley Division

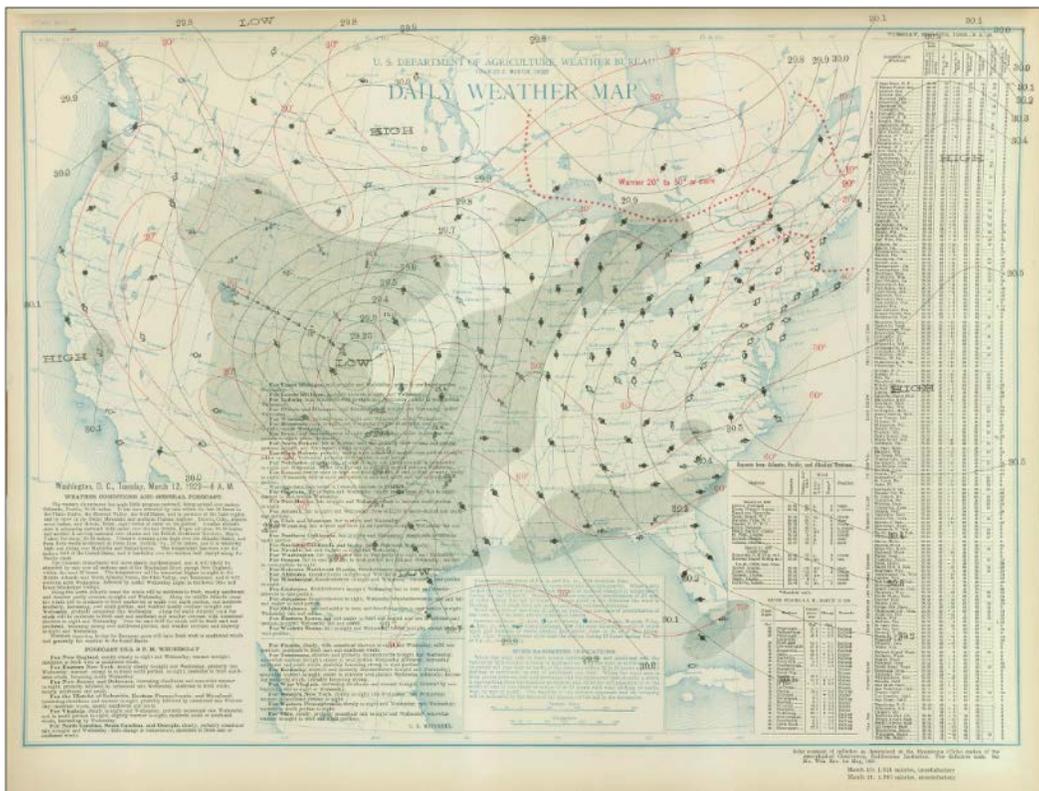
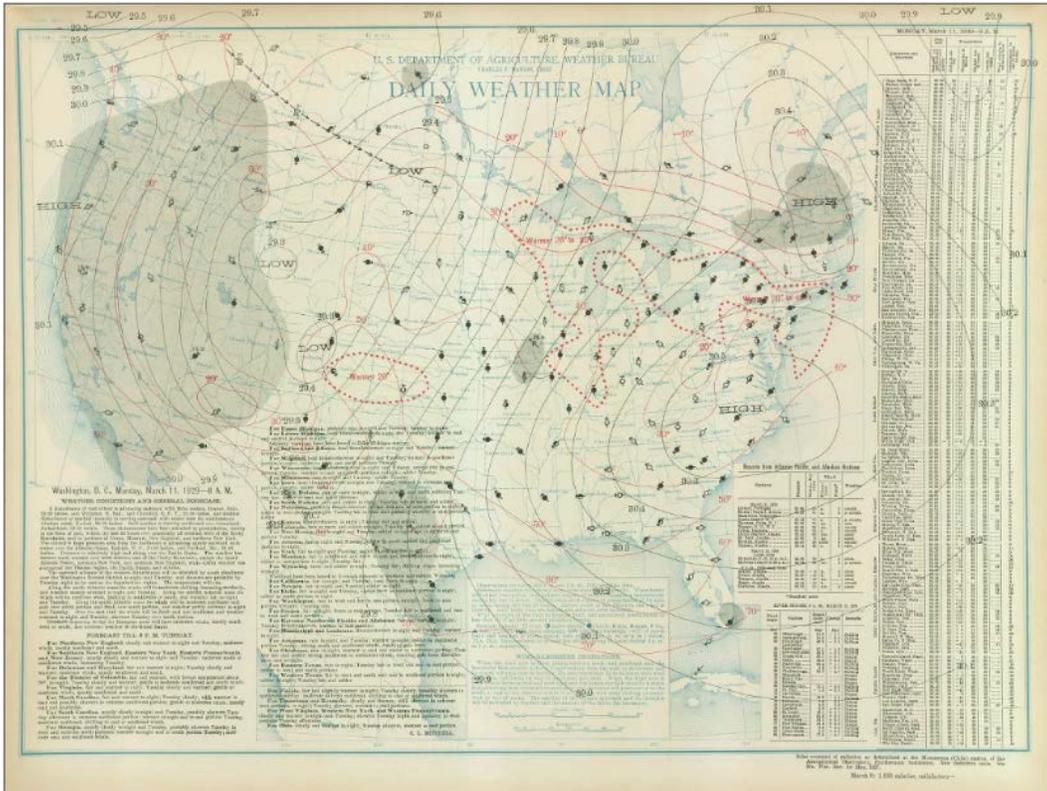


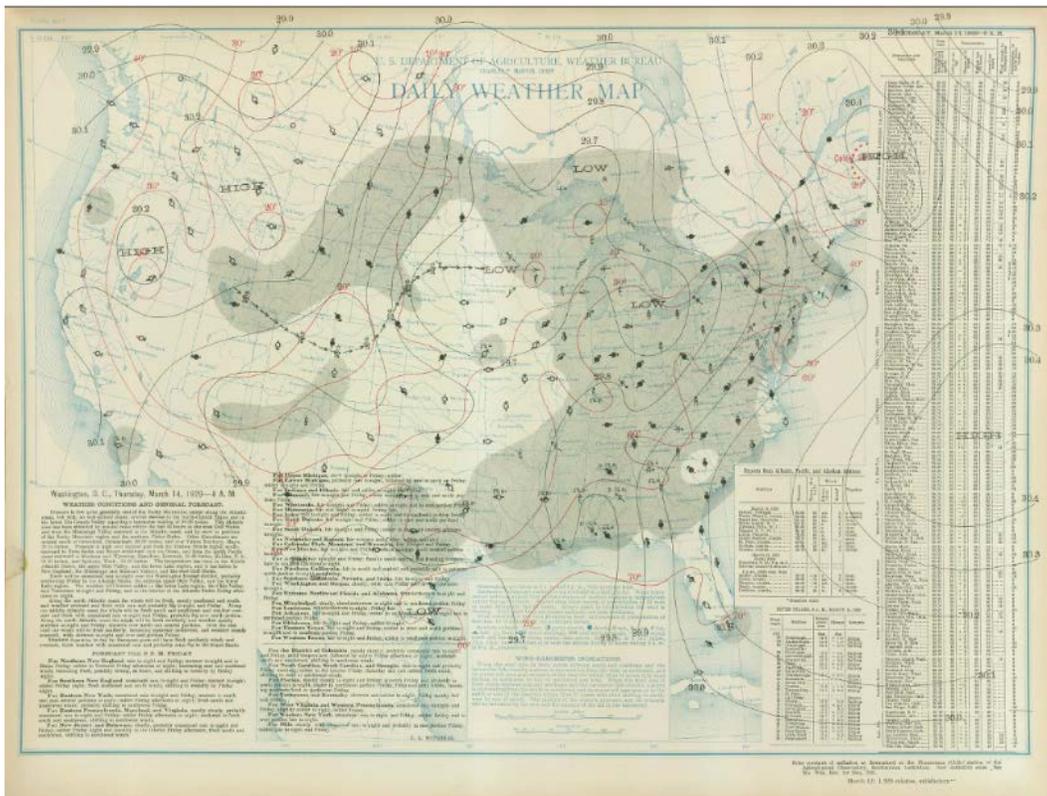
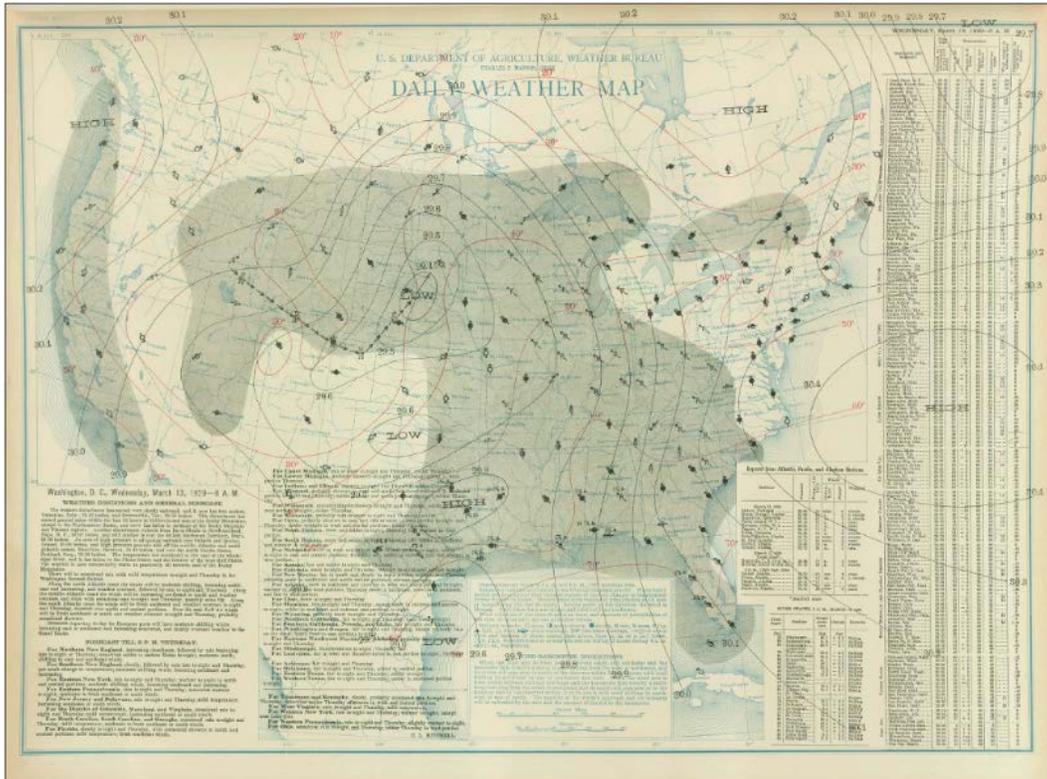
**MASS RAINFALL CURVES**



FORM S-3E





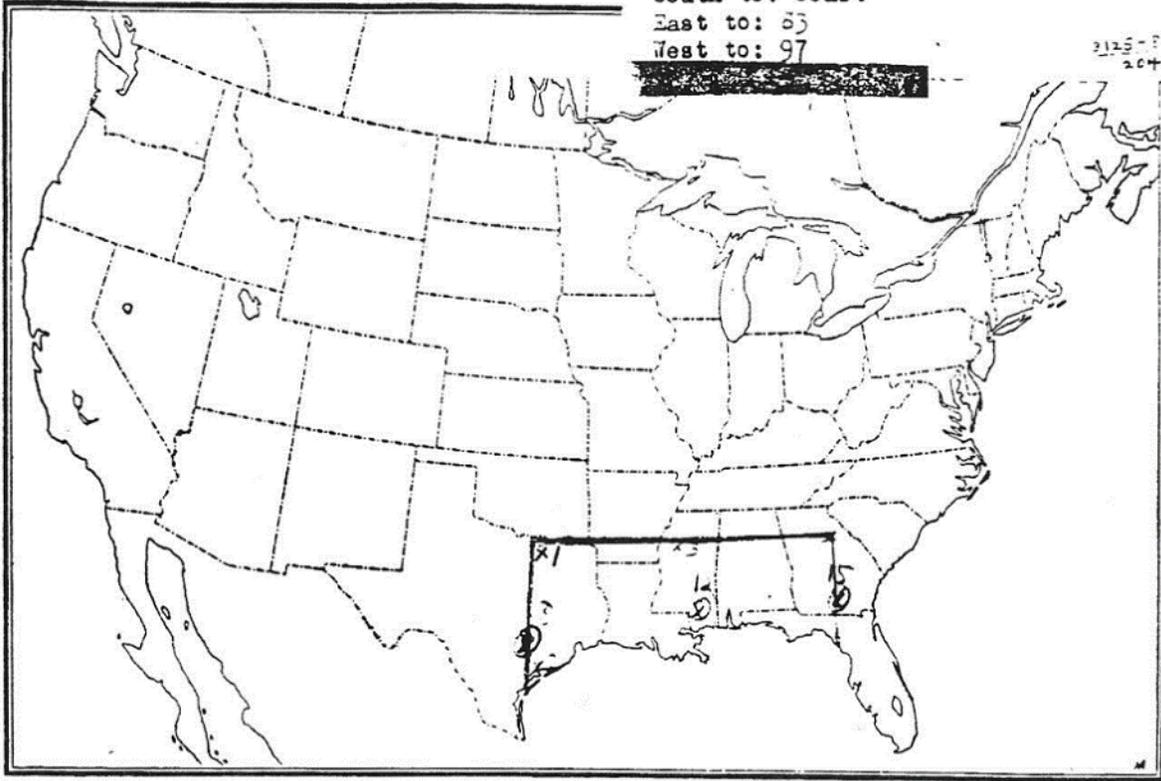




16.

Storm Date	Assignment Number	Representative Storm Dewpoint	Reference Point
<u>1929</u>			
Mar 11-16	LMV 2-20	67	75 S of Elba, Ala.
Mar 21-23	OR 7-15	68	270 SSE of Rock Island, Tenn.
Apr 18-21	MR 3-22	66	200 SSE of Holton, Kans.
May 10-14	MR 3-23	68	200 SE of Lawton, Okla.
May 25-30	GM 4-26	76	190 SSE of Kenly, Tex.
May 25-30	MR 4-27	60	500 SE of Sentinel Butte, Mont.
May 29-Jun 3	MR 3-25	69	250 S of Bethany, Mo.
Jun 6-7	MR 4-28	62	400 SE of Beach, N. Dak.
Jul 15-18	LMV 1-17	74	80 WSW of Woodville, Miss.
Aug 1-2	UMV 2-17	73	190 S of Toledo, Iowa.
Sep 5-9	LMV 4-13	75	90 E of Algiers, La.
Sep 23-28	SA 3-20	74	50 E of Glenville, Ga.
Sep 29-Oct 3	SA 3-23	74	200 E of Vernon, Fla.
Nov 11-15	GM 2-4	71	250 SSE of Helena, Ala.
<u>1930</u>			
Jan 6-11	LMV 2-22	60	190 SE of Arkadelphia, Ark.
May 6-11	LMV 2-23	71	220 SW of Swan Lake, Miss.
May 15-19	LMV 2-24	75	290 SE of Camden, Ark.
Jun 7-11	NA 1-19	62	160 SW of Springfield, Mass.
Jun 12-15	UMV 2-14	67	120 SW of Washington, Iowa.
Sep 13-15	MR 3-26	70	175 SSE of Holton, Kans.
Oct 9-12	SW 2-6	70	540 SE of Porter, N. Mex.
<u>1931</u>			
Jul 20-25	GL 1-27	72	250 SW of Conklingville, N. Y.
<u>1932</u>			
Jan 11-13	LMV 4-16	62	120 SE of Urania, La.
Jun 2-6	SW 2-7	70	250 S of Meeker, Okla.
Jun 2-6	SW 2-7A	70	500 SSE of Tribune, Kans.
Jun 30-Jul 2	GM 5-1	75	175 S of Kerrville, Tex.
Jul 3-8	OR 3-20	73	250 SW of Clay, W. Va.
Aug 1-3	OR 2-8	76	510 SW of Lexington, Ky.
Aug 15-17	SW 2-8	72	160 SSE of Enid, Okla.
Aug 30-Sep 5	GM 5-16A	76	340 S of Fairfield, Tex.
Sep 5-7	GM 5-16B	75	400 SE of Abilene, Tex.
Sep 16-17	KA 1-20	63	75 E of Westerly, R. I.

LEV 2-20..Mar. 11-10, 1929..Elba, Ala.  
12-hr. rfd b7(14tn)...75 S..to 75, 34.6  
North to: 34  
South to: coast  
East to: 85  
West to: 97



## Storm Precipitation Analysis System (SPAS) For Storm #1587\_1

**General Storm Location:** Prairieview, NM

**Storm Dates:** May 21-26, 1941

**Event:** Mid-latitude cyclone

### DAD Zone 1

**Latitude:** 33.1375

**Longitude:** -103.0792

**Max. Grid Rainfall Amount:** 11.08”

**Max. Observed Rainfall Amount:** 10.79”

**Number of Stations:** 665

**SPAS Version:** 10.0

**Basemap:** Mean annual maximum 48-hour precipitation associated with MLCs

**Spatial resolution:** 0.2735

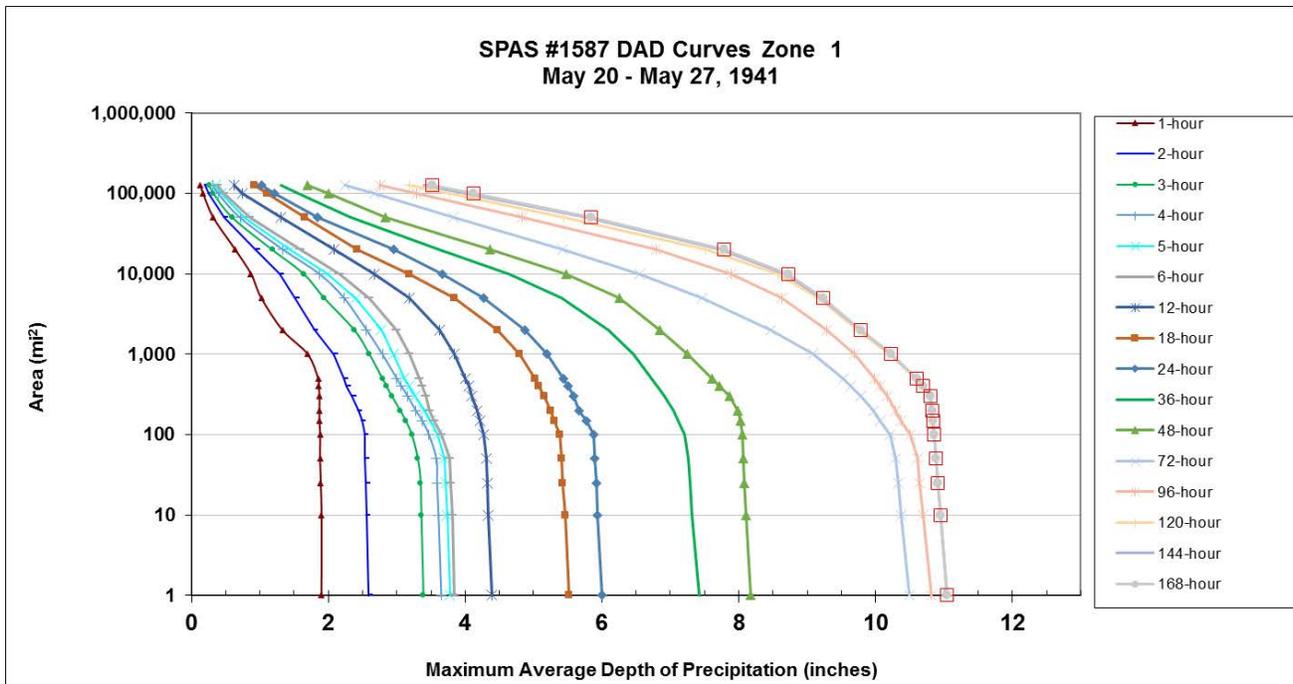
**Radar Included:** No

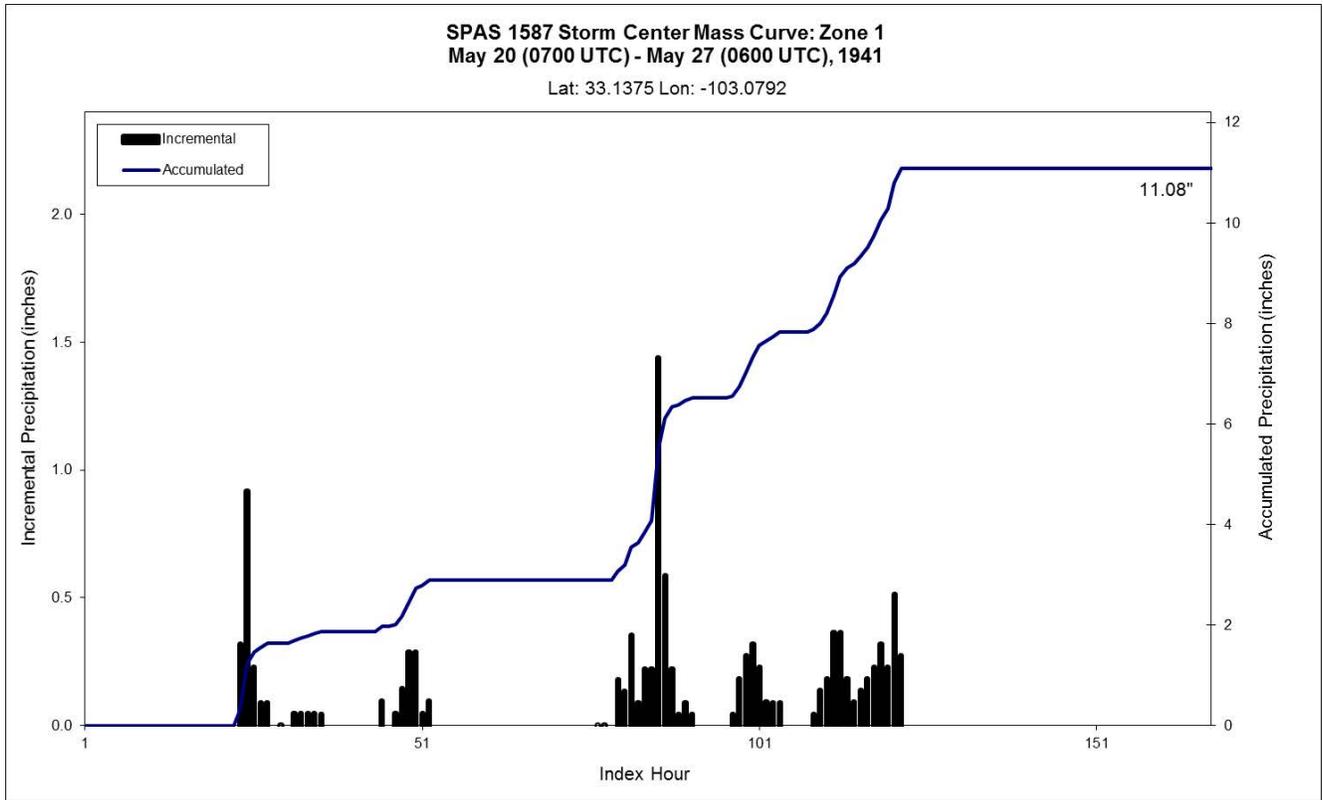
**Depth-Area-Duration (DAD) analysis:** Yes

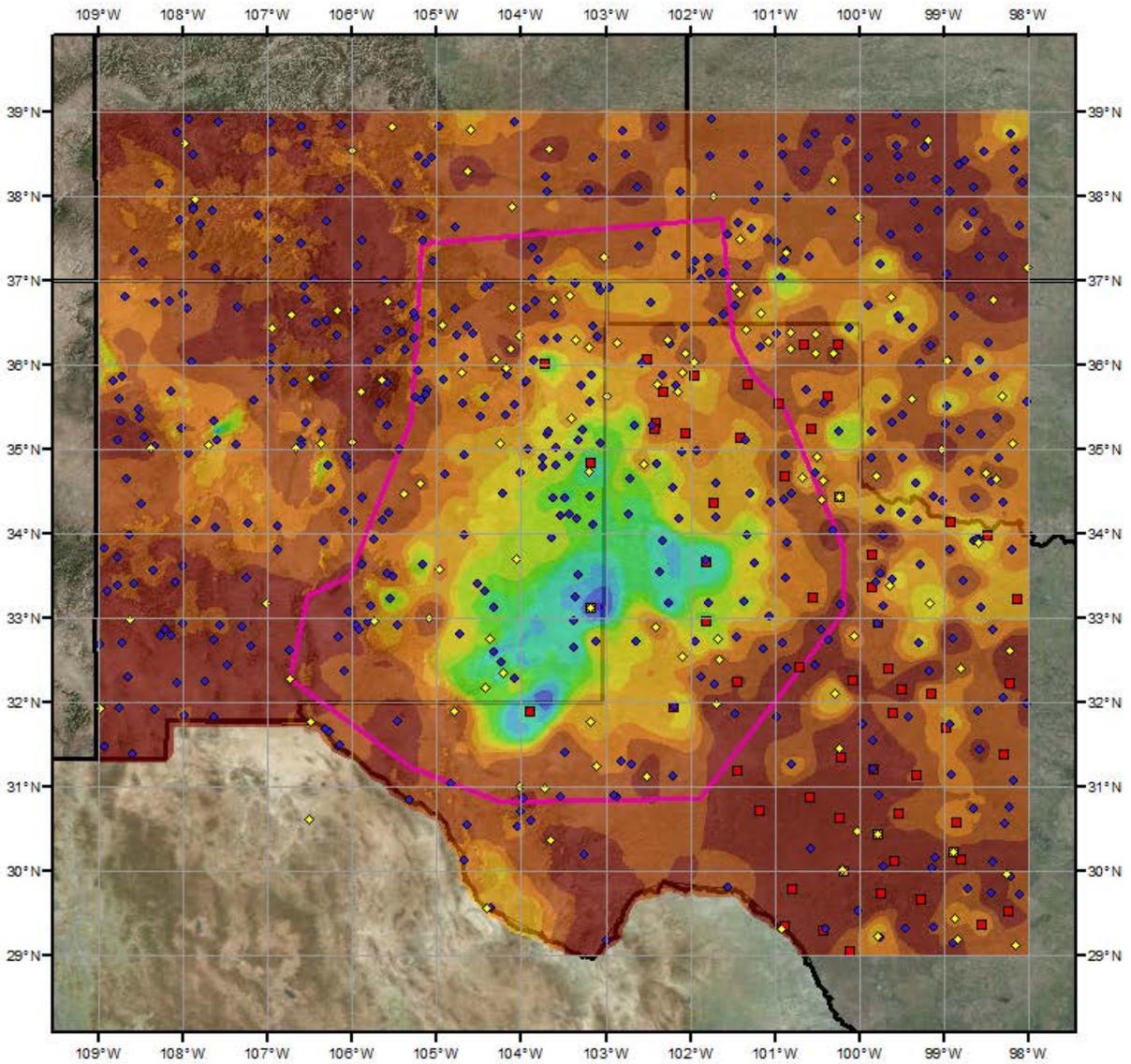
**Reliability of results:** In addition to the NCDC stations, there were also four hourly stations added via digitizing some of the stations listed in the ACE report. With the density of stations available for this storm and with how closely the resulting SPAS analysis was to the ACE report, this analysis is deemed quite reliable.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1587_1	-103.079	33.138	3,800	3,800	71.00	2.36	0.75	64	1.610	78.77	79.0	3.44	0.99	80	2.450	1.500

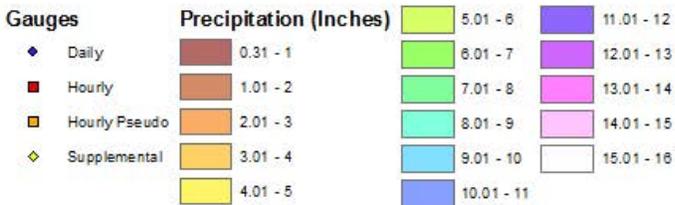
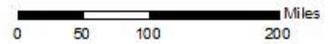
Storm 1587 - May 20 (0700 UTC) - May 27 (0600 UTC), 1941																	
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																	
Area (mi <sup>2</sup> )	Duration (hours)																
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	144	168	Total
0.4	1.90	2.60	3.40	3.66	3.80	3.86	4.40	5.54	6.01	7.44	8.20	10.55	10.85	11.08	11.08	11.08	11.08
1	1.90	2.59	3.39	3.65	3.78	3.84	4.39	5.52	6.00	7.42	8.17	10.50	10.81	11.05	11.05	11.05	11.05
10	1.90	2.56	3.36	3.61	3.74	3.81	4.34	5.46	5.94	7.32	8.11	10.38	10.69	10.95	10.95	10.95	10.95
25	1.89	2.55	3.35	3.59	3.72	3.79	4.32	5.43	5.92	7.29	8.08	10.33	10.64	10.91	10.91	10.91	10.91
50	1.88	2.54	3.31	3.58	3.70	3.77	4.31	5.41	5.90	7.26	8.06	10.29	10.61	10.88	10.88	10.88	10.88
100	1.88	2.53	3.22	3.47	3.60	3.66	4.27	5.38	5.88	7.21	8.05	10.21	10.51	10.85	10.85	10.85	10.85
150	1.87	2.49	3.13	3.37	3.49	3.55	4.22	5.31	5.77	7.11	8.03	10.07	10.38	10.83	10.83	10.84	10.84
200	1.87	2.44	3.05	3.28	3.40	3.48	4.18	5.25	5.66	7.05	7.99	9.97	10.29	10.82	10.82	10.83	10.83
300	1.87	2.35	2.93	3.16	3.27	3.42	4.10	5.15	5.58	6.91	7.86	9.78	10.17	10.79	10.80	10.80	10.80
400	1.86	2.27	2.85	3.07	3.18	3.37	4.05	5.08	5.51	6.80	7.72	9.64	10.06	10.68	10.69	10.69	10.69
500	1.85	2.23	2.79	3.00	3.11	3.33	4.00	5.02	5.44	6.73	7.61	9.53	9.98	10.59	10.60	10.60	10.60
1,000	1.70	2.08	2.60	2.79	2.95	3.19	3.84	4.80	5.20	6.46	7.25	9.09	9.69	10.20	10.22	10.22	10.22
2,000	1.33	1.79	2.38	2.56	2.77	3.00	3.63	4.47	4.88	6.09	6.85	8.47	9.29	9.74	9.78	9.79	9.79
5,000	1.02	1.52	1.94	2.23	2.40	2.60	3.18	3.84	4.27	5.41	6.25	7.46	8.63	9.16	9.21	9.23	9.23
10,000	0.87	1.29	1.64	1.87	1.99	2.17	2.68	3.19	3.67	4.64	5.48	6.55	7.89	8.58	8.69	8.72	8.72
20,000	0.64	0.94	1.18	1.34	1.45	1.59	2.09	2.42	2.95	3.61	4.37	5.42	6.79	7.52	7.73	7.78	7.78
50,000	0.32	0.48	0.60	0.71	0.78	0.85	1.30	1.66	1.84	2.32	2.84	3.83	4.83	5.44	5.77	5.84	5.84
100,000	0.17	0.25	0.32	0.39	0.44	0.47	0.75	1.10	1.21	1.56	2.00	2.67	3.29	3.78	4.02	4.13	4.13
126,432	0.13	0.20	0.26	0.31	0.35	0.38	0.62	0.92	1.02	1.31	1.69	2.24	2.75	3.18	3.40	3.52	3.52







**Total Storm (168-hours) Precipitation (inches)**  
**May 21 - 26, 1941**  
**SPAS 1587**



4/3/2015

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of May 20-25, 1941  
 Assignment GM 5-18  
 Location Texas and New Mexico  
 Study Prepared by:  
 Southwestern Division  
 Galveston District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 7/18/43  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 2/18/44  
 Remarks: Center at  
 Prairieview, New Mexico

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:1,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	76
Form 5001-B (24-hour " " " " )-----	-
Form 5001-D ( " " " " " " )-----	26
Misc. precip. records, meteorological data, etc. (Hydrologic Network Special Supp)	10
Form 5002 (Mass rainfall curves)-----	78

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	4
Form S-11 (Depth-area data from isohyetal map)-----	2
Form S-12 (Maximum depth-duration data)-----	15
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours										
	6	12	18	24	30	36	48	60	72	96	108
10	3.8	4.8	6.0	6.5	6.9	7.0	7.4	7.4	8.4	9.3	10.0
100	3.0	4.0	5.2	6.3	6.7	6.8	6.9	7.0	8.1	9.0	9.6
200	2.7	3.7	4.7	6.0	6.4	6.6	6.7	6.9	8.0	8.8	9.5
500	2.3	3.3	4.1	5.4	5.8	6.1	6.4	6.7	7.7	8.6	9.2
1,000	2.1	3.0	3.7	4.9	5.3	5.7	6.1	6.4	7.5	8.4	9.0
2,000	1.8	2.7	3.2	4.3	4.7	5.2	5.7	6.1	7.2	8.1	8.7
5,000	1.4	2.2	2.7	3.5	3.9	4.4	5.0	5.6	6.6	7.6	8.2
10,000	1.2	1.9	2.2	2.9	3.2	3.7	4.4	5.0	5.9	7.0	7.6
20,000	0.9	1.5	1.8	2.3	2.6	3.0	3.7	4.3	5.1	6.2	6.7
44,000	0.6	1.1	1.3	1.5	1.8	2.1	2.7	3.4	3.9	4.9	5.2

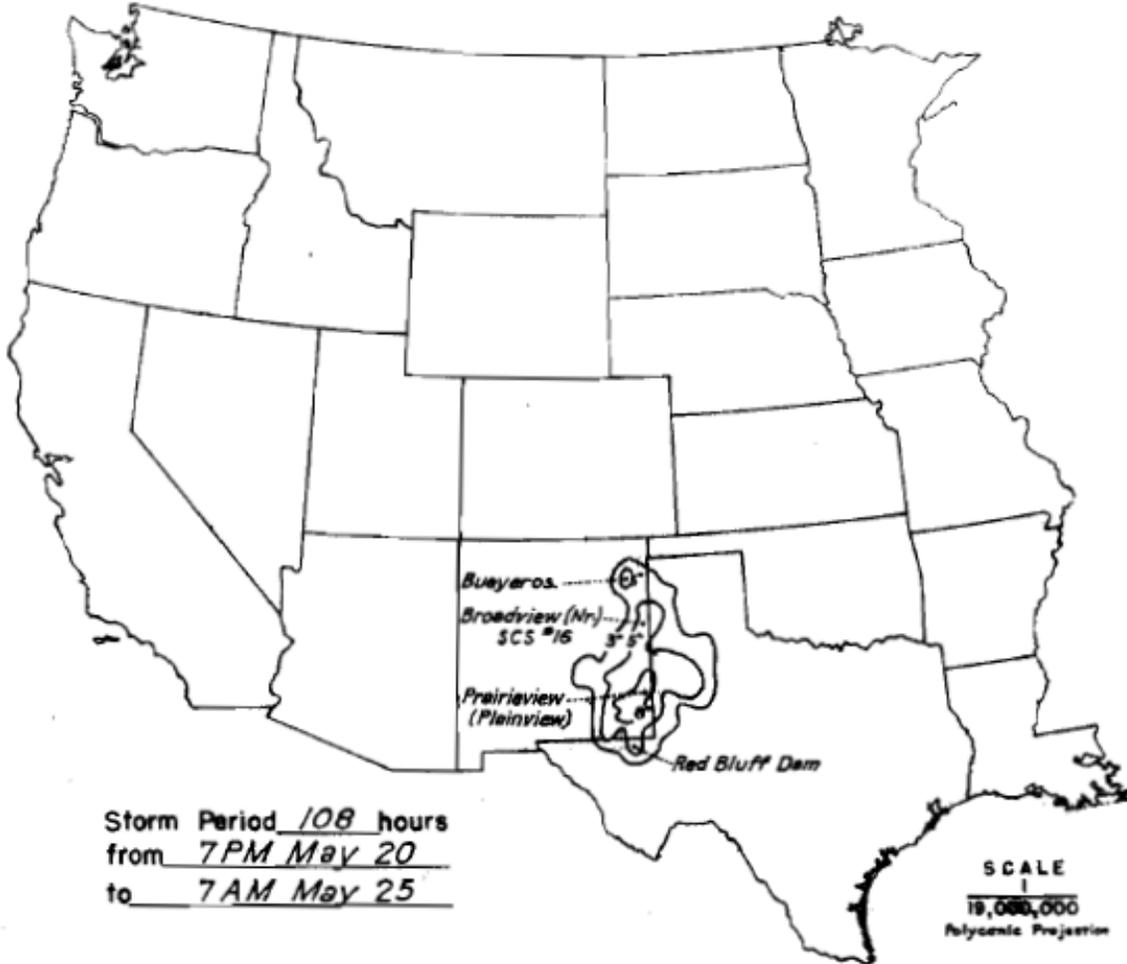
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

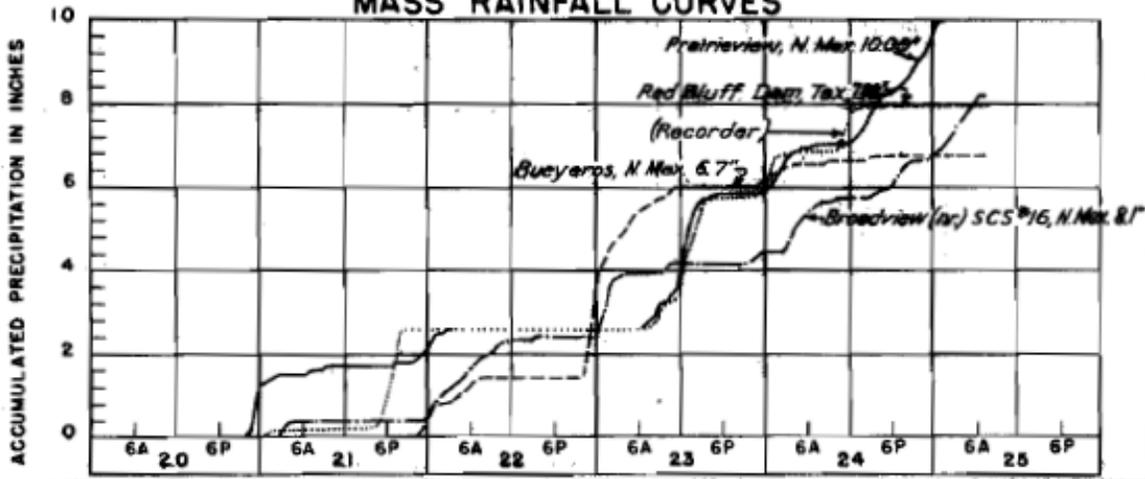
**STORM STUDIES - ISOHYETAL MAP**

Storm of May 20-25, 1941 Assignment GM 5-18

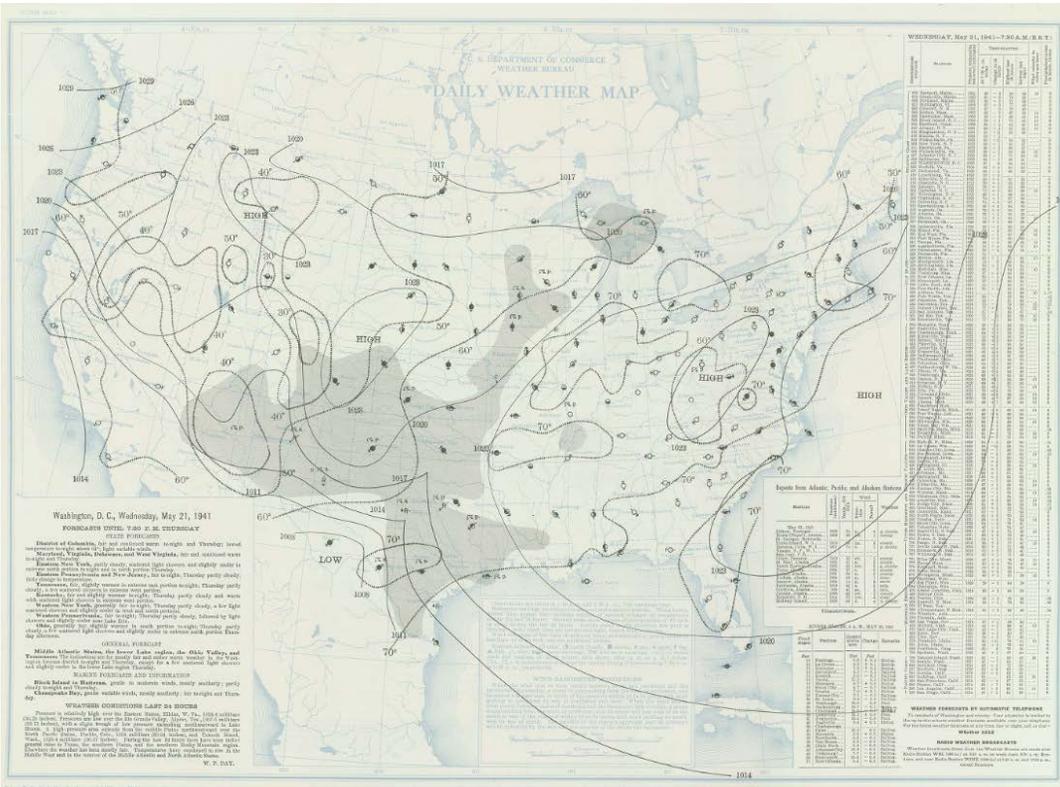
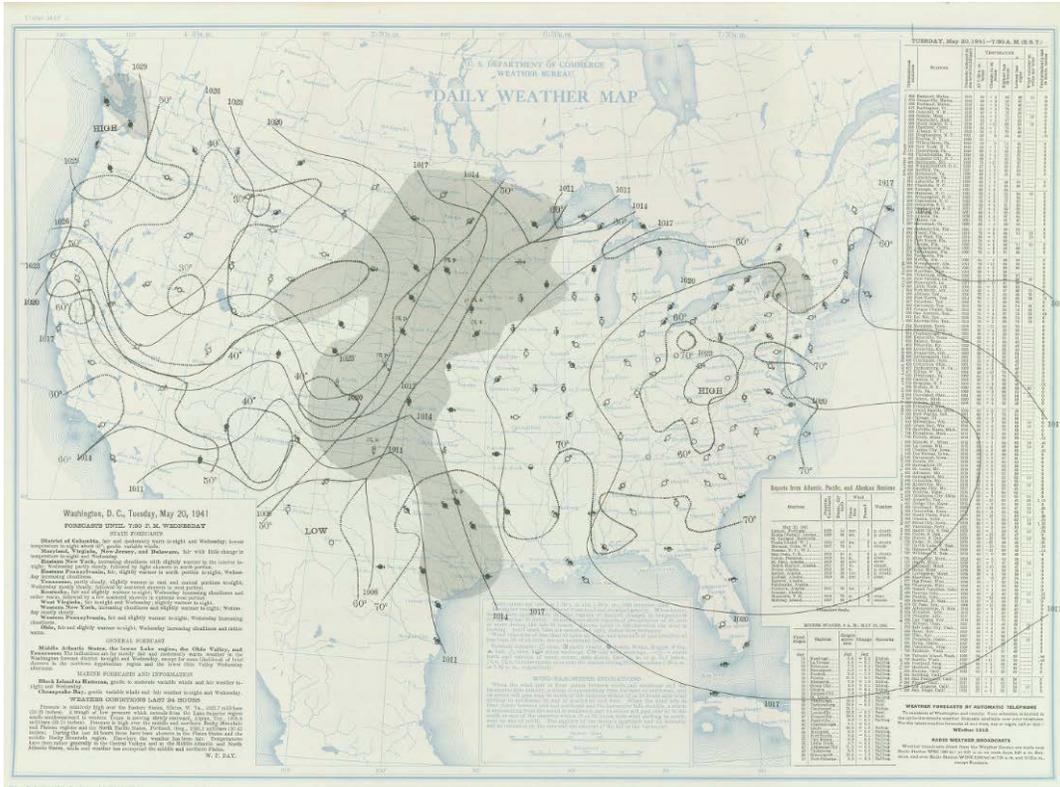
Study Prepared by: Galveston, Tex., District  
Southwestern Division



**MASS RAINFALL CURVES**



FORM 8-3W

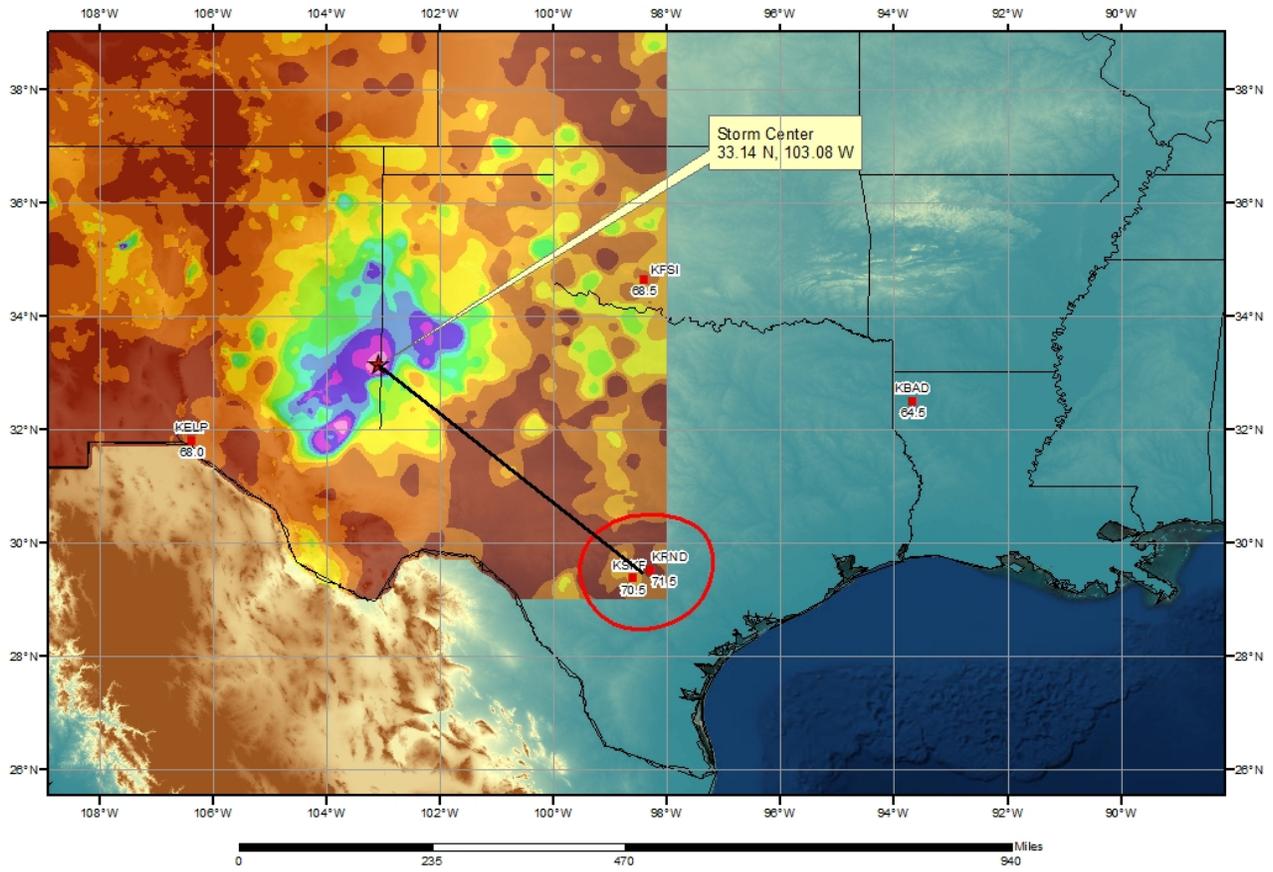








### SPAS 1587 Prairieview, NM Storm Analysis May 22-25, 1941



## Storm Precipitation Analysis System (SPAS) For Storm #1486\_1

**General Storm Location:** Dave McColleum Ranch, NM

**Storm Dates:** September 19-24, 1941

**Event:** Extreme Precipitation Event

**DAD Zone 1**

**Latitude:** 32.1458

**Longitude:** -104.7458

**Max. Grid Rainfall Amount:** 21.81”

**Max. Observed Rainfall Amount:** 21.25”

**Number of Stations:** 317

**SPAS Version:** 10.0

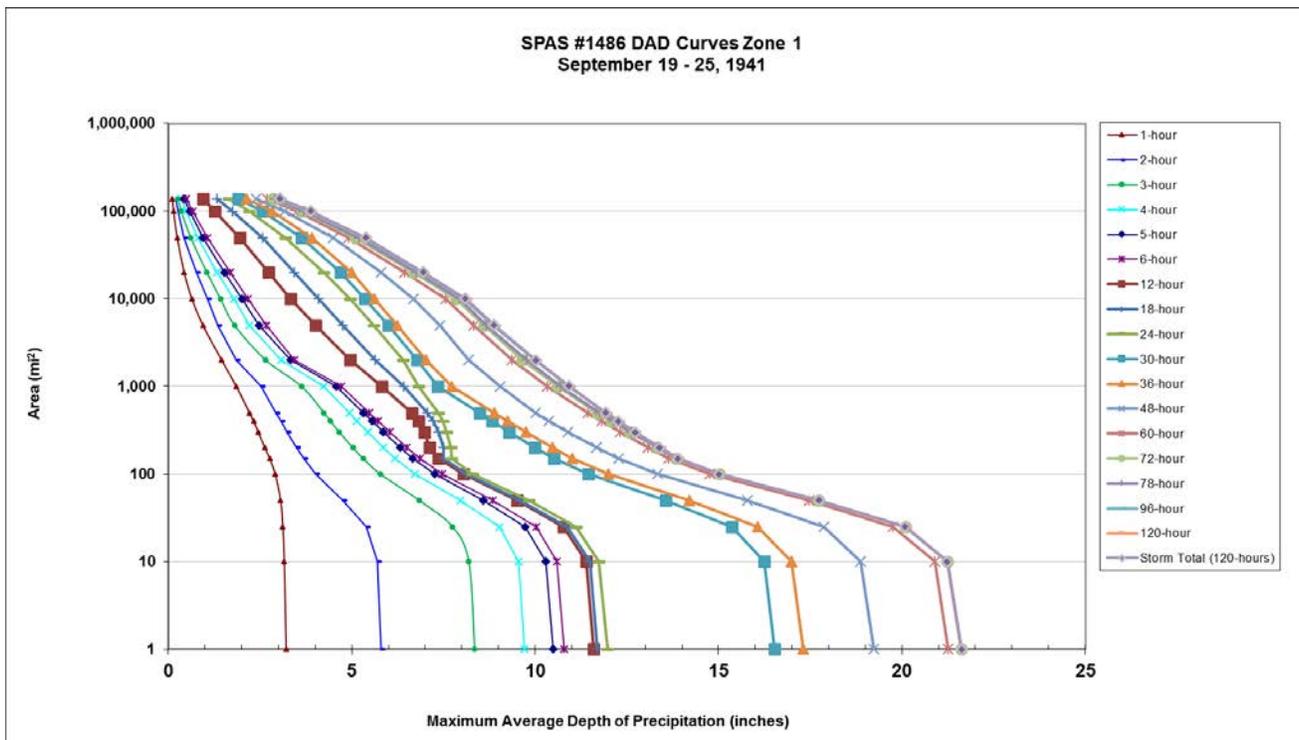
**Basemap:** PRISM Monthly Basemap for September 1941

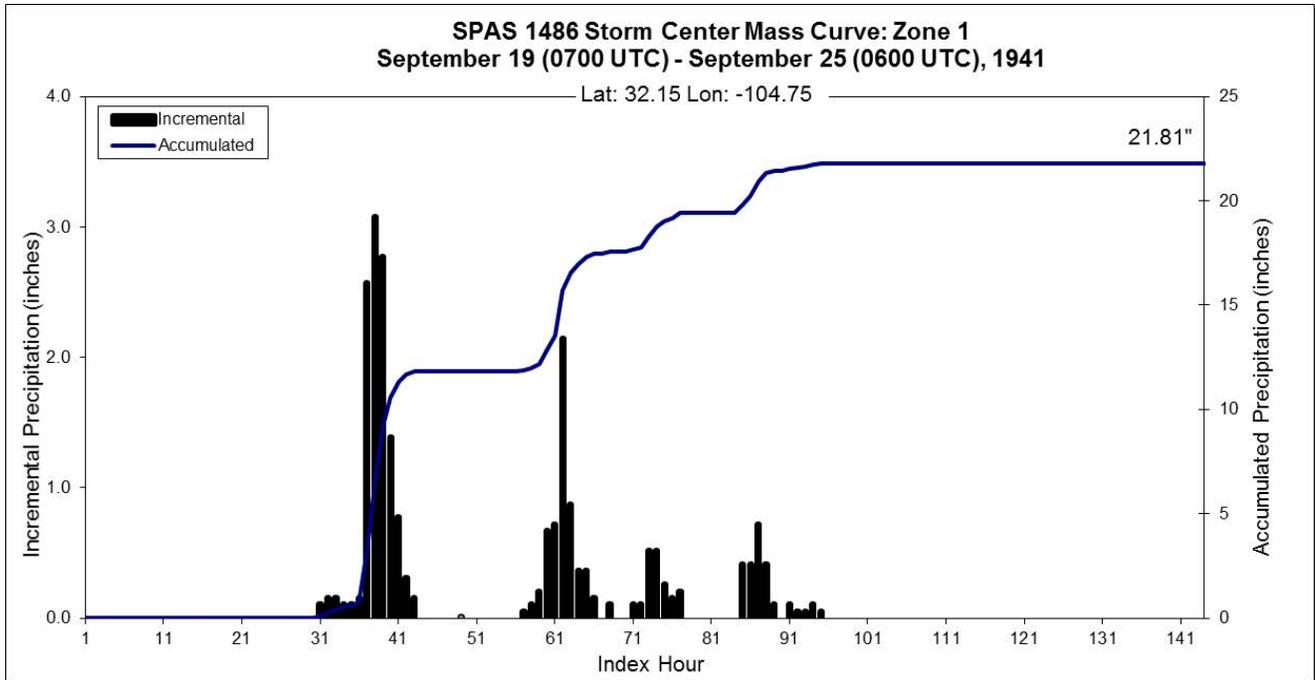
**Radar Included:** No

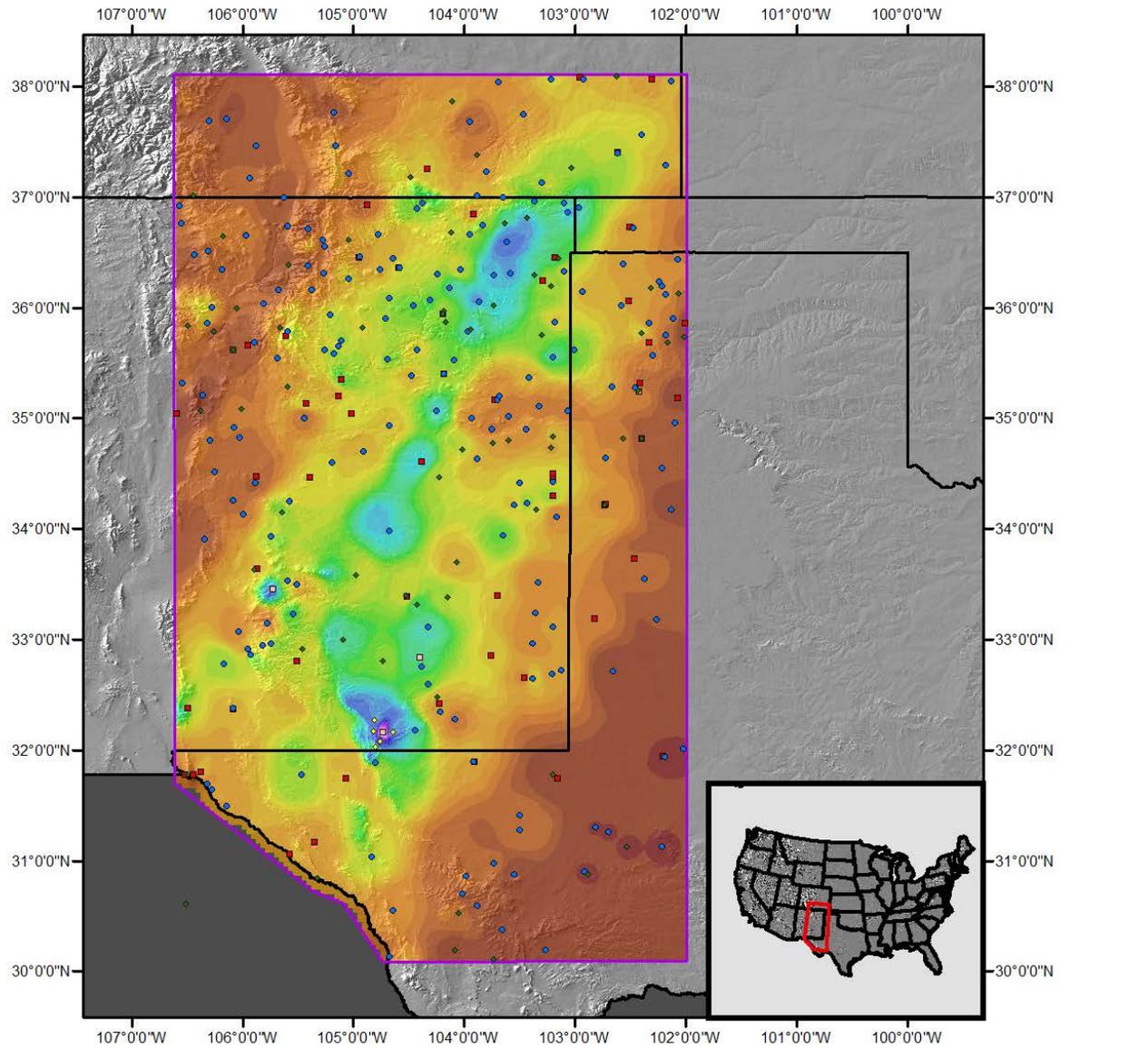
**Depth-Area-Duration (DAD) analysis:** Yes

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1486_1	-104.746	32.146	5,840	6,000	74.00	2.73	1.22	70	1.510	77.95	78.0	3.29	1.41	78	1.880	1.245

Storm 1486 Zone 1 - Sep 19 (0700 UTC) - Sep 25 (0600 UTC), 1941																		
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																		
areasqmi	Duration (hours)																	
	1	2	3	4	5	6	12	18	24	30	36	48	60	72	78	96	120	Total
0.4	3.23	5.84	8.40	9.78	10.54	10.85	11.67	11.77	12.04	16.64	17.40	19.35	21.40	21.75	21.75	21.75	21.75	21.75
1	3.21	5.80	8.35	9.71	10.48	10.79	11.59	11.70	11.97	16.53	17.30	19.24	21.26	21.62	21.62	21.62	21.62	21.62
10	3.16	5.69	8.19	9.55	10.29	10.59	11.40	11.49	11.74	16.24	16.99	18.87	20.89	21.23	21.23	21.23	21.23	21.23
25	3.12	5.39	7.75	9.03	9.73	10.02	10.78	10.87	11.12	15.36	16.07	17.86	19.76	20.09	20.09	20.09	20.09	20.09
50	3.06	4.76	6.84	7.96	8.59	8.84	9.50	9.59	9.82	13.55	14.19	15.78	17.46	17.73	17.73	17.73	17.73	17.73
100	2.91	4.02	5.78	6.73	7.26	7.47	8.04	8.13	8.29	11.46	11.99	13.34	14.77	15.02	15.02	15.02	15.02	15.02
150	2.76	3.69	5.31	6.17	6.66	6.86	7.37	7.51	7.72	10.52	11.02	12.28	13.64	13.86	13.86	13.89	13.89	13.89
200	2.63	3.50	5.03	5.85	6.31	6.50	7.12	7.50	7.71	9.99	10.47	11.68	13.08	13.31	13.33	13.39	13.39	13.39
300	2.45	3.24	4.66	5.43	5.85	6.03	6.99	7.37	7.59	9.29	9.74	10.89	12.32	12.57	12.61	12.71	12.72	12.72
400	2.32	3.07	4.42	5.14	5.55	5.71	6.82	7.22	7.48	8.82	9.25	10.37	11.81	12.07	12.13	12.26	12.27	12.27
500	2.21	2.94	4.24	4.93	5.32	5.48	6.63	7.06	7.36	8.48	8.88	10.01	11.43	11.70	11.76	11.91	11.93	11.93
1,000	1.85	2.52	3.63	4.24	4.58	4.71	5.81	6.41	6.83	7.35	7.72	9.05	10.32	10.61	10.70	10.91	10.93	10.93
2,000	1.45	1.85	2.65	3.08	3.33	3.43	4.95	5.64	6.40	6.79	7.02	8.18	9.37	9.65	9.76	9.99	10.01	10.01
5,000	0.94	1.35	1.80	2.20	2.46	2.67	4.01	4.76	5.60	5.99	6.24	7.41	8.32	8.60	8.67	8.85	8.88	8.88
10,000	0.64	1.06	1.42	1.78	2.00	2.17	3.34	4.10	4.95	5.36	5.62	6.67	7.56	7.84	7.94	8.07	8.10	8.10
20,000	0.43	0.76	1.05	1.33	1.52	1.68	2.72	3.43	4.23	4.69	4.99	5.79	6.44	6.69	6.76	6.89	6.95	6.95
50,000	0.24	0.43	0.61	0.81	0.94	1.07	1.95	2.57	3.19	3.64	3.91	4.50	4.91	5.10	5.20	5.33	5.38	5.38
100,000	0.14	0.26	0.35	0.49	0.58	0.67	1.27	1.75	2.21	2.57	2.82	3.18	3.52	3.65	3.70	3.81	3.88	3.88
138,427	0.11	0.20	0.27	0.36	0.43	0.49	0.95	1.32	1.65	1.91	2.12	2.39	2.68	2.86	2.92	3.00	3.05	3.05







**Total 144-hour Precipitation (Inches)**  
**September 19, 1941 1 AM CST - September 25, 1941 12 AM CST**  
**SPAS #1486**



WJM 01/22/2015

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of September 20-23, 1941  
 Assignment GM 5-19  
 Location New Mexico  
 Study Prepared by:  
 Southwestern Division,  
 Galveston District Office.

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 7/9/43  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 3/27/44  
 Remarks: Center at  
 Dave McColleum Ranch, N. Mex.

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:1,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly preclp. data).....	64
Form 5001-B (24-hour " " " " ).....	-
Form 5001-D ( " " " " " " ).....	26
Miscl. precip. records, meteorological data, etc.....	19
Form 5002 (Mass rainfall curves).....	76

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	4
Form S-11 (Depth-area data from isohyetal map).....	2
Form S-12 (Maximum depth-duration data).....	18
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

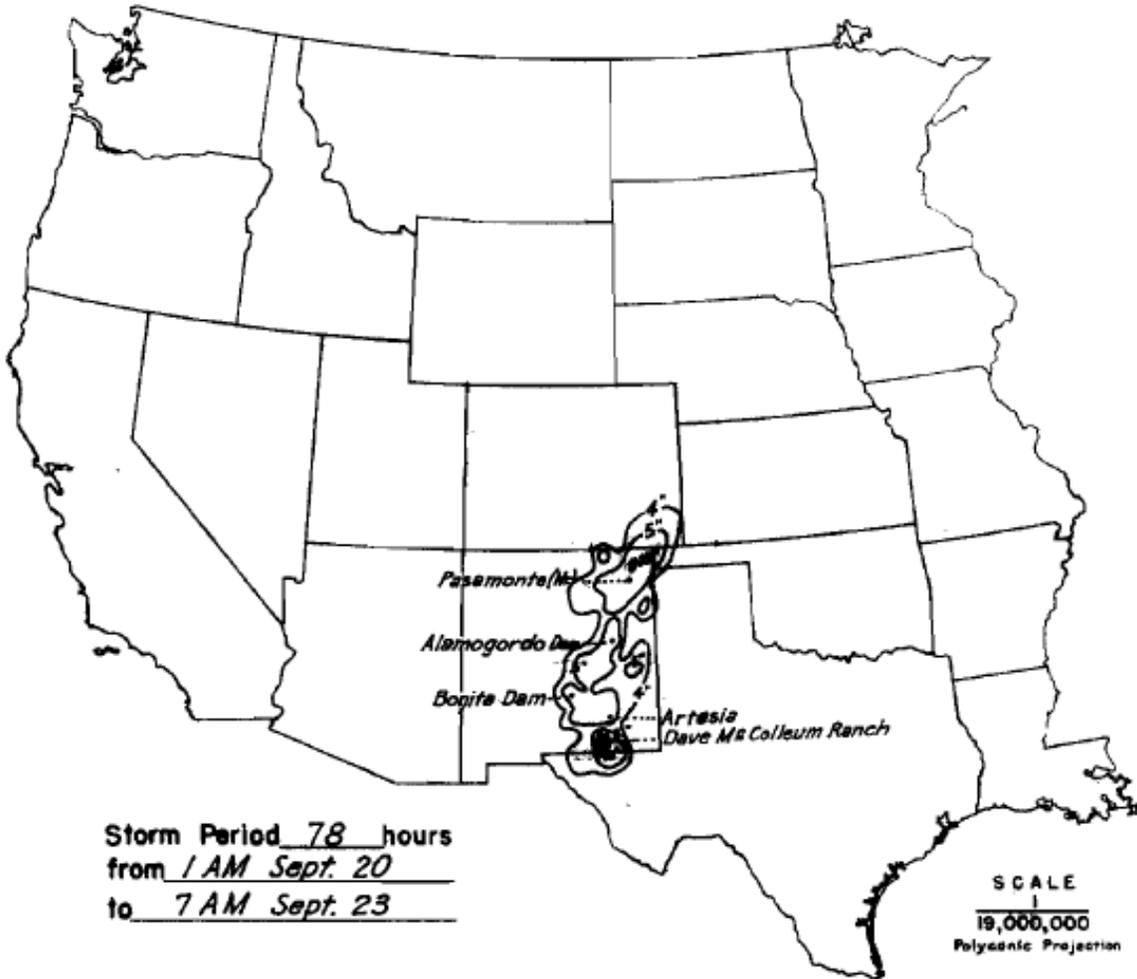
Area in Sq. Mi.	Duration of Rainfall in Hours								
	6	12	18	24	30	36	48	60	78
10	10.1	11.2	11.5	12.1	16.3	16.9	18.7	21.0	21.2
100	5.9	8.3	8.7	9.0	10.1	11.7	13.0	14.7	15.0
200	5.2	7.3	7.8	8.1	8.4	9.7	10.8	12.4	12.7
500	4.4	6.2	6.8	6.9	7.2	7.9	9.1	10.2	10.5
1,000	3.8	5.5	6.1	6.3	6.4	7.1	8.3	9.4	9.6
2,000	3.3	4.8	5.5	5.6	5.8	6.4	7.5	8.6	8.8
5,000	2.6	3.9	4.6	4.8	5.1	5.6	6.6	7.5	7.8
10,000	2.0	3.2	4.0	4.2	4.5	4.9	5.9	6.7	7.0
20,000	1.5	2.6	3.3	3.7	4.0	4.4	5.2	5.9	6.2
38,000	1.1	2.0	2.7	3.2	3.6	3.9	4.6	5.4	5.5

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

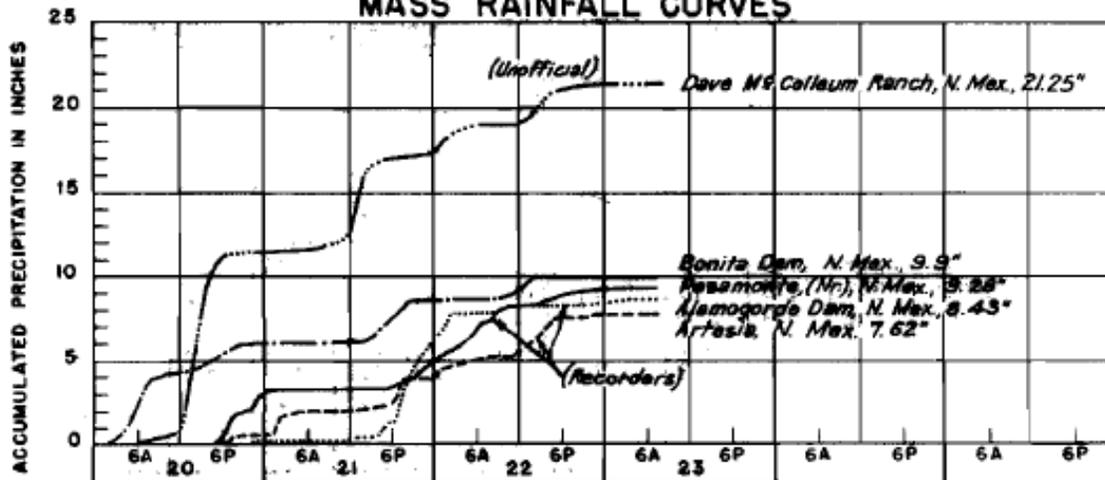
**STORM STUDIES - ISOHYETAL MAP**

Storm of September 20-23, 1941 Assignment GM 5-19  
 Study Prepared by: Galveston, Tex., District  
Southwestern Division



Storm Period 78 hours  
 from 1 AM Sept. 20  
 to 7 AM Sept. 23

**MASS RAINFALL CURVES**



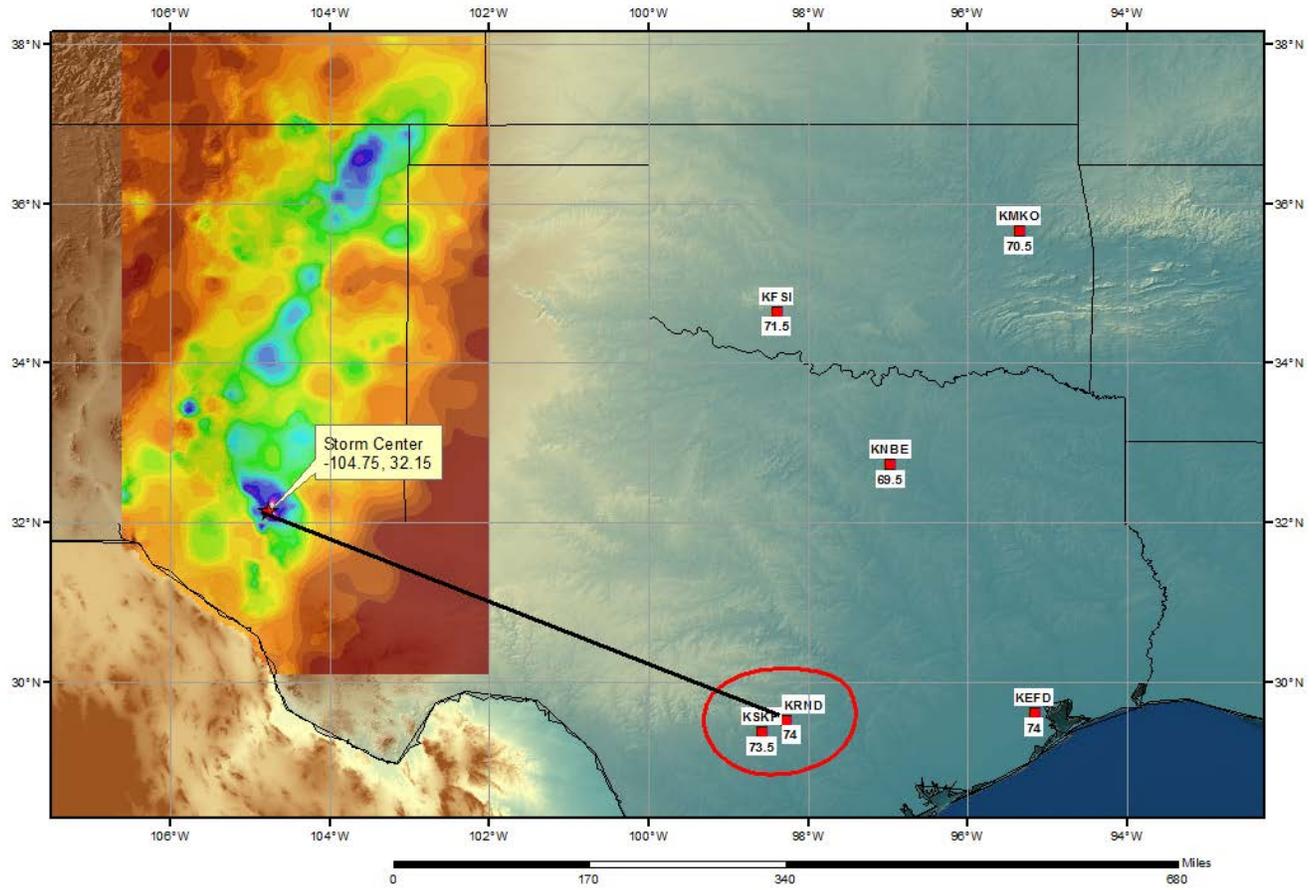




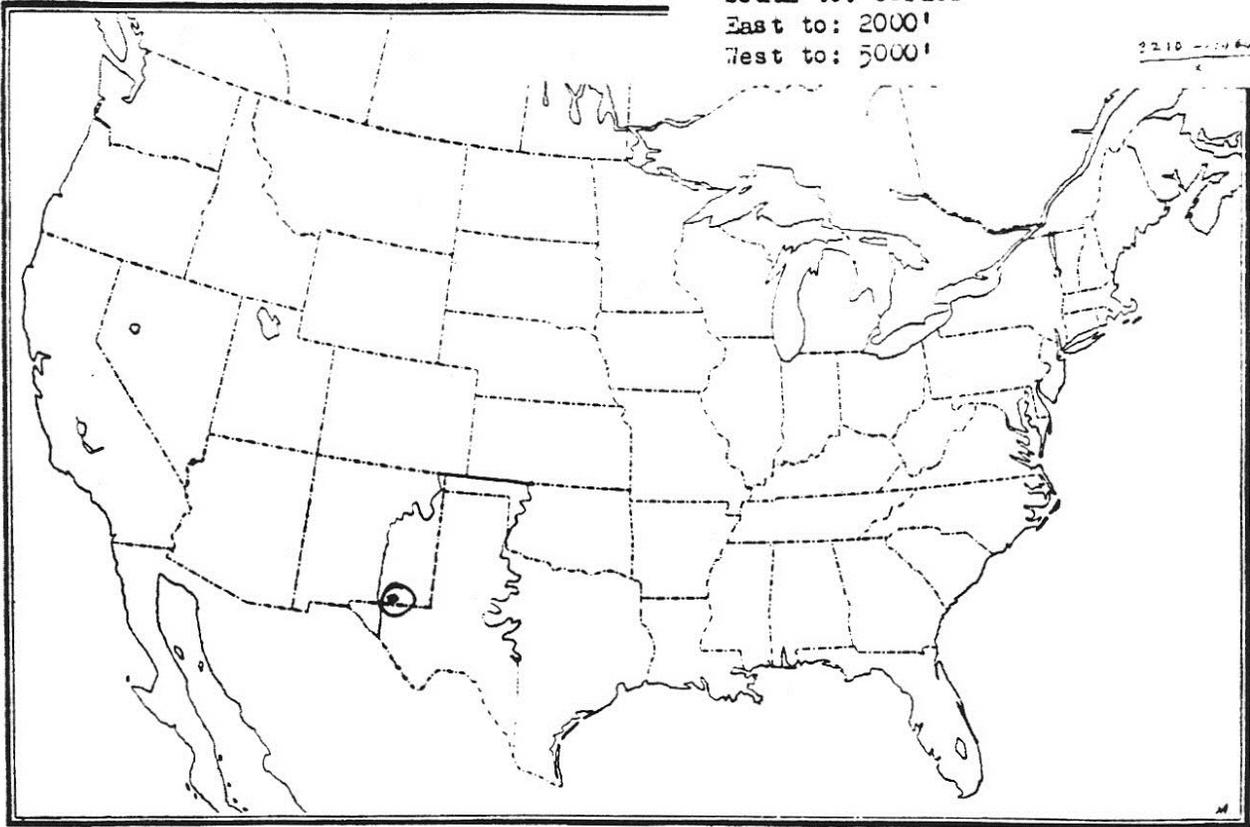




### SPAS 1486 Dave McColleum Ranch, NM Storm Analysis September 19 - 20, 1941



GM 5-19..Sept. 19-24, 1941. McCollieus  
12-hr. rTd 72..50SE..to 76,22% (N  
North to: 37  
South to: border  
East to: 2000'  
West to: 5000'



## Storm Precipitation Analysis System (SPAS) For Storm #1431\_1

**General Storm Location:** Warner, Oklahoma (38.5, -98.9, 33.5, -91.7)

**Storm Dates:** May 7 – May 11, 1943

**Event:** Extreme Precipitation Event

### DAD Zone 1

**Latitude:** 35.4792

**Longitude:** -95.3292

**Max. Grid rainfall amount:** 25.24”

**Max. Observed rainfall amount:** 25.00” (Warner, OK)

**Number of Stations:** 325

**SPAS Version:** 10.0

**Base Map Used:** USACE Isohyetal Map

**Spatial resolution:** 0.2679

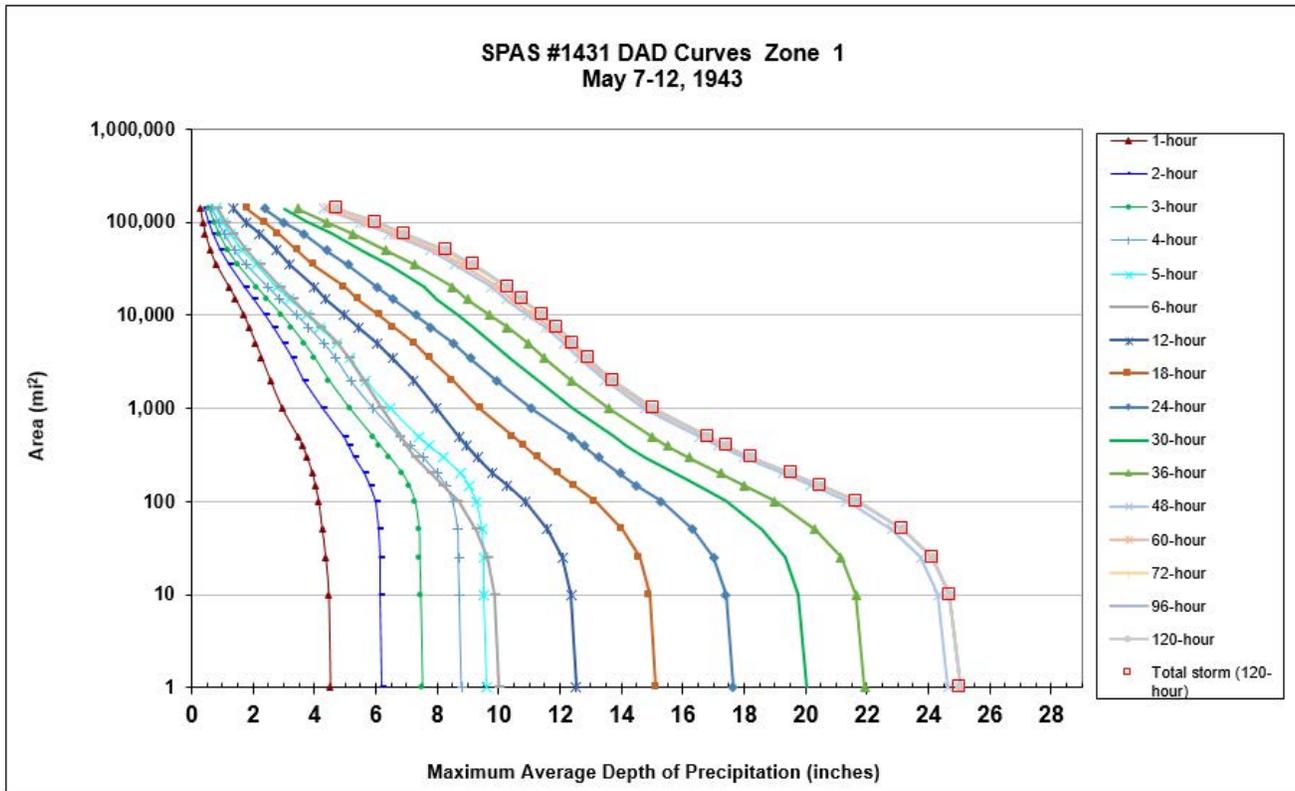
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

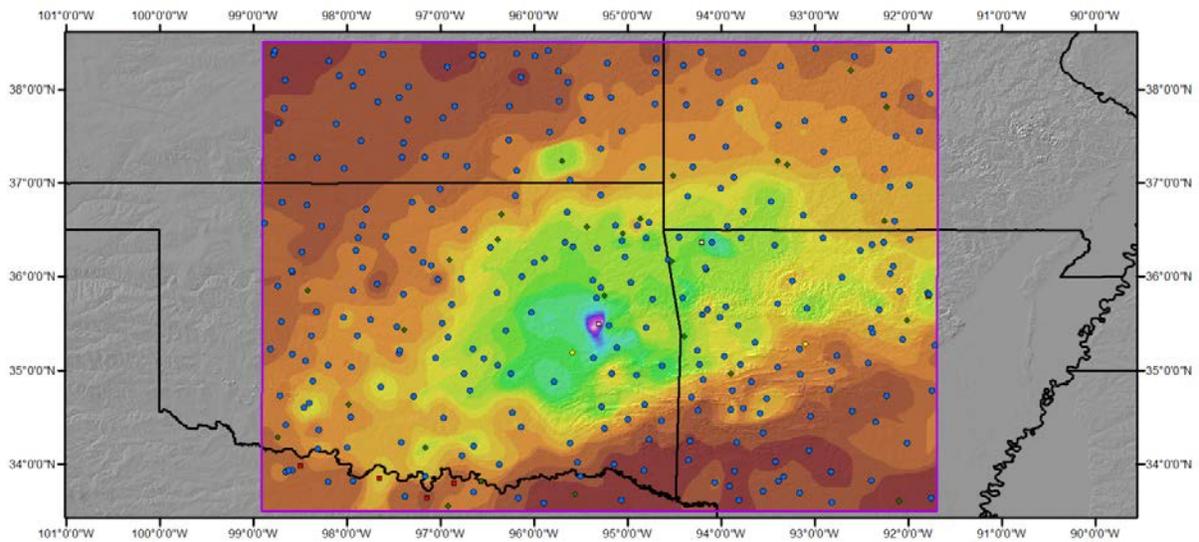
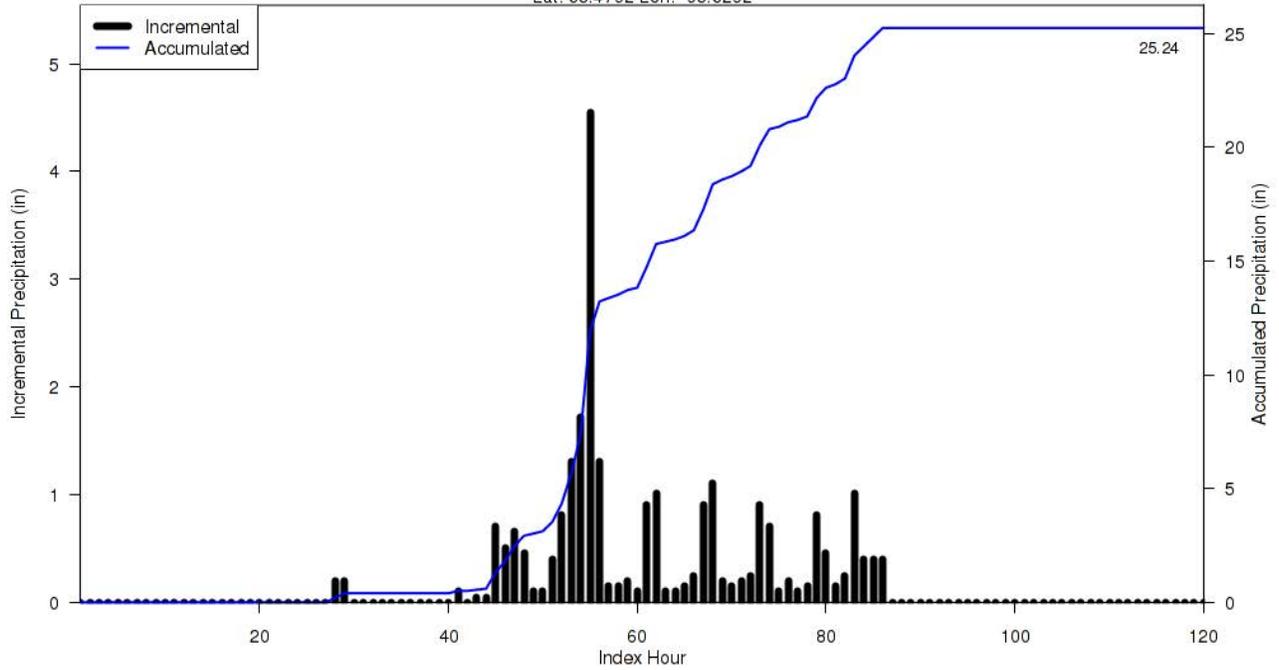
**Reliability of Results:** In addition to the NCDC stations, twenty-seven supplemental stations along with two supplemental estimated stations were added to ensure data consistency. Due to the amount and integrity of the U.S. Army Corps of Engineers (USACE), three hourly stations were digitized based on the mass rainfall curves. With the density of stations available and the consistency of the resulting SPAS analysis to the U.S. Army Corps of Engineers report, this analysis is deemed quite reliable.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1431_1	-95.329	35.479	579	600	71.50	2.42	0.14	65	2.280	77.49	77.5	3.22	0.17	77	3.050	1.338

Storm 1431 - May 7 (0700 UTC) - May 12 (0600 UTC), 1943																	
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																	
Area (mi <sup>2</sup> )	Duration (hours)																
	1	2	3	4	5	6	12	18	24	30	36	48	60	72	96	120	Total
0.4	4.53	6.22	7.52	8.83	9.64	10.07	12.59	15.21	17.73	20.14	22.05	24.77	25.24	25.24	25.24	25.24	25.24
1	4.51	6.20	7.50	8.80	9.62	10.02	12.53	15.12	17.63	20.04	21.93	24.64	25.04	25.04	25.04	25.04	25.04
10	4.45	6.14	7.44	8.73	9.53	9.88	12.36	14.91	17.39	19.77	21.63	24.30	24.69	24.69	24.69	24.69	24.69
25	4.35	6.12	7.41	8.70	9.49	9.65	12.07	14.58	17.00	19.32	21.14	23.75	24.12	24.12	24.12	24.12	24.12
50	4.24	6.11	7.39	8.68	9.46	9.26	11.59	14.02	16.33	18.57	20.31	22.81	23.17	23.17	23.17	23.17	23.17
100	4.12	5.99	7.25	8.51	9.28	8.67	10.86	13.13	15.29	17.39	19.00	21.34	21.66	21.67	21.67	21.67	21.67
150	4.01	5.83	7.05	8.27	9.02	8.18	10.27	12.45	14.47	16.49	17.98	20.16	20.46	20.46	20.46	20.46	20.46
200	3.92	5.64	6.84	8.01	8.74	7.81	9.81	11.94	13.94	15.79	17.24	19.27	19.54	19.54	19.54	19.54	19.54
300	3.74	5.29	6.42	7.53	8.21	7.30	9.30	11.27	13.24	14.80	16.20	18.00	18.23	18.25	18.25	18.25	18.25
400	3.59	5.09	6.11	7.10	7.75	7.02	8.96	10.83	12.77	14.17	15.49	17.16	17.38	17.43	17.43	17.42	17.42
500	3.44	4.94	5.88	6.78	7.40	6.81	8.70	10.46	12.39	13.73	14.99	16.53	16.75	16.82	16.82	16.80	16.80
1,000	2.93	4.25	5.13	5.92	6.48	6.19	7.97	9.40	11.07	12.46	13.61	14.74	14.94	15.06	15.06	15.02	15.02
2,000	2.55	3.65	4.46	5.18	5.68	5.61	7.23	8.48	9.91	11.28	12.36	13.46	13.62	13.70	13.71	13.71	13.71
3,500	2.26	3.28	3.99	4.69	5.13	5.14	6.54	7.77	9.08	10.36	11.49	12.63	12.79	12.90	12.91	12.91	12.91
5,000	2.07	3.00	3.65	4.30	4.71	4.74	6.02	7.24	8.51	9.77	10.96	12.12	12.28	12.41	12.43	12.43	12.43
7,500	1.85	2.66	3.24	3.80	4.16	4.23	5.43	6.58	7.78	9.18	10.27	11.51	11.68	11.88	11.91	11.91	11.91
10,000	1.68	2.40	2.92	3.42	3.75	3.82	4.97	6.12	7.30	8.67	9.72	10.96	11.14	11.40	11.45	11.45	11.45
15,000	1.41	2.02	2.45	2.87	3.20	3.20	4.37	5.42	6.56	8.00	8.99	10.24	10.43	10.71	10.76	10.76	10.76
20,000	1.20	1.73	2.11	2.49	2.78	2.88	3.98	4.97	6.03	7.55	8.50	9.75	9.95	10.25	10.29	10.29	10.29
35,000	0.78	1.19	1.49	1.78	2.09	2.23	3.19	3.97	5.10	6.42	7.26	8.59	8.82	9.12	9.19	9.19	9.19
50,000	0.59	0.93	1.17	1.40	1.64	1.78	2.77	3.46	4.39	5.56	6.33	7.78	7.99	8.23	8.30	8.30	8.30
75,000	0.43	0.69	0.89	1.06	1.25	1.37	2.22	2.81	3.63	4.58	5.24	6.43	6.62	6.83	6.93	6.93	6.93
100,000	0.35	0.57	0.73	0.88	1.03	1.11	1.77	2.38	2.99	3.79	4.38	5.47	5.62	5.87	6.01	6.00	6.00
138,971	0.26	0.43	0.56	0.67	0.80	0.86	1.36	1.82	2.37	3.01	3.46	4.31	4.44	4.63	4.73	4.73	4.73



**SPAS 1431 Storm Center Mass Curve Zone 1**  
**May 7 (0700UTC) to May 12 (0600UTC), 1943**  
 Lat: 35.4792 Lon: -95.3292



**Total 120-hour Precipitation (Inches)**  
**May 7, 1943 0700 UTC - May 11, 1943 0600 UTC**  
**SPAS #1431**

Precipitation (Inches)	
0.19 - 1.00	8.01 - 9.00
1.01 - 2.00	9.01 - 10.00
2.01 - 3.00	10.01 - 11.00
3.01 - 4.00	11.01 - 12.00
4.01 - 5.00	12.01 - 13.00
5.01 - 6.00	13.01 - 14.00
6.01 - 7.00	14.01 - 15.00
7.01 - 8.00	15.01 - 16.00
	16.01 - 17.00
	17.01 - 18.00
	18.01 - 19.00
	19.01 - 20.00
	20.01 - 21.00
	21.01 - 22.00
	22.01 - 23.00
	23.01 - 24.00
	24.01 - 25.00
	25.01 - 26.00

- Stations**
- Daily
  - Hourly
  - Hourly Estimated
  - Hourly Pseudo
  - ◆ Supplemental
  - ◆ Supplemental Estimated

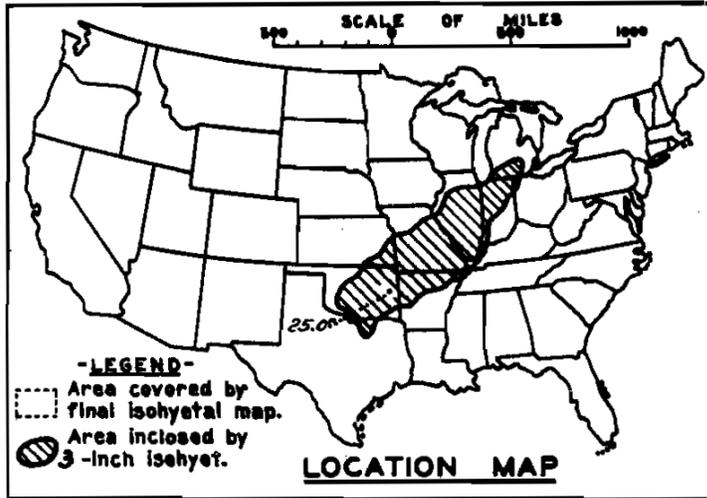


WJM 10/20/2014

DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 6-12 May 1943  
 Assignment SW 2-20  
 Location N. Texas to Great Lakes  
 Study Prepared by:  
 Southwestern Division  
 Tulsa District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 4-14-45  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 7-17-47  
 Remarks: Center at Warner,  
 Oklahoma  
 Dewpt. 70° - Ref. Pt. 225 SSE  
 Grid G-15

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:1,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	553
Form 5001-B (24-hour " " )-----	-
Form 5001-D ( " " " " )-----	178
Misc. precip. records, meteorological data, etc.-----	80
Form 5002 (Mass rainfall curves)-----	281

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	42
Form S-11 (Depth-area data from isohyetal map)-----	12
Form S-12 (Maximum depth-duration data)-----	12
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

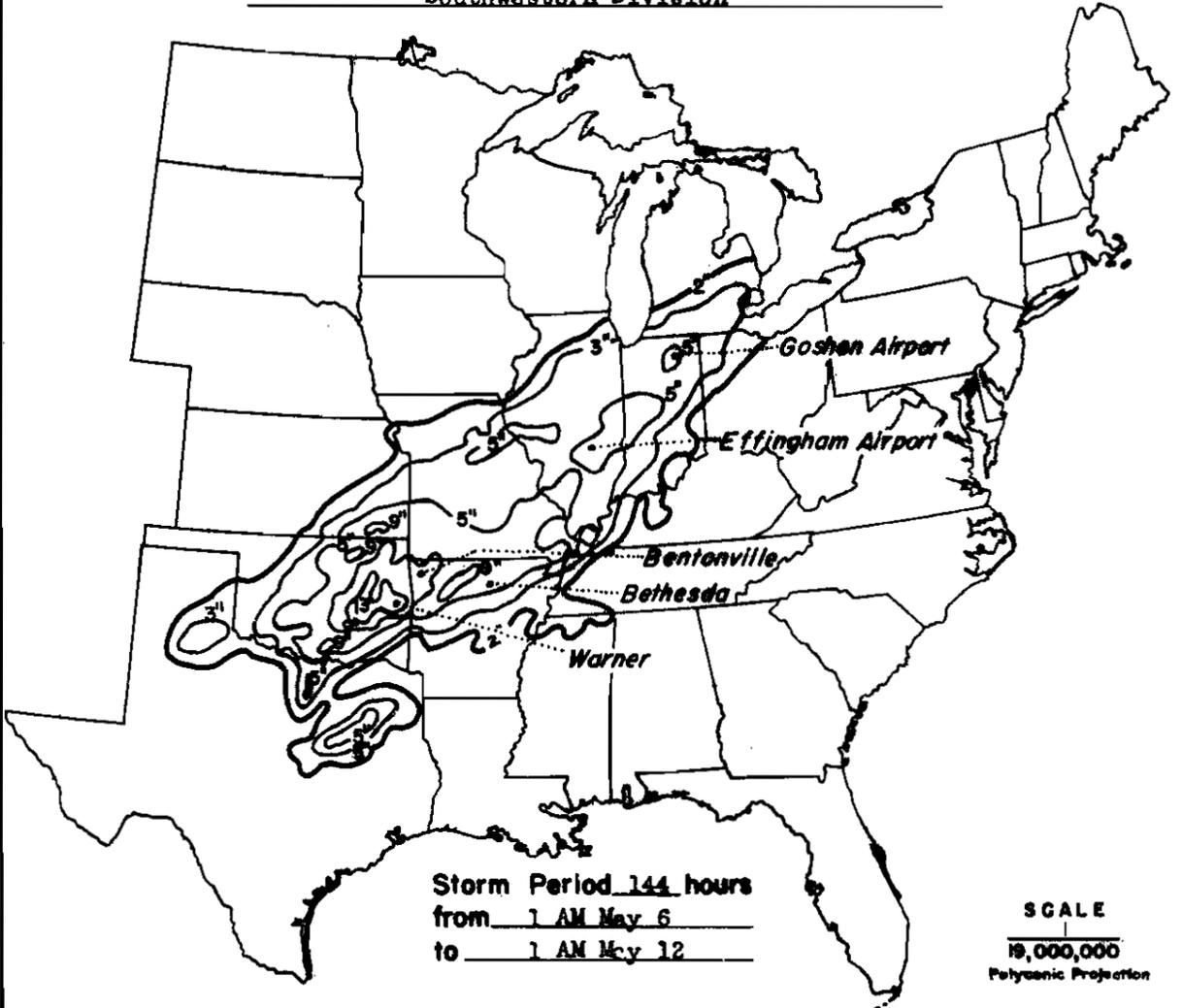
Area in Sq. Mi.	Duration of Rainfall in Hours										
	6	12	18	24	30	36	48	60	72	96	120/
Max. Station	10.0	12.5	15.0	17.6	20.0	21.8	24.6	25.0	25.0	25.0	25.0
10	9.9	12.3	14.6	17.2	19.5	21.5	24.4	24.9	24.9	24.9	24.9
100	8.7	10.8	12.4	14.9	17.1	19.3	21.8	22.5	22.5	22.5	22.5
200	7.4	9.5	11.4	13.8	16.0	18.3	20.6	21.3	21.3	21.3	21.3
500	5.4	7.6	10.0	12.3	14.5	16.7	18.6	19.4	19.4	19.4	19.4
1,000	4.3	6.3	9.0	11.1	13.3	15.4	17.1	18.0	18.0	18.0	18.0
2,000	3.6	5.4	8.0	9.9	12.1	14.0	15.5	16.5	16.5	16.5	16.5
5,000	3.0	4.5	6.8	8.3	10.5	12.1	13.4	14.4	14.4	14.4	14.4
10,000	2.6	3.9	5.8	7.2	9.1	10.4	11.7	12.6	12.6	12.8	12.8
20,000	2.1	3.3	4.9	6.1	7.6	8.7	10.0	10.7	10.8	11.1	11.1
50,000	1.6	2.5	3.7	4.6	5.7	6.5	7.7	8.1	8.3	8.8	8.9
100,000	1.1	1.9	2.7	3.4	4.2	4.9	5.8	6.2	6.4	7.0	7.3
212,000	0.6	1.1	1.7	2.2	2.6	3.0	3.7	4.2	4.4	5.0	5.5

DEPARTMENT OF THE ARMY

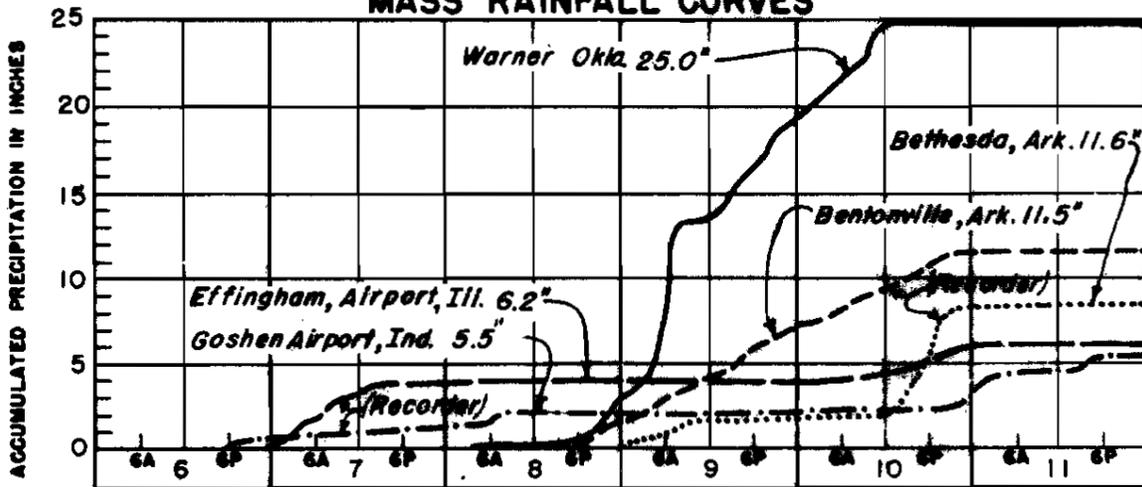
CORPS OF ENGINEERS

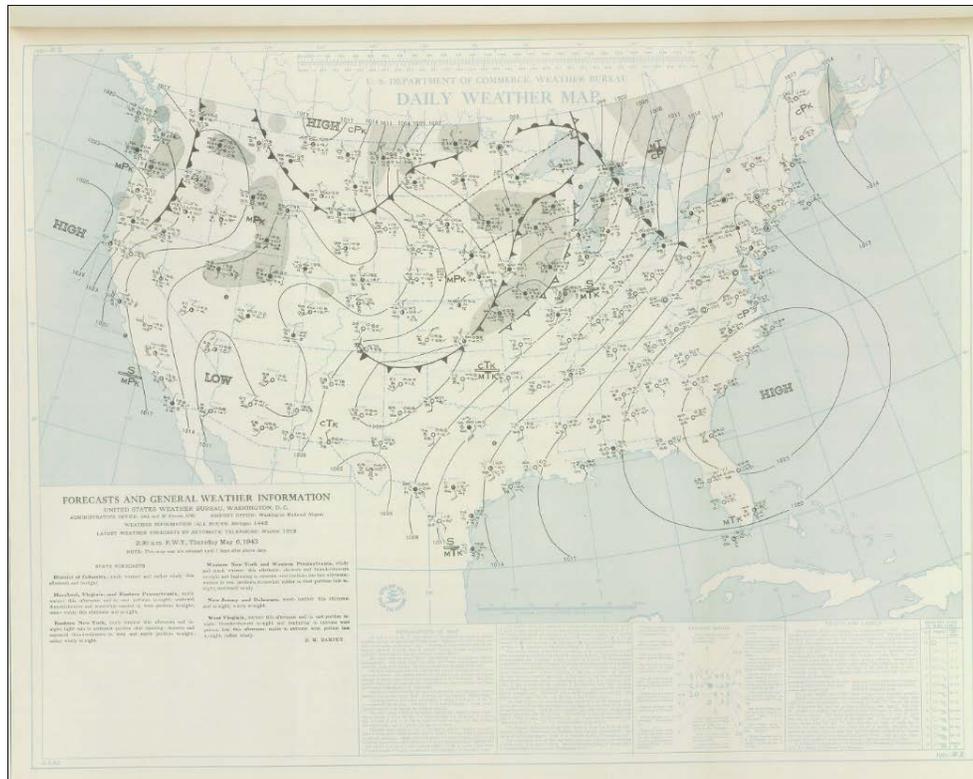
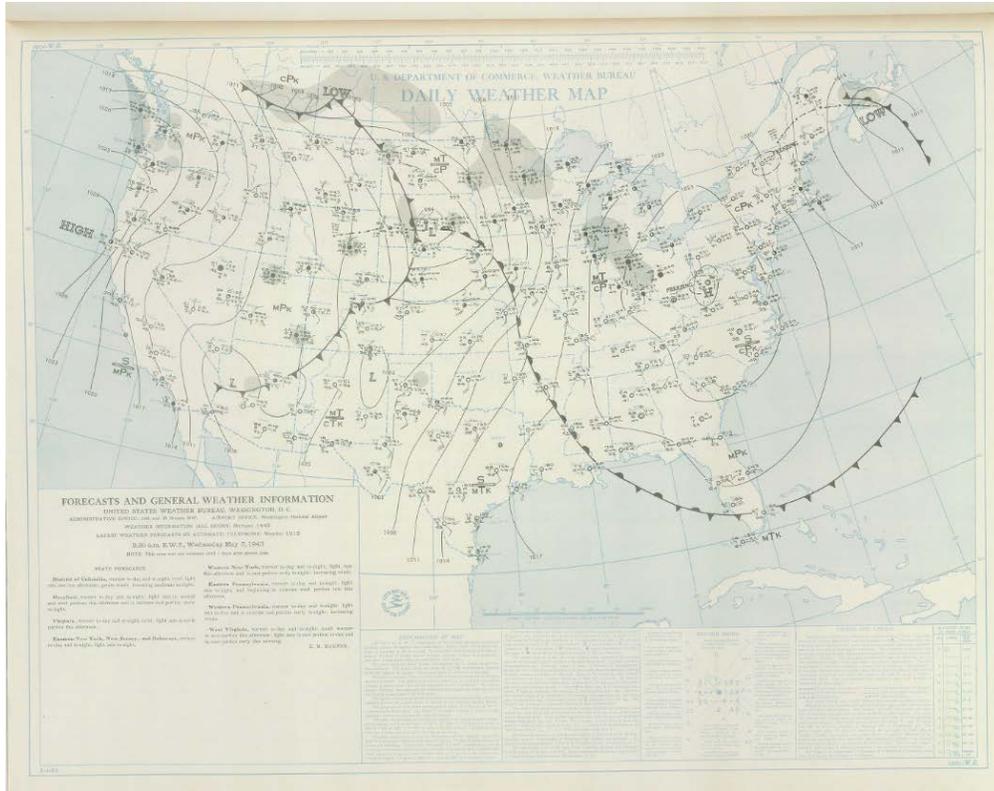
**STORM STUDIES - ISOHYETAL MAP**

Storm of 6-12 May 1943 Assignment SW 2-20  
 Study Prepared by: Tulsa, Okla. District  
Southwestern Division



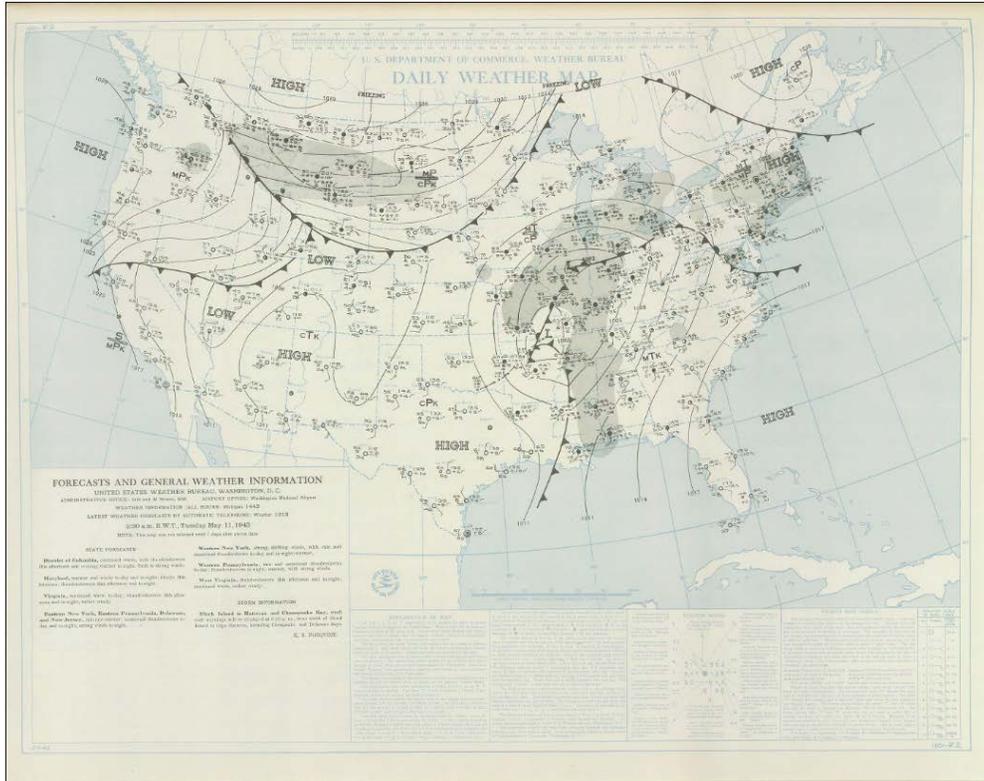
**MASS RAINFALL CURVES**



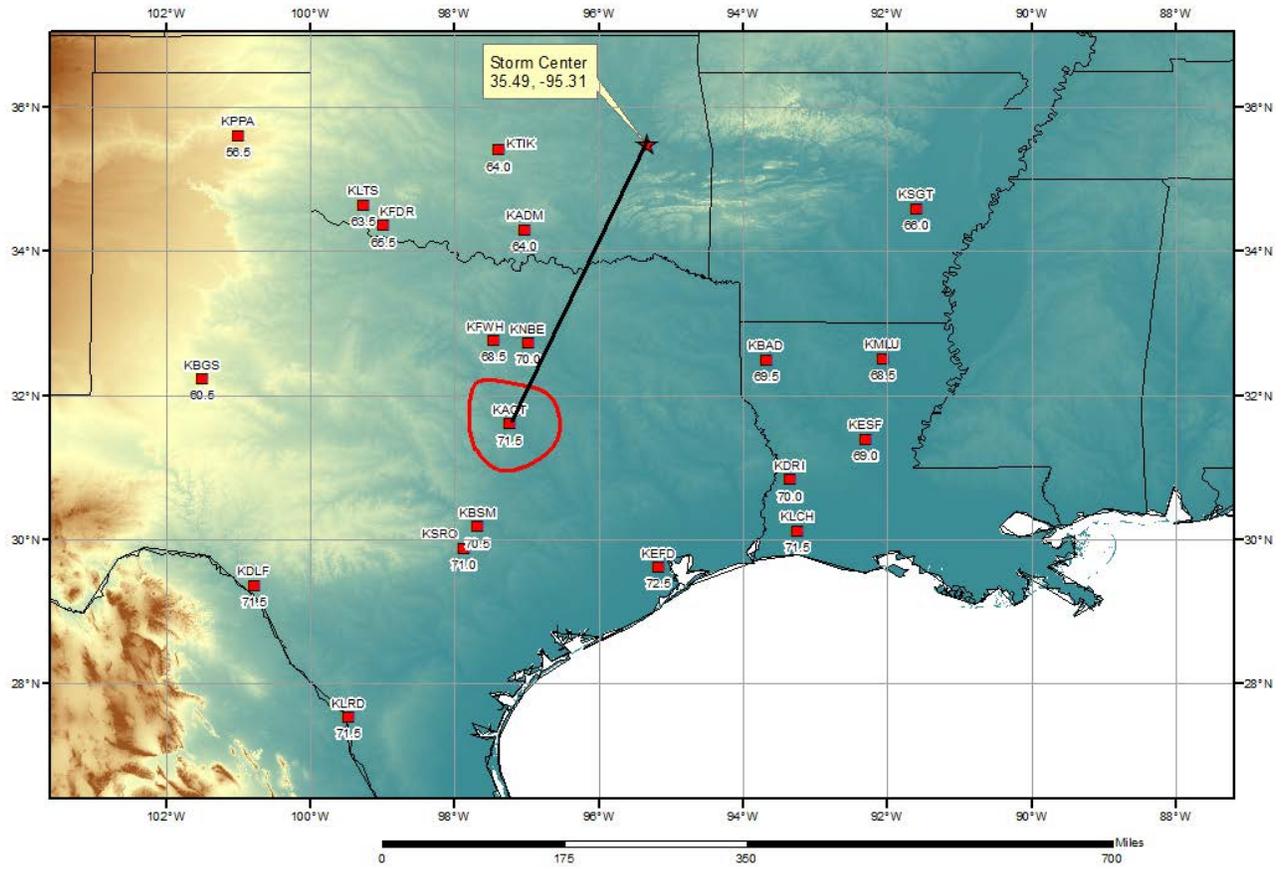






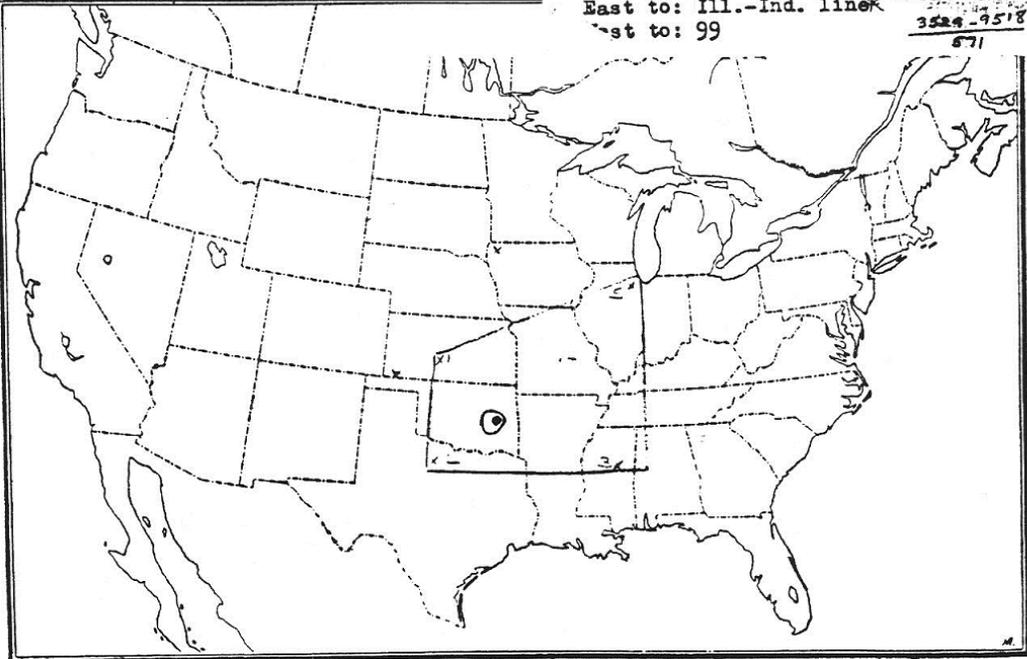


### Warner, OK Storm Analysis May 6-7, 1943



SW 2-20..May 6-11, 1943..Warner, Okla.  
12-hr. rfd 70(10th)..225 ~~225~~ to 76, 348  
North to: Chicago-St. Joseph line.  
South to: 32  
East to: Ill.-Ind. line  
West to: 99  
3524-9518  
671

See VA Myers  
Paper 1966  
Texas Water  
Dist Board



\* Justified to re 865 in Hypo # 30  
numbered

## Storm Precipitation Analysis System (SPAS) For Storm #1433\_1

**General Storm Location:** Collinsville, Illinois (40.0, -91.5, 36.9, -87.3)

**Storm Dates:** August 13 – August 16, 1946

**Event:** Extreme Precipitation Event

### DAD Zone 1

**Latitude:** 38.6708

**Longitude:** -90.0042

**Max. Grid rainfall amount:** 19.07”

**Max. Observed rainfall amount:** 19.07” (Collinsville, IL)

**Number of Stations:** 166

**SPAS Version:** 10.0

**Base Map Used:** Derived basemap based off of SPAS analysis

**Spatial resolution:** 0.2596

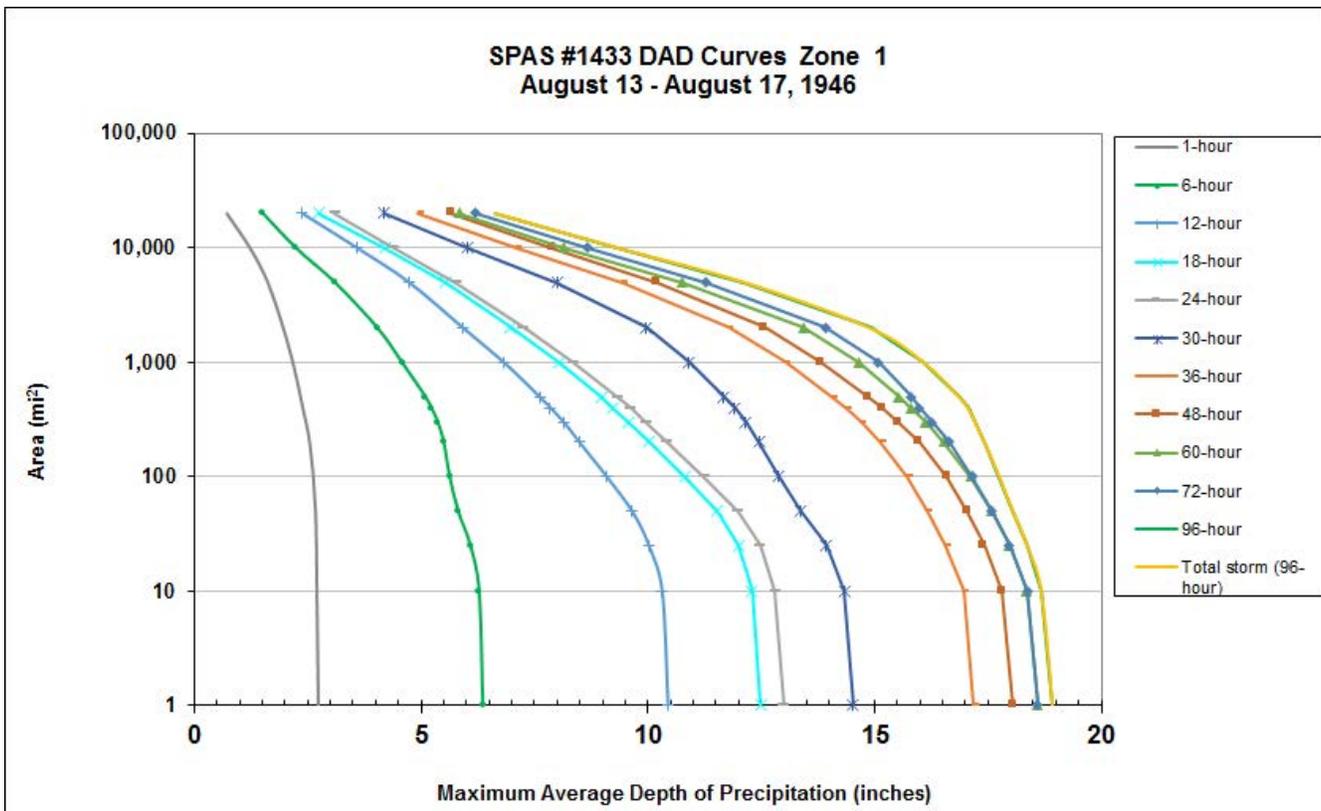
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

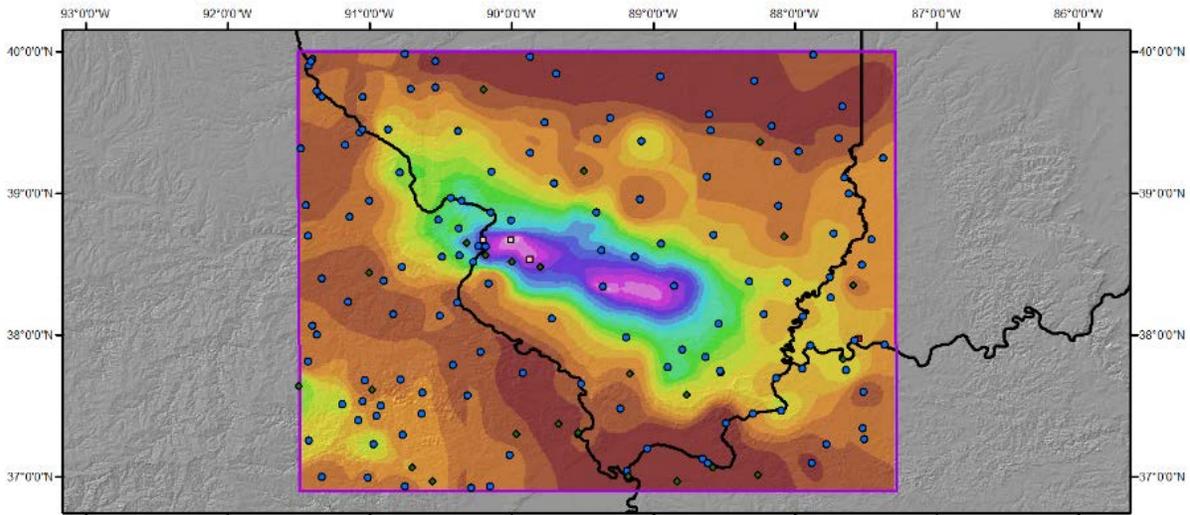
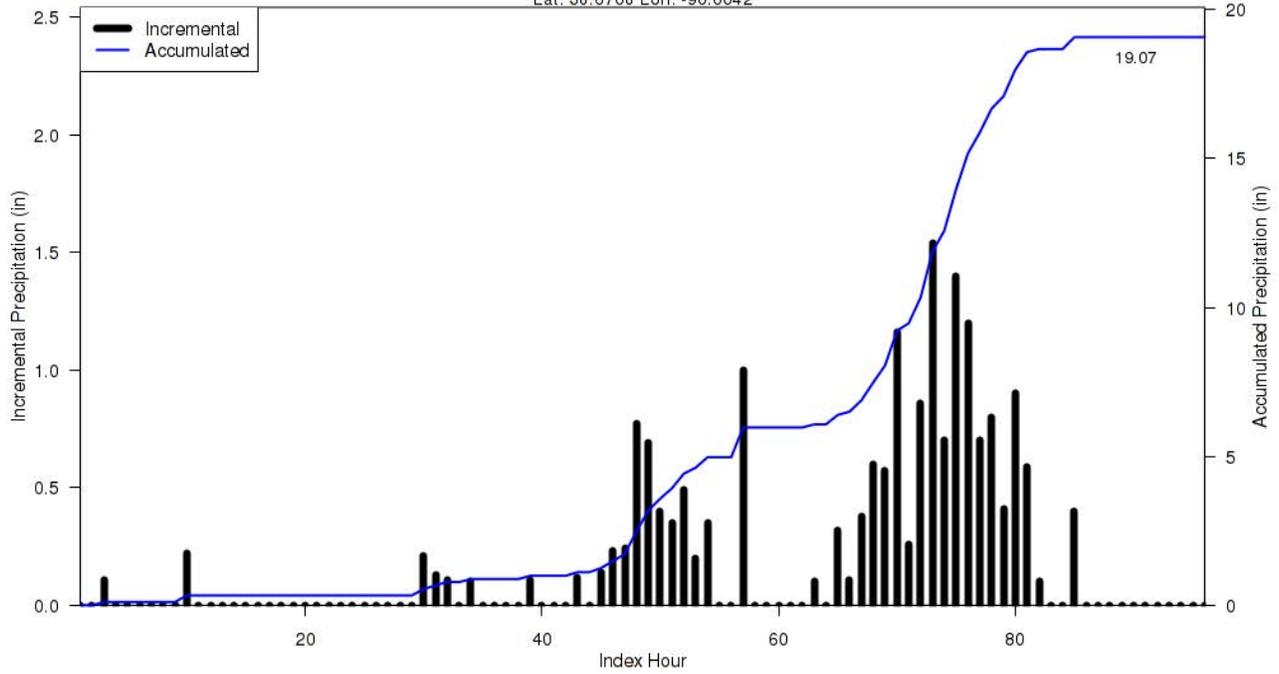
**Reliability of Results:** In addition to the NCDC stations, twenty-four supplemental stations were added to ensure data consistency. Due to the amount and integrity of the U.S. Army Corps of Engineers (USACE), three hourly stations were added based on the mass rainfall curves. Three hourly stations were also added from local climatology from NCDC. With the density of stations available and the consistency of the resulting SPAS analysis to the U.S. Army Corps of Engineers report, this analysis is deemed quite reliable.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1433_1	-90.004	38.671	567	600	76.00	2.99	0.16	74	2.830	80.41	80.5	3.68	0.18	83	3.500	1.237

Storm 1433 - August 13 (0700 UTC) - August 17 (0600 UTC), 1946												
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)												
Area (mi <sup>2</sup> )	Duration (hours)											Total
	1	6	12	18	24	30	36	48	60	72	96	
0.4	2.72	6.39	10.49	12.56	13.07	14.60	17.28	18.15	18.69	18.70	19.02	19.02
1	2.72	6.36	10.44	12.49	12.99	14.53	17.18	18.05	18.60	18.60	18.92	18.92
10	2.69	6.28	10.31	12.30	12.81	14.33	16.96	17.82	18.36	18.37	18.67	18.67
25	2.68	6.09	10.02	12.00	12.47	13.94	16.56	17.42	17.97	17.97	18.36	18.36
50	2.66	5.82	9.65	11.54	11.99	13.38	16.16	17.04	17.58	17.59	18.05	18.05
100	2.61	5.63	9.09	10.81	11.23	12.89	15.72	16.59	17.12	17.16	17.75	17.75
200	2.53	5.50	8.49	10.04	10.42	12.46	15.14	15.98	16.53	16.64	17.42	17.42
300	2.45	5.37	8.14	9.56	9.95	12.16	14.70	15.52	16.13	16.26	17.21	17.21
400	2.38	5.23	7.85	9.22	9.61	11.91	14.36	15.16	15.80	15.99	17.06	17.06
500	2.33	5.10	7.61	8.97	9.33	11.67	14.05	14.86	15.54	15.81	16.86	16.86
1,000	2.16	4.58	6.82	8.03	8.34	10.91	13.02	13.82	14.65	15.08	16.08	16.08
2,000	1.95	4.04	5.92	6.97	7.25	9.96	11.78	12.57	13.42	13.91	14.90	14.90
5,000	1.61	3.10	4.73	5.55	5.77	8.00	9.44	10.21	10.76	11.28	12.14	12.14
10,000	1.22	2.24	3.58	4.21	4.39	6.04	7.12	7.90	8.15	8.68	9.35	9.35
20,000	0.71	1.51	2.37	2.75	3.09	4.18	4.94	5.66	5.84	6.21	6.64	6.64



SPAS 1433 Storm Center Mass Curve Zone 1  
 August 13 (0700UTC) to August 17 (0600UTC), 1946  
 Lat: 38.6708 Lon: -90.0042



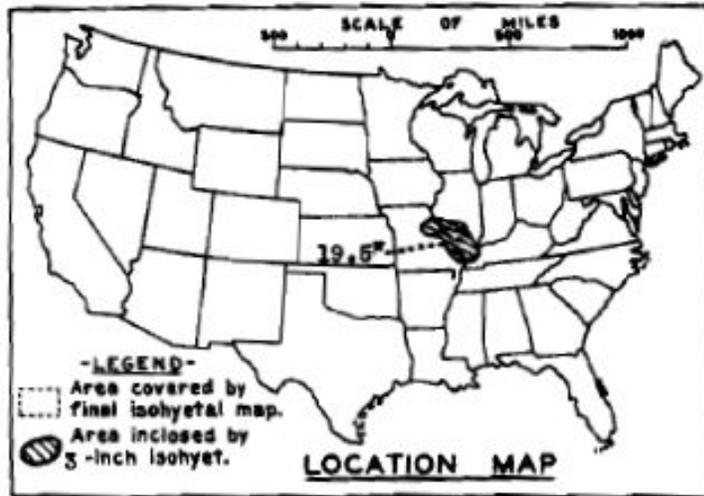
**Total 96-hour Precipitation (Inches)**  
 August 13, 1946 0700 UTC - August 16, 1946 0600 UTC  
 SPAS #1433

Precipitation (Inches)			Stations
0.10 - 1.00	4.01 - 5.00	9.01 - 10.00	● Daily
1.01 - 2.00	5.01 - 6.00	10.01 - 11.00	■ Hourly
2.01 - 3.00	6.01 - 7.00	11.01 - 12.00	□ Hourly Estimated
3.01 - 4.00	7.01 - 8.00	12.01 - 13.00	◆ Supplemental
	8.01 - 9.00	13.01 - 14.00	
		14.01 - 15.00	
		15.01 - 16.00	
		16.01 - 17.00	
		17.01 - 18.00	
		18.01 - 19.00	
		19.01 - 20.00	

Scale: 0 15 30 60 Miles

WJM 10/27/2014

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 12-16 August 1946  
 Assignment MR 7-2B  
 Location Mo., Ill., Ind. & Ky.  
 Study Prepared by:  
 Upper Mississippi Valley  
 Division  
 St. Louis District

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 3/8/49  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 3/20/50  
 Remarks: Center near  
 Collinsville, Ill.  
 Dept. 74<sup>o</sup> Ref. Pt. 225 S  
 Grid F-12

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1: 1,000,000  
 Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	58
Form 5001-B (24-hour " " )-----	—
Form 5001-D ( " " " " )-----	16
Miscl. precip. records, meteorological data, etc.-----	15
Form 5002 (Mass rainfall curves)-----	44

**PART II**

Final isohyetal maps, in 1 sheet, scale 1: 1,000,000  
 Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	5
Form S-11 (Depth-area data from isohyetal map)-----	3
Form S-12 (Maximum depth-duration data)-----	7
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours										
	6	12	18	24	30	36	48	60	72	96	114
Max. Sta.	6.4	10.2	12.6	12.7	14.1	18.0	18.1	18.6	18.7	19.4	19.5
10	6.0	9.8	12.1	12.1	13.7	17.5	17.6	18.3	18.3	18.9	19.0
100	5.6	8.8	10.9	11.1	13.2	16.6	16.7	17.5	17.6	18.0	18.1
200	5.4	8.3	10.5	10.6	13.0	16.2	16.3	17.2	17.3	17.7	17.8
500	5.2	7.7	9.7	9.9	12.8	15.5	15.6	16.7	16.9	17.1	17.2
1,000	4.9	7.0	8.9	9.0	12.6	14.7	14.8	15.9	16.0	16.3	16.4
2,000	4.3	6.1	7.6	7.8	11.2	13.3	13.4	14.3	14.3	14.6	14.7
5,000	3.3	4.8	5.9	6.0	8.6	10.4	10.6	11.3	11.4	11.6	11.8
10,000	2.4	3.7	4.5	4.6	6.6	8.0	8.2	8.7	8.8	9.0	9.1
20,000	1.5	2.5	3.1	3.2	4.5	5.6	5.8	6.0	6.1	6.3	6.5
20,400	1.5	2.5	3.1	3.2	4.5	5.5	5.7	6.0	6.1	6.3	6.4

DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - ISOHYETAL MAP**

Storm of 12-16 August 1946

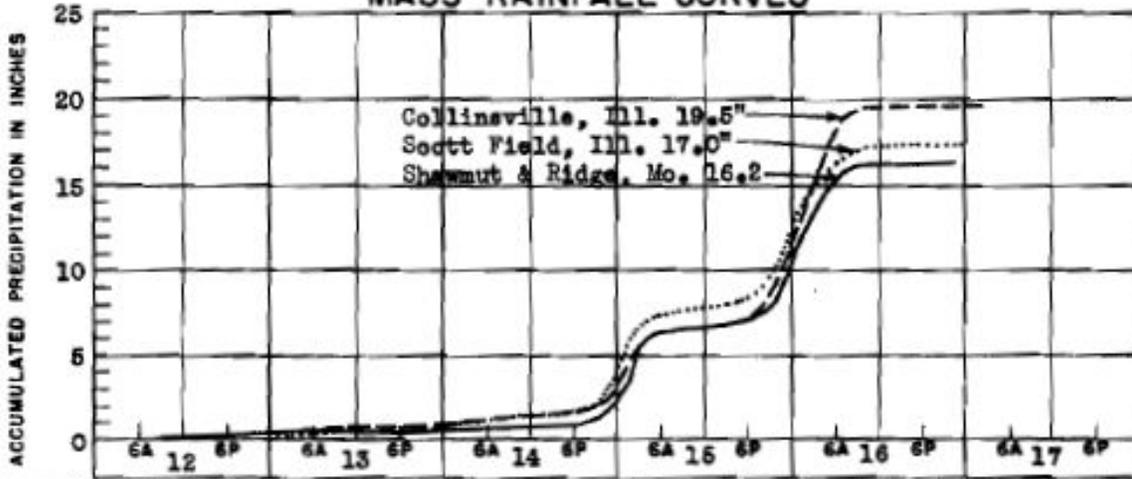
Assignment MR 7-2B

Study Prepared by: St. Louis, Mo. District

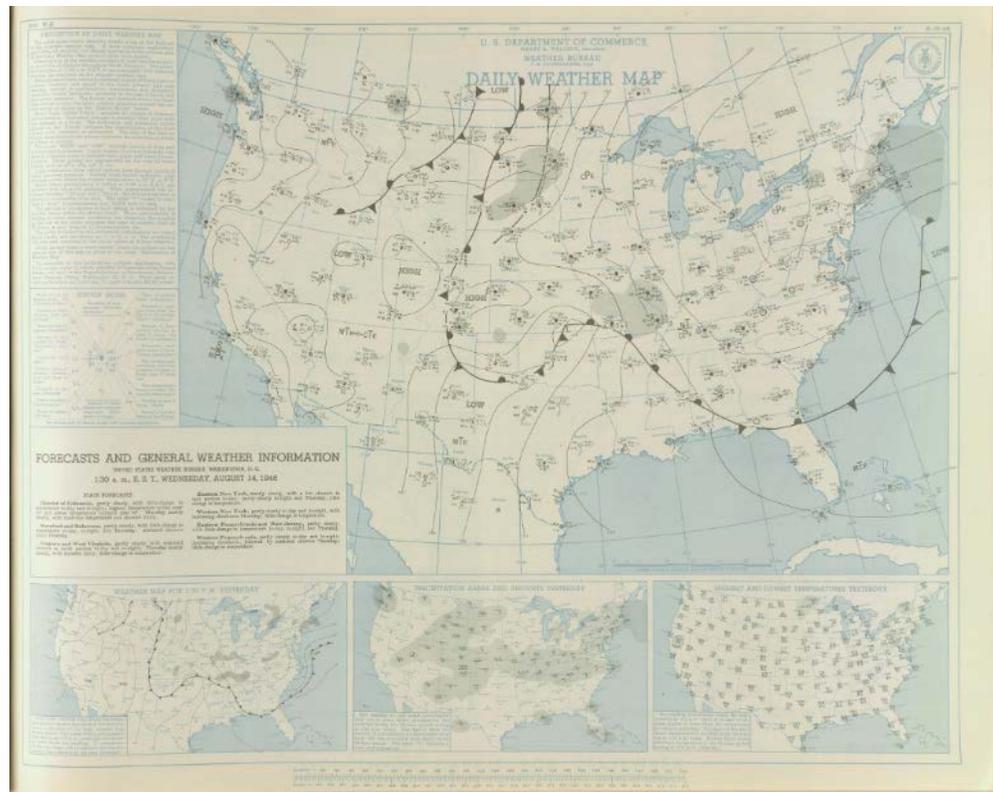
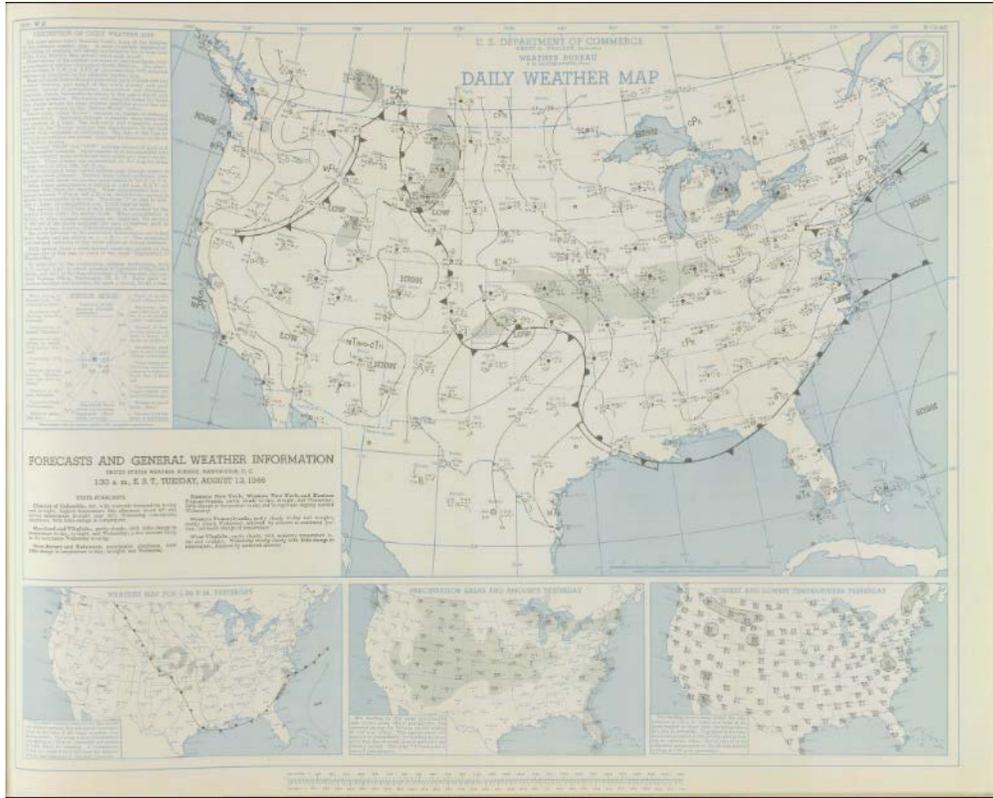
Upper Mississippi Valley Division

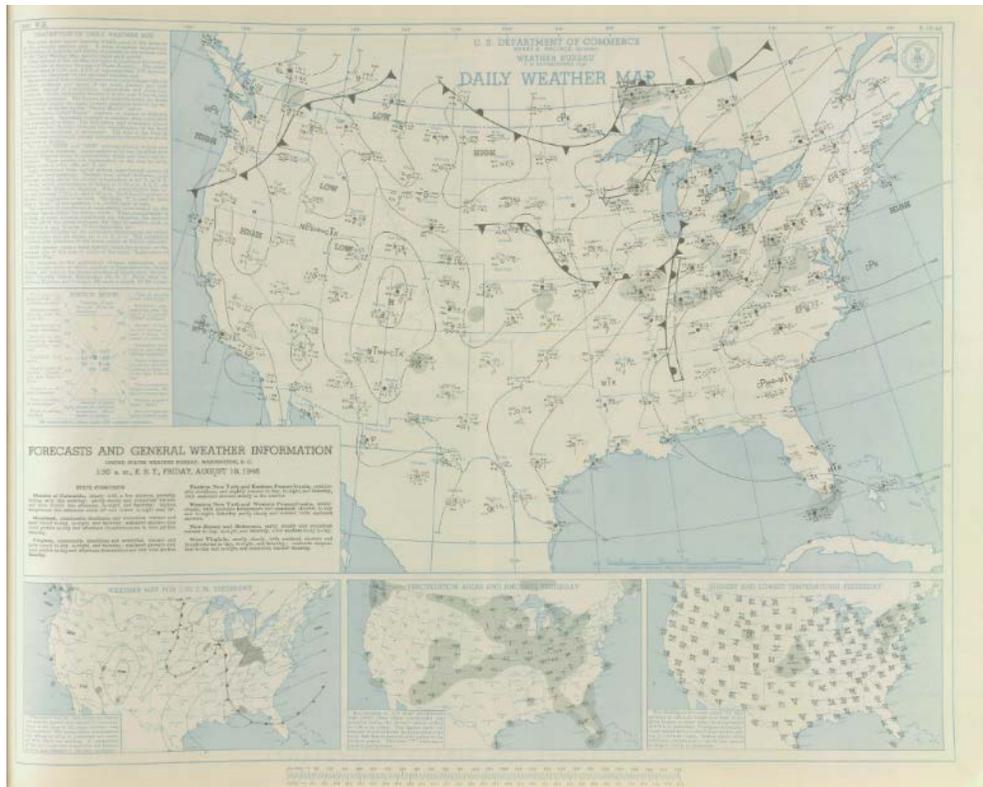
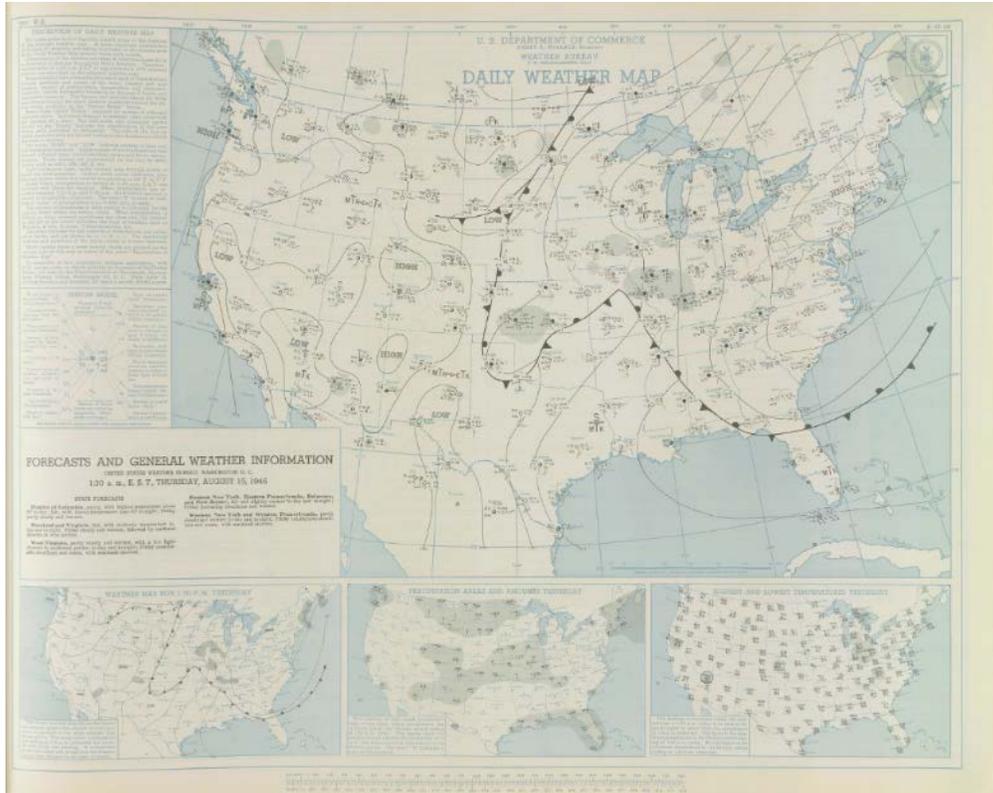


**MASS RAINFALL CURVES**

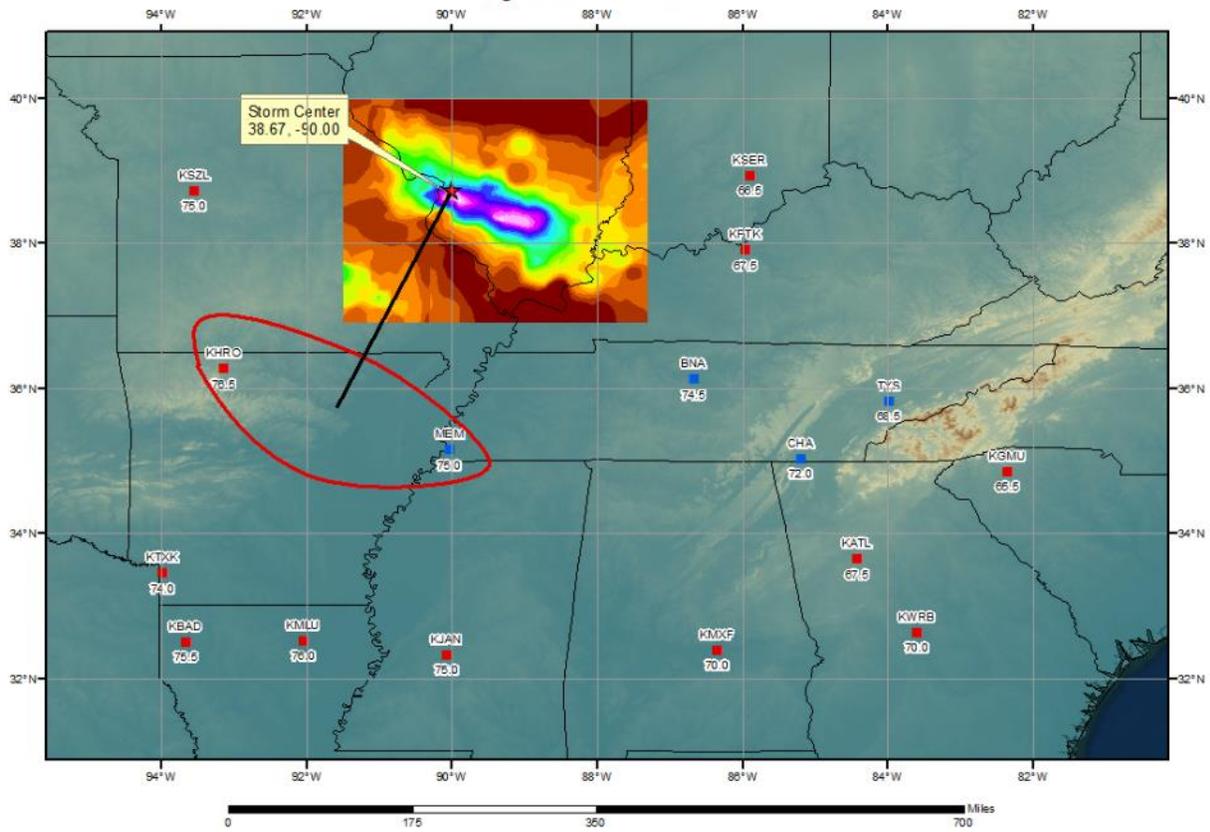






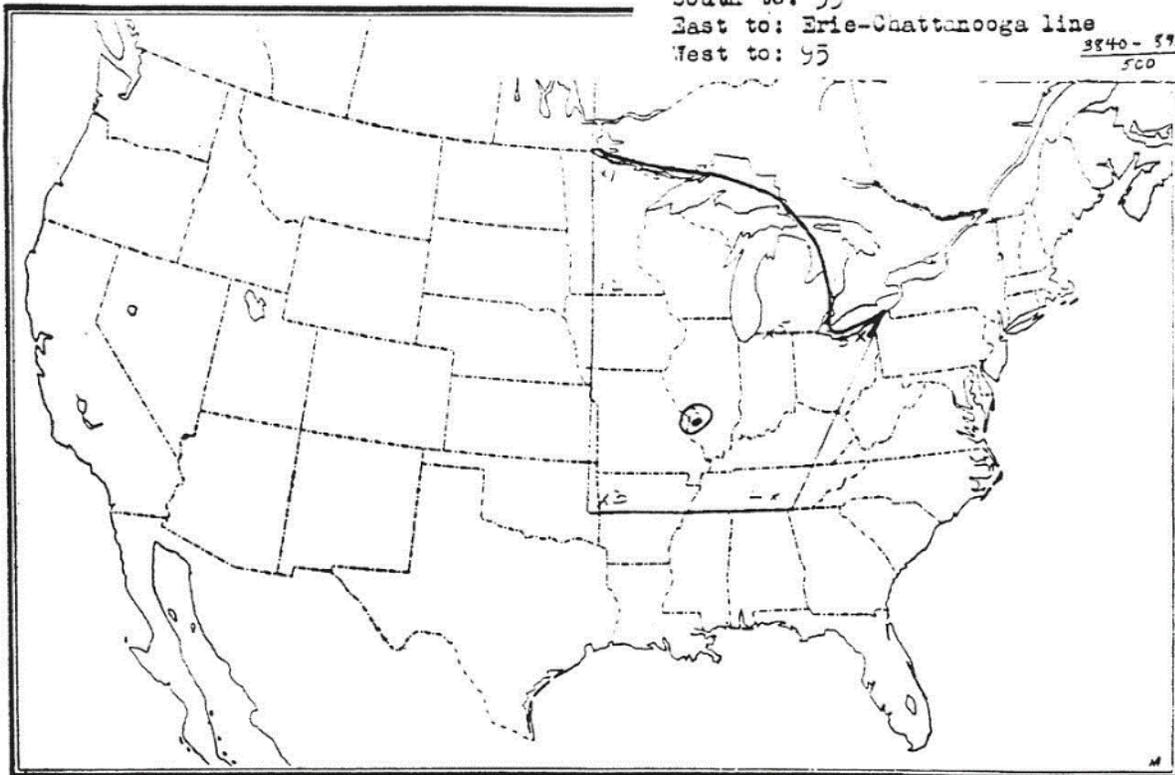


### SPAS 1433 Collinsville, IL Storm Analysis August 14-15, 1946



MR 7-2B.. Aug. 12-16, 1946.. Collinsville.  
12-hr. rTd 74.. 225 S.. to 78, 21 1/2  
North to border  
South to: 35  
East to: Erie-Chatanooga line  
West to: 95

3840 - 595  
500



## Storm Precipitation Analysis System (SPAS) For Storm #1583\_1

**General Storm Location:** Kansas, Oklahoma, Nebraska, Colorado, Iowa, Missouri, Arkansas (42.0, -103.4, 36.0, -91.5)

**Storm Dates:** July 9-13, 1951 (120-hours)

**Event:** Hurricane Georges

### DAD Zone 1

**Latitude:** 38.65

**Longitude:** -96.62

**Max. Grid rainfall amount:** 18.56”

**Max. Observed rainfall amount:** 18.50”

**Number of Stations:** 985

**SPAS Version:** 10

**Base Map Used:** conus\_prism\_ppt\_in\_1971\_2000\_07

**Spatial resolution:** 00:00:30

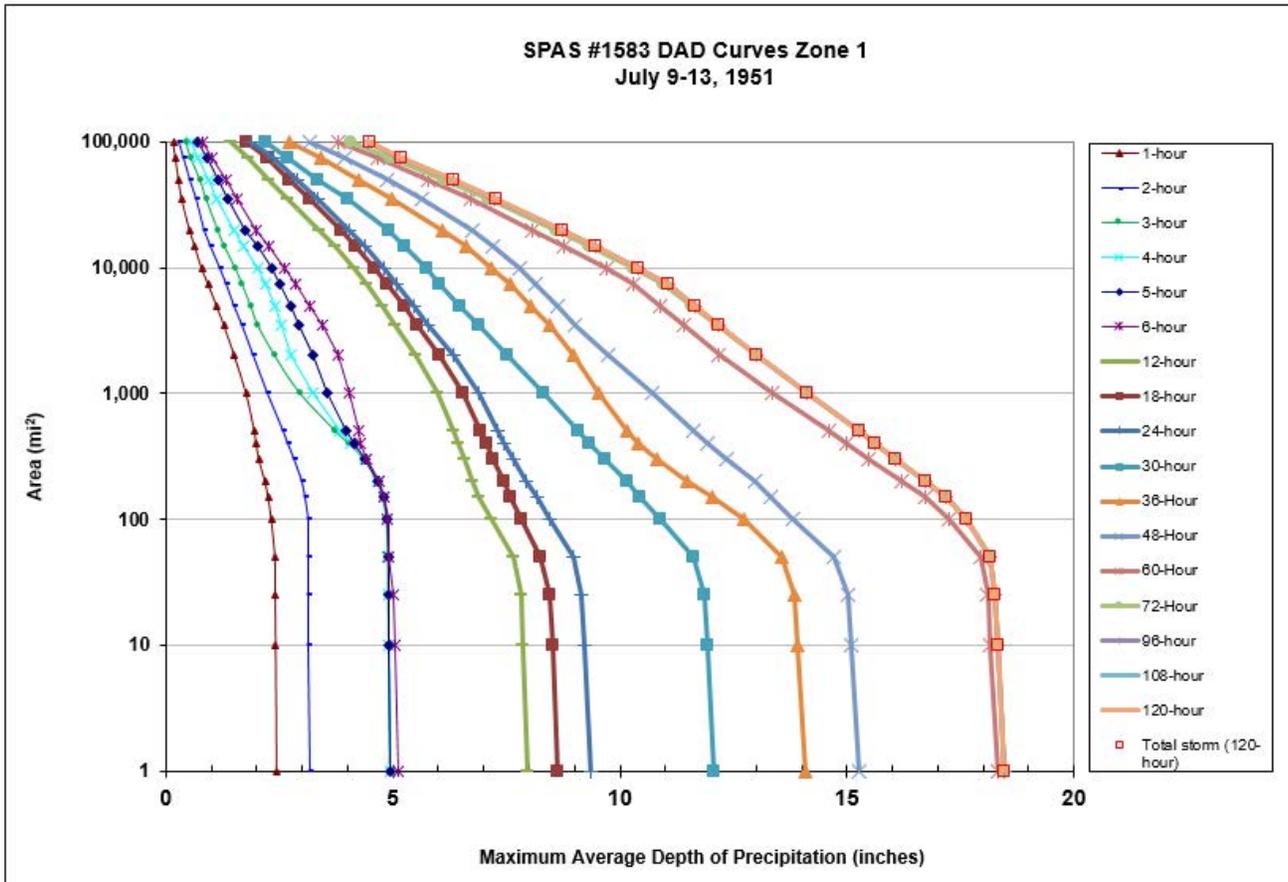
**Radar Included:** No

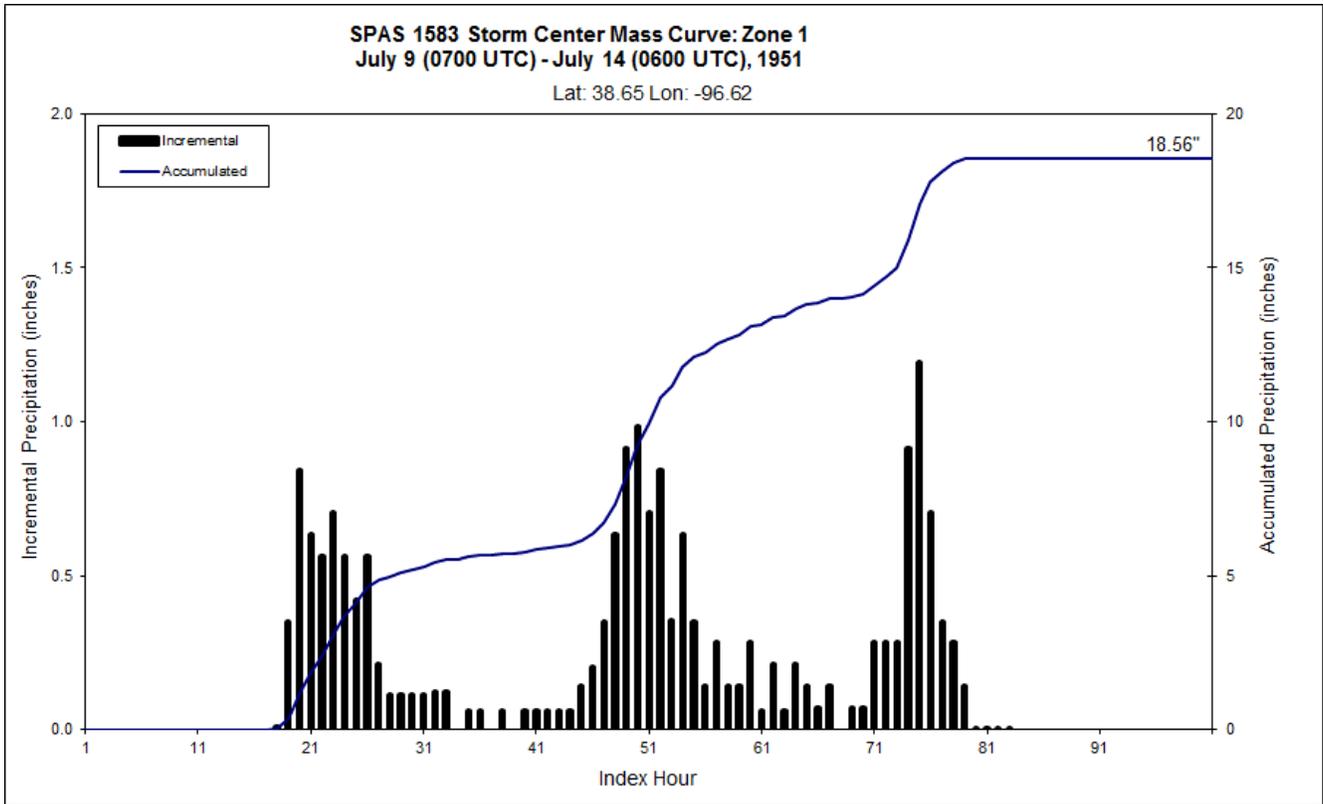
**Depth-Area-Duration (DAD) analysis:** Yes

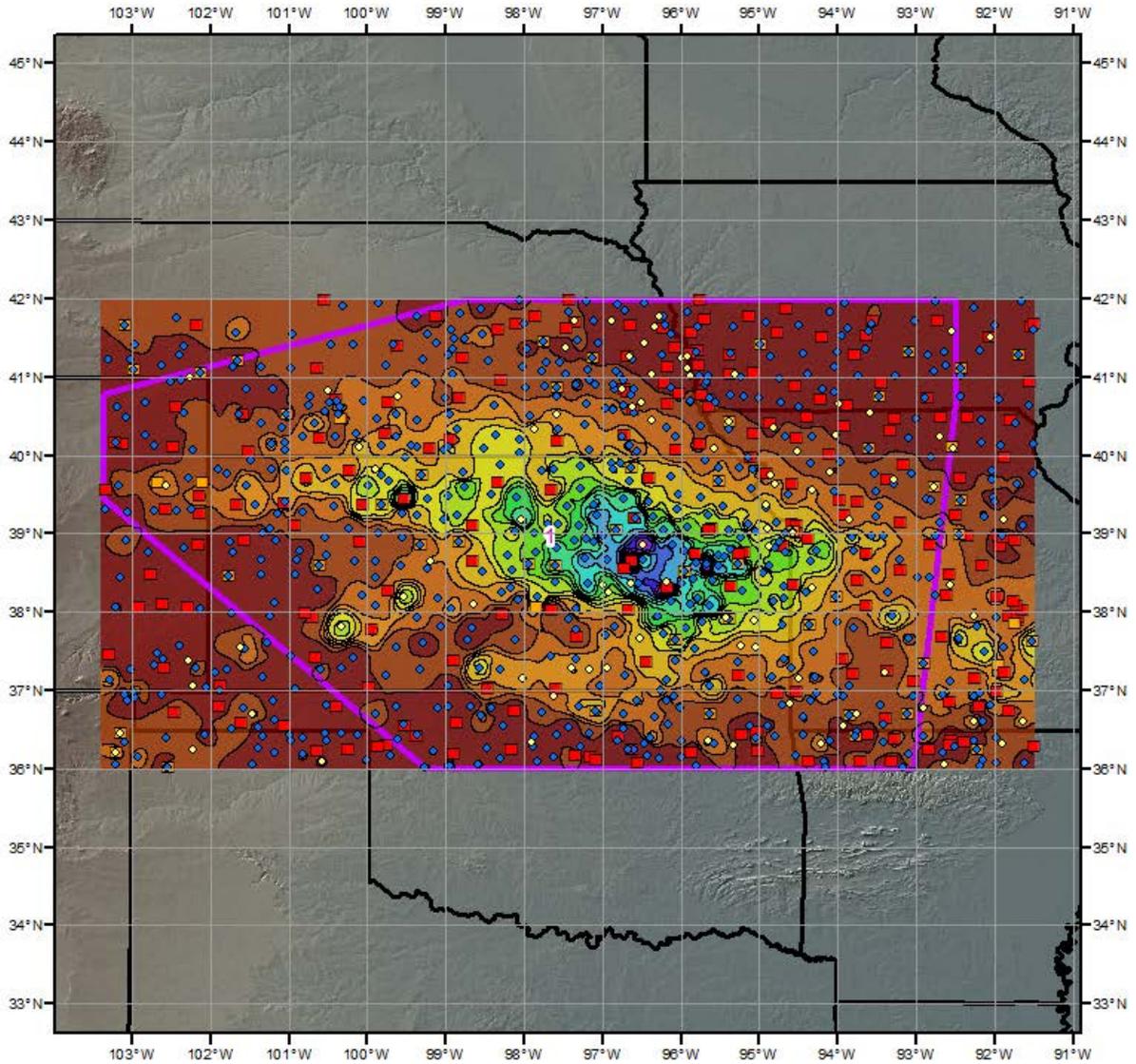
**Reliability of Results:** This analysis was based on hourly data (H), hourly pseudo data (HP), daily data (D) and supplemental data (S). We have a high degree of confidence in the station based storm total results. The spatial pattern is dependent on basemap, and the timing is based on hourly and hourly pseudo stations.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1583_1	-96.621	38.646	1,434	1,400	75.00	2.85	0.34	72	2.510	80.70	80.5	3.68	0.42	83	3.260	1.299

Storm 1583 Zone 1 - Jul. 9 (0700 UTC) - Jul. 14 (0600 UTC), 1951																		
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																		
areasqmi	Duration (hours)																	
	1	2	3	4	5	6	12	18	24	30	36	48	60	72	96	108	120	Total
0.4	2.44	3.18	4.94	4.96	4.96	5.11	7.97	8.62	9.35	12.11	14.14	15.33	18.38	18.56	18.56	18.56	18.56	18.56
1	2.44	3.17	4.93	4.95	4.95	5.11	7.96	8.61	9.34	12.07	14.09	15.28	18.32	18.47	18.47	18.47	18.47	18.47
10	2.42	3.15	4.90	4.92	4.92	5.04	7.86	8.51	9.21	11.93	13.92	15.10	18.16	18.31	18.31	18.31	18.31	18.31
25	2.41	3.15	4.89	4.90	4.91	5.01	7.83	8.47	9.16	11.87	13.85	15.03	18.10	18.24	18.24	18.24	18.24	18.24
50	2.40	3.14	4.88	4.89	4.90	4.90	7.64	8.26	8.96	11.61	13.56	14.70	17.96	18.14	18.14	18.14	18.14	18.14
100	2.32	3.12	4.85	4.88	4.88	4.89	7.17	7.83	8.45	10.89	12.73	13.79	17.26	17.63	17.63	17.63	17.63	17.63
150	2.25	3.07	4.76	4.79	4.79	4.80	6.88	7.59	8.17	10.45	12.02	13.31	16.71	17.17	17.17	17.17	17.17	17.17
200	2.18	2.99	4.65	4.67	4.67	4.69	6.75	7.43	7.94	10.16	11.49	12.96	16.22	16.71	16.72	16.72	16.72	16.72
300	2.05	2.81	4.36	4.37	4.38	4.43	6.58	7.20	7.64	9.67	10.80	12.35	15.48	16.05	16.06	16.06	16.06	16.06
400	1.99	2.68	4.03	4.06	4.15	4.29	6.44	7.05	7.45	9.32	10.39	11.92	14.99	15.60	15.61	15.61	15.61	15.61
500	1.95	2.57	3.74	3.84	3.98	4.24	6.33	6.93	7.31	9.07	10.15	11.60	14.60	15.25	15.26	15.26	15.26	15.26
1,000	1.77	2.22	2.96	3.24	3.54	4.05	5.98	6.54	6.89	8.33	9.52	10.70	13.35	14.11	14.12	14.12	14.12	14.12
2,000	1.51	1.92	2.40	2.75	3.25	3.80	5.50	6.03	6.34	7.52	8.98	9.75	12.19	13.00	13.02	13.02	13.02	13.02
3,500	1.28	1.68	2.03	2.56	2.94	3.45	5.06	5.55	5.78	6.88	8.47	9.00	11.41	12.14	12.18	12.18	12.18	12.18
5,000	1.12	1.51	1.87	2.42	2.75	3.18	4.77	5.26	5.46	6.47	8.04	8.64	10.87	11.59	11.64	11.64	11.64	11.64
7,500	0.93	1.31	1.68	2.20	2.50	2.87	4.41	4.86	5.09	6.02	7.59	8.15	10.28	10.94	11.05	11.05	11.05	11.05
10,000	0.79	1.18	1.53	2.02	2.32	2.61	4.15	4.60	4.80	5.73	7.17	7.80	9.69	10.31	10.41	10.41	10.41	10.41
15,000	0.64	0.97	1.29	1.71	2.01	2.25	3.71	4.17	4.38	5.25	6.60	7.19	8.76	9.33	9.46	9.47	9.47	9.47
20,000	0.53	0.84	1.15	1.49	1.76	2.00	3.37	3.85	4.05	4.90	6.09	6.75	8.08	8.60	8.72	8.73	8.73	8.73
35,000	0.36	0.65	0.90	1.13	1.36	1.56	2.69	3.17	3.34	4.00	4.99	5.64	6.70	7.11	7.24	7.26	7.26	7.26
50,000	0.29	0.54	0.76	0.95	1.14	1.32	2.27	2.72	2.89	3.35	4.25	4.89	5.77	6.11	6.32	6.34	6.34	6.34
75,000	0.22	0.39	0.56	0.70	0.90	1.03	1.82	2.23	2.36	2.68	3.42	3.92	4.66	4.94	5.16	5.18	5.18	5.18
100,000	0.17	0.30	0.45	0.56	0.69	0.81	1.43	1.79	1.90	2.19	2.73	3.18	3.81	4.08	4.45	4.47	4.48	4.48
200,207	0.09	0.16	0.23	0.30	0.38	0.44	0.79	0.99	1.06	1.29	1.53	1.79	2.20	2.38	2.66	2.67	2.68	2.68







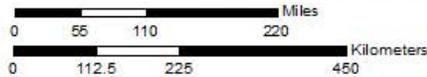
**Total Storm (120-hours) Precipitation (inches)**

**July 9-13, 1951**

**SPAS 1583 Council Grove, KS (MR 10-2)**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Pseudo
- ◇ Supplemental



**Precipitation (inches)**

0.01 - 1.00	5.01 - 6.00	10.01 - 11.00	15.01 - 16.00
1.01 - 2.00	6.01 - 7.00	11.01 - 12.00	16.01 - 17.00
2.01 - 3.00	7.01 - 8.00	12.01 - 13.00	17.01 - 18.00
3.01 - 4.00	8.01 - 9.00	13.01 - 14.00	18.01 - 19.00
4.01 - 5.00	9.01 - 10.00	14.01 - 15.00	

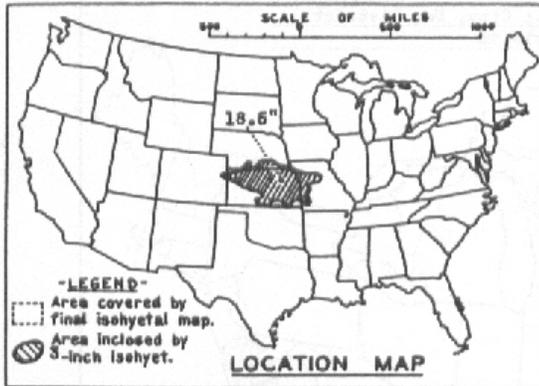


3/9/2016

DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 9-13 July 1951  
 Assignment MR 10-2  
 Location Kans., Nebr. Mo.  
 Study Prepared by:  
 Missouri River Division  
 Kansas City District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 10/29/51  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 12/10/52  
 Remarks: Center near  
 Council Grove, Kans.  
 Dewpt. 73°F-Ref.Pt. 205 SSW  
 Grid F-16

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1: 1,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	78
Form 5001-B (24-hour " " " " ).....	-
Form 5001-D ( " " " " " ).....	2
Misc. precip. records, meteorological data, etc.....	151
Form 5002 (Mass rainfall curves).....	61

**PART II**

Final isohyetal maps, in 1 sheet, scale 1: 1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	7
Form S-11 (Depth-area data from isohyetal map).....	2
Form S-12 (Maximum depth-duration data).....	11
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	6

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours										
	6	12	18	24	30	36	48	60	72	96	108
Max. Station	5.8	7.5	8.2	9.3	13.1	13.5	14.4	17.9	18.5	18.5	18.5
10	5.3	7.0	7.9	8.6	11.8	13.1	14.3	17.2	18.2	18.2	18.2
100	4.7	6.4	7.4	7.9	10.6	12.4	13.8	16.3	17.5	17.5	17.5
200	4.6	6.2	7.2	7.5	10.2	12.0	13.3	15.9	17.0	17.0	17.0
500	4.3	5.8	6.7	7.0	9.5	11.3	12.4	15.0	16.2	16.2	16.2
1,000	4.0	5.5	6.3	6.6	9.0	10.5	11.5	14.2	15.5	15.5	15.5
2,000	3.8	5.1	5.9	6.2	8.3	9.6	10.5	13.1	14.6	14.6	14.6
5,000	3.4	4.5	5.1	5.4	7.2	8.4	9.3	11.7	13.0	13.1	13.1
10,000	2.9	3.9	4.4	4.8	6.2	7.3	8.2	10.4	11.4	11.5	11.5
20,000	2.4	3.2	3.7	4.1	5.1	6.1	6.9	8.6	9.4	9.6	9.6
50,000	1.3	2.0	2.5	2.8	3.4	4.0	4.7	5.8	6.3	6.5	6.5
57,000	1.1	1.7	2.3	2.5	3.0	3.8	4.4	5.4	5.9	6.0	6.0

Form S-2

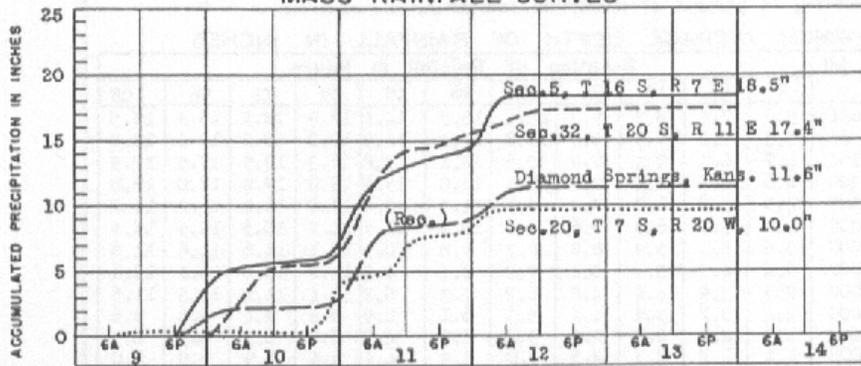
DEPARTMENT OF THE ARMY CORPS OF ENGINEERS

**STORM STUDIES - ISOHYETAL MAP**

Storm of 9-13 July 1951 Assignment MR 10-2  
 Study Prepared by: Kansas City, Mo. District  
Missouri River Division

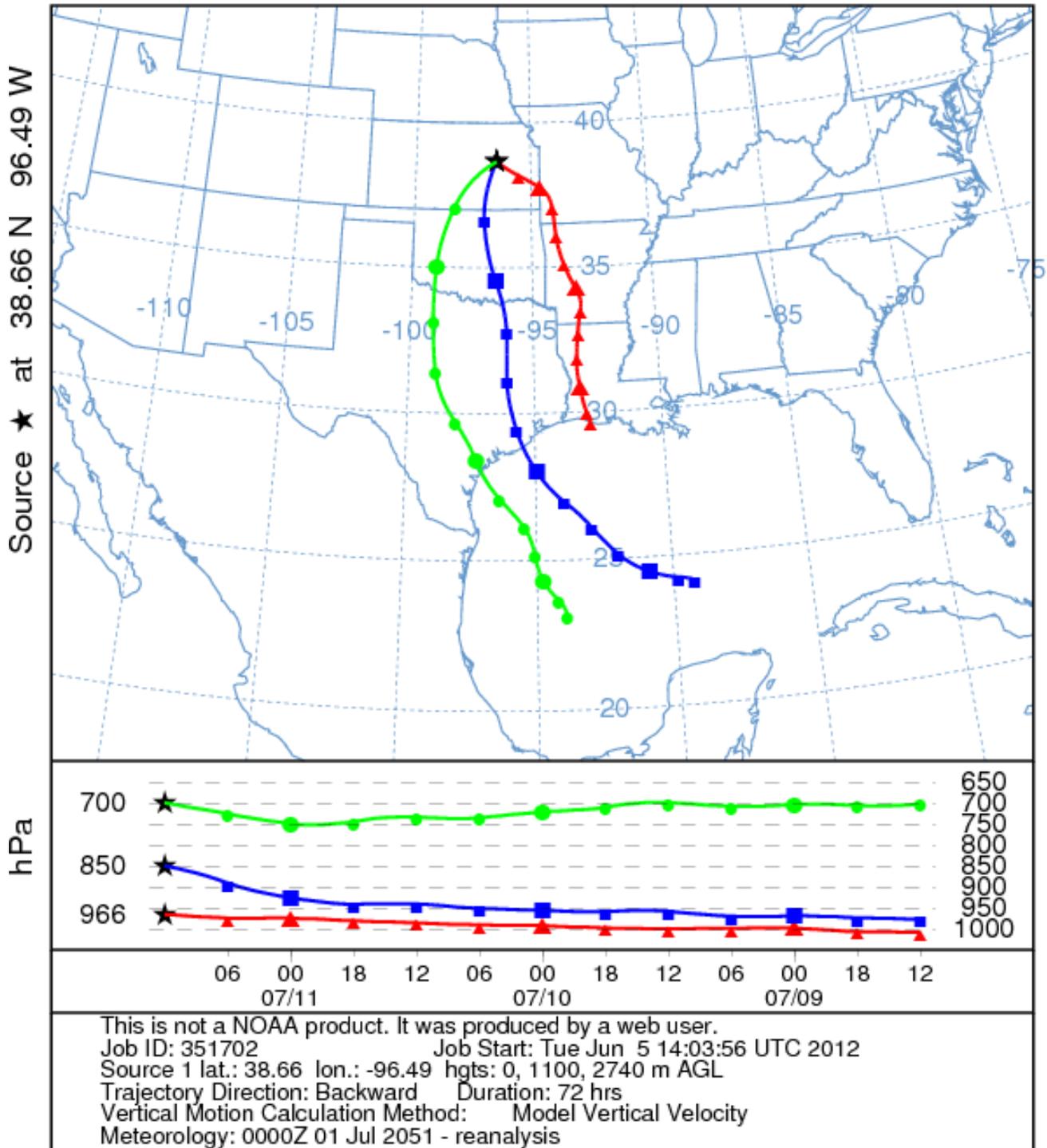


**MASS RAINFALL CURVES**

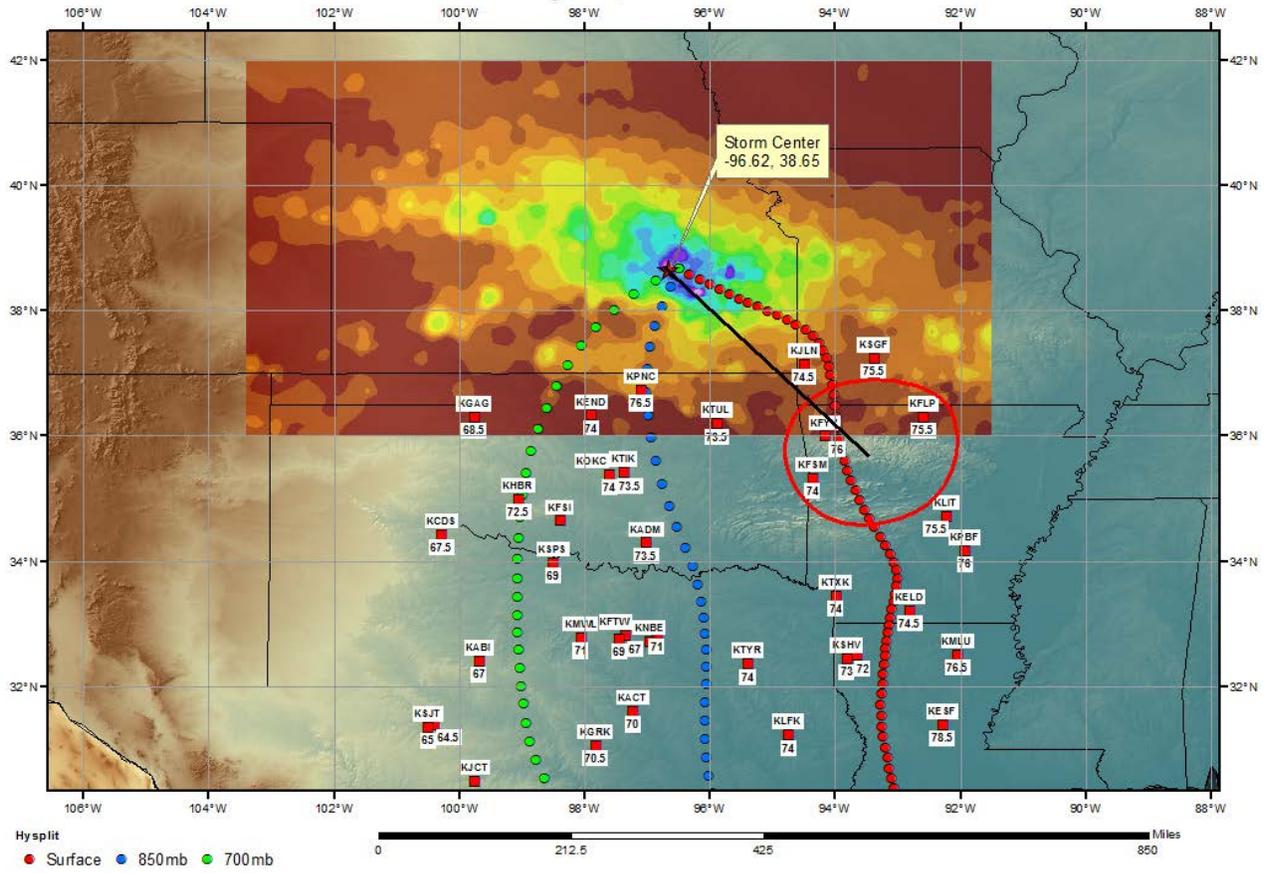


FORM 5-3E

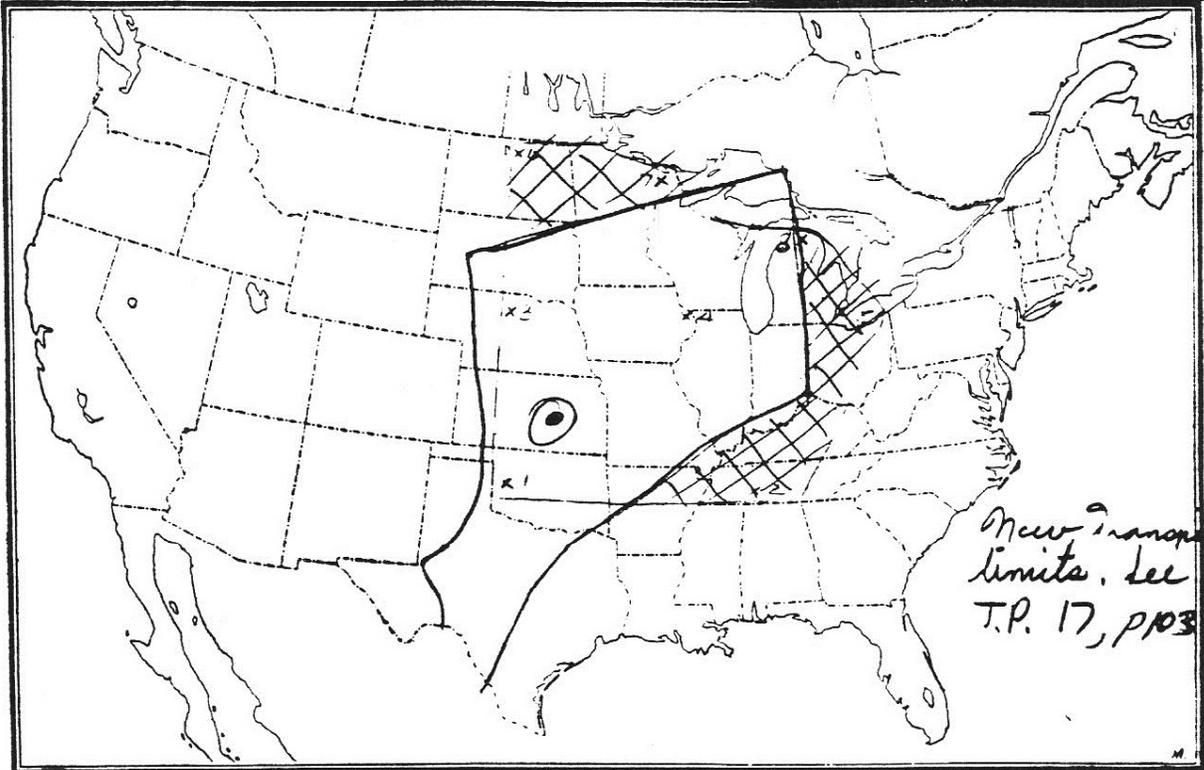
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 11 Jul 51  
 CDC1 Meteorological Data



### SPAS 1583 Council Grove (MR 10-2) Storm Analysis July 9-11, 1951



MR10-2 July 9-13, 1951  
Council Grove, Kansas  
- Tol 73°F 205 SSW



## Storm Precipitation Analysis System (SPAS) For Storm #1251\_1

**General Storm Location:** New Mexico and Colorado

**Storm Dates:** May 17-21, 1955

**Event:** Synoptic

### DAD Zone 1

**Latitude:** 37.009

**Longitude:** -104.341

**Max. Grid Rainfall Amount:** 14.82"

**Max. Observed Rainfall Amount:** 13.69"

**Number of Stations:** 182 (133 Daily, 18 Hourly, 15 Hourly Pseudo, and 16 Supplemental)

**SPAS Version:** 9.5

**Basemap:** PRISM May 1955 precipitation

**Spatial resolution:** 00:00:30 (~ 0.30 mi<sup>2</sup>)

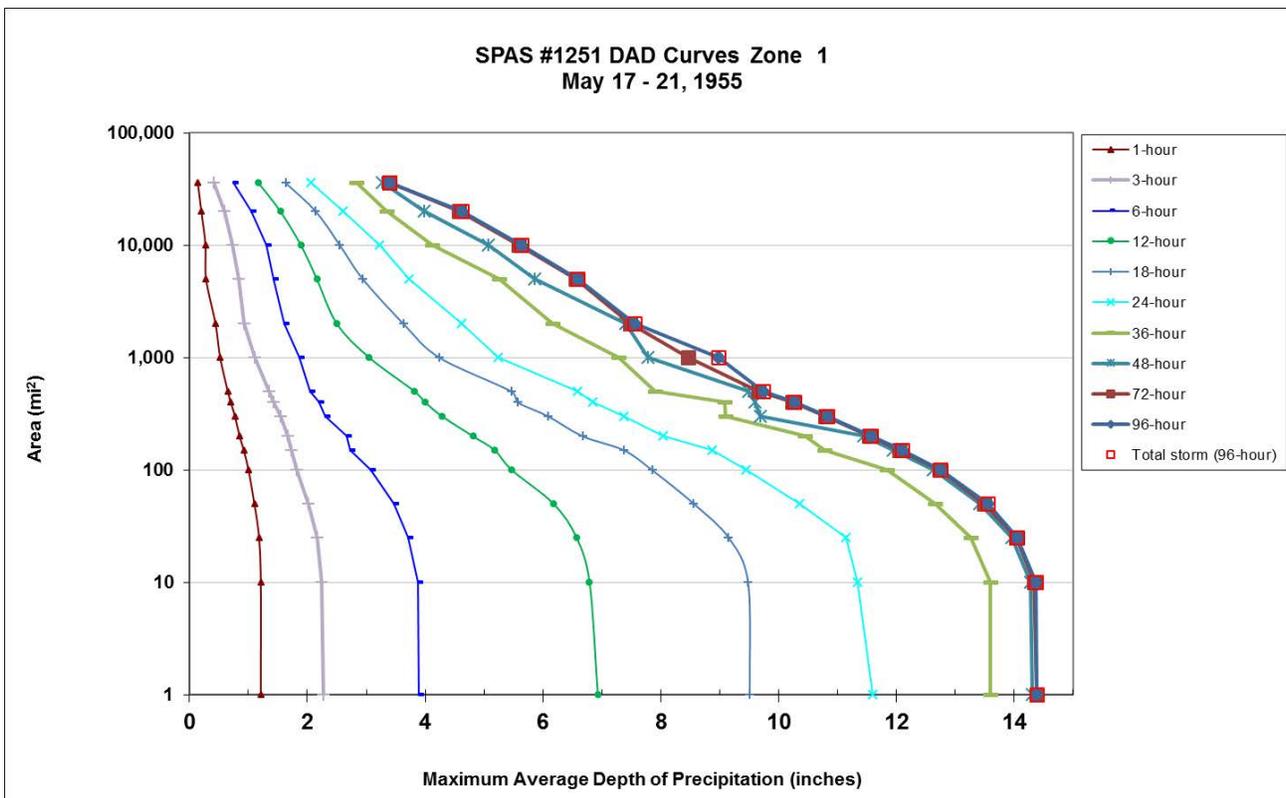
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

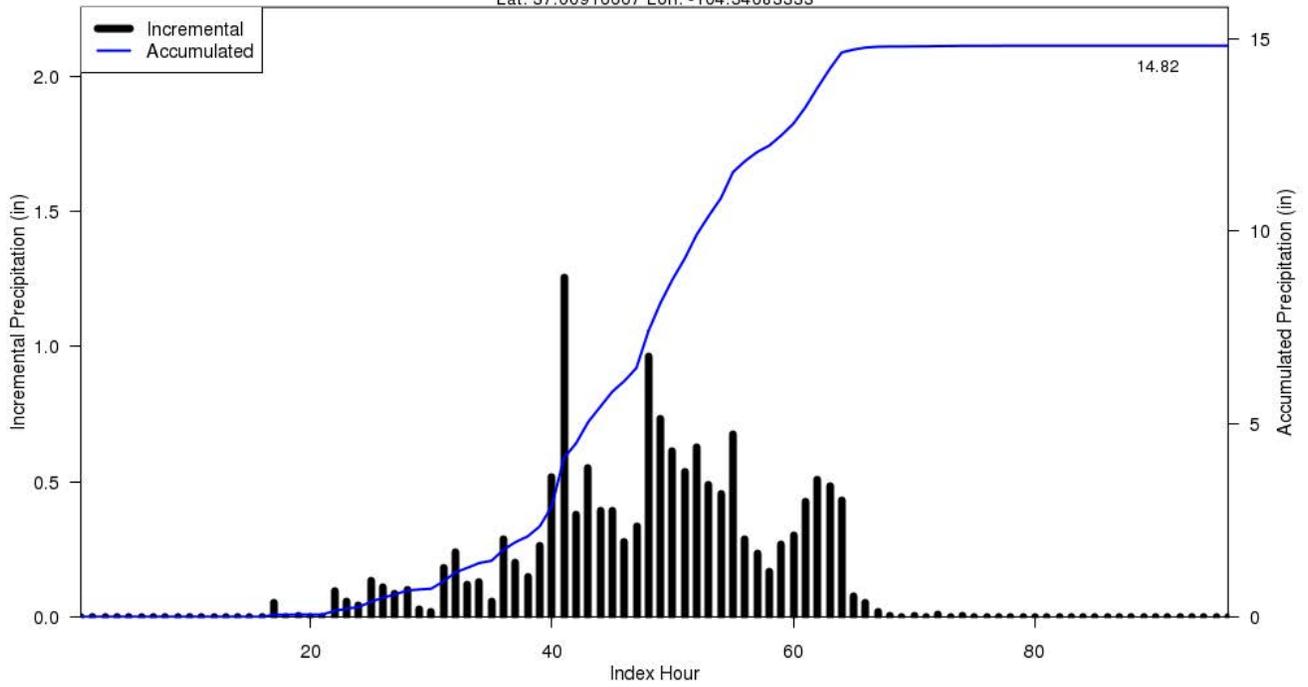
**Reliability of results:** This analysis was based on hourly data, daily data, and previously analyzed isohyetal pattern. We have a high degree of confidence in the station based results, and spatial pattern is dependent on PRISM basemap. The closest hourly station to Lake Maloya, NM was Raton, NM. The Lake Maloya, NM station recorded 11.28: in a 24-hr period, this value is a state record for New Mexico.

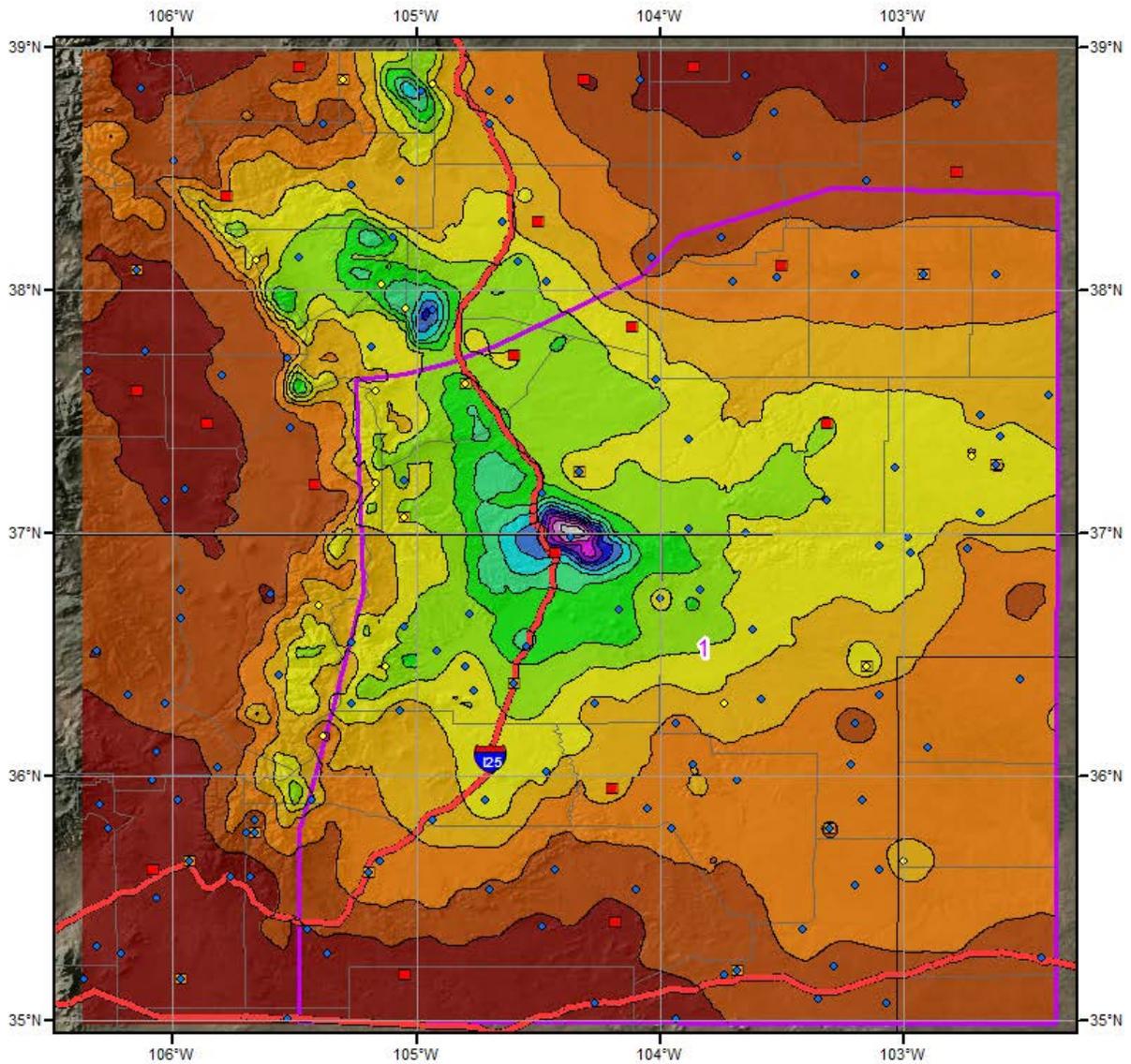
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1251_1	-104.341	37.009	7,954	8,000	70.50	2.31	1.34	63	0.970	78.26	78.5	3.37	1.78	79	1.585	1.500

SPAS 1251 - May 17 (800 UTC) - May 21 (700 UTC), 1955											
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)											
Area (mi <sup>2</sup> )	Duration (hours)										
	1	3	6	12	18	24	36	48	72	96	Total
0.3	1.26	2.32	3.98	7.09	9.77	11.90	14.04	14.74	14.82	14.82	14.82
1	1.21	2.27	3.89	6.93	9.51	11.60	13.60	14.30	14.38	14.38	14.38
10	1.21	2.25	3.87	6.79	9.48	11.34	13.60	14.27	14.34	14.36	14.36
25	1.18	2.16	3.71	6.57	9.15	11.14	13.26	13.95	14.03	14.04	14.04
50	1.10	2.02	3.47	6.18	8.56	10.36	12.65	13.41	13.49	13.54	13.54
100	1.00	1.82	3.08	5.47	7.85	9.45	11.84	12.63	12.73	12.74	12.74
150	0.92	1.73	2.72	5.18	7.37	8.87	10.78	11.95	12.05	12.10	12.10
200	0.85	1.67	2.66	4.81	6.67	8.04	10.44	11.44	11.54	11.57	11.57
300	0.77	1.54	2.30	4.29	6.09	7.37	9.10	9.69	10.80	10.83	10.83
400	0.70	1.42	2.20	4.00	5.57	6.85	9.08	9.59	10.23	10.26	10.26
500	0.65	1.35	2.04	3.82	5.46	6.58	7.91	9.49	9.66	9.74	9.74
1,000	0.52	1.11	1.86	3.05	4.24	5.24	7.28	7.78	8.47	8.97	8.97
2,000	0.44	0.93	1.60	2.50	3.63	4.62	6.16	7.40	7.48	7.55	7.55
5,000	0.28	0.83	1.42	2.16	2.94	3.73	5.25	5.86	6.56	6.59	6.59
10,000	0.27	0.73	1.31	1.89	2.55	3.22	4.12	5.08	5.59	5.63	5.63
20,000	0.20	0.60	1.04	1.54	2.14	2.60	3.35	3.98	4.58	4.62	4.62
35,752	0.14	0.41	0.75	1.17	1.63	2.06	2.83	3.27	3.40	3.40	3.40



SPAS 1251 Storm Center Mass Curve Zone 1  
May 17 (800UTC) to May 21 (700UTC), 1955  
Lat: 37.00916667 Lon: -104.34083333





**Total Precipitation (96-hours)**  
**SPAS1251 - Lake Maloya, NM**  
**5/17/1955 0800 GMT - 5/21/1955 0700 GMT**

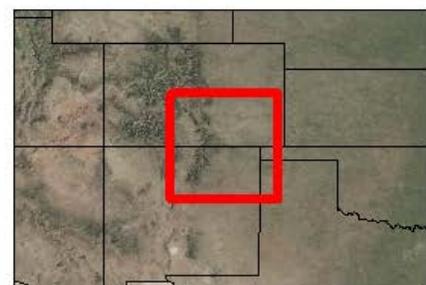
**Gauges**

- ◆ Daily
- Hourly
- Hourly Pseudo
- ◇ Supplemental



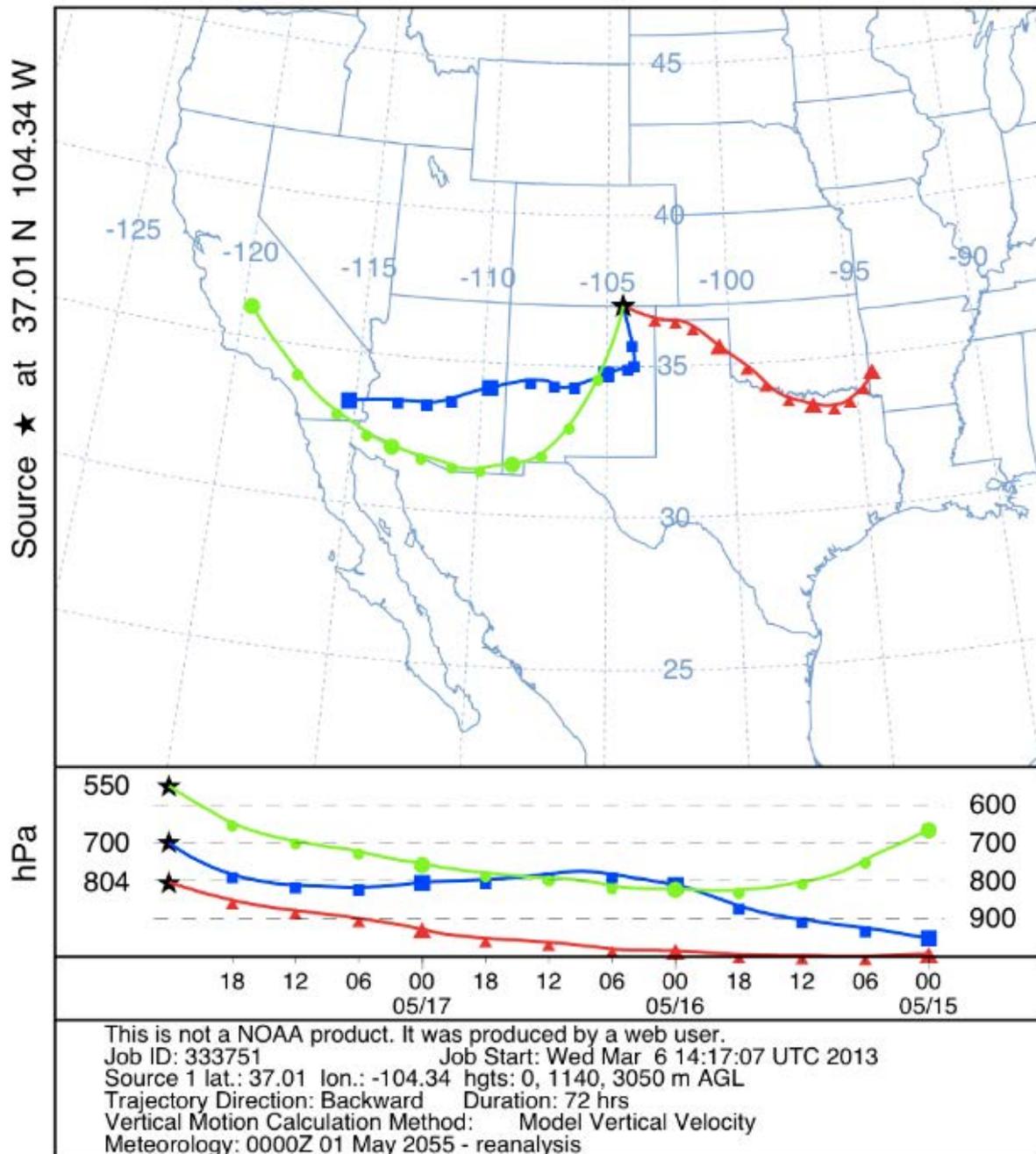
**Precipitation (inches)**

0.00 - 1.00	3.01 - 4.00	6.01 - 7.00	9.01 - 10.00	12.01 - 13.00
1.01 - 2.00	4.01 - 5.00	7.01 - 8.00	10.01 - 11.00	13.01 - 14.00
2.01 - 3.00	5.01 - 6.00	8.01 - 9.00	11.01 - 12.00	14.01 - 15.00

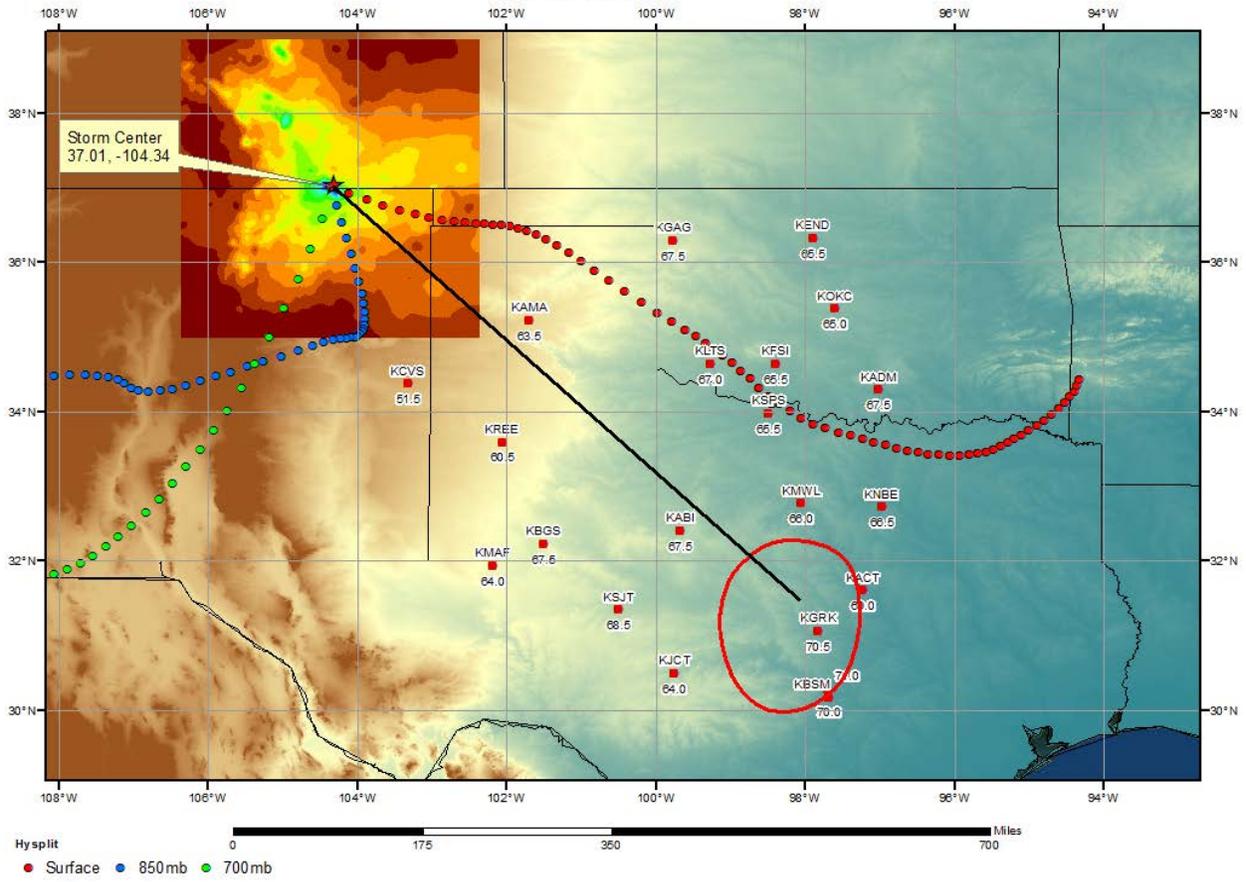


9/11/2012

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 18 May 55  
 CDC1 Meteorological Data



### SPAS 1251 Lake Mayola, NM Storm Analysis May 16-17, 1955



## Storm Precipitation Analysis System (SPAS) For Storm #1183\_1

**General Storm Location:** Edgerton, Missouri

**Storm Dates:** July 18-20, 1965

**Event:** Synoptic

### DAD Zone 1

**Latitude:** 40.4125

**Longitude:** -95.5125

**Max. Grid Rainfall Amount:** 20.76"

**Max. Observed Rainfall Amount:** 20.10" at ATCHISON 65N 41W SCT34

**Number of Stations:** 387 (90 Daily, 41 Hourly, 4 Hourly Estimated, 2 Hourly Estimated Pseudo, 13 Hourly Pseudo, and 237 Supplemental)

**SPAS Version:** 8.5

**Base Map Used:** Yes, conus\_prism\_ppt\_in\_1971\_2000\_07

**Spatial resolution:** 00:00:30 (0.3 sq. miles)

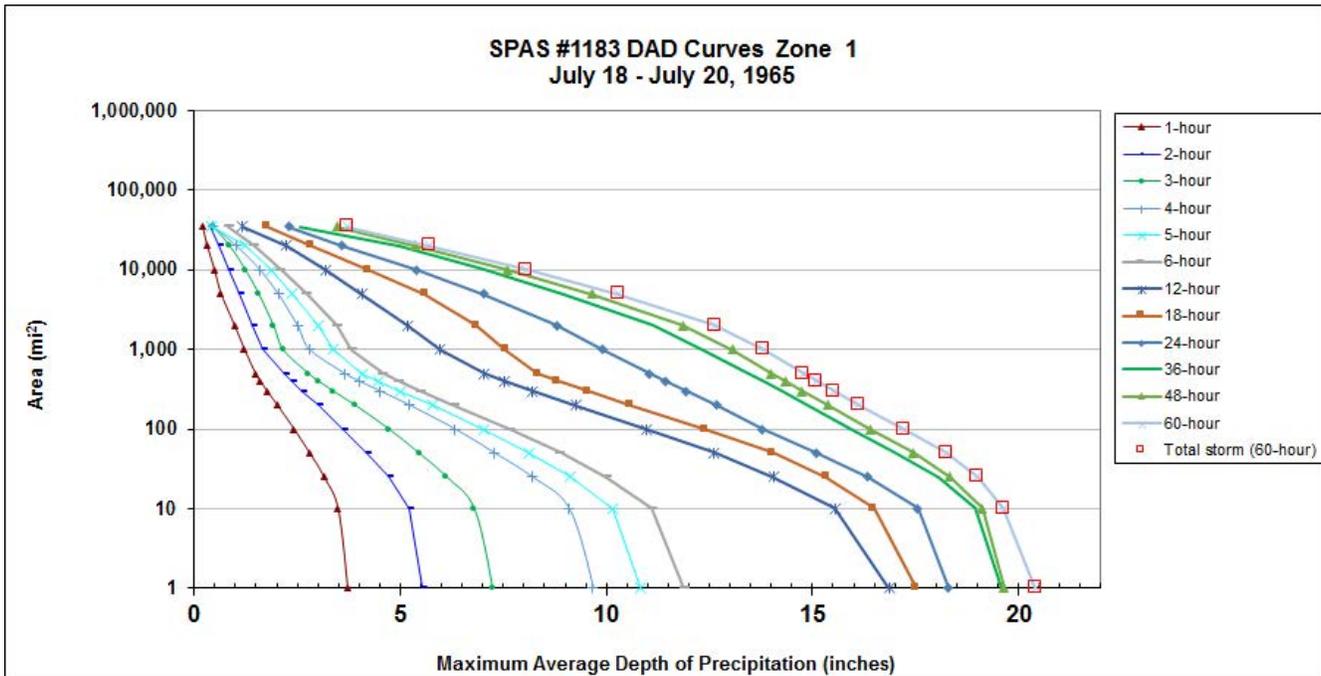
**Radar Included:** No

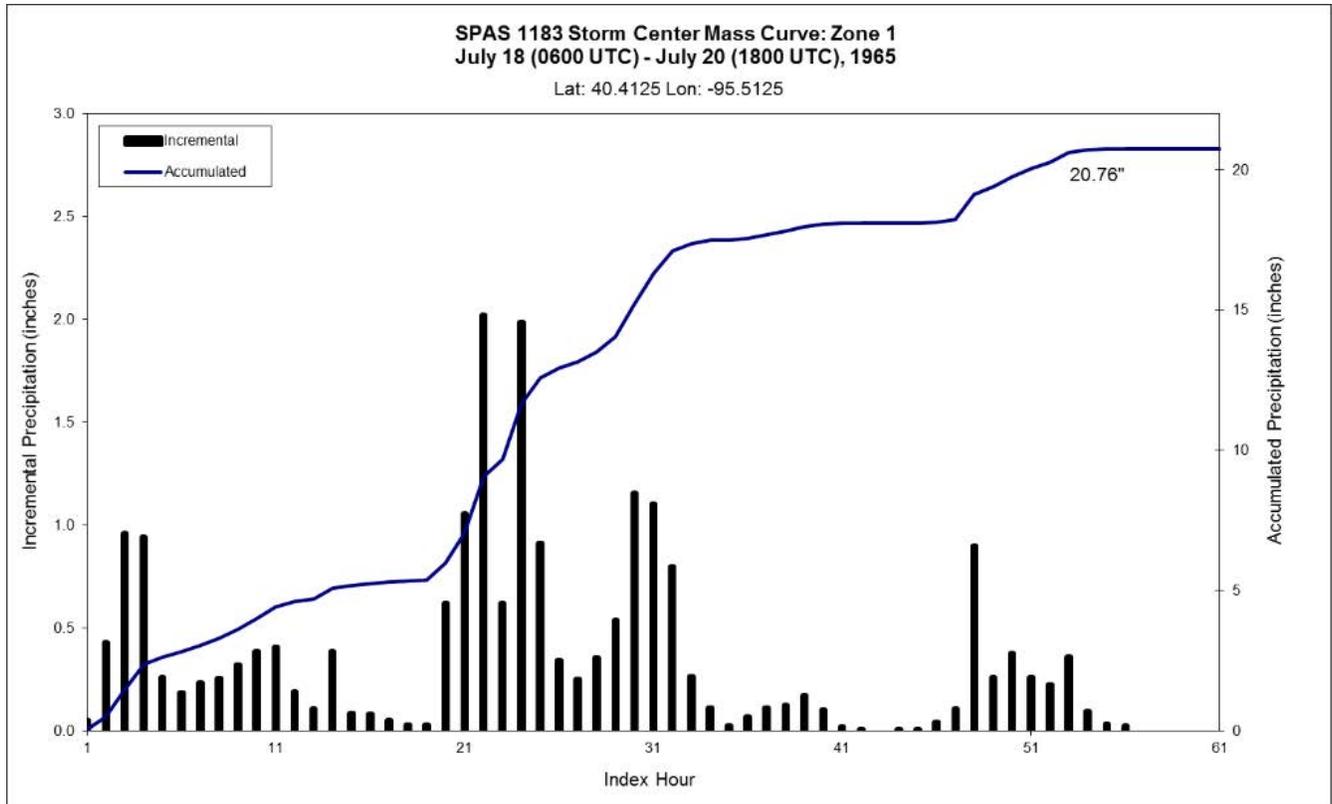
**Depth-Area-Duration (DAD) analysis:** Yes

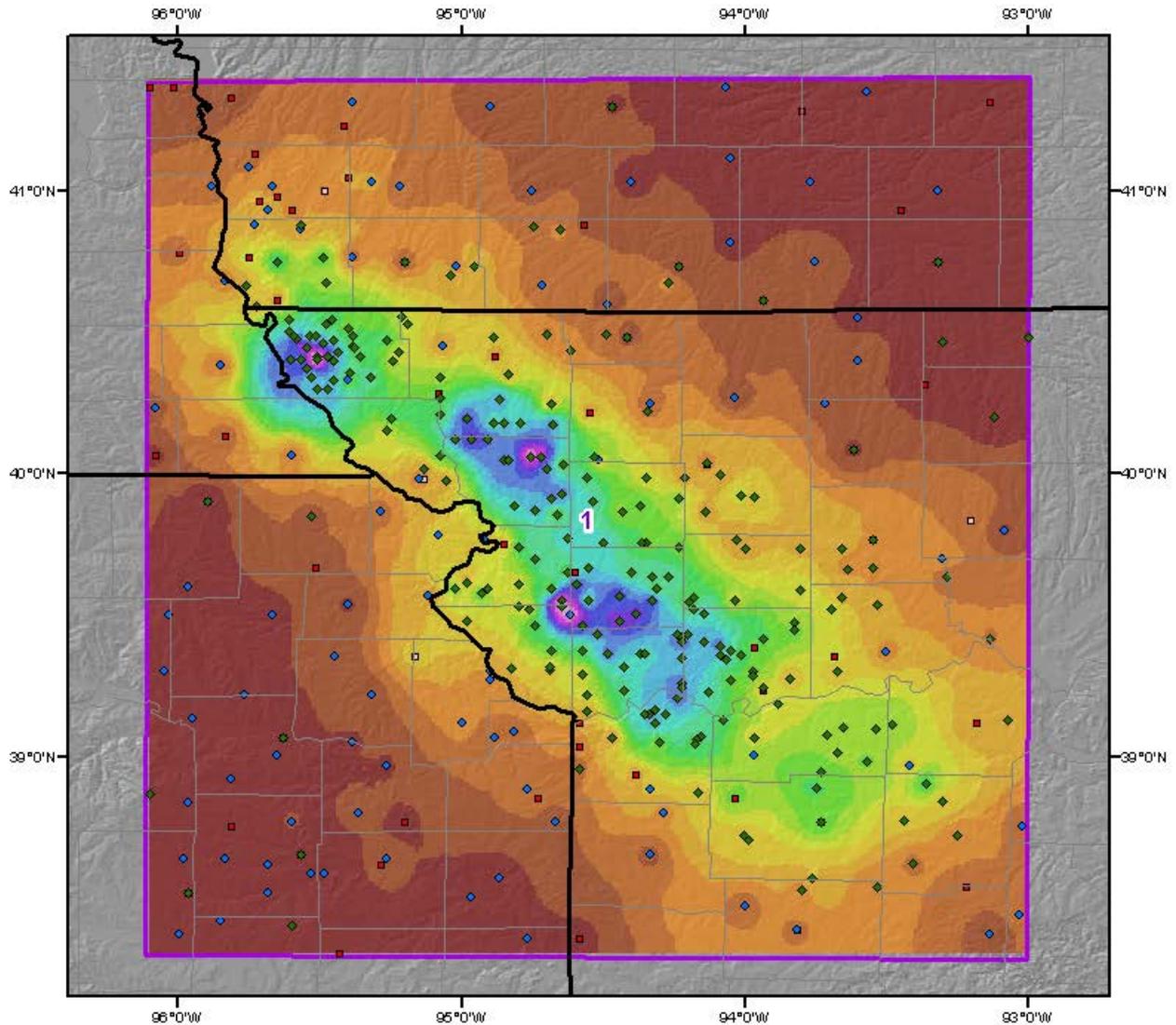
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1183_1	-95.513	40.413	915	900	76.00	2.99	0.23	74	2.760	80.47	80.5	3.68	0.27	83	3.410	1.236

**Storm 1183 - July 18 (0600 UTC) - July 20 (1800 UTC), 1965**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)												
	1	2	3	4	5	6	12	18	24	36	48	60	Total
0.4	3.75	5.61	7.30	9.78	10.92	12.00	17.04	17.70	18.50	19.74	19.79	20.64	20.64
1	3.72	5.55	7.23	9.67	10.82	11.88	16.86	17.51	18.30	19.58	19.64	20.41	20.41
10	3.49	5.22	6.79	9.09	10.15	11.11	15.55	16.48	17.56	18.95	19.11	19.63	19.63
25	3.15	4.71	6.12	8.20	9.14	10.00	14.06	15.33	16.35	18.05	18.33	19.01	19.01
50	2.80	4.18	5.45	7.29	8.12	8.88	12.61	14.04	15.09	17.00	17.44	18.24	18.24
100	2.42	3.62	4.72	6.33	7.02	7.65	10.96	12.38	13.79	15.93	16.40	17.21	17.21
200	2.01	3.02	3.90	5.23	5.79	6.30	9.25	10.59	12.69	14.90	15.38	16.13	16.13
300	1.76	2.62	3.37	4.52	5.01	5.49	8.21	9.56	11.94	14.24	14.75	15.52	15.52
400	1.60	2.36	3.02	4.01	4.47	4.95	7.51	8.81	11.43	13.79	14.33	15.10	15.10
500	1.48	2.18	2.77	3.66	4.09	4.58	7.03	8.34	11.05	13.45	14.00	14.78	14.78
1,000	1.21	1.65	2.15	2.80	3.37	3.82	5.97	7.55	9.92	12.35	13.05	13.83	13.83
2,000	0.97	1.41	1.92	2.51	3.00	3.46	5.17	6.84	8.80	11.13	11.85	12.63	12.63
5,000	0.64	1.10	1.56	2.04	2.38	2.73	4.06	5.59	7.02	8.97	9.64	10.28	10.28
10,000	0.48	0.86	1.24	1.60	1.86	2.10	3.18	4.21	5.38	7.05	7.59	8.07	8.07
20,000	0.30	0.61	0.86	1.03	1.25	1.45	2.23	2.84	3.58	4.98	5.36	5.71	5.71
35,221	0.19	0.37	0.45	0.46	0.43	0.83	1.17	1.78	2.29	2.57	3.46	3.72	3.72



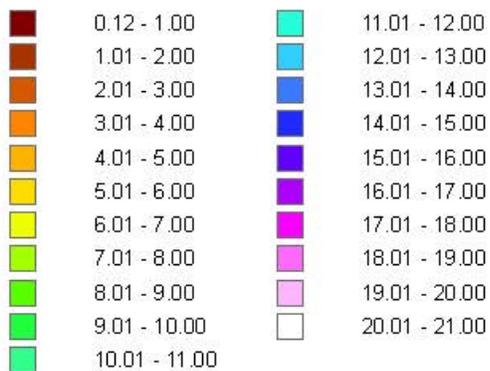




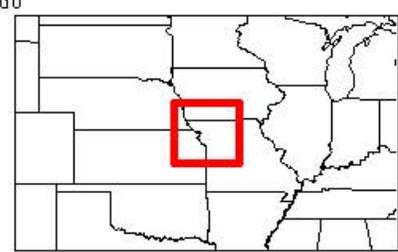
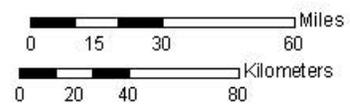
**Total Precipitation (60-hours)**  
**SPAS storm number: 1183**  
**July 18, 1965 (0600 UTC) - July 20, 1965 (1800 UTC)**



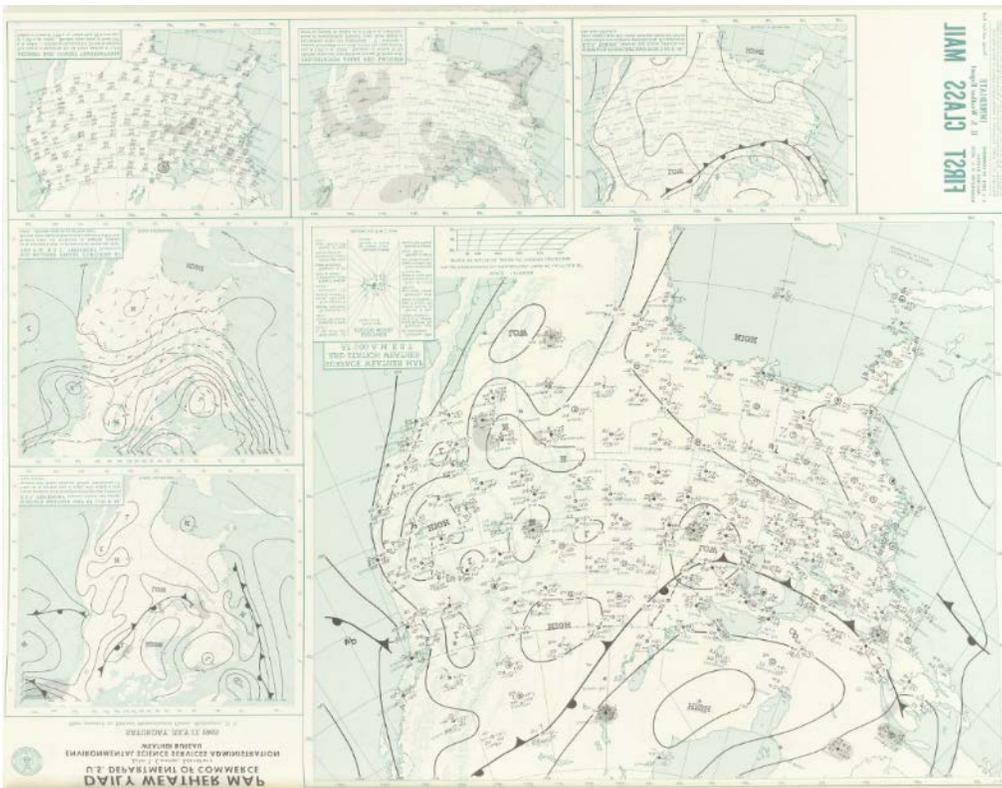
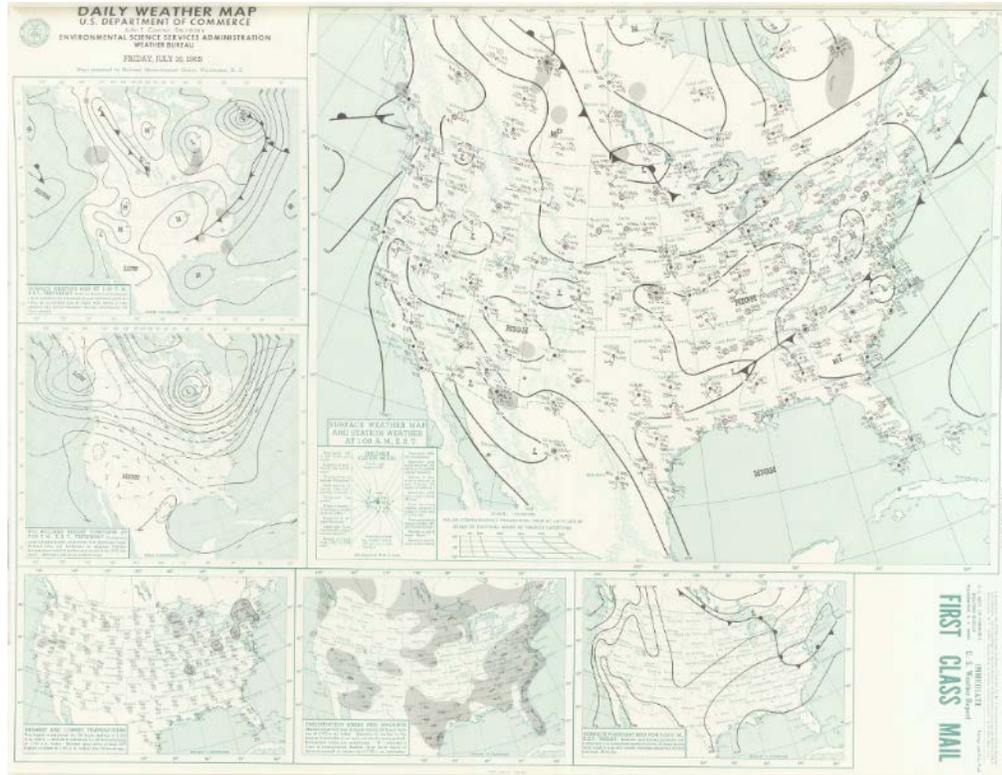
**Precipitation (inches)**

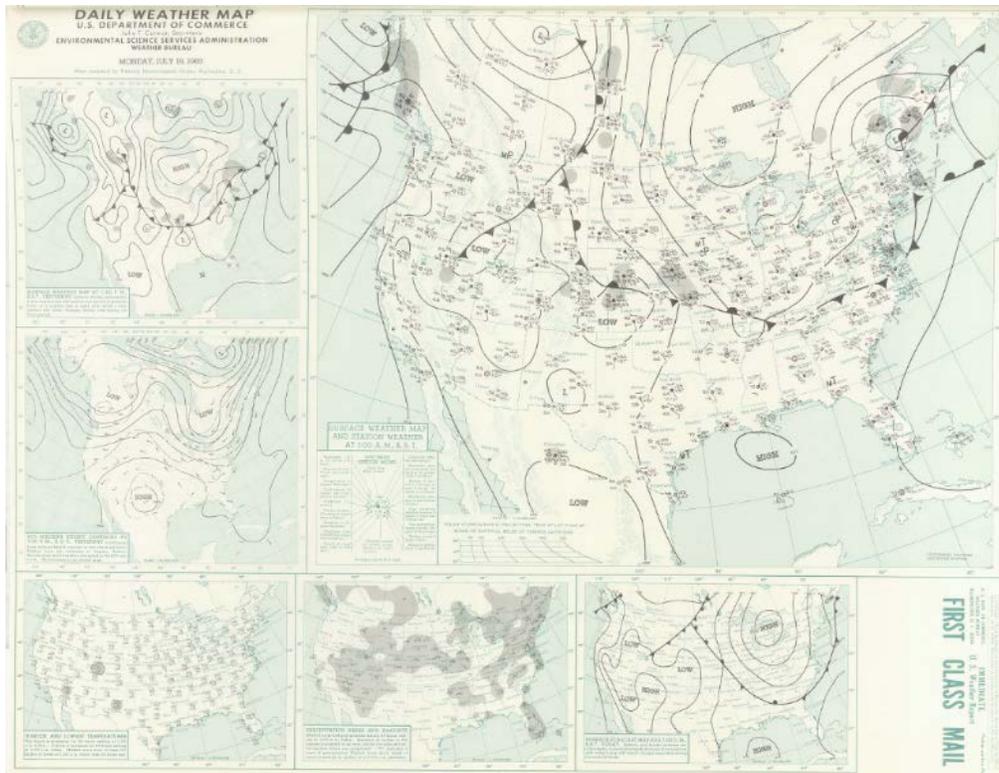
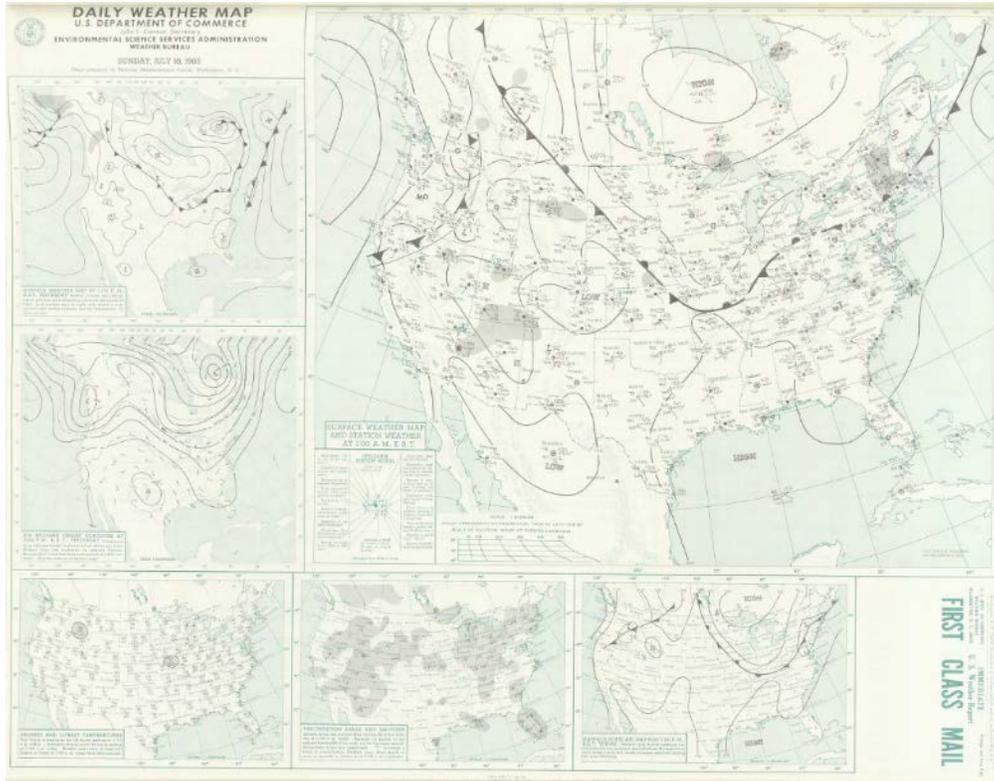


- Daily
- Hourly
- Hourly Estimated
- Hourly Estimated Pseudo
- Hourly Pseudo
- Supplemental



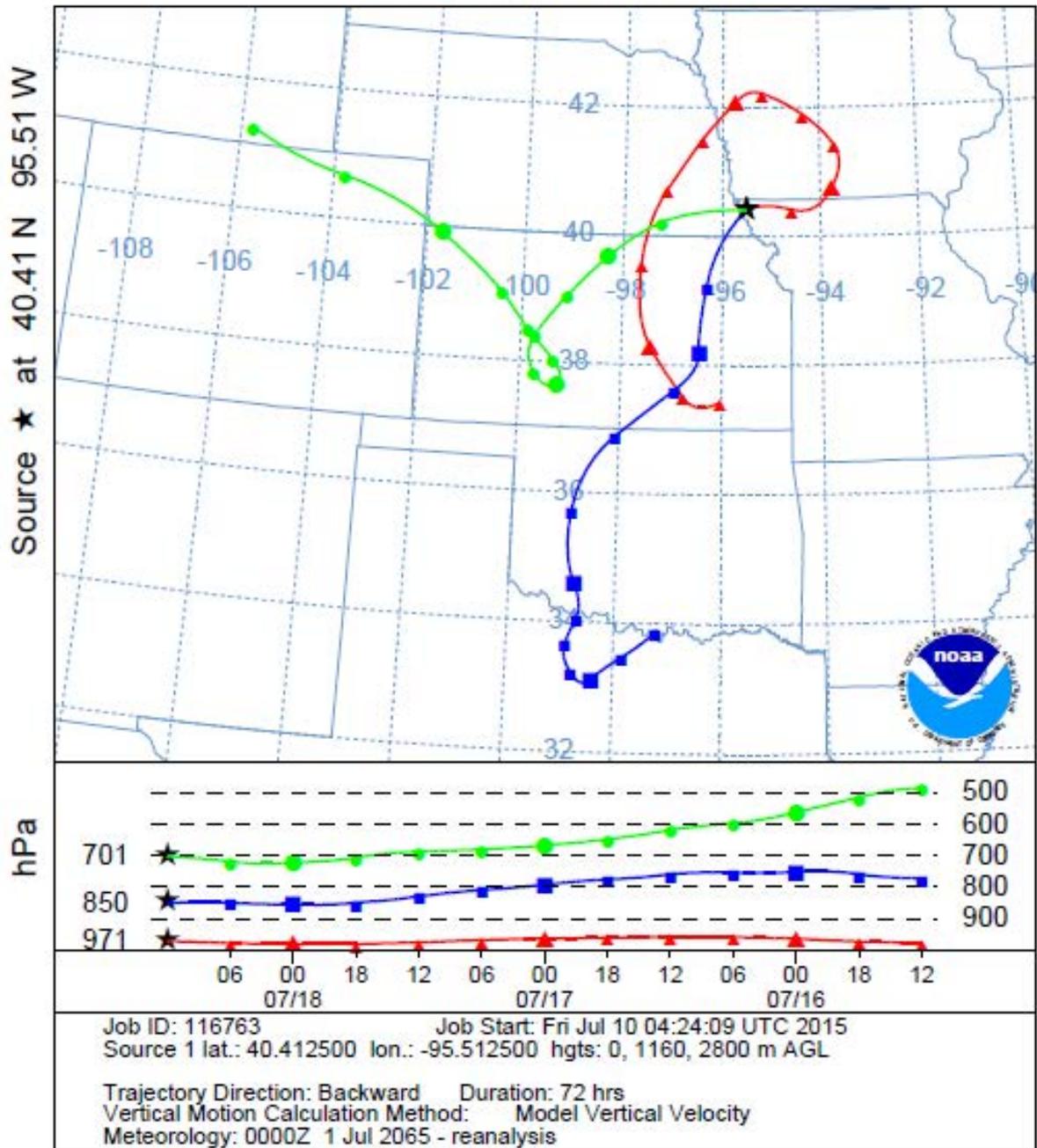
NE SPAS IAWA May 20, 2010



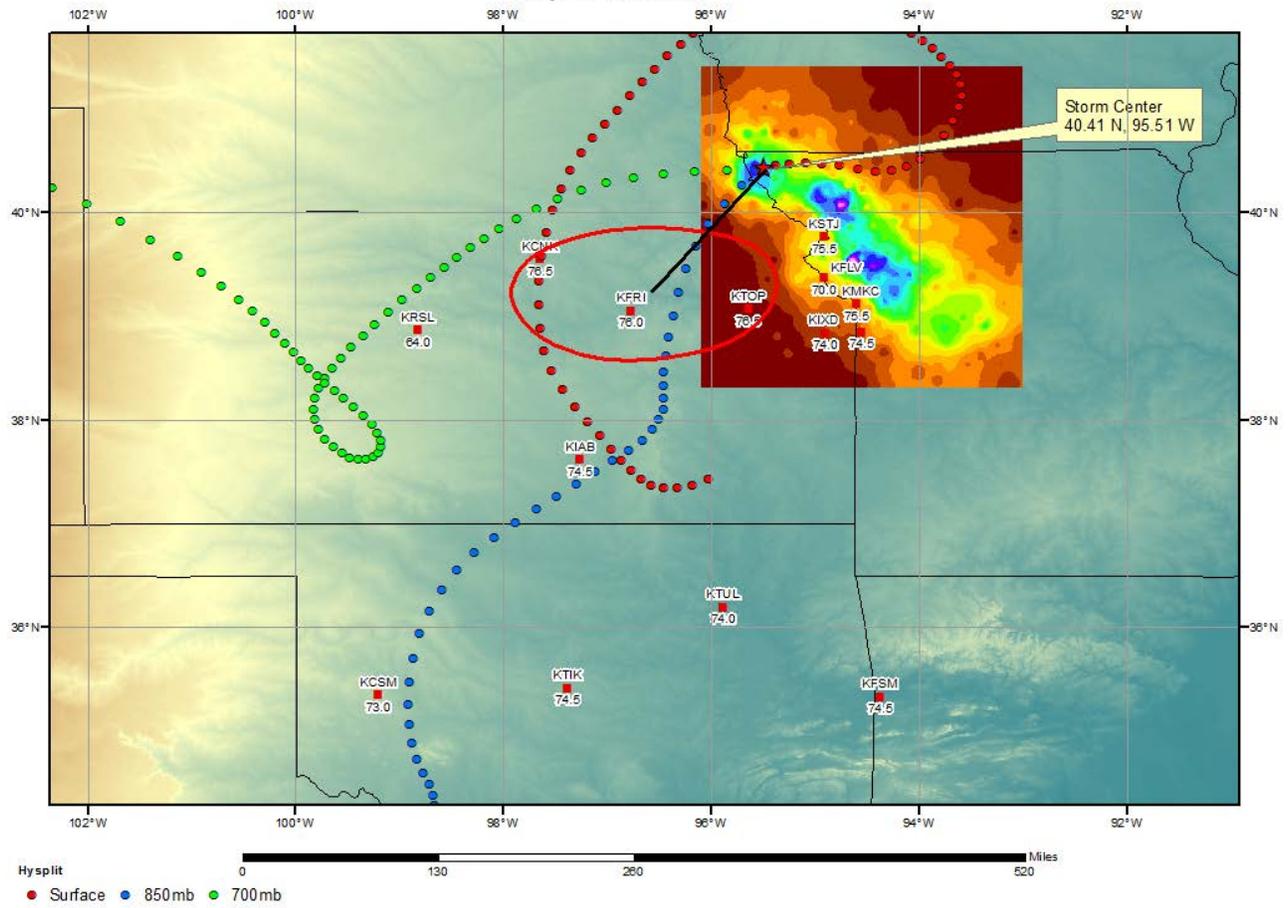




NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 18 Jul 65  
 CDC1 Meteorological Data



### SPAS 1183 Edgerton, MO Storm Analysis July 16-19, 1965



## Storm Precipitation Analysis System (SPAS) For Storm #1253\_1

**General Storm Location:** Colorado

**Storm Dates:** May 3-8, 1969

**Event:** Synoptic

### DAD Zone 1

**Latitude:** 40.27

**Longitude:** -105.42

**Max. Grid Rainfall Amount:** 20.01"

**Max. Observed Rainfall Amount:** 20.00"

**Number of Stations:** 332 (182 Daily, 27 Hourly, 7 Hourly Pseudo, 107 Supplemental, and 9 Supplemental Estimated)

**SPAS Version:** 9.5

**Basemap:** PRISM May 1969 precipitation

**Spatial resolution:** 00:00:30 (~ 0.30 mi<sup>2</sup>)

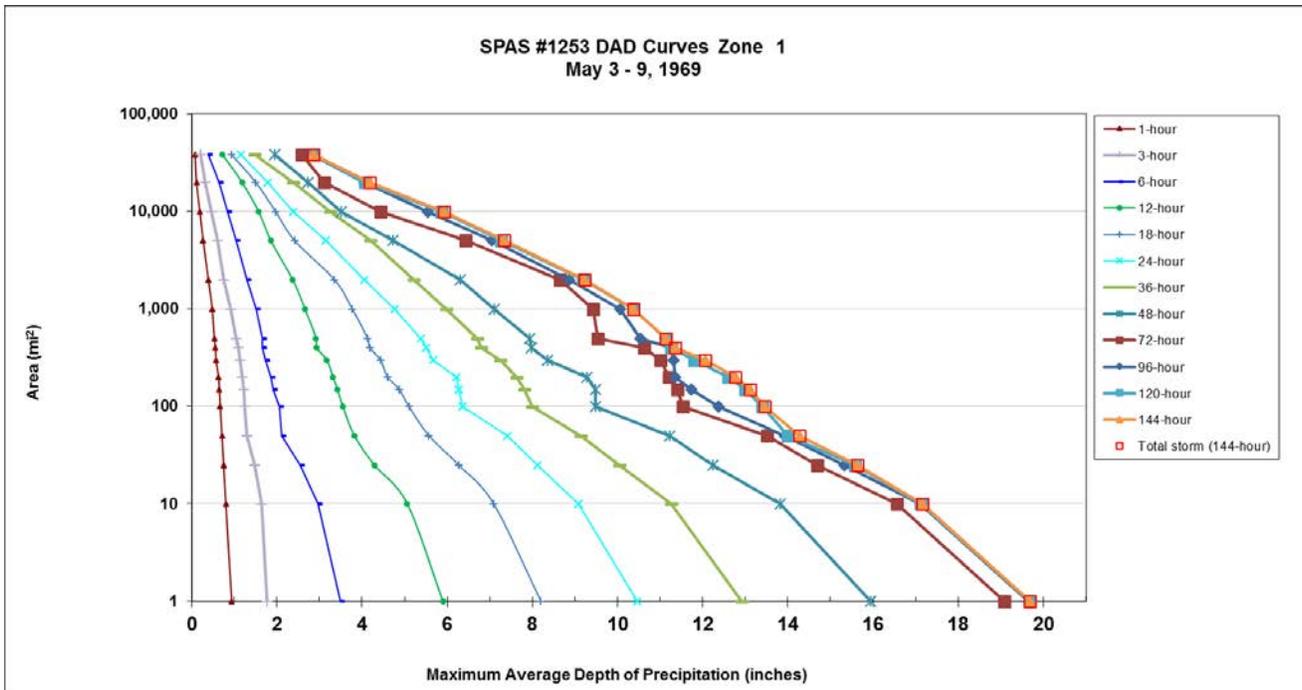
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

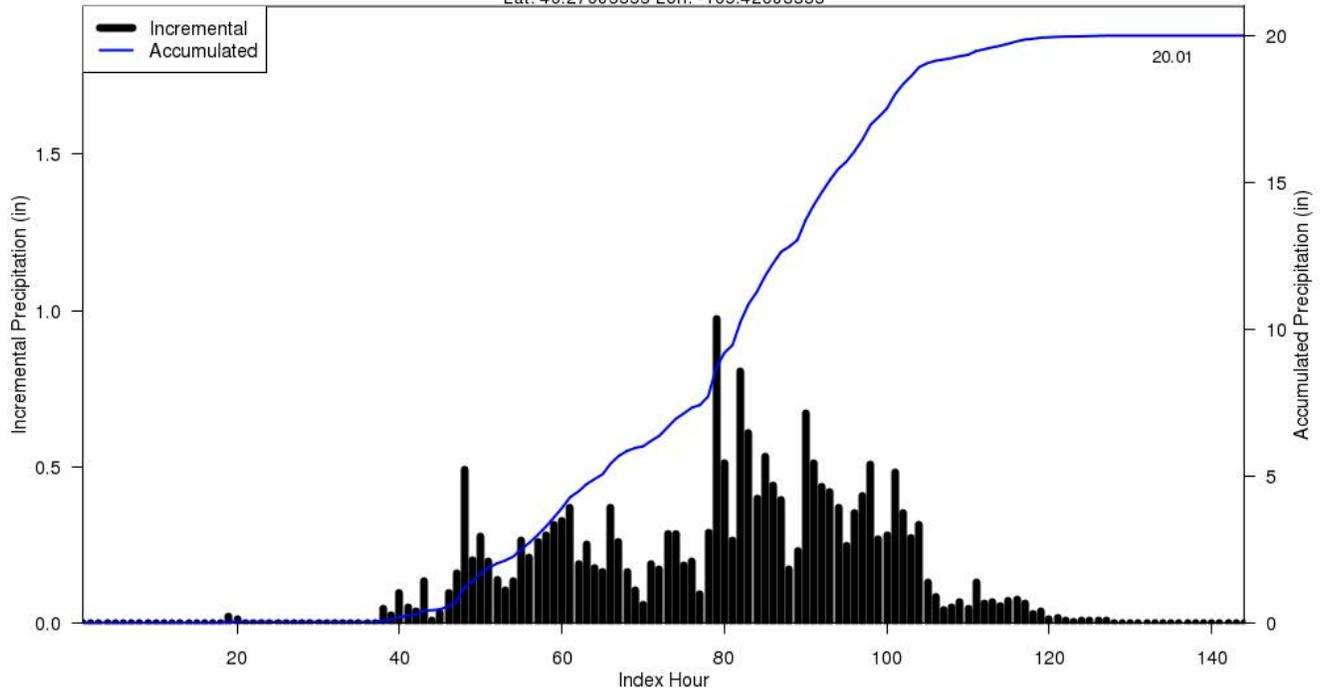
**Reliability of results:** This analysis was based on hourly data, daily data, supplemental bucket survey data, and previously analyzed isohyetal pattern. We have a high degree of confidence in the station based results, and spatial pattern is dependent on PRISM basemap. The closest hourly station to Big Elk Meadow was Boulder no2, CO. The Big Elk Meadow, CO bucket survey supplemental station recorded 20.00" (bucket survey data from NCDC Colorado Climatological Data May 1969). This value was adjusted to 20.21" in order for SPAS to maintain a 20.00" value at the station grid cell location.

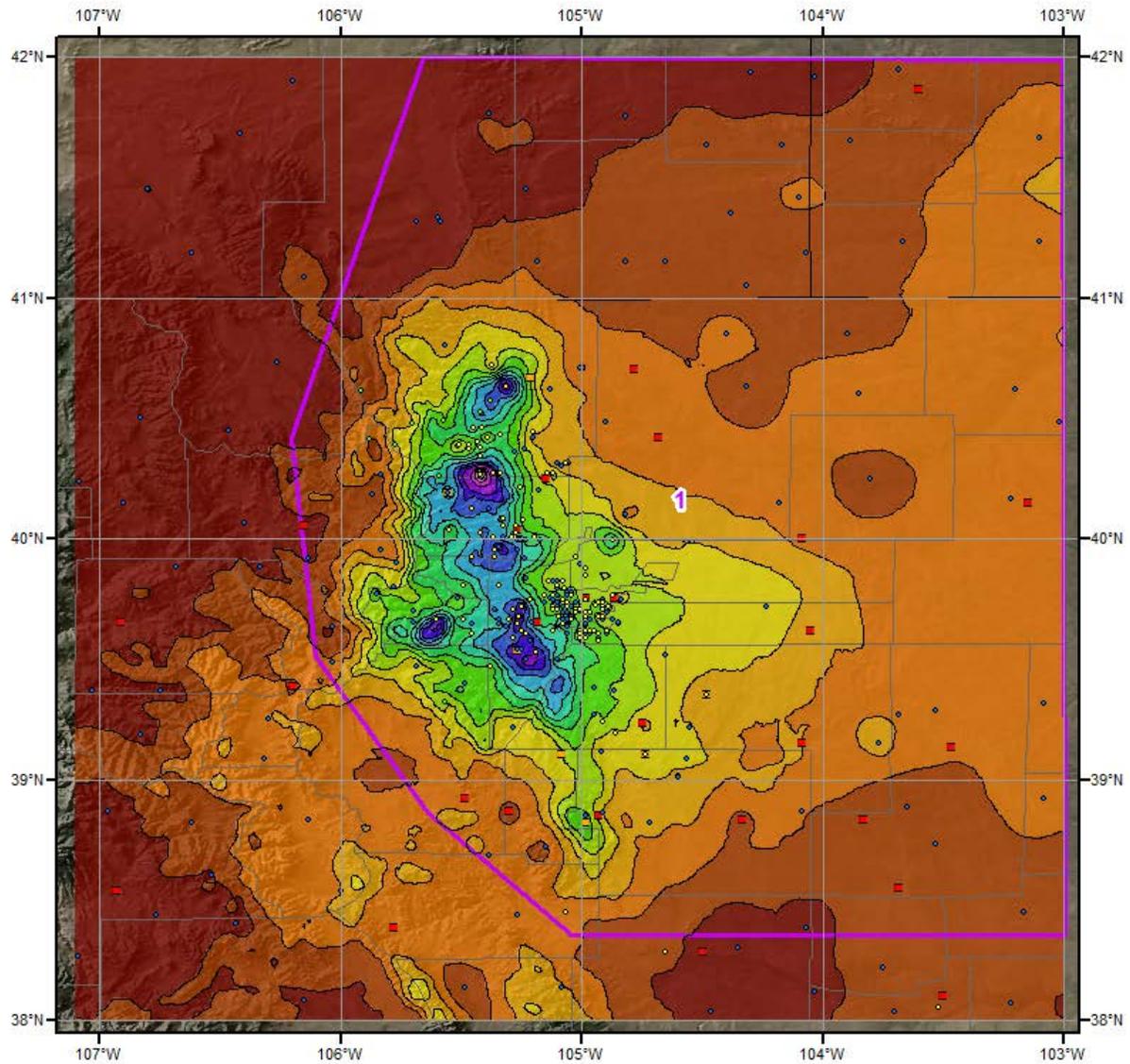
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1253_1	-105.417	40.267	7,656	7,500	64.00	1.68	1.00	50	0.680	74.33	74.5	2.79	1.48	71	1.315	1.500

SPAS 1253 - May 3 (800 UTC) - May 9 (700 UTC), 1969													
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)													
Area (mi <sup>2</sup> )	Duration (hours)												
	1	3	6	12	18	24	36	48	72	96	120	144	Total
0.3	0.97	1.82	3.56	6.00	8.34	10.64	13.13	16.21	19.41	19.97	20.01	20.01	20.01
1	0.94	1.77	3.50	5.90	8.20	10.46	12.92	15.94	19.09	19.65	19.69	19.69	19.69
10	0.80	1.65	2.97	5.06	7.09	9.08	11.26	13.83	16.57	17.10	17.12	17.16	17.16
25	0.75	1.47	2.55	4.29	6.27	8.13	10.04	12.25	14.70	15.32	15.58	15.64	15.64
50	0.71	1.30	2.11	3.82	5.57	7.42	9.14	11.22	13.51	13.93	14.01	14.28	14.28
100	0.67	1.25	2.06	3.55	5.10	6.36	8.00	9.49	11.53	12.37	13.41	13.46	13.46
150	0.65	1.22	1.91	3.42	4.87	6.27	7.81	9.48	11.40	11.73	13.01	13.11	13.11
200	0.63	1.19	1.86	3.32	4.60	6.21	7.63	9.29	11.21	11.36	12.61	12.76	12.76
300	0.57	1.14	1.74	3.17	4.43	5.67	7.25	8.36	11.00	11.32	11.80	12.06	12.06
400	0.56	1.09	1.66	2.93	4.18	5.50	6.80	7.97	10.63	11.26	11.27	11.36	11.36
500	0.53	1.05	1.66	2.92	4.13	5.38	6.70	7.94	9.54	10.54	11.14	11.14	11.14
1,000	0.48	0.91	1.52	2.66	3.77	4.77	5.98	7.11	9.43	10.07	10.38	10.38	10.38
2,000	0.39	0.75	1.29	2.37	3.35	4.06	5.21	6.30	8.65	8.87	9.20	9.23	9.23
5,000	0.27	0.60	1.04	1.86	2.42	3.15	4.20	4.72	6.44	7.05	7.27	7.35	7.35
10,000	0.19	0.47	0.85	1.57	1.97	2.38	3.25	3.52	4.44	5.54	5.87	5.93	5.93
20,000	0.11	0.32	0.65	1.18	1.50	1.79	2.38	2.73	3.12	4.06	4.08	4.18	4.18
38,492	0.08	0.21	0.39	0.72	0.93	1.15	1.47	1.95	2.58	2.82	2.86	2.86	2.86



SPAS 1253 Storm Center Mass Curve Zone 1  
May 3 (800UTC) to May 9 (700UTC), 1969  
Lat: 40.27083333 Lon: -105.42083333

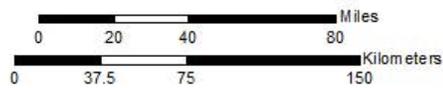




**Total Precipitation (144-hours)**  
**SPAS 1253 - Big Elk Meadows, CO**  
**5/3/1969 0800 GMT - 5/9/1969 0700 GMT**

**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Supplemental
- Supplemental Estimated



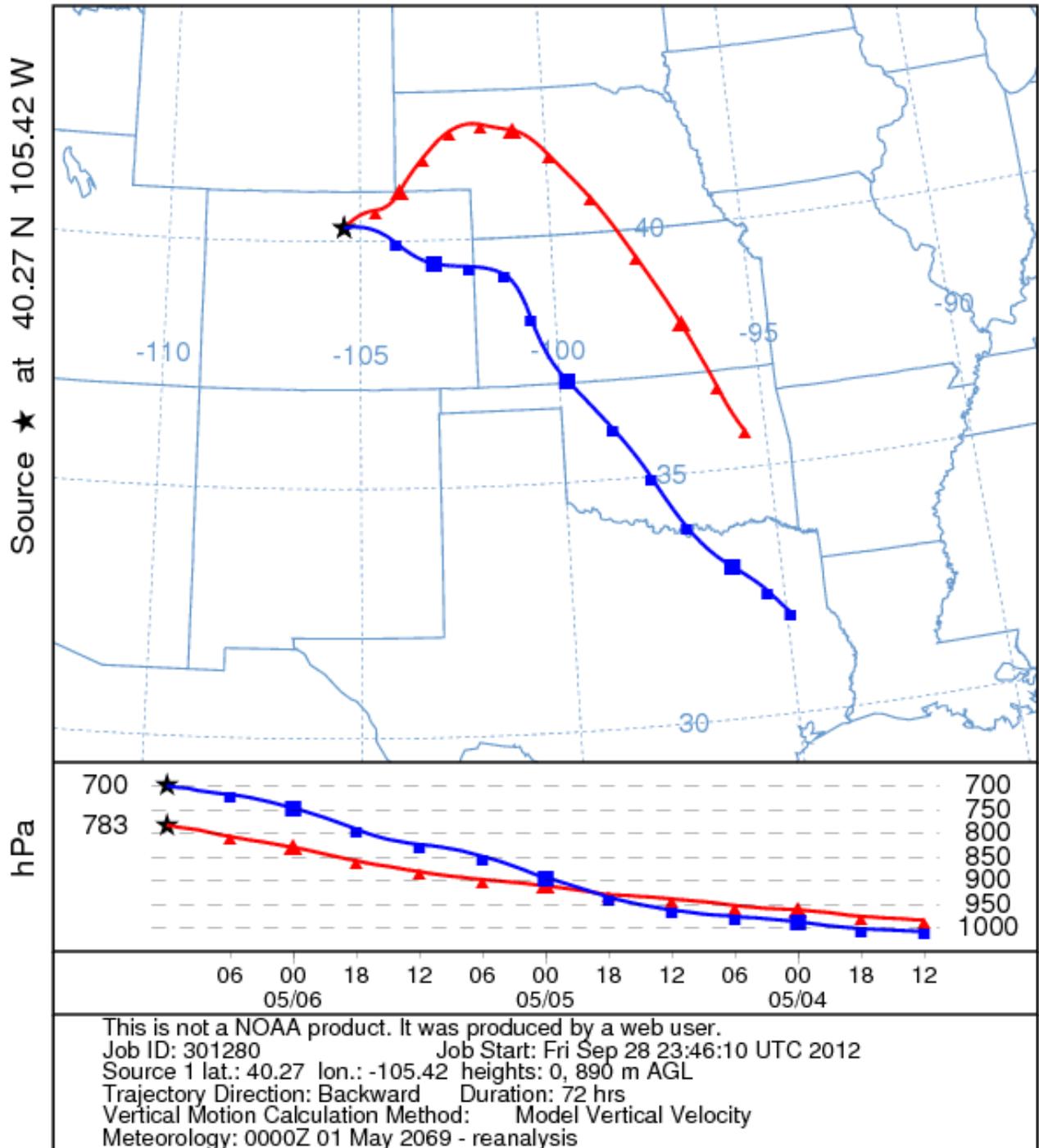
**Precipitation (inches)**

0.00 - 1.00	4.01 - 5.00	8.01 - 9.00	12.01 - 14.00
1.01 - 2.00	5.01 - 6.00	9.01 - 10.00	14.01 - 16.00
2.01 - 3.00	6.01 - 7.00	10.01 - 11.00	16.01 - 18.00
3.01 - 4.00	7.01 - 8.00	11.01 - 12.00	18.01 - 20.00

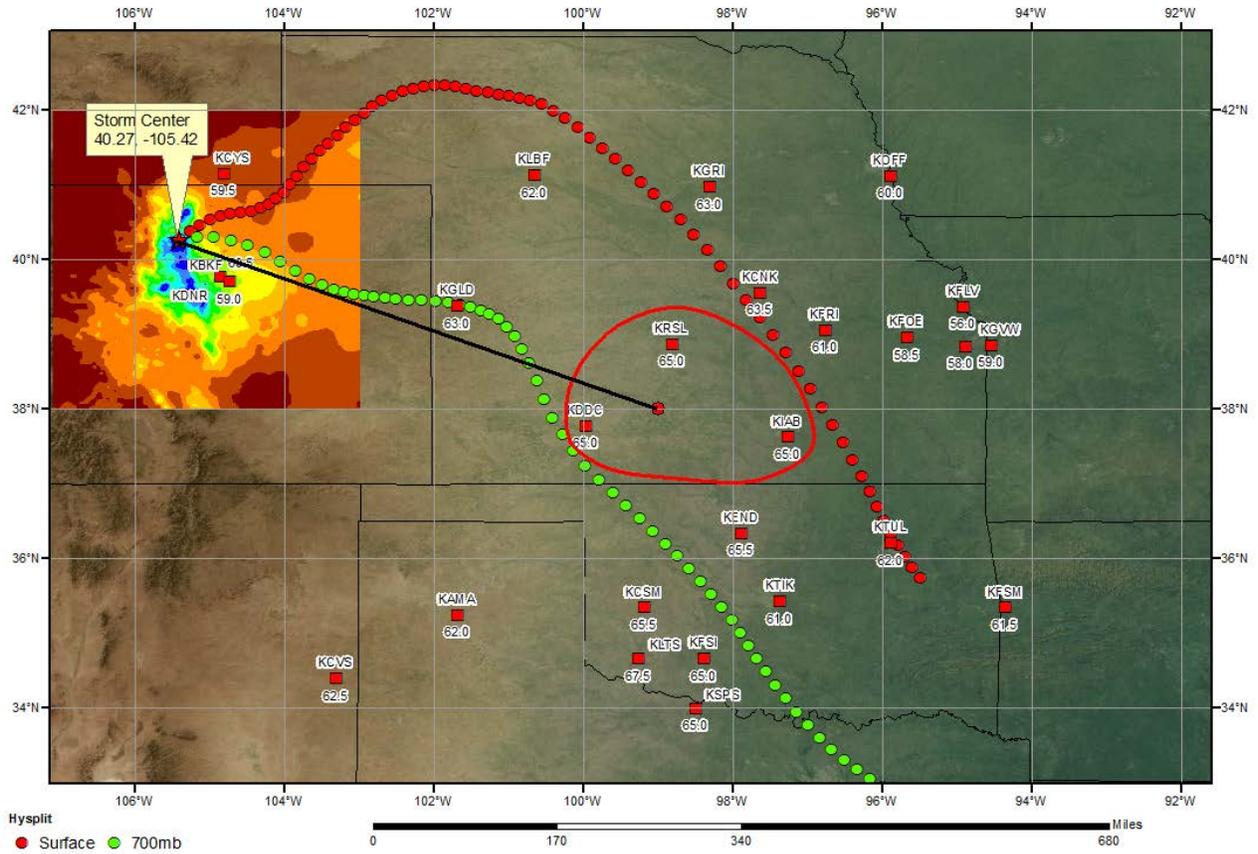


9/26/2012

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 06 May 69  
 CDC1 Meteorological Data



### SPAS 1253 Big Elk Meadow, CO Storm Analysis May 2-5, 1969



## Storm Precipitation Analysis System (SPAS) For Storm #1219\_1

**General Storm Location:** Mountain View-Big Fork, AR

**Storm Dates:** December 1 (0600) - December 5 (0500), 1982

**Event:** Convective

### DAD Zone 1

**Latitude:** 35.8708

**Longitude:** -92.1208

**Max. Grid/Radar Rainfall Amount:** 15.92"

**Max. Observed Rainfall Amount:** 15.59"

**Number of Stations:** 733 (524 Daily, 148 Hourly, 40 Hourly Pseudo, 21 Supplemental)

**SPAS Version:** 9.0

**Base Map Used:** Mean (1971-2000) PRISM July Precipitation

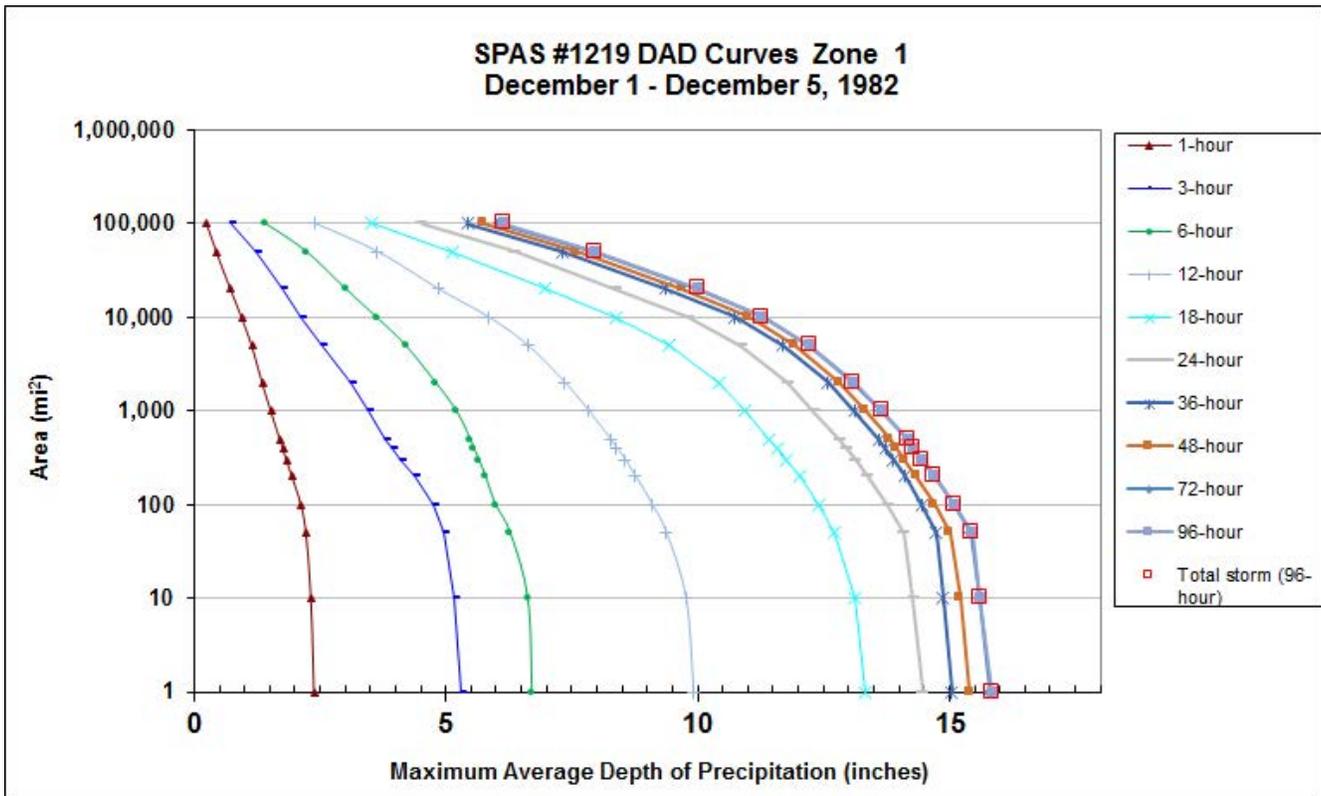
**Spatial resolution:** 0.30 sq-mi

**Radar Included:** No

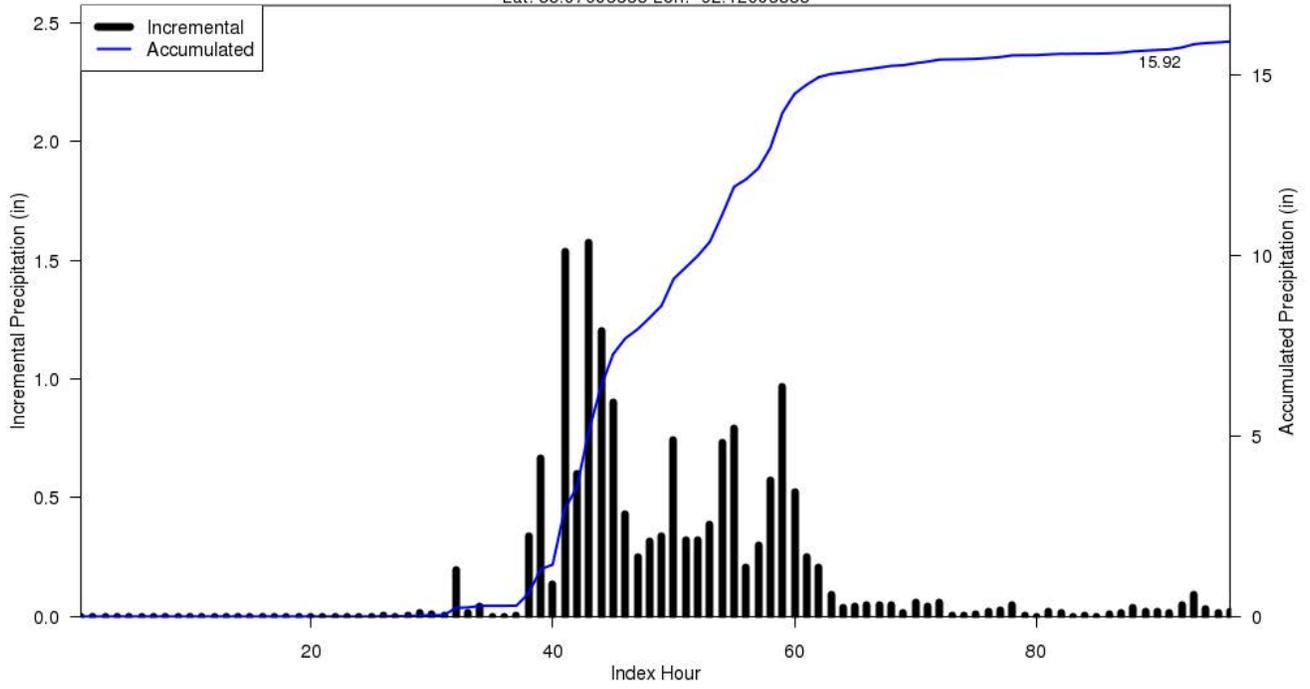
**Depth-Area-Duration (DAD) analysis:** Yes

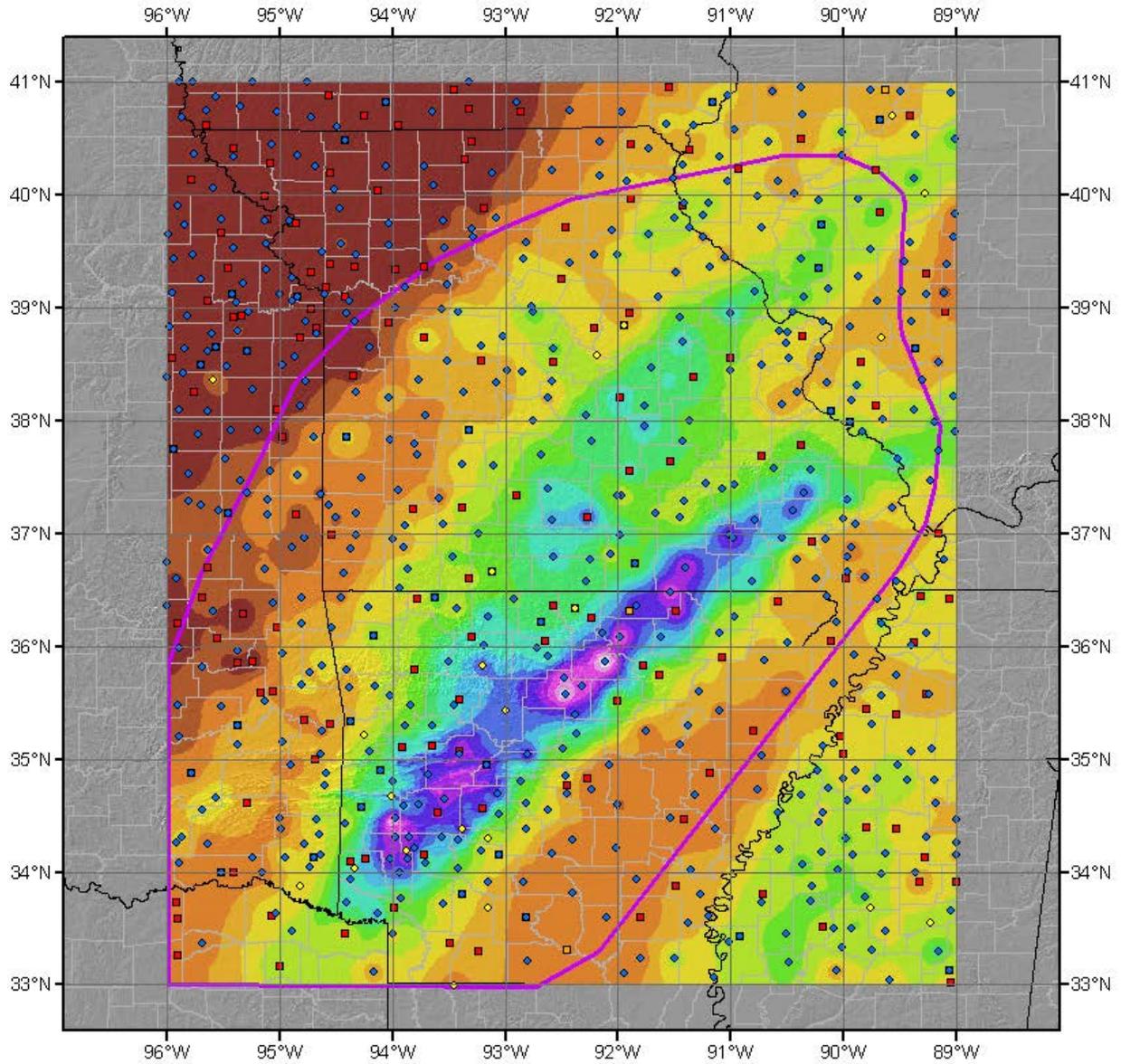
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1219_1	-92.121	35.871	764	800	72.00	2.47	0.18	66	2.290	74.86	75.0	2.85	0.20	72	2.650	1.157

Storm 1219 - December 1 (0600 UTC) - December 5 (0500 UTC), 1982											
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)											
Area (mi <sup>2</sup> )	Duration (hours)										
	1	3	6	12	18	24	36	48	72	96	Total
0.4	2.41	5.34	6.73	9.97	13.40	14.55	15.13	15.47	15.88	15.92	15.92
1	2.39	5.29	6.70	9.91	13.32	14.47	15.05	15.40	15.80	15.85	15.85
10	2.33	5.17	6.62	9.76	13.11	14.27	14.87	15.21	15.59	15.61	15.61
50	2.23	4.96	6.27	9.37	12.70	14.09	14.74	15.02	15.43	15.45	15.45
100	2.13	4.74	5.98	9.09	12.39	13.77	14.45	14.70	15.08	15.10	15.10
200	1.95	4.38	5.78	8.76	12.03	13.38	14.13	14.34	14.70	14.71	14.71
300	1.84	4.12	5.65	8.56	11.76	13.14	13.89	14.11	14.45	14.47	14.47
400	1.77	3.94	5.55	8.39	11.57	12.96	13.73	13.95	14.29	14.30	14.30
500	1.71	3.81	5.48	8.26	11.43	12.80	13.60	13.82	14.16	14.17	14.17
1000	1.53	3.45	5.20	7.83	10.94	12.30	13.12	13.34	13.65	13.67	13.67
2,000	1.36	3.12	4.79	7.36	10.43	11.78	12.58	12.81	13.08	13.10	13.10
5,000	1.15	2.53	4.19	6.62	9.44	10.86	11.69	11.93	12.21	12.22	12.22
10,000	0.95	2.12	3.61	5.84	8.39	9.81	10.74	11.01	11.28	11.29	11.29
20,000	0.73	1.73	3.00	4.85	6.99	8.37	9.38	9.70	10.01	10.03	10.03
50,000	0.45	1.23	2.22	3.64	5.13	6.37	7.31	7.60	7.92	7.95	7.95
100,000	0.26	0.73	1.40	2.40	3.51	4.52	5.43	5.75	6.05	6.14	6.14



SPAS 1219 Storm Center Mass Curve Zone 1  
December 1 (600UTC) to December 5 (500UTC), 1982  
Lat: 35.87083333 Lon: -92.12083333





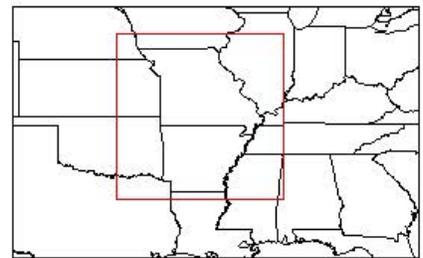
**Total Precipitation (96 hours)**  
**SPAS #1219**  
**12/01/1982 0100 UTC - 12/05/1982 0500 UTC**

- ◆ Daily
- Hourly Pseudo
- Hourly
- ◇ Supplemental

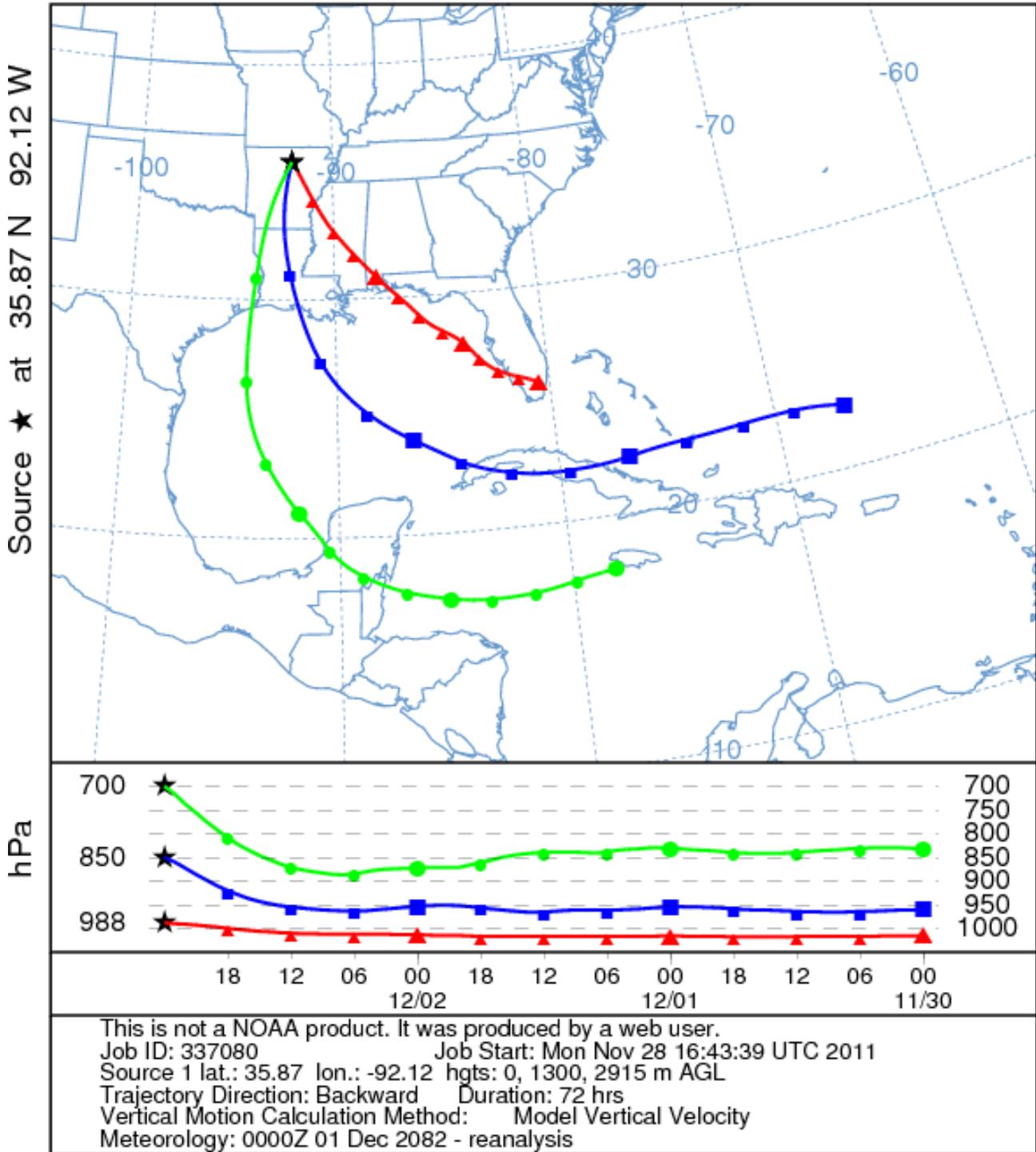


**Precipitation (inches)**

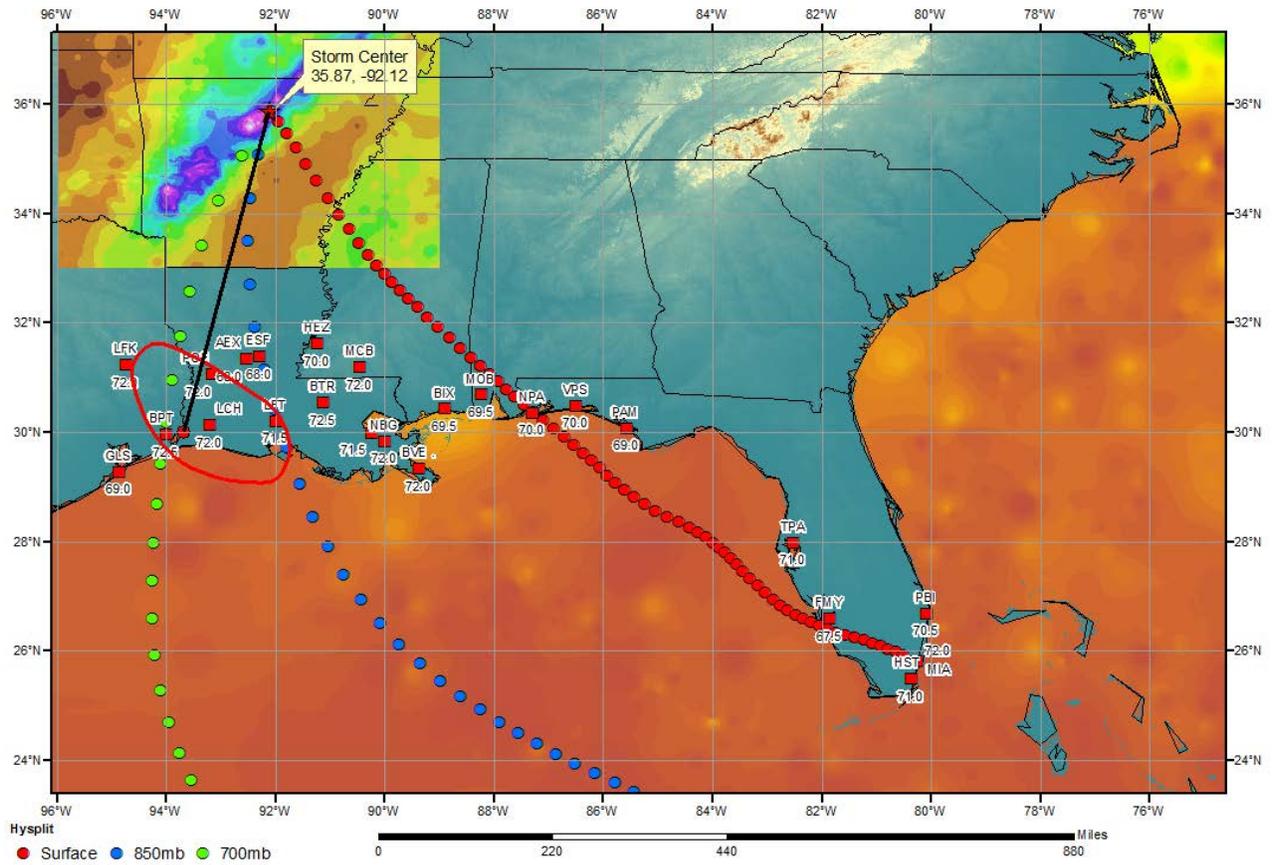
0.00 - 1.00	4.01 - 5.00	8.01 - 9.00	12.01 - 13.00
1.01 - 2.00	5.01 - 6.00	9.01 - 10.00	13.01 - 14.00
2.01 - 3.00	6.01 - 7.00	10.01 - 11.00	14.01 - 15.00
3.01 - 4.00	7.01 - 8.00	11.01 - 12.00	15.01 - 16.00



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 03 Dec 82  
 CDC1 Meteorological Data



### SPAS 1219 - Big Fork, AR Storm Analysis November 30 - December 4, 1982



## Storm Precipitation Analysis System (SPAS) For Storm #1719\_1

**General Storm Location:** Necaise, MS

**Storm Dates:** May 8-10, 1995

**Event:** Synoptic Event

### DAD Zone 1

**Latitude:** 30.5650

**Longitude:** -89.4950

**Max. Grid Rainfall Amount:** 28.51”

**Max. Observed Rainfall Amount:** 27.49”

**Number of Stations:** 284

**SPAS Version:** 10.0

**Base Map Used:** defaultP\_Tropical

**Radar Included:** Yes

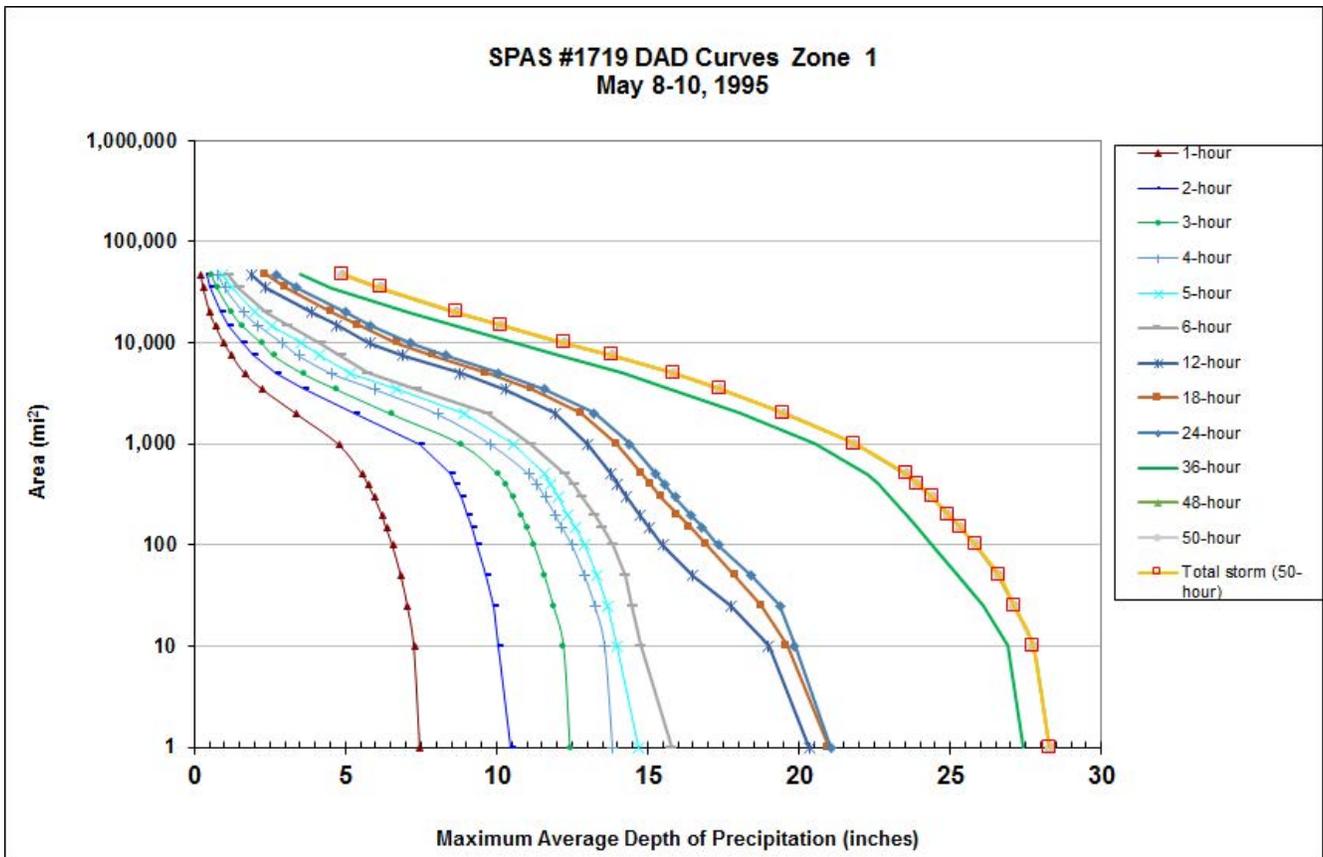
**Depth-Area-Duration (DAD) analysis:** Yes

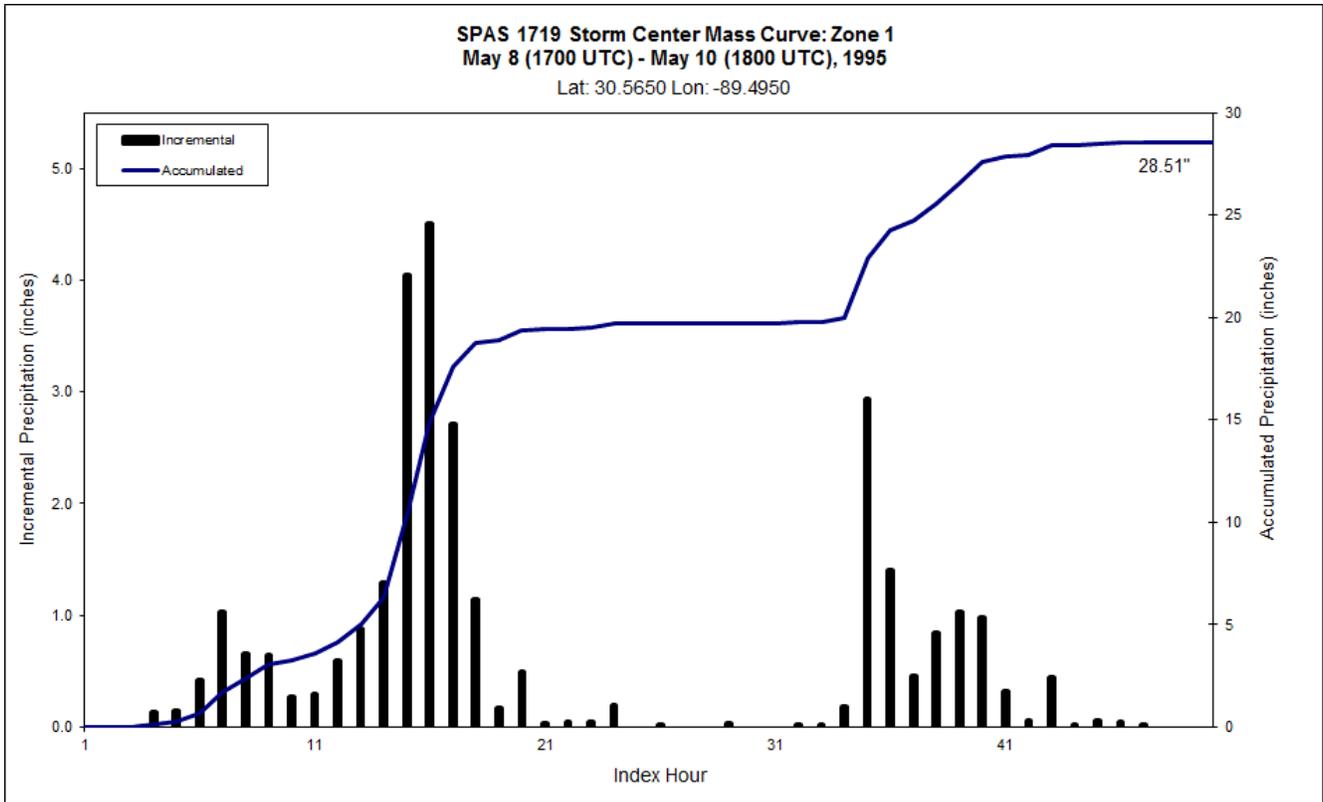
**Reliability of Results:** This analysis was based on 284 hourly stations, daily data, supplemental station data and NEXRAD Radar. We have a good degree of confidence for the radar/station based storm total results. The spatial pattern is dependent on the radar data and basemap. Timing is based on the hourly and hourly pseudo stations. Several daily stations were moved to supplemental due to timing issues and to ensure data consistency.

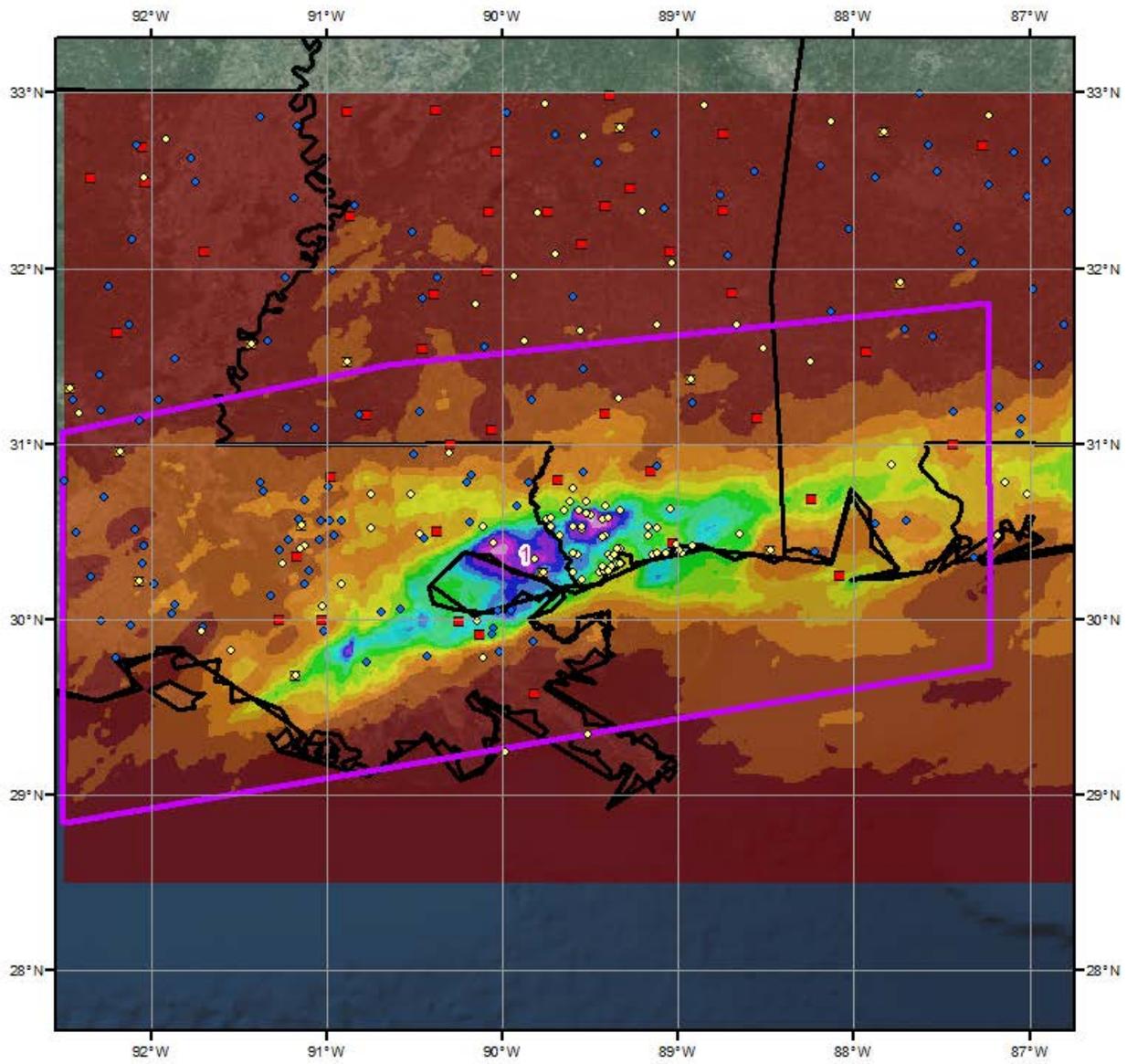
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1719_1	-89.495	30.565	84	100	79.50	3.52	0.03	81	3.490	82.50	82.5	4.03	0.03	87	4.000	1.146

**Storm 1719 - May 8 (1700 UTC) - May 10 (1800 UTC), 1995**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)												
	1	2	3	4	5	6	12	18	24	36	48	50	Total
0.4	7.53	10.63	12.51	13.94	14.98	16.07	20.68	21.34	21.41	27.61	28.51	28.51	28.51
1	7.47	10.46	12.43	13.84	14.69	15.77	20.34	20.98	21.05	27.41	28.30	28.30	28.30
10	7.28	10.06	12.22	13.58	13.97	14.77	18.99	19.61	19.86	26.88	27.75	27.75	27.75
25	7.07	9.89	11.89	13.26	13.65	14.48	17.73	18.77	19.36	26.07	27.11	27.12	27.12
50	6.85	9.63	11.59	12.92	13.30	14.24	16.48	17.90	18.42	25.26	26.62	26.64	26.64
100	6.57	9.35	11.25	12.50	12.89	13.83	15.51	16.95	17.33	24.42	25.84	25.85	25.85
150	6.36	9.18	11.00	12.17	12.58	13.49	15.05	16.38	16.79	23.91	25.33	25.35	25.35
200	6.22	9.06	10.83	11.95	12.35	13.23	14.74	15.99	16.41	23.56	24.94	24.96	24.96
300	5.97	8.82	10.54	11.61	12.02	12.83	14.30	15.45	15.90	23.04	24.39	24.41	24.41
400	5.76	8.63	10.31	11.35	11.77	12.55	14.00	15.08	15.54	22.62	23.92	23.94	23.94
500	5.58	8.45	10.07	11.10	11.57	12.25	13.78	14.80	15.27	22.27	23.55	23.57	23.57
1,000	4.79	7.48	8.84	9.81	10.59	11.12	13.00	13.96	14.40	20.51	21.84	21.85	21.85
2,000	3.40	5.33	6.53	8.05	8.95	9.69	11.92	12.80	13.23	18.04	19.49	19.50	19.50
3,500	2.27	3.64	4.71	5.98	6.70	7.37	10.30	11.18	11.59	15.78	17.40	17.41	17.41
5,000	1.68	2.71	3.61	4.57	5.18	5.73	8.80	9.67	10.06	14.17	15.85	15.86	15.86
7,500	1.26	1.93	2.65	3.47	4.14	4.84	6.90	7.89	8.33	12.14	13.83	13.84	13.84
10,000	0.99	1.59	2.24	2.93	3.52	4.17	5.82	6.74	7.16	10.68	12.23	12.24	12.24
15,000	0.70	1.13	1.59	2.12	2.55	3.08	4.71	5.44	5.81	8.53	10.13	10.15	10.15
20,000	0.52	0.88	1.25	1.65	2.01	2.40	3.90	4.55	5.01	7.10	8.67	8.70	8.70
35,000	0.30	0.54	0.77	1.03	1.24	1.48	2.38	3.02	3.39	4.50	6.12	6.16	6.16
47,766	0.22	0.42	0.58	0.78	0.94	1.13	1.89	2.36	2.71	3.50	4.90	4.93	4.93







**Total Storm (50-hours) Precipitation (inches)**  
**May 8, 1995 1700Z - May 10, 1995 1800Z**  
**SPAS NEXRAD 1719 - Necaise, MS**

**Gauges**

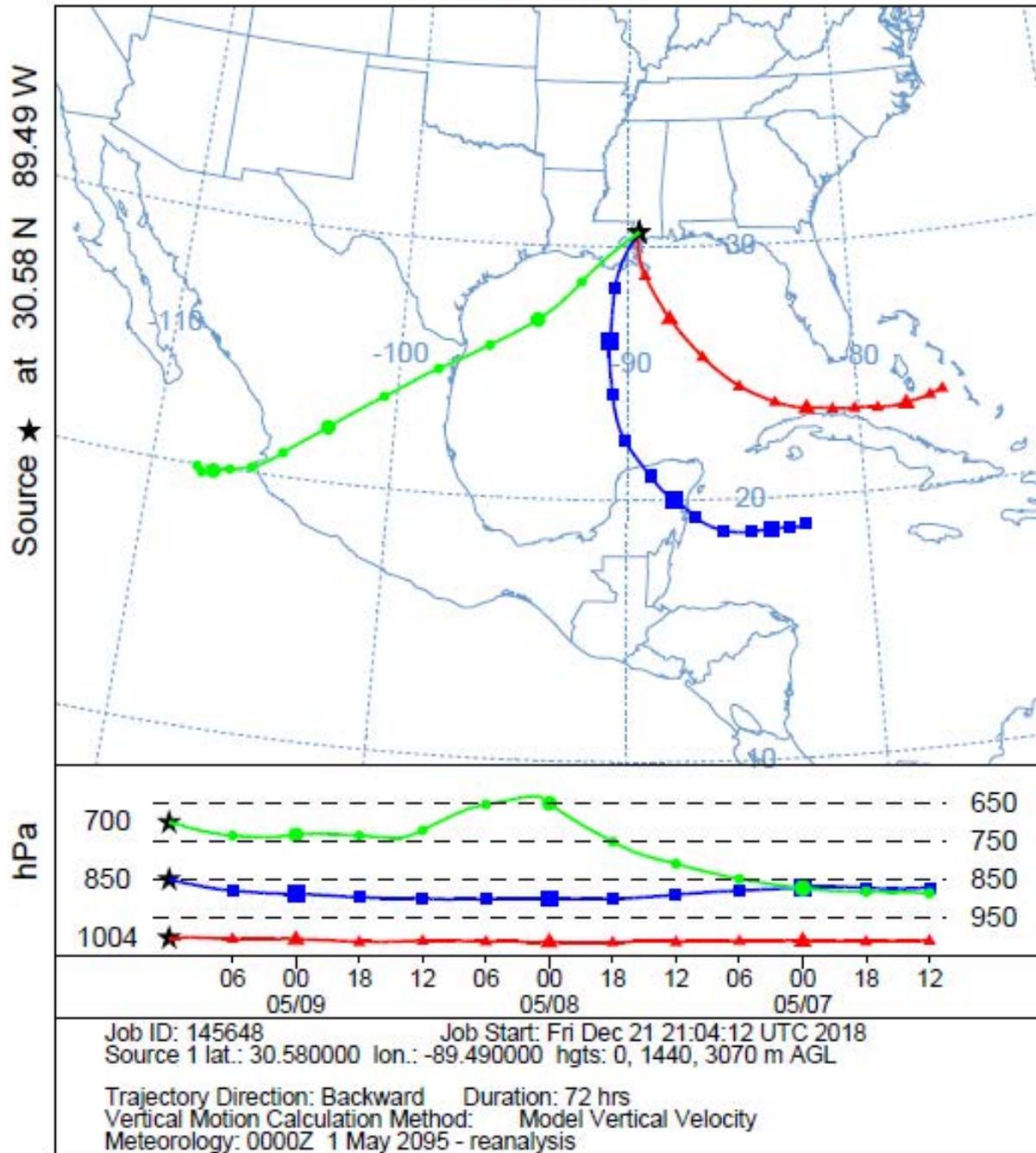
- ◆ Daily
- Hourly
- Hourly Pseudo
- ◇ Supplemental



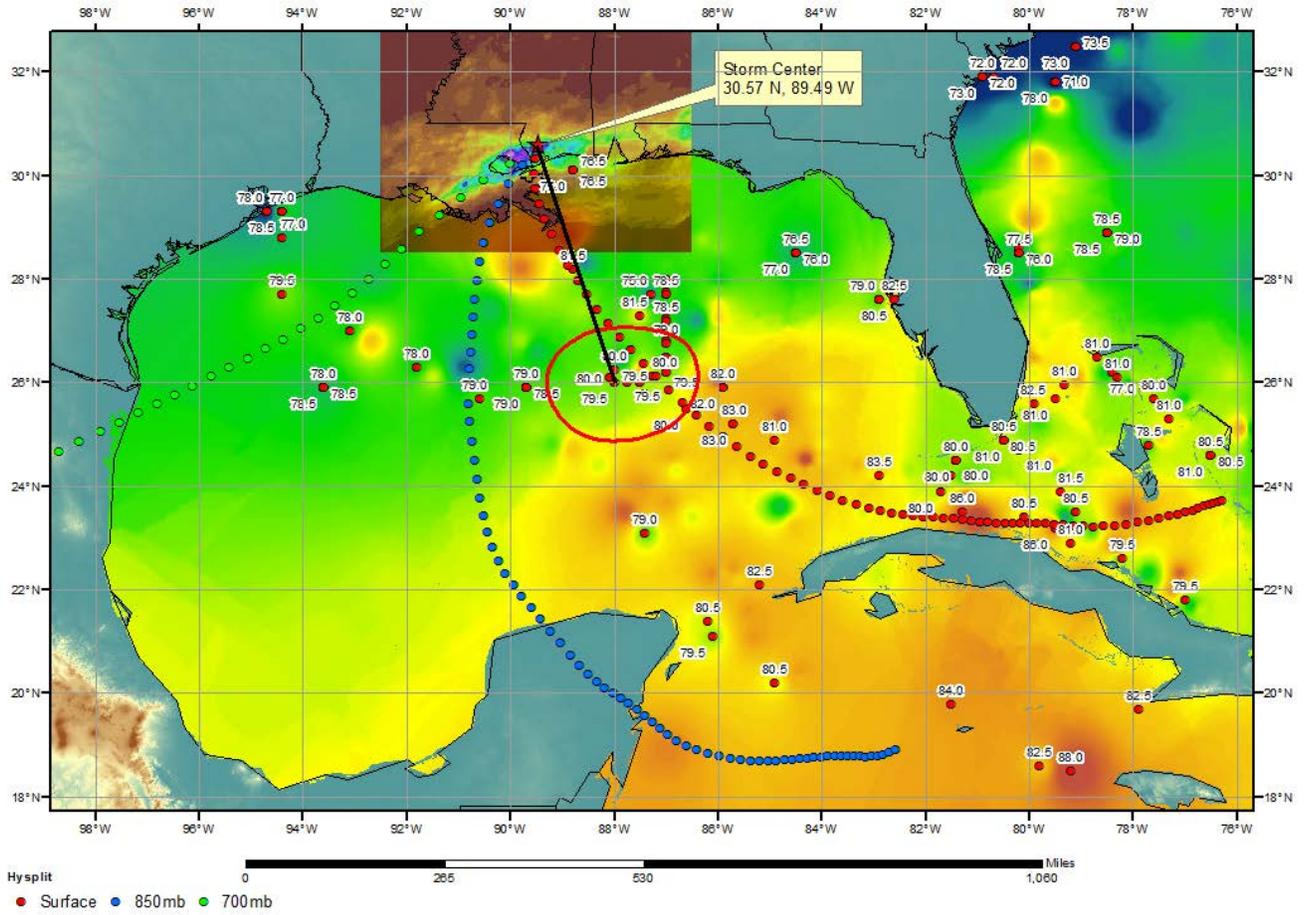
Precipitation (inches)	
0.00 - 2.00	8.01 - 10.00
2.01 - 4.00	10.01 - 12.00
4.01 - 6.00	12.01 - 14.00
6.01 - 8.00	14.01 - 16.00
	16.01 - 18.00
	18.01 - 20.00
	20.01 - 22.00
	22.01 - 24.00
	24.01 - 26.00
	26.01 - 28.00
	28.01 - 30.00



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 09 May 95  
 CDC1 Meteorological Data



### SPAS 1719 Necaise, MS Sea Surface Temperatures (F) May 9, 1995



## Storm Precipitation Analysis System (SPAS) For Storm #1286\_1 (Re-analysis of SPAS #1029)

**General Storm Location:** Northern Illinois (Aurora College, IL)

**Storm Dates:** July 17, 1996 0100 UTC – July 19, 1996 0000 UTC (48 hours)

**Event:** Mesoscale convective complex (MCC)

### DAD Zone 1

**Latitude:** 41.4575

**Longitude:** -88.0699

**Max. Grid Rainfall Amount:** 18.13”

**Number of Stations:** 173

**SPAS Version:** 10.0

**Base Map Used:** 1981-2010 Mean July Precipitation (PRISM)

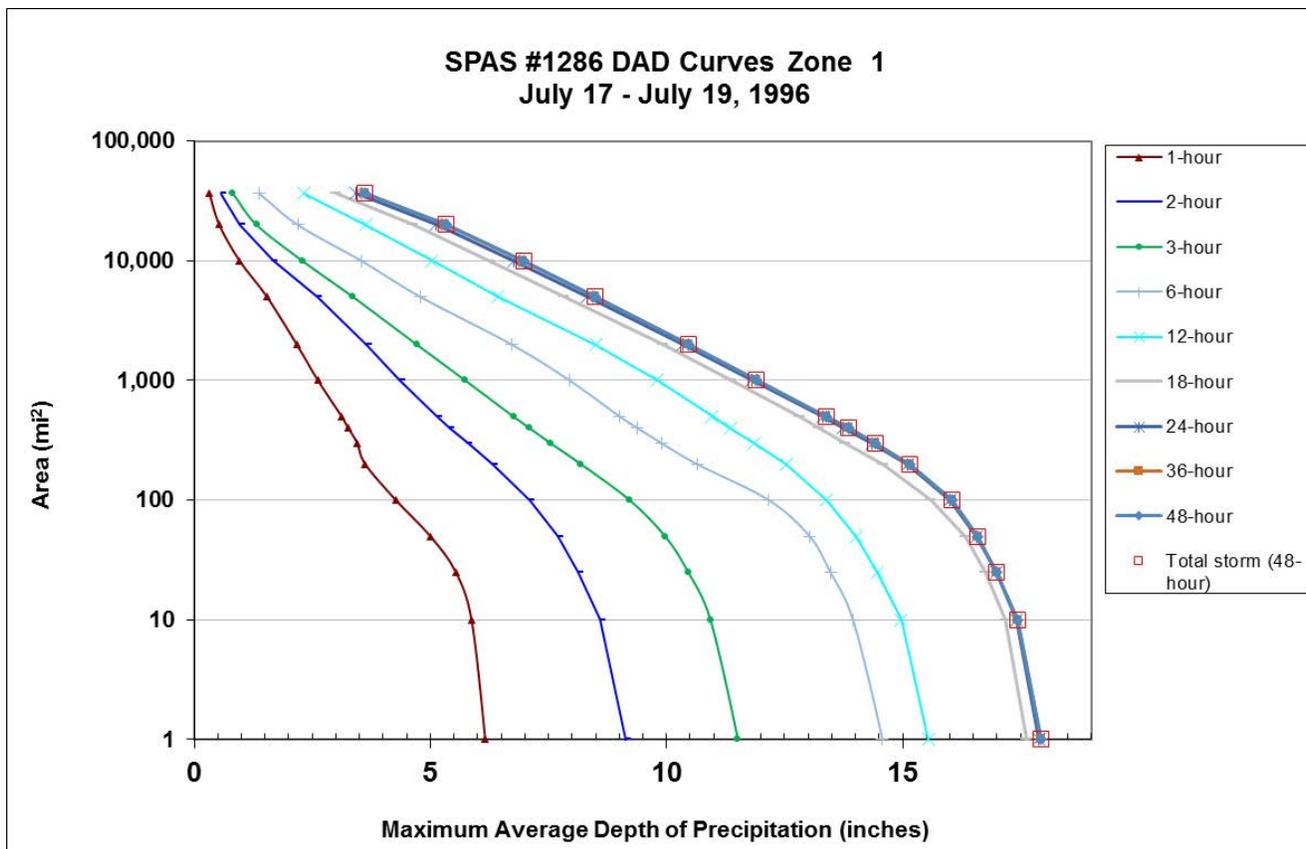
**Radar Included:** Yes (KMKX, KLOT and KIND)

**Depth-Area-Duration (DAD) analysis:** Yes, 1, 2, 3, 4, 5, 6, 12, 18, 24, 36 and 48 hours

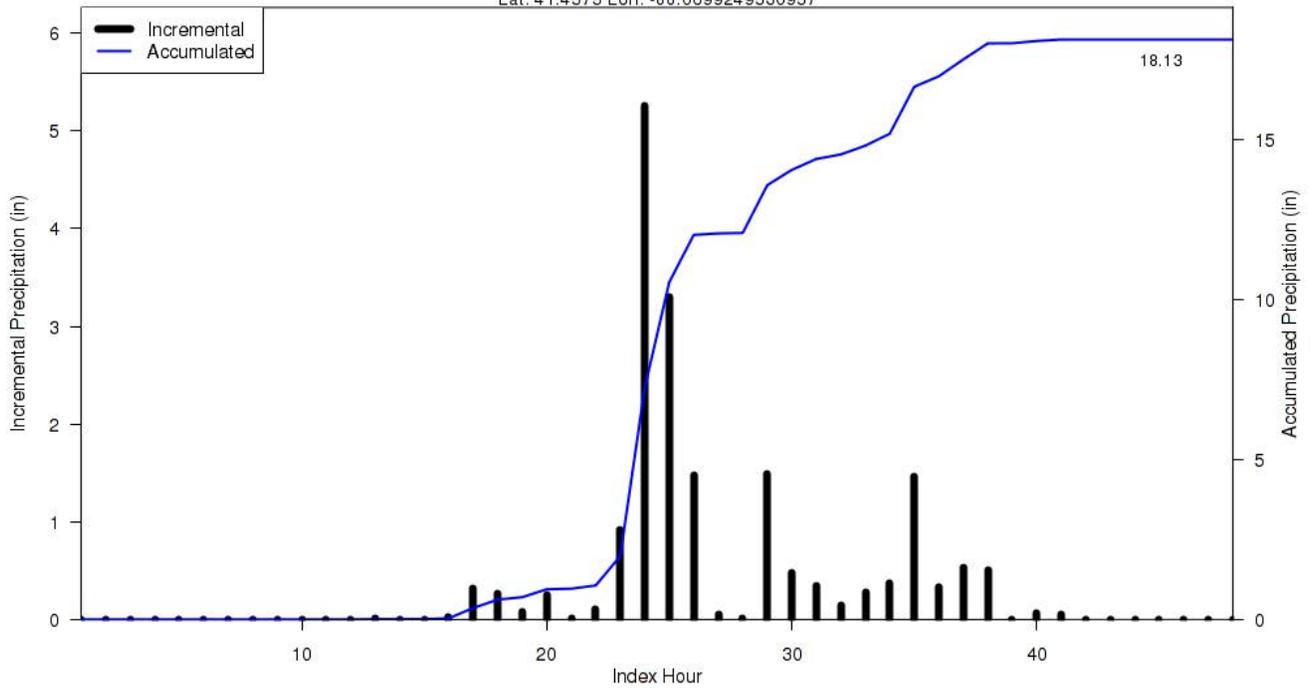
**Reliability of Results:** With the exception of the Southwestern corner of the analysis domain, we generally have a high degree of confidence in the results. Although there was a good deal of measured daily rainfall amounts in/around the storm center, a lack of hourly data forced us to develop and include several hourly-pseudo stations based on radar data and a default Z-R relationship.

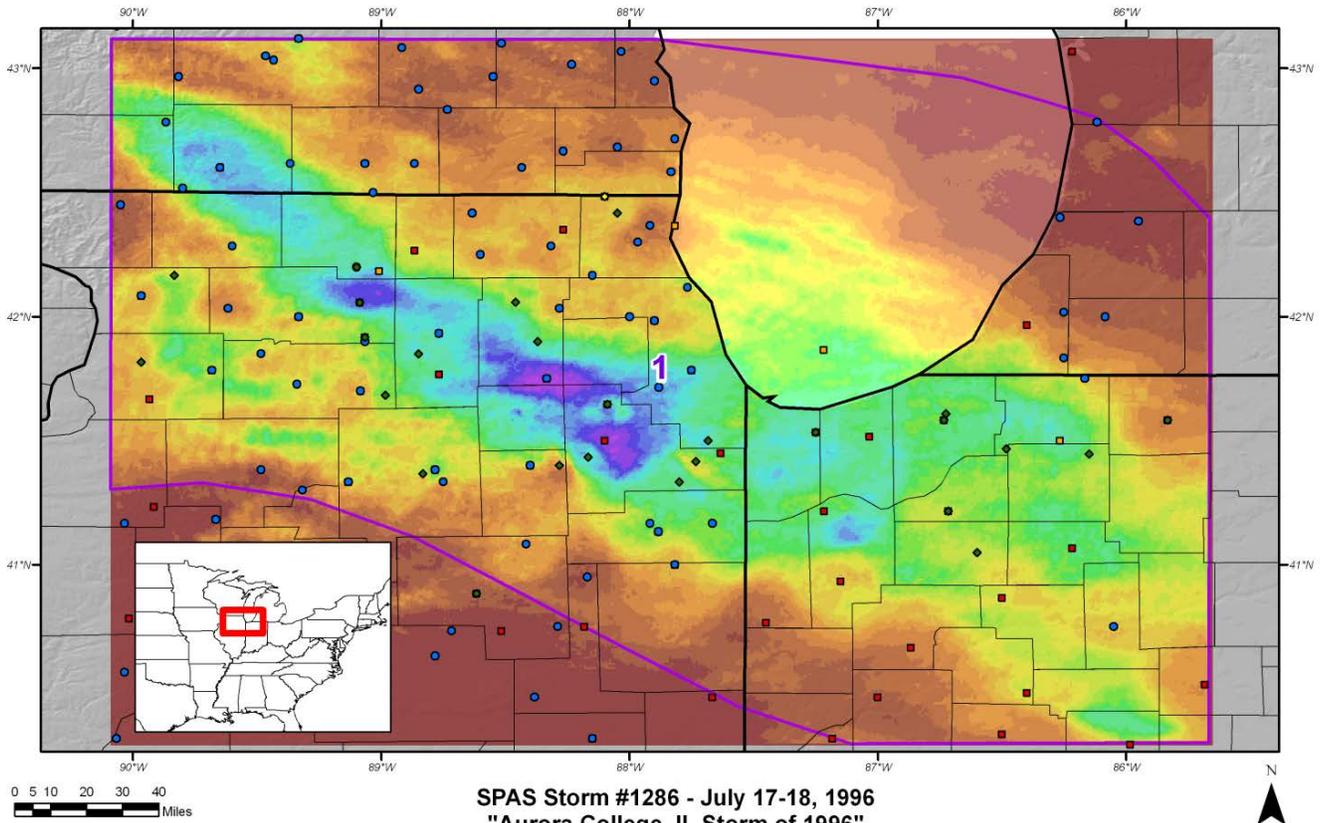
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1286_1	-88.070	41.458	634	600	74.00	2.73	0.15	70	2.580	80.61	80.5	3.68	0.18	83	3,500	1.357

Storm 1286 - July 17 (0100 UTC) - July 19 (0000 UTC), 1996										
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)										
Area (mi <sup>2</sup> )	Duration (hours)									
	1	2	3	6	12	18	24	36	48	Total
0.4	6.22	9.20	11.64	14.70	15.68	17.75	18.00	18.06	18.06	18.06
1	6.16	9.14	11.51	14.57	15.55	17.62	17.89	17.92	17.92	17.92
10	5.87	8.60	10.93	13.95	14.97	17.18	17.42	17.43	17.43	17.43
25	5.54	8.13	10.46	13.47	14.46	16.75	16.98	17.00	17.00	17.00
50	5.00	7.70	9.97	13.03	14.02	16.32	16.57	16.59	16.59	16.59
100	4.27	7.11	9.22	12.17	13.39	15.60	16.01	16.04	16.04	16.04
200	3.62	6.32	8.19	10.65	12.53	14.59	15.11	15.16	15.16	15.16
300	3.45	5.79	7.54	9.89	11.85	13.79	14.35	14.42	14.42	14.42
400	3.26	5.41	7.10	9.39	11.36	13.23	13.75	13.86	13.86	13.86
500	3.12	5.14	6.76	9.01	10.97	12.81	13.31	13.39	13.39	13.39
1,000	2.62	4.36	5.74	7.95	9.81	11.37	11.82	11.90	11.90	11.90
2,000	2.17	3.65	4.71	6.72	8.50	9.93	10.36	10.46	10.46	10.46
5,000	1.54	2.61	3.36	4.79	6.45	7.82	8.33	8.49	8.49	8.49
10,000	0.96	1.66	2.29	3.54	5.03	6.25	6.77	6.96	6.97	6.97
20,000	0.53	0.97	1.32	2.19	3.63	4.63	5.11	5.32	5.33	5.33
36,456	0.32	0.57	0.82	1.38	2.33	3.00	3.43	3.61	3.62	3.62



SPAS 1286 Storm Center Mass Curve Zone 1  
July 17 (100UTC) to July 19 (0UTC), 1996  
Lat: 41.4575 Lon: -88.0699249530957

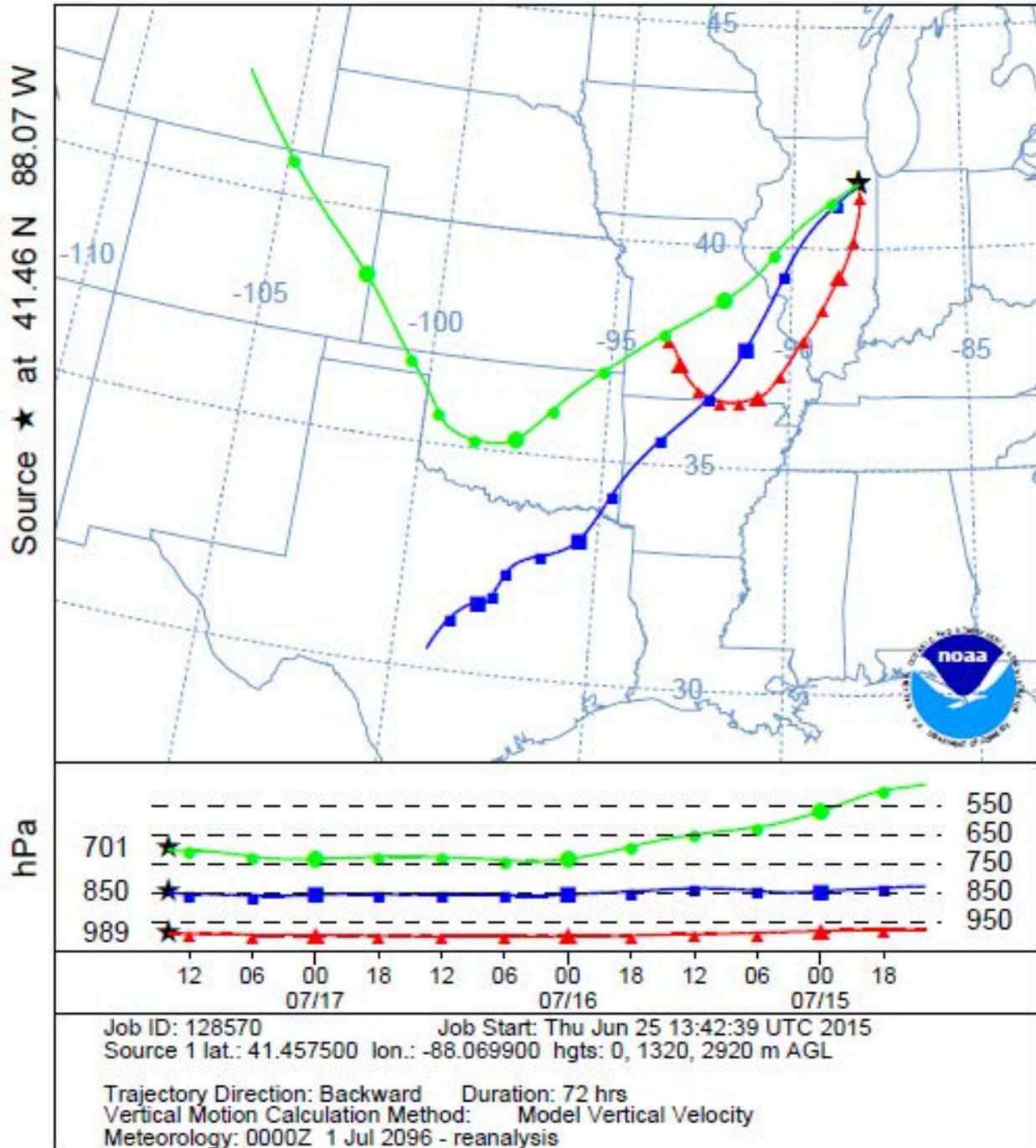




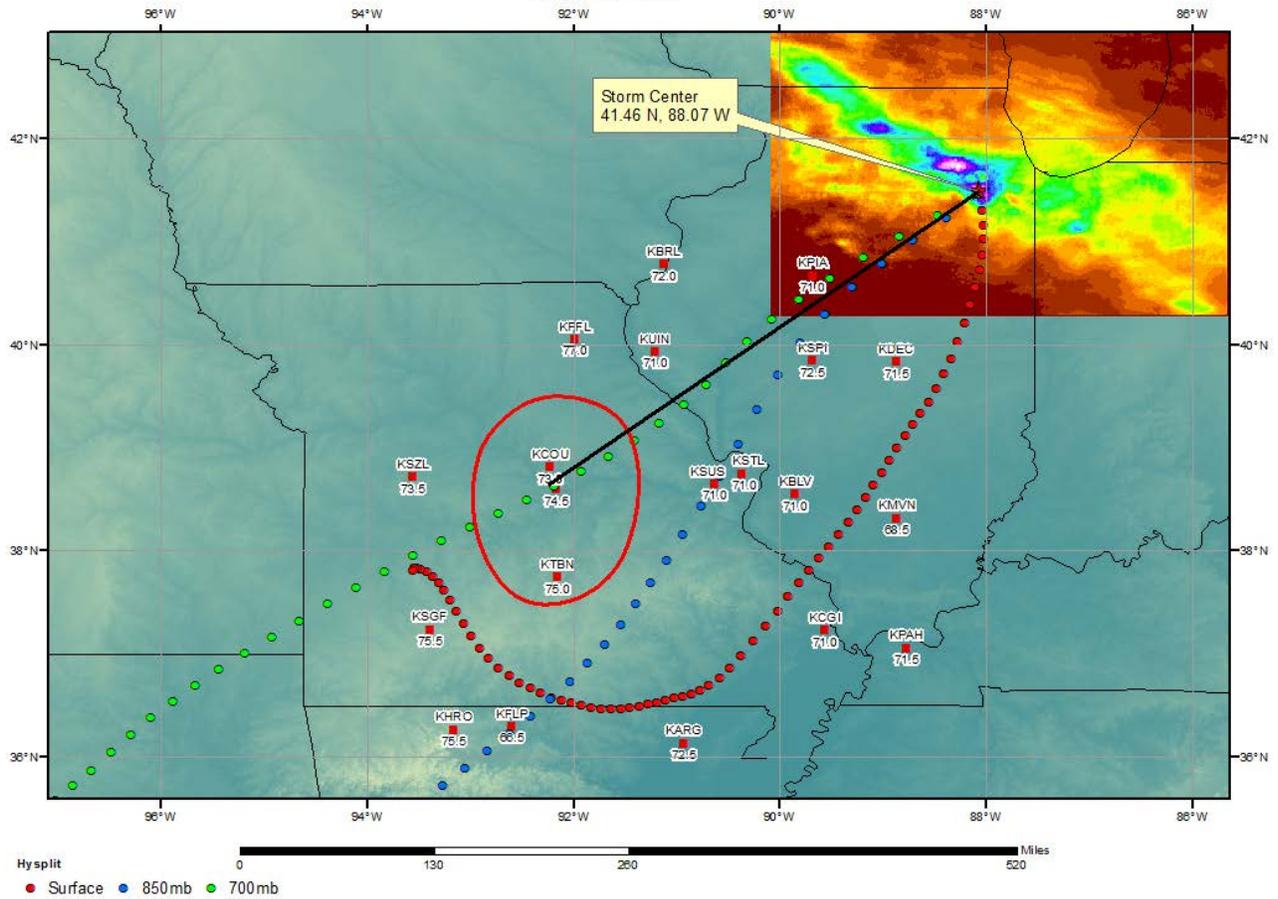
**SPAS Storm #1286 - July 17-18, 1996**  
**"Aurora College, IL Storm of 1996"**  
**Total 48-hour Rainfall**  
**July 17, 1996 0100 UTC – July 19, 1996 0000 UTC (48 hours)**



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1400 UTC 17 Jul 96  
 CDC1 Meteorological Data



### SPAS 1286 Aurora College, IL Storm Analysis July 17, 1996



## Storm Precipitation Analysis System (SPAS) For Storm #1242\_1

**General Storm Location:** Mainly Missouri, Illinois, and northern Arkansas.

**Storm Dates:** March 17-20, 2008

**Event:** General storm

### DAD Zone 1

**Latitude:** 37.155

**Longitude:** -91.445

**Max. Grid Rainfall Amount:** 15.09

**Max. Observed Rainfall Amount:** 15.10

**Number of Stations:** 1142 (474 Daily, 242 Hourly, 0 Hourly Estimated, 32 Hourly Pseudo, 390 Supplemental, and 4 Supplemental Estimated)

**SPAS Version:** 9.5

**Basemap:** PRISM Mean (1971-2000) March precipitation plus Stage IV 48-hr total rainfall

**Spatial resolution:** 36 seconds (~ 0.40 mi<sup>2</sup>)

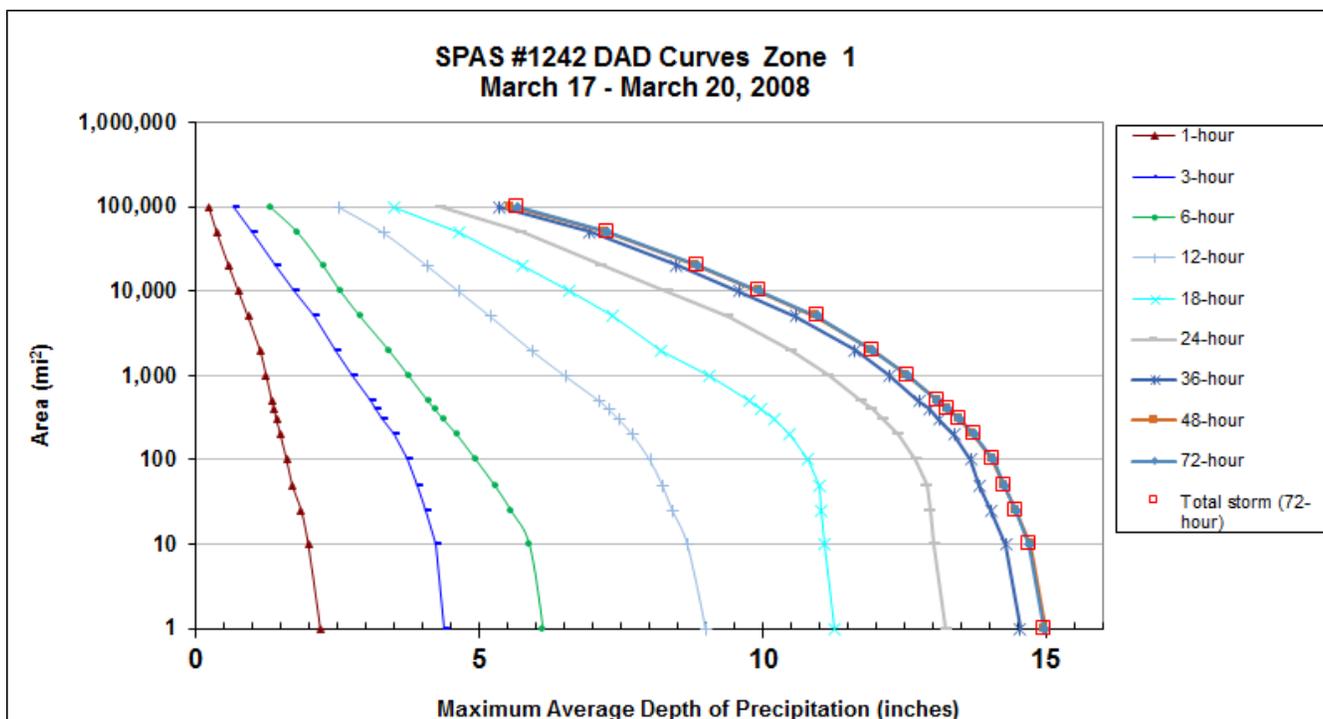
**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

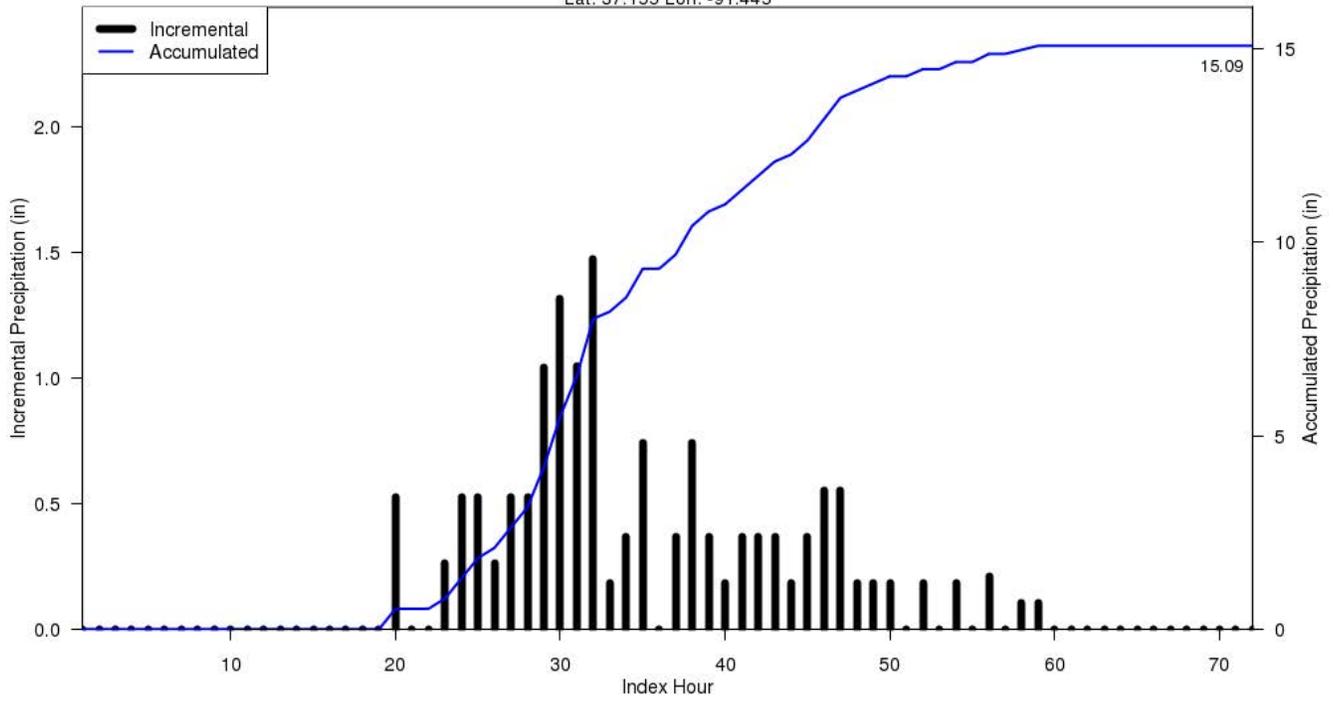
**Reliability of results:** This analysis was based on WDT NEXRAD data (unblocked) and extensive gauge data, we have a very high degree of confidence in the results. There were a few areas of radar beam blockage in the domain, these areas were adjusted using a beam blockage mask. The radar blocked areas did not affect the SPAS analysis.

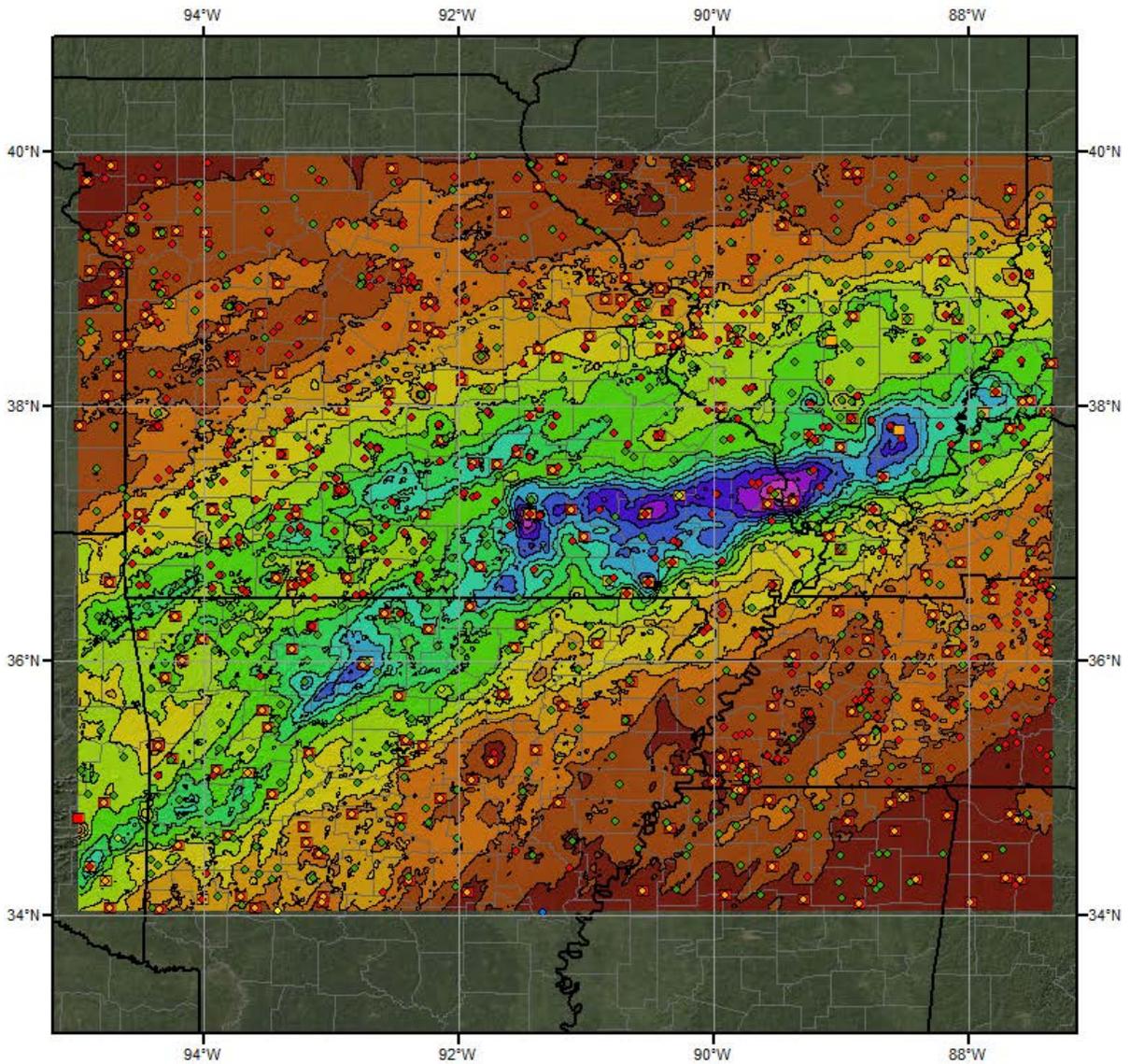
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1242_1	-91.445	37.115	946	900	66.00	1.86	0.17	54	1.690	71.79	72.0	2.47	0.21	66	2.260	1.337

Storm 1242 - March 17 (0700 UTC) - March 20 (0600 UTC), 2008										
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)										
Area (mi <sup>2</sup> )	Duration (hours)									
	1	3	6	12	18	24	36	48	72	Total
0.4	2.23	4.43	6.18	9.07	11.32	13.32	14.66	15.08	15.08	15.08
1	2.19	4.39	6.13	9.00	11.26	13.24	14.55	14.98	14.97	14.97
10	1.98	4.23	5.89	8.68	11.10	13.03	14.29	14.73	14.70	14.70
25	1.86	4.05	5.57	8.42	11.04	12.96	14.03	14.47	14.47	14.47
50	1.70	3.91	5.28	8.24	10.99	12.90	13.82	14.27	14.27	14.27
100	1.60	3.74	4.95	8.02	10.81	12.71	13.67	14.06	14.07	14.07
200	1.49	3.48	4.61	7.71	10.47	12.39	13.38	13.72	13.73	13.73
300	1.42	3.30	4.38	7.48	10.20	12.13	13.11	13.48	13.49	13.49
400	1.38	3.17	4.22	7.29	9.98	11.92	12.94	13.26	13.27	13.27
500	1.34	3.07	4.10	7.13	9.78	11.75	12.77	13.10	13.10	13.10
1,000	1.24	2.77	3.76	6.52	9.05	11.16	12.24	12.54	12.55	12.55
2,000	1.13	2.47	3.41	5.93	8.20	10.49	11.63	11.92	11.94	11.94
5,000	0.92	2.07	2.91	5.21	7.35	9.39	10.59	10.94	10.96	10.96
10,000	0.75	1.74	2.56	4.65	6.60	8.32	9.59	9.94	9.95	9.95
20,000	0.58	1.40	2.25	4.09	5.77	7.15	8.48	8.81	8.84	8.84
50,000	0.37	0.99	1.80	3.31	4.64	5.74	6.94	7.22	7.26	7.26
100,000	0.23	0.68	1.32	2.53	3.49	4.31	5.34	5.57	5.66	5.66



SPAS 1242 Storm Center Mass Curve Zone 1  
March 17 (700UTC) to March 20 (600UTC), 2008  
Lat: 37.155 Lon: -91.445

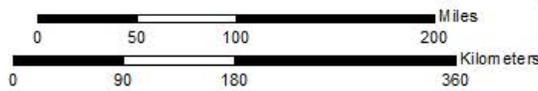




**Total Precipitation (72-hrs)**  
**SPAS-NEXRAD: 1242 Alley Spring, MO**  
**3/17/2008 0700 UTC - 3/20/2008 0600 UTC**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Pseudo
- ◇ Supplemental
- ◇ Supplemental Estimated



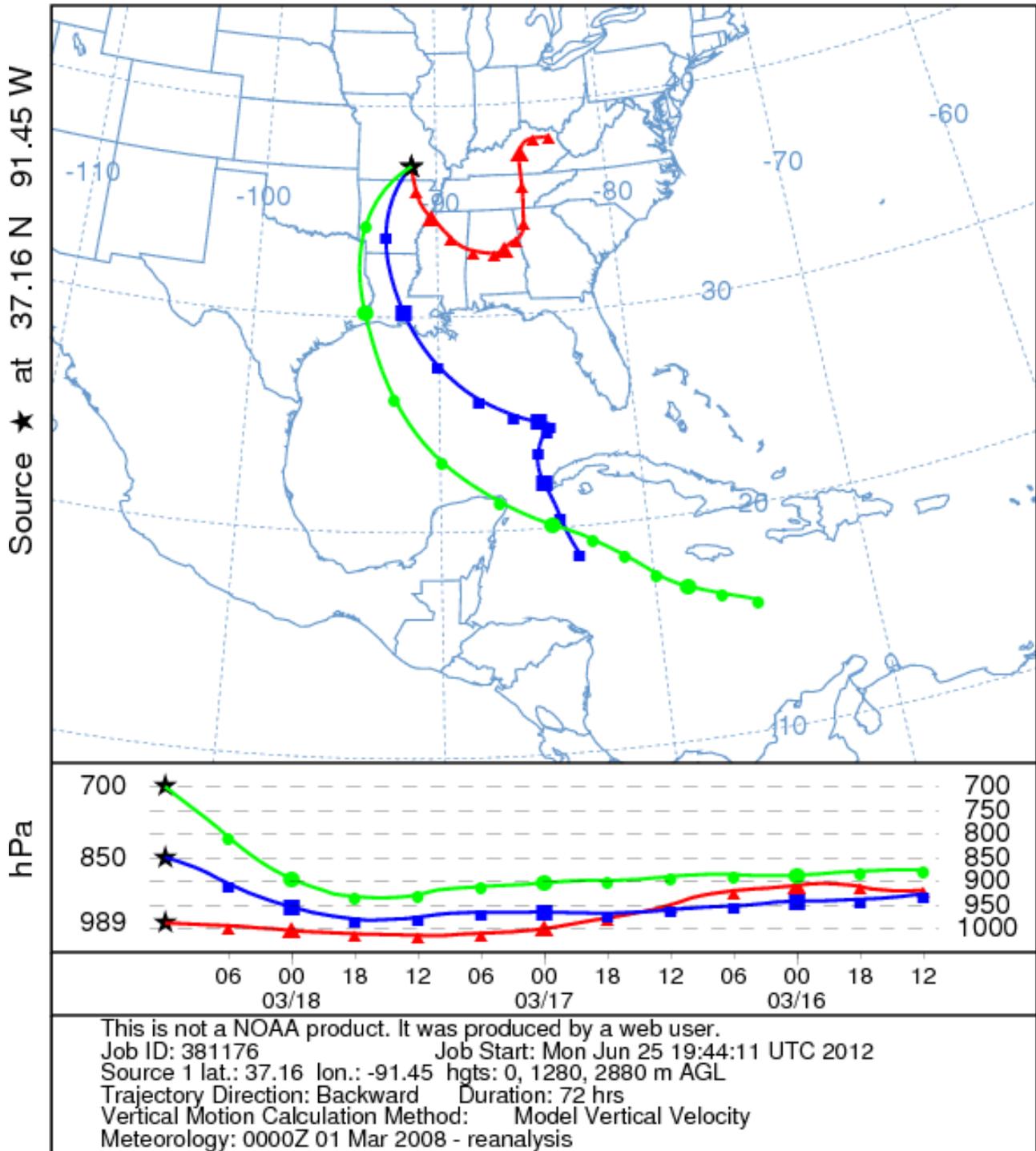
**Precipitation (inches)**

0.01 - 1.00	4.01 - 5.00	8.01 - 9.00	12.01 - 13.00
1.01 - 2.00	5.01 - 6.00	9.01 - 10.00	13.01 - 14.00
2.01 - 3.00	6.01 - 7.00	10.01 - 11.00	14.01 - 15.00
3.01 - 4.00	7.01 - 8.00	11.01 - 12.00	15.01 - 16.00

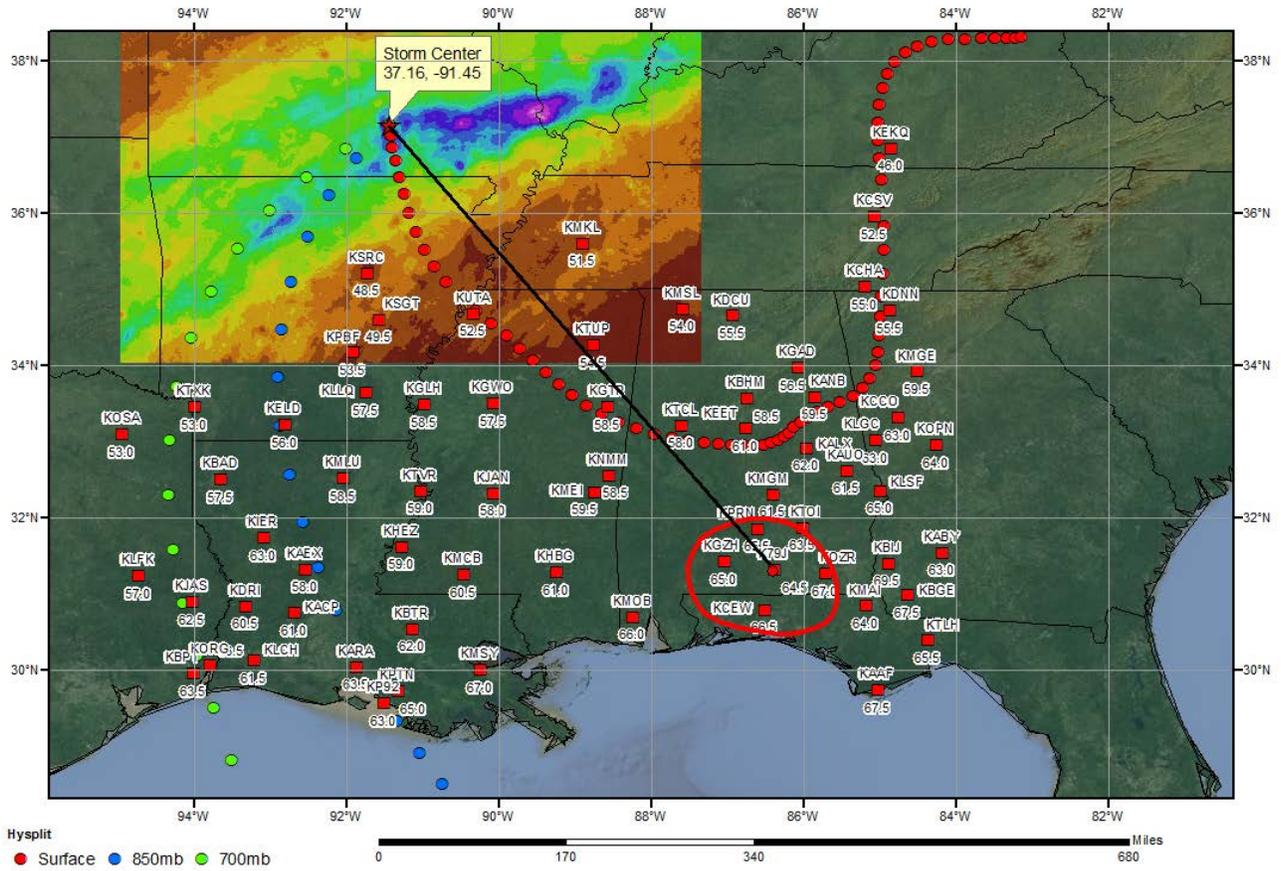


6/27/2012

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 18 Mar 08  
 CDC1 Meteorological Data



### SPAS 1242 Alley Spring, MO Storm Analysis March 15-18, 2008



## Storm Precipitation Analysis System (SPAS) For Storm #1218\_1

**General Storm Location:** Northwestern Georgia and portions of adjacent states

**Storm Dates:** September 19-22, 2009

**Event:** Thunderstorm

**DAD Zone 1 (southern center)**

**Latitude:** 33.87

**Longitude:** -84.76

**Max. Grid Rainfall Amount:** 25.37" (full storm period)

**Max. Observed Rainfall Amount:** 21.03" (24-hr total)

**Number of Stations:** 447 (59 Daily, 48 Hourly, 0 Hourly Estimated, 0 Hourly Estimated Pseudo, 62 Hourly Pseudo, 272 Supplemental, and 6 Supplemental Estimated)

**SPAS Version:** 8.5

**Base Map Used:** PRISM Mean (1971-2000) September precipitation

**Spatial resolution:** 36 seconds (~ 0.39 mi<sup>2</sup>)

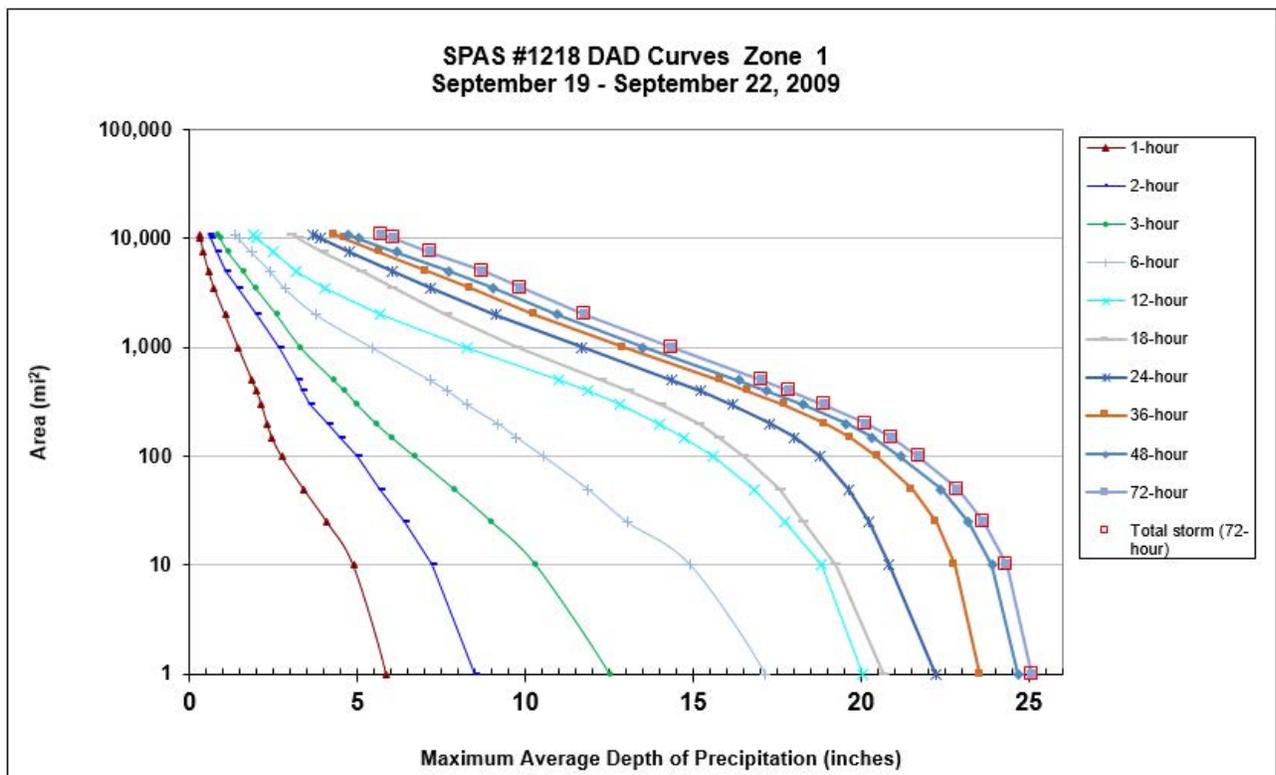
**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

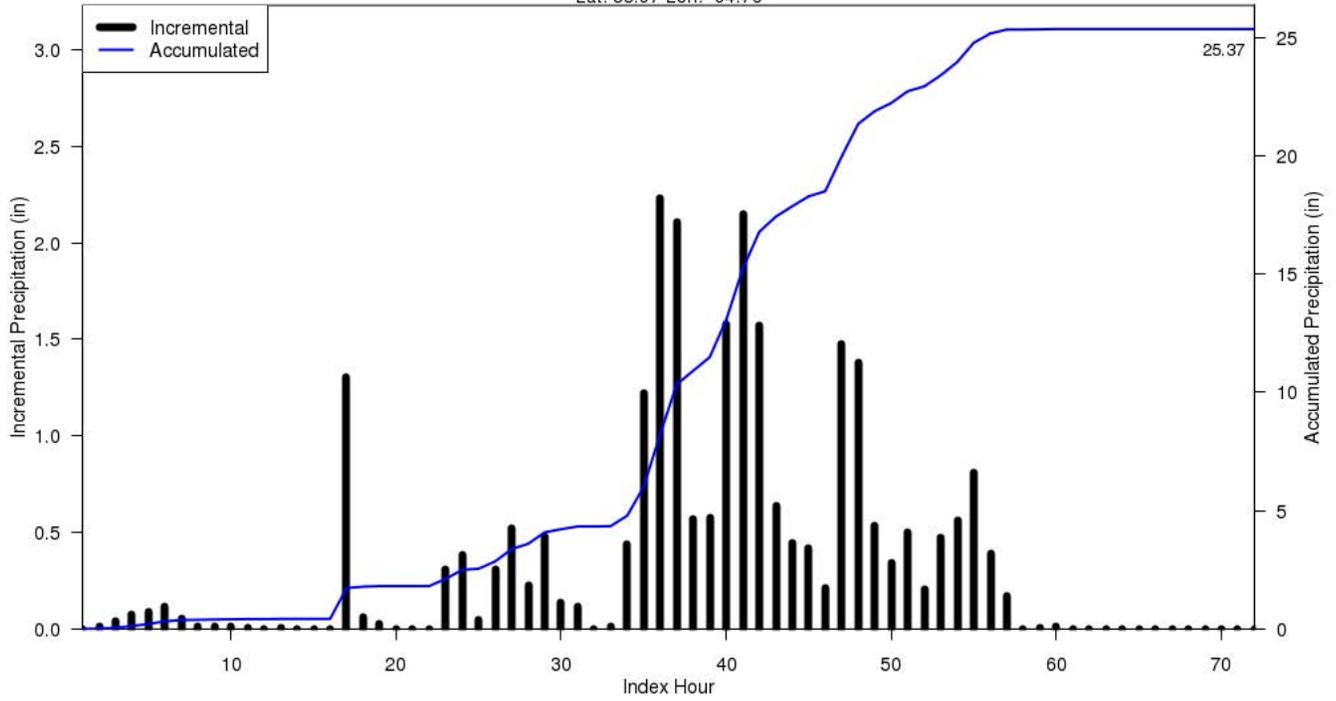
**Reliability of results:** Given the unblocked, clean and QC'ed radar data coupled with extensive gauge data, we have a very high degree of confidence in the results, particularly in DAD zone 1. We have slightly less confidence in the DAD results for Zone 2 given fewer stations sampled the peak rainfall center.

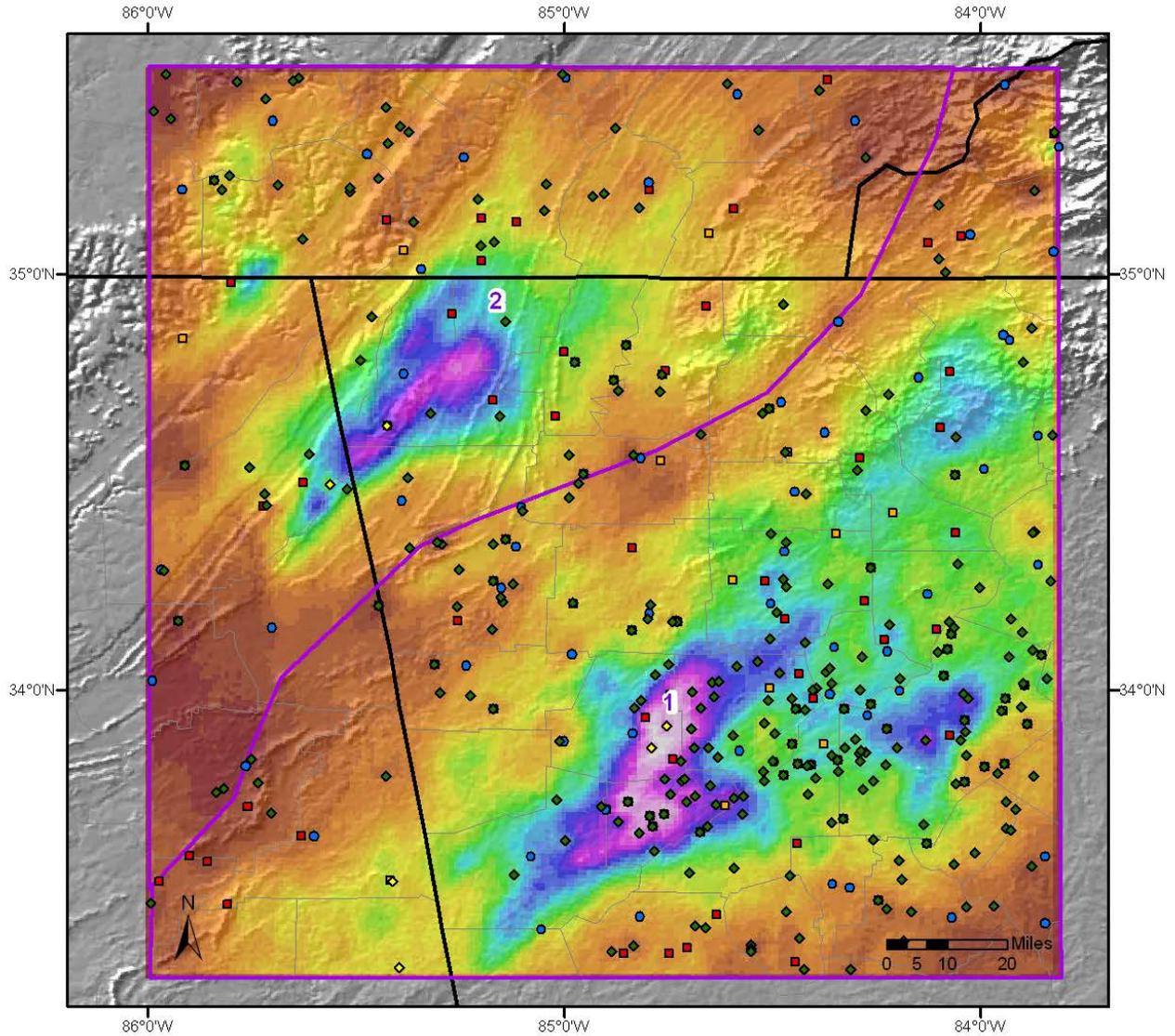
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1218_1	-84.760	33.870	939	900	76.00	2.99	0.23	74	2.760	78.74	78.5	3.37	0.26	79	3.110	1.127

Storm 1218 - September 19 (1300 UTC) - September 22 (1200 UTC), 2009											
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)											
Area (mi <sup>2</sup> )	Duration (hours)										
	1	2	3	6	12	18	24	36	48	72	Total
0.4	5.94	8.82	12.98	17.36	20.31	21.07	22.82	23.83	24.95	25.37	25.37
1	5.87	8.49	12.53	17.14	20.06	20.69	22.24	23.55	24.69	25.10	25.10
10	4.89	7.22	10.34	14.92	18.82	19.25	20.85	22.80	23.91	24.34	24.34
25	4.10	6.42	9.02	13.03	17.75	18.29	20.24	22.25	23.21	23.67	23.67
50	3.41	5.70	7.90	11.87	16.82	17.60	19.63	21.53	22.39	22.89	22.89
100	2.75	5.01	6.72	10.55	15.59	16.53	18.80	20.50	21.19	21.74	21.74
150	2.46	4.51	6.03	9.74	14.75	15.77	18.02	19.69	20.35	20.91	20.91
200	2.32	4.11	5.58	9.19	14.02	15.17	17.29	18.94	19.58	20.15	20.15
300	2.15	3.57	5.01	8.26	12.83	14.07	16.17	17.73	18.30	18.90	18.90
400	2.00	3.38	4.65	7.70	11.87	13.10	15.24	16.64	17.20	17.89	17.89
500	1.87	3.24	4.31	7.17	10.99	12.29	14.38	15.82	16.37	17.07	17.07
1,000	1.46	2.66	3.33	5.45	8.26	9.77	11.70	12.93	13.52	14.36	14.36
2,000	1.06	2.01	2.61	3.78	5.68	7.67	9.13	10.29	10.96	11.79	11.79
3,500	0.74	1.46	1.99	2.85	4.02	6.05	7.18	8.35	9.03	9.87	9.87
5,000	0.57	1.10	1.61	2.42	3.16	5.13	6.04	7.06	7.71	8.74	8.74
7,500	0.42	0.80	1.17	1.86	2.48	3.98	4.78	5.67	6.17	7.18	7.18
10,000	0.33	0.64	0.94	1.48	2.01	3.26	3.91	4.61	5.02	6.09	6.09
10,922	0.31	0.59	0.87	1.37	1.89	3.06	3.68	4.33	4.71	5.72	5.72



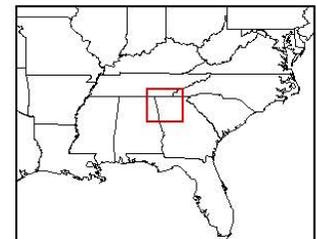
SPAS 1218 Storm Center Mass Curve Zone 1  
September 19 (1300UTC) to September 22 (1200UTC), 2009  
Lat: 33.87 Lon: -84.76



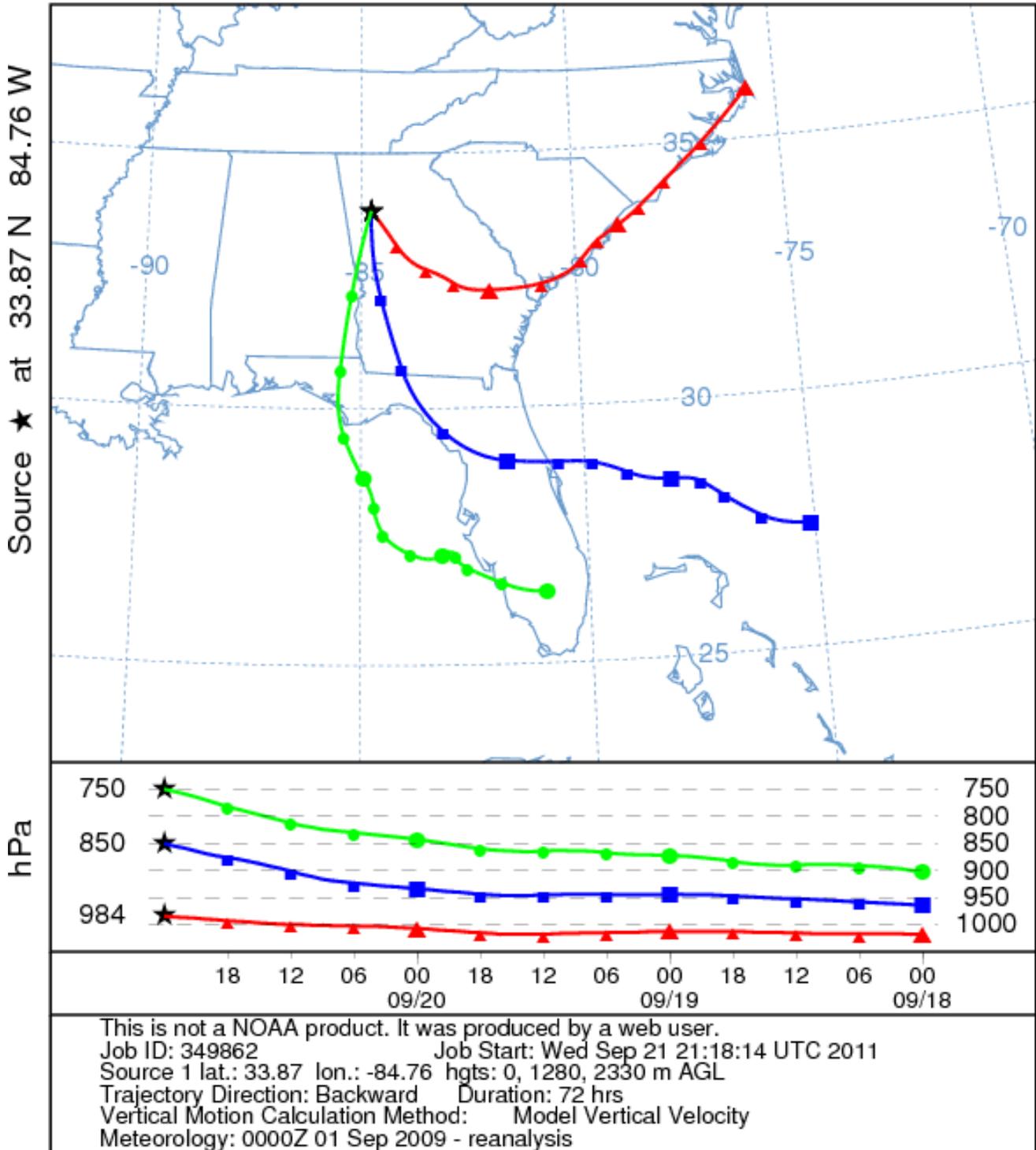


**Total 72-hour Rainfall (Inches)**  
**09/19/2009 1300 UTC - 09/22/2009 1300 UTC**  
**SPAS #1218**

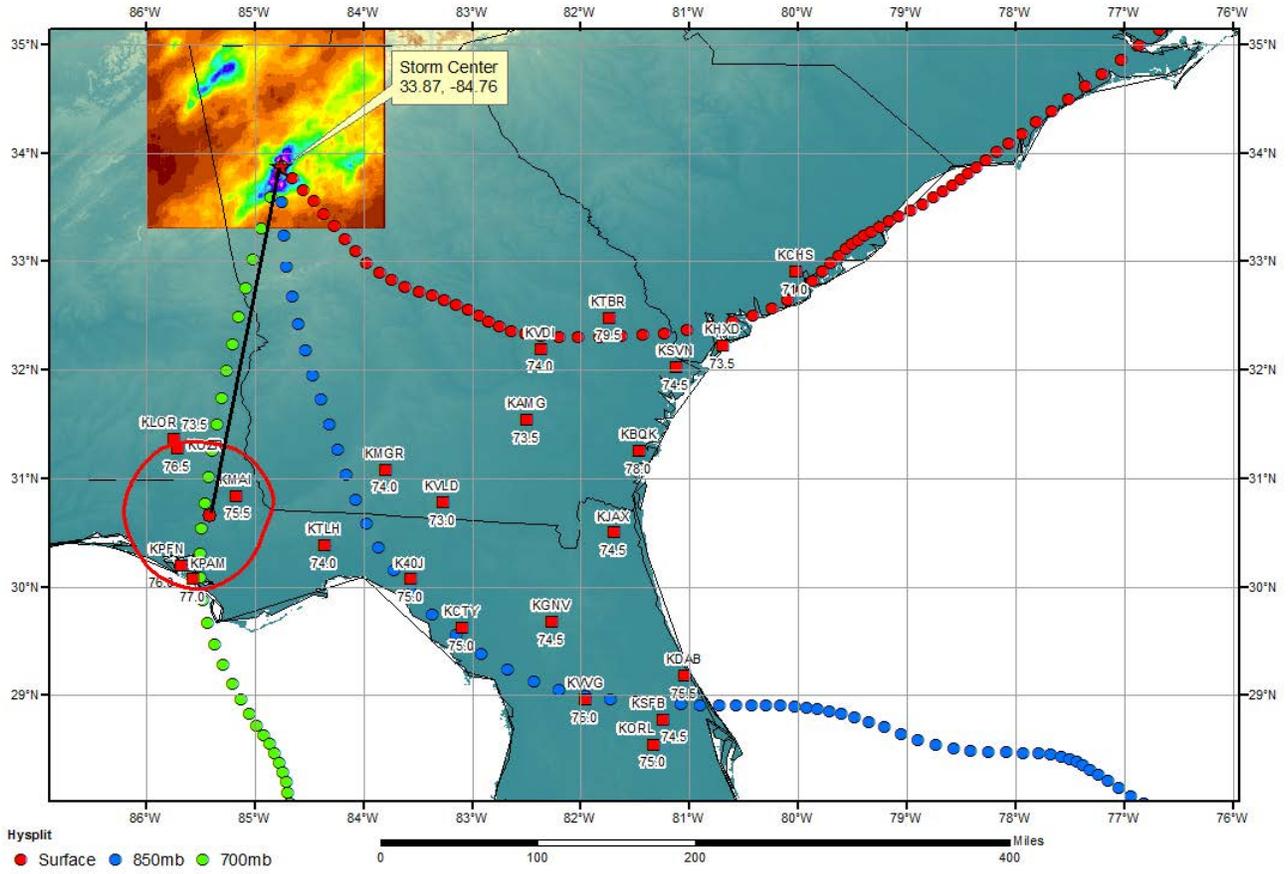
**Rainfall in Inches**



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 21 Sep 09  
 CDC1 Meteorological Data



### SPAS 1218 - Dew Point Temperature (F) September 18-22, 2009



## Storm Precipitation Analysis System (SPAS) For Storm #1208\_1

**General Storm Location:** Western and Central Tennessee, Southwestern Kentucky and adjacent portions of nearby states

**Storm Dates:** April 30 – May 3, 2010

**Event:** Synoptic

### DAD Zone 1

**Latitude:** 36.06

**Longitude:** -86.91

**Max. Grid Rainfall Amount:** 19.71”

**Max. Observed Rainfall Amount:** 19.70” at WARNER PARK, TN, followed by 19.51” at USGS SR840 Rain gauge No. 4 near Bending Chestnut, TN followed by 19.41” at CoCoRaHS Camden 4.5 NW, TN.

**Number of Stations:** 753

**SPAS Version:** 8.5

**Base Map Used:** Mean (1971-2000) PRISM May Precipitation

**Spatial resolution:** 36 seconds (0.39 sq-mi)

**Radar Included:** Yes

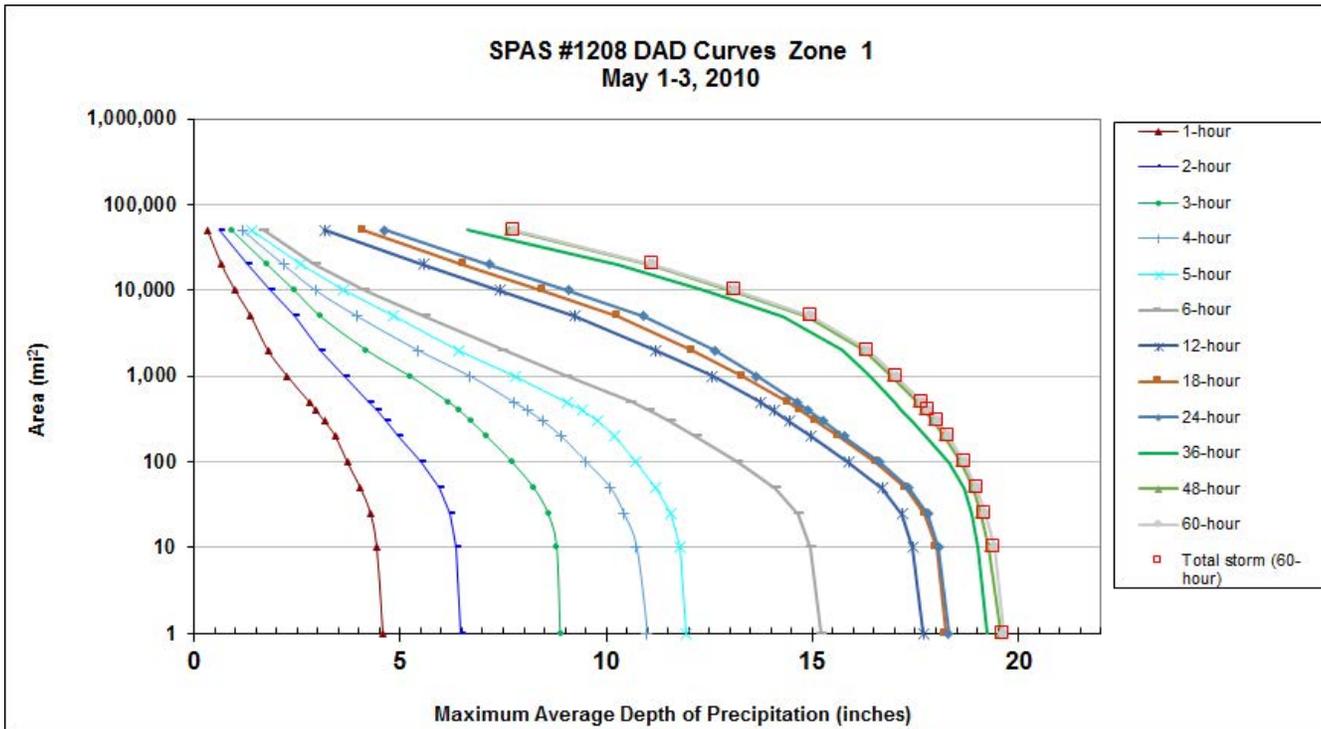
**Depth-Area-Duration (DAD) analysis:** Yes

**Degree of confidence in results:** This was a difficult storm to analyze due to the extreme intensities, strong spatial rainfall gradients, large amount of data, relatively low radar reflectivity values across western Tennessee where among the heaviest rains fell. However, given this analysis was based on WDT NEXRAD data and a plethora of gauge data, our confidence in the results is high.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1208_1	-86.906	36.061	621	600	75.00	2.85	0.15	72	2.700	77.00	77.0	3.14	0.16	76	2.980	1.104

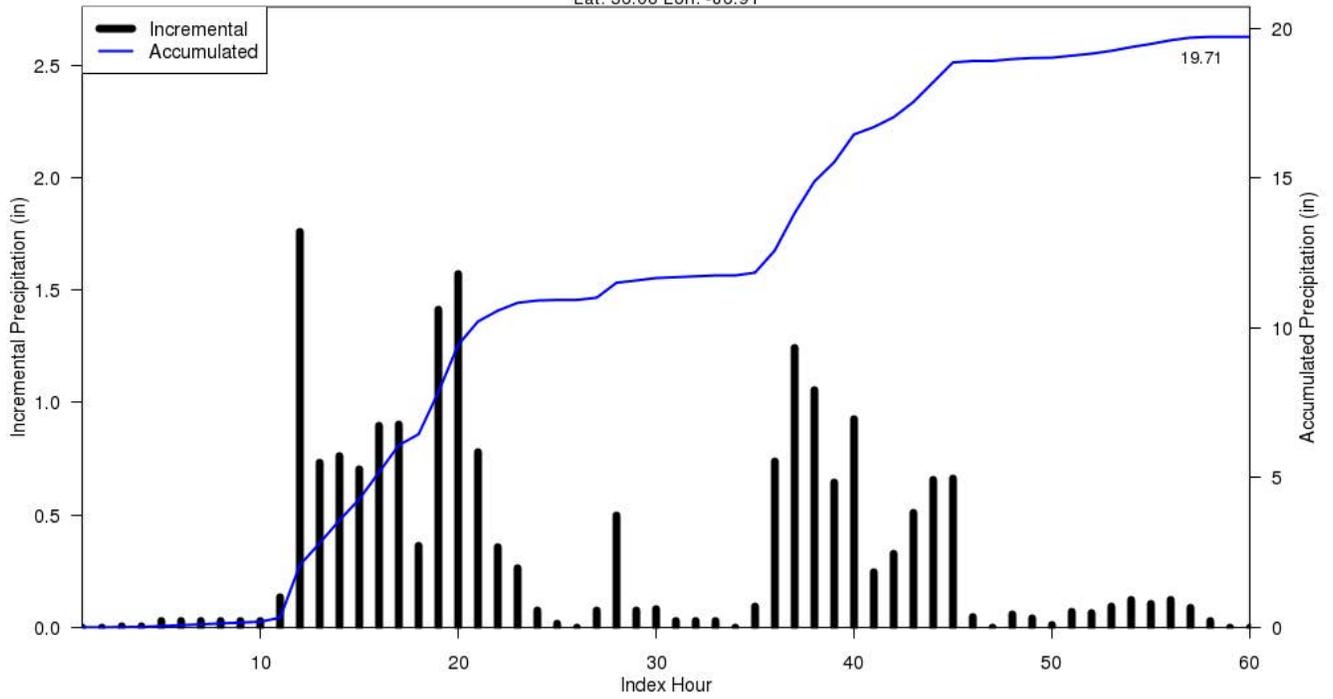
**Storm 1208 - May 1 (0100 UTC) - May 3 (1200 UTC), 2010**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

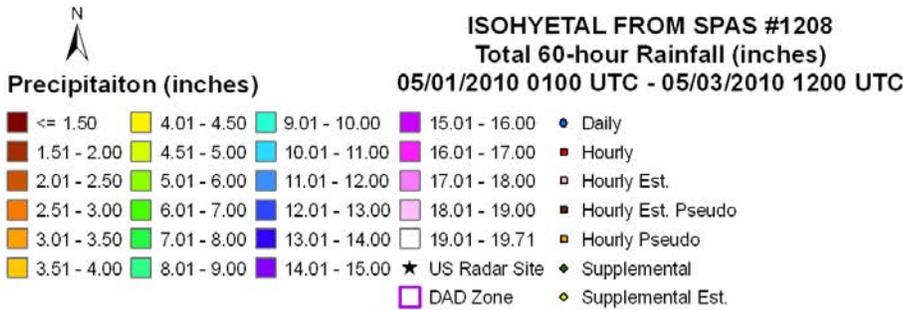
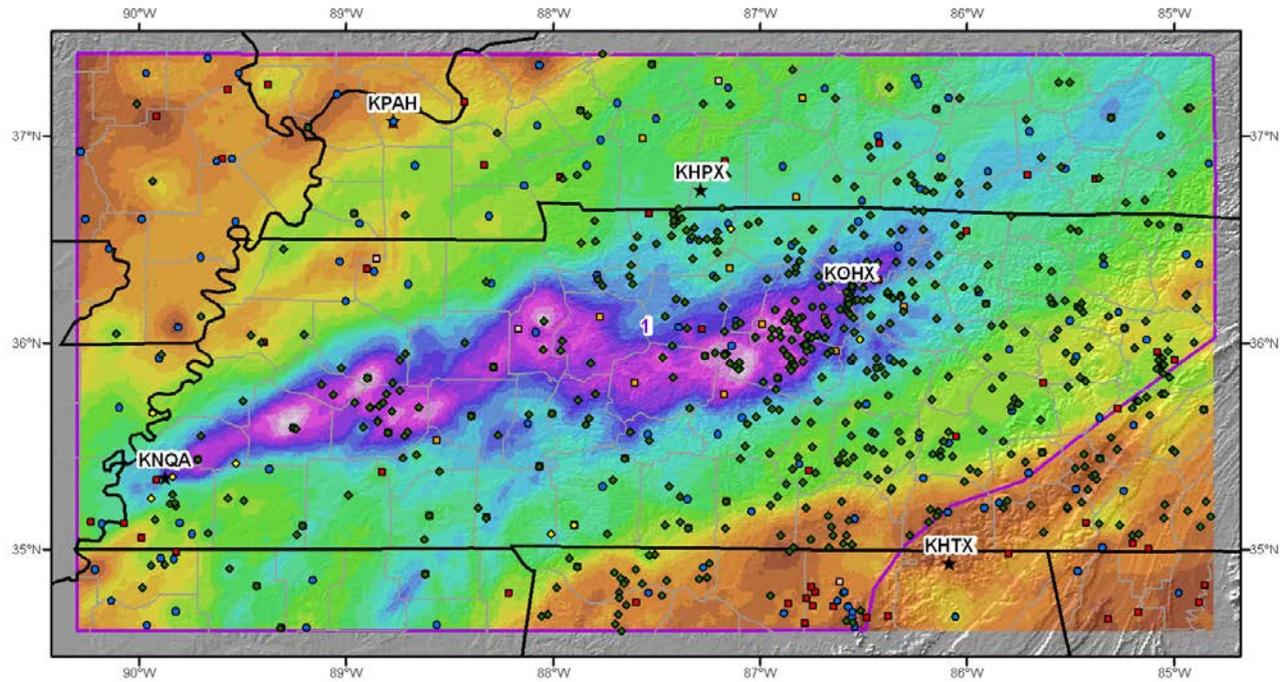
Area (mi <sup>2</sup> )	Duration (hours)												
	1	2	3	4	5	6	12	18	24	36	48	60	Total
0.4	4.63	6.50	8.92	11.04	12.01	15.31	17.77	18.33	18.39	19.35	19.66	19.70	19.70
1	4.59	6.48	8.89	10.99	11.95	15.22	17.69	18.24	18.30	19.24	19.57	19.63	19.63
10	4.44	6.36	8.81	10.73	11.77	14.96	17.44	18.01	18.06	19.03	19.28	19.41	19.41
25	4.29	6.20	8.60	10.42	11.56	14.66	17.18	17.74	17.81	18.87	19.08	19.19	19.19
50	4.04	5.93	8.25	10.09	11.21	14.11	16.69	17.27	17.34	18.67	18.89	18.98	18.98
100	3.72	5.50	7.72	9.51	10.73	13.20	15.89	16.55	16.64	18.30	18.60	18.69	18.69
200	3.43	4.96	7.10	8.89	10.19	12.18	14.98	15.64	15.78	17.77	18.19	18.30	18.30
300	3.16	4.65	6.72	8.45	9.80	11.55	14.45	15.09	15.27	17.43	17.93	18.04	18.04
400	2.96	4.42	6.44	8.08	9.42	11.06	14.07	14.71	14.91	17.18	17.72	17.83	17.83
500	2.80	4.25	6.18	7.74	9.07	10.62	13.73	14.40	14.63	16.99	17.54	17.66	17.66
1,000	2.26	3.65	5.24	6.69	7.80	9.04	12.57	13.29	13.64	16.38	16.92	17.03	17.03
2,000	1.79	3.06	4.19	5.43	6.44	7.50	11.19	12.07	12.63	15.72	16.25	16.35	16.35
5,000	1.37	2.44	3.06	3.95	4.85	5.60	9.25	10.29	10.91	14.28	14.89	14.98	14.98
10,000	0.99	1.84	2.43	2.94	3.62	4.14	7.41	8.46	9.08	12.39	13.02	13.12	13.12
20,000	0.66	1.27	1.77	2.16	2.60	2.94	5.56	6.53	7.16	10.28	11.05	11.14	11.14
50,000	0.32	0.62	0.91	1.17	1.41	1.68	3.17	4.08	4.63	6.64	7.63	7.75	7.75



SPAS 1208 Storm Center Mass Curve Zone 1  
May 1 (100UTC) to May 3 (1200UTC), 2010

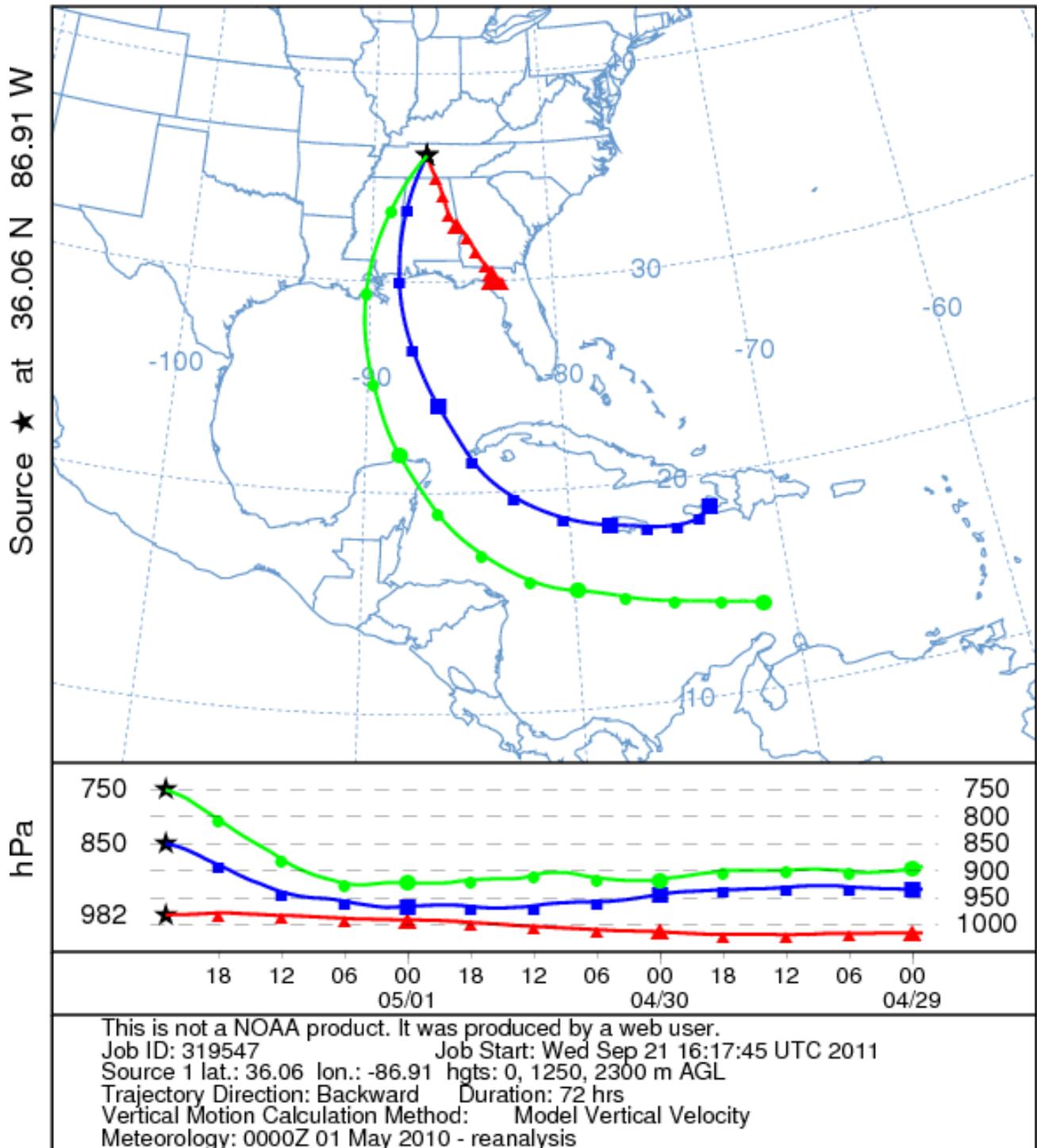
Lat: 36.06 Lon: -86.91



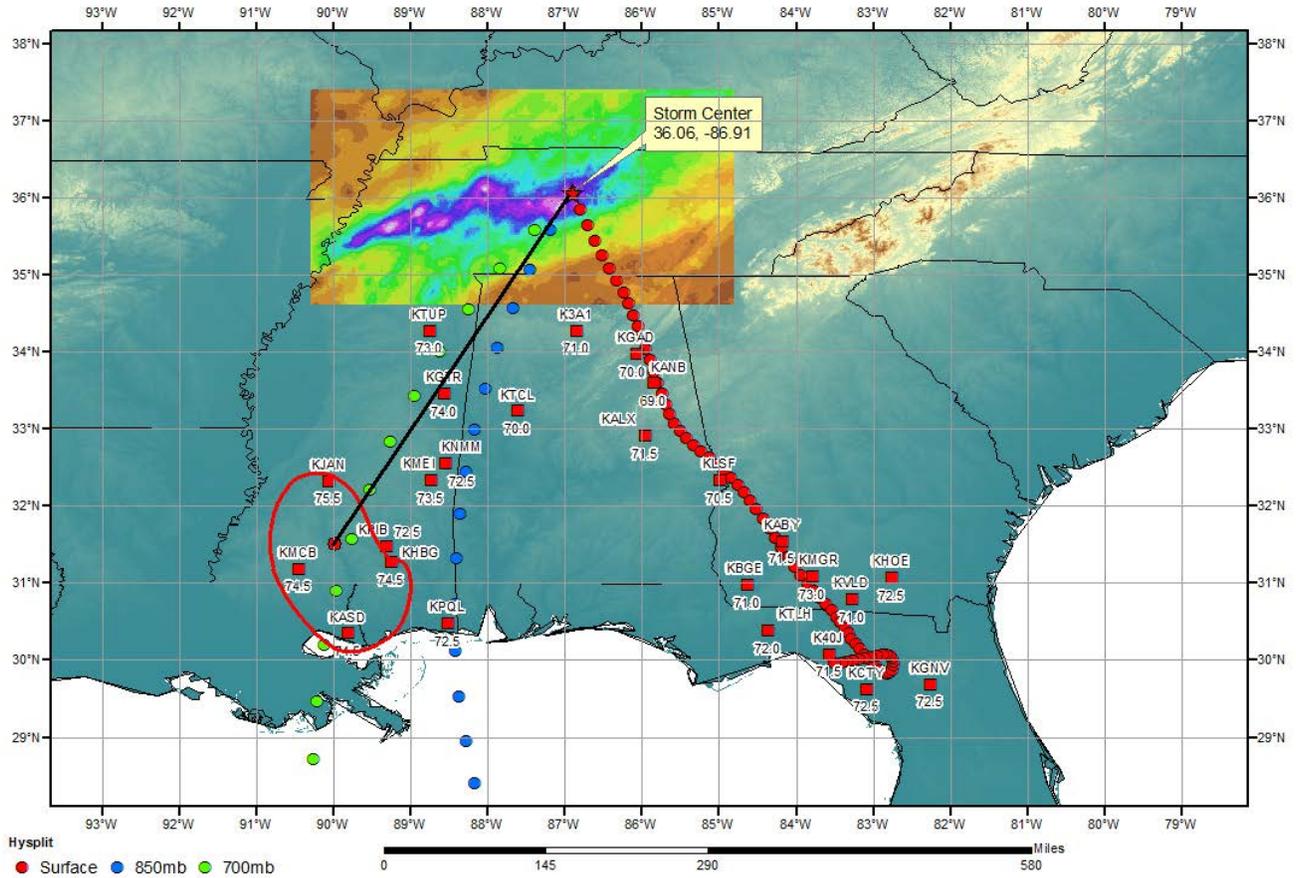


METSIAI  
05/03/2010

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 2300 UTC 01 May 10  
 CDC1 Meteorological Data



### SPAS 1208 - Dew Point Temperature (F) April 29 - May 2, 2010



## Storm Precipitation Analysis System (SPAS) For Storm #1530\_1

**General Storm Location:** Guadalupe Pass, TX (37.0, -108.0, 30.0, -102.0)

**Storm Dates:** September 10-14, 2013 (84-hours)

**Event:** Synoptic

### DAD Zone 1

**Latitude:** 32.035

**Longitude:** -104.555

**Max. Grid Rainfall Amount:** 18.34"

**Max. Observed Rainfall Amount:** 15.76" Guadalupe Pass, TX

**Number of Stations:** 910

**SPAS Version:** 10

**Base Map Used:** us\_ppt\_in\_map\_1961\_1990\_usda\_northamerica

**Spatial resolution:** 00:00:36

**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

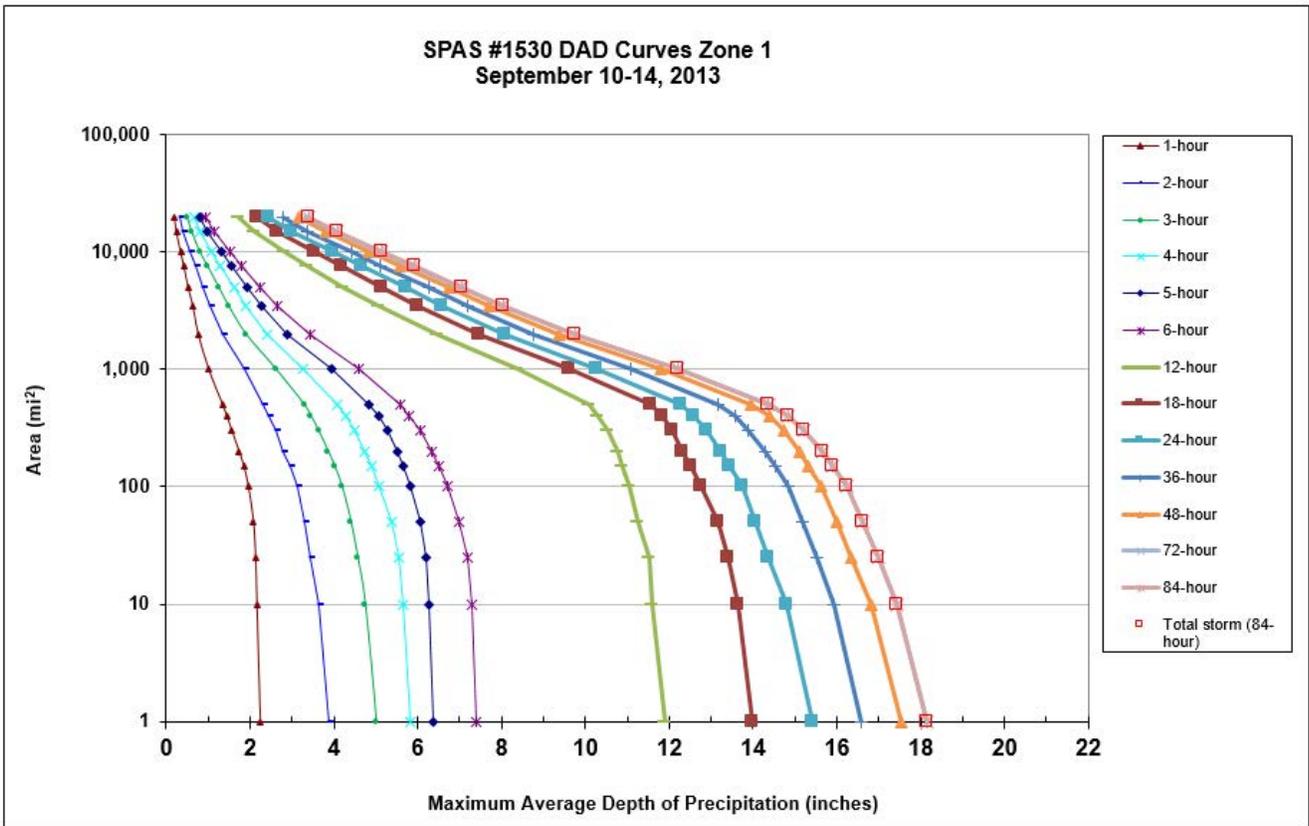
**Degree of confidence in results:** This analysis was based on an abundance of hourly data, daily data, supplemental station data and one hourly estimated station at the storm center. We have a good degree of confidence for the station based storm total results. The spatial pattern is dependent on the basemap (us\_ppt\_in\_map\_1961\_1990\_usda\_northamerica). There is a high degree of confidence with the timing based on the several hourly and hourly pseudo stations. Some daily stations were moved to supplemental due to timing issues or removed due to erroneous storm precipitation observations. Additional details can be found in the "Read\_Me\_1530.docx" file. The Guadalupe Pass hourly station had missing data at the beginning and end of the ippt 144 hour period, but captured the main precipitation event. After consideration and several runs, an hourly estimated pseudo (HEP) station was not used instead of the Guadalupe Pass station.

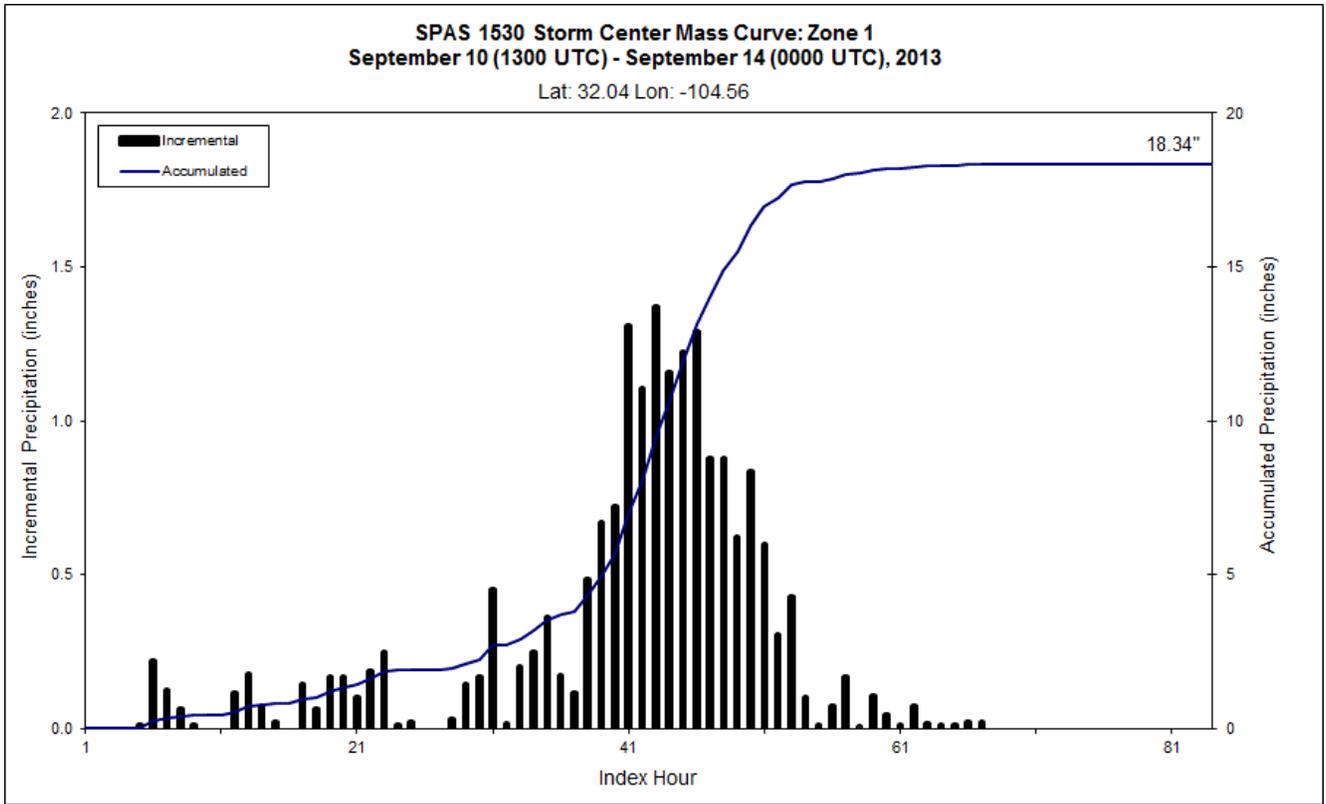
Due to beam blockage issues, some of the hourly precipitation intensities, at the storm center, were likely high. An hourly estimated (HE) station was created at the SPAS storm center from its mass curve with radar index hours 34, 42, 49 and 52 estimated from nearby stations (see below). Also, a supplemental station was created near the original SPAS created storm center in order to control the overall magnitude

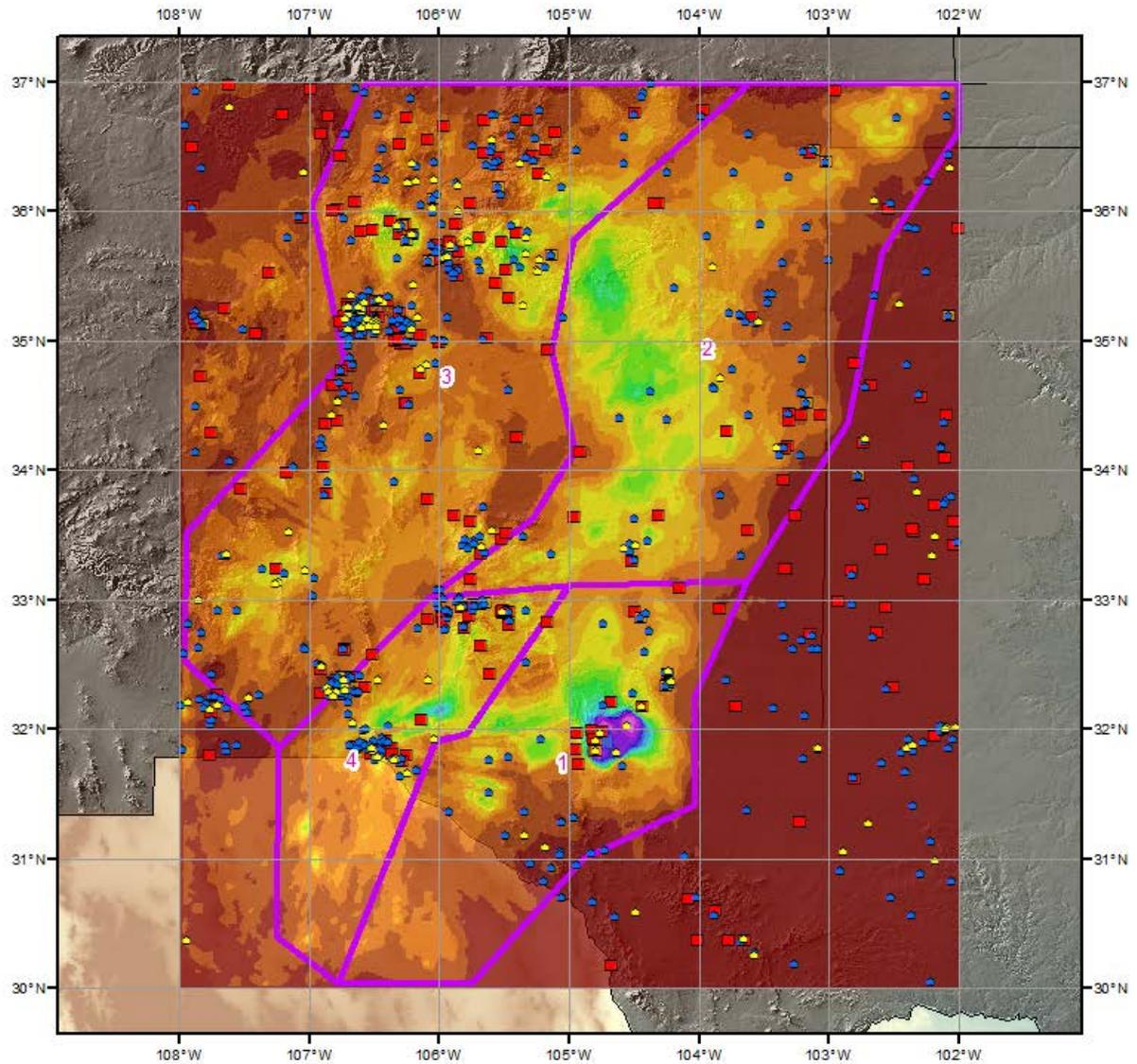
of the storm (highest observation near storm center was 15.76 inches; SPAS without supplemental at storm center was about 20 inches due to beam blockage issues). This SPAS storm center supplemental station was set to 17.50 inches (over the radar period), which was the approximate difference between the 20 inch storm center and 15.76 inch highest observation.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1530_1	-104.555	32.035	3,986	4,000	74.00	2.73	0.87	70	1.860	78.80	79.0	3.44	1.03	80	2.410	1.296

Storm 1530 Zone 1 - Sep. 10 (1300 UTC) - Sep. 14 (0000 UTC), 2013														
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)														
areasqmi	Duration (hours)													
	1	2	3	4	5	6	12	18	24	36	48	72	84	Total
0.4	2.27	3.93	5.06	5.89	6.43	7.46	12.05	14.15	15.59	16.76	17.71	18.34	18.34	18.34
1	2.24	3.88	5.00	5.83	6.38	7.41	11.91	14.00	15.42	16.59	17.54	18.15	18.15	18.15
10	2.16	3.63	4.74	5.64	6.28	7.29	11.61	13.65	14.81	15.93	16.83	17.44	17.44	17.44
25	2.13	3.43	4.56	5.56	6.21	7.20	11.52	13.41	14.37	15.52	16.35	16.98	16.98	16.98
50	2.08	3.31	4.40	5.39	6.07	7.00	11.25	13.15	14.07	15.18	15.99	16.62	16.62	16.62
100	1.96	3.12	4.19	5.09	5.84	6.70	11.04	12.74	13.73	14.85	15.63	16.24	16.24	16.24
150	1.85	2.95	4.01	4.89	5.67	6.51	10.88	12.51	13.44	14.54	15.32	15.90	15.90	15.90
200	1.74	2.80	3.86	4.73	5.53	6.33	10.76	12.32	13.22	14.31	15.10	15.65	15.65	15.65
300	1.57	2.60	3.63	4.49	5.29	6.05	10.52	12.08	12.88	13.90	14.73	15.21	15.21	15.21
400	1.45	2.45	3.45	4.30	5.07	5.80	10.30	11.82	12.59	13.56	14.38	14.83	14.83	14.83
500	1.35	2.32	3.29	4.10	4.85	5.59	10.08	11.56	12.27	13.17	13.94	14.40	14.36	14.36
1,000	1.02	1.86	2.62	3.28	3.94	4.60	8.38	9.62	10.27	11.07	11.79	12.21	12.21	12.21
2,000	0.77	1.35	1.90	2.41	2.90	3.44	6.48	7.48	8.09	8.77	9.39	9.75	9.75	9.75
3,500	0.64	1.03	1.48	1.90	2.29	2.66	5.06	5.98	6.57	7.18	7.71	8.01	8.04	8.04
5,000	0.53	0.88	1.25	1.62	1.94	2.23	4.22	5.14	5.71	6.26	6.74	7.01	7.05	7.05
7,500	0.43	0.69	0.99	1.30	1.55	1.79	3.38	4.18	4.65	5.12	5.59	5.84	5.94	5.94
10,000	0.35	0.55	0.80	1.08	1.31	1.52	2.81	3.53	3.98	4.43	4.85	5.07	5.15	5.15
15,000	0.25	0.41	0.60	0.81	0.98	1.14	2.10	2.65	2.99	3.37	3.81	4.02	4.09	4.09
19,842	0.20	0.34	0.49	0.66	0.80	0.93	1.72	2.17	2.45	2.78	3.17	3.33	3.39	3.39



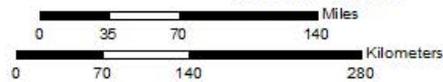




**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Hourly Estimated
- Supplemental

**Total Storm (84-hours) Precipitation (inches)  
September 10 - 14, 2013  
SPAS 1530**

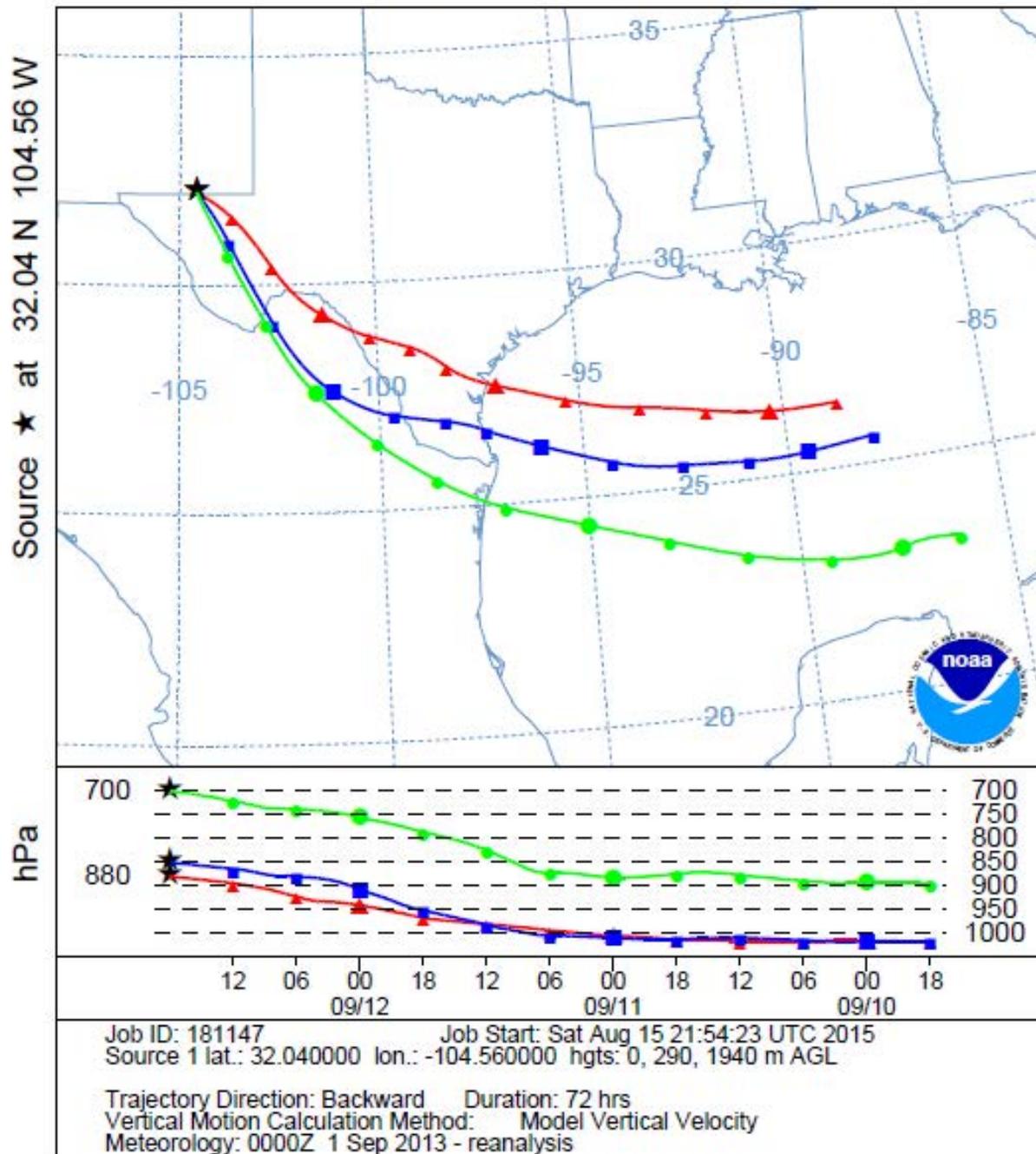


**Precipitation (inches)**

0.00 - 1.00	4.01 - 5.00	9.01 - 10.00	14.01 - 15.00
1.01 - 2.00	5.01 - 6.00	10.01 - 11.00	15.01 - 16.00
2.01 - 3.00	6.01 - 7.00	11.01 - 12.00	16.01 - 17.00
3.01 - 4.00	7.01 - 8.00	12.01 - 13.00	17.01 - 18.00
	8.01 - 9.00	13.01 - 14.00	18.01 - 19.00

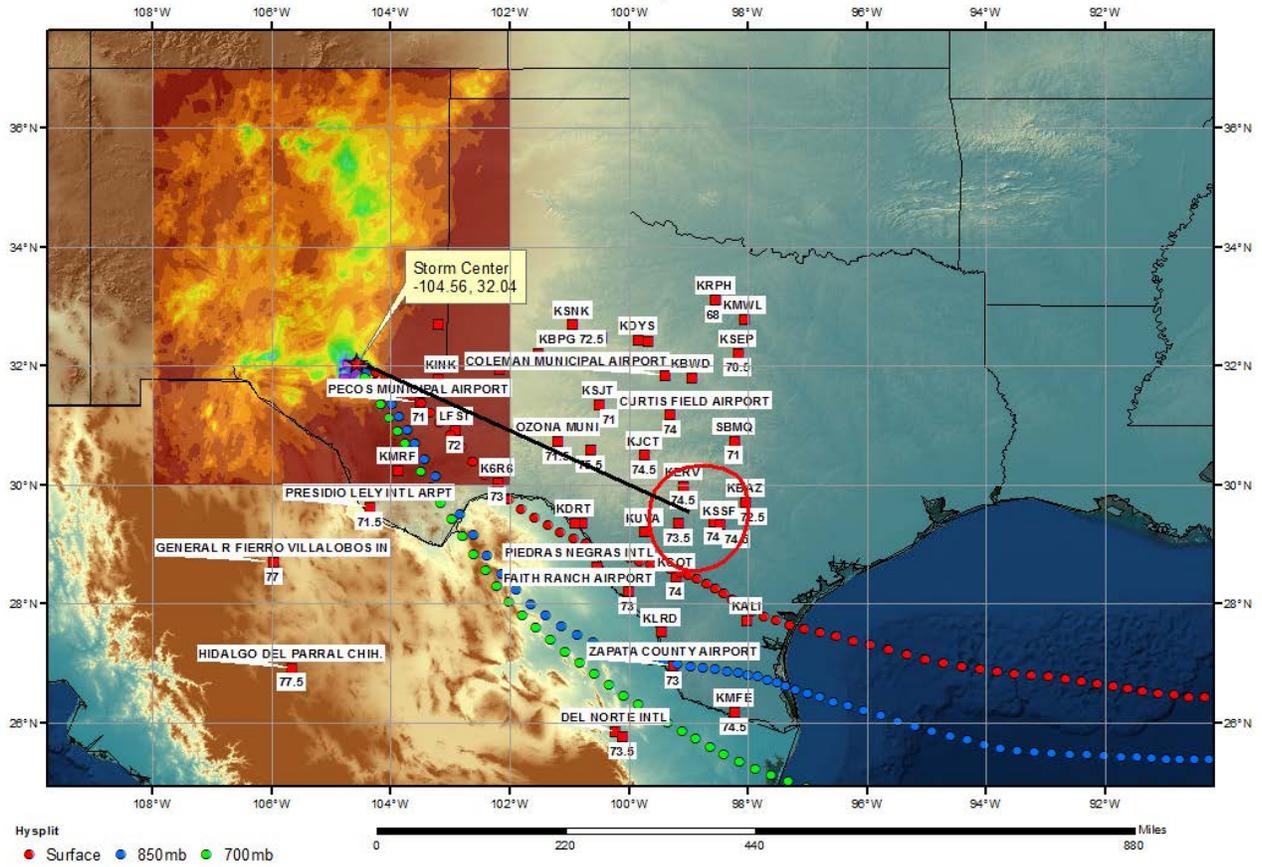


NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1800 UTC 12 Sep 13  
 CDC1 Meteorological Data



### SPAS 1530 Guadalupe Pass, TX Storm Analysis Zone 1

September 11-12, 2013



## **Local Storms**

## Storm Precipitation Analysis System (SPAS) For Storm #1426\_1

**General Storm Location:** Cooper, MI

**Storm Dates:** September 1 – September 2, 1914

**Event:** Extreme Precipitation Event

### DAD Zone 1

**Latitude:** 42.3708

**Longitude:** -85.5875

**Max. Grid Rainfall Amount:** 13.39”

**Max. Observed Rainfall Amount:** 12.80”

**Number of Stations:** 30

**SPAS Version:** 10.0

**Base Map Used:** Continental United States 2 year 6 hour (conus\_0002yr06h)

**Spatial resolution:** 0.2451

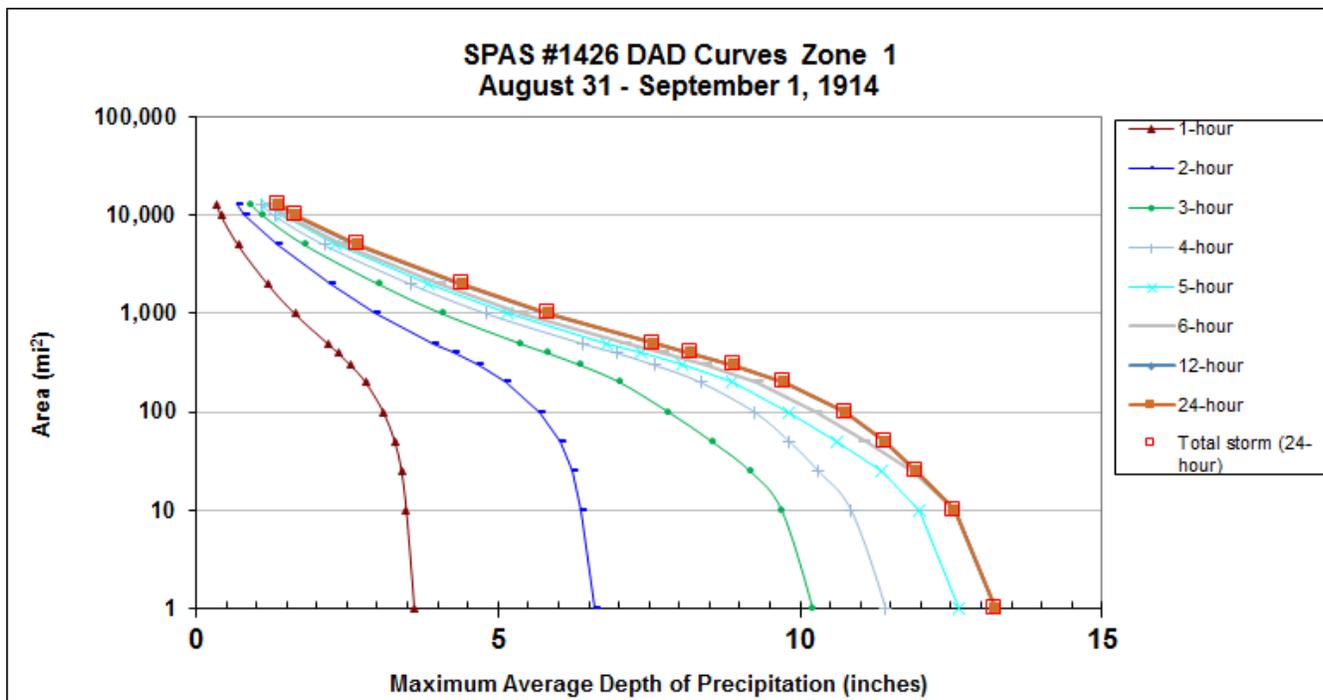
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

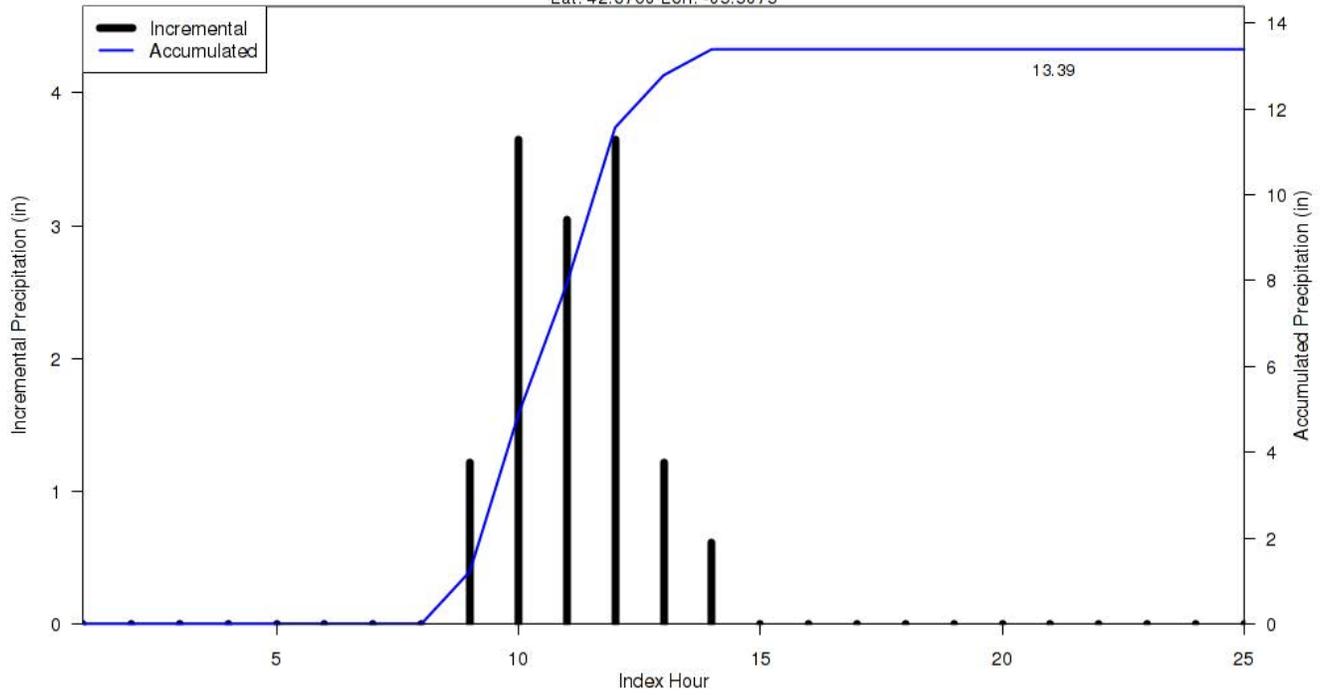
**Reliability of results:** In addition to the NCDC stations, three hourly stations were digitized from the U.S. Army Corp of Engineers (USACE) Storm Study Pertinent Data Sheet (included below). These stations only provided precipitation timing for the time period beginning on August 31, 1914 at 6pm EST and ending at 6pm the following day. Due to the lack of hourly information, a 25-hour Core Precipitation Period (CPP) was established for this time period. While precipitation did fall outside of the CPP, results are unreliable due to the lack of data. The resulting DAD values are slightly less than those determined by the initial USACE report. Major adjustments were completed in order to simulate USACE results, however the original analysis likely over generalized the storm area and this analysis likely provides a more accurate depiction of the event.

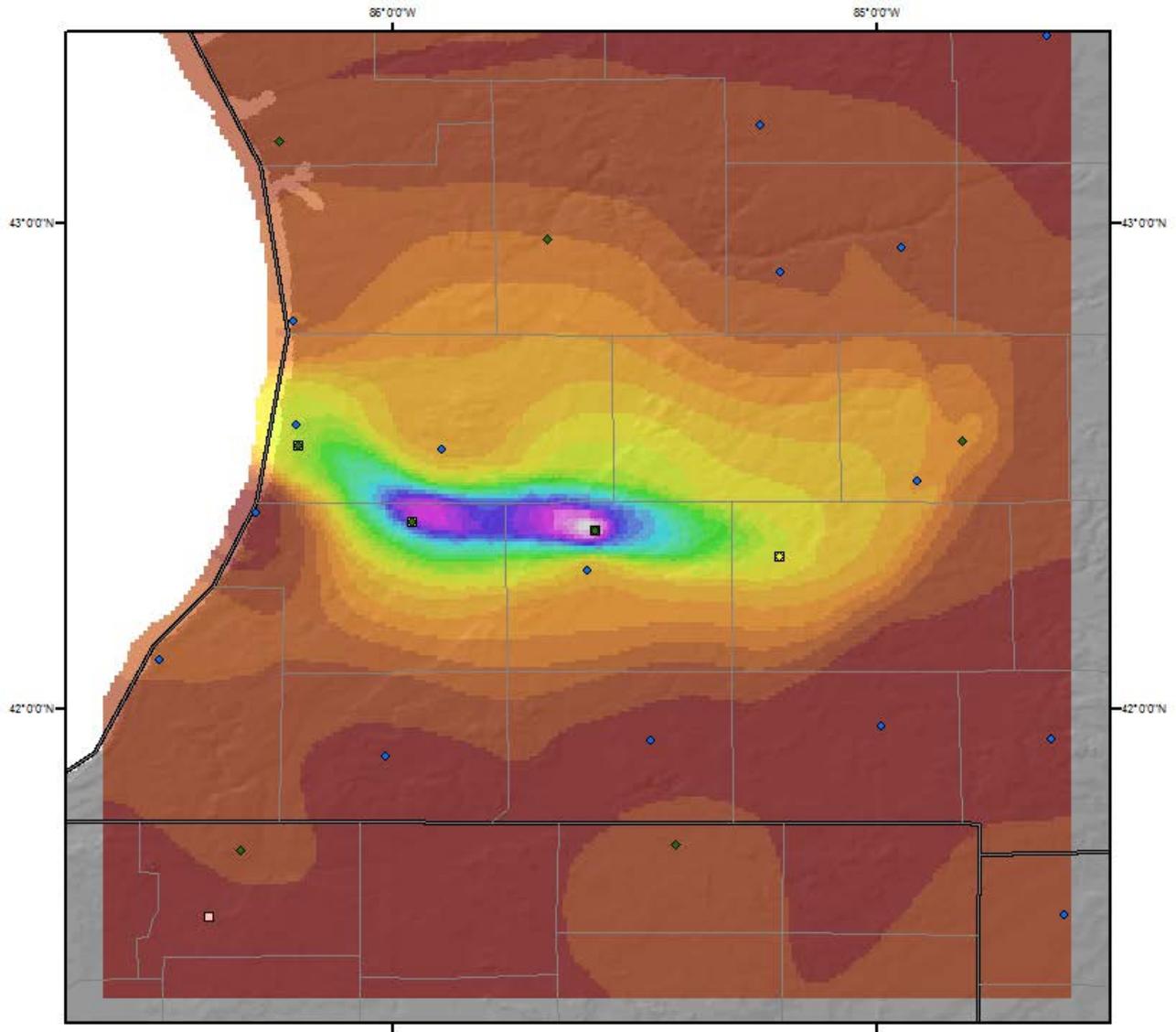
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1426_1	-85.588	42.371	816	800	75.00	2.85	0.20	72	2.650	80.56	80.5	3.68	0.24	83	3.440	1.298

Storm 1426 - August 31 (0000 UTC) - September 1 (0000 UTC), 1914									
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)									
Area (mi <sup>2</sup> )	Duration (hours)								
	1	2	3	4	5	6	12	24	Total
0.4	3.64	6.66	10.30	11.51	12.73	13.33	13.33	13.33	13.33
1	3.61	6.61	10.21	11.41	12.62	13.23	13.23	13.23	13.23
10	3.48	6.38	9.70	10.84	11.98	12.55	12.55	12.55	12.55
25	3.40	6.23	9.18	10.30	11.34	11.88	11.93	11.93	11.93
50	3.29	6.02	8.55	9.82	10.61	11.07	11.40	11.40	11.40
100	3.10	5.68	7.83	9.24	9.82	10.26	10.74	10.75	10.75
200	2.81	5.13	7.03	8.36	8.87	9.29	9.74	9.74	9.74
300	2.56	4.67	6.37	7.60	8.06	8.45	8.88	8.89	8.89
400	2.35	4.27	5.82	6.96	7.37	7.74	8.17	8.18	8.18
500	2.18	3.93	5.37	6.39	6.79	7.11	7.58	7.58	7.58
1,000	1.64	2.97	4.09	4.82	5.16	5.40	5.83	5.84	5.84
2,000	1.19	2.23	3.03	3.56	3.83	4.04	4.40	4.41	4.41
5,000	0.70	1.33	1.81	2.13	2.30	2.43	2.67	2.68	2.68
10,000	0.42	0.81	1.11	1.30	1.41	1.49	1.64	1.65	1.65
12,928	0.35	0.68	0.92	1.09	1.18	1.24	1.37	1.37	1.37



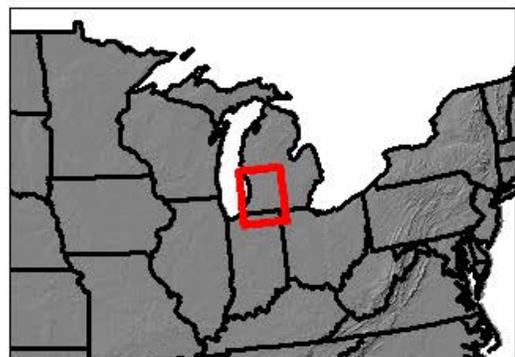
SPAS 1426 Storm Center Mass Curve Zone 1  
August 31 (0000UTC) to September 1 (0000UTC), 1914  
Lat: 42.3708 Lon: -85.5875





**Total 25-hour Precipitation (inches)**  
**September 1, 1914 0000 UTC - September 2, 1914 0500 UTC**  
**SPAS #1426**

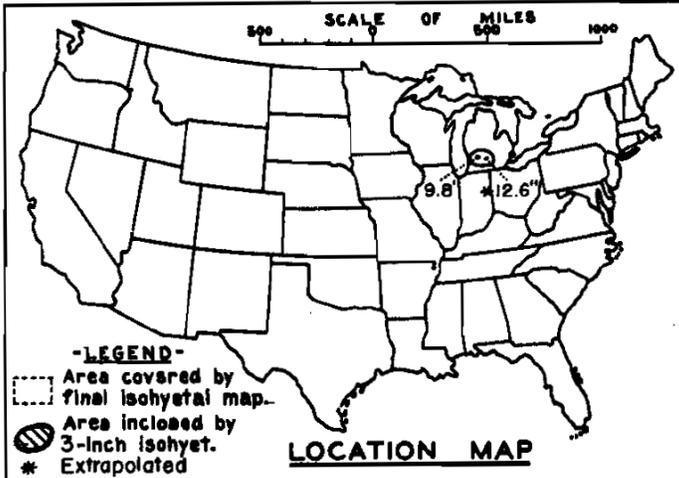
Stations	Precipitation (inches)		
◆ D	0.00 - 0.50	4.51 - 5.00	9.01 - 9.50
□ HE	0.51 - 1.00	5.01 - 5.50	9.51 - 10.00
■ HEP	1.01 - 1.50	5.51 - 6.00	10.01 - 10.50
◆ S	1.51 - 2.00	6.01 - 6.50	10.51 - 11.00
◆ SE	2.01 - 2.50	6.51 - 7.00	11.01 - 11.50
	2.51 - 3.00	7.01 - 7.50	11.51 - 12.00
	3.01 - 3.50	7.51 - 8.00	12.01 - 12.50
	3.51 - 4.00	8.01 - 8.50	12.51 - 13.00
	4.01 - 4.50	8.51 - 9.00	13.01 - 13.50



WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 31 Aug.-1 Sept. 1914  
 Assignment GL 2-16  
 Location Michigan  
 Study Prepared by:  
 Great Lakes Division  
 Milwaukee District Office and  
 Hydrometeorological Section of  
 U. S. Weather Bureau  
 Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 10/26/39  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 10/26/46  
 Remarks: Centers near  
 Cooper and Bloomingdale,  
 Mich.

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary Isohyetal map, in 1 sheet, scale 1 : 2,500,000  
 Precipitation data and mass curves: (Number of Sheets)  
 Form 5001-C (Hourly precip. data)----- 8  
 Form 5001-B (24-hour " " )----- 5  
 Form 5001-D ( " " " " )----- -  
 Misc. precip. records, meteorological data, etc.----- 6  
 Form 5002 (Mass rainfall curves)----- 4

**PART II**

Final isohyetal maps, in 1 sheet, scale 1 : 1,000,000  
 Data and computation sheets:  
 Form S-10 (Data from mass rainfall curves)----- 2  
 Form S-11 (Depth-area data from isohyetal map)----- -  
 Form S-12 (Maximum depth-duration data)----- -  
 Maximum duration-depth-area curves----- 1  
 Data relating to periods of maximum rainfall----- -

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

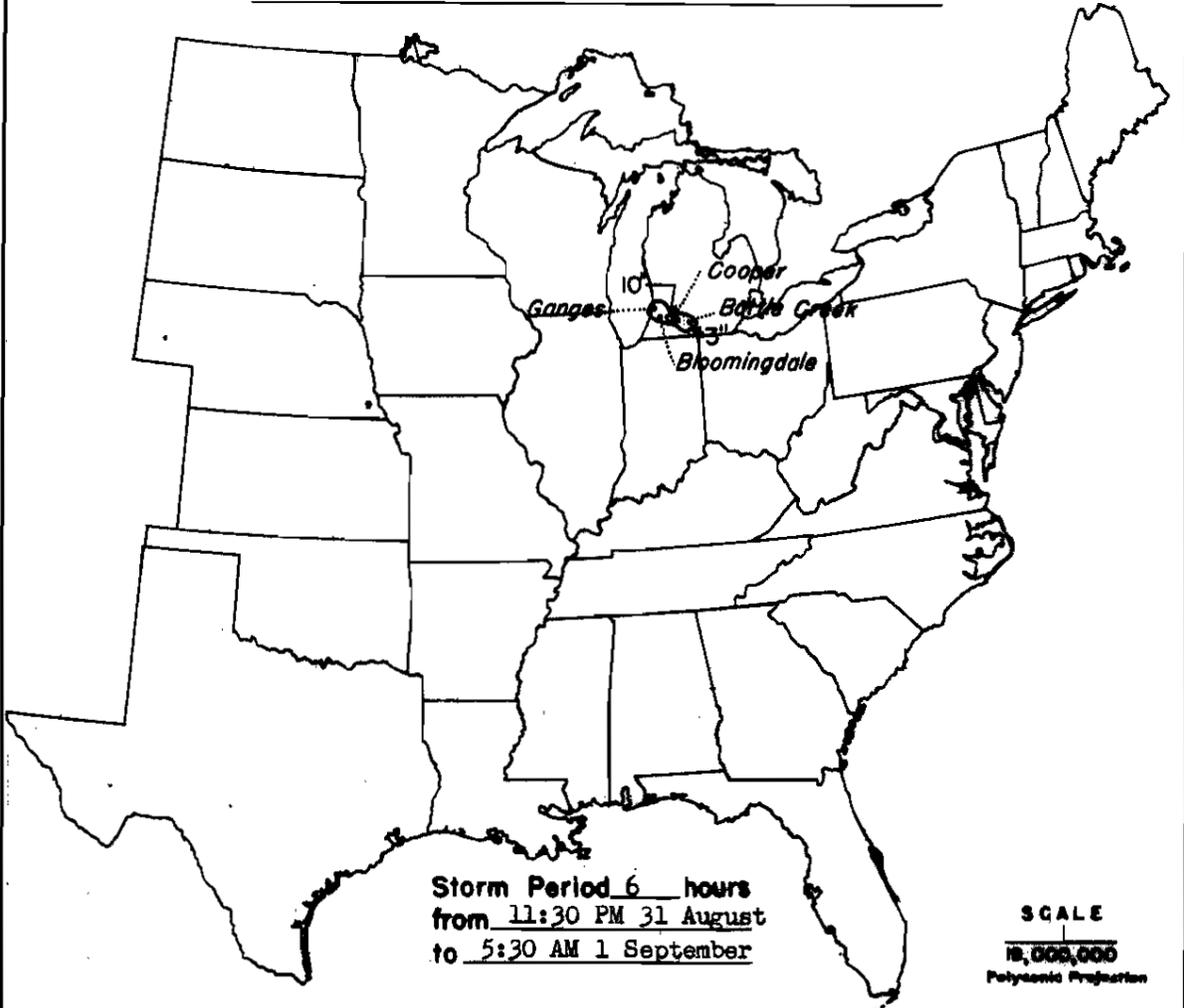
Area in Sq. Mi.	Duration of Rainfall in Hours							
	6							
10	12.6							
50	12.0							
100	11.3							
200	10.0							
500	7.6							
800	6.3							
1,000	5.7							
1,200	5.2							

WAR DEPARTMENT

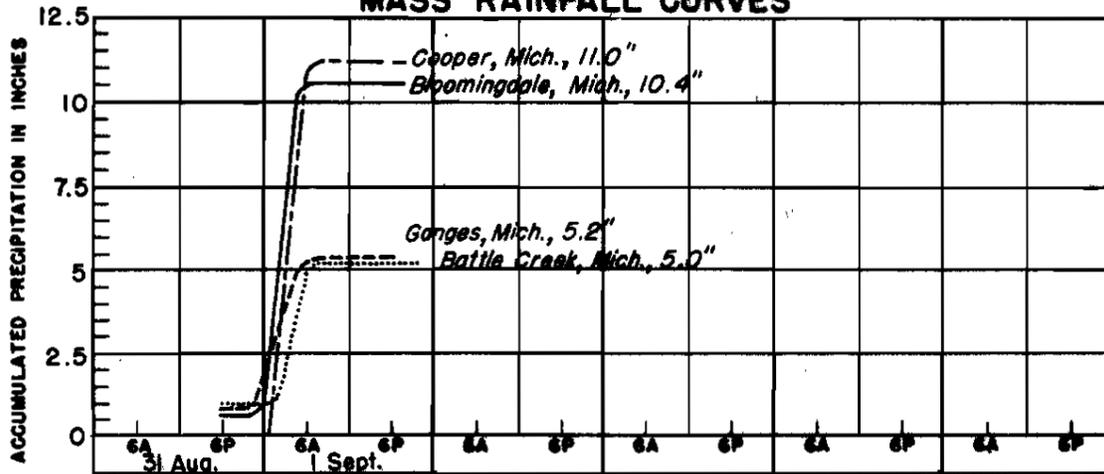
CORPS OF ENGINEERS, U. S. ARMY

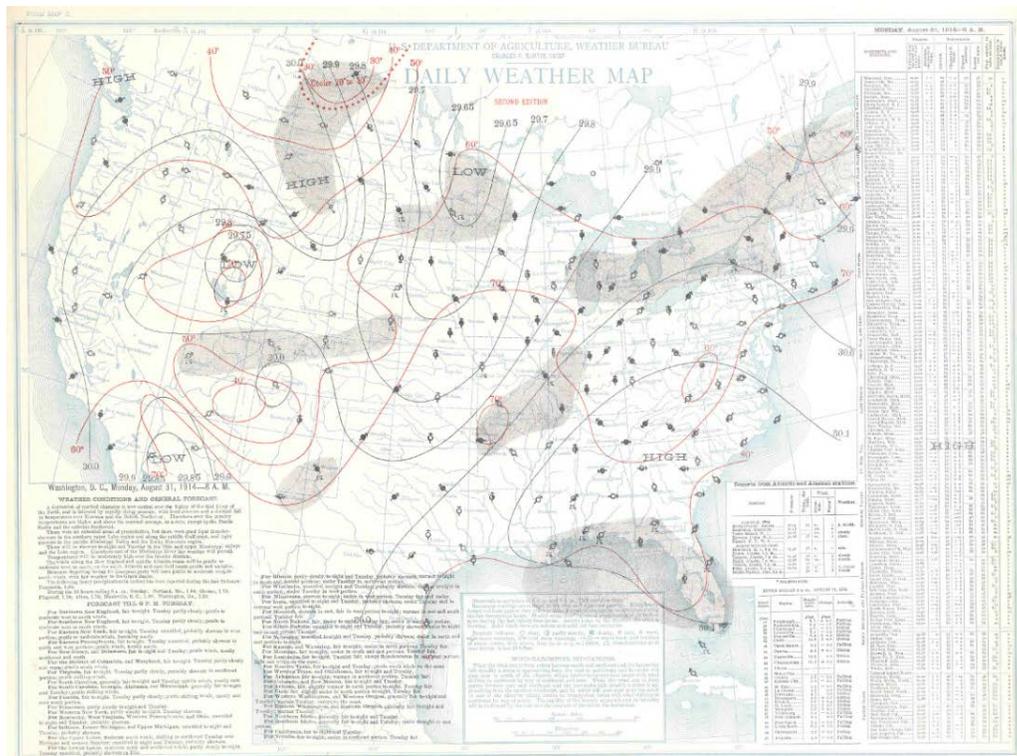
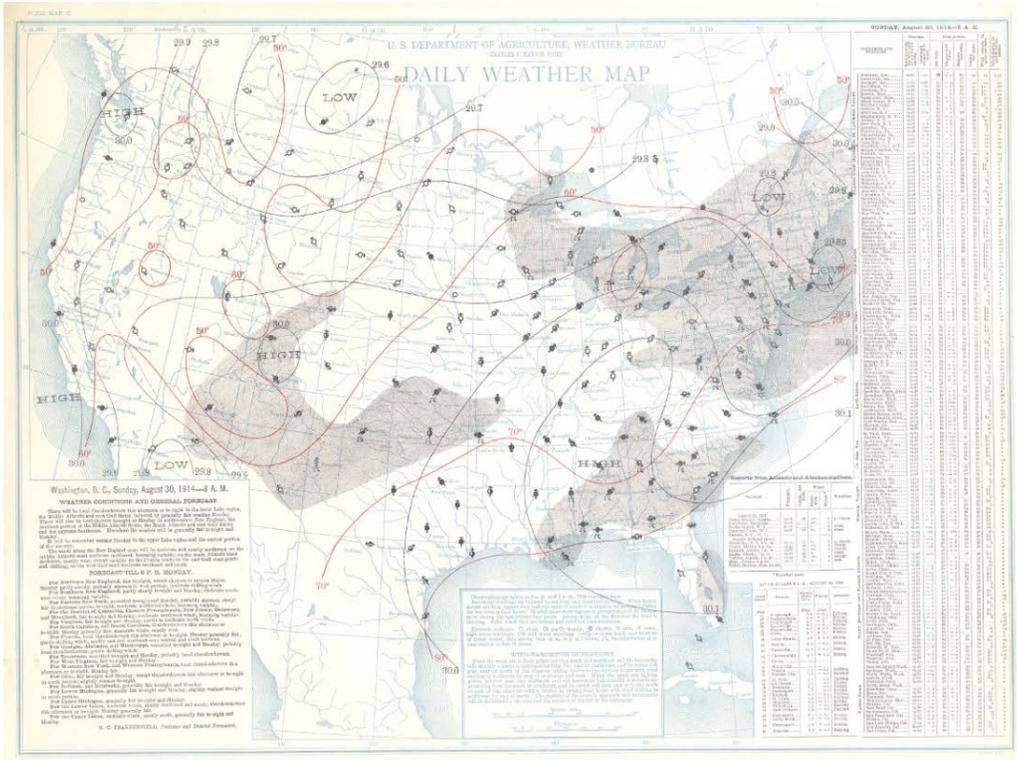
**STORM STUDIES - ISOHYETAL MAP**

Storm of Aug. 31-Sept. 1, 1914 Assignment GL 2-16  
 Study Prepared by: Milwaukee, Wisc. District  
 Great Lakes Division



**MASS RAINFALL CURVES**

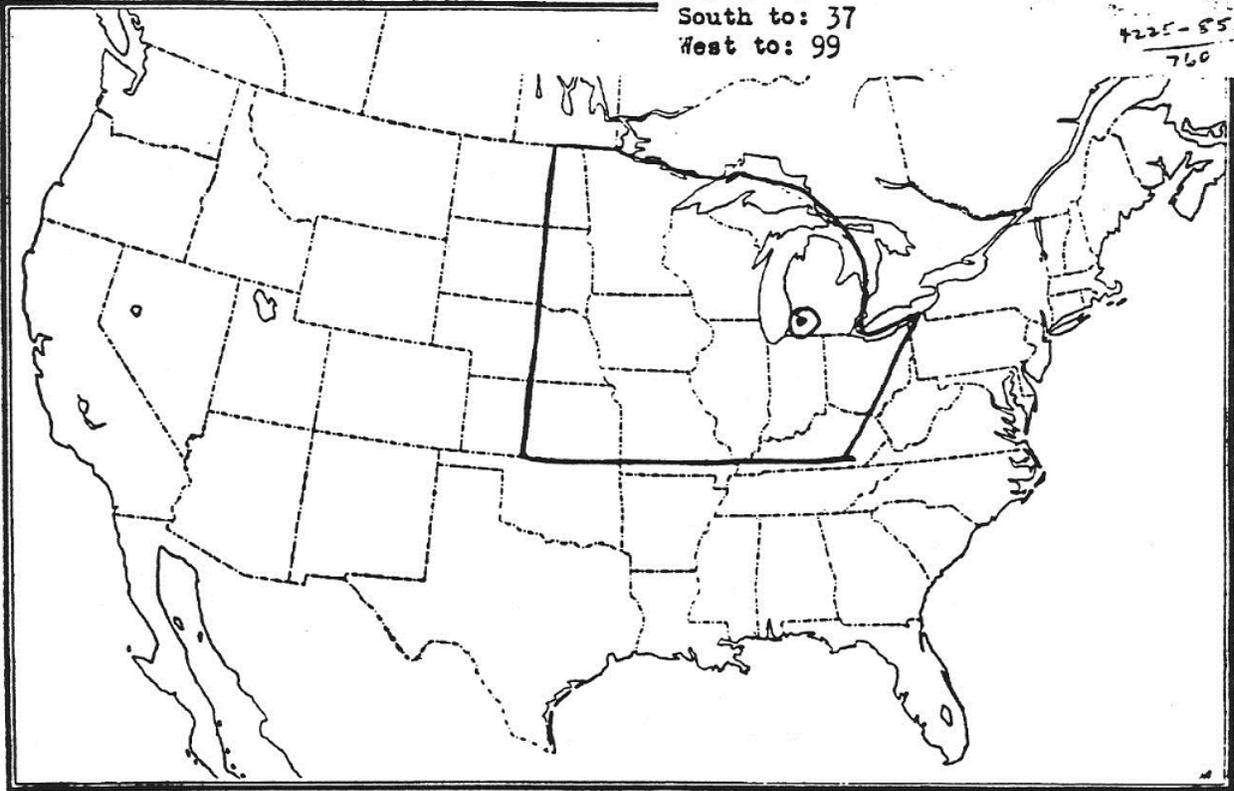






GL 2-16..Aug.31-Sept.1, 1914..Cooper, L  
12-hr. rfd 68..250 SW..to 77.55%  
North to: border  
East to: Erie-Chatanooga line  
South to: 37  
West to: 99

425-853  
760



## Storm Precipitation Analysis System (SPAS) For Storm #1427\_1

**General Storm Location:** Boyden, IA

**Storm Dates:** September 17 – September 18, 1926

**Event:** Extreme Precipitation Event

### DAD Zone 1

**Latitude:** 43.1958

**Longitude:** -95.9958

**Max. Grid Rainfall Amount:** 24.22”

**Max. Observed Rainfall Amount:** 24.01”

**Number of Stations:** 159

**SPAS Version:** 10.0

**Basemap:** Manually digitized contours

**Spatial resolution:** 0.242

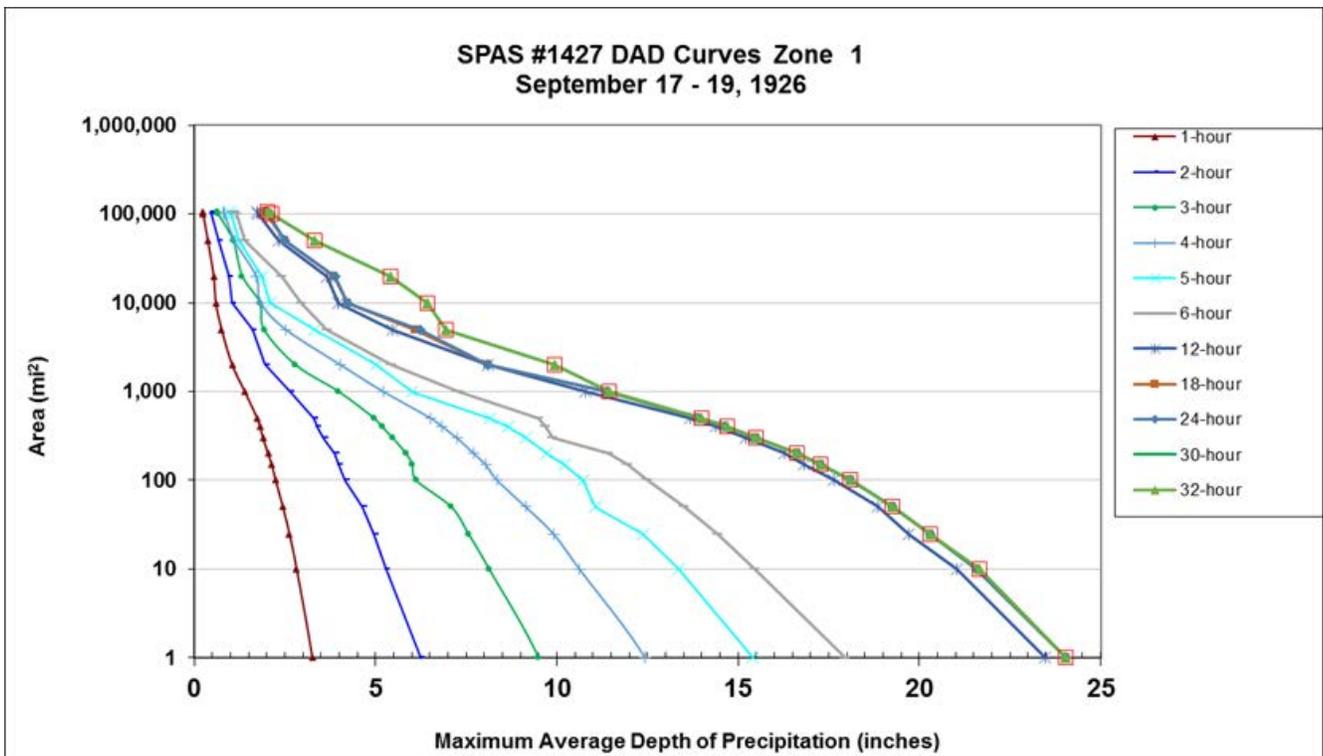
**Radar Included:** No

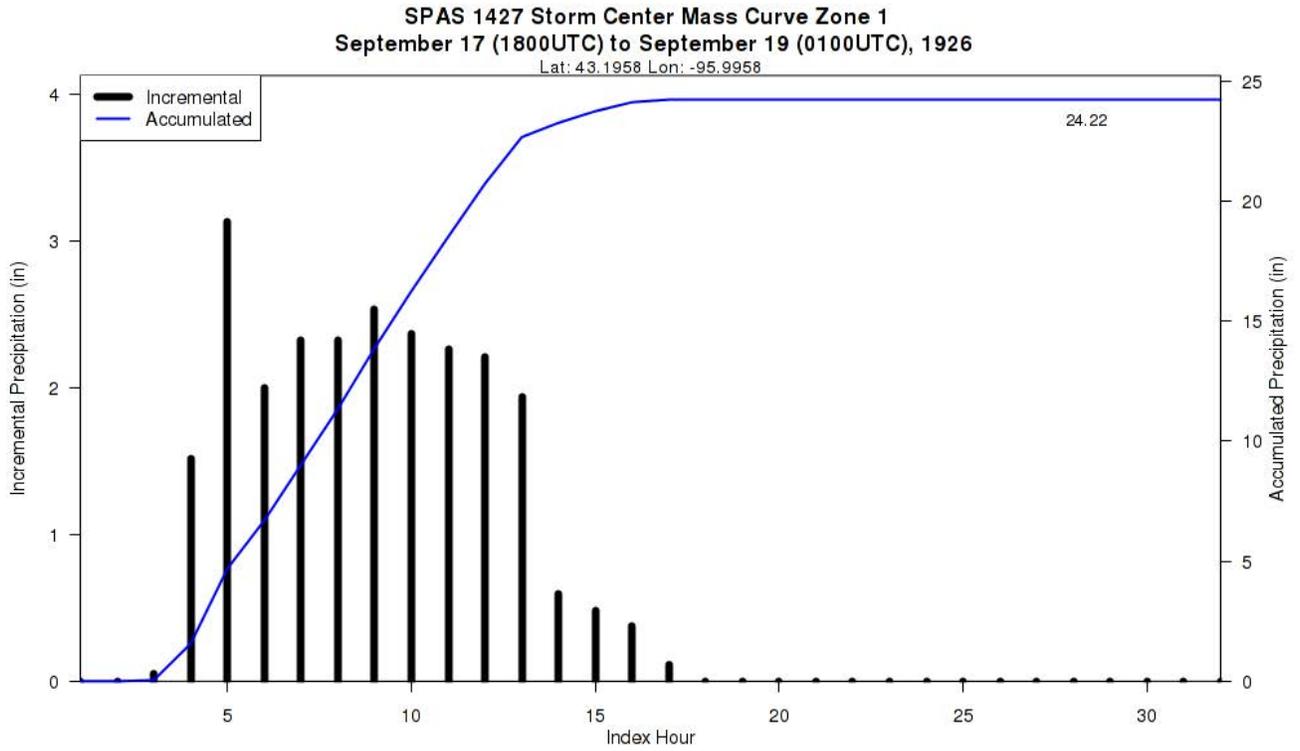
**Depth-Area-Duration (DAD) analysis:** Yes

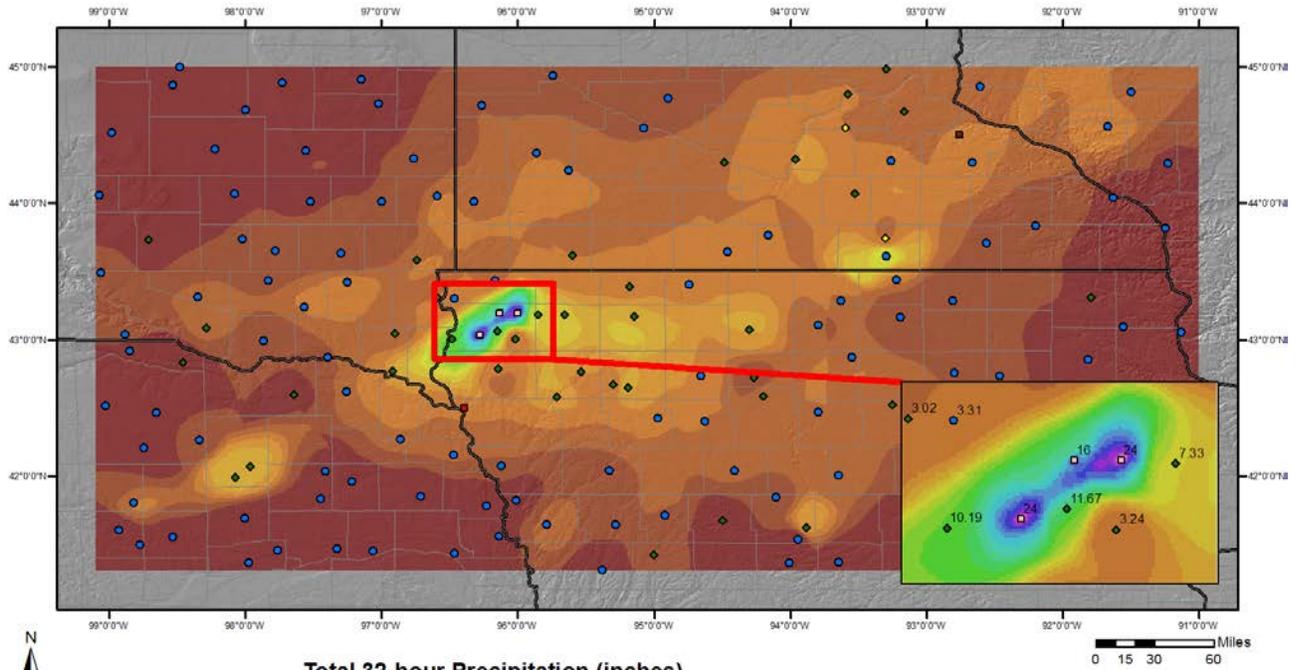
**Reliability of results:** In addition to the NCDC stations, four hourly stations were digitized from the U.S. Army Corp of Engineers (USACE) Storm Study Pertinent Data Sheet (included below). These stations only provided precipitation timing for the time period beginning on September 17 around 12:00 CST to 18:00 CST on September 18. Data mining also produced an additional supplemental station at Foss Field/Sioux Falls Regional Airport, SD. Due to the lack of hourly information, a 32-hour Core Precipitation Period (CPP) was established for this time period. While precipitation did fall outside of the CPP, results are unreliable due to the lack of data. In addition to the three digitized hourly stations, an additional estimated hourly station with 2.40 inches of accumulated precipitation over the CPP was created in order to represent later timing as the frontal passage moved eastward. The resulting DAD values are about equal to those of the previous analysis. There are slight deviations, both high and low, which are likely due to the original analysis over generalizing the storm area. For this reason, the current analysis is considered more reliable and represents a more accurate depiction of the event.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1427_1	-95.996	43.196	1,438	1,400	76.50	3.07	0.37	75	2.700	78.93	79.0	3.44	0.39	80	3.050	1.130

Storm 1427 - September 17 (1800 UTC) - September 19 (0100 UTC), 1926												
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)												
Area (mi <sup>2</sup> )	Duration (hours)											
	1	2	3	4	5	6	12	18	24	30	32	Total
0.4	3.37	6.39	9.68	12.72	15.78	18.37	23.60	24.14	24.14	24.14	24.14	24.14
1	3.29	6.23	9.45	12.42	15.41	17.93	23.46	24.01	24.01	24.01	24.01	24.01
10	2.83	5.35	8.15	10.67	13.25	15.45	20.98	21.48	21.48	21.48	21.48	21.48
25	2.62	4.97	7.57	9.91	12.33	14.38	19.73	20.17	20.17	20.17	20.17	20.17
50	2.44	4.62	7.06	9.20	11.48	13.41	18.79	19.18	19.19	19.19	19.19	19.19
100	2.24	4.25	6.47	8.46	10.60	12.43	17.62	18.04	18.04	18.04	18.04	18.04
200	2.03	3.88	5.89	7.71	9.66	11.32	16.17	16.51	16.51	16.51	16.51	16.51
300	1.90	3.63	5.45	7.17	8.98	10.52	15.10	15.41	15.42	15.42	15.42	15.42
400	1.81	3.45	5.16	6.82	8.51	9.94	14.21	14.50	14.51	14.51	14.51	14.51
500	1.73	3.32	4.96	6.55	8.16	9.50	13.49	13.77	13.78	13.78	13.78	13.78
1,000	1.40	2.67	4.00	5.28	6.57	7.68	11.07	11.33	11.35	11.35	11.35	11.35
2,000	1.03	1.98	2.93	3.86	4.83	5.73	8.55	8.94	9.03	9.03	9.03	9.03
5,000	0.79	1.50	2.18	2.73	3.32	3.89	6.20	6.60	6.69	6.69	6.69	6.69
10,000	0.65	1.26	1.80	2.24	2.66	3.09	4.90	5.34	5.43	5.43	5.43	5.43
20,000	0.53	1.02	1.44	1.82	2.15	2.49	3.87	4.33	4.40	4.40	4.40	4.40
50,000	0.38	0.72	1.05	1.31	1.53	1.73	2.66	2.99	3.08	3.08	3.08	3.08
100,000	0.24	0.47	0.66	0.83	1.01	1.16	1.79	2.02	2.06	2.06	2.06	2.06
104,550	0.23	0.45	0.64	0.81	0.96	1.12	1.74	1.97	2.01	2.01	2.01	2.01

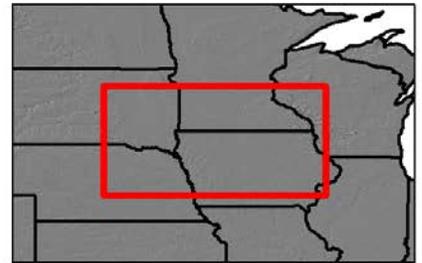






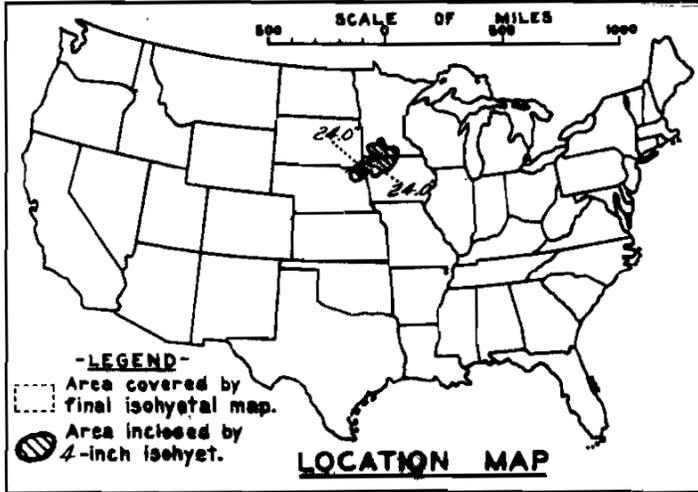
**Total 32-hour Precipitation (inches)**  
**September 17, 1926 1800 UTC - September 19, 1926 0100 UTC**  
**SPAS #1427**

Stations	Precipitation (inches)											
● Daily	0.12 - 1.00	6.01 - 7.00	12.01 - 13.00	18.01 - 19.00								
■ Hourly	1.01 - 2.00	7.01 - 8.00	13.01 - 14.00	19.01 - 20.00								
□ Hourly Estimated	2.01 - 3.00	8.01 - 9.00	14.01 - 15.00	20.01 - 21.00								
■ Hourly Estimated Pseudo	3.01 - 4.00	9.01 - 10.00	15.01 - 16.00	21.01 - 22.00								
● Supplemental	4.01 - 5.00	10.01 - 11.00	16.01 - 17.00	22.01 - 23.00								
◆ Supplemental Estimated	5.01 - 6.00	11.01 - 12.00	17.01 - 18.00	23.01 - 24.00								
					24.00 +							



ADH 10/24/2014

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 17-19 September 1926  
 Assignment MR 4-24  
 Location Ia, Minn., Nebr., S.D. & Wis.  
 Study Prepared by:  
 Missouri River Division  
 Omaha District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 8/5/47  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 12/25/47  
 Remarks: Centers near  
 Boyden & Maurice, Ia.  
 Dewpt. 70° - Ref. Pt. 175 SSE  
 Grid C-15

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 2 sheets, scale 1:500,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	8
Form 5001-B (24-hour " " )-----	-
Form 5001-D ( " " " " )-----	11
Miscl. precip. records, meteorological data, etc.-----	29
Form 5002 (Mass rainfall curves)-----	27

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	3
Form S-11 (Depth-area data from isohyetal map)-----	2
Form S-12 (Maximum depth-duration data)-----	17
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	7

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

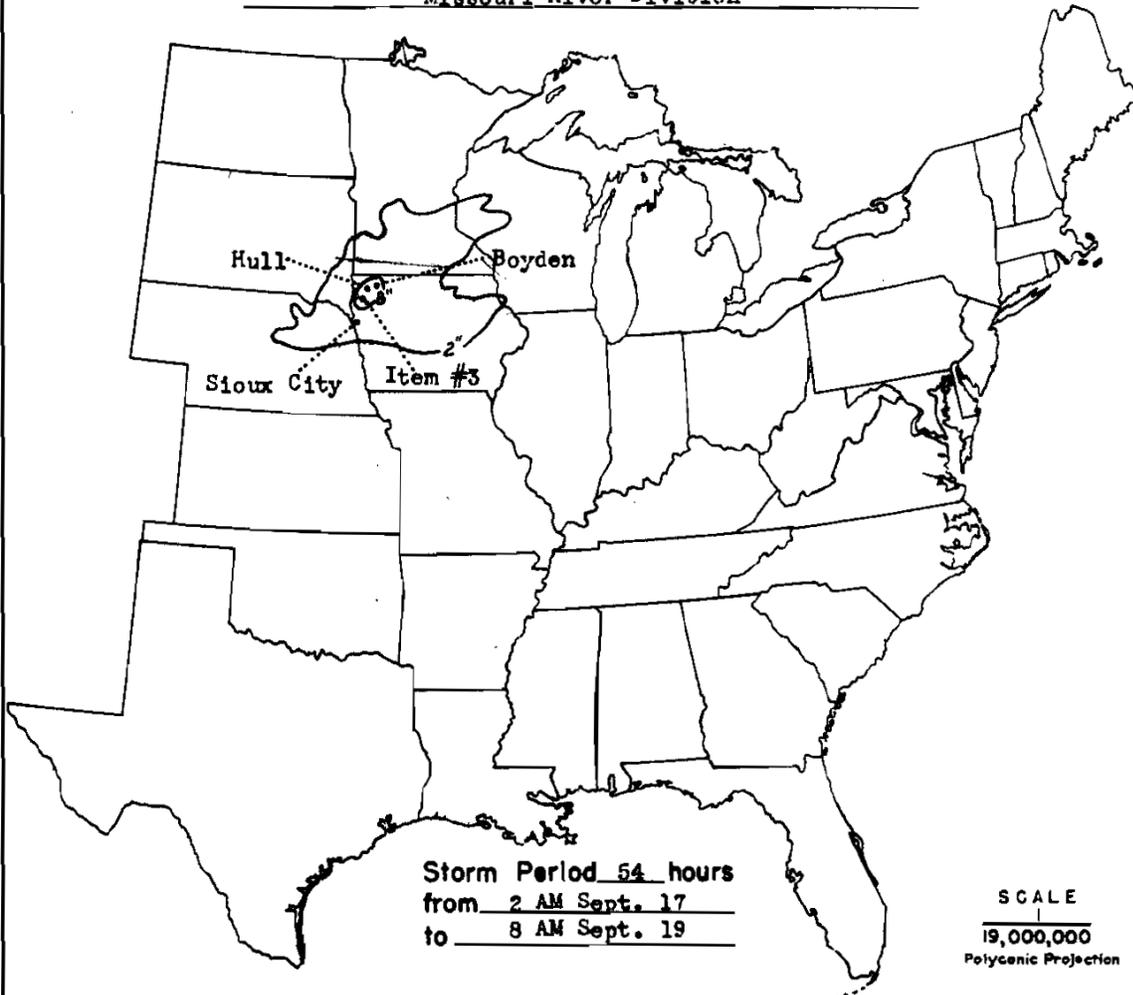
Area in Sq. Mi.	Duration of Rainfall in Hours								
	6	12	18	24	30	36	48	54	
Max. Station	18.4	23.8	24.0	24.0	24.0	24.0	24.0	24.0	
10	15.1	20.7	21.7	21.7	21.7	21.7	21.7	21.7	
100	12.8	17.1	17.8	17.8	17.8	17.8	17.8	17.8	
200	11.7	15.8	16.6	16.6	16.6	16.6	16.6	16.6	
500	9.4	12.6	13.3	13.3	13.3	13.3	13.3	13.3	
1,000	7.5	10.1	10.4	10.6	10.6	10.6	10.6	10.6	
2,000	5.9	8.0	8.2	8.6	8.6	8.6	8.6	8.6	
5,000	4.1	6.3	6.4	6.6	6.6	6.6	6.6	6.6	
10,000	3.0	5.2	5.4	5.5	5.6	5.6	5.6	5.6	
20,000	2.1	4.1	4.3	4.4	4.6	4.8	4.9	4.9	
50,000	1.4	2.7	2.9	3.0	3.2	3.6	3.8	3.8	
63,000	1.2	2.4	2.6	2.7	2.9	3.3	3.5	3.5	

DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - ISOHYETAL MAP**

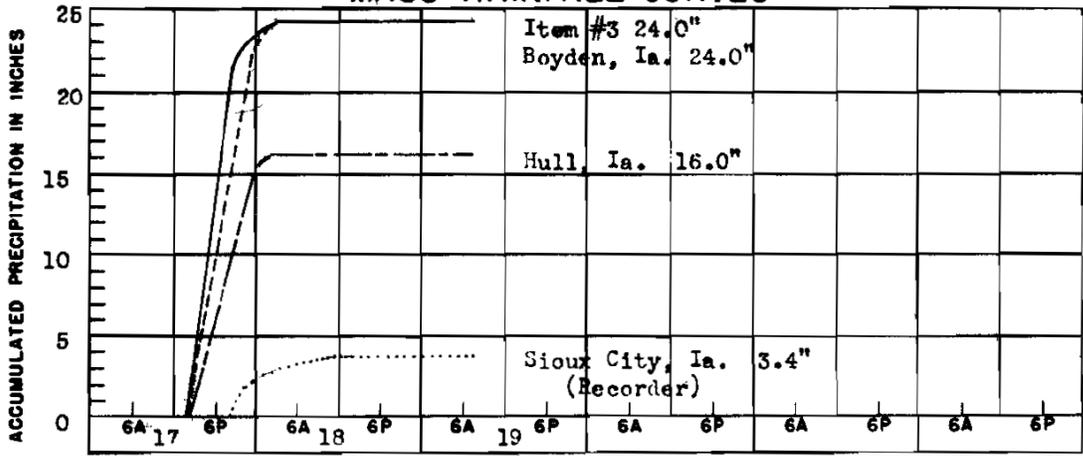
Storm of 17-19 September 1926 Assignment MR 4-24  
 Study Prepared by: Omaha, Nebr. District  
Missouri River Division

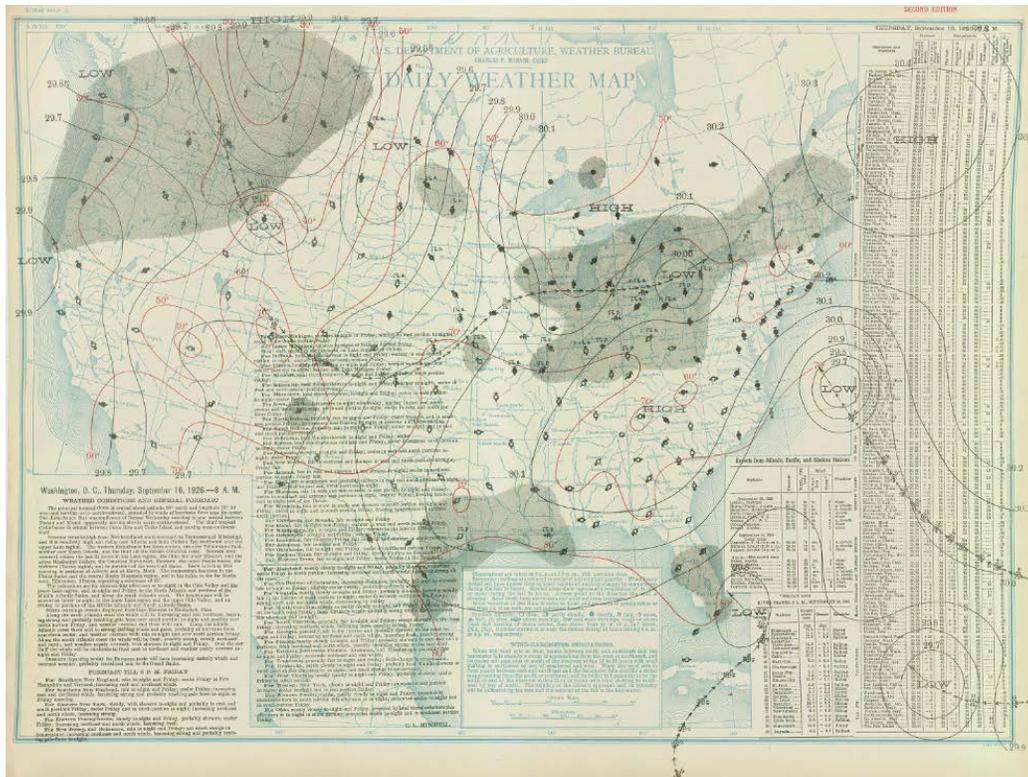
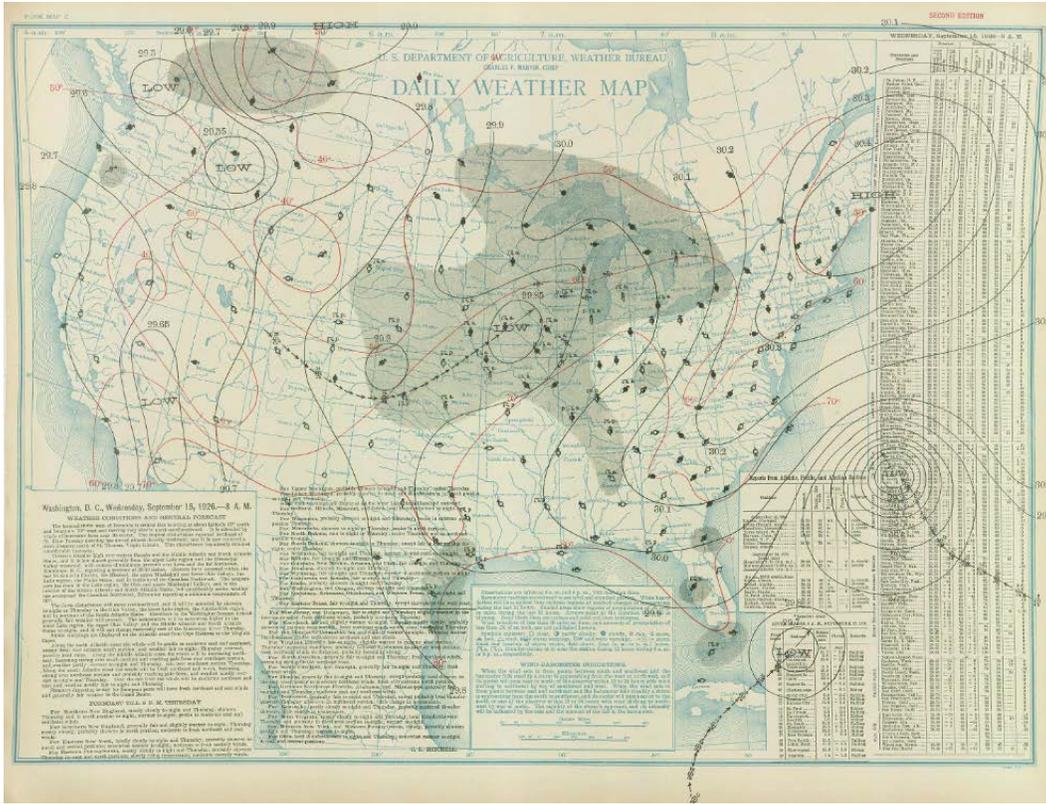


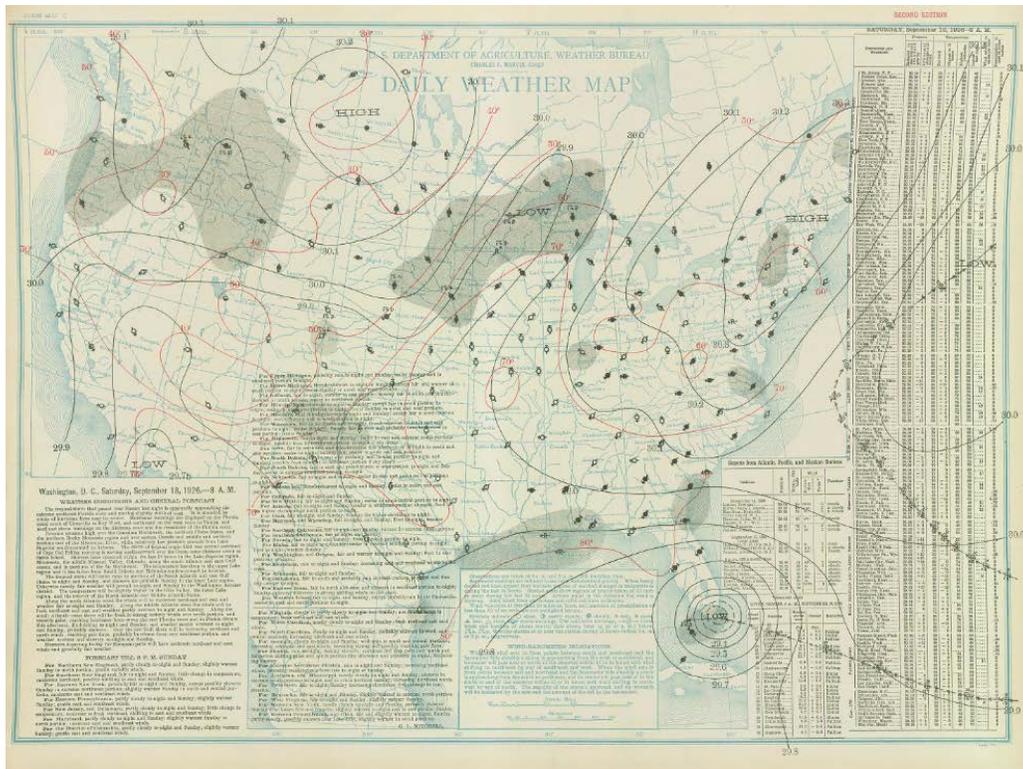
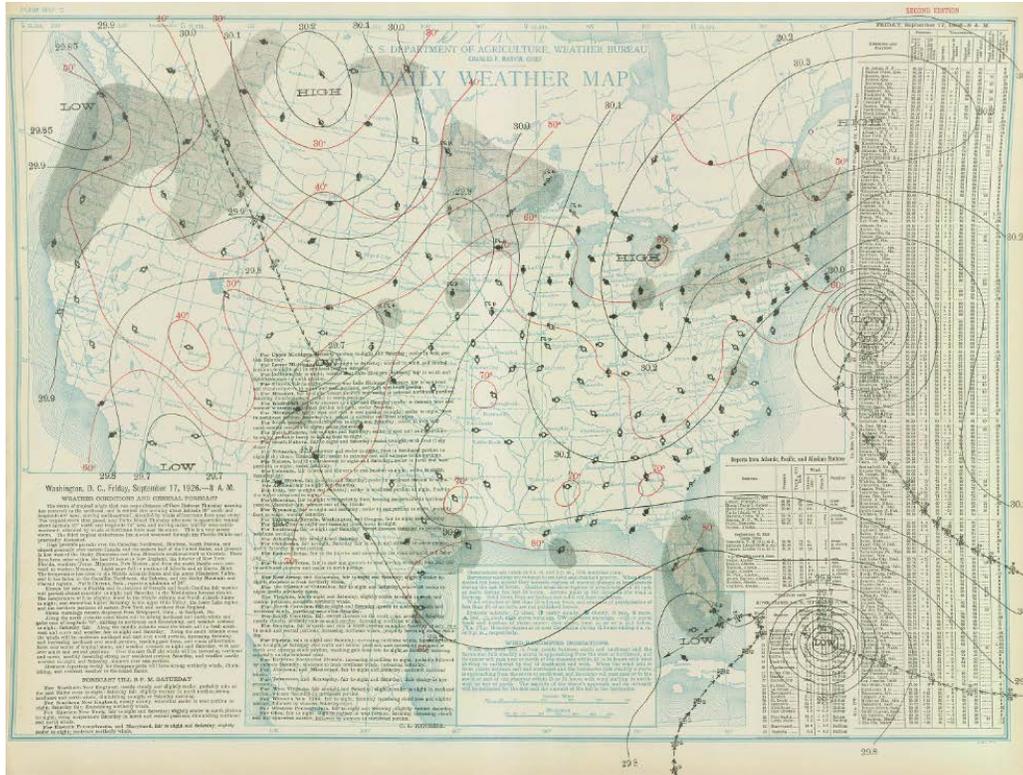
Storm Period 54 hours  
 from 2 AM Sept. 17  
 to 8 AM Sept. 19

SCALE  
19,000,000  
 Polycenic Projection

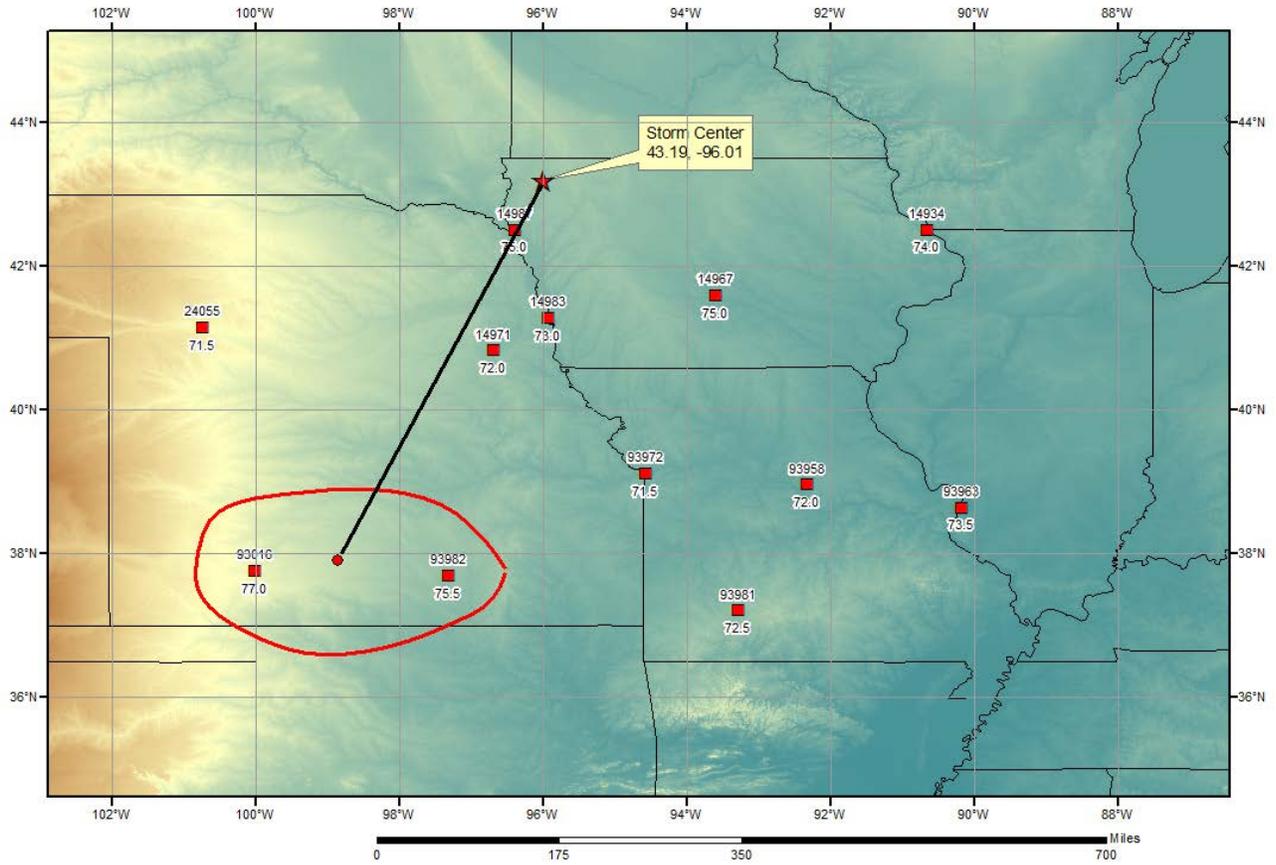
**MASS RAINFALL CURVES**





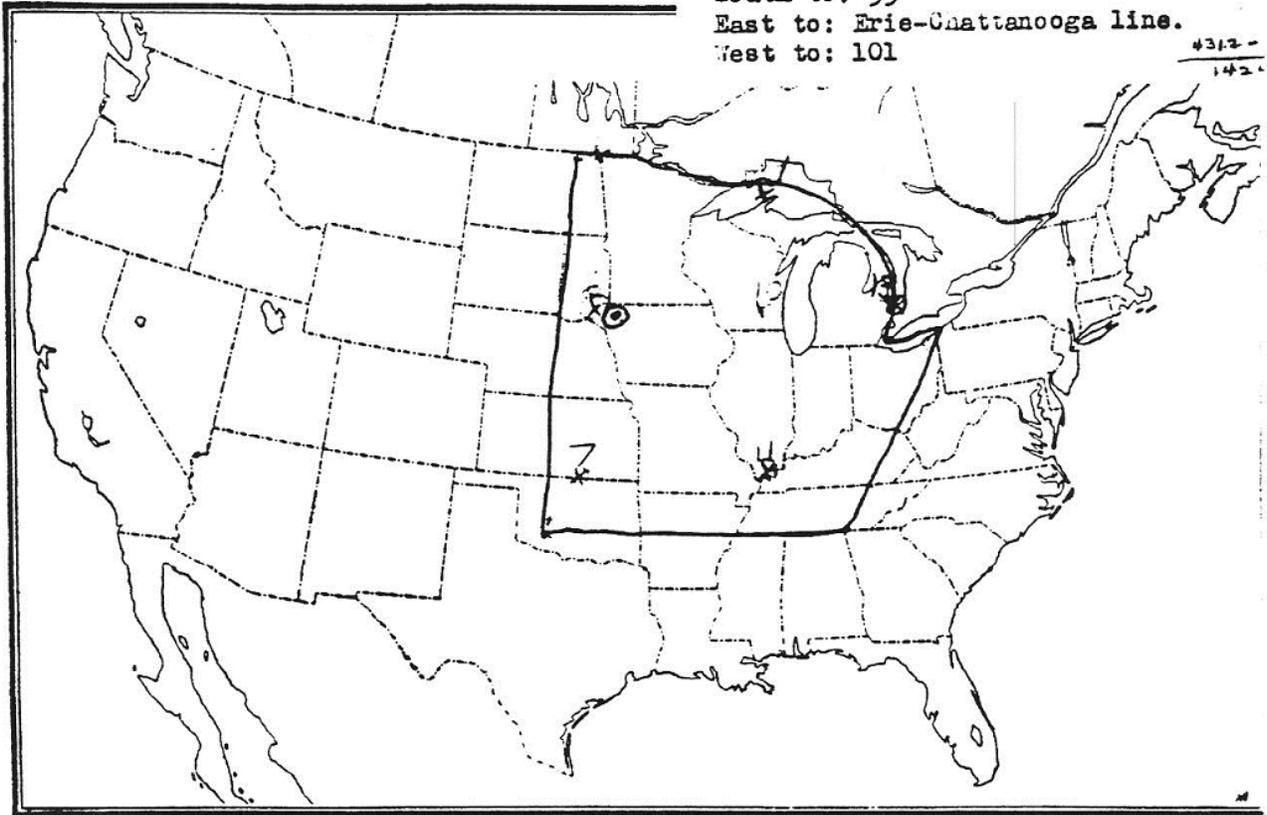


### Boyden, IA Storm Analysis September 15-18, 1926



MR 4-24..Sept. 17-19, 1926..Boyd, I  
12-hr. rfd 70(18tn)..175 SSE.. to 76;  
North to: Border  
South to: 35  
East to: Erie-Chattanooga line.  
West to: 101

4312-  
142



## Storm Precipitation Analysis System (SPAS) For Storm #1494\_1

**General Storm Location:** South Central Texas -101.2, 32.6, 27.6, -97.5

**Storm Dates:** June 30 – July 2, 1932

**Event:** CORPS of Engineers, US Army Assignment GM 5 – 1

### DAD Zone 1

**Latitude:** 30.1708

**Longitude:** -99.3792

**Max. Grid Rainfall Amount:** 35.56”

**Max. Observed Rainfall Amount:** 35.56” Mountain Home

**Number of Stations:** 68

**SPAS Version:** 10

**Base Map Used:** Manually digitized contours

**Spatial resolution:** 0.2861

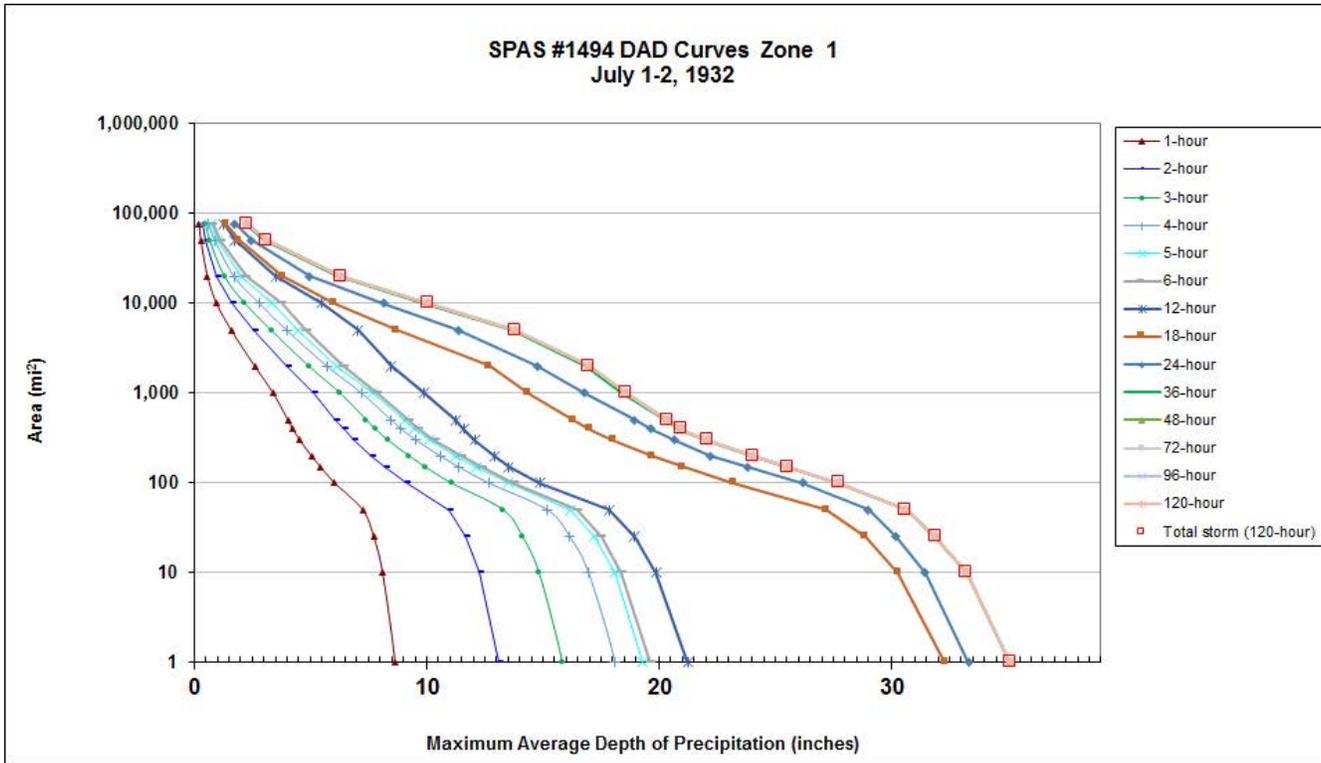
**Radar Included:** No

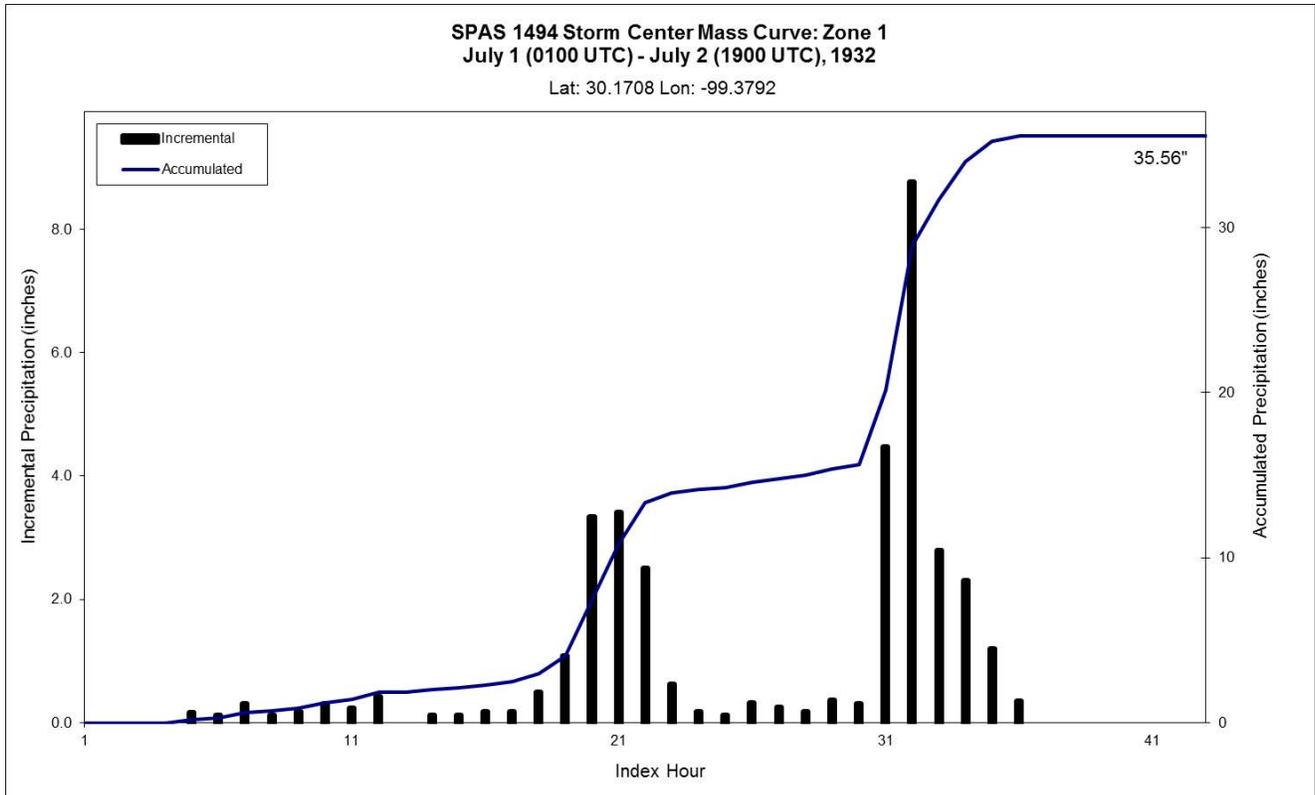
**Depth-Area-Duration (DAD) analysis:** Yes

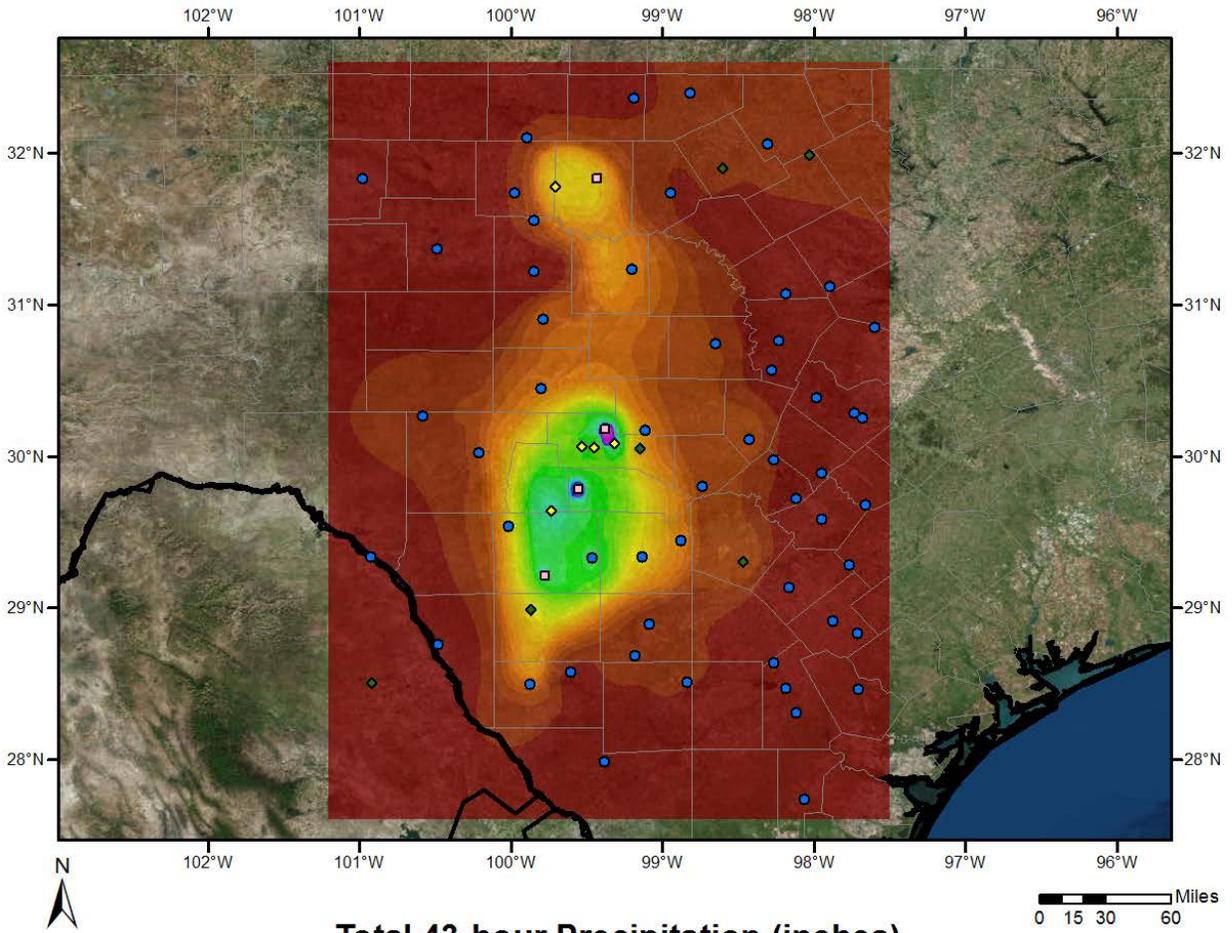
**Degree of confidence in results:** All of the hourly stations used in this analysis were manually digitized from the Army CORPS of Engineers’ pertinent data report. This provided very high accuracy of the hourly data based on previous well-known reports. These hourly stations were essential in the timing of the daily and supplemental stations. Five of the 11 supplemental stations were added based on reports found in an online book (Flash Floods in Texas), and the remaining six supplemental stations were converted from daily stations as their timing was questionable. With all of the data being thoroughly inspected, the DAD and precipitation pattern following reasonably close to the Army CORPS of Engineers report, and the precipitation totals for various periods throughout the storm being consistent with previous reports, this analysis is considered to be reliable.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1494_1	-99.379	30.171	1,915	1,900	77.00	3.14	0.49	76	2.650	80.61	80.5	3.68	0.55	83	3.130	1.181

Storm 1494 - July 1 (0100 UTC) - July 2 (1900 UTC), 1932															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	8.73	13.19	15.98	18.27	19.47	19.82	21.42	32.61	33.64	35.43	35.43	35.43	35.43	35.56	35.56
1	8.64	13.07	15.83	18.10	19.28	19.63	21.22	32.30	33.31	35.09	35.09	35.09	35.09	35.09	35.09
10	8.10	12.24	14.83	16.96	18.07	18.39	19.88	30.27	31.44	33.22	33.22	33.22	33.22	33.22	33.22
25	7.72	11.67	14.13	16.16	17.22	17.53	18.95	28.87	30.18	31.87	31.87	31.87	31.87	31.87	31.87
50	7.25	10.97	13.29	15.19	16.19	16.48	17.83	27.17	28.99	30.61	30.61	30.61	30.61	30.61	30.61
100	6.04	9.13	11.06	12.66	13.49	13.73	14.87	23.20	26.18	27.70	27.71	27.71	27.71	27.71	27.71
150	5.44	8.22	9.96	11.40	12.14	12.36	13.54	21.03	23.80	25.46	25.51	25.51	25.51	25.51	25.51
200	5.04	7.63	9.25	10.58	11.27	11.48	12.90	19.69	22.19	23.95	24.02	24.02	24.02	24.02	24.02
300	4.54	6.86	8.33	9.53	10.14	10.34	12.08	18.01	20.66	22.02	22.07	22.07	22.07	22.07	22.07
400	4.24	6.41	7.78	8.90	9.49	9.66	11.59	17.00	19.67	20.89	20.94	20.94	20.94	20.94	20.94
500	4.03	6.10	7.41	8.48	9.04	9.21	11.23	16.31	18.93	20.26	20.34	20.34	20.34	20.34	20.34
1000	3.39	5.15	6.28	7.20	7.69	7.89	9.91	14.35	16.81	18.45	18.58	18.58	18.58	18.58	18.58
2000	2.60	3.97	4.93	5.71	6.16	6.43	8.46	12.71	14.75	16.84	16.97	16.97	16.97	16.97	16.97
5000	1.60	2.59	3.32	3.98	4.48	4.82	7.03	8.72	11.36	13.68	13.81	13.81	13.81	13.81	13.81
10,000	0.96	1.59	2.18	2.80	3.36	3.76	5.51	6.03	8.15	9.93	10.09	10.09	10.09	10.09	10.09
20,000	0.57	0.97	1.30	1.71	2.04	2.22	3.51	3.81	4.95	6.16	6.30	6.30	6.30	6.30	6.30
50,000	0.29	0.51	0.67	0.89	1.05	1.11	1.76	1.93	2.45	3.04	3.12	3.12	3.12	3.12	3.12
76,299	0.21	0.36	0.49	0.62	0.73	0.81	1.26	1.35	1.75	2.19	2.26	2.26	2.26	2.26	2.26







**Total 43-hour Precipitation (inches)**  
**July 1, 1932 0100 UTC - July 2, 1932 1900 UTC**  
**SPAS #1494**

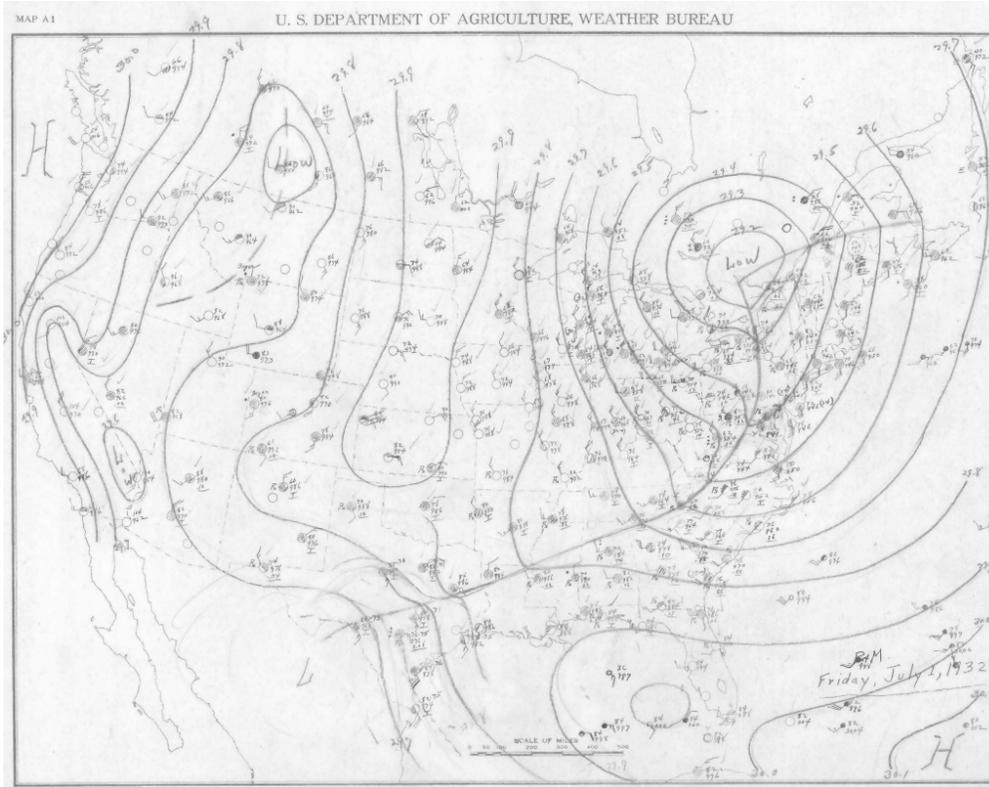
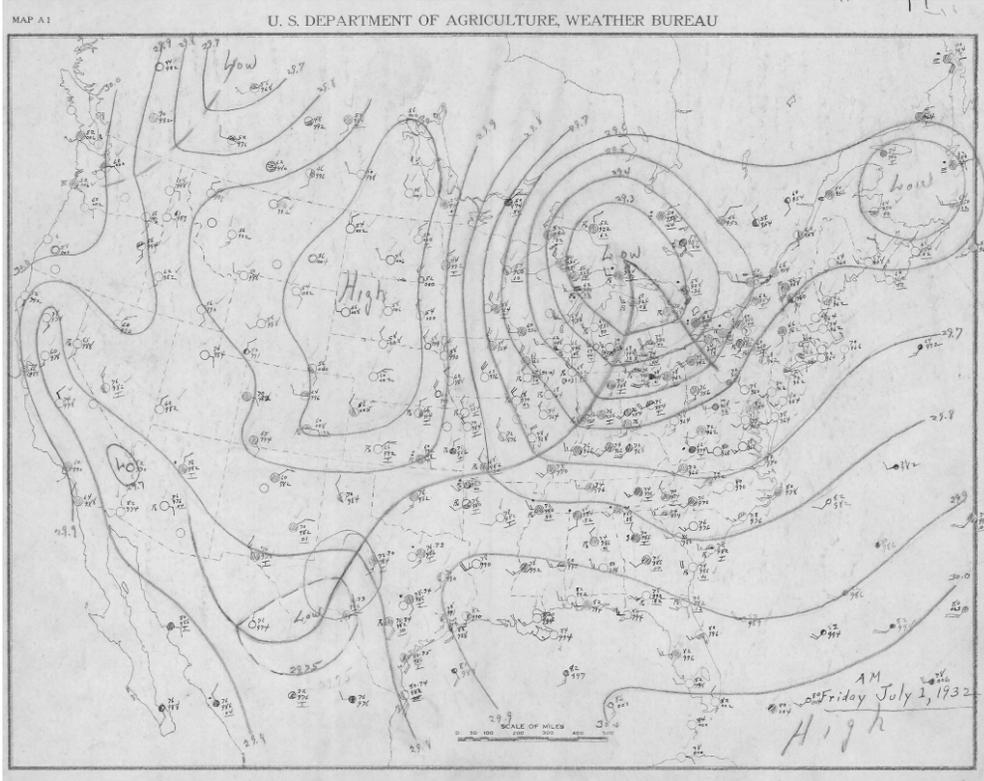
**Precipitation (inches)**

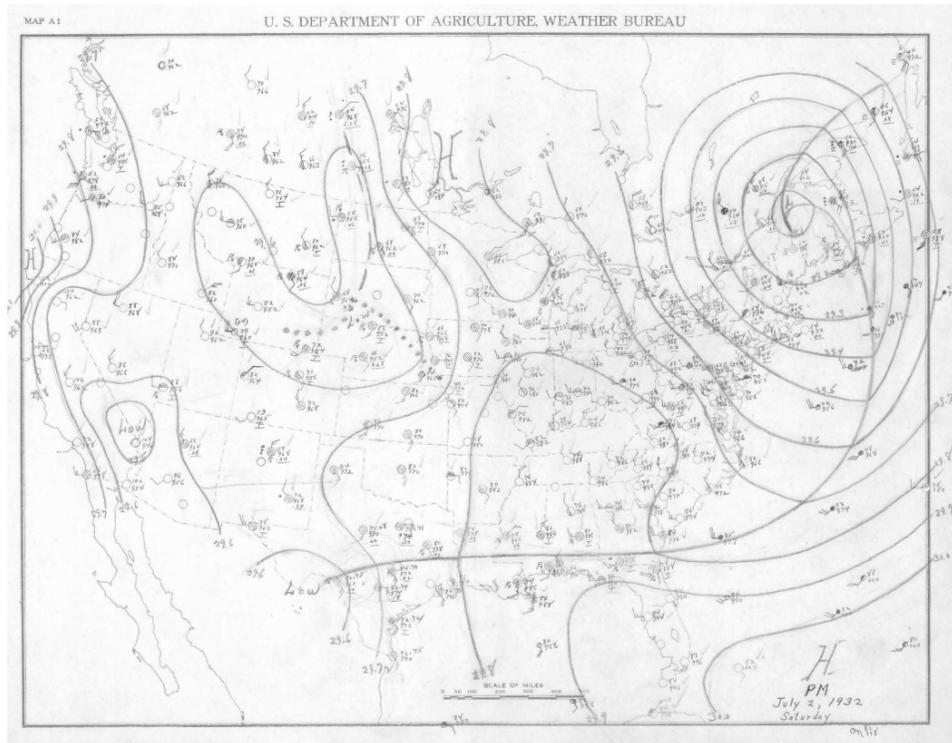
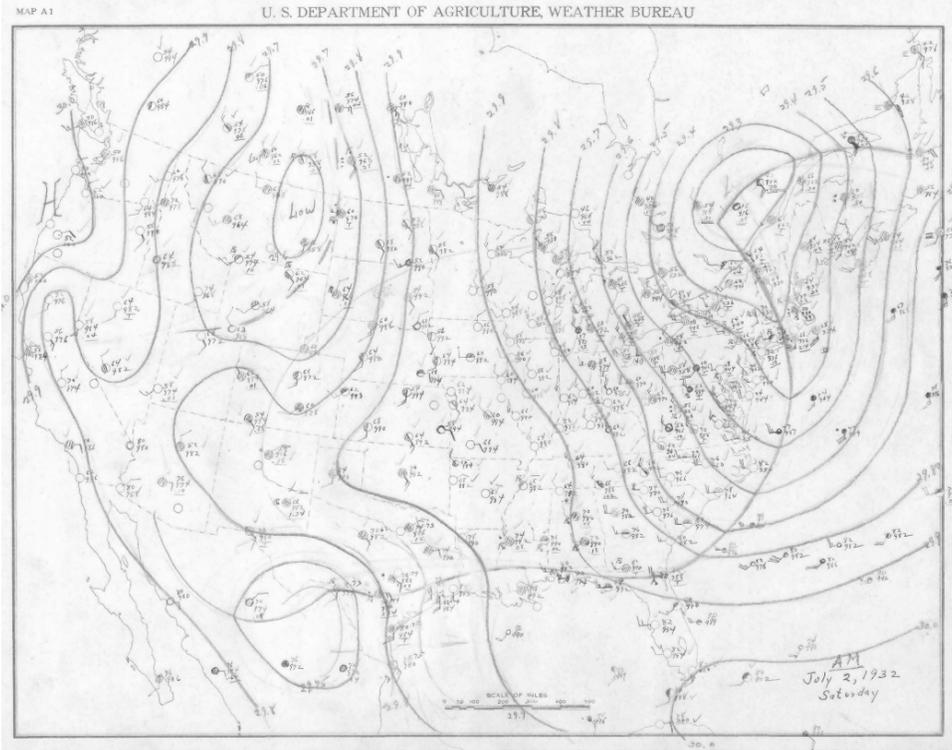
0.01 - 1.00	7.01 - 8.00	14.1 - 15.0	21.1 - 22.0	28.1 - 29.0
1.01 - 2.00	8.01 - 9.00	15.1 - 16.0	22.1 - 23.0	29.1 - 30.0
2.01 - 3.00	9.01 - 10.0	16.1 - 17.0	23.1 - 24.0	30.1 - 31.0
3.01 - 4.00	10.1 - 11.0	17.1 - 18.0	24.1 - 25.0	31.1 - 32.0
4.01 - 5.00	11.1 - 12.0	18.1 - 19.0	25.1 - 26.0	32.1 - 33.0
5.01 - 6.00	12.1 - 13.0	19.1 - 20.0	26.1 - 27.0	33.1 - 34.0
6.01 - 7.00	13.1 - 14.0	20.1 - 21.0	27.1 - 28.0	34.1 - 35.0
				35.1 - 36.0

**Stations**

- Daily
- Hourly Estimated
- ◆ Supplemental
- ◇ Supplemental Estimated







WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of June 30 - July 2, 1932

Assignment O M 5 - 1

Location Southwestern Texas

Study Prepared by:

Southwestern Division  
Galveston District Office

Part I Reviewed by H. M. Sec. of  
Weather Bureau, 6/7/34

Part II Approved by Office, Chief  
of Engineers for Distribution  
of Factual Data, 2/28/35

Remarks: Center at:  
State Fish Hatchery, Texas

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:2,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	9
Form 5001-B (24-hour " " " " ).....	16
Form 5001-D ( " " " " " " ).....	3
Misc. precip. records, meteorological data, etc.....	5
Form 5002 (Mass rainfall curves).....	28

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	2
Form S-11 (Depth-area data from isohyetal map).....	2
Form S-12 (Maximum depth-duration data).....	9
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours								
	6	12	18	24	30	36	42		
Max. Station	19.6	21.4	32.4	33.6	34.6	35.6	35.6		
10	13.3	19.5	30.0	31.7	32.9	33.6	33.7		
25	12.9	19.2	29.3	30.8	32.0	32.6	32.8		
100	11.2	15.8	25.7	25.8	26.8	27.5	27.7		
200	10.3	14.3	21.2	25.8	24.9	25.5	25.7		
500	8.8	12.1	17.9	21.1	22.2	22.8	23.0		
1,000	7.7	10.5	15.5	19.0	20.2	20.7	20.9		
2,000	6.5	8.9	13.0	16.9	18.2	18.7	18.9		
5,000	4.8	6.8	9.8	13.5	14.9	15.3	15.6		
10,000	3.6	5.2	7.4	10.3	11.3	11.6	11.8		
20,000	2.4	3.6	4.9	7.0	7.7	7.9	8.1		
30,000	1.6	2.6	3.5	5.0	5.5	5.7	5.9		

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

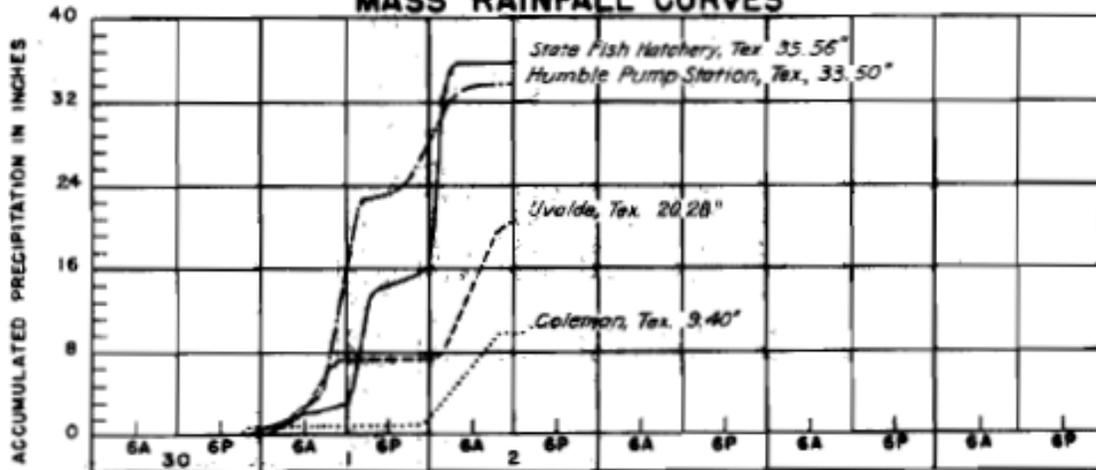
**STORM STUDIES - ISOHYETAL MAP**

Storm of June 30 - July 2, 1932 Assignment GM 5-1

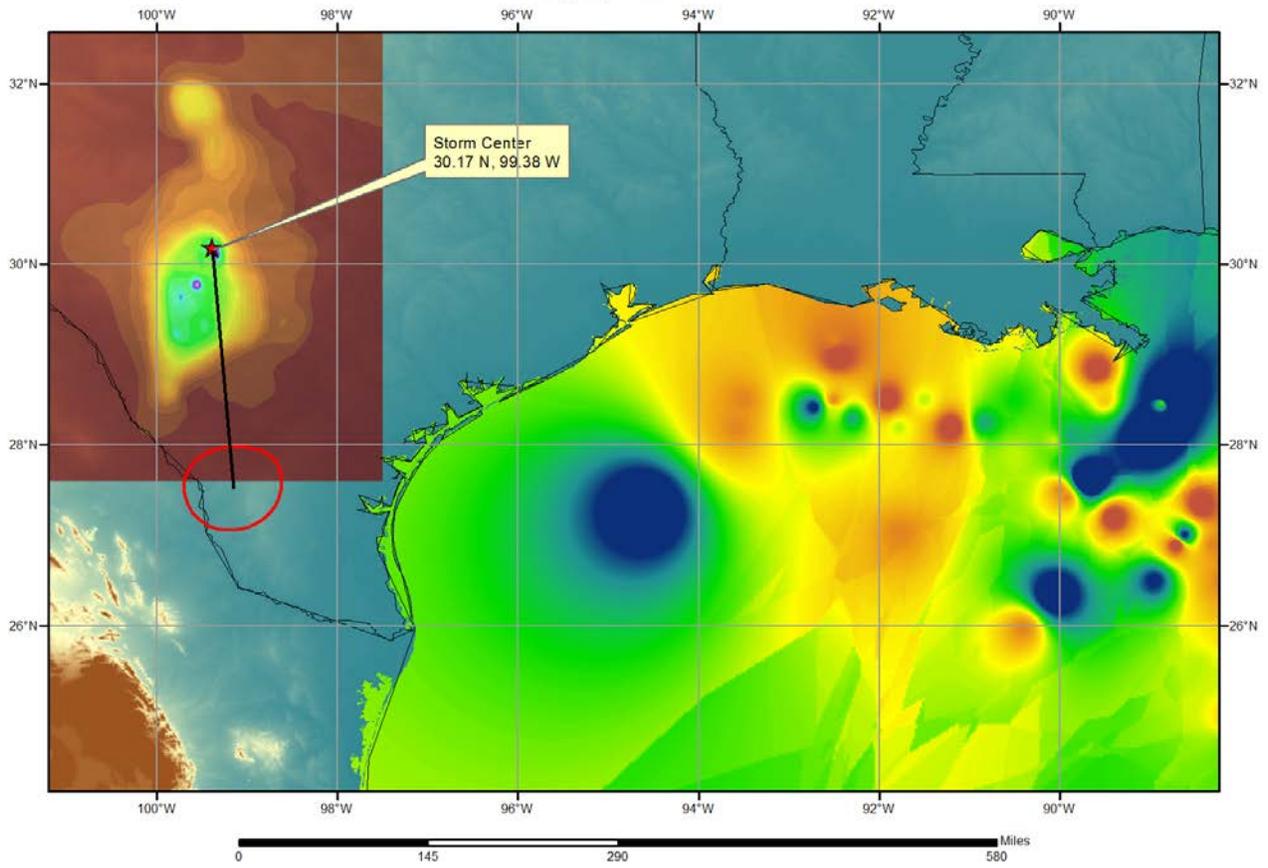
Study Prepared by: Galveston, Tex. District  
Southwestern Division



**MASS RAINFALL CURVES**



### SPAS 1494 Mountain Home, TX Storm Analysis July 1, 1932



16.

Storm Date	Assignment Number	Representative Storm Dewpoint	Reference Point
<u>1929</u>			
Mar 11-16	LMW 2-20	67	75 S of Elba, Ala.
Mar 21-23	OR 7-15	68	270 SSE of Rock Island, Tenn.
Apr 18-21	MR 3-22	66	200 SSE of Holton, Kans.
May 10-14	MR 3-23	68	200 SE of Lawton, Okla.
May 25-30	GM 4-26	76	190 SSE of Henry, Tex.
May 25-30	MR 4-27	63	500 SE of Sentinel Butte, Mont.
May 29-Jun 3	MR 3-25	69	250 S of Bethany, Mo.
Jun 6-7	MR 4-28	62	400 SE of Beach, N. Dak.
Jul 15-18	LMW 1-17	74	80 WSW of Woodville, Miss.
Aug 1-2	UMW 2-17	73	190 S of Toledo, Iowa.
Sep 5-9	LMW 4-13	75	90 E of Algiers, La.
Sep 23-28	SA 3-20	74	50 E of Glenville, Ga.
Sep 29-Oct 3	SA 3-23	74	200 E of Vernon, Fla.
Nov 11-15	GM 2-4	71	250 SSE of Helena, Ala.
<u>1930</u>			
Jan 6-11	LMW 2-22	60	190 SE of Arkadelphia, Ark.
May 6-11	LMW 2-23	71	220 SW of Swan Lake, Miss.
May 15-19	LMW 2-24	75	290 SE of Camden, Ark.
Jun 7-11	NA 1-19	62	160 SW of Springfield, Mass.
Jun 12-15	UMW 2-14	67	120 SW of Washington, Iowa.
Sep 13-15	MR 3-26	70	175 SSE of Holton, Kans.
Oct 9-12	SW 2-6	70	540 SE of Porter, N. Mex.
<u>1931</u>			
Jul 20-25	GL 1-27	72	250 SW of Conklingville, N. Y.
<u>1932</u>			
Jan 11-13	LMW 4-16	62	120 SE of Urania, La.
Jun 2-6	SW 2-7	70	250 S of Meeker, Okla.
Jun 2-6	SW 2-7A	70	500 SSE of Tribune, Kans.
Jun 30-Jul 2	GM 5-1	75	175 S of Kerrville, Tex.
Jul 3-8	OR 3-20	73	250 SW of Clay, W. Va.
Aug 1-3	OR 2-8	76	510 SW of Lexington, Ky.
Aug 13-17	SW 2-8	72	160 SSE of Enid, Okla.
Aug 30-Sep 5	GM 5-16A	76	340 S of Fairfield, Tex.
Sep 5-7	GM 5-16B	75	400 SE of Abilene, Tex.
Sep 16-17	NA 1-20	63	75 E of Westerly, R. I.

## Storm Precipitation Analysis System (SPAS) For Storm #1495\_1

**General Storm Location:** Oklahoma and Texas (36.3, -101.0, 34.8, -98.9)

**Storm Dates:** April 3 – April 5, 1934

**Event:** Localized Extreme Precipitation Event

### DAD Zone 1

**Latitude:** 35.6208

**Longitude:** -99.6792

**Max. Grid Rainfall Amount:** 23.11”

**Max. Observed Rainfall Amount:** 23.00”

**Number of Stations:** 143

**SPAS Version:** 10

**Base Map Used:** EDADS USACE Total Storm Isohyetal

**Spatial resolution:** 00:00:30 (0.30-sqmi)

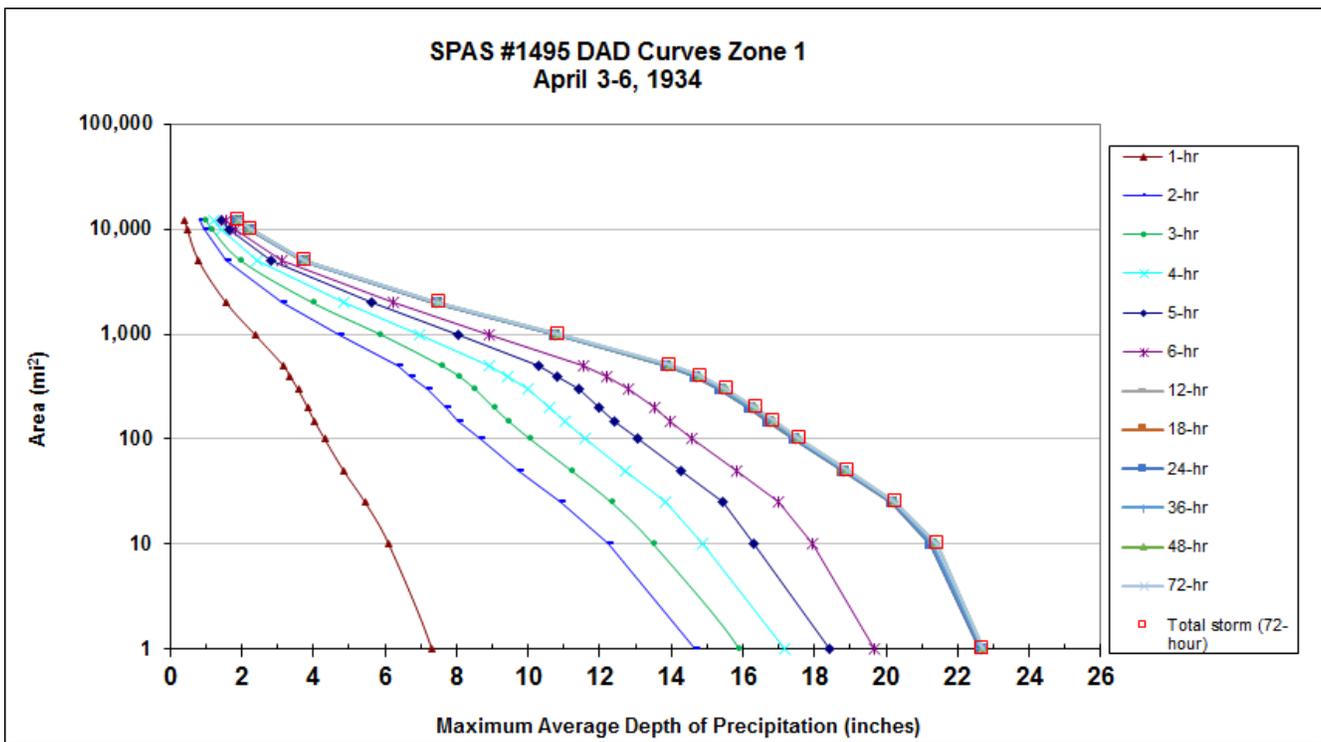
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

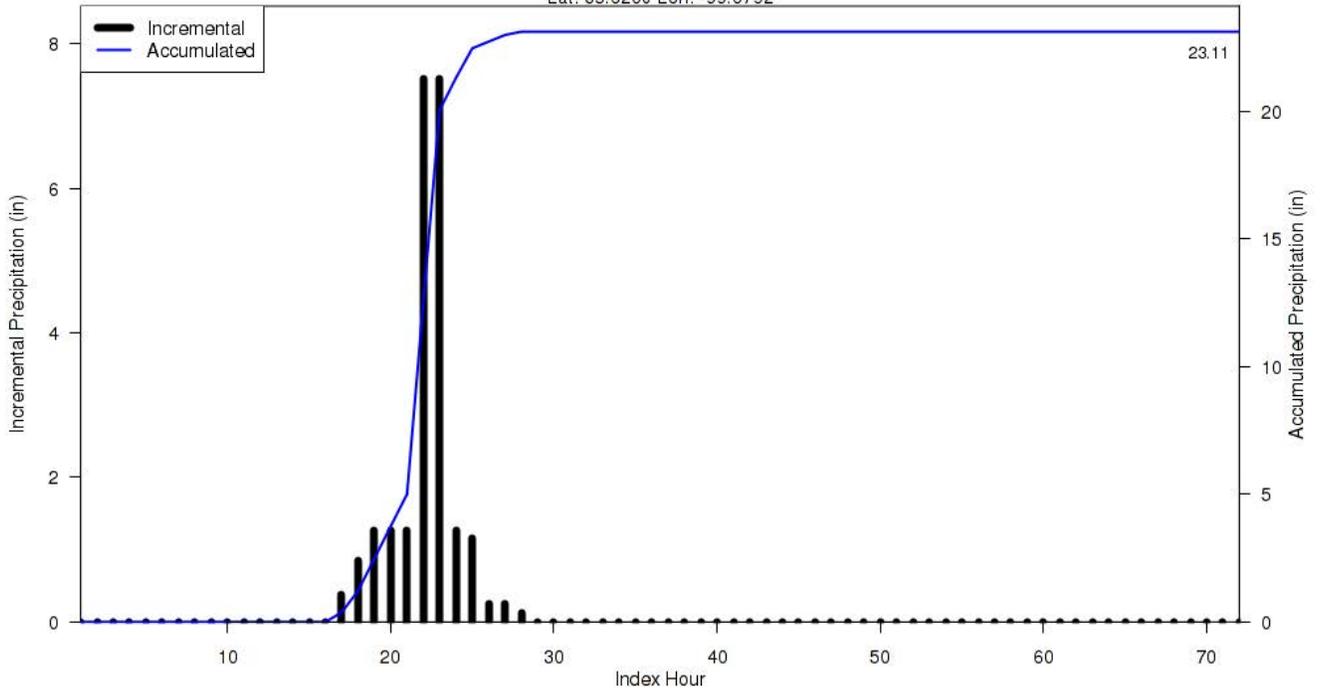
**Degree of confidence in results:** While no NCDC hourly stations were available for this storm, two recorder stations and three estimated stations were digitized from the U.S. Army Corp of Engineers (USACE) Storm Study and EDADS pertinent data; these three estimated stations contained the storm center and provided timing. The storm center timing (no79) was based on the EDADs mass curve combined with bucket survey timing and the USACE max point data. The timing insured the maximum point data matched observed values at 2hrs (15.00"), 6hrs (20.00"), and 12hrs (23.00"). A period on intense rainfall was noted between 10pm and min-night, this period was selected to represent the maximum 2hr observation of 15.00" (note the 15.00" fell in 2hrs 20mins, for the analysis we placed in 2hrs). The USGS did a post-storm bucket survey collecting ~200 observations, the EDADS document contained 150 bucket survey data. The 150 observations included amount, location, timing, and remarks.

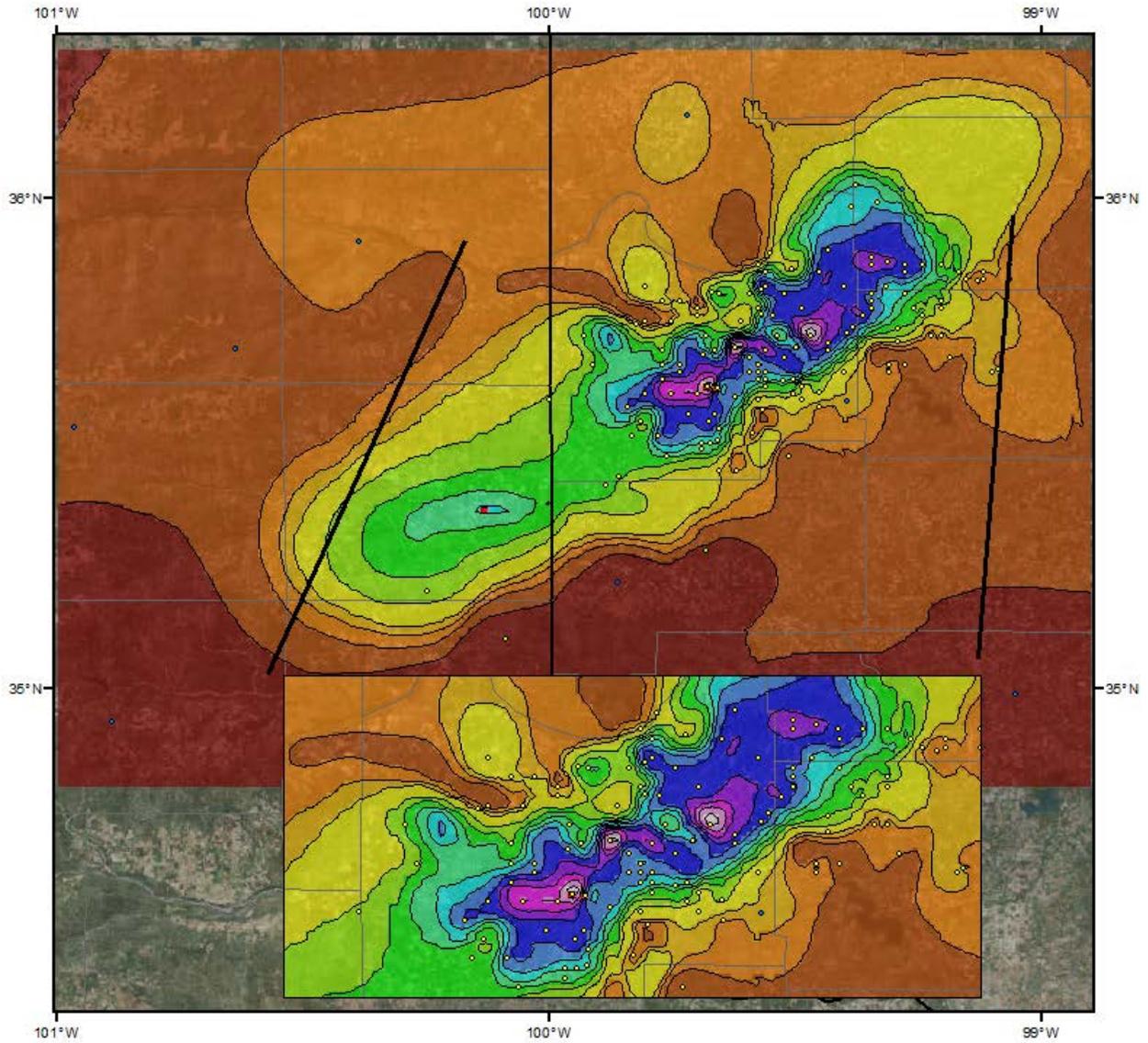
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1495_1	-99.679	35.621	1,930	1,900	68.00	2.05	0.37	58	1.680	74.28	74.5	2.79	0.45	71	2.338	1.391

Storm 1495 Zone 1 - April 3 (0700 UTC) - April 6 (0600 UTC), 1934													
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)													
areasqmi	Duration (hours)												
	1-hr	2-hr	3-hr	4-hr	5-hr	6-hr	12-hr	18-hr	24-hr	36-hr	48-hr	72-hr	Total
0.3	7.5	14.9	16.2	17.4	18.7	20.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
1	7.3	14.7	15.9	17.2	18.4	19.7	22.6	22.6	22.6	22.7	22.7	22.7	22.7
10	6.1	12.3	13.5	14.9	16.3	17.9	21.3	21.3	21.3	21.3	21.4	21.4	21.4
25	5.5	10.9	12.4	13.9	15.4	17.0	20.2	20.2	20.2	20.2	20.3	20.3	20.3
50	4.9	9.7	11.2	12.7	14.3	15.8	18.8	18.8	18.8	18.8	18.9	18.9	18.9
100	4.3	8.6	10.1	11.6	13.1	14.6	17.4	17.4	17.4	17.5	17.6	17.6	17.6
150	4.0	8.1	9.5	11.0	12.4	14.0	16.7	16.7	16.7	16.8	16.9	16.9	16.9
200	3.9	7.7	9.1	10.6	12.0	13.5	16.2	16.2	16.2	16.3	16.4	16.4	16.4
300	3.6	7.2	8.5	10.0	11.4	12.8	15.4	15.4	15.4	15.4	15.5	15.6	15.6
400	3.4	6.7	8.1	9.5	10.8	12.2	14.7	14.7	14.7	14.7	14.8	14.8	14.8
500	3.2	6.4	7.6	8.9	10.3	11.6	13.8	13.8	13.8	13.9	14.0	14.0	14.0
1,000	2.4	4.7	5.9	7.0	8.1	8.9	10.7	10.7	10.7	10.8	10.8	10.8	10.8
2,000	1.6	3.1	4.0	4.8	5.6	6.2	7.4	7.4	7.4	7.5	7.5	7.5	7.5
5,000	0.8	1.6	2.0	2.4	2.8	3.1	3.7	3.7	3.7	3.8	3.8	3.8	3.8
10,000	0.5	0.9	1.2	1.4	1.7	1.8	2.2	2.2	2.2	2.2	2.2	2.2	2.2
12,235	0.4	0.8	1.0	1.2	1.4	1.6	1.9	1.9	1.9	1.9	1.9	1.9	1.9



SPAS 1495 Storm Center Mass Curve Zone 1  
April 3 (0700UTC) to April 6 (0600UTC), 1934  
Lat: 35.6208 Lon: -99.6792





**Total 72-hour Precipitation (inches)**  
**April 3, 1934 (0700 UTC) - April 6, 1934 (0600 UTC)**  
**SPAS #1495**

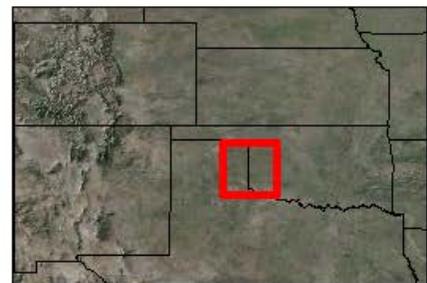
**Gauges**

- Daily
- Hourly Estimated
- Hourly Est. Pseudo
- Supplemental
- Supplemental Est.



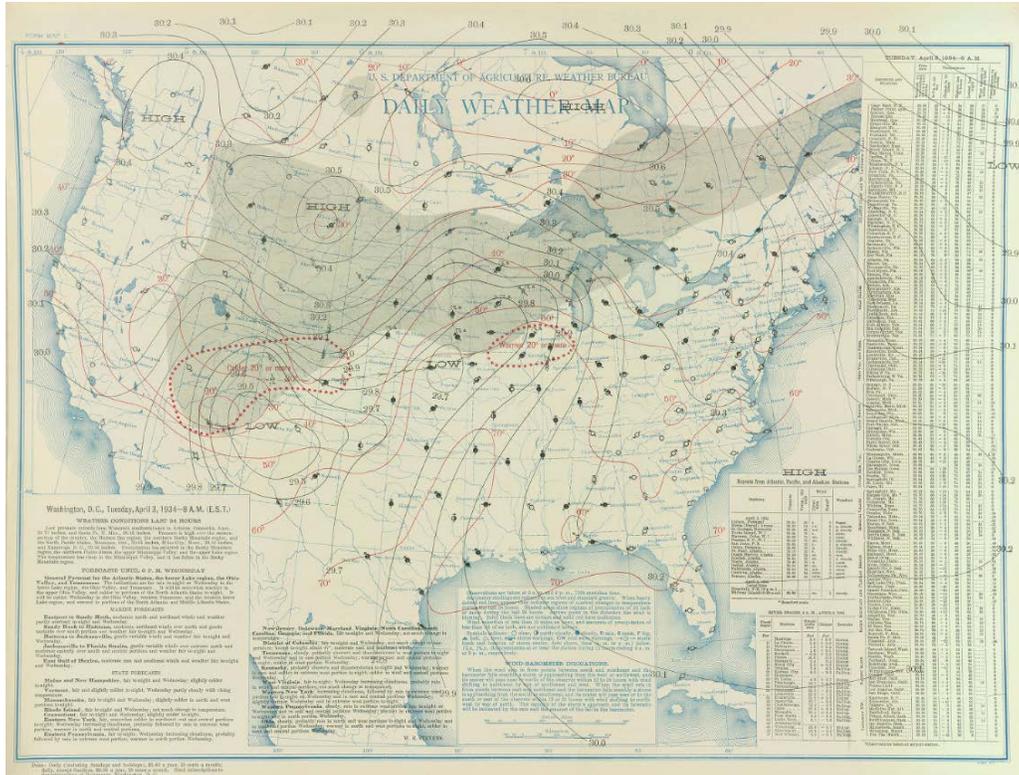
**Precipitation (inches)**

■ 0.00 - 0.50	■ 1.51 - 2.00	■ 6.01 - 8.00	■ 12.01 - 14.00	■ 18.01 - 20.00
■ 0.51 - 1.00	■ 2.01 - 4.00	■ 8.01 - 10.00	■ 14.01 - 16.00	■ 20.01 - 22.00
■ 1.01 - 1.50	■ 4.01 - 6.00	■ 10.01 - 12.00	■ 16.01 - 18.00	■ 22.01 - 24.00



2/29/2016

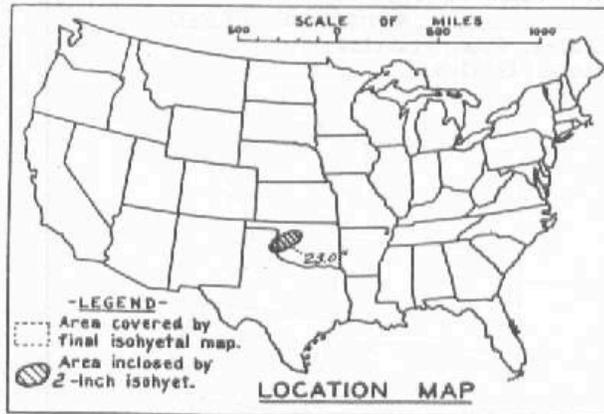




DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 3-4 April 1934  
 Assignment SW 2-11  
 Location Oklahoma and Texas  
 Study Prepared by:  
 Southwestern Division  
 Tulsa District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 7/22/46  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 8/19/47  
 Remarks: Center near  
 Cheyenne, Oklahoma  
 Dewpt. 84° - Ref. Pt. 250 SE  
 Grid G-17

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:250,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly preclp. data).....	2
Form 5001-B (24-hour " " " " ).....	-
Form 5001-D (" " " " " " ).....	7
Miscl. precip. records, meteorological data, etc. (Supplemental Folder).....	112
Form 5002 (Mass rainfall curves).....	21

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:250,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	3
Form S-11 (Depth-area data from isohyetal map).....	2
Form S-12 (Maximum depth-duration data).....	4
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	1

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours									
	6	12	18							
Max. Station	20.0	23.0	23.0							
10	17.3	20.8	21.3							
100	14.4	17.1	17.7							
200	13.3	15.7	16.4							
500	11.5	13.5	14.0							
1,000	9.1	10.7	11.1							
2,000	6.2	7.3	7.5							
2,200	5.8	6.9	7.1							

Form S-2

DEPARTMENT OF THE ARMY CORPS OF ENGINEERS

**STORM STUDIES - ISOHYETAL MAP**

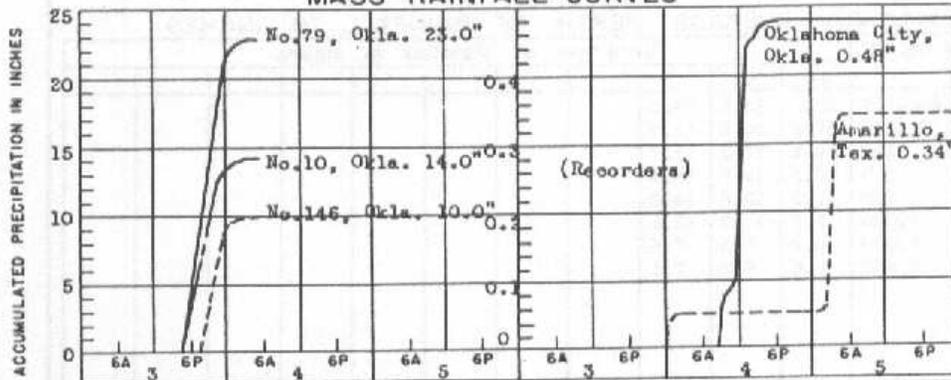
Storm of 3-4 April 1934 Assignment EW 2-11  
 Study Prepared by: Tulsa, Okla. District  
Southwestern Division



Storm Period 18 hours  
 from 12 N April 3  
 to 6 AM April 4

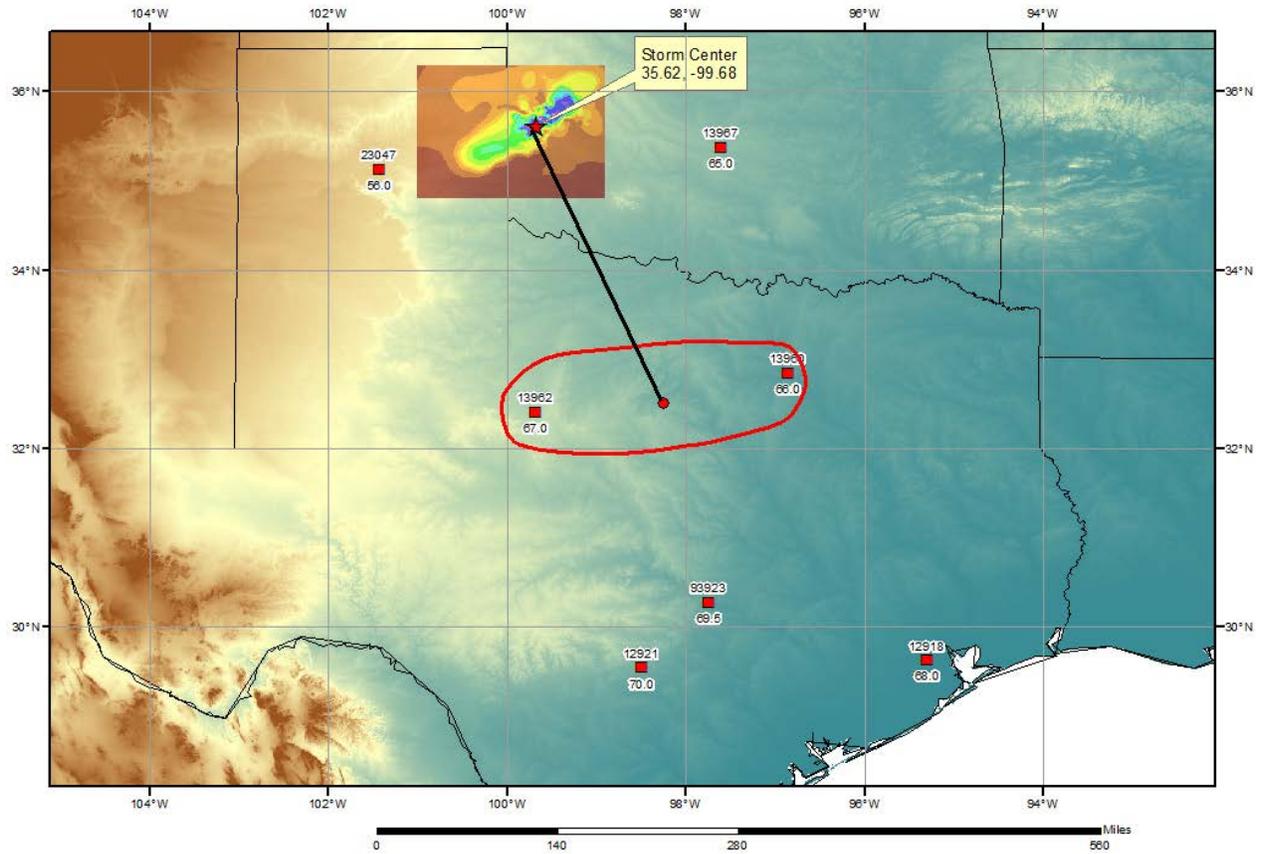
SCALE  
 1  
 19,000,000  
 Polyconic Projection

**MASS RAINFALL CURVES**



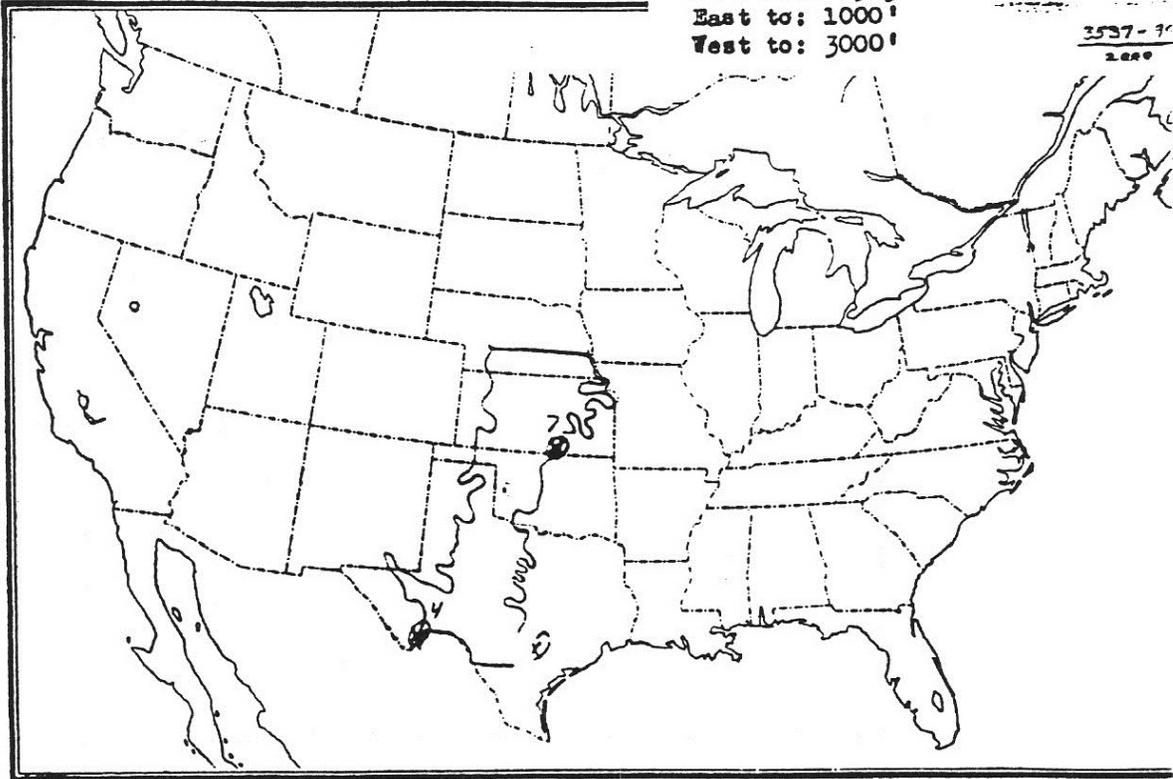
FORM 8-3W

### SPAS 1495 - Cheyenne, OK Storm Analysis April 1-3, 1934



SW 2-11..April 3-4, 1934 Cheyenne  
12-hr. rfd 64(4th)..250' ..to 70'  
North to: 41  
South to: 29.5  
East to: 1000'  
West to: 3000'

3537-70  
2.000



## Storm Precipitation Analysis System (SPAS) For Storm #1295\_1 (re-run/expansion of Storm #1039)

**General Storm Location:** Eastern Colorado and southern Colorado Front Range

**Storm Dates:** May 29-31, 1935

**Event:** MCCs/Thunderstorms

### DAD Zone 1

**Latitude:** 39.2375

**Longitude:** -104.4875

**Max. Grid Rainfall Amount:** 23.86”

**Max. Observed Rainfall Amount:** 24.00” (“estimated” via bucket survey in Elbert County, CO)

**Number of Stations:** 102

**SPAS Version:** 9.5

**Basemap:** Final SPAS #1008 Precip Map, which used June 1965 Total Precipitation PRISM Grid

**Spatial resolution:** 30 seconds

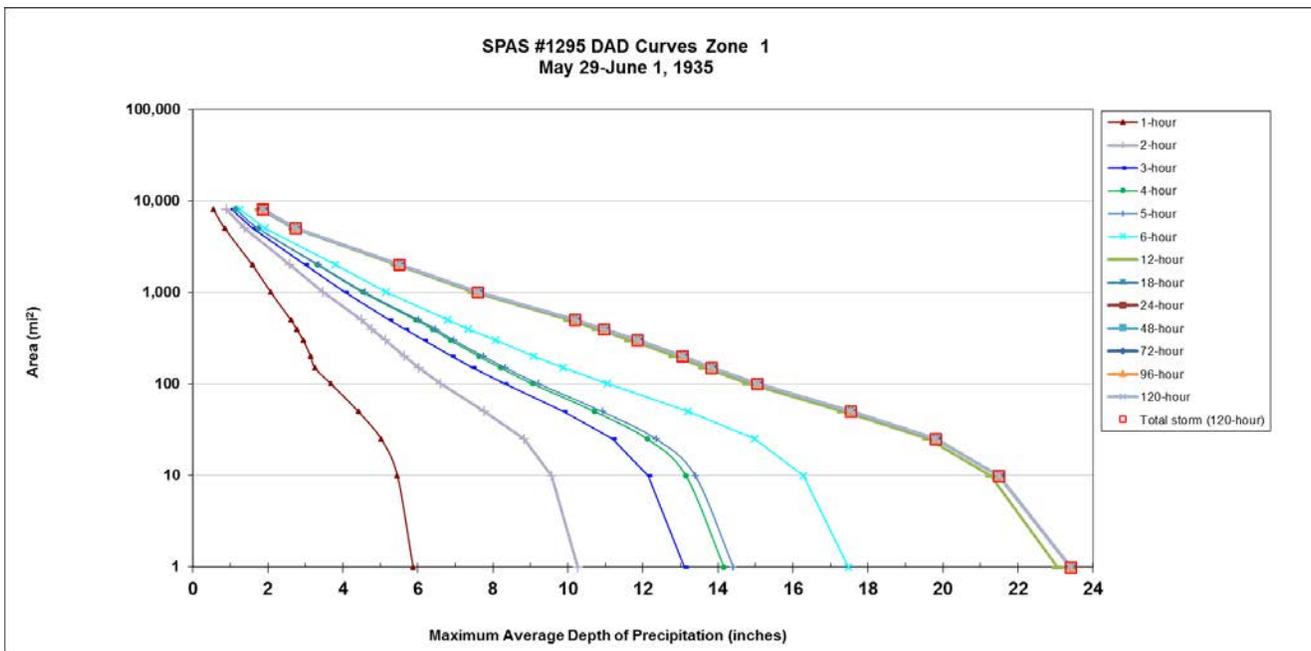
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

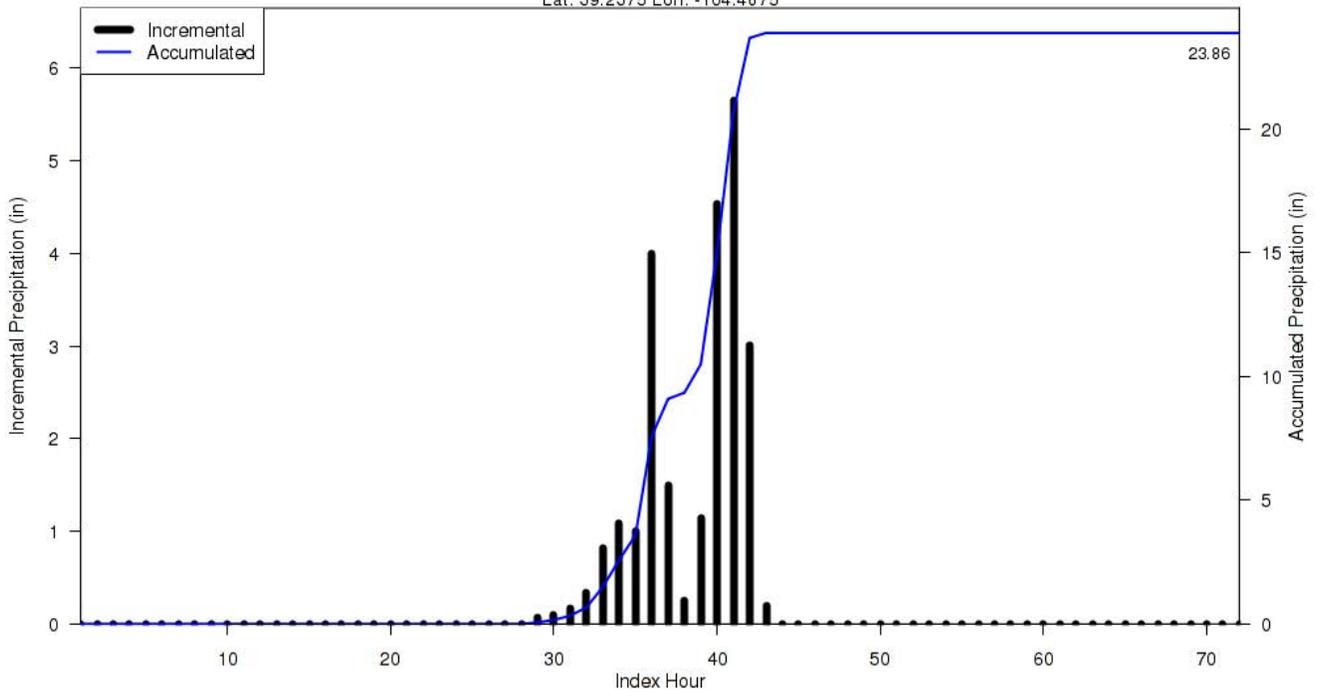
**Reliability of results:** This was a challenging storm to analyze given the lack of accurate measurements and hourly recording data. The storm analysis is consistent with the numerous other analyses of this storm by the USACE, USACE and NWS. Although we have a moderate degree of confidence in the magnitudes of precipitation; some areas reported heavy amounts of hail, which introduces error precipitation totals. We have low confidence in the precise precipitation patterns and temporal distributions given the lack of hourly data and radar data.

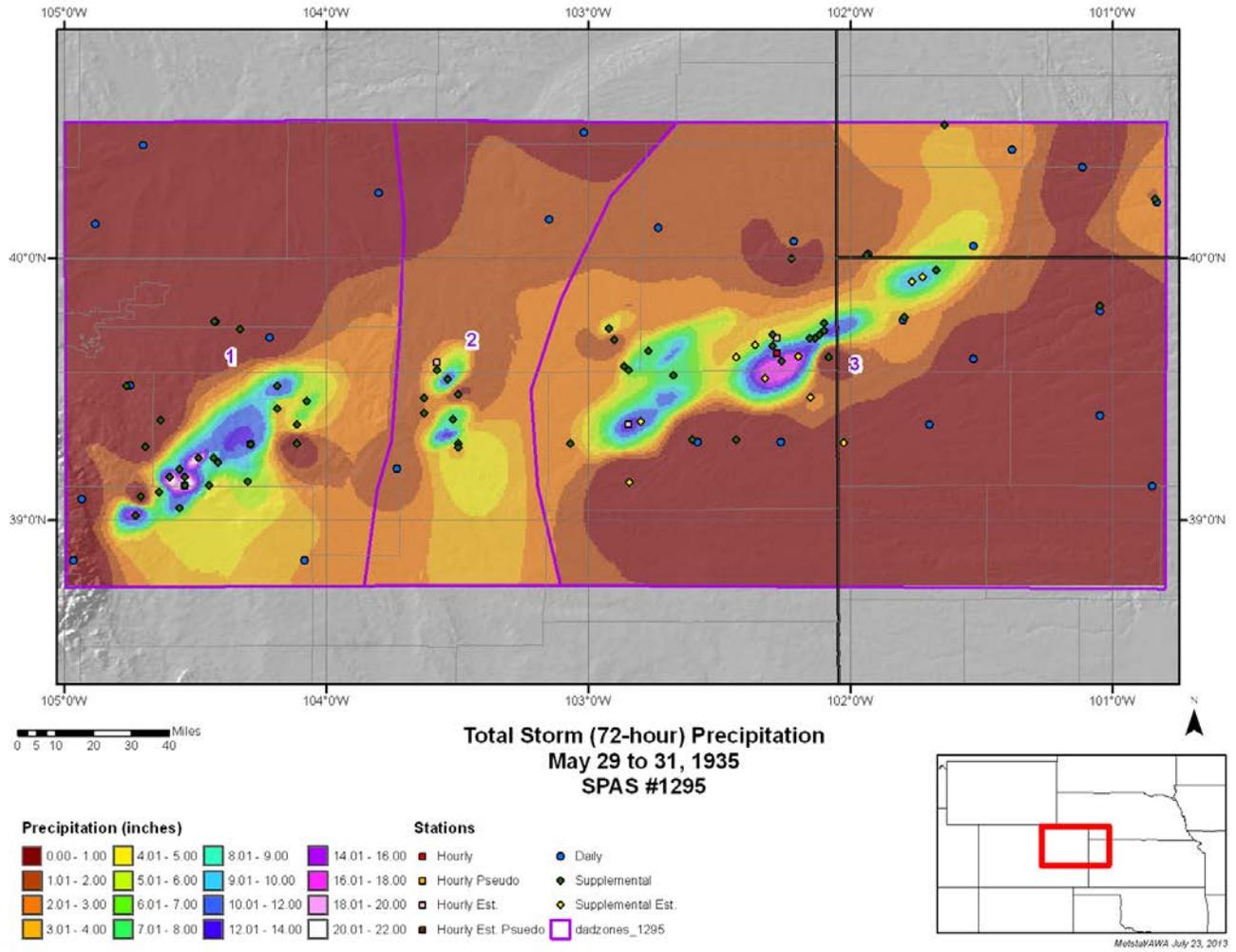
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1295_1	-104.488	39.238	6,787	7,000	76.50	3.07	1.51	75	1.560	78.71	78.5	3.37	1.62	79	1.750	1.122

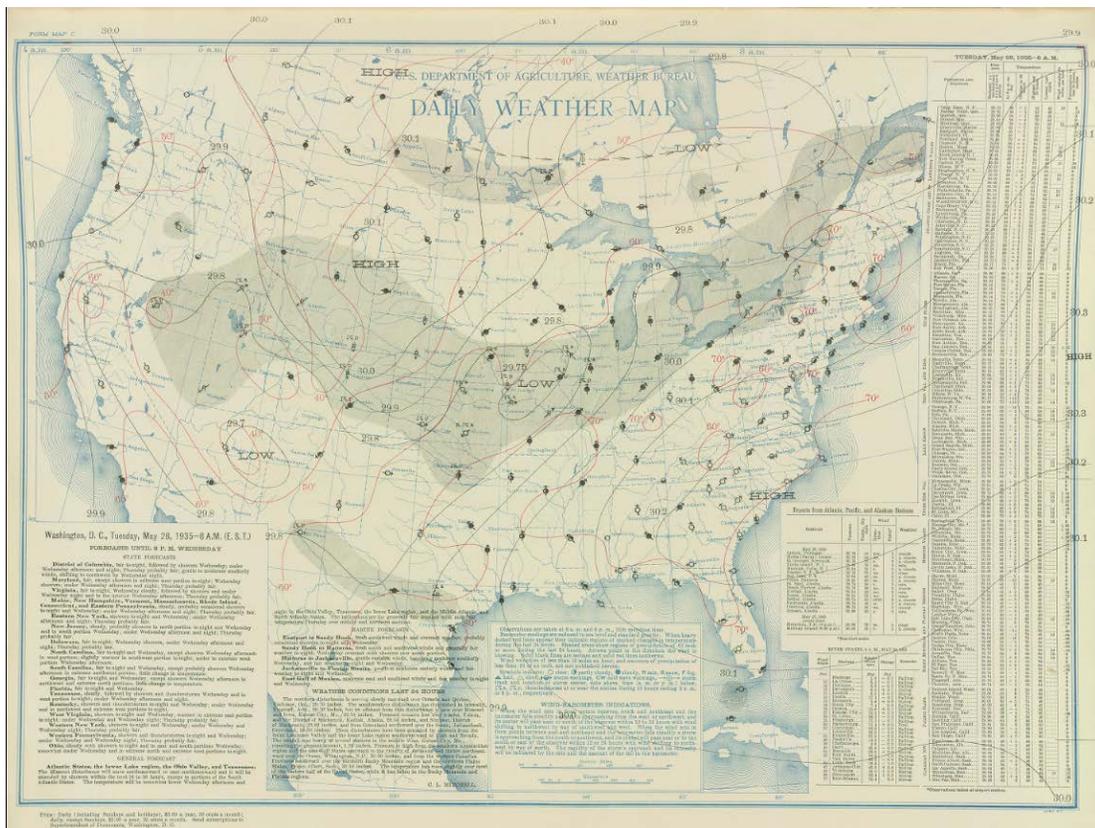
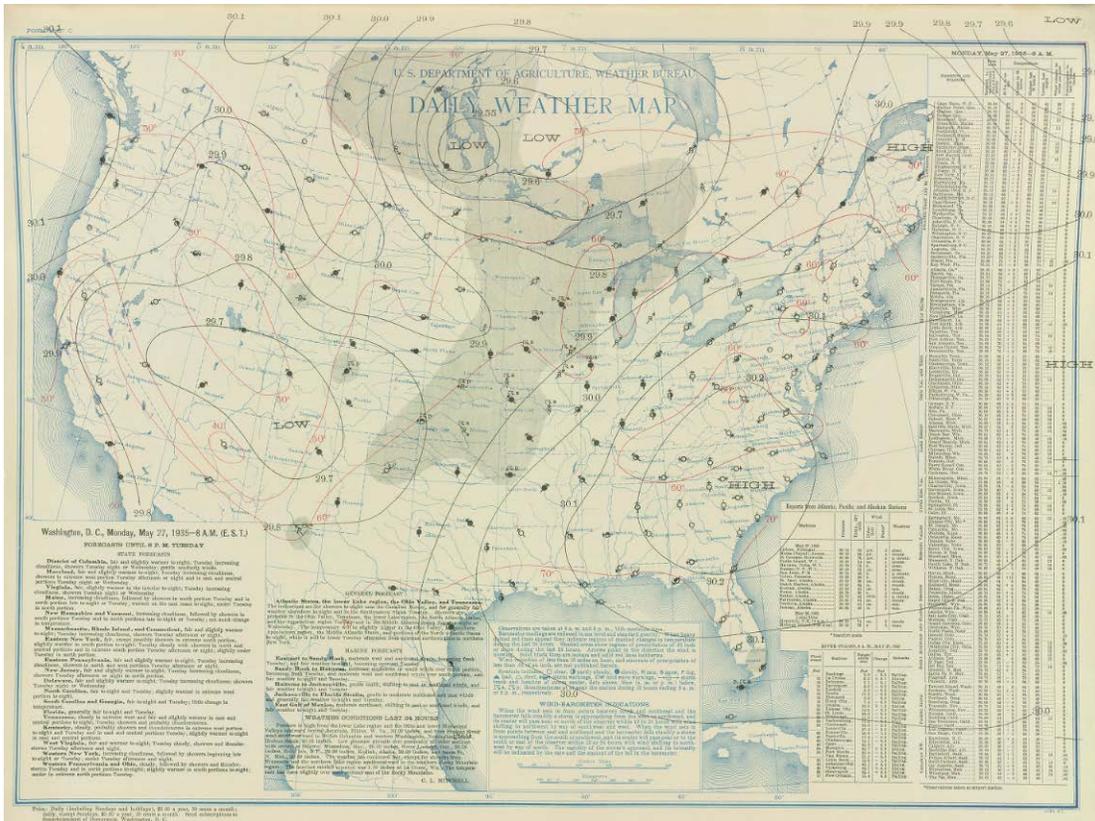
SPAS 1295 - May 29 (800 UTC) - June 1 (700 UTC), 1935														
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)														
Area (mi <sup>2</sup> )	Duration (hours)													Total
	1	2	3	4	5	6	12	18	24	48	72	96	120	
0.3	5.95	10.39	13.26	14.31	14.58	17.72	23.38	23.71	23.71	23.71	23.71	23.71	23.71	23.71
1	5.87	10.26	13.11	14.16	14.41	17.49	23.06	23.40	23.40	23.40	23.40	23.40	23.40	23.40
10	5.45	9.57	12.13	13.14	13.39	16.28	21.27	21.49	21.49	21.49	21.49	21.49	21.49	21.49
25	5.02	8.82	11.19	12.12	12.35	14.99	19.61	19.81	19.81	19.81	19.81	19.81	19.81	19.81
50	4.41	7.77	9.88	10.71	10.91	13.20	17.33	17.53	17.53	17.53	17.53	17.53	17.53	17.53
100	3.68	6.60	8.31	9.06	9.22	11.06	14.81	15.04	15.04	15.04	15.04	15.04	15.04	15.04
150	3.25	6.02	7.46	8.20	8.33	9.88	13.62	13.83	13.83	13.83	13.83	13.83	13.83	13.83
200	3.14	5.64	6.89	7.63	7.75	9.08	12.83	13.04	13.04	13.04	13.04	13.04	13.04	13.04
300	2.94	5.13	6.15	6.87	6.96	8.07	11.65	11.84	11.84	11.84	11.84	11.84	11.84	11.84
400	2.76	4.76	5.65	6.38	6.46	7.34	10.78	10.95	10.95	10.95	10.95	10.95	10.95	10.95
500	2.61	4.50	5.22	5.95	6.02	6.80	10.02	10.18	10.19	10.19	10.19	10.19	10.19	10.19
1,000	2.08	3.46	4.05	4.53	4.58	5.16	7.47	7.59	7.59	7.59	7.59	7.59	7.59	7.59
2,000	1.58	2.58	2.98	3.32	3.35	3.80	5.42	5.49	5.49	5.49	5.49	5.49	5.49	5.49
5,000	0.85	1.37	1.59	1.74	1.74	1.92	2.70	2.72	2.73	2.73	2.73	2.73	2.73	2.73
8,125	0.54	0.90	1.03	1.13	1.14	1.26	1.81	1.85	1.86	1.86	1.86	1.86	1.86	1.86

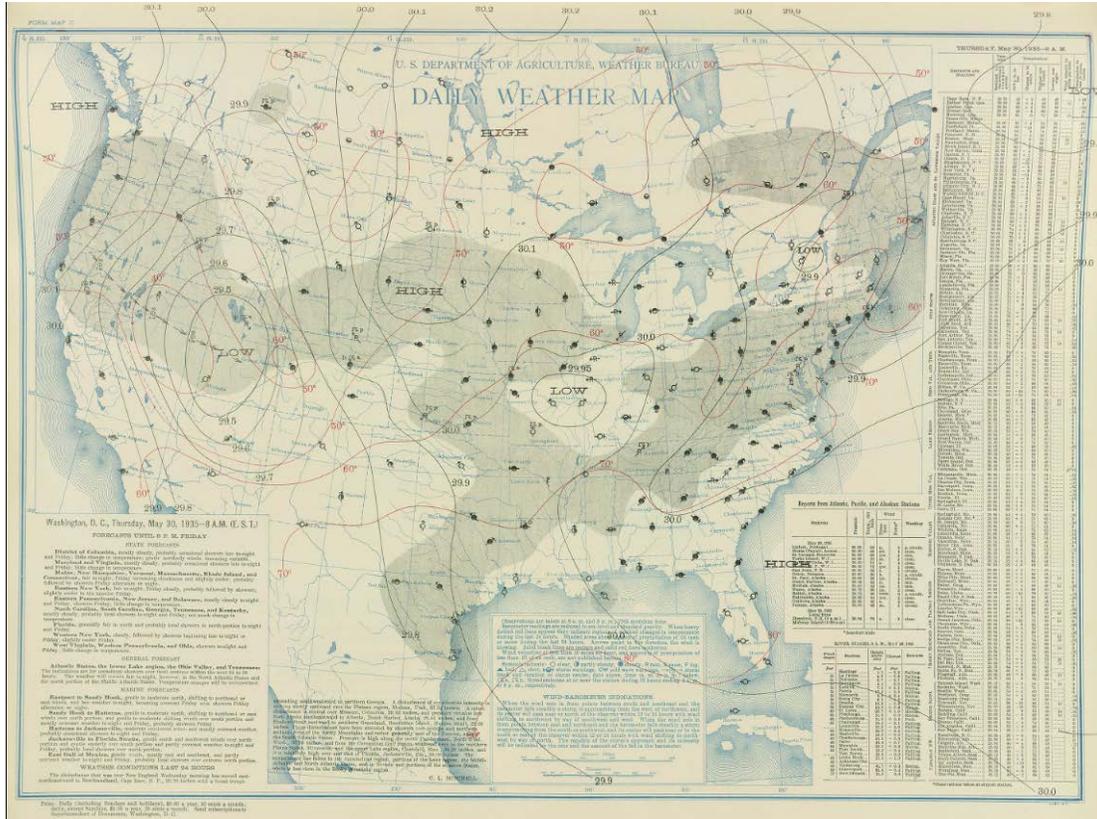
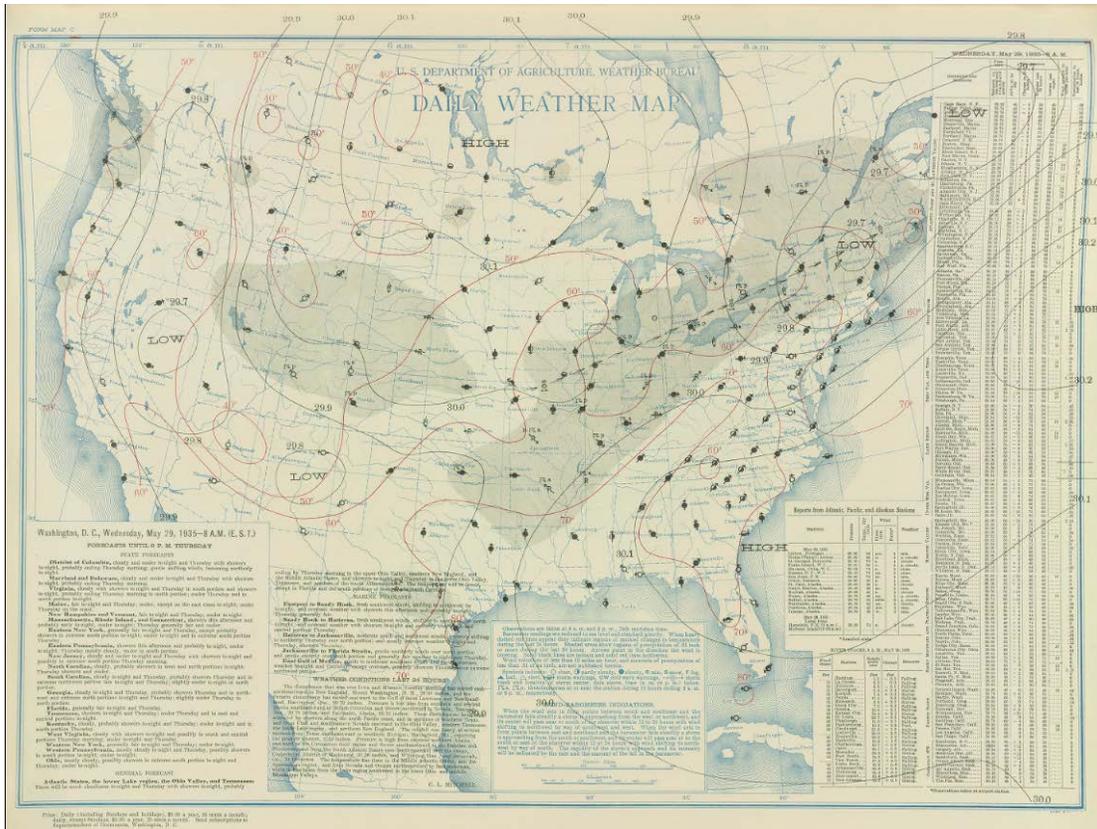


SPAS 1295 Storm Center Mass Curve Zone 1  
May 29 (800UTC) to June 1 (700UTC), 1935  
Lat: 39.2375 Lon: -104.4875



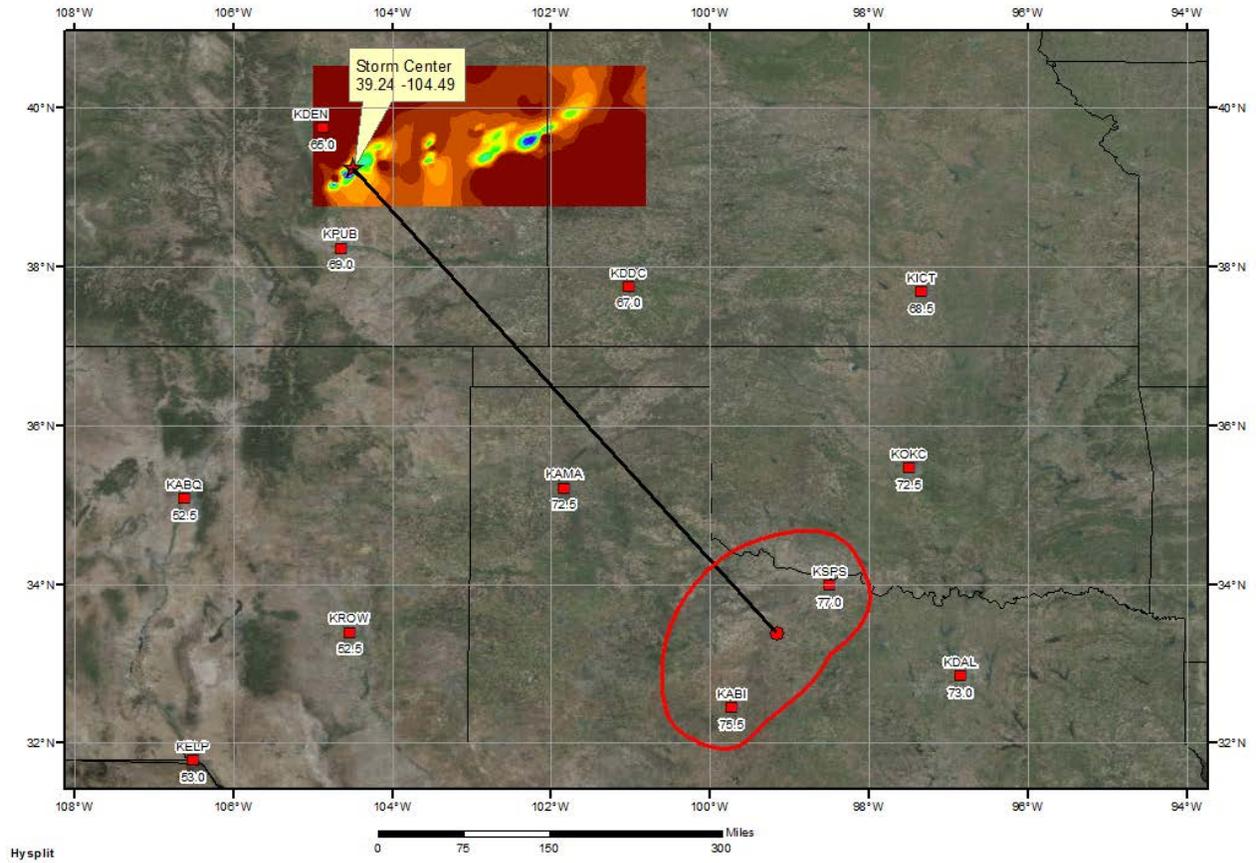








### SPAS 1295 Zone 1 Elbert-Cherry Creek, CO Storm Analysis May 29-31, 1935



## Storm Precipitation Analysis System (SPAS) For Storm #1295\_2 (re-run/expansion of Storm #1039)

*Metstat, Inc/AWA*

08/12/2013

**General Storm Location:** Eastern Colorado and southern Colorado Front Range

**Storm Dates:** May 29-31, 1935

**Event:** MCCs/Thunderstorms

### DAD Zone 2

**Latitude:** 39.32916

**Longitude:** -103.5375

**Max. Grid Rainfall Amount:** 12.65”

**Max. Observed Rainfall Amount:** 11.00” (Limon 19 NE)

**Number of Stations:** 102

**SPAS Version:** 9.5

**Basemap:** Final SPAS #1008 Precip Map, which used June 1965 Total Precipitation PRISM Grid

**Spatial resolution:** 30 seconds

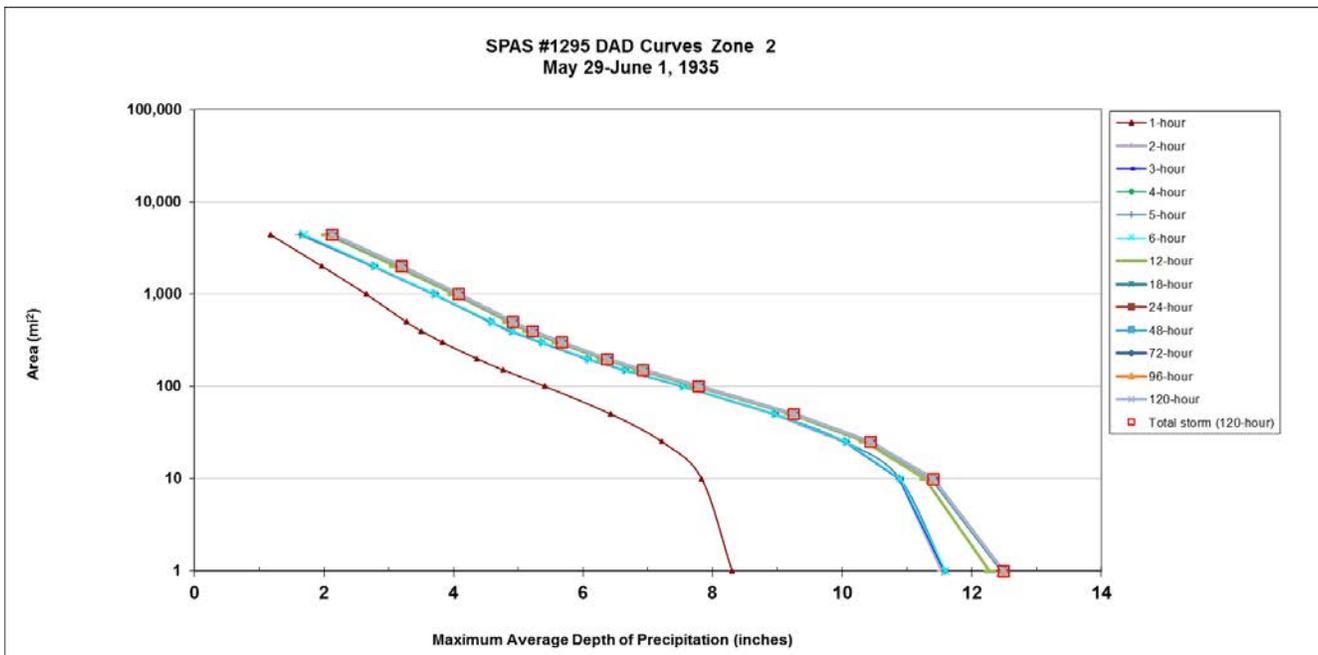
**Radar Included:** No

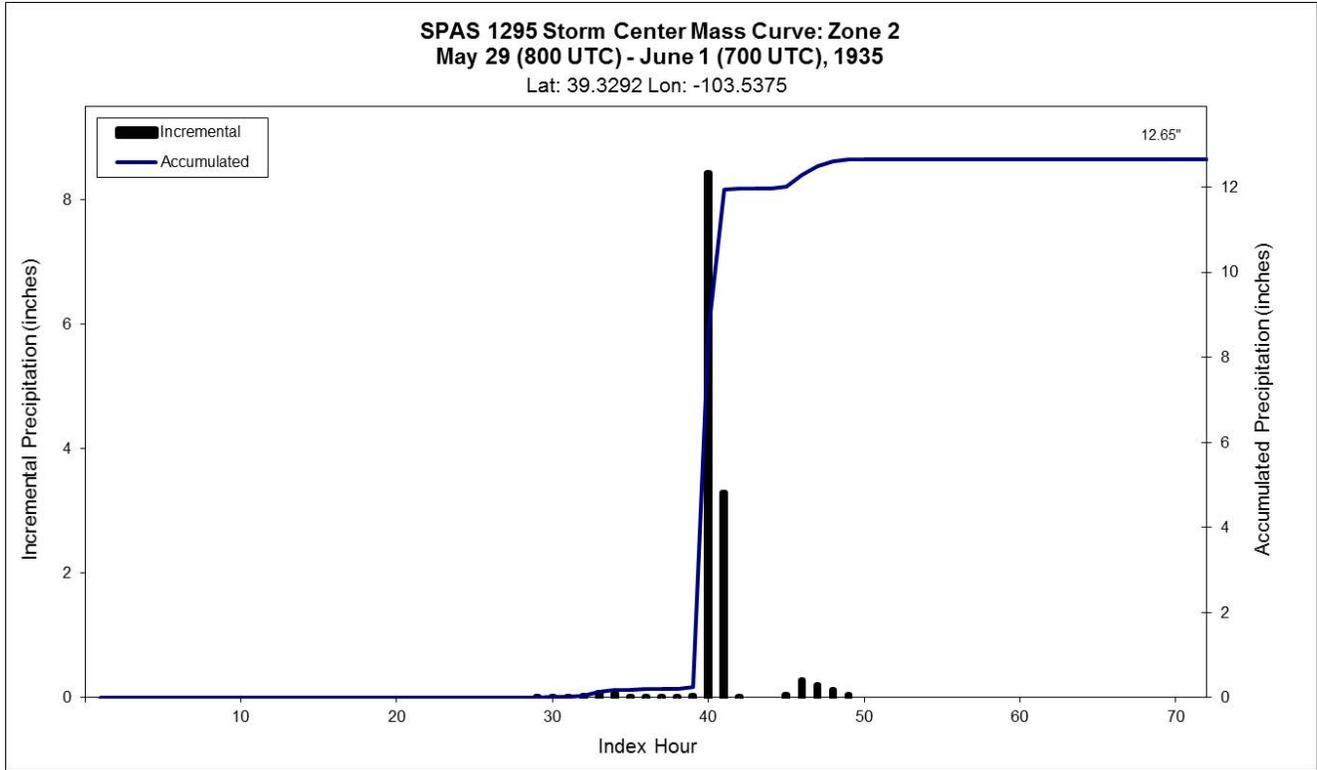
**Depth-Area-Duration (DAD) analysis:** Yes

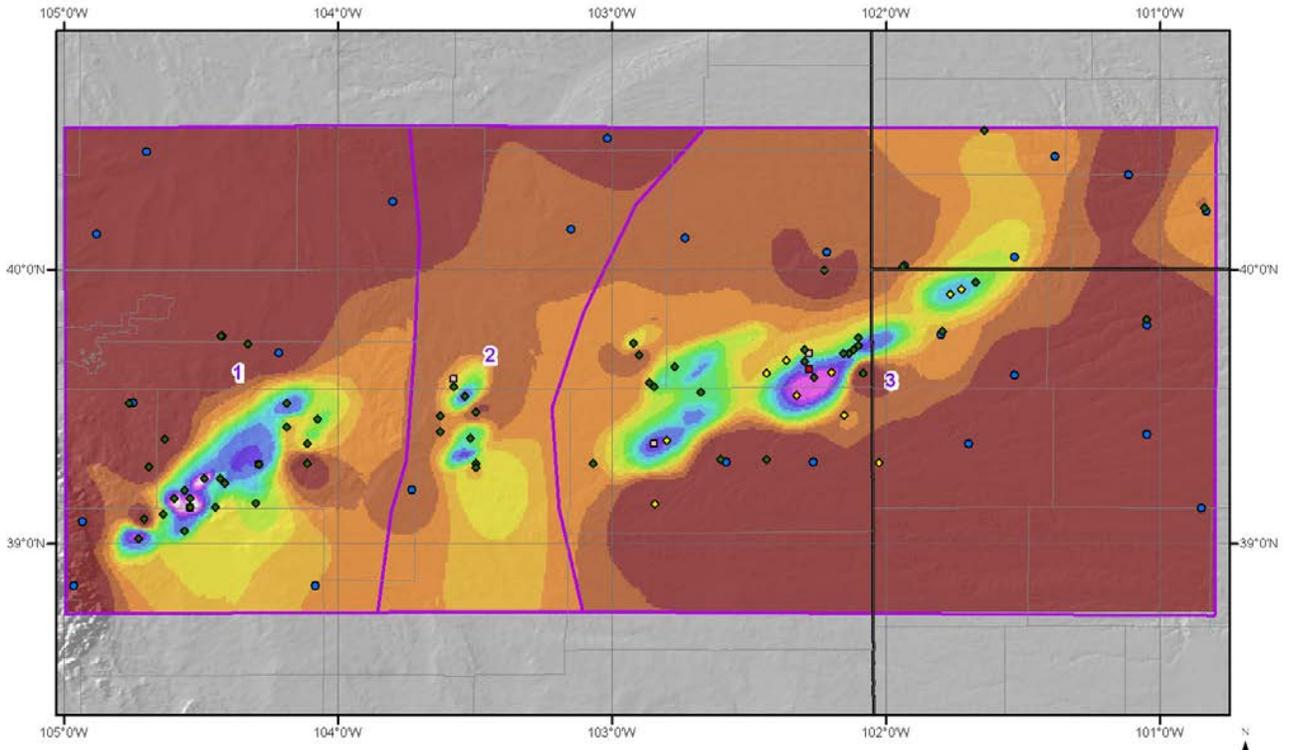
**Reliability of results:** This was a challenging storm to analyze given the lack of accurate measurements and hourly recording data. The storm analysis is consistent with the numerous other analyses of this storm by the USACE, USACE and NWS. Although we have a moderate degree of confidence in the magnitudes of precipitation; some areas reported heavy amounts of hail, which introduces error precipitation totals. We have low confidence in the precise precipitation patterns and temporal distributions given the lack of hourly data and radar data.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1295_2	-103.538	39.329	5,563	5,500	76.50	3.07	1.25	75	1.820	78.71	78.5	3.37	1.33	79	2.035	1.118

SPAS 1295 - May 29 (800 UTC) - June 1 (700 UTC), 1935														
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)														
Area (mi <sup>2</sup> )	Duration (hours)													
	1	2	3	4	5	6	12	18	24	48	72	96	120	Total
0.3	8.38	11.66	11.69	11.70	11.70	11.71	12.39	12.58	12.60	12.60	12.60	12.60	12.60	12.60
1	8.30	11.54	11.57	11.59	11.59	11.60	12.28	12.47	12.49	12.49	12.49	12.49	12.49	12.49
10	7.83	10.89	10.89	10.89	10.89	10.90	11.28	11.38	11.40	11.40	11.40	11.40	11.40	11.40
25	7.22	10.03	10.05	10.05	10.05	10.06	10.34	10.42	10.43	10.43	10.43	10.43	10.43	10.43
50	6.43	8.93	8.96	8.96	8.96	8.96	9.19	9.25	9.25	9.25	9.25	9.25	9.25	9.25
100	5.41	7.52	7.53	7.53	7.53	7.54	7.71	7.77	7.78	7.78	7.78	7.78	7.78	7.78
150	4.77	6.63	6.64	6.64	6.64	6.65	6.85	6.91	6.92	6.92	6.92	6.92	6.92	6.92
200	4.36	6.06	6.06	6.07	6.07	6.08	6.30	6.36	6.37	6.37	6.37	6.37	6.37	6.37
300	3.83	5.34	5.34	5.35	5.35	5.36	5.60	5.66	5.67	5.67	5.67	5.67	5.67	5.67
400	3.50	4.88	4.88	4.89	4.89	4.90	5.15	5.22	5.22	5.22	5.22	5.22	5.22	5.22
500	3.27	4.56	4.56	4.57	4.57	4.58	4.84	4.90	4.91	4.91	4.91	4.91	4.91	4.91
1,000	2.65	3.68	3.70	3.70	3.71	3.71	4.00	4.07	4.08	4.08	4.08	4.08	4.08	4.08
2,000	1.97	2.74	2.77	2.77	2.77	2.78	3.09	3.18	3.20	3.20	3.20	3.20	3.20	3.20
4,425	1.17	1.63	1.64	1.65	1.65	1.69	2.04	2.10	2.12	2.12	2.12	2.12	2.12	2.12

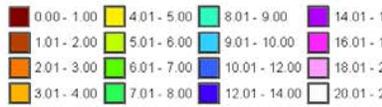




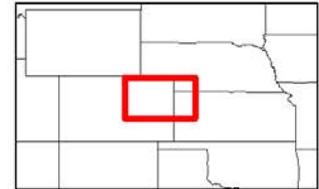


**Total Storm (72-hour) Precipitation  
May 29 to 31, 1935  
SPAS #1295**

**Precipitation (inches)**



**Stations**



MetStat/AVR July 23, 2013

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of May 30 - 31, 1935  
 Assignment M R 3 - 28 A  
 Location Eastern Colorado  
 Study Prepared by:  
 Missouri River Division  
 Kansas City District

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 11/16/42  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 7/14/45  
 Remarks: Centers:  
 N.E. of Colorado Springs, Colo.  
 and N.E. of Burlington, Colo.

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1 : 1,000,000  
 Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	29
Form 5001-B (24-hour " " " " ).....	64
Form 5001-D ( " " " " ).....	3
Misc. precip. records, meteorological data, etc.....	37
Form 5002 (Mass rainfall curves).....	63

**PART II**

Final isohyetal maps, in 2 sheet, scale 1 : 1,000,000 & 1 : 500,000  
 Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	3
Form S-11 (Depth-area data from isohyetal map).....	2
Form S-12 (Maximum depth-duration data).....	7
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

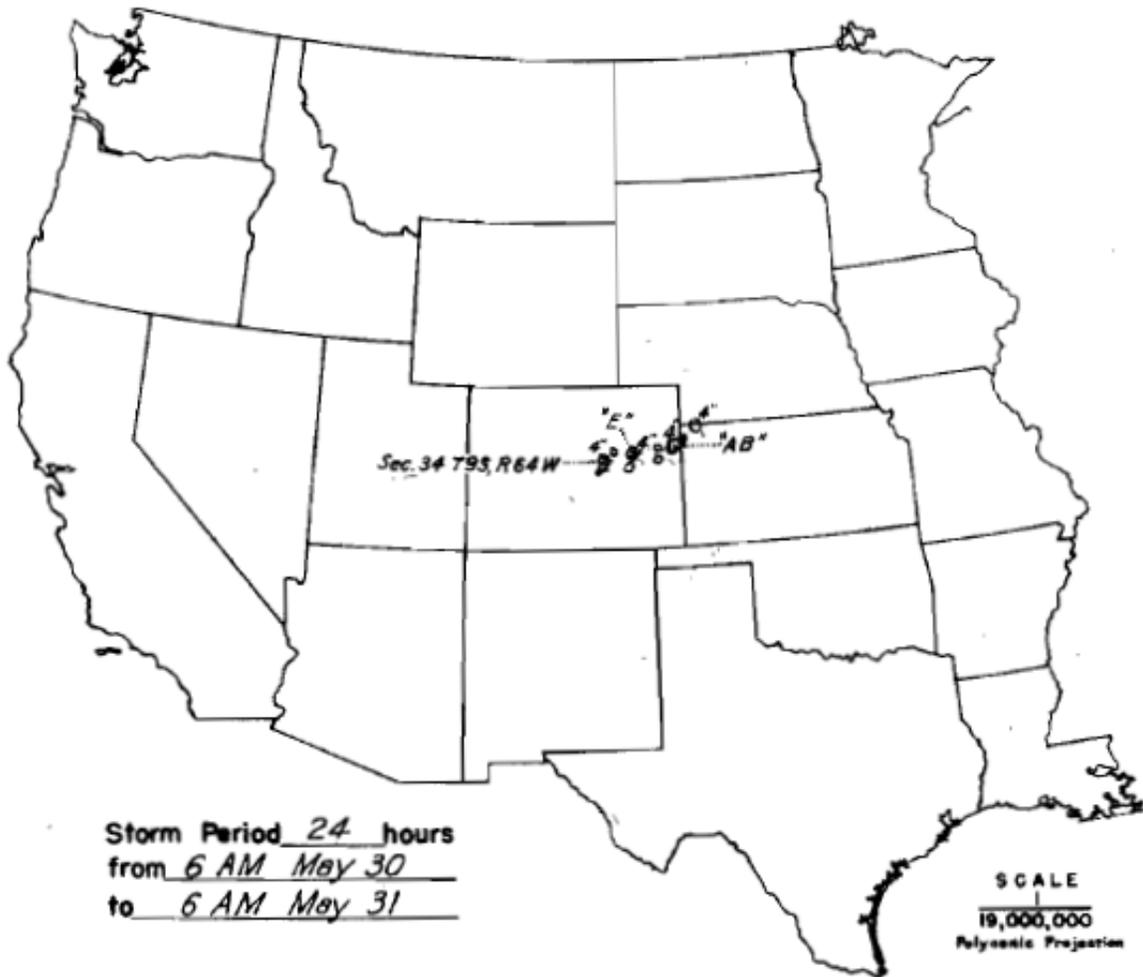
Area in Sq. Mi.	Duration of Rainfall in Hours									
	6	12	18	24						
Max. Station	24.0	24.0	24.0	24.0						
5	22.1	23.3	23.3	23.3						
10	20.6	22.2	22.2	22.2						
20	18.8	20.7	20.7	20.7						
50	16.0	18.0	18.0	18.0						
100	13.7	15.4	15.4	15.4						
200	11.2	12.6	12.6	12.6						
500	7.8	9.3	9.3	9.3						
1,000	5.8	7.2	7.2	7.2						
2,000	4.1	5.3	5.5	5.5						
5,000	2.4	3.5	3.8	4.0						
6,300	2.1	3.1	3.6	3.8						

WAR DEPARTMENT

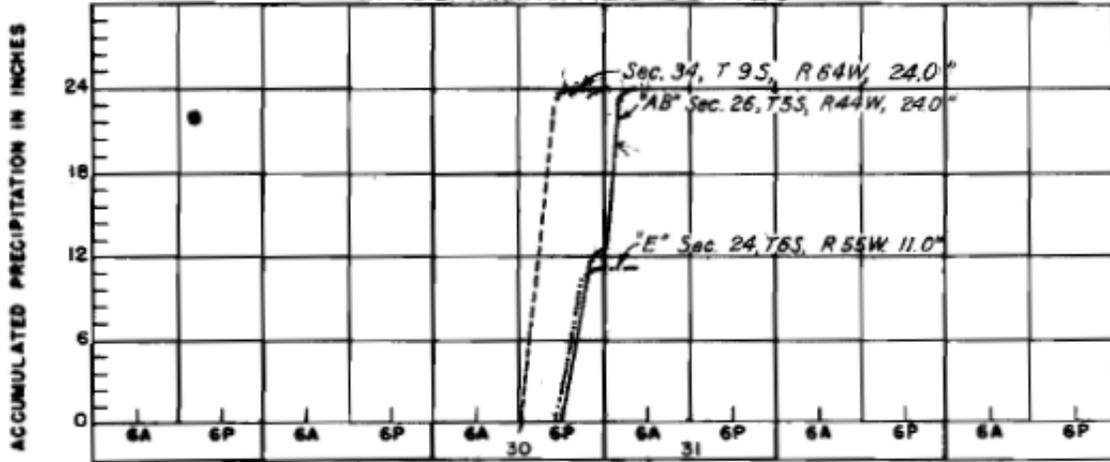
CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - ISOHYETAL MAP**

Storm of May 30-31, 1935 Assignment MR-3-28(A)  
 Study Prepared by: Kansas City, Mo. District  
Missouri River Division

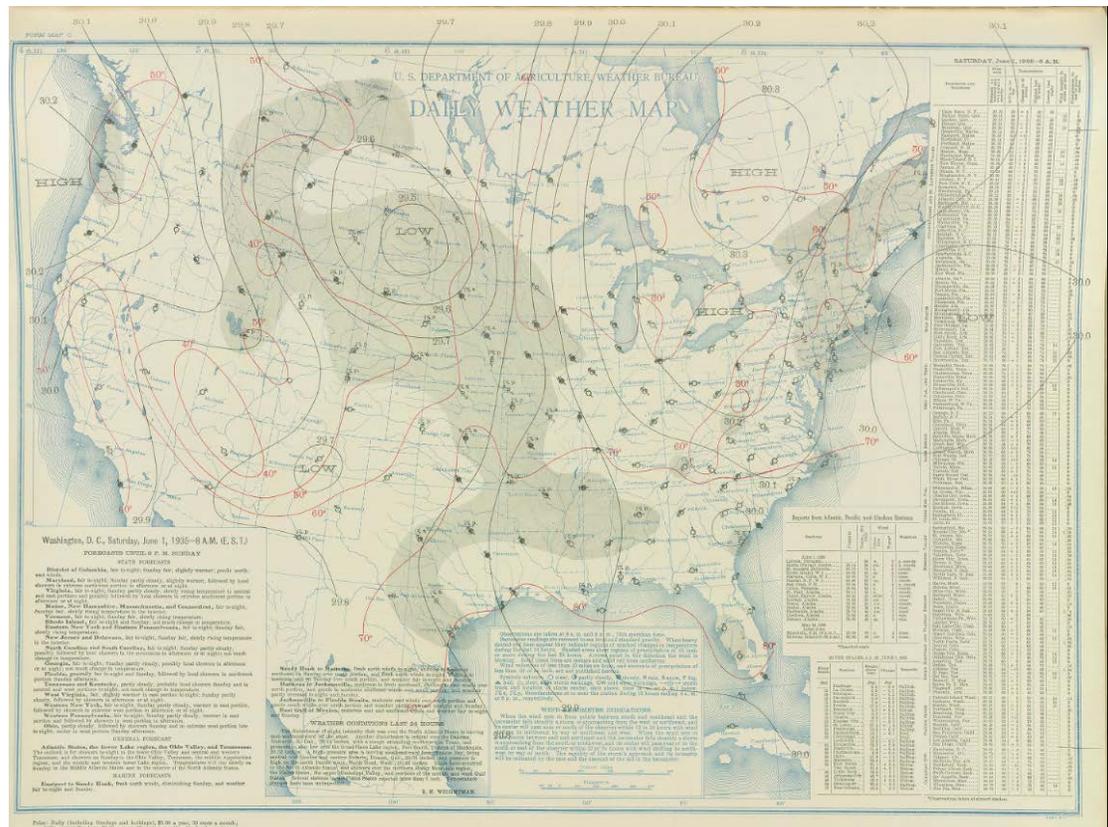
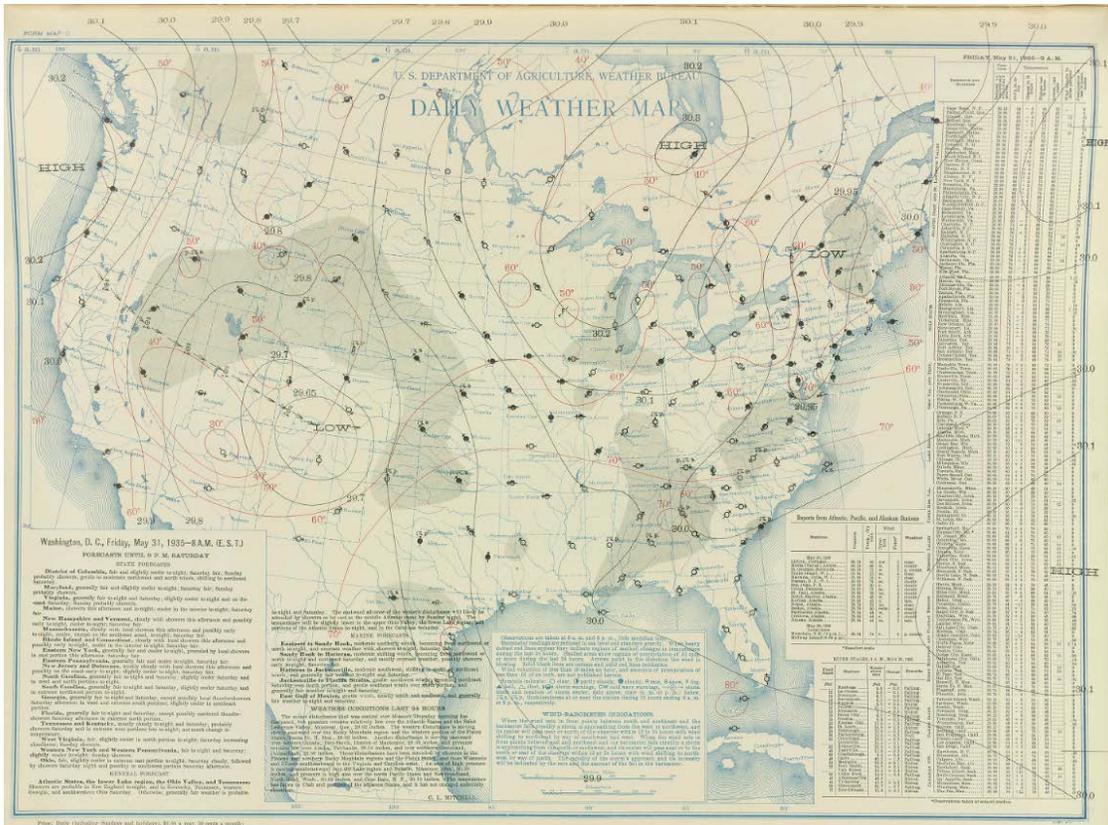


**MASS RAINFALL CURVES**

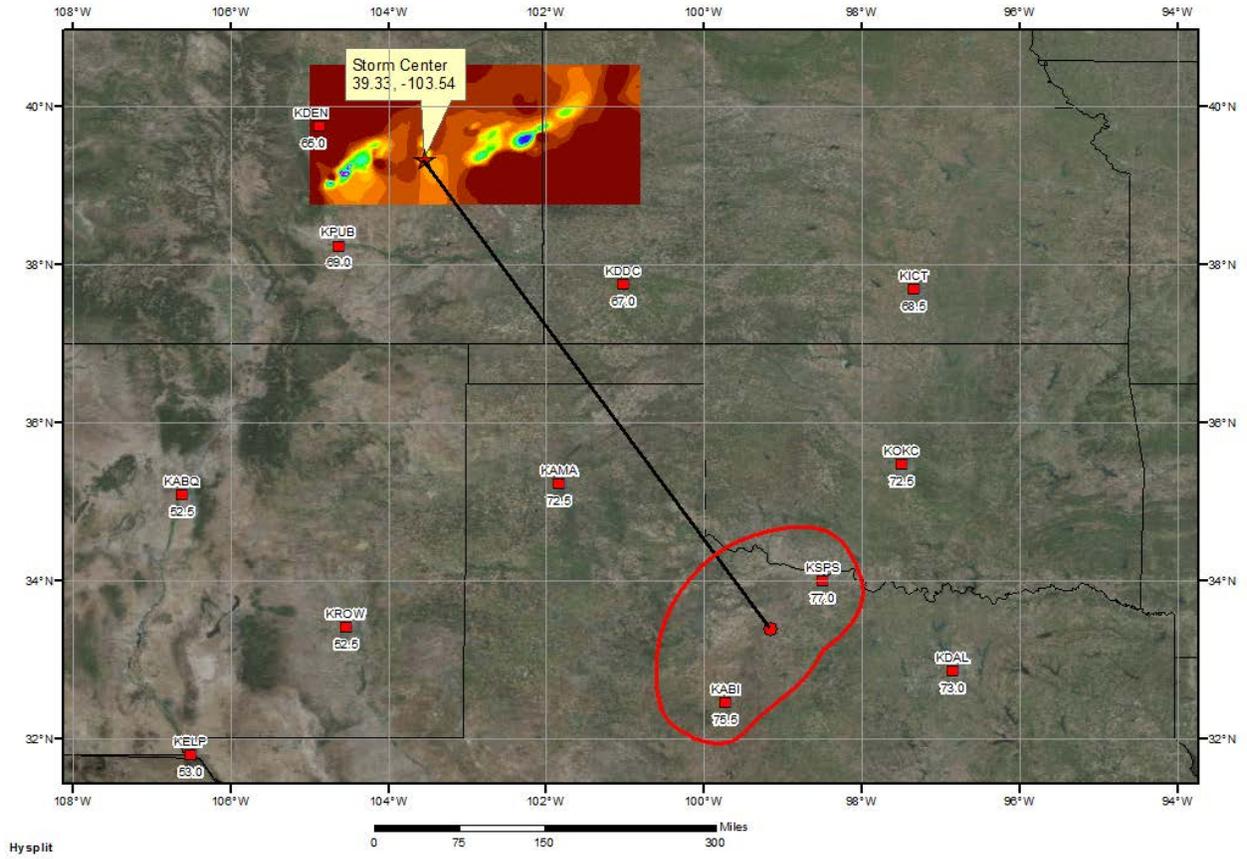








### SPAS 1295 Zone 2 Genoa, CO Storm Analysis May 29-31, 1935



## Storm Precipitation Analysis System (SPAS) For Storm #1295\_3 (re-run/expansion of Storm #1039)

*Metstat, Inc/AWA*

08/12/2013

**General Storm Location:** Eastern Colorado and southern Colorado Front Range

**Storm Dates:** May 29-31, 1935

**Event:** MCCs/Thunderstorms

### DAD Zone 3

**Latitude:** 39.6125

**Longitude:** -102.2625

**Max. Grid Rainfall Amount:** 18.00”

**Max. Observed Rainfall Amount:** 18.00” (Idalia 5SE, CO near Holly; we excluded the highly unreliable reports of up to 24” in/around Holly)

**Number of Stations:** 102

**SPAS Version:** 9.5

**Basemap:** Final SPAS #1008 Precip Map, which used June 1965 Total Precipitation PRISM Grid

**Spatial resolution:** 30 seconds

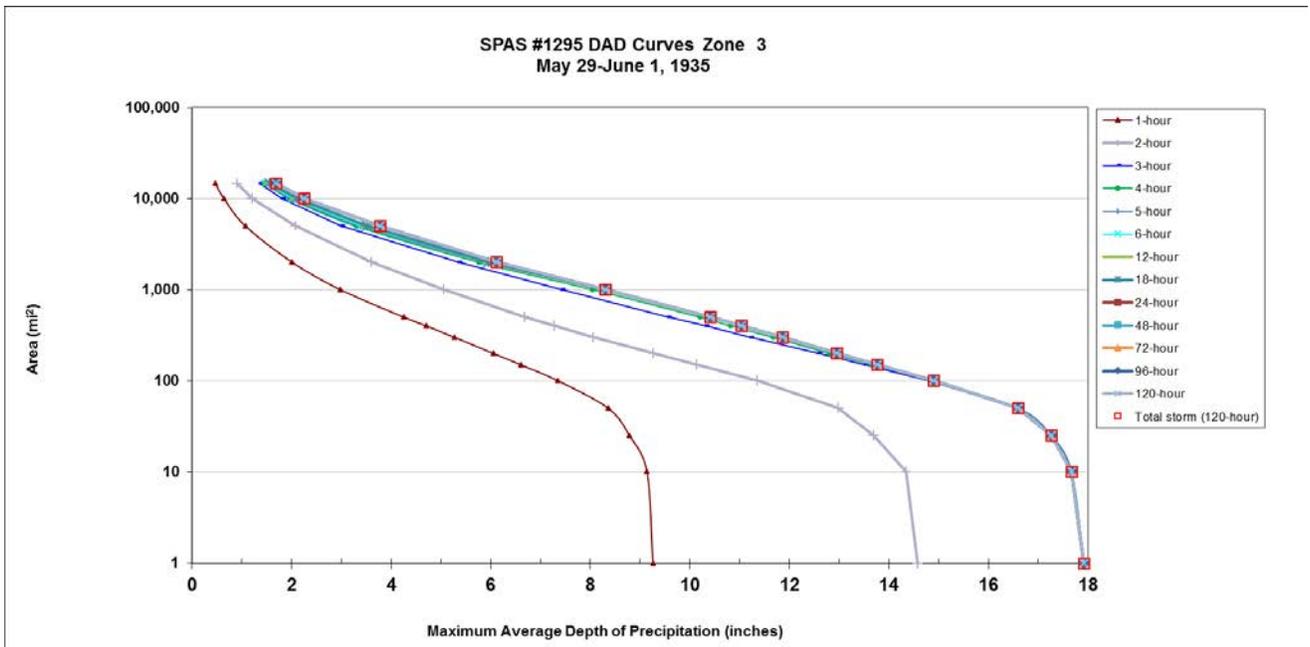
**Radar Included:** No

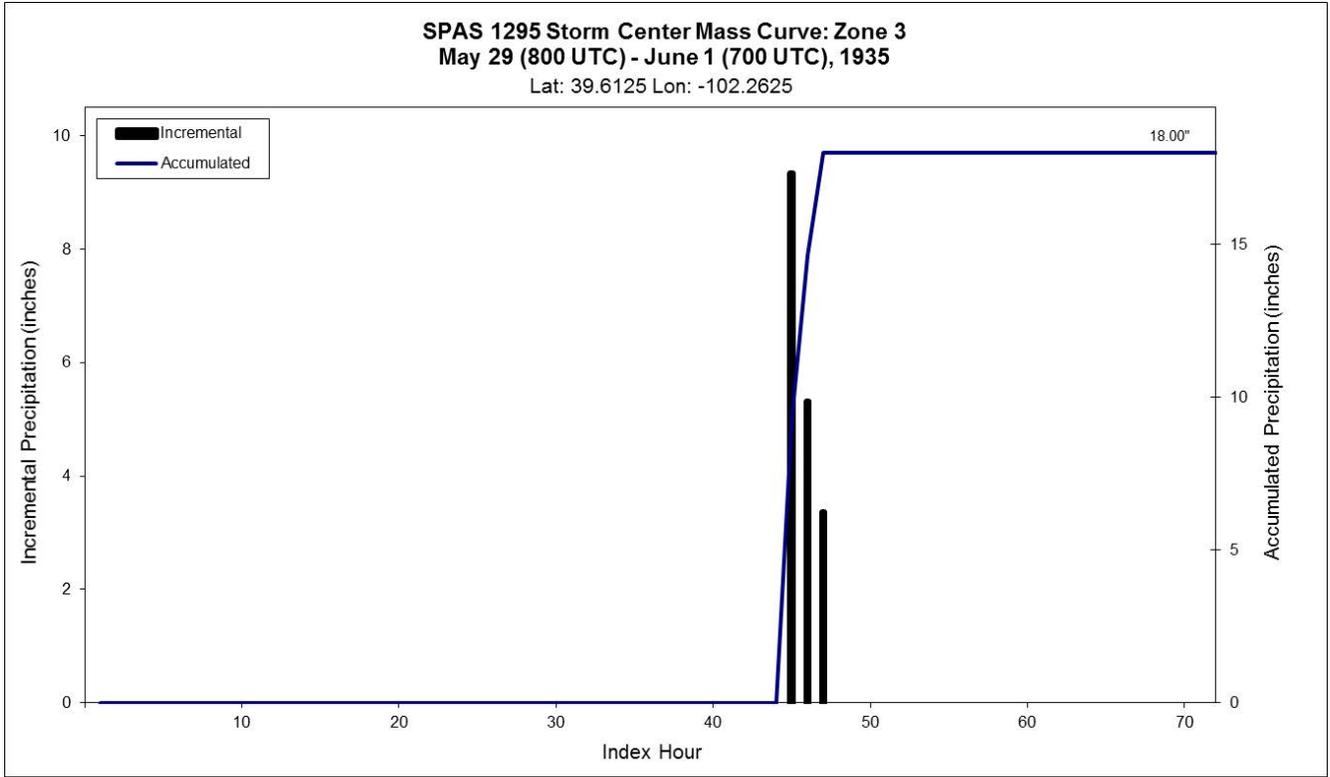
**Depth-Area-Duration (DAD) analysis:** Yes

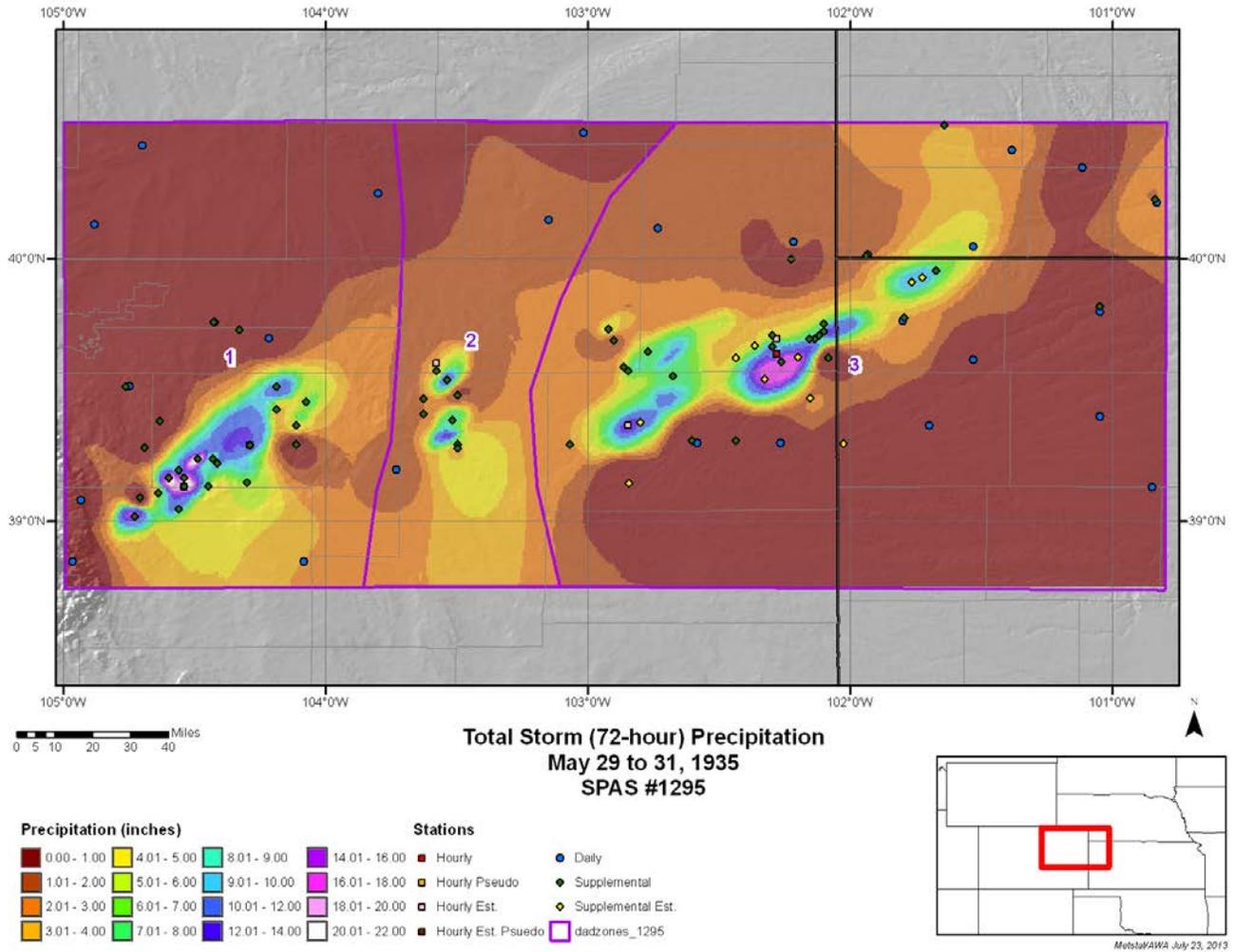
**Reliability of results:** This was a challenging storm to analyze given the lack of accurate measurements and hourly recording data. The storm analysis is consistent with the numerous other analyses of this storm by the USACE, USACE and NWS. Although we have a moderate degree of confidence in the magnitudes of precipitation; some areas reported heavy amounts of hail, which introduces error precipitation totals. We have low confidence in the precise precipitation patterns and temporal distributions given the lack of hourly data and radar data.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1295_3	-102.263	39.613	3,699	3,700	76.50	3.07	0.89	75	2.175	78.71	78.5	3.37	0.96	79	2.410	1.108

SPAS 1295 - May 29 (800 UTC) - June 1 (700 UTC), 1935														
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)														
Area (mi <sup>2</sup> )	Duration (hours)													
	1	2	3	4	5	6	12	18	24	48	72	96	120	Total
0.3	9.31	14.64	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
1	9.26	14.58	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92
10	9.14	14.35	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67
25	8.79	13.69	17.26	17.26	17.26	17.26	17.26	17.26	17.26	17.26	17.26	17.26	17.26	17.26
50	8.36	12.98	16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60	16.60
100	7.35	11.35	14.80	14.83	14.89	14.89	14.89	14.89	14.89	14.89	14.89	14.89	14.89	14.89
150	6.60	10.13	13.51	13.66	13.77	13.77	13.77	13.77	13.77	13.77	13.77	13.77	13.77	13.77
200	6.05	9.26	12.57	12.80	12.95	12.95	12.95	12.95	12.95	12.95	12.95	12.95	12.95	12.95
300	5.27	8.06	11.21	11.67	11.85	11.85	11.86	11.86	11.86	11.86	11.86	11.86	11.86	11.86
400	4.71	7.28	10.31	10.82	11.01	11.01	11.03	11.03	11.03	11.03	11.03	11.03	11.03	11.03
500	4.25	6.68	9.56	10.20	10.39	10.39	10.41	10.41	10.41	10.41	10.41	10.41	10.41	10.41
1,000	2.98	5.05	7.42	8.05	8.25	8.25	8.28	8.28	8.31	8.31	8.31	8.31	8.31	8.31
2,000	2.01	3.60	5.34	5.76	5.90	5.90	5.95	5.95	6.12	6.12	6.12	6.12	6.12	6.12
5,000	1.07	2.08	2.99	3.29	3.38	3.38	3.50	3.51	3.77	3.77	3.77	3.77	3.77	3.77
10,000	0.64	1.21	1.80	1.96	2.00	2.00	2.09	2.10	2.25	2.25	2.25	2.25	2.25	2.25
14,855	0.46	0.90	1.35	1.45	1.48	1.48	1.56	1.56	1.68	1.68	1.68	1.68	1.68	1.68







WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of May 30 - 31, 1935  
 Assignment M R 3 - 28 A  
 Location Eastern Colorado  
 Study Prepared by:  
 Missouri River Division  
 Kansas City District

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 11/16/42  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 7/14/45

Remarks: Centers:  
 N.E. of Colorado Springs, Colo.  
 and N.E. of Burlington, Colo.

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1 : 1,000,000  
 Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	29
Form 5001-B (24-hour " " " " ).....	64
Form 5001-D ( " " " " " " ).....	3
Misc. precip. records, meteorological data, etc.....	37
Form 5002 (Mass rainfall curves).....	63

**PART II**

Final isohyetal maps, in 2 sheet, scale 1 : 1,000,000 & 1 : 500,000  
 Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	3
Form S-11 (Depth-area data from isohyetal map).....	2
Form S-12 (Maximum depth-duration data).....	7
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

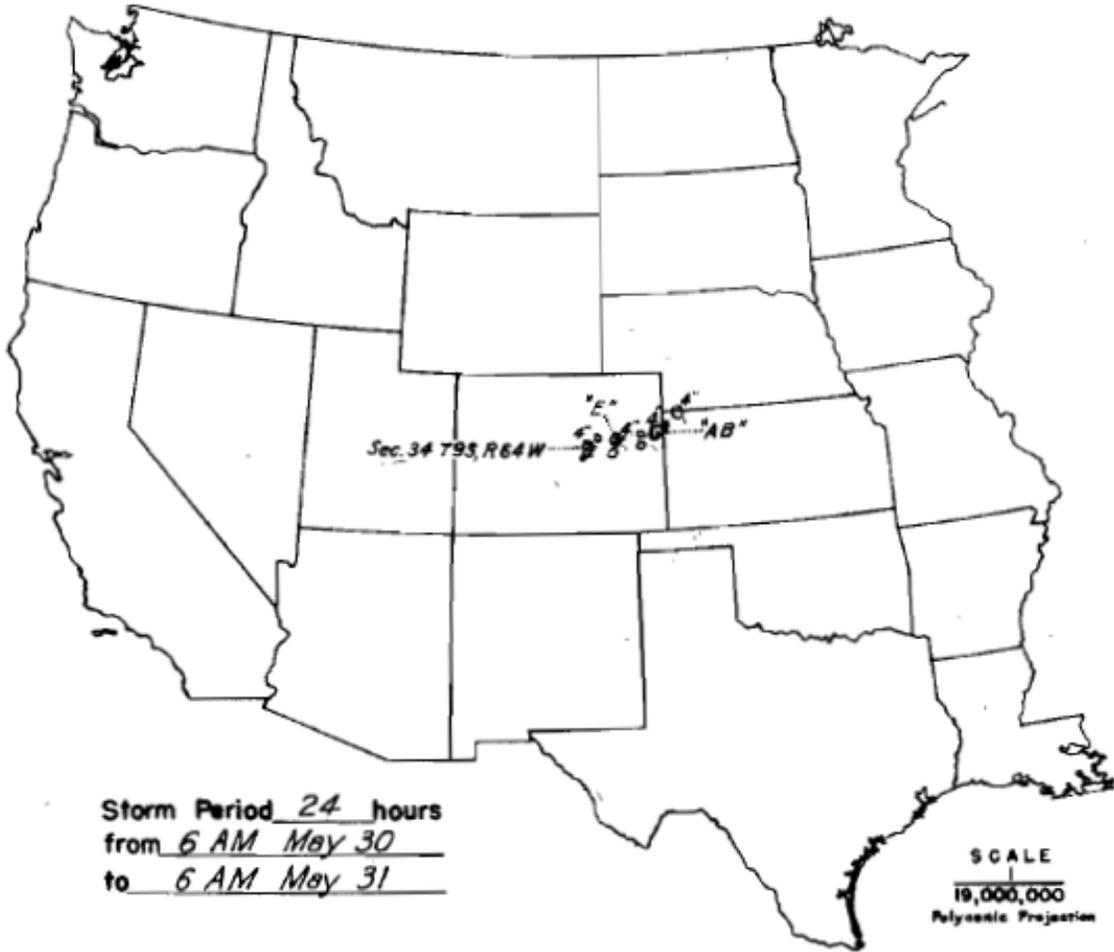
Area in Sq. Mi.	Duration of Rainfall in Hours				
	6	12	18	24	
Max. Station	24.0	24.0	24.0	24.0	
5	22.1	23.3	23.3	23.3	
10	20.6	22.2	22.2	22.2	
20	18.8	20.7	20.7	20.7	
50	16.0	18.0	18.0	18.0	
100	13.7	15.4	15.4	15.4	
200	11.2	12.6	12.6	12.6	
500	7.8	9.3	9.3	9.3	
1,000	5.8	7.2	7.2	7.2	
2,000	4.1	5.3	5.5	5.5	
5,000	2.4	3.5	3.8	4.0	
6,300	2.1	3.1	3.6	3.8	

WAR DEPARTMENT

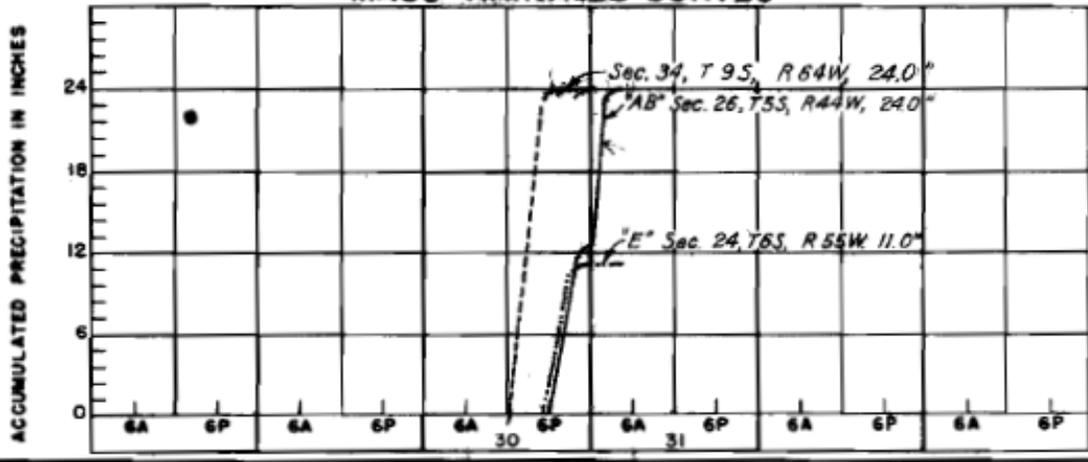
CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - ISOHYETAL MAP**

Storm of May 30-31, 1935 Assignment MR-3-28(A)  
 Study Prepared by: Kansas City, Mo. District  
Missouri River Division

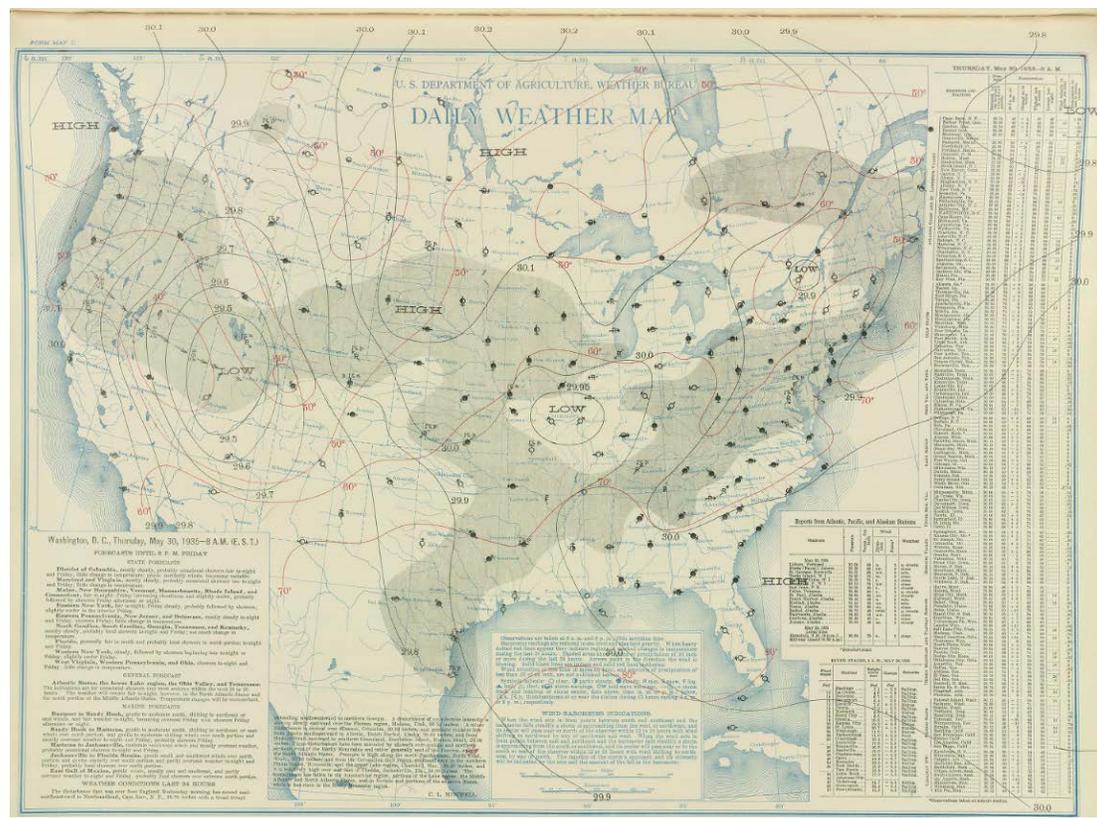
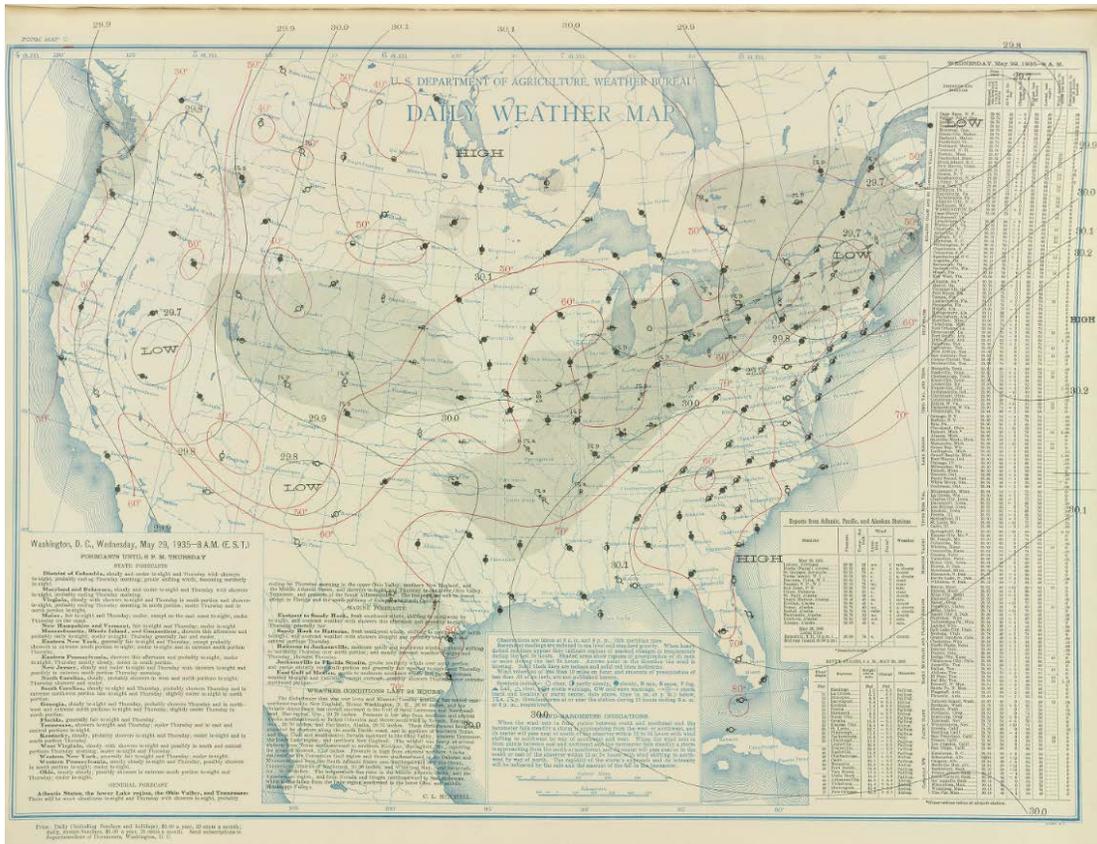


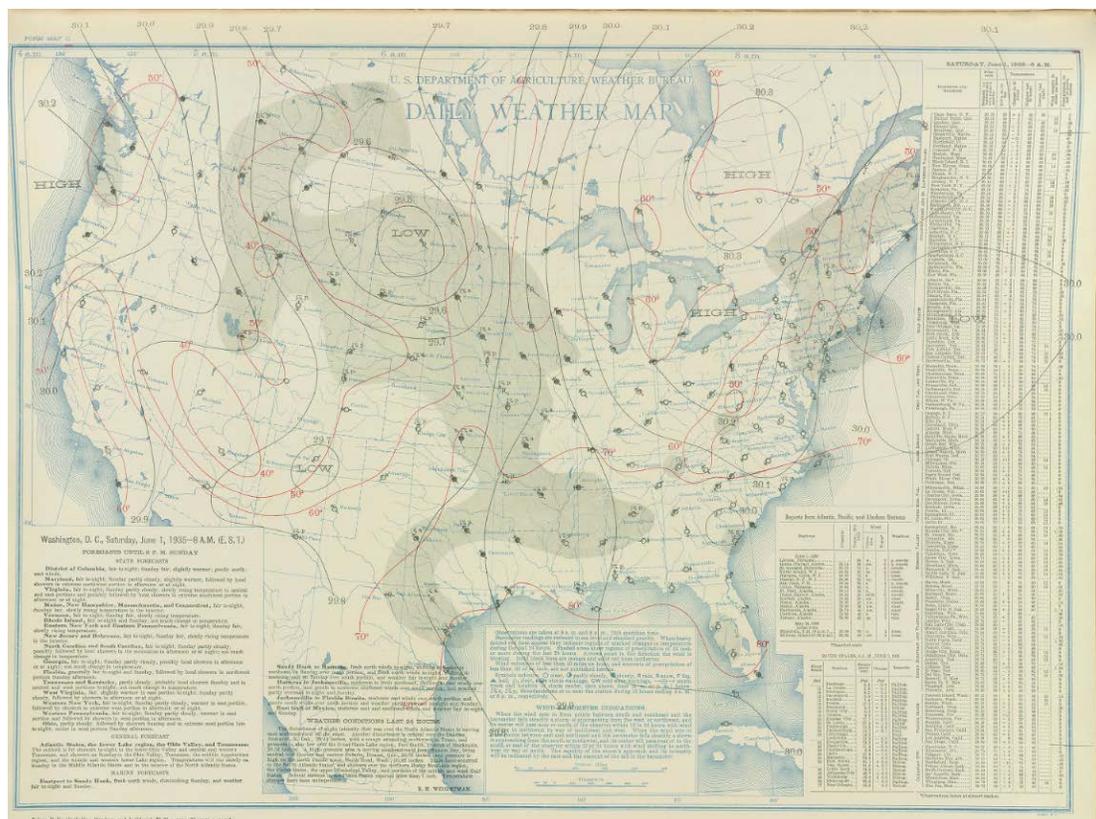
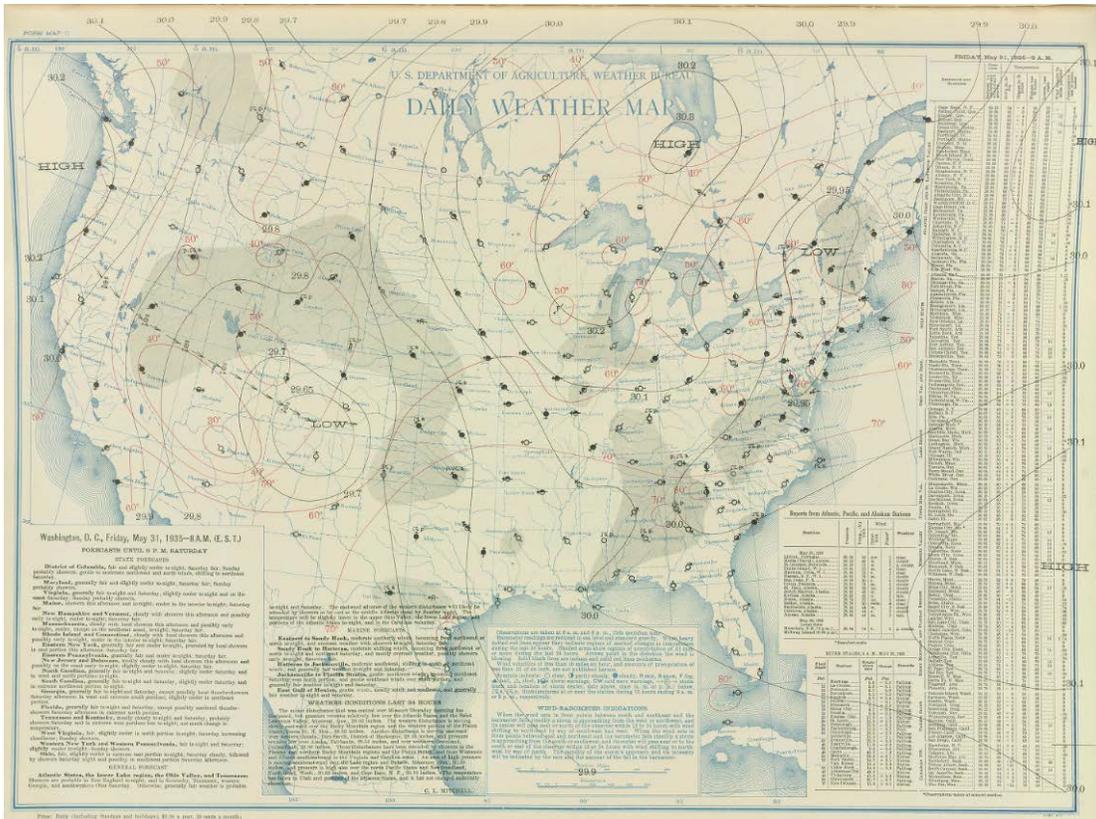
**MASS RAINFALL CURVES**



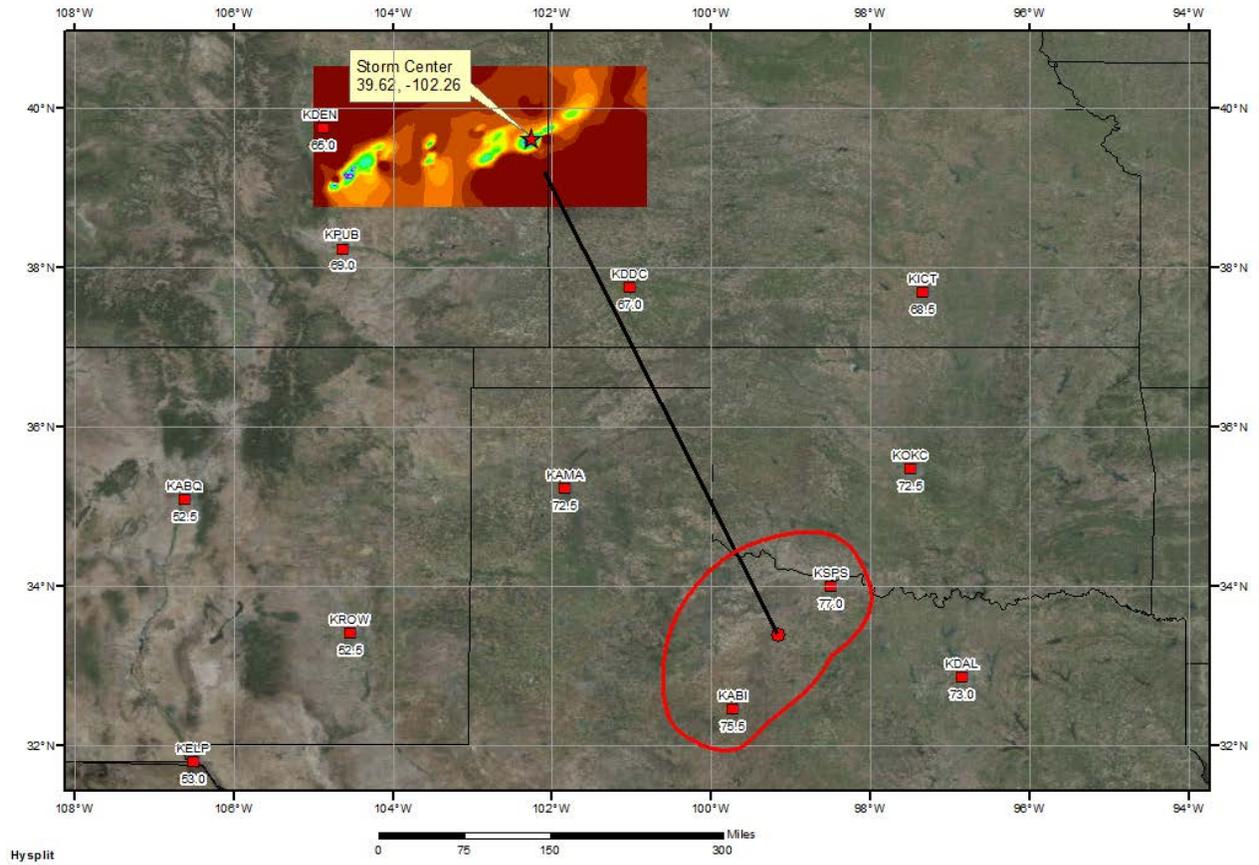
FORM 8-3W







### SPAS 1295 Zone 3 Hale, CO Storm Analysis May 29-31, 1935



## Storm Precipitation Analysis System (SPAS) For Storm #1485\_1

**General Storm Location:** Southwest New Mexico 33.8,-109.0,31.7,-105.9

**Storm Dates:** August 30, 1935

**Event:** Mesoscale convective event

### DAD Zone 1

**Latitude:** 32.3042

**Longitude:** -106.7958

**Max. Grid Rainfall Amount:** 10.03”

**Max. Observed Rainfall Amount:** 10.00”

**Number of Stations:** 30

**SPAS Version:** 10

**Base Map Used:** Combination of manually digitized contours using isohyetal map from a report by Leopold on the storm and a two-year six-hour prism climatological basemap.

**Spatial resolution:** 0.2785

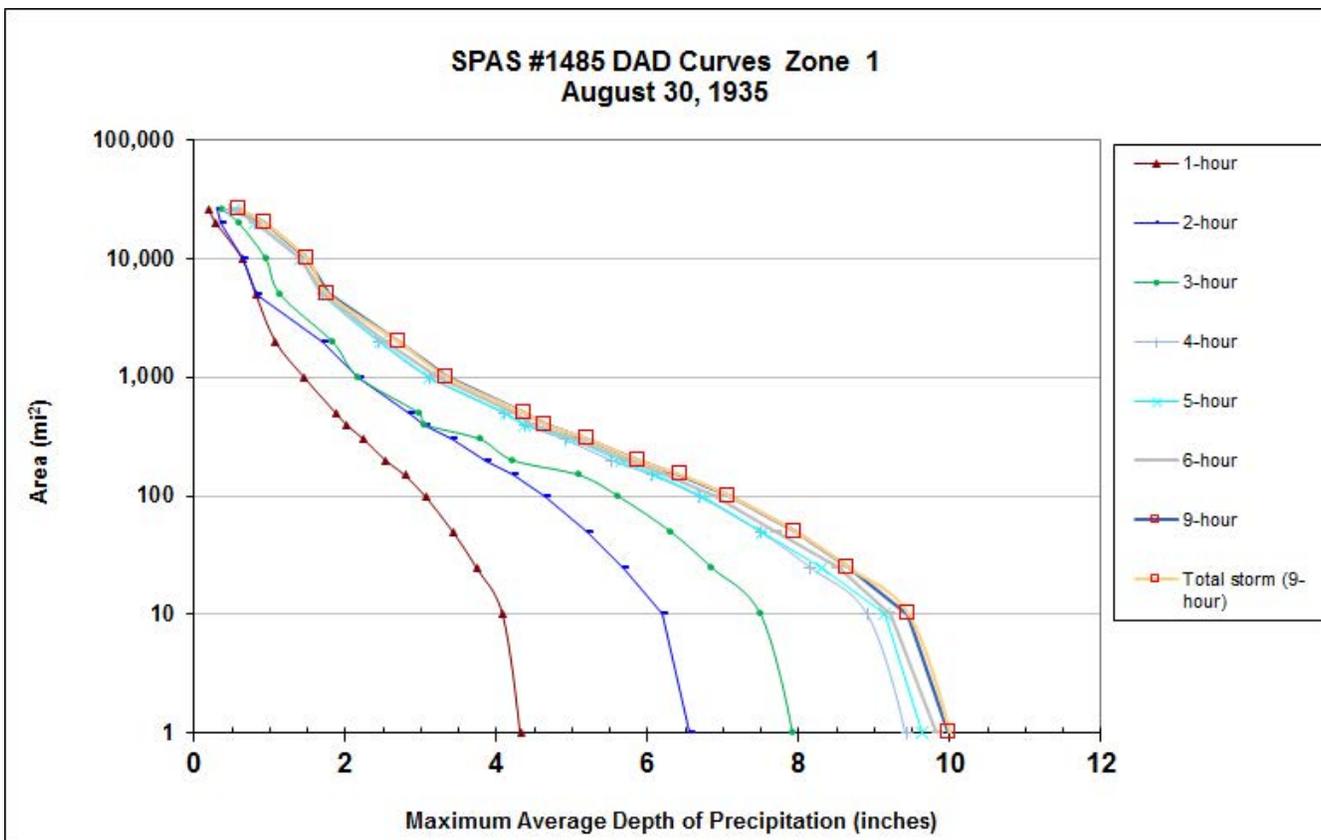
**Radar Included:** No

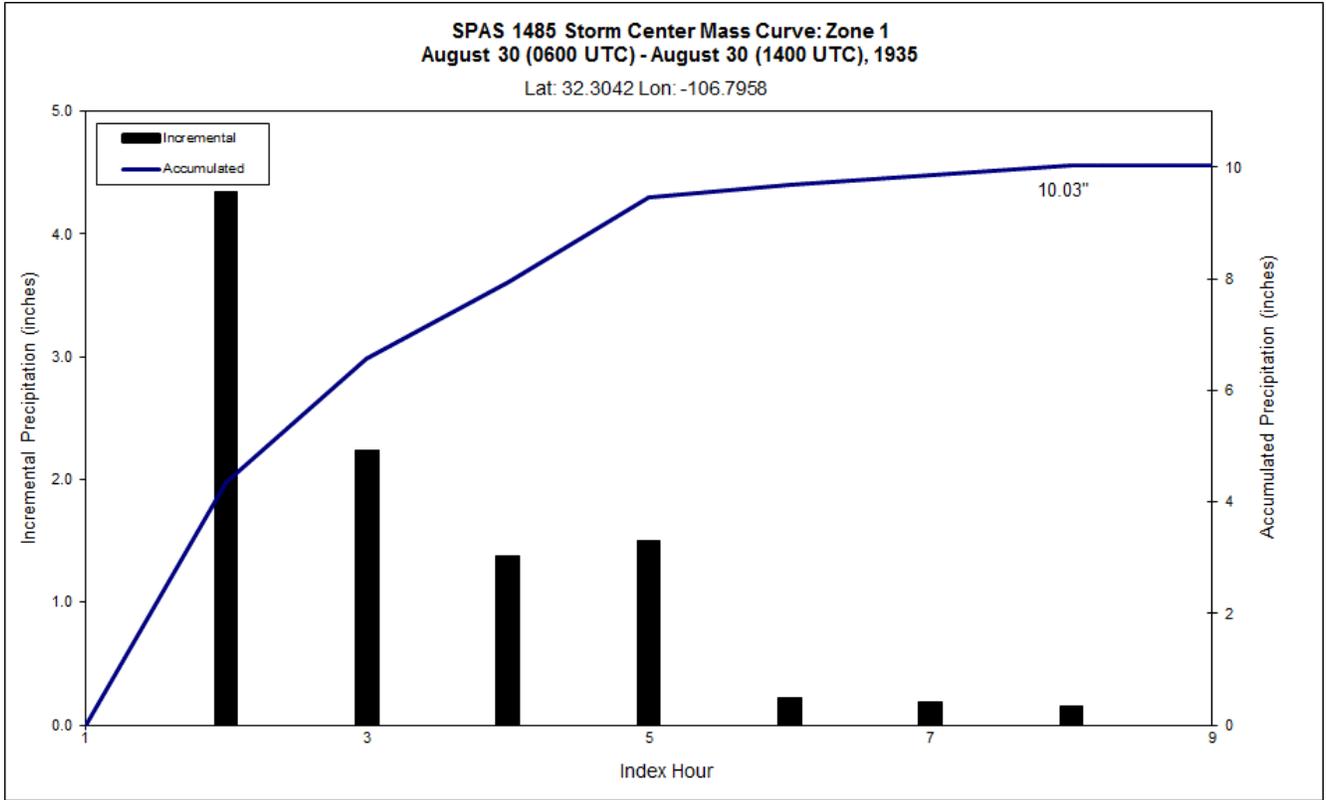
**Depth-Area-Duration (DAD) analysis:** Yes

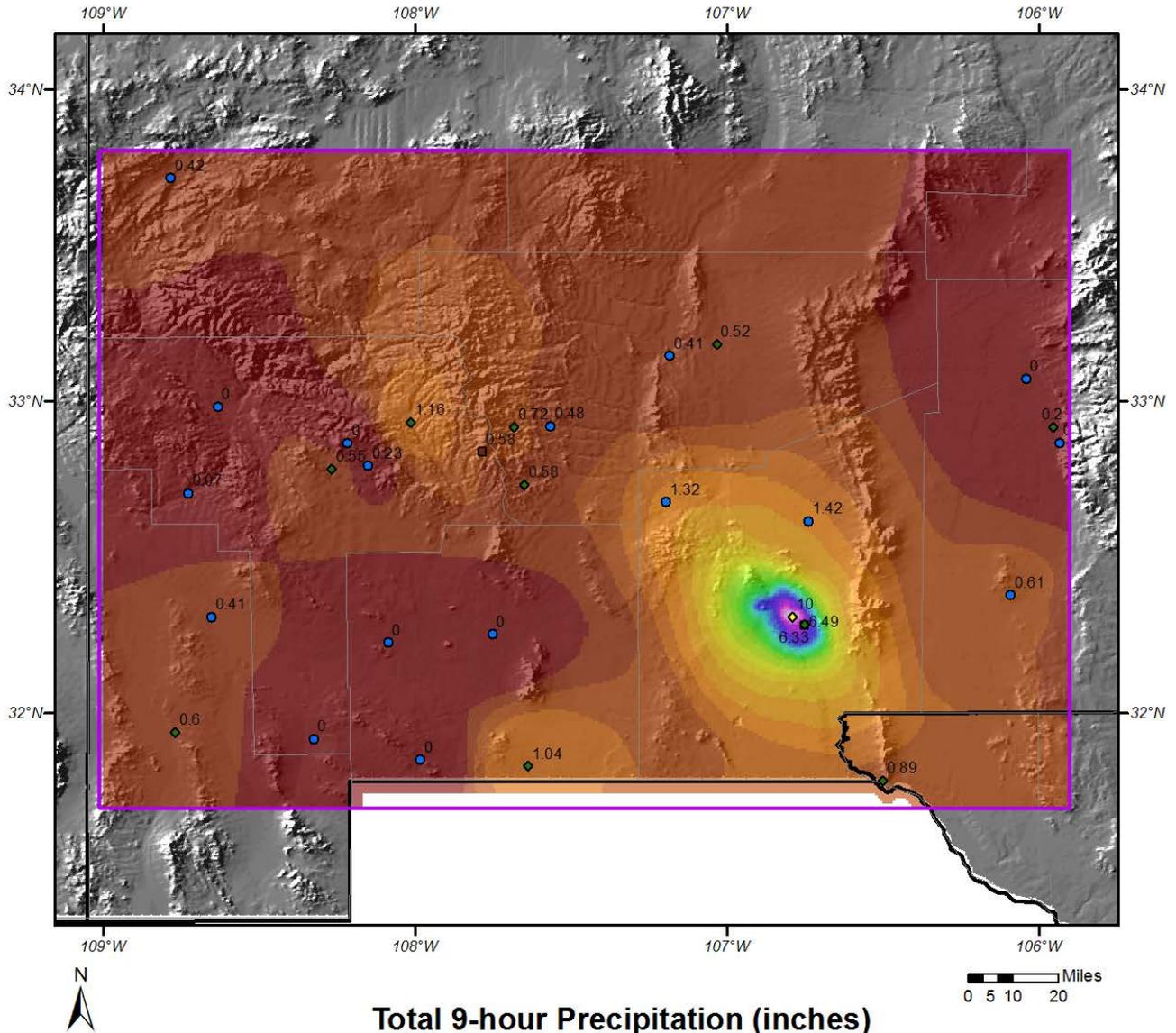
**Degree of confidence in results:** One of the two hourly stations used in this analysis was manually digitized from the L.B. Leopold report of the storm. The other hourly station was estimated based on timing provided by nearby daily cooperative reports. While not many hourly stations were used, the area and duration of the storm were both fairly small, so they are sufficient in providing a high degree of accuracy of the timing of this storm. Ten of the eleven supplemental stations were converted from daily station type due to uncertainty in observation time. The eleventh supplemental station was estimated based on a report from the PMP analysis of the storm. With all of the data being thoroughly inspected and the precipitation totals for various periods throughout the storm being consistent with previous reports, this analysis is considered to be reliable.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1485_1	-106.796	32.304	3,890	3,900	78.00	3.29	0.98	78	2.310	81.02	81.0	3.77	1.07	84	2.700	1.169

Storm 1485 - August 30 (0600 UTC) - August 30 (1400 UTC), 1935								
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)								
Area (mi <sup>2</sup> )	Duration (hours)							
	1	2	3	4	5	6	9	Total
0.3	4.34	6.57	7.95	9.45	9.68	9.87	10.03	10.03
1	4.32	6.55	7.92	9.42	9.64	9.83	9.99	9.99
10	4.09	6.20	7.50	8.92	9.13	9.21	9.45	9.45
25	3.74	5.67	6.85	8.16	8.31	8.51	8.65	8.65
50	3.43	5.21	6.31	7.50	7.52	7.69	7.95	7.95
100	3.06	4.64	5.61	6.68	6.73	6.88	7.08	7.08
150	2.79	4.22	5.10	6.07	6.11	6.25	6.44	6.44
200	2.54	3.85	4.22	5.53	5.66	5.73	5.87	5.87
300	2.25	3.41	3.79	4.91	4.97	5.07	5.21	5.21
400	2.02	3.04	3.05	4.37	4.37	4.48	4.65	4.65
500	1.88	2.85	2.98	4.11	4.12	4.22	4.37	4.37
1,000	1.46	2.17	2.18	3.12	3.12	3.21	3.35	3.35
2,000	1.08	1.69	1.83	2.45	2.46	2.51	2.70	2.70
5,000	0.82	0.82	1.14	1.70	1.70	1.70	1.77	1.77
10,000	0.64	0.64	0.95	1.40	1.40	1.40	1.49	1.49
20,000	0.29	0.35	0.59	0.81	0.81	0.81	0.93	0.93
25,835	0.20	0.30	0.38	0.47	0.54	0.56	0.60	0.60







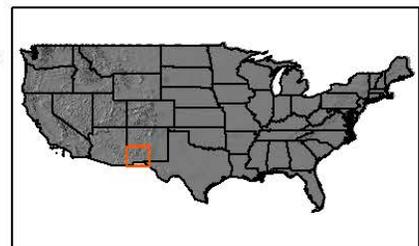
**Total 9-hour Precipitation (inches)**  
**August 30, 1935 0600 UTC - August 30, 1935 1400 UTC**  
**SPAS #1485**

**Precipitation (inches)**

0.00 - 0.30	2.11 - 2.40	4.21 - 4.50	6.31 - 6.60
0.31 - 0.60	2.41 - 2.70	4.51 - 4.80	6.61 - 6.90
0.61 - 0.90	2.71 - 3.00	4.81 - 5.10	6.91 - 7.20
0.91 - 1.20	3.01 - 3.30	5.11 - 5.40	7.21 - 7.50
1.21 - 1.50	3.31 - 3.60	5.41 - 5.70	7.51 - 7.80
1.51 - 1.80	3.61 - 3.90	5.71 - 6.00	7.81 - 8.10
1.81 - 2.10	3.91 - 4.20	6.01 - 6.30	8.11 - 8.40

**Stations**

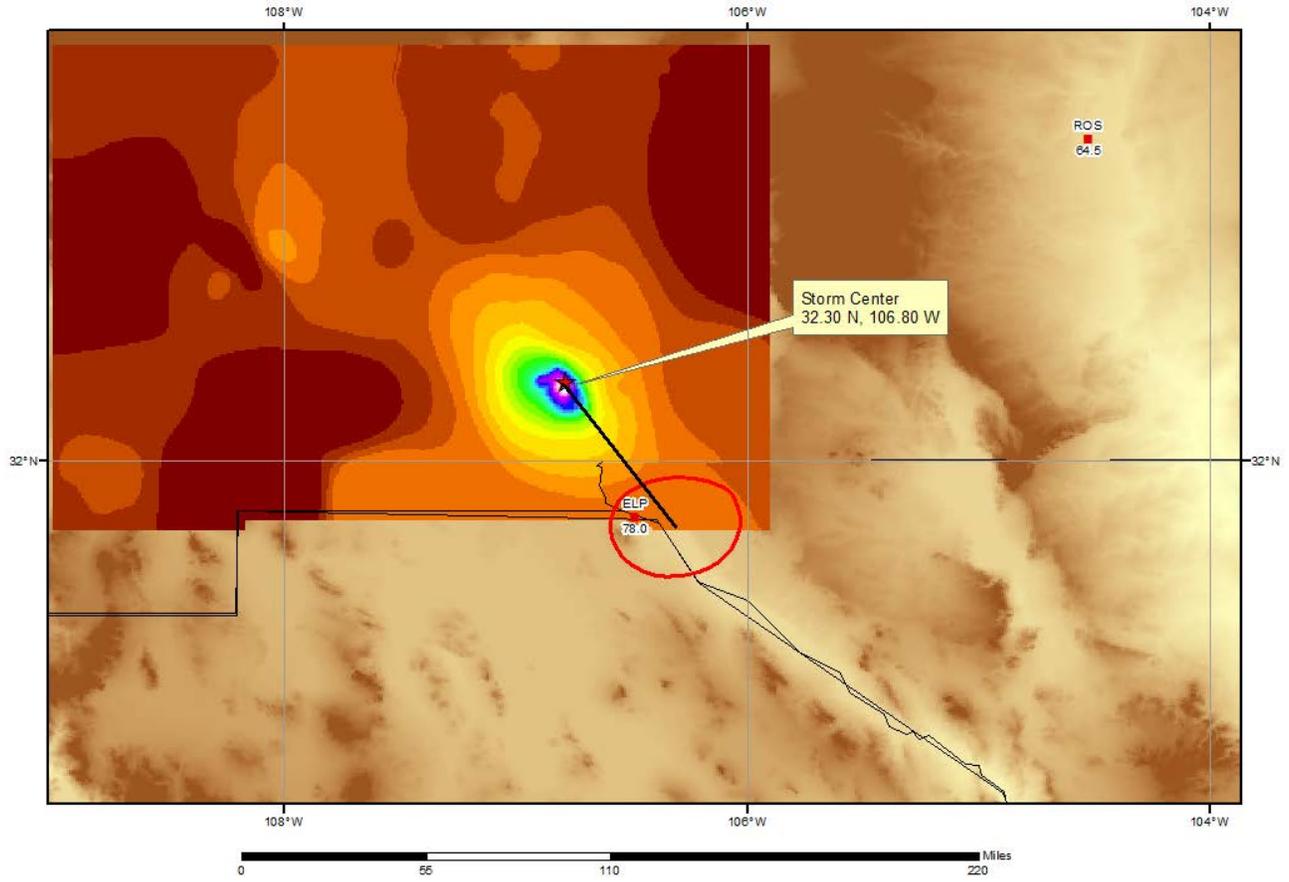
- Daily
- Hourly Estimated Pseudo
- Hourly Pseudo
- ◆ Supplemental
- ◆ Supplemental Estimated







### SPAS 1485 Las Cruces, NM Storm Analysis August 29-30, 1935



## Storm Precipitation Analysis System (SPAS) For Storm #1496\_1

**General Storm Location:** Woodward Ranch, TX (31.1, -101.0, 27.7, -97.2)

**Storm Dates:** May 30 – June 1, 1935

**Event:** Extreme Precipitation Event

### DAD Zone 1

**Latitude:** 29.4792

**Longitude:** -99.3875

**Max. Grid Rainfall Amount:** 21.93”

**Max. Observed Rainfall Amount:** 21.84” Woodward Ranch, TX

**Number of Stations:** 58

**SPAS Version:** 10

**Base Map Used:** PRISM Monthly Basemap for September 1941(us\_ppt\_1941\_09\_30sec\_in )

**Spatial resolution:** 0.2882

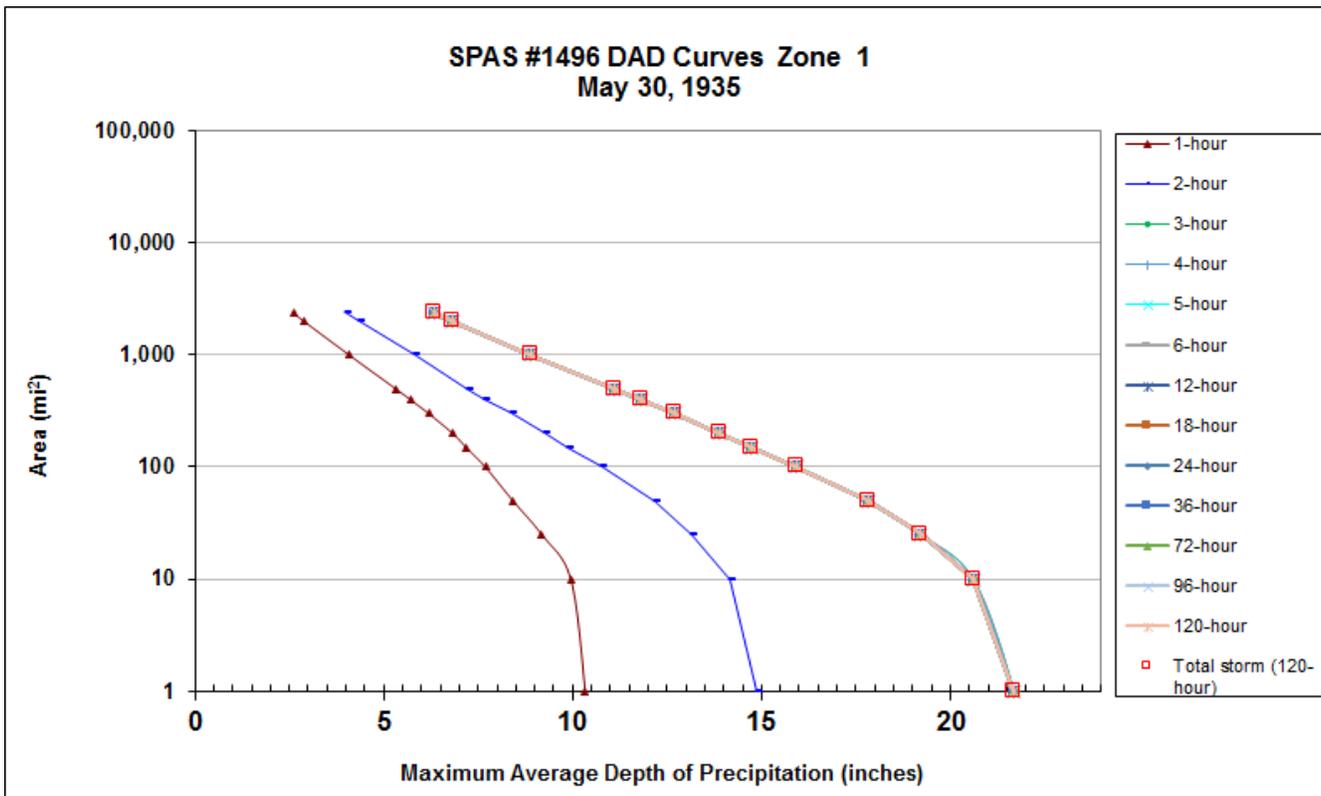
**Radar Included:** No

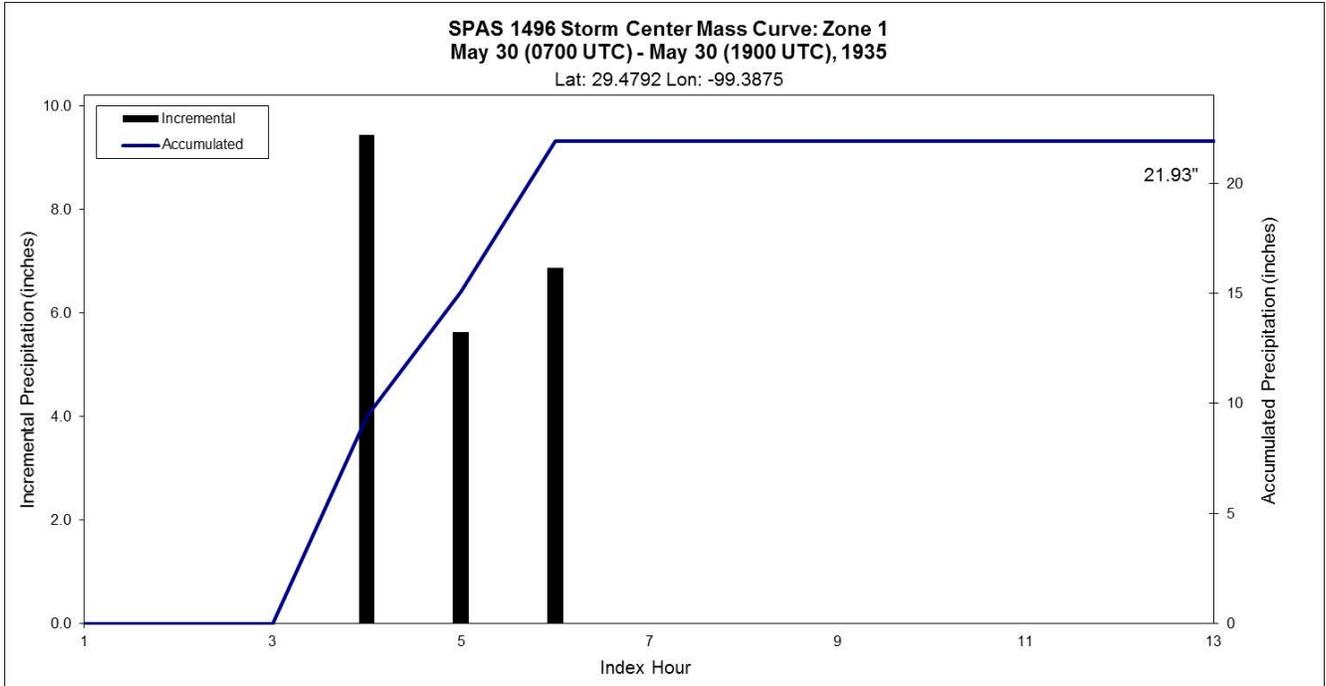
**Depth-Area-Duration (DAD) analysis:** Yes

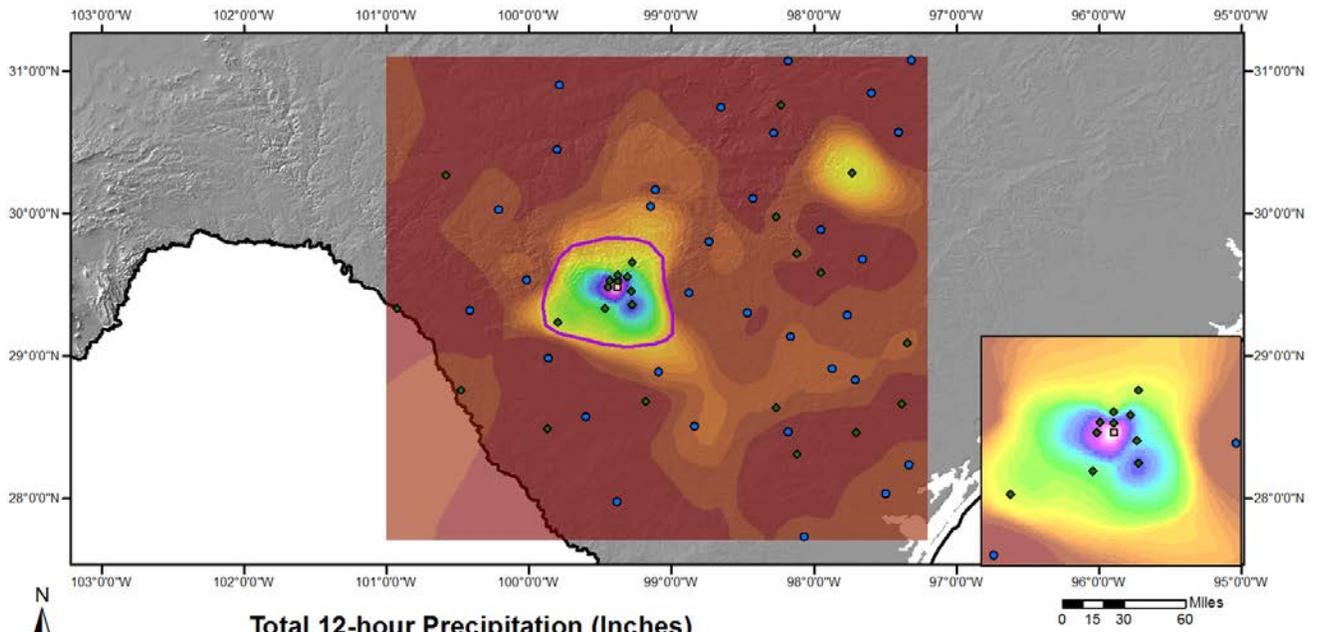
**Degree of confidence in results:** In addition to the NCDC stations, twenty-five supplemental stations were added to ensure data consistency. Due to the amount and integrity of the U.S. Army Corps of Engineers (USACE), one hourly station was digitized based on the mass rainfall curves from the USACE report. With the density of stations available and the consistency of the resulting SPAS analysis to the U.S. Army Corps of Engineers report, this analysis is deemed quite reliable to the fact that this analysis only had one hourly station. Attempts were made to the USACE branches for the full storm reports to no avail.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1496_1	-99.388	29.479	1,175	1,200	77.00	3.14	0.32	76	2.820	81.22	81.0	3.77	0.36	84	3.410	1.209

Storm 1496 - May 30 (0700 UTC) - May 30 (1900 UTC), 1935															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	10.40	15.01	21.86	21.86	21.86	21.86	21.86	21.86	21.86	21.86	21.86	21.86	21.86	21.93	21.93
1	10.33	14.89	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68
10	9.95	14.15	20.61	20.61	20.61	20.61	20.61	20.61	20.61	20.61	20.61	20.61	20.61	20.61	20.61
25	9.18	13.17	19.21	19.21	19.21	19.21	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22
50	8.42	12.16	17.80	17.80	17.80	17.80	17.82	17.82	17.82	17.82	17.82	17.82	17.82	17.82	17.82
100	7.69	10.76	15.90	15.90	15.90	15.90	15.93	15.93	15.93	15.93	15.93	15.93	15.93	15.93	15.93
150	7.18	9.88	14.71	14.71	14.71	14.71	14.73	14.73	14.73	14.73	14.73	14.73	14.73	14.73	14.73
200	6.82	9.26	13.87	13.87	13.87	13.87	13.90	13.90	13.90	13.90	13.90	13.90	13.90	13.90	13.90
300	6.19	8.38	12.69	12.69	12.69	12.69	12.72	12.72	12.72	12.72	12.72	12.72	12.72	12.72	12.72
400	5.70	7.68	11.79	11.79	11.79	11.79	11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83
500	5.31	7.23	11.06	11.06	11.06	11.06	11.10	11.10	11.10	11.10	11.10	11.10	11.10	11.10	11.10
1,000	4.08	5.82	8.87	8.87	8.87	8.87	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90
2,000	2.88	4.35	6.82	6.82	6.82	6.82	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84
2,355	2.61	4.00	6.33	6.33	6.33	6.33	6.34	6.34	6.34	6.34	6.34	6.34	6.34	6.34	6.34







**Total 12-hour Precipitation (Inches)**  
**May 31, 1935 12 AM CST - May 31, 1935 12 PM CST**  
**SPAS #1496**

Precipitation (Inches)	
0.00 - 0.50	3.01 - 3.50
0.51 - 1.00	3.51 - 4.00
1.01 - 1.50	4.01 - 4.50
1.51 - 2.00	4.51 - 5.00
2.01 - 2.50	5.01 - 5.50
2.51 - 3.00	5.51 - 6.00
	6.01 - 6.50
	6.51 - 7.00
	7.01 - 7.50
	7.51 - 8.00
	8.01 - 8.50
	8.51 - 9.00
	9.01 - 9.50
	9.51 - 10.00
	10.01 - 11.00
	11.01 - 12.00
	12.01 - 13.00
	13.01 - 14.00
	14.01 - 15.00
	15.01 - 16.00
	16.01 - 17.00
	17.01 - 18.00
	18.01 - 19.00
	19.01 - 20.00
	20.01 - 21.00
	21.01 - 22.00

**Stations**

- Daily
- Hourly Estimated
- ◆ Supplemental



WJM 02/05/2015

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of May 31, 1935  
 Assignment G M 5 - 20  
 Location Southwestern Texas  
 Study Prepared by:  
 Southwestern Division  
 Galveston District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 5/8/44  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 2/27/45  
 Remarks: Center at :  
 Woodward Ranch, New Mexico

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1 : 1,000,000  
 Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	4
Form 5001-B (24-hour " " " " )-----	-
Form 5001-D ( " " " " " " )-----	4
Misc. precip. records, meteorological data, etc.-----	1
Form 5002 (Mass rainfall curves)-----	10

**PART II**

Final isohyetal maps, in 1 sheet, scale 1 : 1,000,000  
 Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	1
Form S-11 (Depth-area data from isohyetal map)-----	1
Form S-12 (Maximum depth-duration data)-----	2
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	-

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

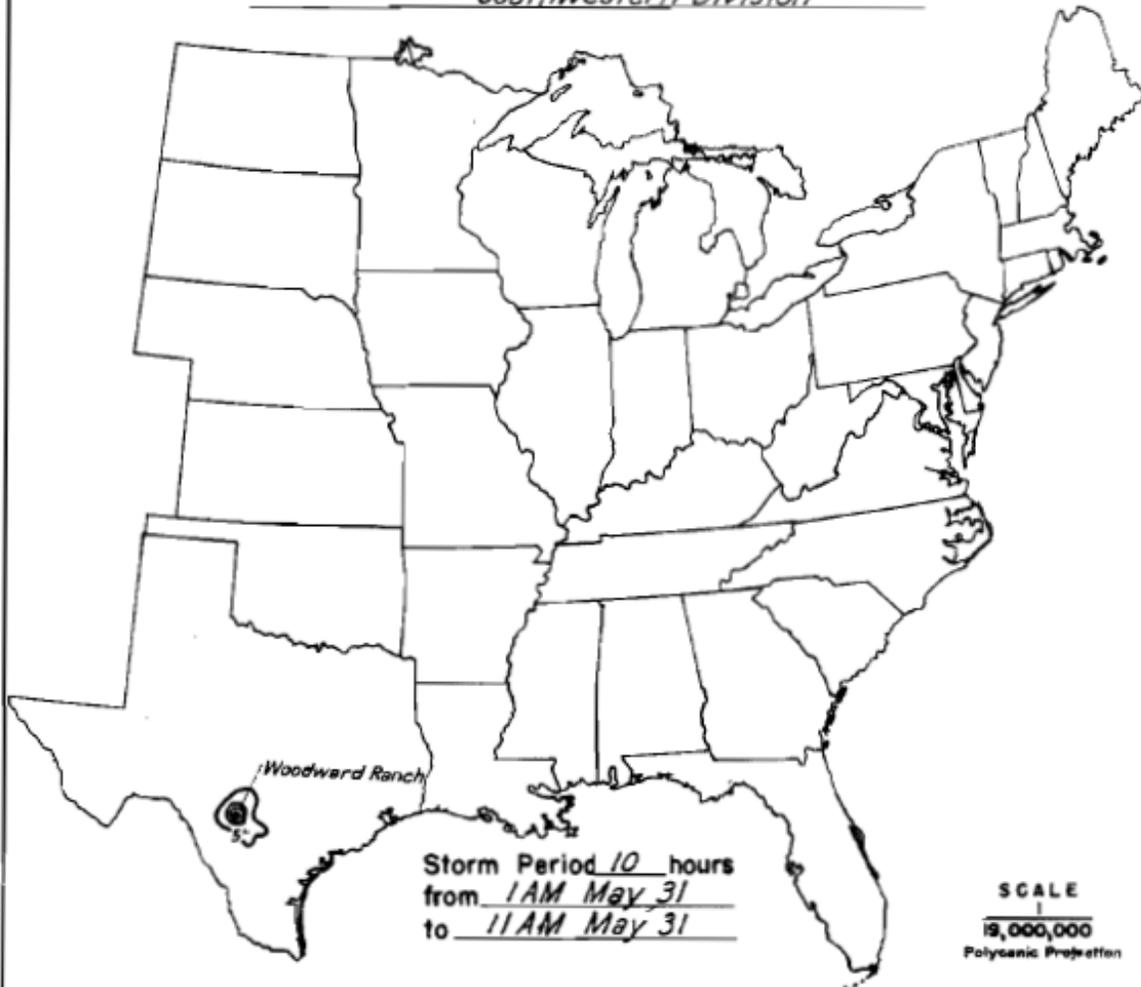
Area in Sq. Mi.	Duration of Rainfall in Hours									
	2	4	6	8	10					
Max. Station	15.0	22.0	22.0	22.0	22.0					
5	13.0	20.6	21.0	21.0	21.0					
10	12.9	20.1	20.5	20.5	20.5					
50	12.1	17.9	18.2	18.2	18.2					
100	11.1	16.0	16.4	16.4	16.4					
200	9.7	13.5	14.0	14.0	14.0					
500	7.6	10.1	10.9	11.0	11.0					
1,000	5.8	7.8	8.6	8.8	8.9					
2,000	4.3	5.7	6.5	6.8	6.9					
4,000	3.0	4.0	4.6	4.8	4.9					
5,000	2.6	3.5	4.0	4.2	4.3					
7,000	2.1	2.8	3.2	3.3	3.4					

WAR DEPARTMENT

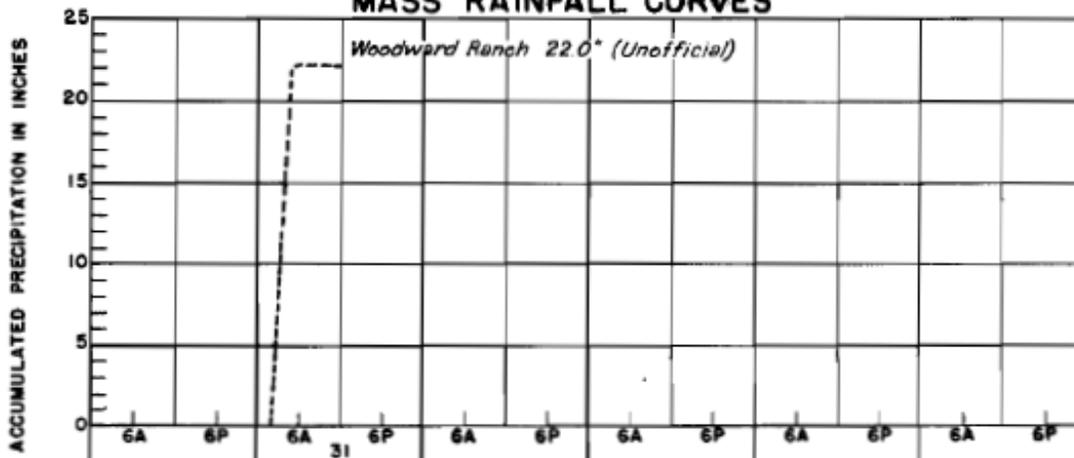
CORPS OF ENGINEERS, U. S. ARMY

### STORM STUDIES - ISOHYETAL MAP

Storm of May 31, 1935 Assignment GM 5-20  
Study Prepared by: Galveston, Tex. District  
Southwestern Division



### MASS RAINFALL CURVES



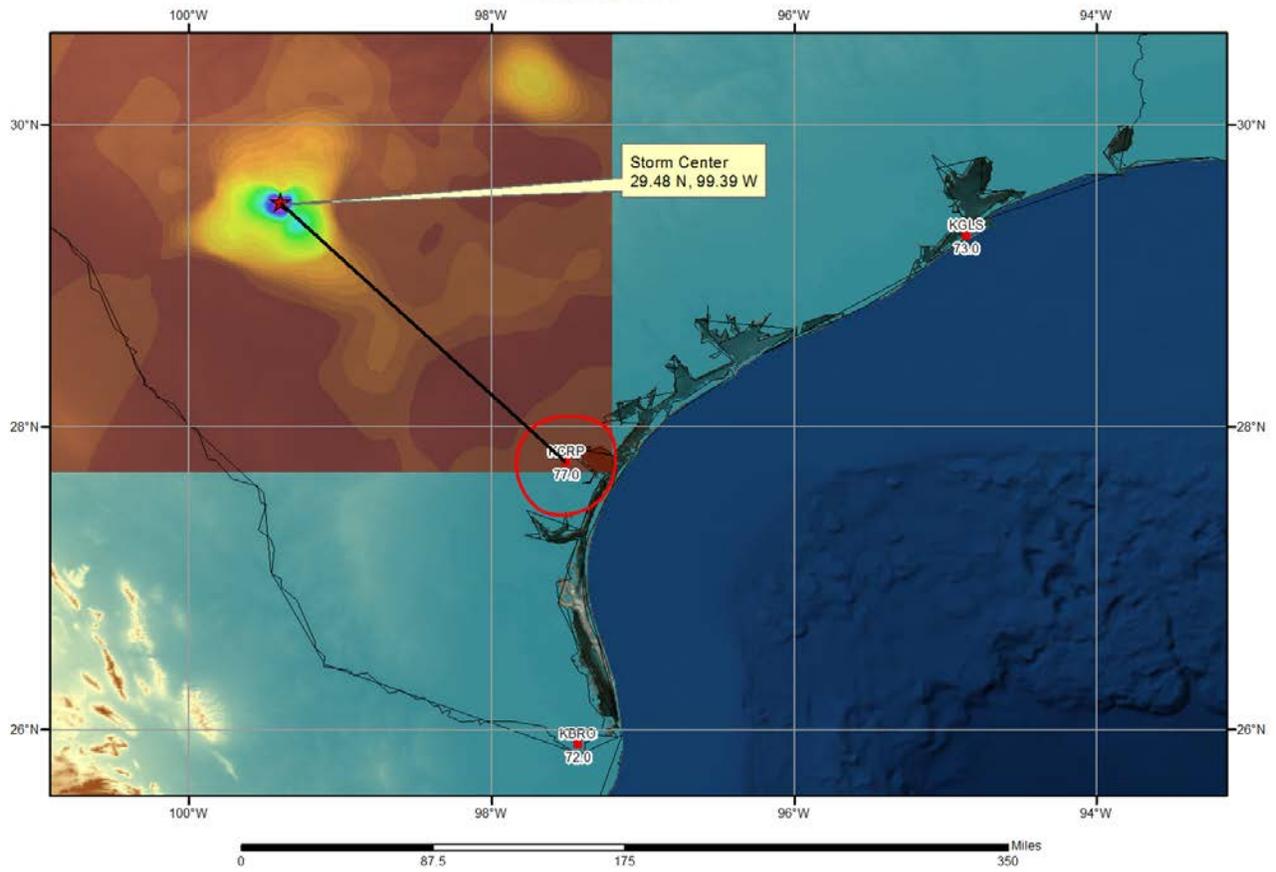
FORM 8-3E

U. S. GOVERNMENT PRINTING OFFICE ©-1945





### SPAS 1496 Woodward Ranch, TX Storm Analysis May 30, 1935



11.

Storm Date	Assignment Number	Representative Storm Dewpoint	Reference Point
<u>1932 (cont.)</u>			
Oct 4-6	NA 1-21	69	180 S of Elks Park, N. Y.
Oct 14-18	SA 5-11B	70	260 SE of Tuscaloosa, Ala.
Oct 15-18	SA 5-11A	71	210 SE of Rocky Mount, Va.
Nov 4-9	SA 4-28	75	50 SE of Canal Point, Fla.
Dec 8-14	GM 2-11	64	175 SE of Wetburg, Miss.
Dec 21-24	SW 2-9	64	250 SE of Sulphur, Okla.
<u>1933</u>			
Apr 11-14	NA 1-23	61	660 SW of Durham, N. C.
Jun 28-29	UMV 2-15	70	175 S of Corin, Mo.
Jul 22-27	LMV 2-26	76	190 SE of Logansport, La.
Jul 24	SA 1-11	70	100 S of Lakeville, Pa.
Aug 20-24	NA 1-24A	70	80 SE of Peekamoose, N. Y.
Aug 20-24	NA 1-24B	70	80 E of York, Pa.
Sep 3-8	SA 4-30	73	140 SE of Clermont, Fla.
Sep 14-18	NA 1-25	76	490 SW of Provincetown, Mass.
Dec 15-20	SW 2-10	66	210 S of Stuttgart, Ark.
<u>1934</u>			
Feb 27-Mar 4	LMV 4-19	65	250 E of De Ridder, La.
Apr 3-4	SW 2-11	64	250 SE of Cheyenne, Okla.
Jun 12-16	SA 5-1	77	50 SW of St. Lec, Fla.
Sep 5-9	SA 5-12	73	110 SW of Beaufort, N. C.
Sep 16-19	NA 1-26	70	70 E of Emmitsburg, Md.
Oct 16-18	MR 3-27	67	150 SSE of Sedan, Kans.
Nov 19-21	LMV 1-18	69	140 SW of Millry, Ala.
<u>1935</u>			
Jan 18-21	LMV 1-19	63	180 SSW of Hernando, Miss.
May 2-7	LMV 4-20	73	100 ESE of Melville, La.
May 16-20	LMV 4-21	73	85 S of Simmesport, La.
May 27-Jun 2	MR 3-28B	70	175 S of Chanute, Kans.
May 30-31	MR 3-28A	68	325 SSE of Hale, Colo.
May 31	GM 5-20	74	200 SE of D'Hanis, Tex.
Jun 10-15	GM 5-2	75	230 SE of Segovia, Tex.
Jun 12-18	SW 2-13	74	160 SSE of Waldron, Ark.
Jun 21-22	OR 5-5	70	180 SW of Greenville, Ky.
Jun 25-26	UMV 3-14	69	160 S of Clinton, Mo.
Jul 6-10	NA 1-27	71	220 SSE of Hector, N. Y.
Aug 6-7	OR 9-11	73	250 SW of Keene, Ohio.
Sep 2-6	SA 1-26	76	210 S of Easton, Md.
Sep 2-7	GM 5-3	75	300 SE of Ballinger, Tex.
Dec 5-8	GM 5-4	64	60 SE of Satsuma, Tex.

## Storm Precipitation Analysis System (SPAS) For Storm #1429\_2

**General Storm Location:** Hallett, OK

**Storm Dates:** September 2 – September 5 1940

**Event:** CORPS of Engineers, US Army Assignment S W 2 – 18

### DAD Zone 2

**Latitude:** 36.2458

**Longitude:** -96.6125

**Max. Grid Rainfall Amount:** 24.00”

**Max. Observed Rainfall Amount:** 24.00”

**Number of Stations:** 186

**SPAS Version:** 10.0

**Basemap:** Manually digitized contours

**Spatial resolution:** 0.2642

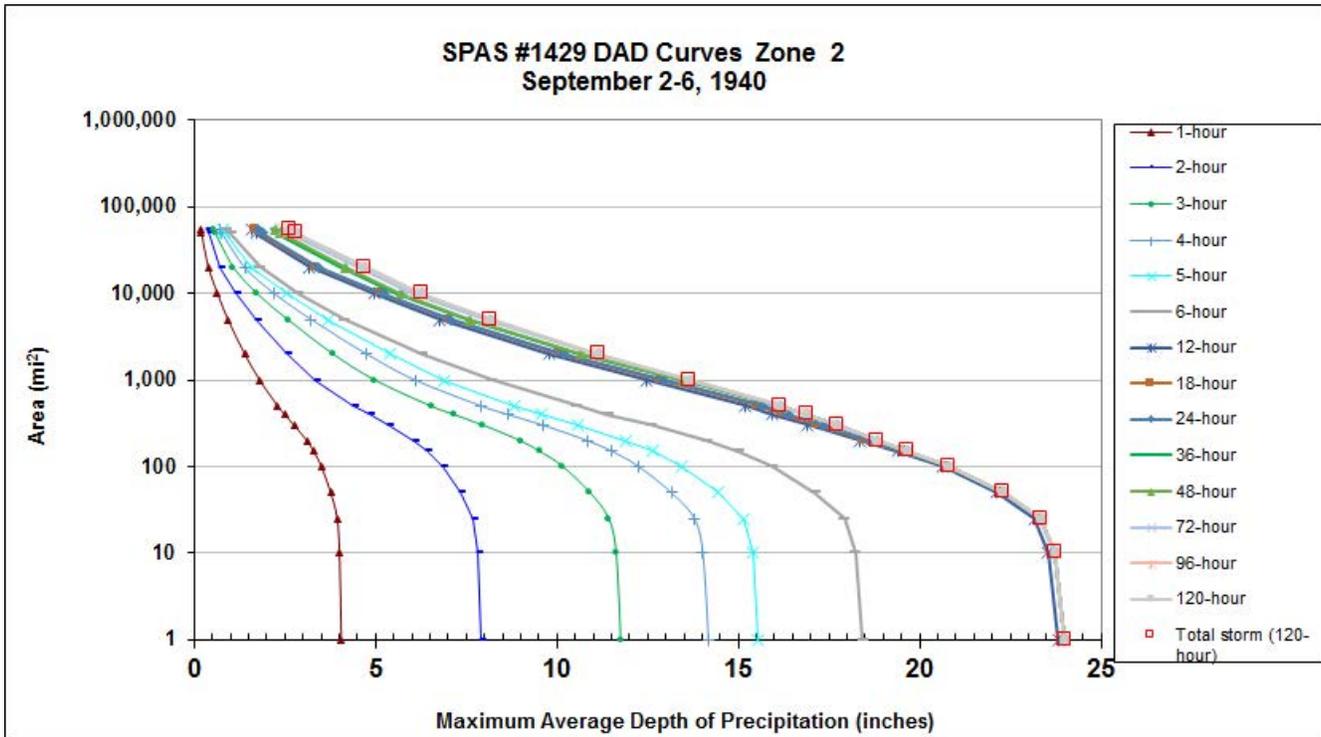
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

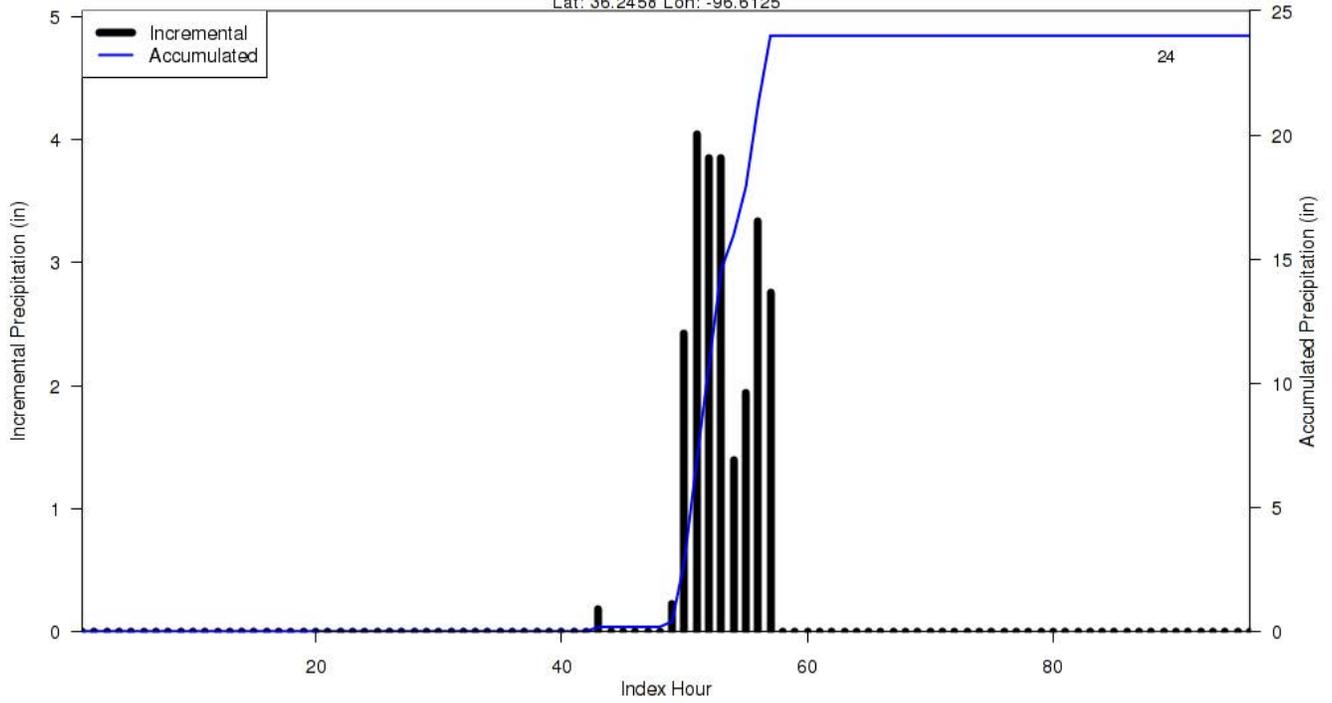
**Reliability of results:** All seven of the hourly stations were digitized from either the Army CORPS of Engineers’ pertinent data report or from a NCDC local climatology report of the storm. This provided very high accuracy of the hourly data, which is essential in the timing of the daily and supplemental stations. Of the 43 supplemental stations, 30 were formatted as daily stations. These stations were in the supplemental file due to there being more data on either end of the storm duration as defined for this analysis. For example, if the daily station took measurements in the morning, then there may have been more precipitation reported for the remainder of the storm that was actually part of the following day’s observation. Alternatively, if a station had an observation time in the evening then there could have been data not used from the day before that was valid for the period of the storm and could be added to the analysis. With all of the data being thoroughly inspected, the DAD and precipitation pattern following closely to the Army CORPS of Engineers report, and the precipitation totals for various periods throughout the storm being consistent with previous reports, this analysis is considered to be reliable.

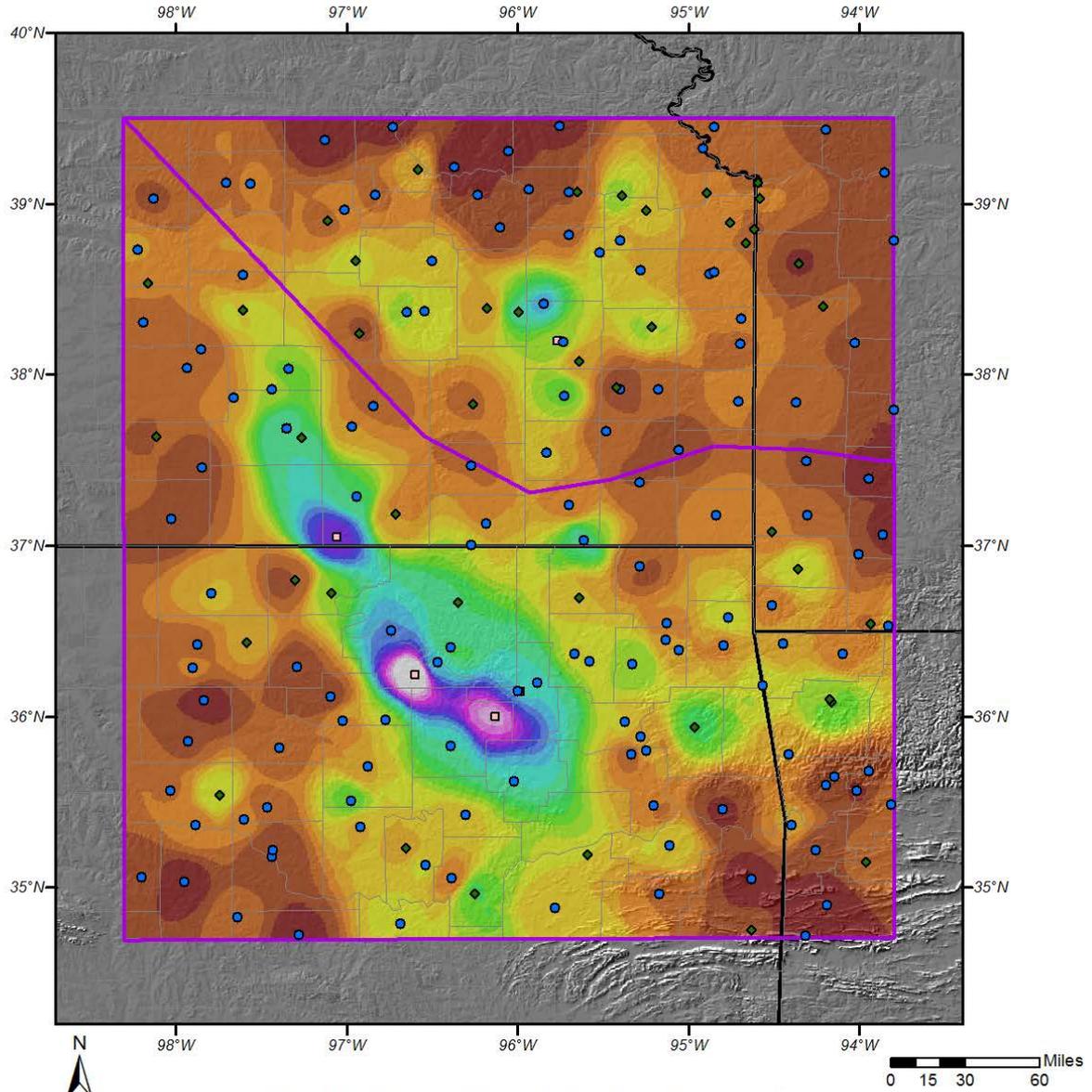
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1429_2	-96.613	36.246	871	900	77.50	3.22	0.25	77	2.970	80.97	81.0	3.77	0.27	84	3.500	1.178

Storm 1429 - September 2 (0700 UTC) - September 6 (0600 UTC), 1940															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	4.05	7.90	11.75	14.17	15.56	18.42	23.82	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1	4.05	7.90	11.75	14.17	15.56	18.42	23.82	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
10	4.00	7.81	11.63	14.02	15.39	18.22	23.54	23.73	23.73	23.73	23.73	23.73	23.73	23.73	23.73
25	3.94	7.68	11.43	13.79	15.14	17.92	23.17	23.35	23.35	23.35	23.35	23.35	23.35	23.35	23.35
50	3.76	7.33	10.91	13.15	14.45	17.10	22.13	22.29	22.29	22.30	22.30	22.30	22.30	22.30	22.30
100	3.50	6.83	10.16	12.25	13.45	15.93	20.62	20.78	20.78	20.80	20.80	20.80	20.80	20.80	20.80
150	3.29	6.41	9.53	11.52	12.63	15.00	19.40	19.54	19.58	19.66	19.66	19.67	19.67	19.67	19.67
200	3.10	6.04	8.98	10.83	11.90	14.13	18.36	18.50	18.61	18.83	18.83	18.83	18.84	18.84	18.84
300	2.75	5.36	7.97	9.62	10.57	12.59	16.91	17.18	17.33	17.71	17.71	17.72	17.72	17.72	17.72
400	2.49	4.82	7.16	8.65	9.57	11.41	15.94	16.24	16.39	16.86	16.87	16.88	16.89	16.89	16.89
500	2.30	4.40	6.53	7.92	8.83	10.55	15.20	15.55	15.69	16.14	16.14	16.15	16.16	16.16	16.16
1,000	1.80	3.35	4.98	6.09	6.89	8.23	12.49	12.86	12.97	13.46	13.47	13.63	13.67	13.67	13.67
2,000	1.39	2.57	3.83	4.75	5.41	6.30	9.80	10.12	10.19	10.64	10.69	11.07	11.14	11.14	11.14
5,000	0.93	1.72	2.58	3.23	3.69	4.15	6.77	7.04	7.09	7.51	7.59	8.00	8.18	8.18	8.18
10,000	0.64	1.15	1.73	2.20	2.57	2.86	4.97	5.16	5.21	5.58	5.69	6.02	6.26	6.26	6.26
20,000	0.39	0.72	1.08	1.39	1.60	1.82	3.18	3.35	3.42	4.00	4.16	4.51	4.72	4.72	4.72
50,000	0.20	0.39	0.58	0.76	0.86	1.00	1.70	1.79	1.88	2.27	2.39	2.61	2.80	2.80	2.80
55,417	0.19	0.36	0.54	0.70	0.80	0.90	1.59	1.67	1.76	2.14	2.25	2.46	2.64	2.64	2.64



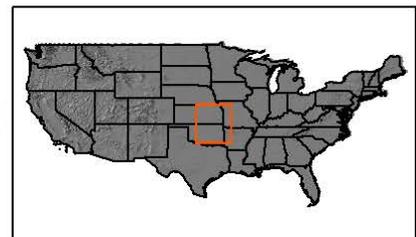
SPAS 1429 Storm Center Mass Curve Zone 2  
September 2 (0700UTC) to September 6 (0600UTC), 1940  
Lat: 36.2458 Lon: -96.6125





**Total 96-hour Precipitation (inches)**  
**September 2, 1940 0700 UTC - September 6, 1940 0600 UTC**  
**SPAS #1429**

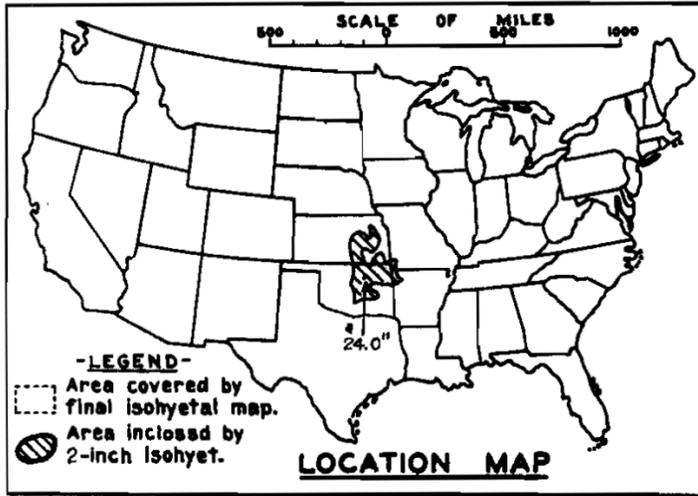
Precipitation (inches)			Stations		
0.0250 - 0.500	2.51 - 3.00	5.01 - 6.00	10.1 - 11.5	●	Daily
0.501 - 1.00	3.01 - 3.50	6.01 - 7.00	11.6 - 13.0	■	Hourly
1.01 - 1.50	3.51 - 4.00	7.01 - 8.00	13.1 - 14.5	□	Hourly Estimated
1.51 - 2.00	4.01 - 4.50	8.01 - 9.00	14.6 - 16.0	■	Hourly Pseudo
2.01 - 2.50	4.51 - 5.00	9.01 - 10.0	16.1 - 17.5	◆	Supplemental
			17.6 - 24.0	□	



WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of September 2 - 6, 1940  
 Assignment S W 2 - 18  
 Location Okla. Kans. Mo. & Ark.  
 Study Prepared by:  
 Southwestern Division  
 Tulsa District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 8/18/41  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 3/25/43  
 Remarks: Centers at;  
 Hallett, Okla. and Lebo, Kans.

**DATA AND COMPUTATIONS COMPILED**  
**PART I**

Preliminary isohyetal map, in 2 sheet, scale 1 : 1,000,000  
 Precipitation data and mass curves: (Number of Sheets)  
 Form 5001-C (Hourly precip. data)----- 38  
 Form 5001-B (24-hour " " )----- -  
 Form 5001-D ( " " " " )----- 23  
 Misc. precip. records, meteorological data, etc.----- 1  
 Form 5002 (Mass rainfall curves)----- 19

**PART II**

Final isohyetal maps, in 1 sheet, scale 1 : 1,000,000  
 Data and computation sheets:  
 Form S-10 (Data from mass rainfall curves)----- 9  
 Form S-11 (Depth-area data from isohyetal map)----- 3  
 Form S-12 (Maximum depth-duration data)----- 11  
 Maximum duration-depth-area curves----- 1  
 Data relating to periods of maximum rainfall----- 2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES.**

Area in Sq. Mi.	Duration of Rainfall in Hours									
	6	12	18	24	30	36	48	54	90	
Max. Station	18.9	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
10	18.4	23.4	23.6	23.6	23.6	23.6	23.6	23.6	23.6	
100	14.7	19.2	19.4	19.6	19.7	19.8	19.8	19.8	19.8	
200	12.5	17.6	17.8	18.0	18.1	18.2	18.3	18.3	18.3	
500	9.7	15.4	15.6	15.7	15.8	16.1	16.2	16.2	16.2	
1,000	7.9	13.3	13.4	13.6	13.7	14.0	14.1	14.1	14.1	
2,000	6.2	10.3	10.5	10.7	10.9	11.1	11.3	11.3	11.3	
5,000	4.3	7.3	7.4	7.5	7.7	7.8	7.9	8.0	8.0	
10,000	3.0	5.3	5.4	5.5	5.6	5.7	5.8	5.9	5.9	
15,000	2.4	4.4	4.5	4.7	4.7	4.8	4.9	5.1	5.1	
20,000	2.0	3.9	4.1	4.2	4.3	4.4	4.5	4.6	4.6	

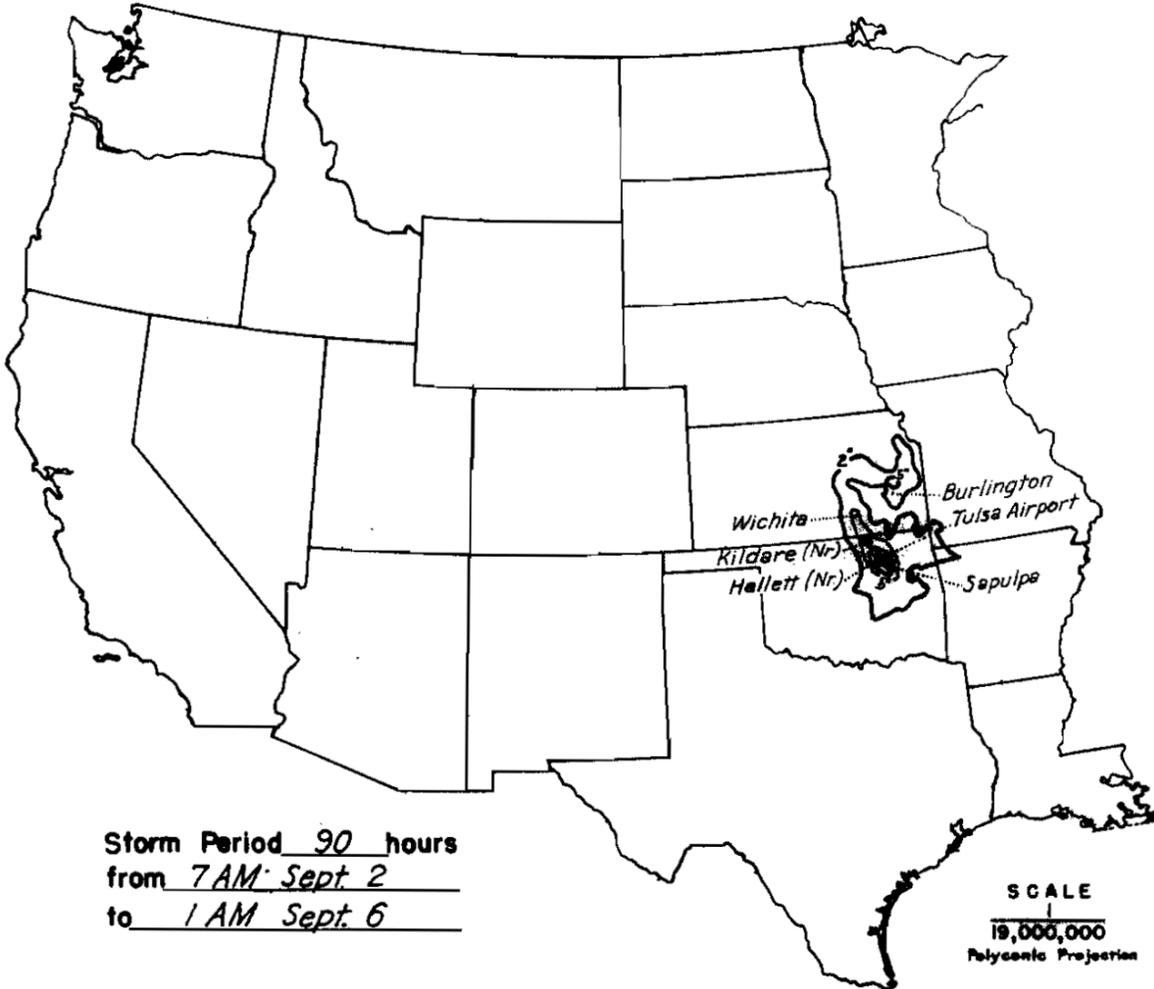
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

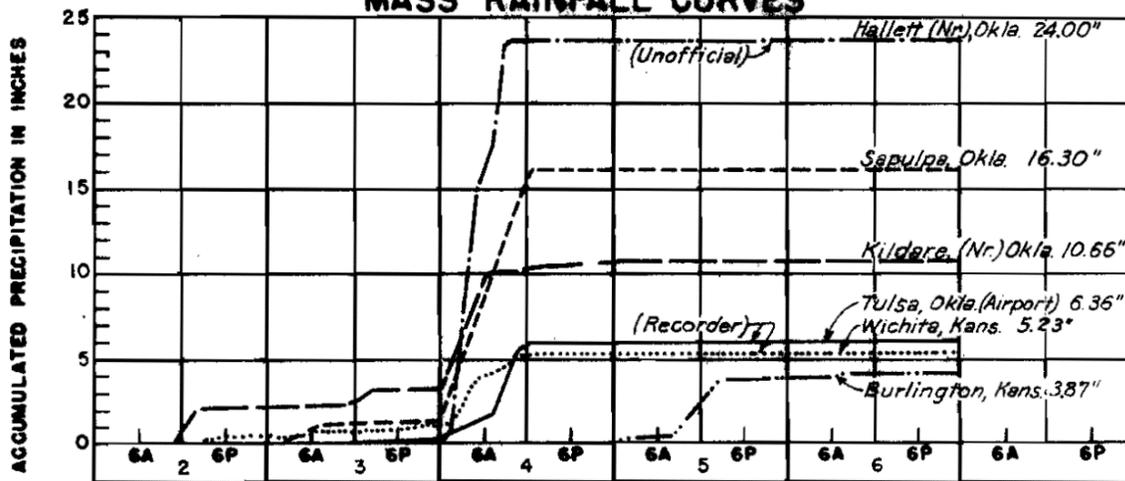
**STORM STUDIES - ISOHYETAL MAP**

Storm of September 2-6, 1940 Assignment SW 2-18

Study Prepared by: Tulsa, Okla. District  
Southwestern Division



**MASS RAINFALL CURVES**

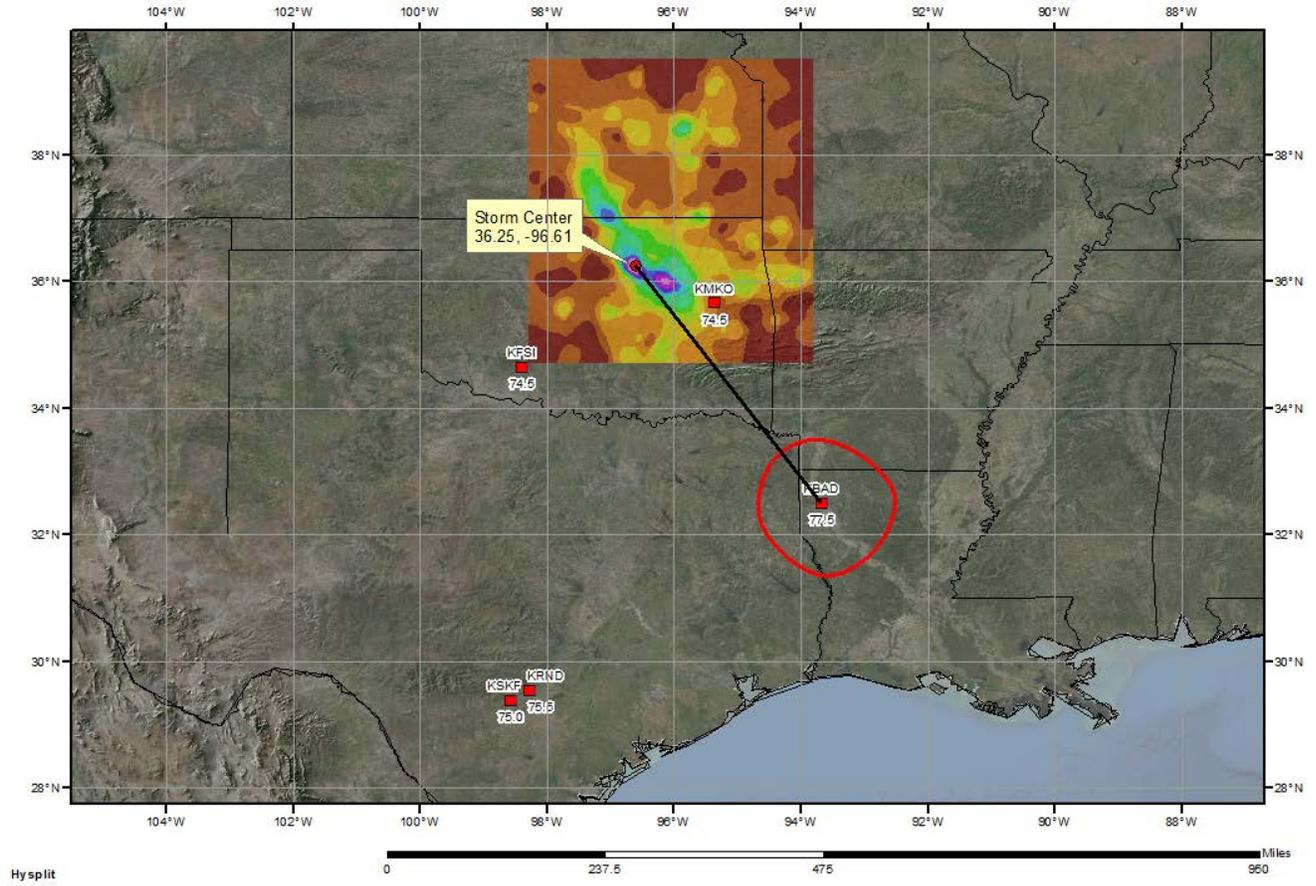


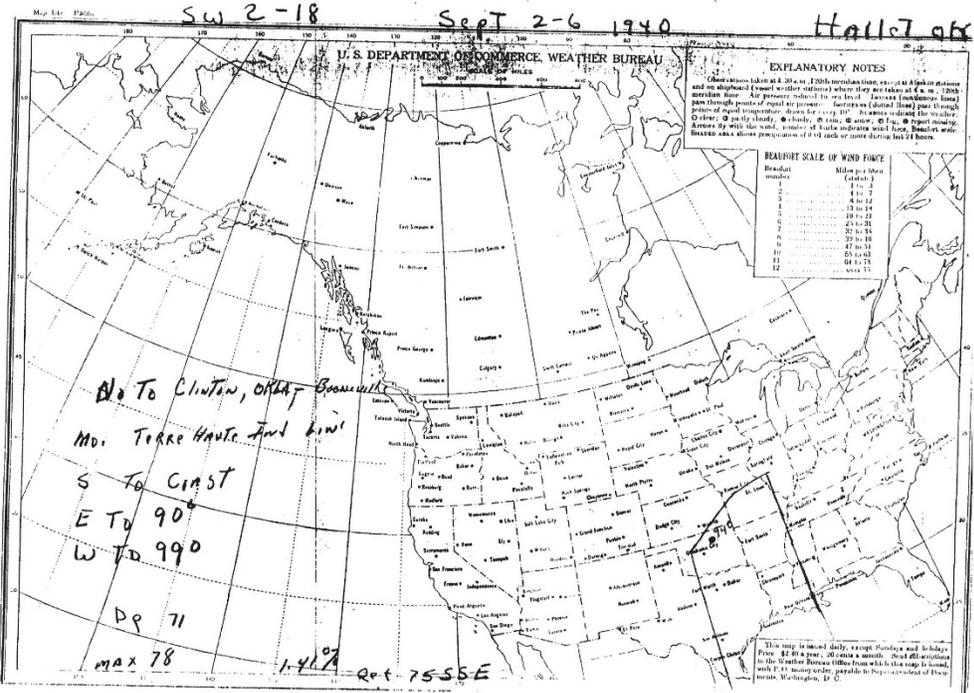






### SPAS 1429 Hallett, OK Storm Analysis September 2-4, 1940





## Storm Precipitation Analysis System (SPAS) For Storm #1432\_1

**General Storm Location:** Mounds, Oklahoma

**Storm Dates:** May 15 – May 20, 1943

**Event:** Extreme Precipitation Event

### DAD Zone 1

**Latitude:** 35.8458

**Longitude:** -96.0708

**Max. Grid Rainfall Amount:** 19.27”

**Max. Observed Rainfall Amount:** 19.23”

**Number of Stations:** 415

**SPAS Version:** 10.0

**Basemap:** Continental United States 2 year 6 hour (conus\_0002yr06h)

**Spatial resolution:** 0.2624

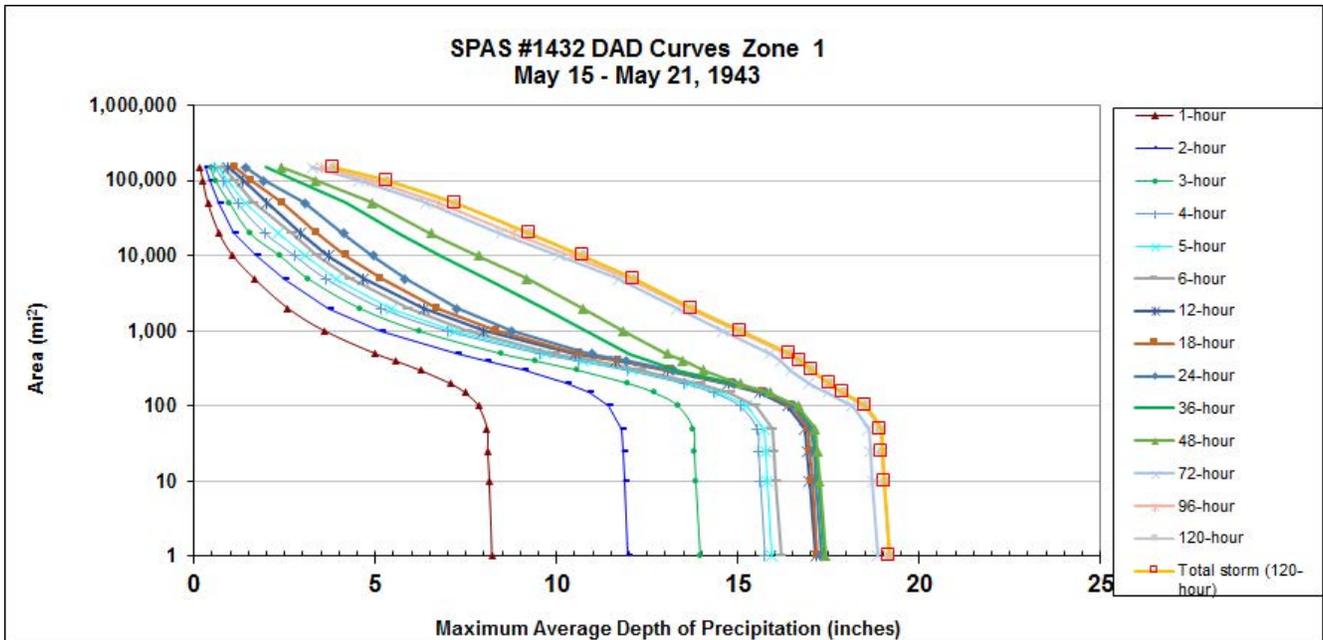
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

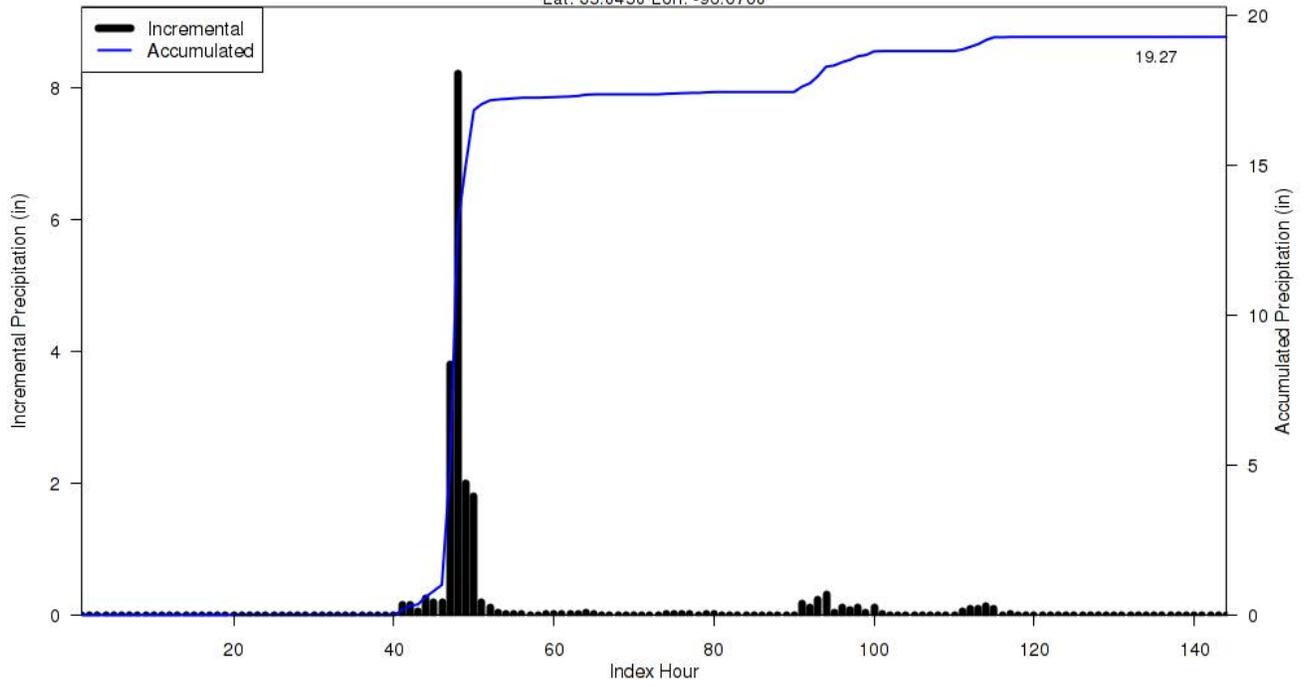
**Reliability of results:** In addition to the NCDC stations, seventeen supplemental stations were added to ensure data consistency. Due to the amount and integrity of the U.S. Army Corps of Engineers (USACE), five hourly stations were digitized based on the mass rainfall curves. With the density of stations available and the consistency of the resulting SPAS analysis to the U.S. Army Corps of Engineers report, this analysis is deemed quite reliable.

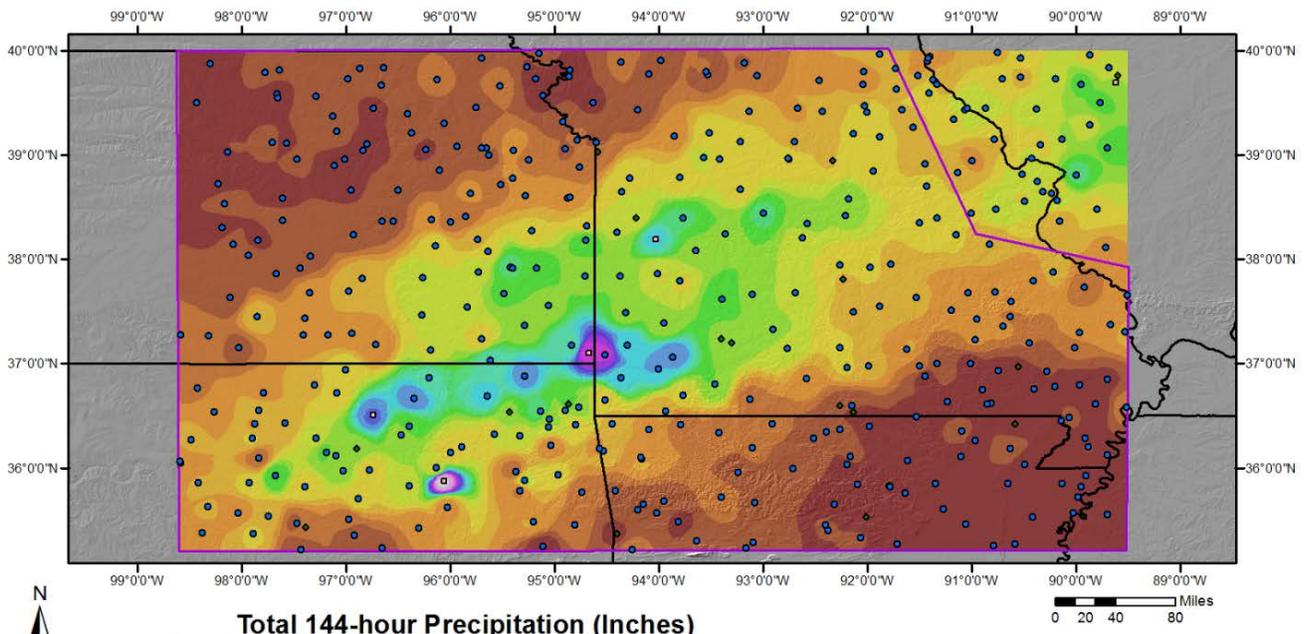
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1432_1	-96.071	35.846	766	800	73.00	2.60	0.19	68	2.410	79.55	79.5	3.52	0.24	81	3.285	1.363

Storm 1432 - May 15 (0700 UTC) - May 21 (0600 UTC), 1943																		
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																		
Area (mi <sup>2</sup> )	Duration (hours)																	
	1	2	3	4	5	6	12	18	24	30	36	48	60	72	96	120	144	Total
0.3	8.21	12.02	14.02	15.82	16.02	16.23	17.15	17.24	17.34	17.35	17.39	17.43	18.79	18.94	19.27	19.27	19.27	19.27
1	8.21	12.02	14.02	15.82	16.02	16.23	17.15	17.19	17.20	17.39	17.39	17.39	18.66	18.66	19.26	19.26	19.26	19.26
10	8.19	11.98	13.98	15.78	15.98	16.18	17.10	17.14	17.16	17.35	17.35	17.35	18.63	18.65	19.22	19.22	19.22	19.22
25	8.16	11.92	13.91	15.70	15.90	16.11	17.03	17.08	17.12	17.12	17.27	17.27	18.58	18.64	19.13	19.14	19.14	19.14
50	8.10	11.83	13.80	15.57	15.77	15.99	16.90	16.98	17.06	17.06	17.15	17.15	18.50	18.61	19.00	19.00	19.00	19.00
100	7.85	11.45	13.36	15.07	15.26	15.47	16.39	16.43	16.43	16.48	16.51	16.59	17.82	18.15	18.42	18.52	18.53	18.53
150	7.48	10.90	12.71	14.35	14.53	14.76	15.62	15.68	15.71	15.71	15.78	15.85	17.19	17.41	17.73	17.92	17.96	17.96
200	7.06	10.28	12.00	13.54	13.71	13.95	14.35	14.83	14.89	14.89	14.96	15.00	16.48	16.76	17.36	17.56	17.57	17.57
300	6.26	9.10	10.61	11.98	12.13	12.32	13.08	13.08	13.08	13.08	13.22	13.89	15.90	16.35	16.75	17.15	17.18	17.18
400	5.58	8.10	9.46	10.67	10.81	11.00	11.65	11.65	11.83	11.83	12.04	13.20	15.41	16.04	16.65	16.74	16.78	16.78
500	5.03	7.26	8.46	9.56	9.67	9.95	10.40	10.40	11.02	11.02	11.99	12.63	15.18	15.84	16.27	16.45	16.45	16.45
1,000	3.90	5.64	6.27	7.89	7.89	7.89	7.89	8.06	8.20	9.05	10.31	11.57	13.11	13.11	14.75	15.37	15.37	15.37
2,000	2.86	3.48	3.77	5.10	5.34	5.48	6.20	6.20	7.05	8.15	9.39	10.27	12.63	12.99	13.42	13.99	13.99	13.99
5,000	1.74	2.69	2.69	2.77	2.88	4.00	4.45	4.86	5.35	6.51	7.19	8.77	11.09	11.40	11.99	12.27	12.27	12.27
10,000	0.72	1.59	2.36	2.61	2.64	3.02	3.02	3.91	4.56	4.99	6.78	7.49	9.64	9.89	10.26	10.62	10.98	10.98
20,000	0.57	0.88	1.35	2.01	2.40	2.61	2.80	2.98	4.11	4.67	5.33	6.26	7.84	8.30	8.49	9.35	9.38	9.38
50,000	0.37	0.70	0.97	1.19	1.19	1.26	1.94	2.40	2.94	3.66	3.82	4.95	6.17	6.33	6.68	7.35	7.38	7.38
100,000	0.24	0.41	0.52	0.85	0.92	1.02	1.31	1.45	1.60	2.18	2.42	2.65	3.56	3.70	4.68	5.32	5.36	5.36
151,933	0.16	0.31	0.46	0.58	0.70	0.79	0.95	1.13	1.41	1.77	1.99	2.39	3.06	3.26	3.53	3.83	3.88	3.88



SPAS 1432 Storm Center Mass Curve Zone 1  
May 15 (0700UTC) to May 21 (0600UTC), 1943  
Lat: 35.8458 Lon: -96.0708

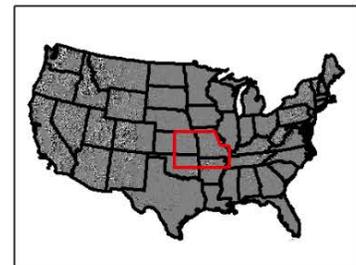




**Total 144-hour Precipitation (Inches)**  
**May 15, 1943 0700 UTC - May 20, 1943 0600 UTC**  
**SPAS #1432**

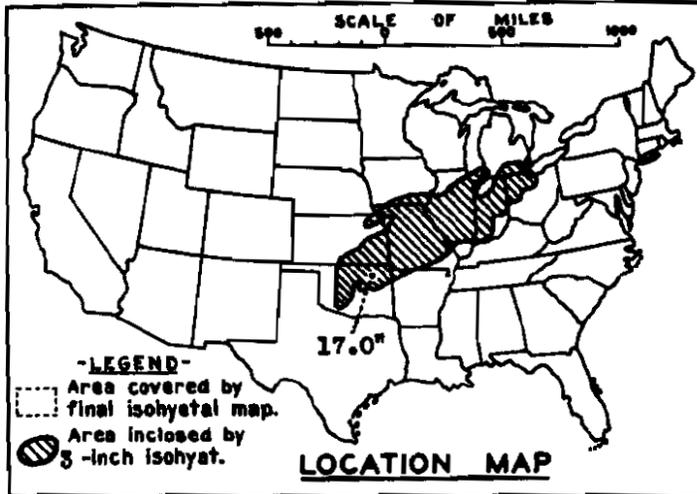


- Stations**
- Daily
  - Hourly Estimated
  - ◆ Supplemental



WJM 10/20/2014

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 12-20 May 1943  
 Assignment SW 2-21  
 Location Oklahoma to Great Lakes  
 Study Prepared by:  
 Southwestern Division  
 Tulsa District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 10/9/46  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 8/15/49  
 Remarks: Center near  
 Mounds, Okla.  
 Dewpt. 71° - Ref. Pt. 60 ESE  
 Grid G-15

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1: 1,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	531
Form 5001-B (24-hour " " )-----	--
Form 5001-D ( " " " " )-----	147
Misc. precip. records, meteorological data, etc.-----	10
Form 5002 (Mass rainfall curves)-----	251

**PART II**

Final isohyetal maps, in 1 sheet, scale 1: 1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	42
Form S-11 (Depth-area data from isohyetal map)-----	8
Form S-12 (Maximum depth-duration data)-----	12
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	1

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours										144
	6	12	18	24	36	48	60	72	96	120	
Max. Station	16.2	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
10	15.9	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.8	16.9	16.9
100	14.2	14.8	14.9	14.9	14.9	14.9	15.0	15.4	15.6	15.9	15.9
200	13.0	13.5	13.9	13.9	13.9	13.9	13.9	14.4	15.0	15.5	15.5
500	9.2	10.6	11.1	11.1	11.5	12.0	13.7	14.4	14.6	14.9	14.9
1,000	6.2	7.9	8.4	8.5	10.0	10.8	13.2	13.8	14.1	14.9	14.9
2,000	4.0	5.3	6.3	6.6	9.2	10.0	12.6	13.2	13.5	13.7	13.7
5,000	3.0	3.6	4.9	5.4	8.3	8.9	11.5	12.1	12.4	12.5	12.6
10,000	2.6	3.1	4.2	4.8	7.3	8.0	10.2	10.7	11.0	11.3	11.4
20,000	2.1	2.6	3.5	4.2	6.2	6.9	8.6	9.1	9.4	9.8	10.1
50,000	1.6	2.0	2.6	3.4	4.6	5.3	6.6	7.0	7.4	7.8	8.2
100,000	1.1	1.5	2.0	2.6	3.5	4.1	5.0	5.4	5.8	6.4	6.8
200,000	0.7	1.0	1.3	1.7	2.3	2.7	3.5	3.8	4.3	4.9	5.2

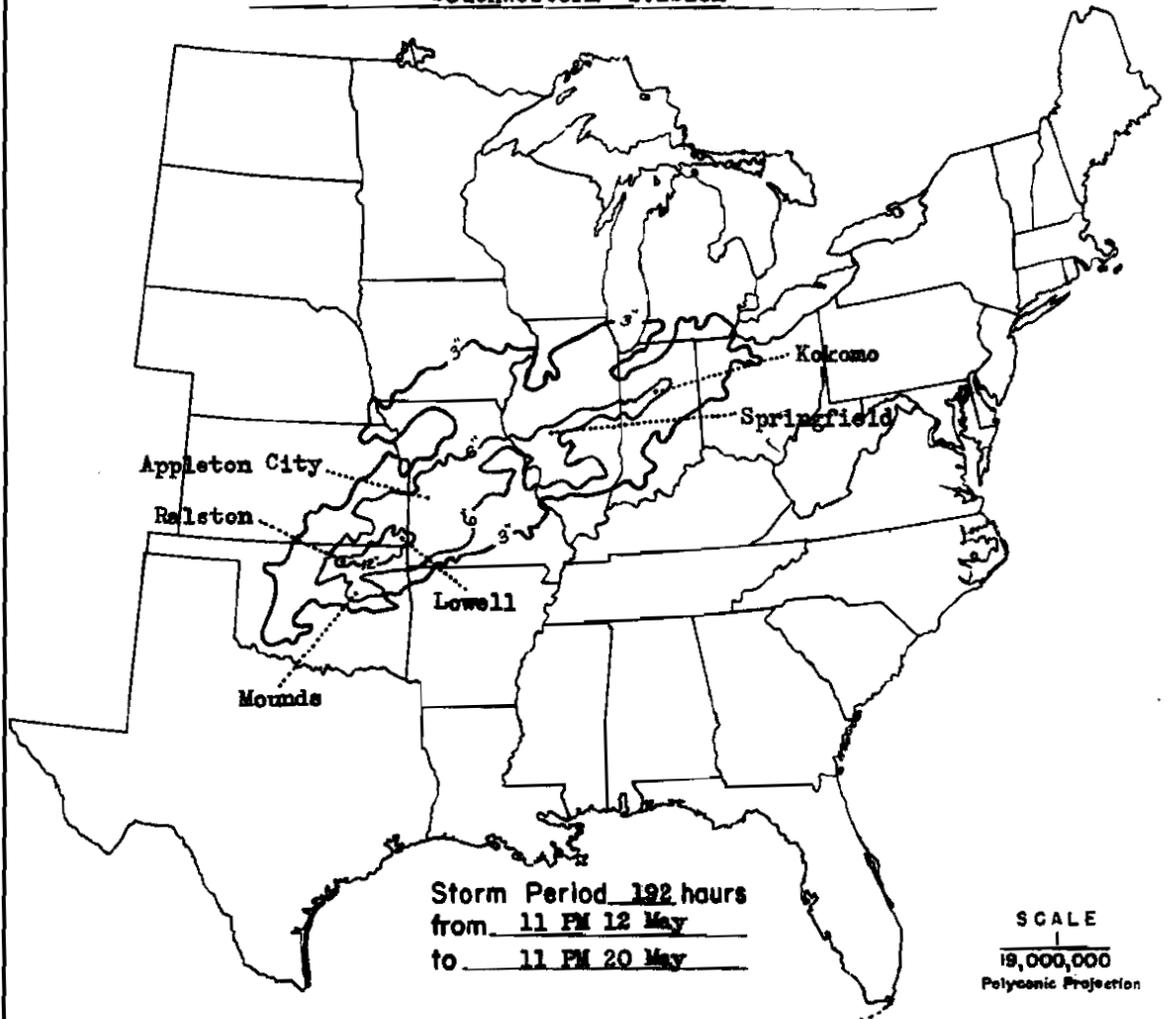
DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - ISOHYETAL MAP**

Storm of 12-20 May 1943 Assignment SW 2-21

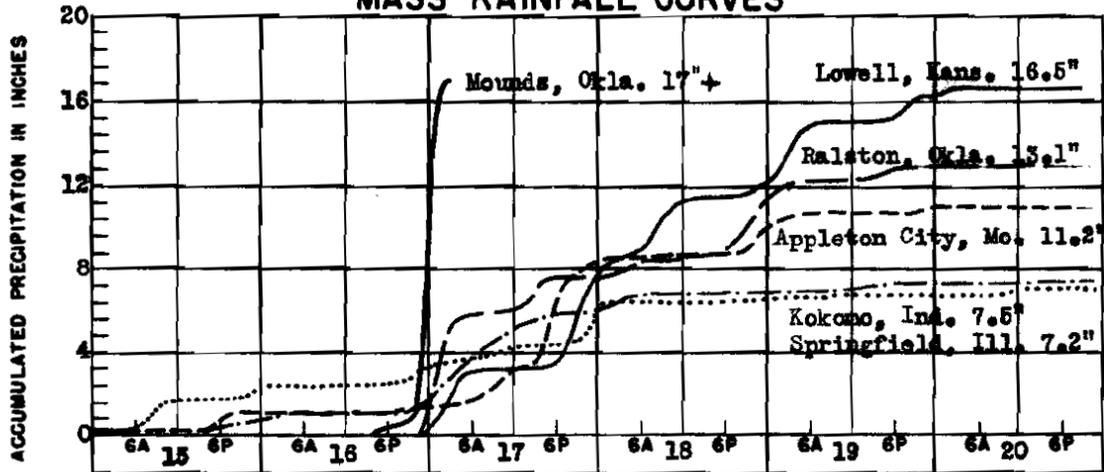
Study Prepared by: Tulsa, Okla. District  
Southwestern Division

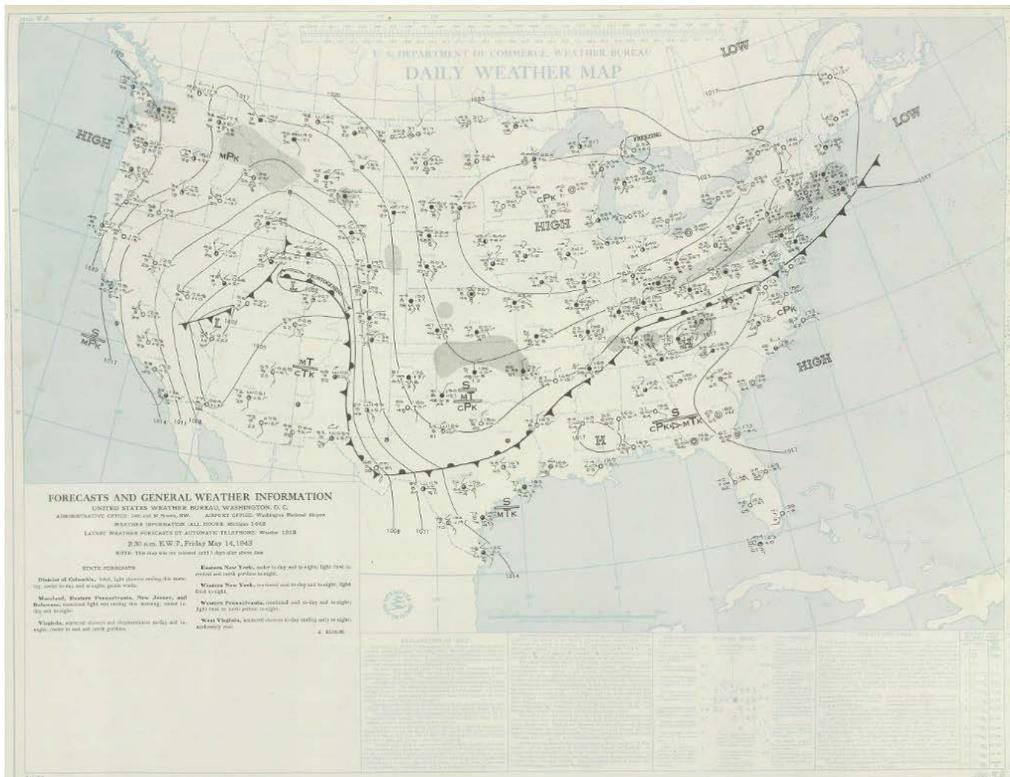
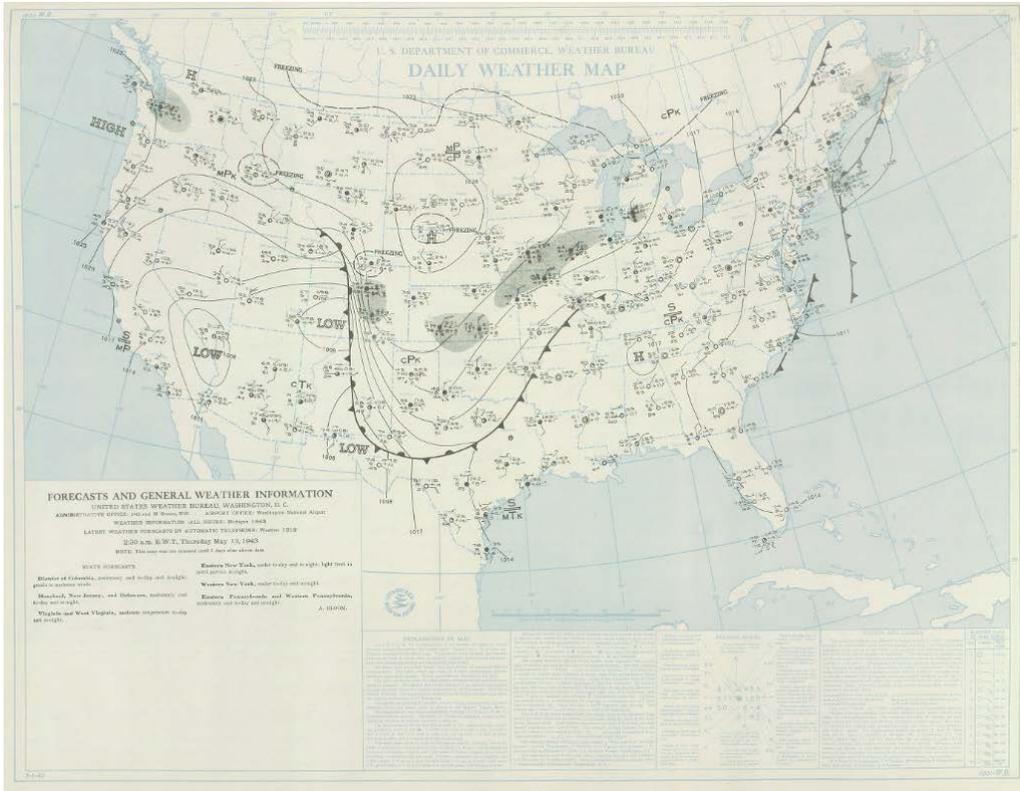


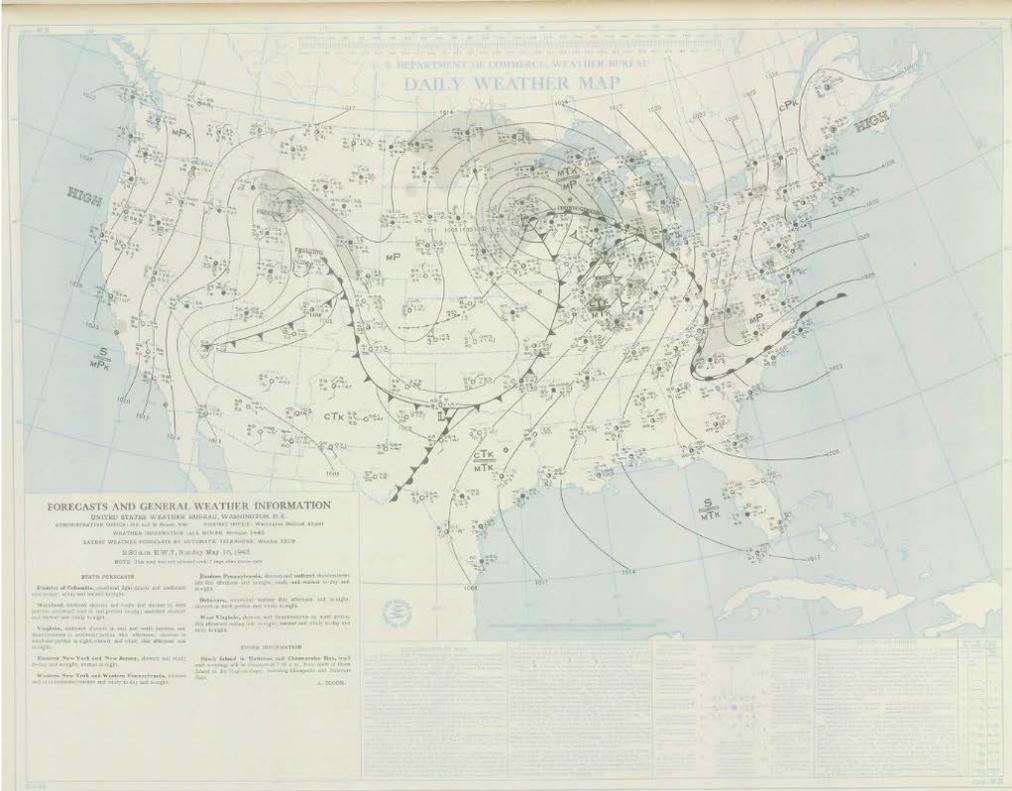
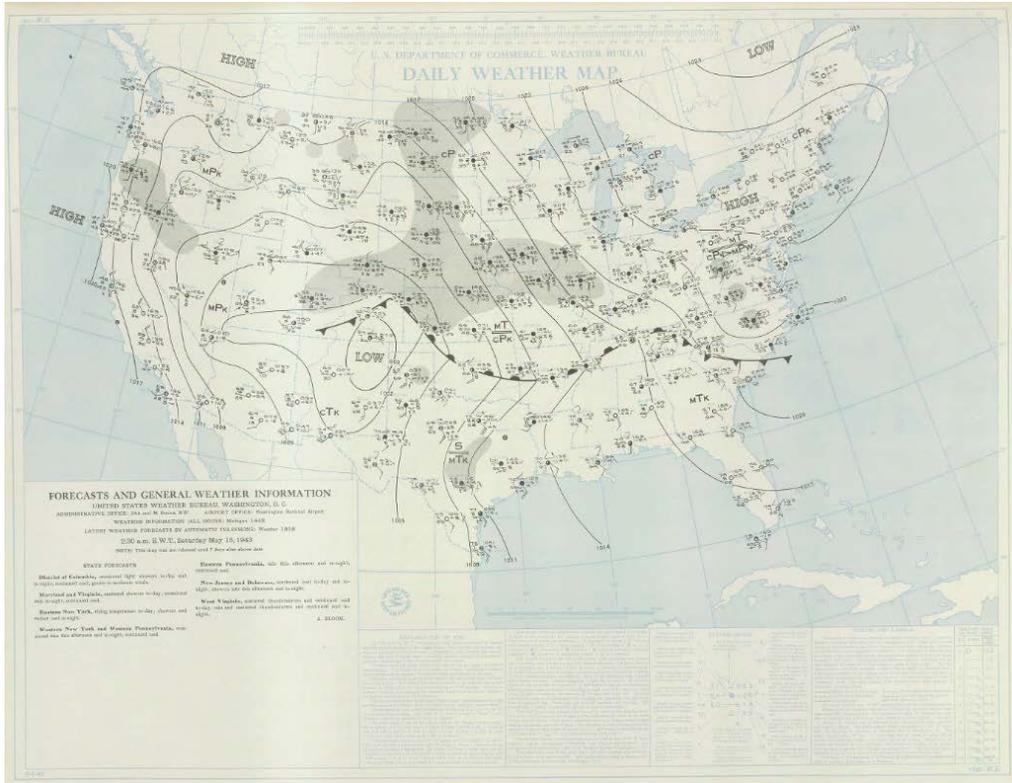
Storm Period 192 hours  
 from 11 PM 12 May  
 to 11 PM 20 May

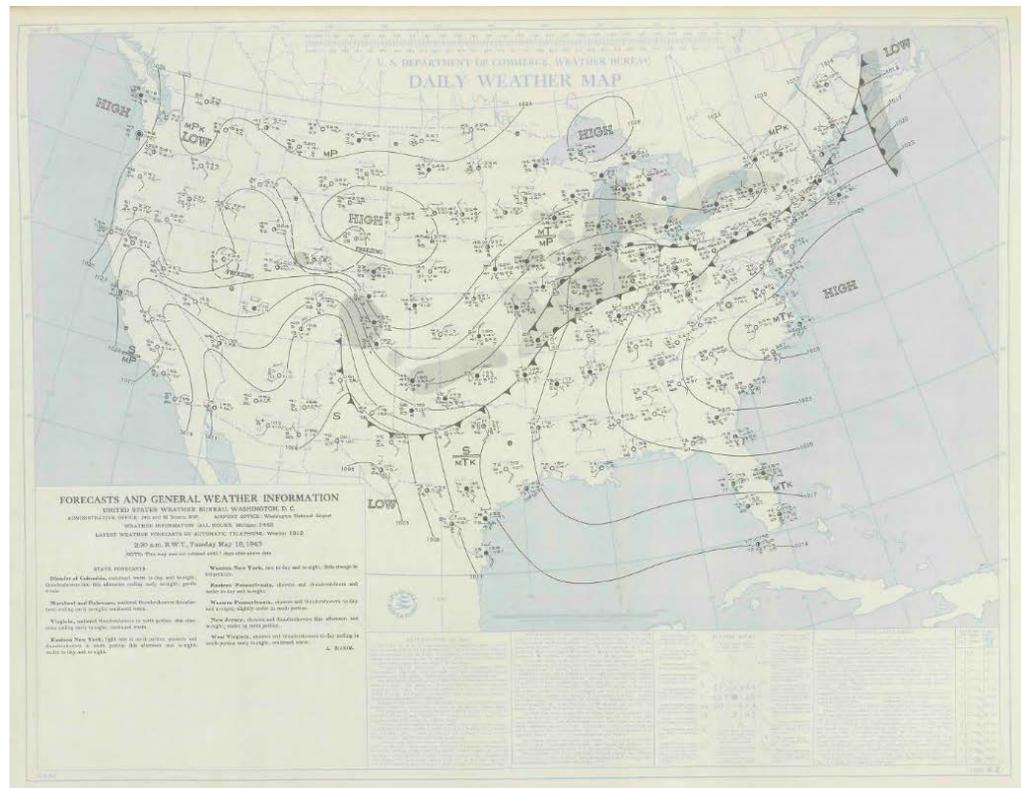
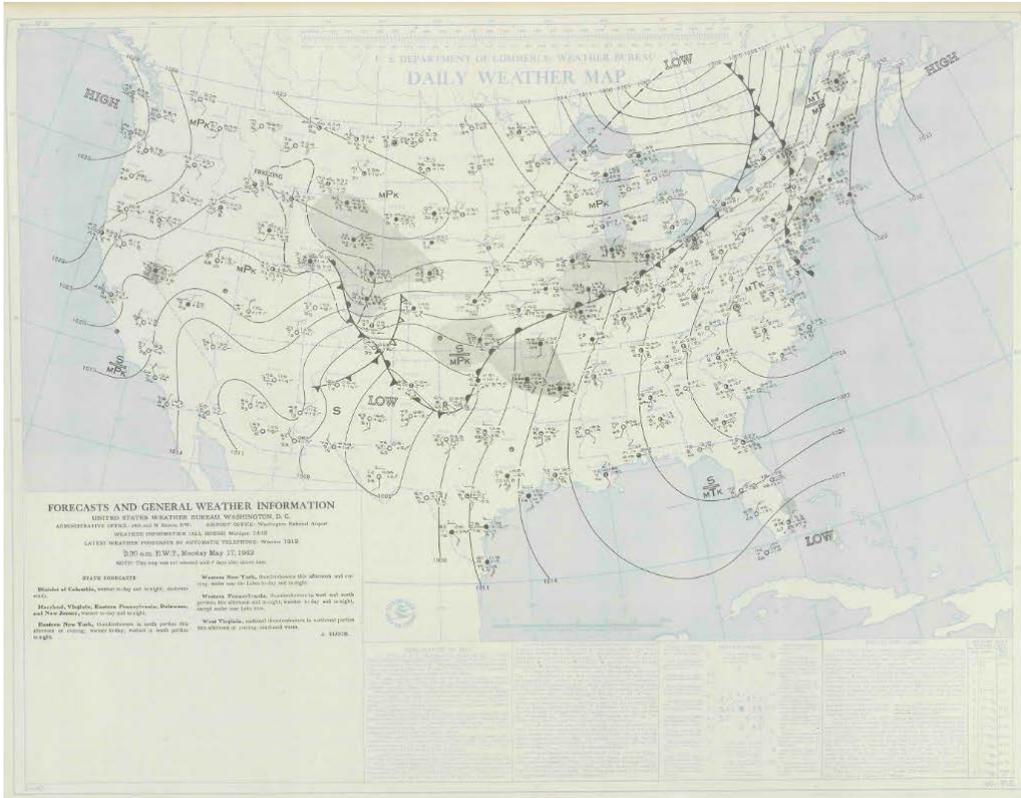
SCALE  
19,000,000  
 Polyconic Projection

**MASS RAINFALL CURVES**



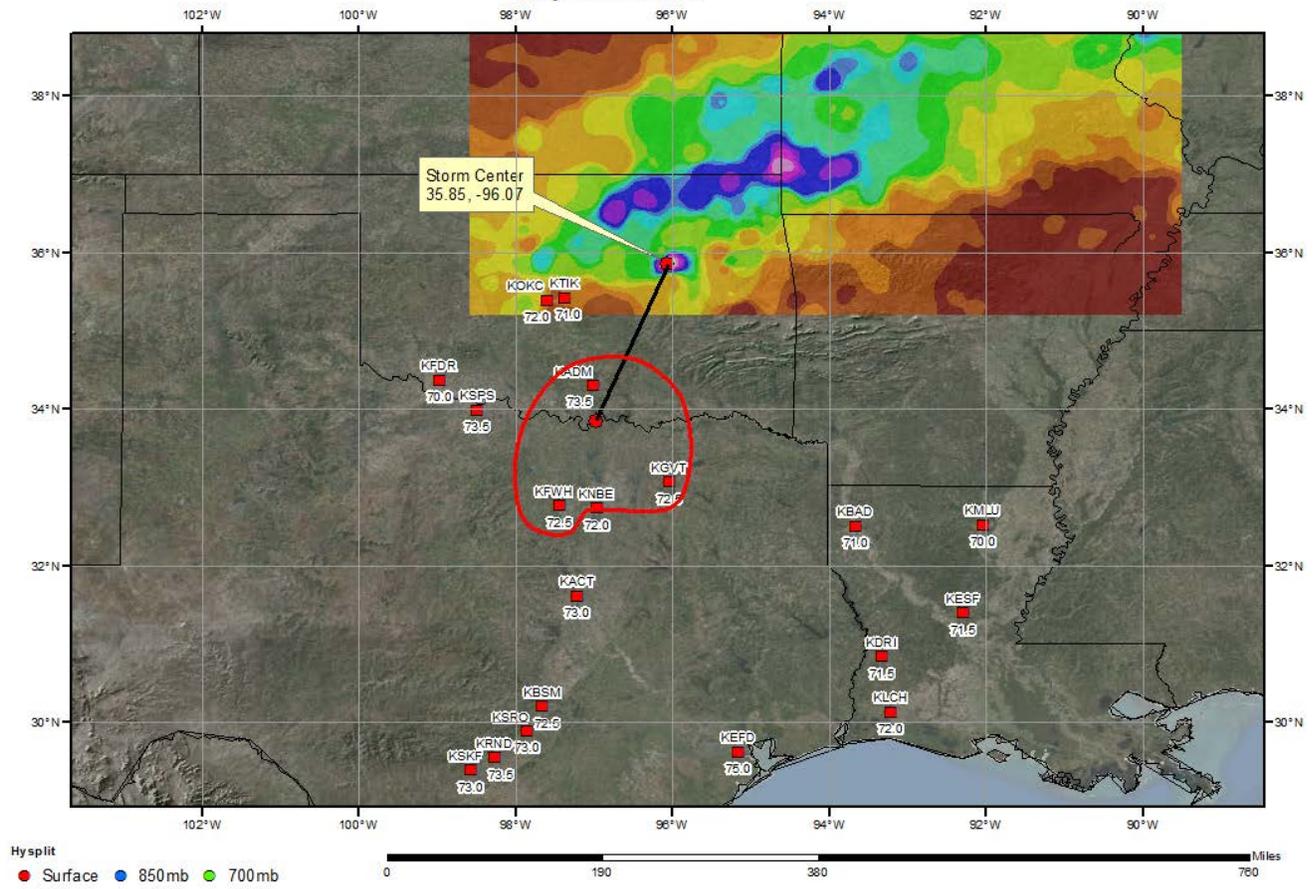






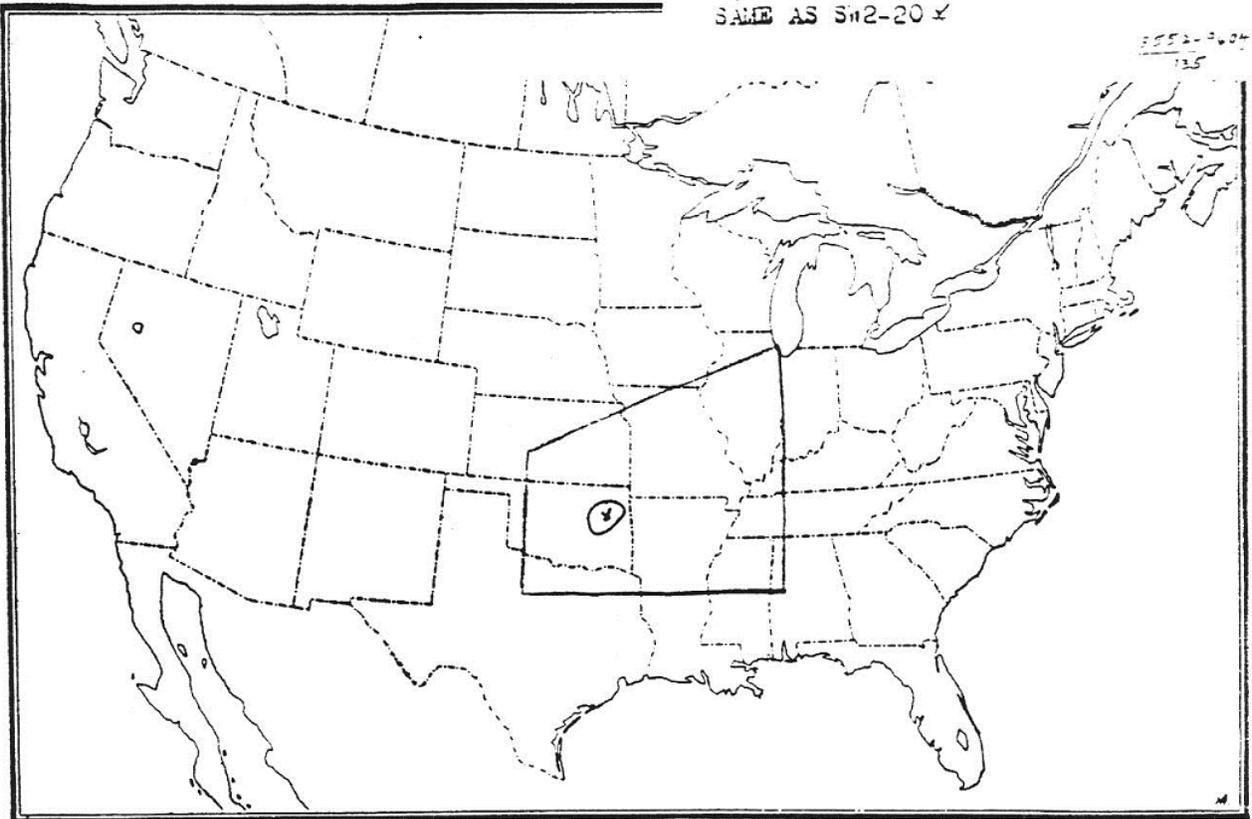


### SPAS 1432 Mounds, OK Storm Analysis May 15-20, 1943



Sw 2-21..May 13-20, 1943..ounds, Oal  
12-hr. rTd 71(16tn)..to 76, 28\$.60

SAME AS Sw2-20 x



## Storm Precipitation Analysis System (SPAS) For Storm #1434\_1

**General Storm Location:** Holt, Missouri

**Storm Dates:** June 18 – June 23, 1947

**Event:** CORPS of Engineers, US Army Assignment MR 8 – 20

### DAD Zone 1

**Latitude:** 39.4542

**Longitude:** -94.3292

**Max. Grid Rainfall Amount:** 17.62”

**Max. Observed Rainfall Amount:** 17.62”

**Number of Stations:** 162

**SPAS Version:** 10.0

**Basemap:** Manually digitized contours using Army CORPS of Engineers isohyetal map.

**Spatial resolution:** 0.2548

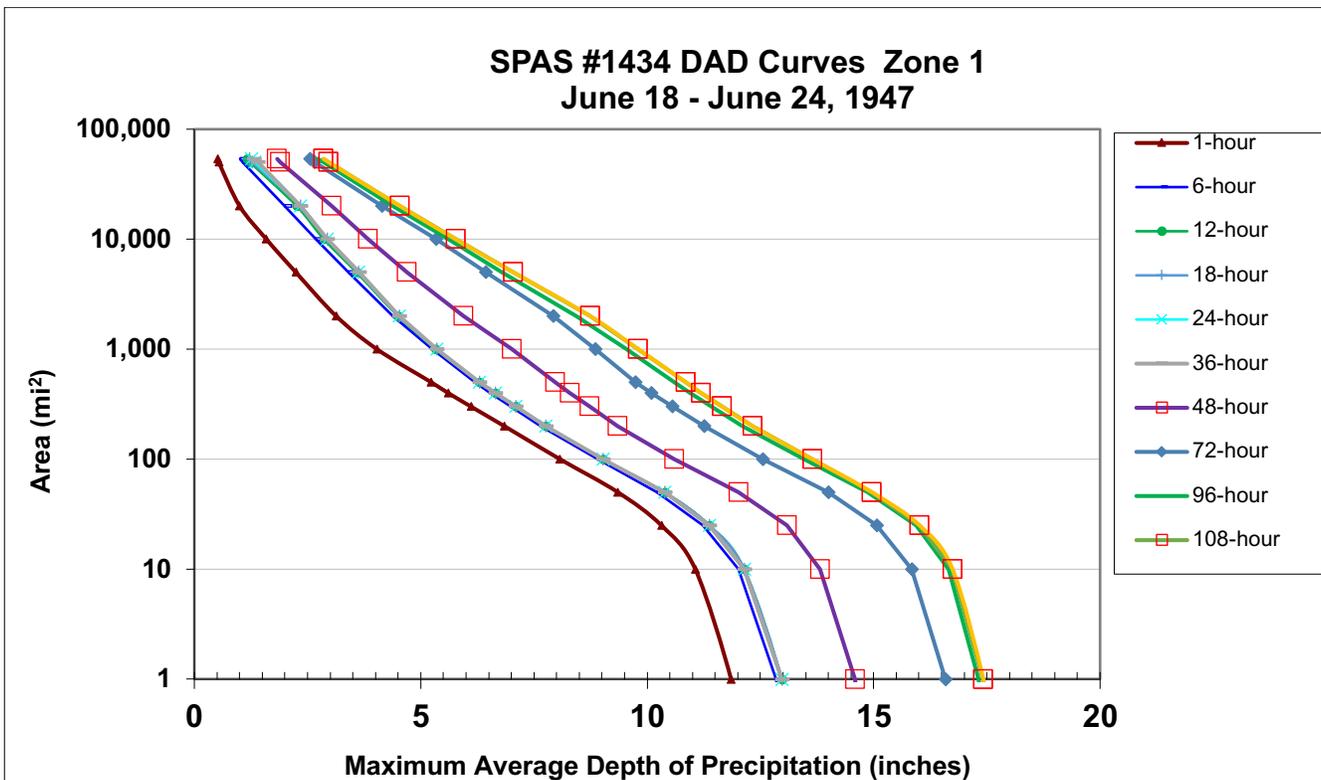
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

**Reliability of results:** Ten of the eleven hourly stations used in this analysis were manually digitized from either the Army CORPS of Engineers’ pertinent data report or from local climatological data. The last hourly station was estimated from the spas precipitation grid due to daily and supplemental stations nearby needing more accurate timing. This provided very high accuracy of the hourly data, which is essential in the timing of the daily and supplemental stations. Of the 28 supplemental stations, 8 were formatted as daily stations. These stations were in the supplemental file due to there being more data on either end of the storm duration as defined for this analysis. For example, if the daily station took measurements in the morning, then there may have been more precipitation reported for the remainder of the storm that was actually part of the following day’s observation. Alternatively, if a station had an observation time in the evening then there could have been data not used from the day before that was valid for the period of the storm and could be added to the analysis. An additional 8 stations found in the CORPS report were added to the supplemental file as well. With all of the data being thoroughly inspected, the DAD and precipitation pattern following closely to the Army CORPS of Engineers report, and the precipitation totals for various periods throughout the storm being consistent with previous reports, this analysis is considered to be reliable.

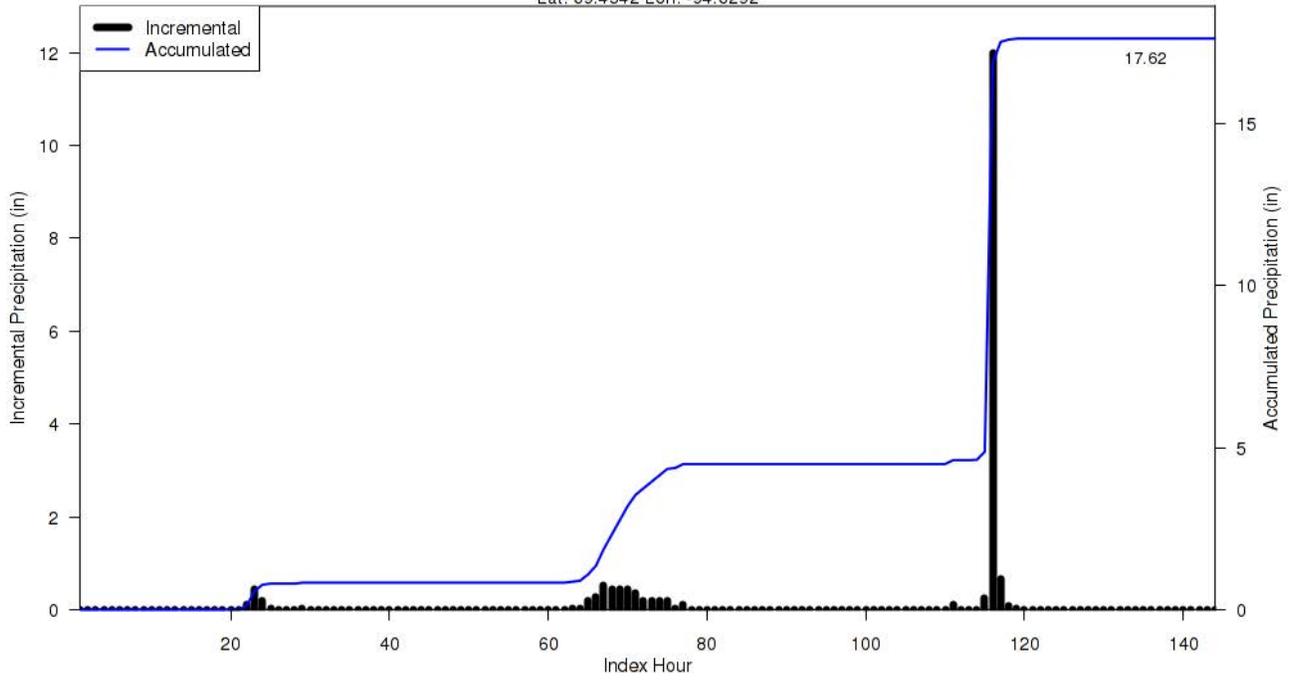
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1434_1	-94.329	39.454	957	1,000	79.00	3.44	0.28	80	3.160	81.63	81.5	3.86	0.30	85	3,560	1.127

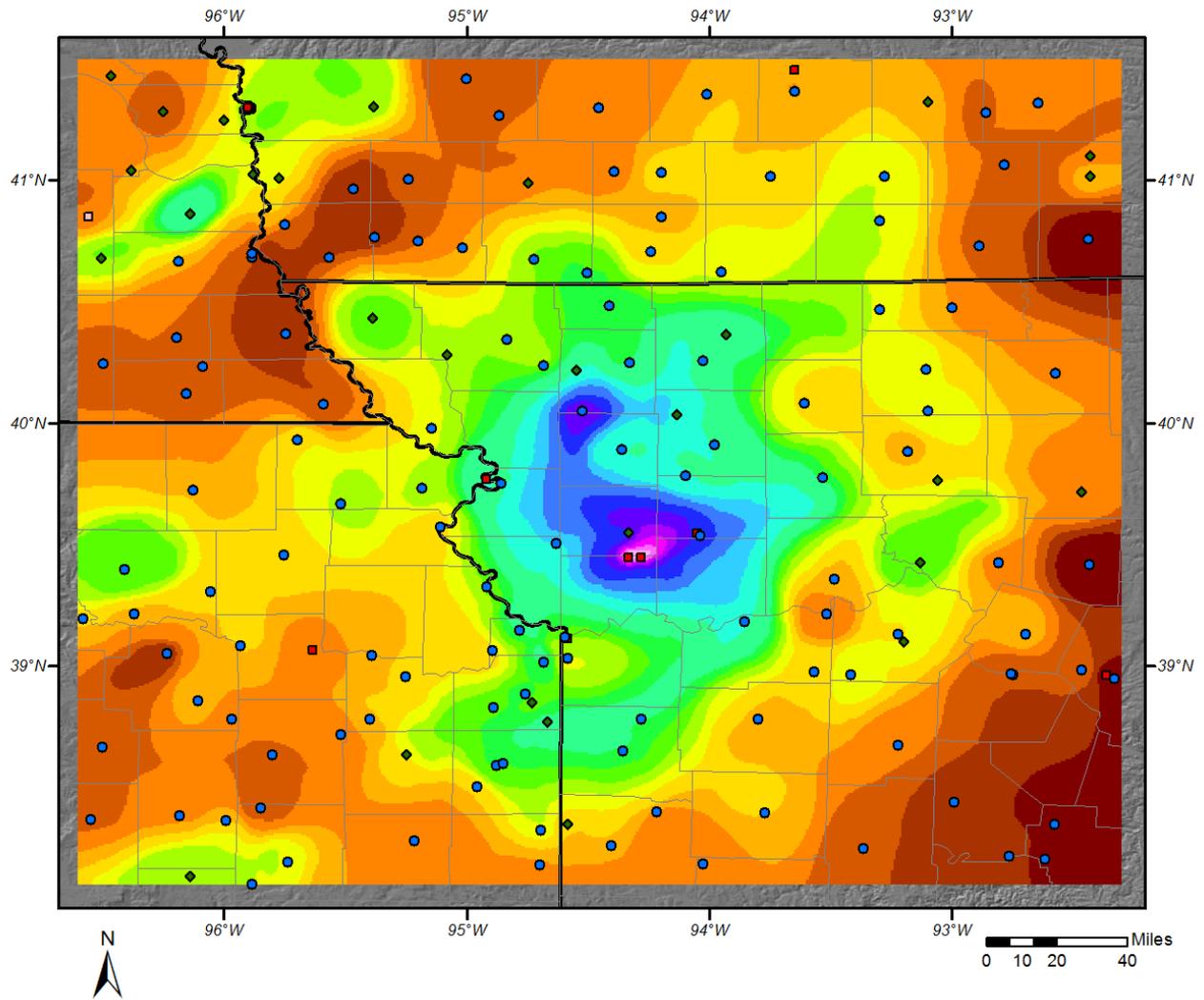
Storm 1434 - June 18 (0700 UTC) - June 24 (0600 UTC), 1947											
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)											
Area (mi <sup>2</sup> )	Duration (hours)										
	1	6	12	18	24	36	48	72	96	108	Total
0.4	11.95	12.96	13.08	13.08	13.08	13.08	14.71	16.72	17.45	17.55	17.55
1	11.85	12.85	12.97	12.97	12.97	12.97	14.59	16.58	17.31	17.42	17.42
10	11.06	12.01	12.14	12.14	12.14	12.14	13.81	15.84	16.66	16.74	16.74
25	10.31	11.23	11.37	11.37	11.37	11.37	13.08	15.07	15.94	16.01	16.01
50	9.35	10.22	10.38	10.38	10.38	10.38	12.01	14.00	14.87	14.96	14.96
100	8.07	8.91	9.02	9.02	9.02	9.02	10.60	12.55	13.46	13.64	13.64
200	6.84	7.65	7.75	7.75	7.75	7.75	9.35	11.25	12.10	12.32	12.32
300	6.11	6.99	7.09	7.09	7.09	7.09	8.72	10.55	11.41	11.65	11.65
400	5.60	6.54	6.64	6.64	6.64	6.64	8.29	10.09	10.95	11.19	11.19
500	5.23	6.20	6.29	6.30	6.30	6.30	7.97	9.74	10.60	10.85	10.85
1,000	4.03	5.25	5.33	5.35	5.35	5.35	7.01	8.85	9.54	9.80	9.80
2,000	3.13	4.39	4.50	4.53	4.53	4.53	5.95	7.92	8.43	8.74	8.74
5,000	2.24	3.40	3.58	3.63	3.63	3.64	4.69	6.44	6.79	7.04	7.04
10,000	1.59	2.68	2.86	2.93	2.93	2.93	3.84	5.34	5.60	5.77	5.77
20,000	1.00	2.00	2.26	2.34	2.34	2.34	3.03	4.15	4.39	4.54	4.54
50,000	0.54	1.06	1.23	1.28	1.34	1.40	1.90	2.66	2.85	2.97	2.97
53,668	0.52	1.01	1.17	1.22	1.27	1.32	1.83	2.55	2.73	2.85	2.85



SPAS 1434 Storm Center Mass Curve Zone 1  
June 18 (0700UTC) to June 24 (0600UTC), 1947

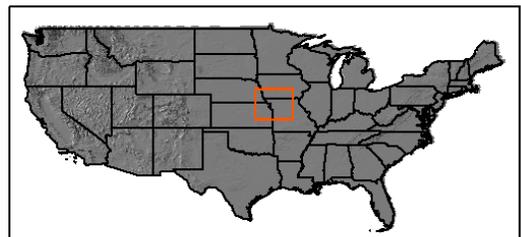
Lat: 39.4542 Lon: -94.3292



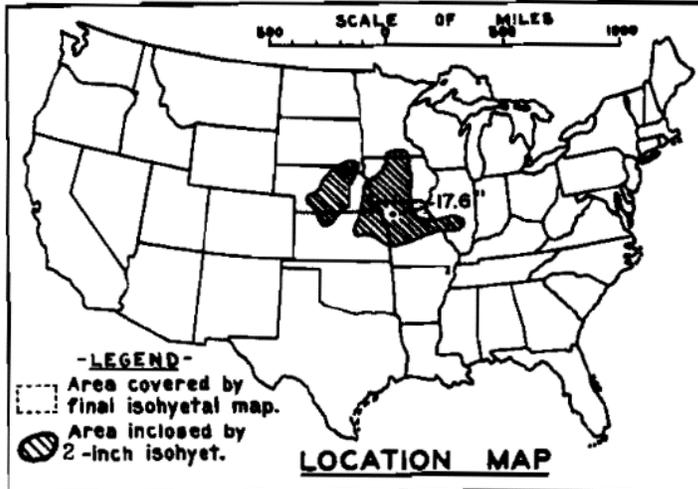


**Total 108-hour Precipitation (inches)**  
**June 19, 1947 0000 UTC - June 23, 1947 1200 UTC**  
**SPAS #1434**

Precipitation (inches)				Stations
0.00 - 0.50	2.51 - 3.00	5.01 - 6.00	10.1 - 11.5	● D
0.51 - 1.00	3.01 - 3.50	6.01 - 7.00	11.6 - 13.0	■ H
1.01 - 1.50	3.51 - 4.00	7.01 - 8.00	13.1 - 14.5	□ HE
1.51 - 2.00	4.01 - 4.50	8.01 - 9.00	14.6 - 16.0	◆ S
2.01 - 2.50	4.51 - 5.00	9.01 - 10.0	16.1 - 17.5	□
			17.6 +	



**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 18-23 June 1947  
 Assignment MR 8-20  
 Location Ill, Ia, Kans, Minn.  
 Mo, Nebr, & S.Dak.  
 Study Prepared by:  
 Missouri River Division  
 Omaha District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 12/17/52  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 9/10/54

**Remarks:**

Center near Holt, Mo.  
 Dewpoint 75°, Ref. Pt. 140 S

**DATA AND COMPUTATIONS COMPILED** Grid E-14

**PART I**

Preliminary Isohyetal map, in \_\_\_\_\_ sheet, scale \_\_\_\_\_  
 Precipitation data and mass curves: \_\_\_\_\_ (Number of Sheets)  
 Form 5001-C (Hourly precip. data) -- NOTE: This study was computed  
 Form 5001-B (24-hour " " ) ----- by the Regional Method  
 Form 5001-D ( " " " " ) ----- which does not employ the  
 Misc. precip. records, meteorological data, etc. Part I and Part II phases  
 Form 5002 (Mass rainfall curves) ----- in their entirety.

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:100,000  
 Data and computation sheets:  
 Form S-10 (Data from mass rainfall curves) ----- 9  
 Form S-11 (Depth-area data from isohyetal map) ----- 4  
 Form S-12 (Maximum depth-duration data) ----- 7  
 Maximum duration-depth-area curves ----- 1  
 Data relating to periods of maximum rainfall -----

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours									
	6	12	18	24	36	48	72	96	120	
Max. Station	12.0	12.0	12.0	12.0	12.0	14.4	16.6	18.6	17.6	
10	11.5	11.5	11.5	11.5	11.5	12.6	15.9	15.8	16.9	
100	7.9	7.9	7.9	7.9	7.9	9.3	12.9	12.9	14.1	
200	7.1	7.1	7.1	7.1	7.1	8.4	11.9	11.9	13.0	
500	6.3	6.3	6.3	6.3	6.3	7.4	10.6	10.6	11.6	
1000	5.6	5.6	5.6	5.6	5.6	6.6	9.6	9.6	10.5	
2000	4.9	4.9	4.9	4.9	4.9	5.7	8.4	8.4	9.3	
5000	3.5	3.7	3.7	3.7	3.7	4.6	6.7	6.7	7.3	
10000	2.6	2.9	3.0	3.0	3.0	3.7	5.4	5.4	5.9	
20000	1.8	2.1	2.2	2.2	2.2	3.1	4.4	4.6	4.9	
50000	1.2	1.4	1.5	1.6	1.8	2.5	3.2	3.5	3.8	
100000	0.8	1.0	1.1	1.4	1.6	2.1	2.7	2.9	3.0	
200000	0.7	0.7	0.8	1.1	1.4	1.7	2.1	2.2	2.3	
306000	0.5	0.5	0.6	0.7	0.9	1.2	1.6	1.6	1.8	

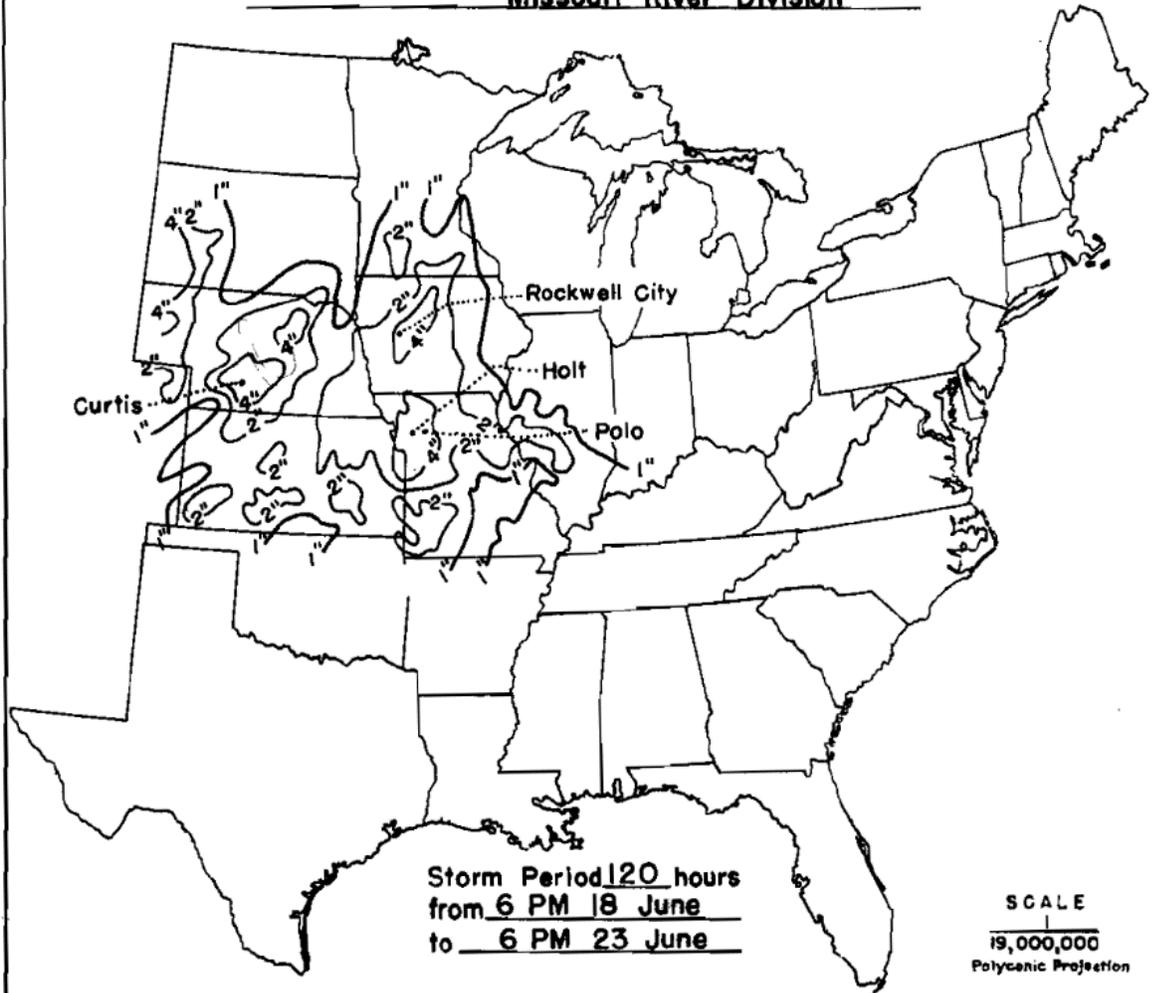
DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

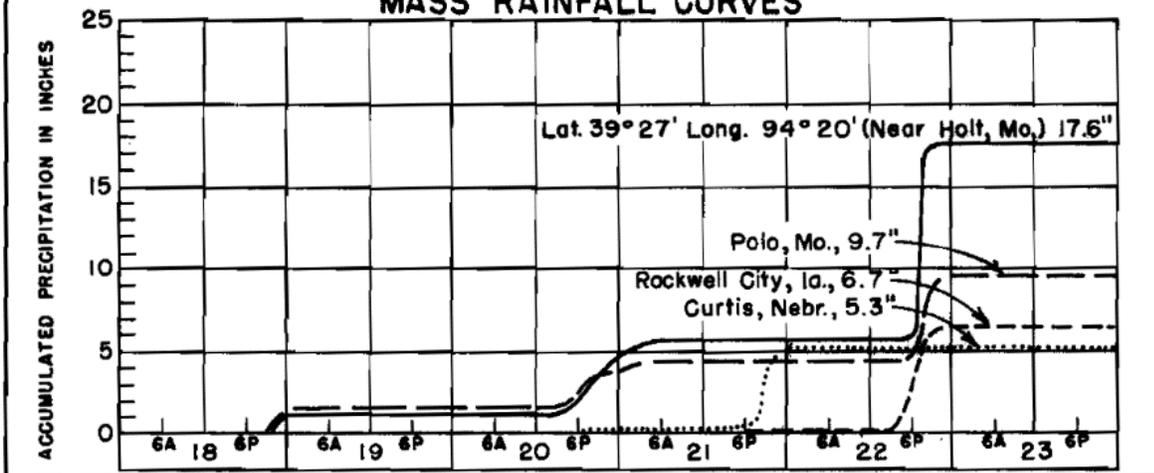
**STORM STUDIES - ISOHYETAL MAP**

Storm of 18-23 June 1947 Assignment MR 8-20

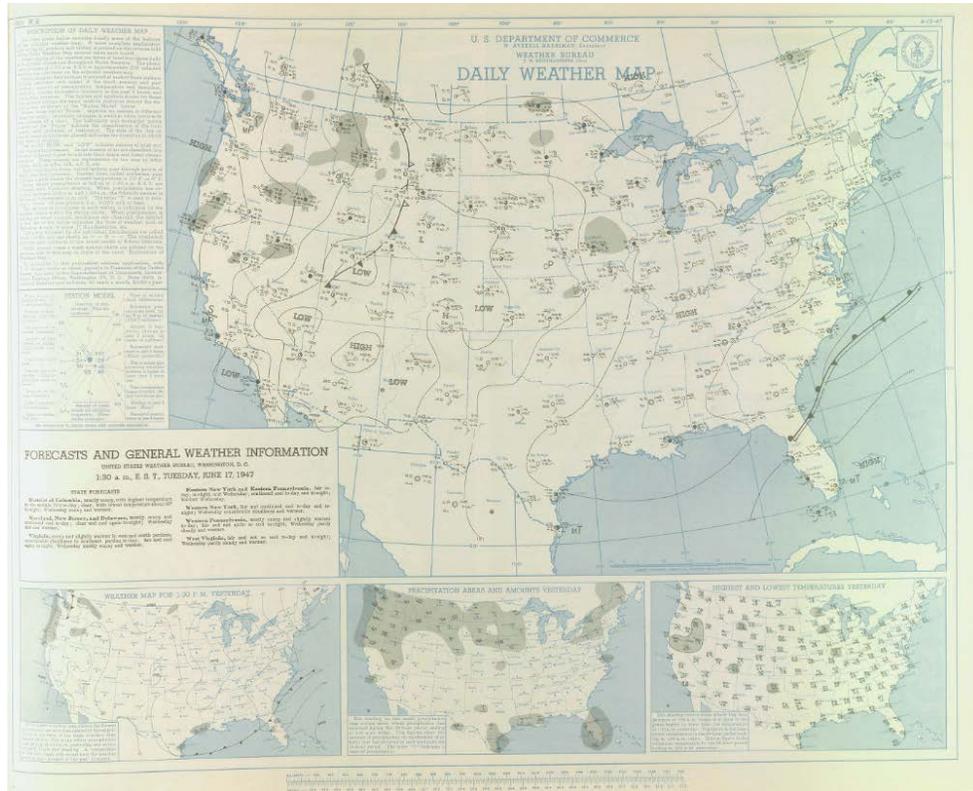
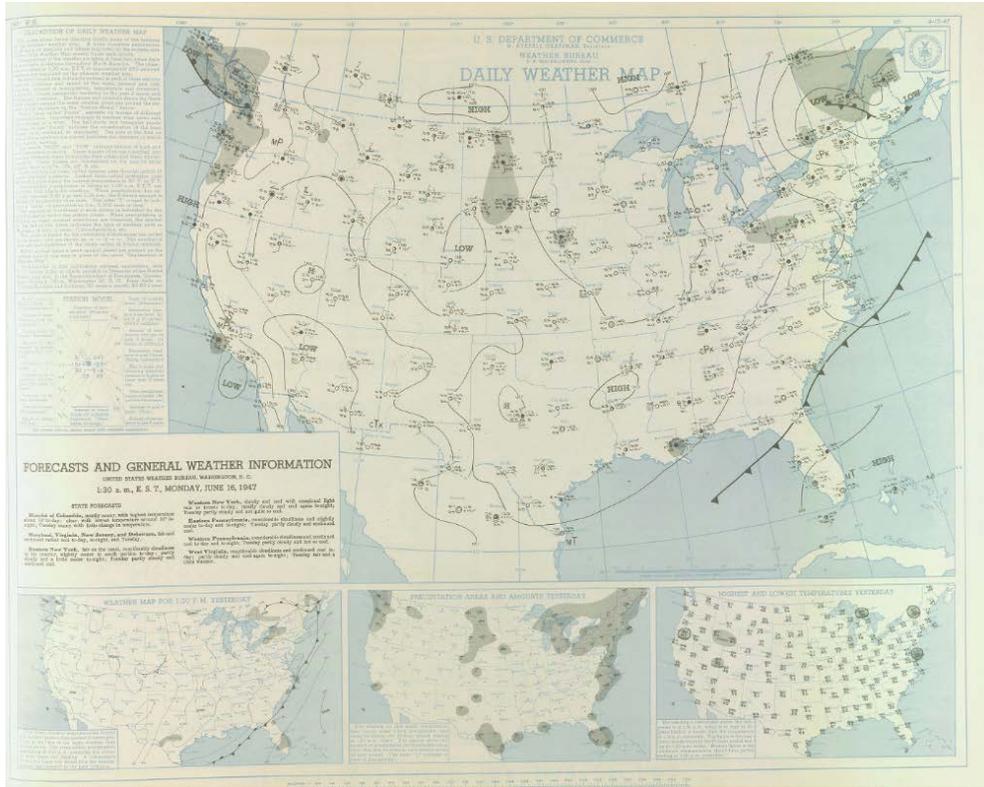
Study Prepared by: Omaha, Nebr., District  
Missouri River Division

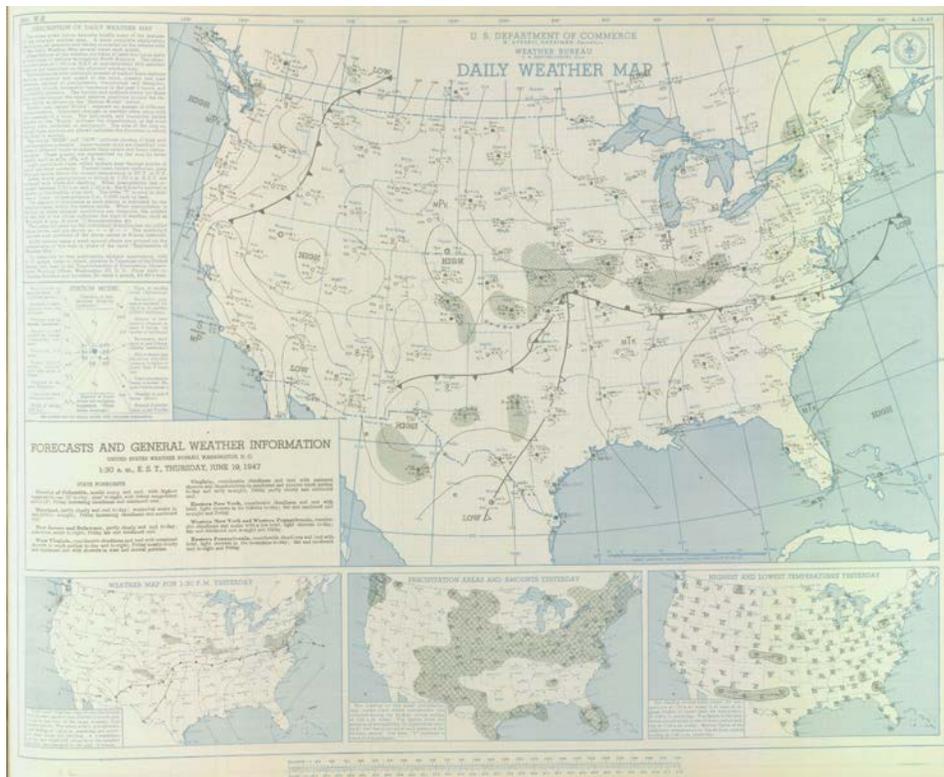
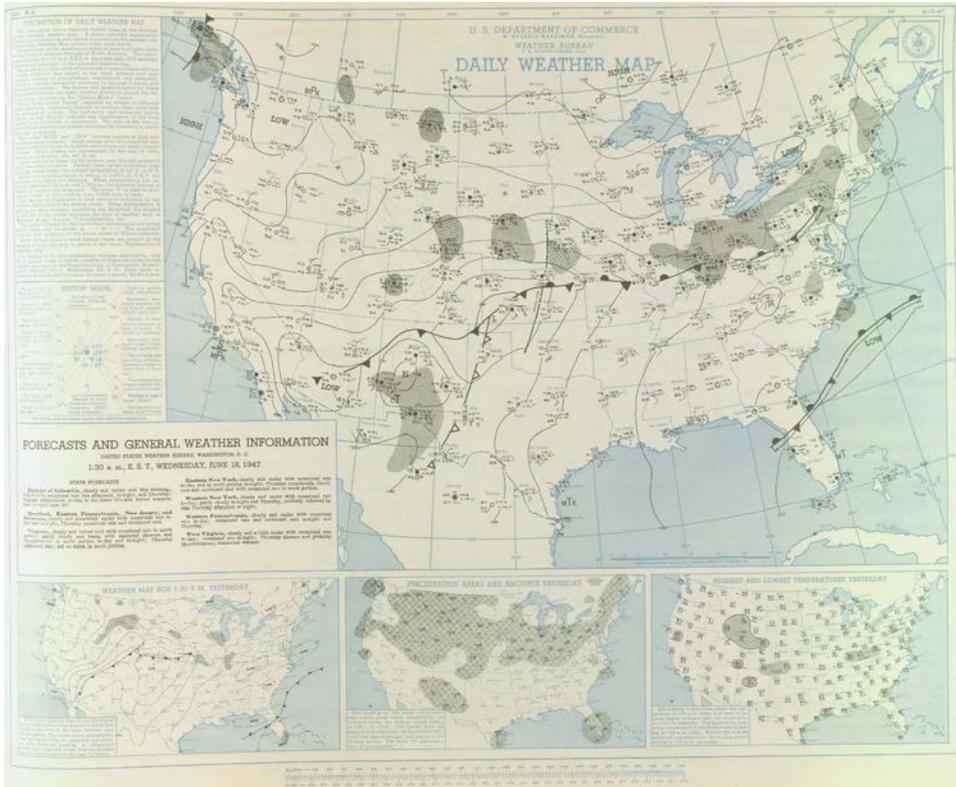


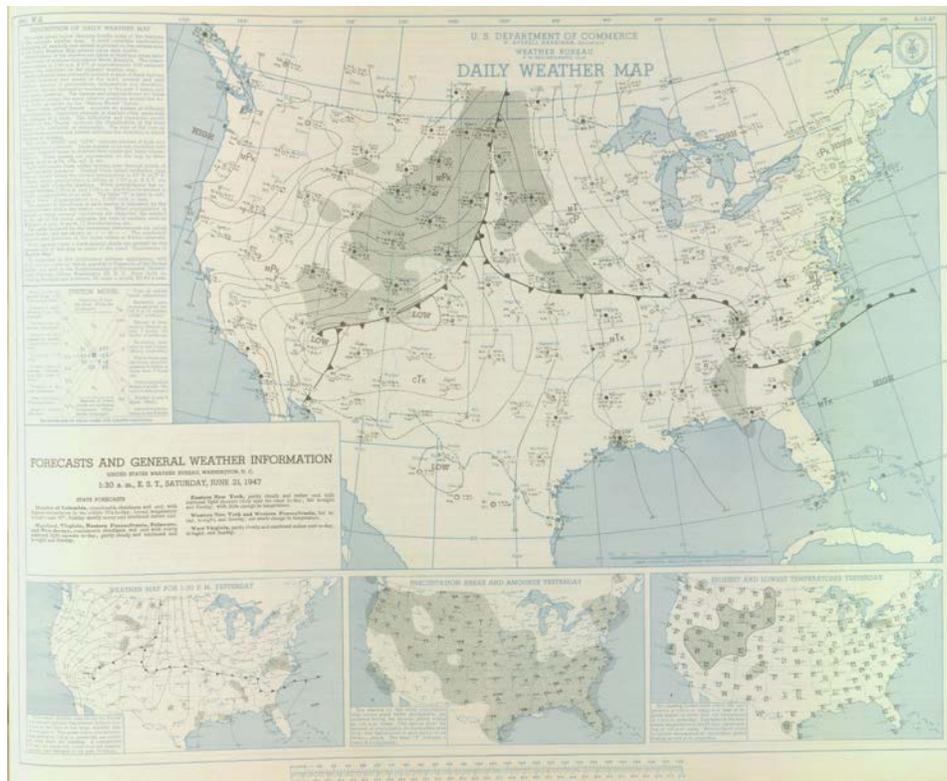
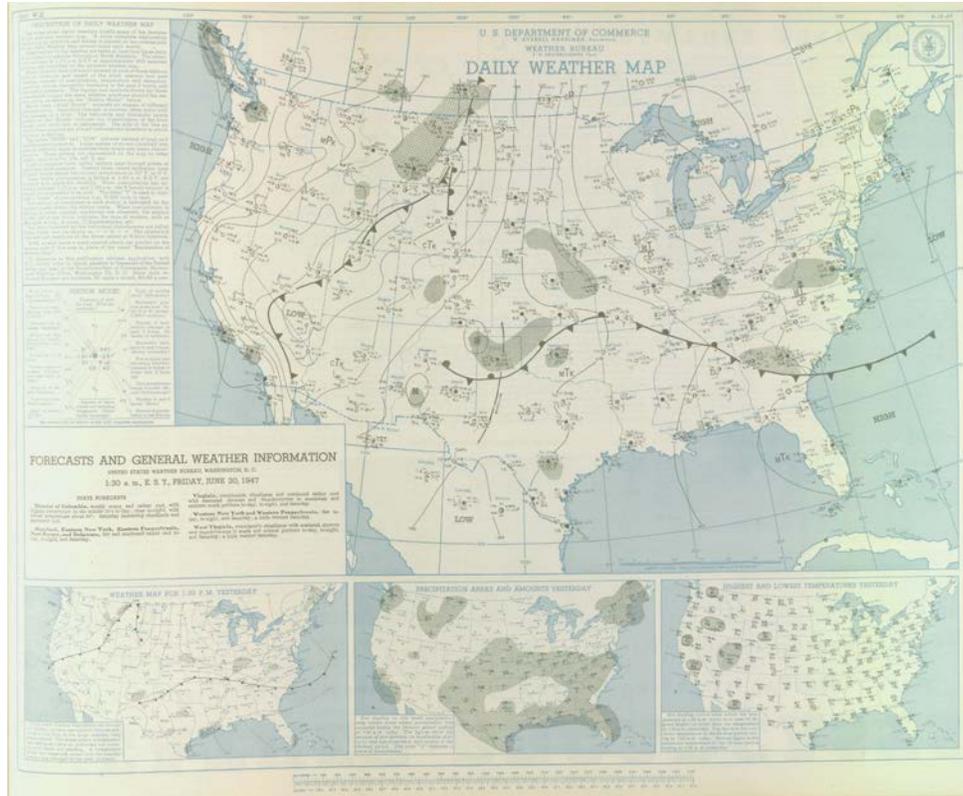
**MASS RAINFALL CURVES**

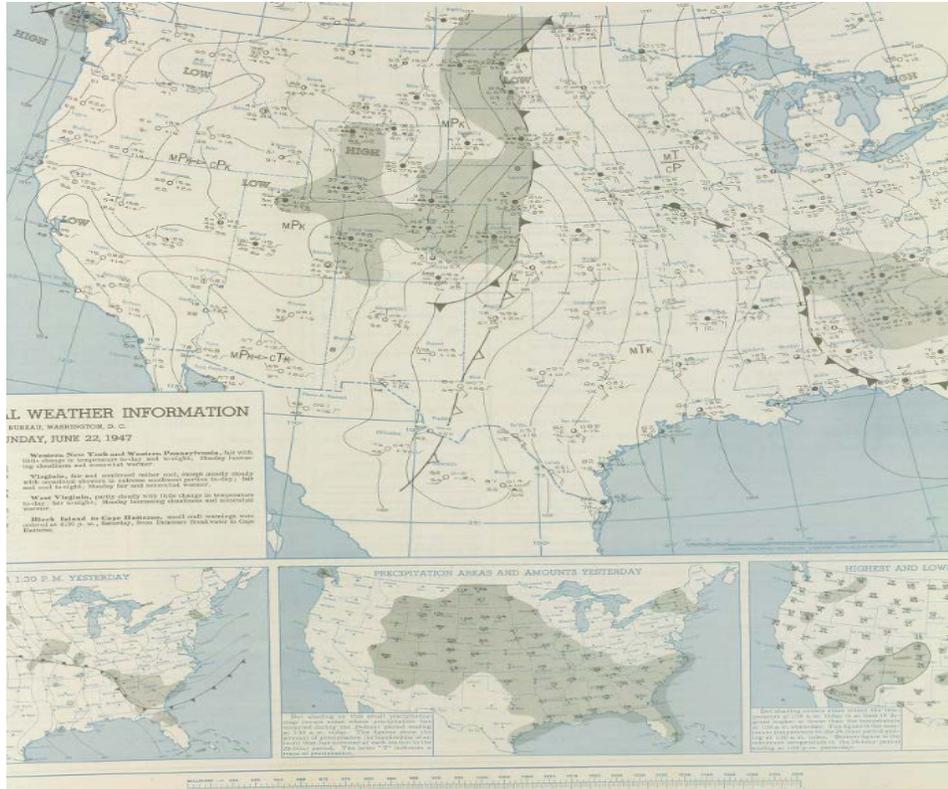


FORM 8-3E

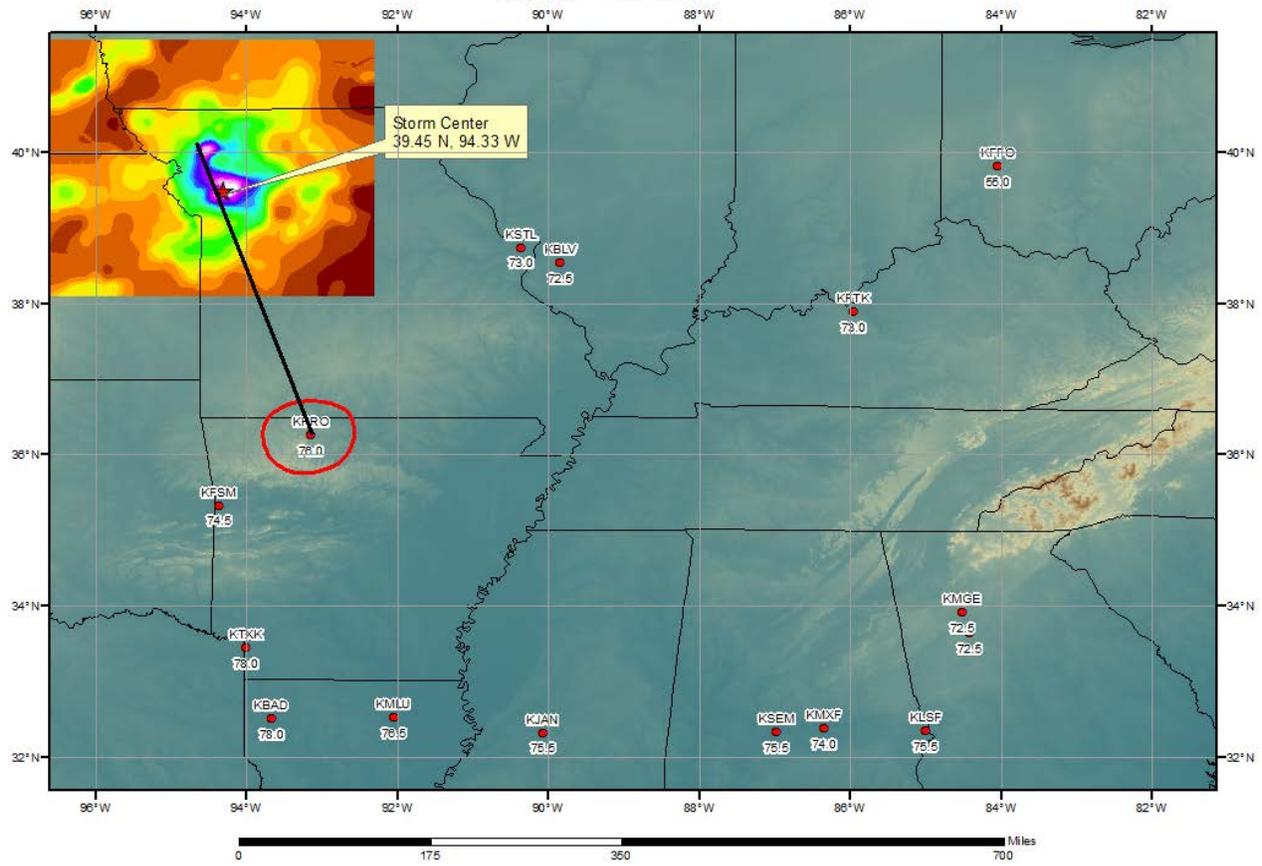








### SPAS 1434 Holt, MO Storm Analysis June 20 - 23, 1947



## Storm Precipitation Analysis System (SPAS) For Storm #1613\_1

**General Storm Location:** Northern Colorado

**Storm Dates:** June 6-8, 1948

**Event:** Local

**DAD Zone 1**

**Latitude:** 39.7875

**Longitude:** -105.2875

**Max. Grid Rainfall Amount:** 6.00”

**Max. Observed Rainfall Amount:** 6.00” (Golden, CO)

**Number of Stations:** 17

**SPAS Version:** 10.0

**Basemap:** USACE Isohyetal Map

**Spatial resolution:** 0.2549

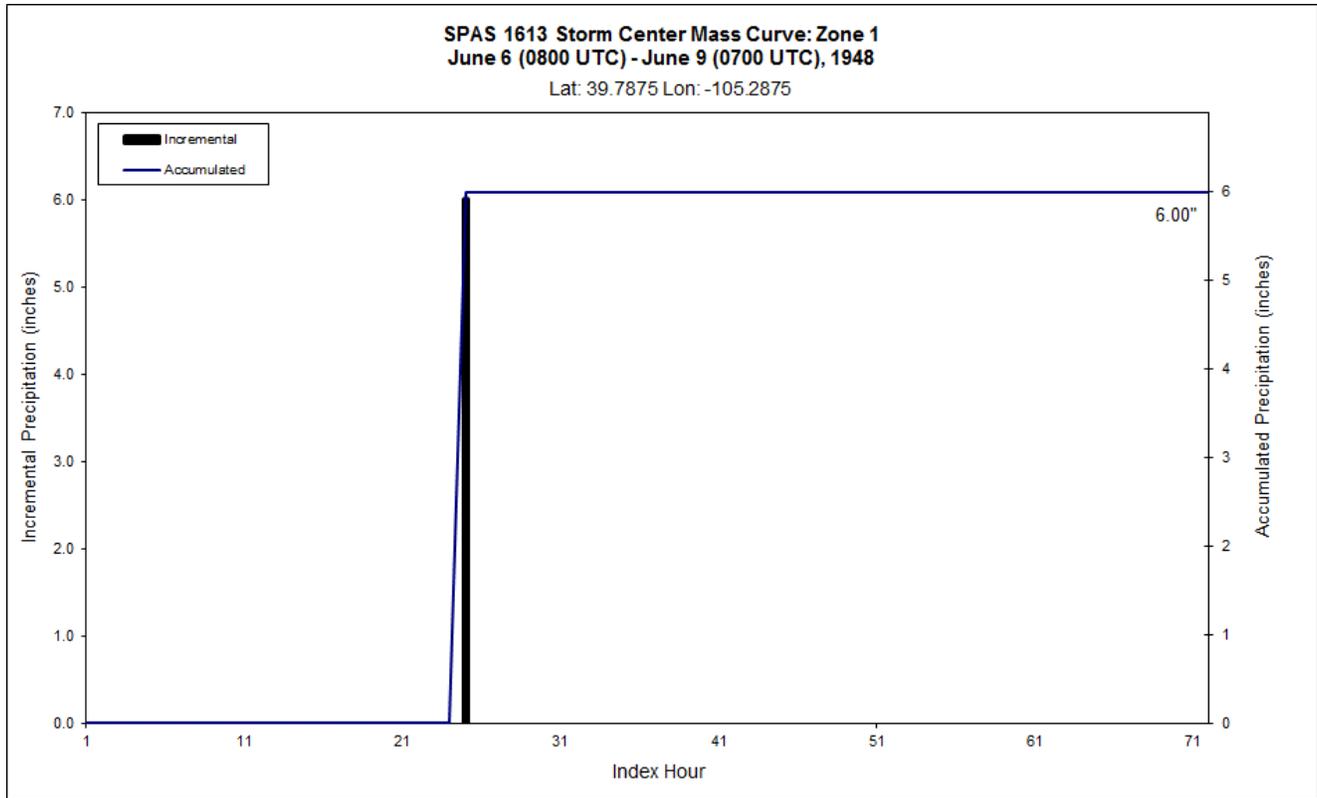
**Radar Included:** No

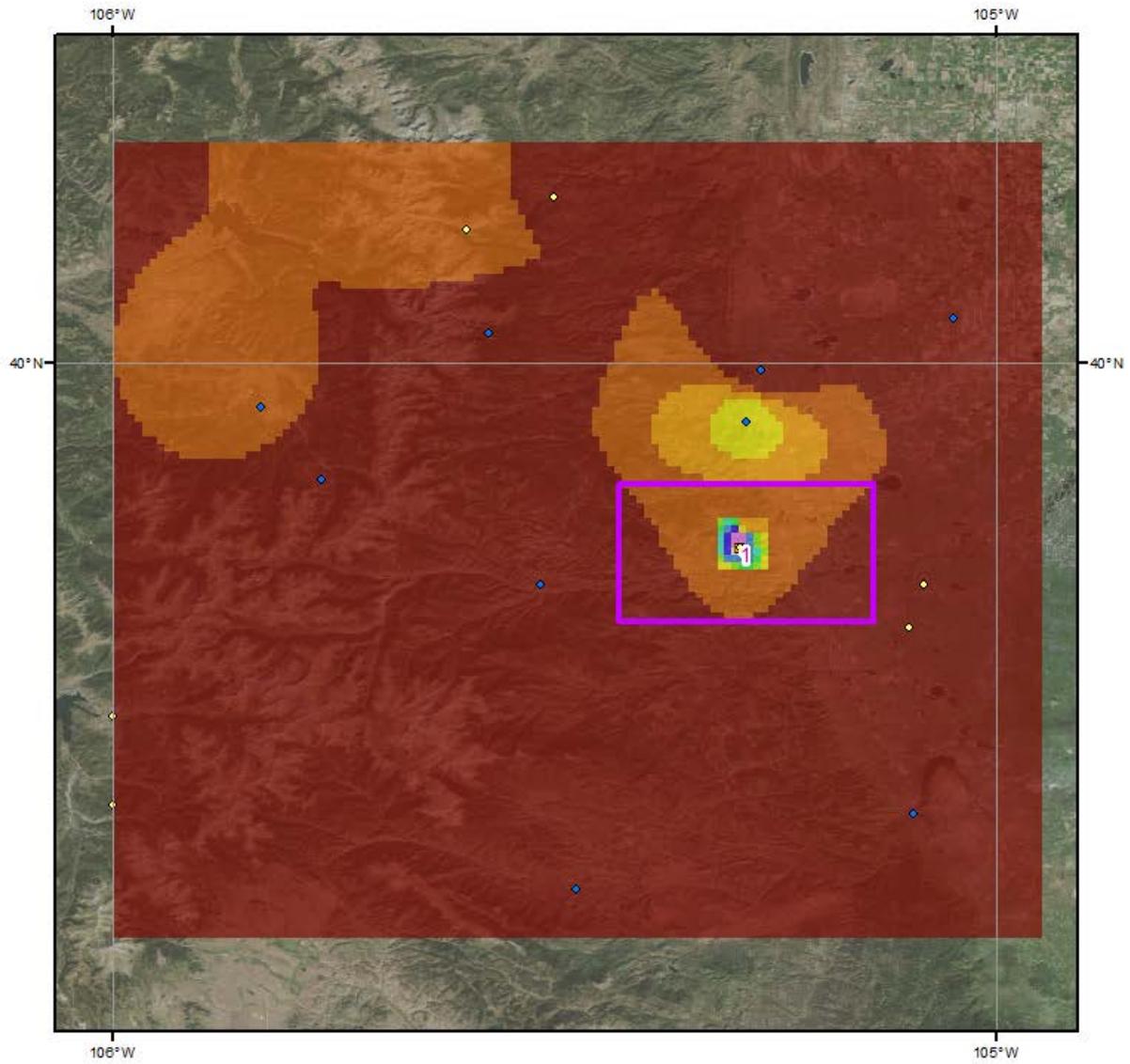
**Depth-Area-Duration (DAD) analysis:** Yes

**Reliability of results:** This analysis was based on 17 hourly stations, daily data, and supplemental station data. We have a good degree of confidence for the station based storm total results. The spatial pattern is dependent heavily on the basemap created from the USGS Isohyetal image. Timing is based on the hourly pseudo station near the storm center. Several daily stations were moved to supplemental stations due to timing issues and to ensure data consistency.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1613_1	-105.288	39.788	7,154	7,000	74.00	2.73	1.38	70	1.350	79.94	80.0	3.60	1.70	82	1.900	1.407



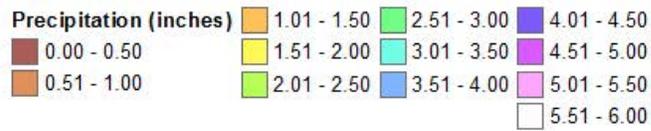
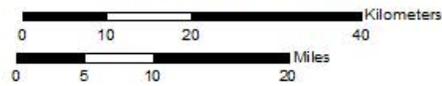




**Total Storm (72-hours) Precipitation (inches)**  
**June 6-8, 1948**  
**SPAS 1613 - Golden, CO**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Pseudo
- ◇ Supplemental



7/21/2016

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 7 June 1948  
 Assignment NR 7-19  
 Location Colorado  
 Study Prepared by:  
 Missouri River Division  
 Omaha District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 10/1/52  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 4/30/57

Remarks:  
 Center Near Golden, Colo.  
 Dewpoint 65° Ref. Pt.  
 310 SE

**DATA AND COMPUTATIONS COMPILED** Grid E-20

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1" = 2 Miles  
 Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	0
Form 5001-B (24-hour " " ).....	0
Form 5001-D ( " " " " ).....	1
Misc. precip. records, meteorological data, etc.....	21
Form 5002 (Mass rainfall curves).....	3

**PART II**

Final isohyetal maps, in 1 sheet, scale 1" = 2 Miles  
 Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	1
Form S-11 (Depth-area data from isohyetal map).....	1
Form S-12 (Maximum depth-duration data).....	2
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	3

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours									
	1	2								
Max. Station	6.0	6.0								
1	5.6	5.6								
2	4.9	4.9								
5	3.9	4.0								
8	3.8	3.6								

DEPARTMENT OF THE ARMY CORPS OF ENGINEERS

### STORM STUDIES - ISOHYETAL MAP

Storm of 7 June 1948 Assignment MR 7-19

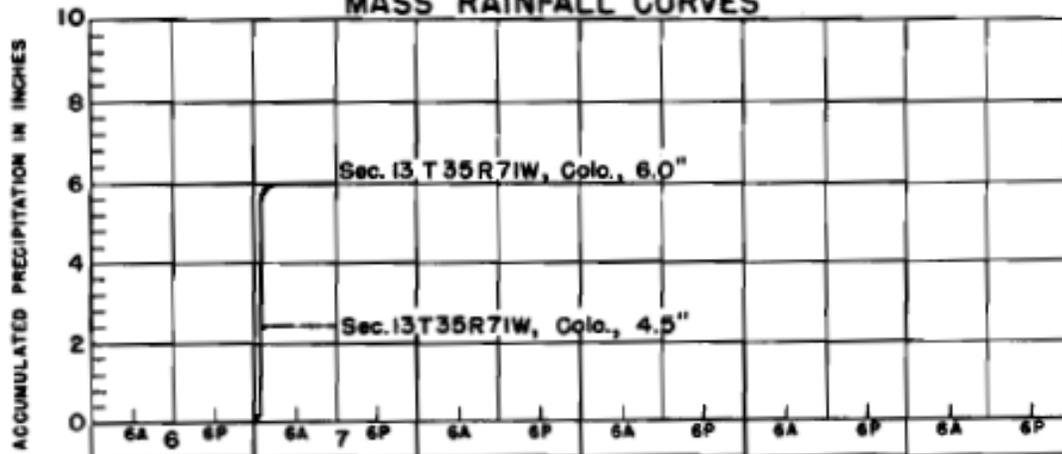
Study Prepared by: Missouri River Division  
Omaha, Nebr. District



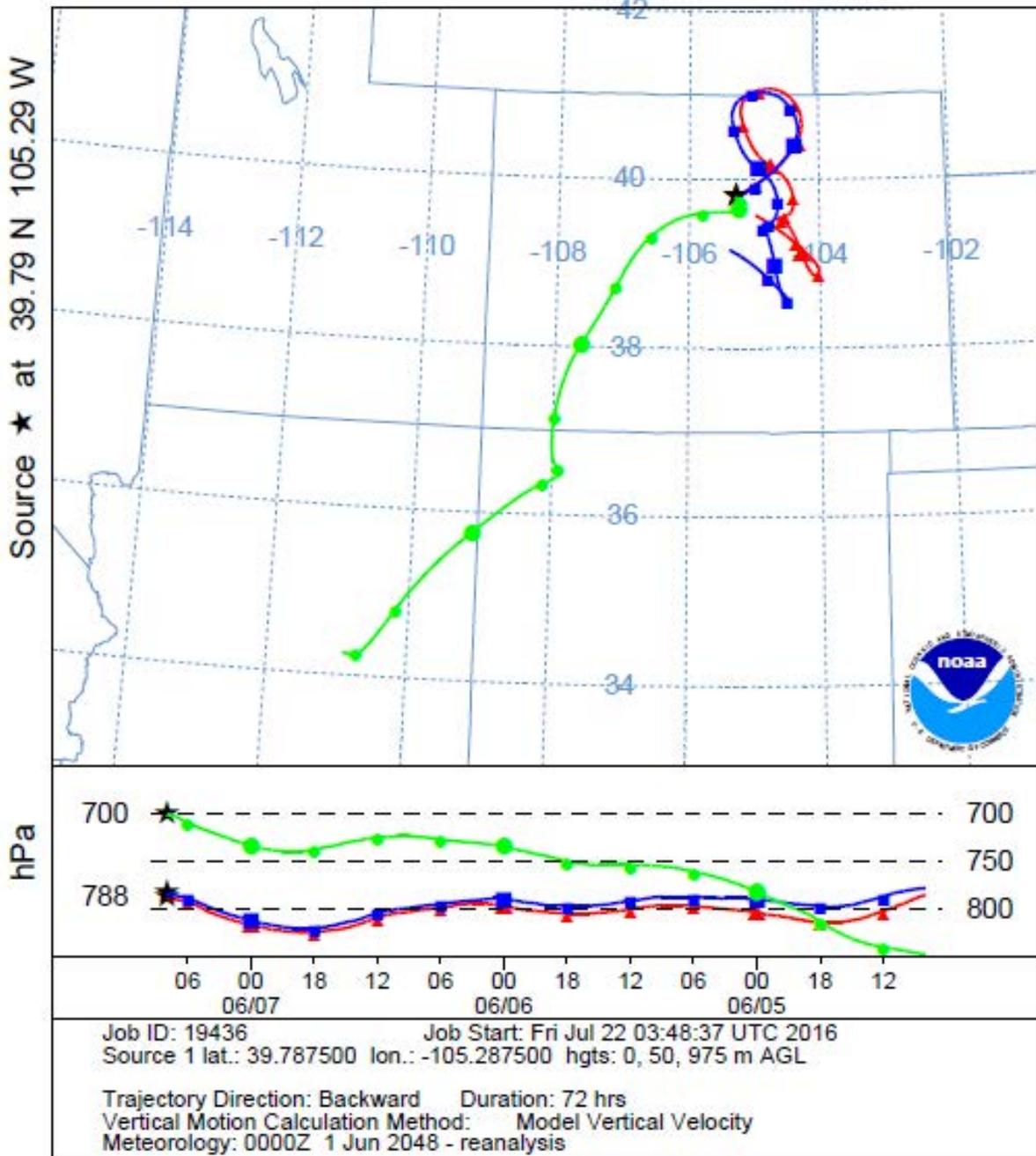
Storm Period 2 hours  
from 12 M June 6  
to 2 AM June 7

SCALE  
1:19,000,000  
Polyconic Projection

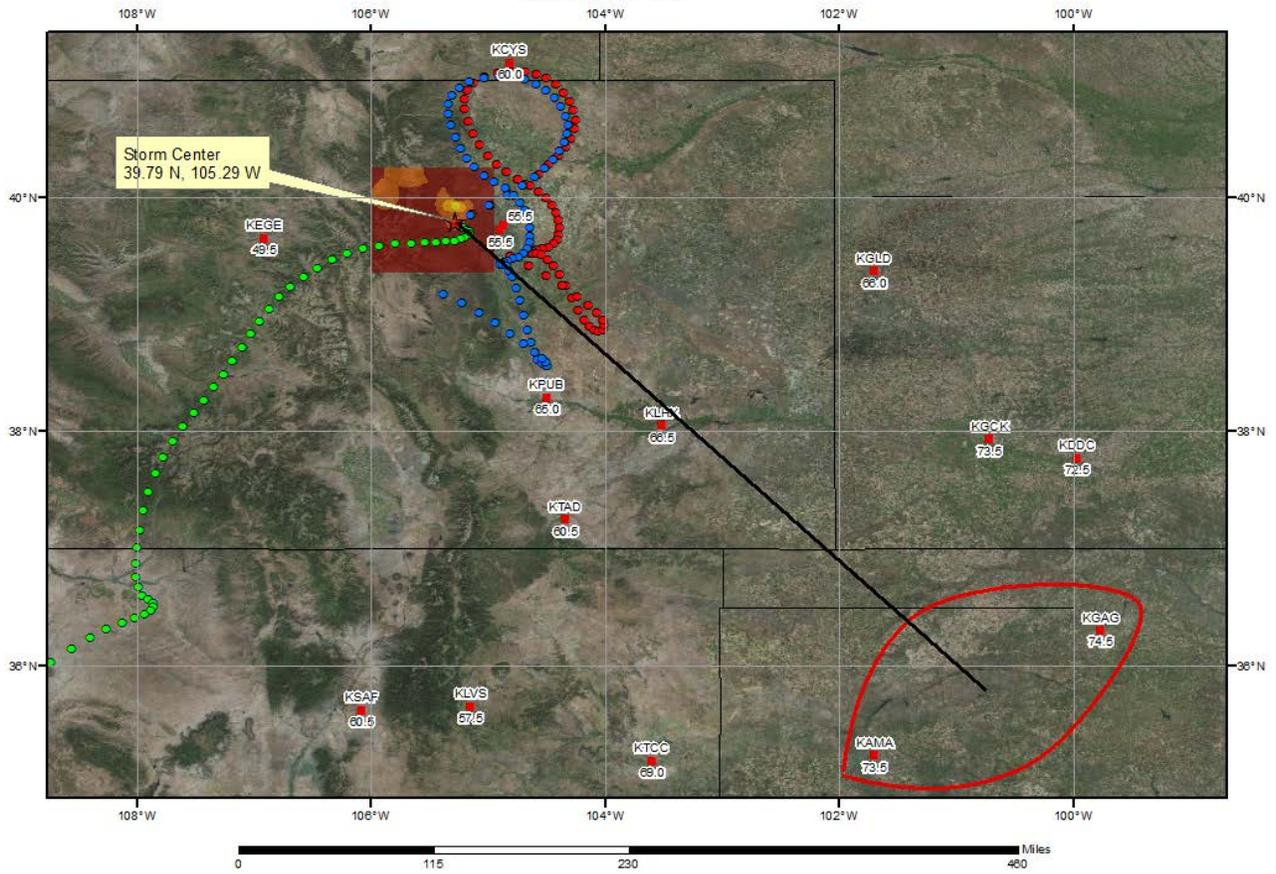
### MASS RAINFALL CURVES



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0800 UTC 07 Jun 48  
 CDC1 Meteorological Data



### SPAS 1613 Golden, CO Storm Analysis June 6-7, 1948



## Storm Precipitation Analysis System (SPAS) For Storm #1602\_1

**General Storm Location:** Southern Texas (31.75,-102.5,26.0,-97.0)

**Storm Dates:** June 24-29, 1954

**Event:** Hurricane Alice

### DAD Zone 1

**Latitude:** 30.4042

**Longitude:** -101.4375

**Max. Grid Rainfall Amount:** 35.79" RJEverett, TX

**Max. Observed Rainfall Amount:** 35.10"

**Number of Stations:** 279

**SPAS Version:** 10.0

**Basemap:** Blend between us\_ppt\_in\_map\_1961\_1990\_usda\_northamerica and USGS Isohyetal image

**Spatial resolution:** 0.2894

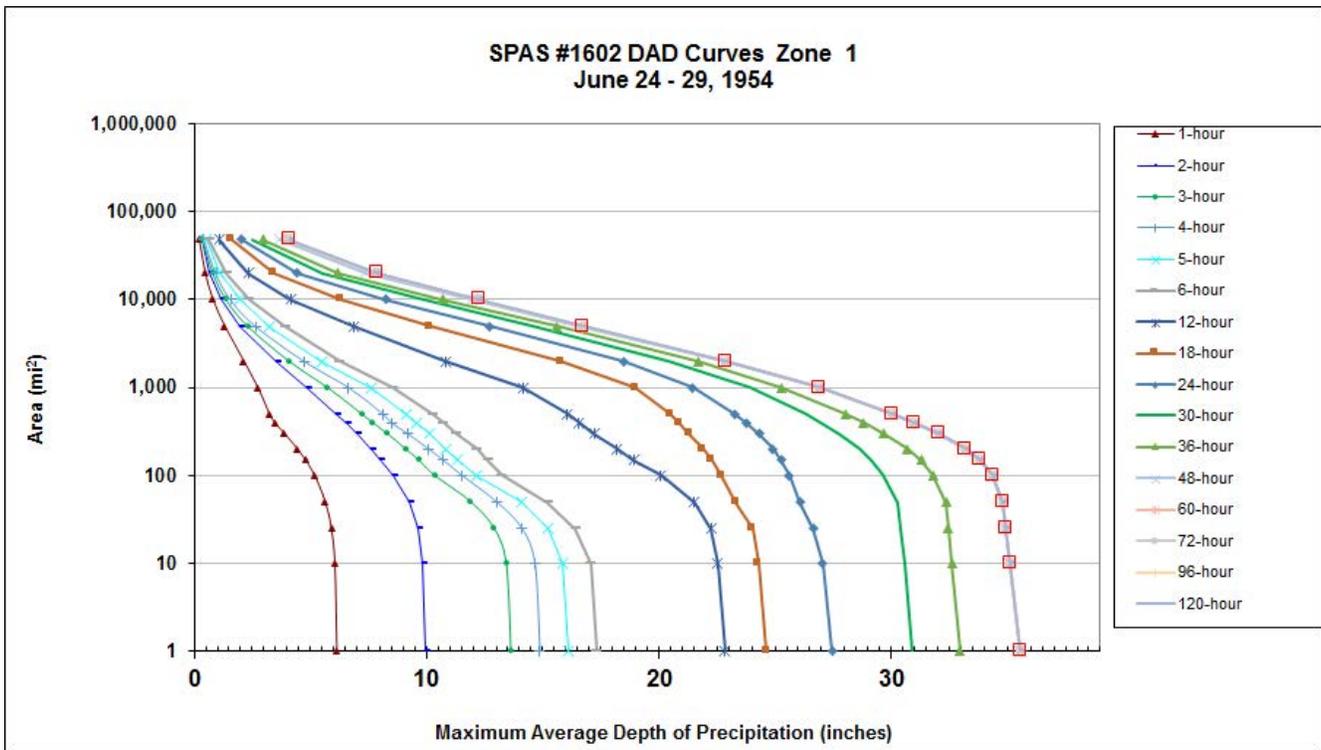
**Radar Included:** No

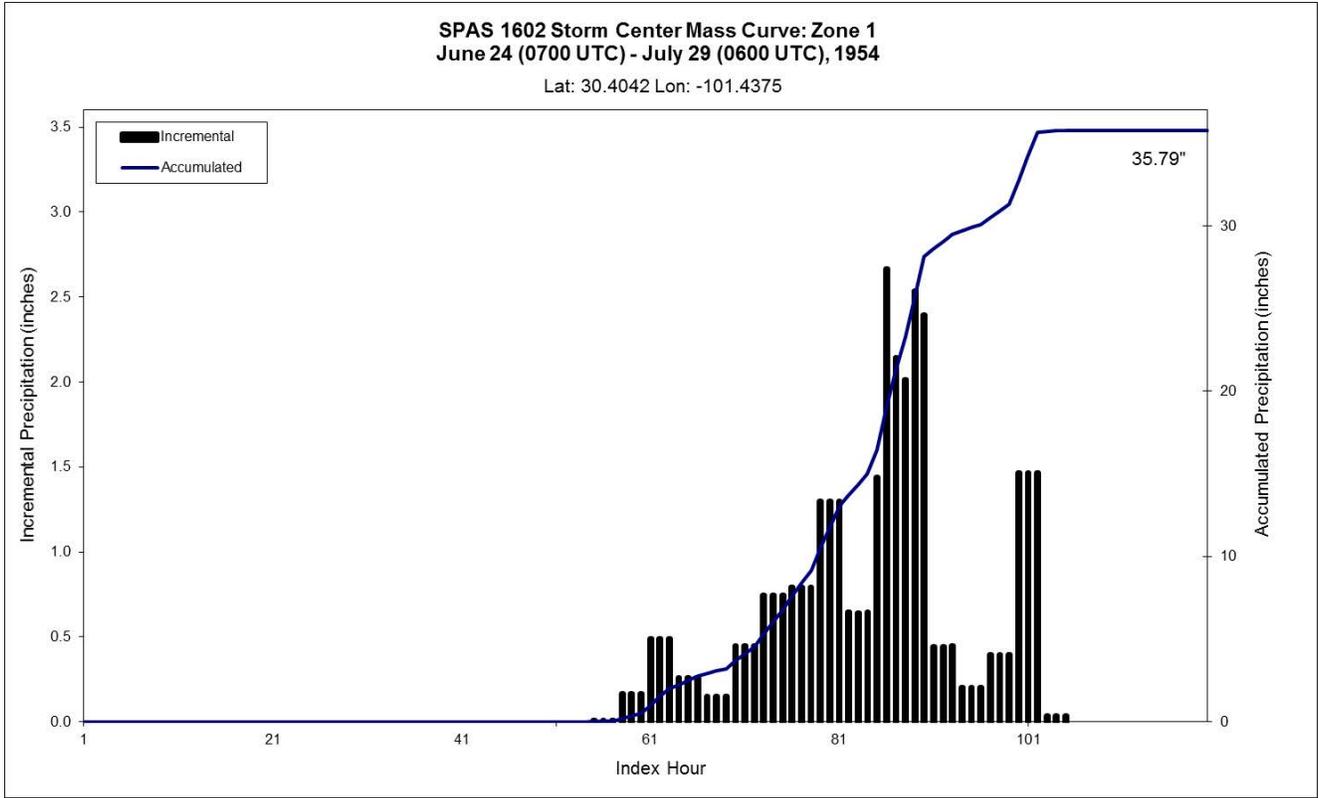
**Depth-Area-Duration (DAD) analysis:** Yes

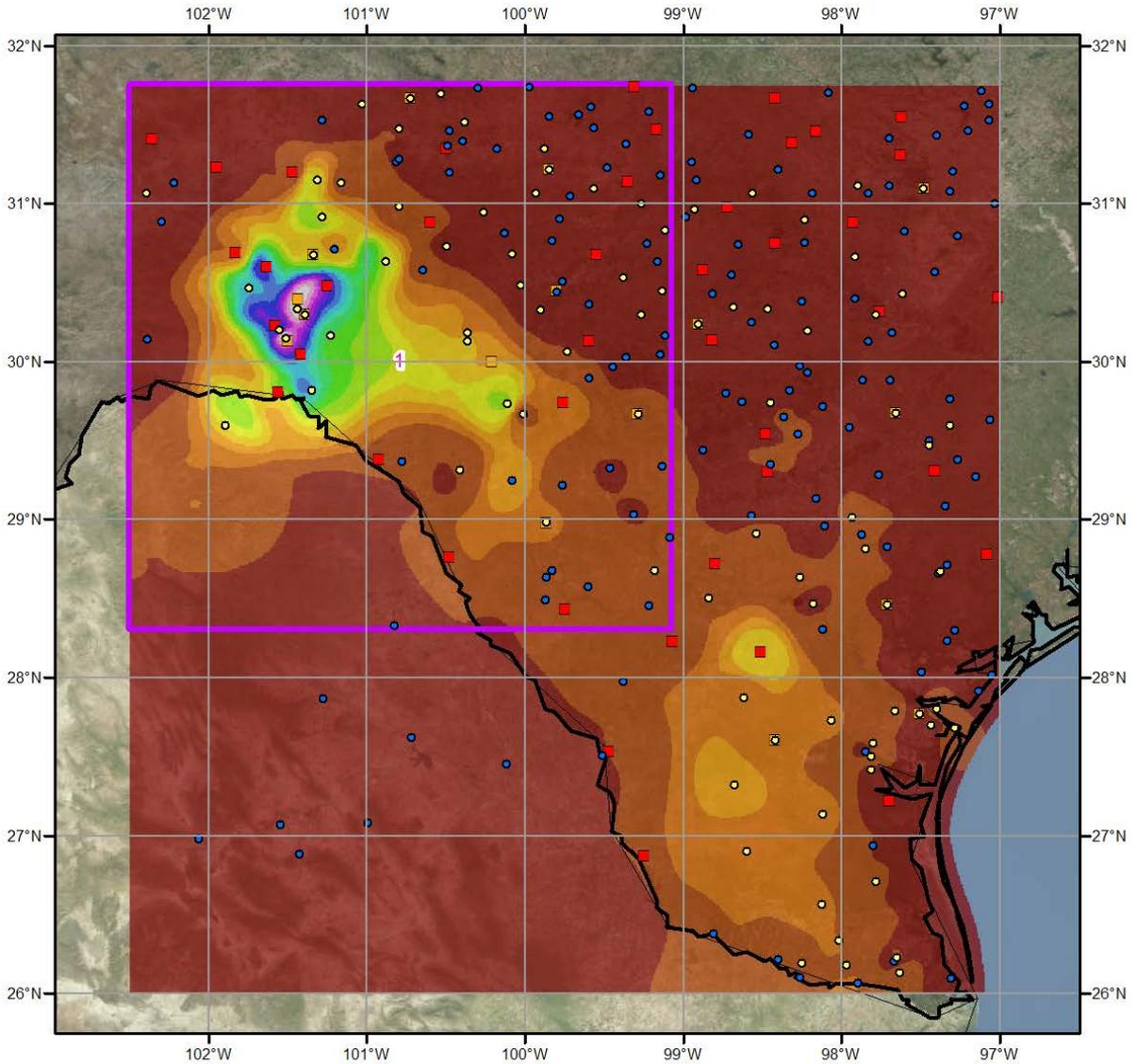
**Reliability of results:** This analysis was based on 279 hourly stations, daily data, and supplemental station data. We have a good degree of confidence for the station based storm total results. The spatial pattern is dependent heavily on the basemap created from the USGS Isohyetal image. Timing is based on the hourly and hourly pseudo stations near the storm center. Several daily stations were moved to supplemental due to timing issues and to ensure data consistency.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1602_1	-101.438	30.404	2,287	2,300	76.50	3.07	0.58	75	2.485	79.60	79.5	3.52	0.64	81	2.880	1.159

Storm 1602 - June 24 (0700 UTC) - July 29 (0600 UTC), 1954																	
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																	
Area (mi <sup>2</sup> )	Duration (hours)																
	1	2	3	4	5	6	12	18	24	30	36	48	60	72	96	120	Total
0.4	6.18	10.03	13.73	14.96	16.20	17.43	22.97	24.78	27.63	31.07	33.10	35.70	35.72	35.72	35.72	35.72	35.72
1	6.14	9.97	13.64	14.87	16.10	17.33	22.84	24.64	27.46	30.92	32.96	35.52	35.55	35.55	35.55	35.55	35.55
10	6.05	9.81	13.44	14.65	15.85	17.06	22.54	24.30	27.05	30.56	32.60	35.09	35.11	35.11	35.11	35.11	35.11
25	5.90	9.61	12.92	14.09	15.25	16.42	22.26	24.05	26.66	30.41	32.46	34.91	34.94	34.94	34.94	34.94	34.94
50	5.64	9.25	11.92	13.01	14.11	15.21	21.52	23.30	26.09	30.30	32.35	34.79	34.81	34.81	34.81	34.81	34.81
100	5.18	8.57	10.37	11.52	12.17	13.23	20.08	22.69	25.60	29.66	31.78	34.33	34.36	34.36	34.36	34.36	34.36
150	4.78	8.03	9.67	10.70	11.32	12.64	18.92	22.27	25.26	29.12	31.28	33.81	33.84	33.84	33.84	33.84	33.84
200	4.44	7.63	9.12	10.08	10.85	12.15	18.20	21.91	24.92	28.62	30.70	33.19	33.22	33.22	33.22	33.22	33.22
300	3.88	7.01	8.32	9.17	10.11	11.30	17.23	21.31	24.32	27.73	29.70	32.05	32.08	32.08	32.08	32.08	32.08
400	3.46	6.54	7.70	8.48	9.57	10.72	16.57	20.86	23.74	26.97	28.81	30.97	30.99	30.99	30.99	30.99	30.99
500	3.24	6.13	7.23	8.12	9.16	10.24	16.06	20.50	23.24	26.30	28.03	30.03	30.05	30.05	30.05	30.05	30.05
1,000	2.73	4.85	5.76	6.64	7.60	8.56	14.13	18.99	21.45	23.92	25.26	26.93	26.93	26.93	26.93	26.93	26.93
2,000	2.13	3.57	4.10	4.72	5.51	6.25	10.83	15.79	18.48	20.43	21.69	22.83	22.86	22.86	22.86	22.86	22.86
5,000	1.31	1.98	2.32	2.64	3.23	3.92	6.87	10.14	12.72	14.56	15.61	16.51	16.69	16.73	16.74	16.74	16.74
10,000	0.80	1.15	1.39	1.57	1.95	2.36	4.16	6.31	8.23	9.91	10.70	11.97	12.18	12.25	12.27	12.27	12.27
20,000	0.47	0.64	0.83	0.94	1.09	1.39	2.34	3.44	4.45	5.53	6.19	7.40	7.77	7.85	7.89	7.89	7.89
48,658	0.20	0.31	0.37	0.43	0.52	0.63	1.09	1.60	2.05	2.50	2.97	3.67	3.98	4.04	4.07	4.08	4.08



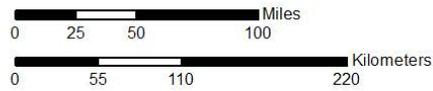




**Total Storm (120-hours) Precipitation (inches)**  
**June 24-29, 1954**  
**SPAS 1602, Vic Pierce, TX**

**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Supplemental



Precipitation (inches)	
0.00 - 2.00	8.01 - 10.00
2.01 - 4.00	10.01 - 12.00
4.01 - 6.00	12.01 - 14.00
6.01 - 8.00	14.01 - 16.00
	16.01 - 18.00
	18.01 - 20.00
	20.01 - 22.00
	22.01 - 24.00
	24.01 - 26.00
	26.01 - 28.00
	28.01 - 30.00
	30.01 - 32.00
	32.01 - 34.00
	34.01 - 36.00



4/3/2015

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 23-28 June 1954  
 Assignment SW 3-22  
 Location Texas & Mexico  
 Study Prepared by:  
 Southwestern Division  
 Albuquerque District

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 3/1/55  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 4/25/56  
 Remarks: Center at Vic. Pierce  
 Texas. Dewpoint 75° - Ref. Pt.  
 250 SE Grid J-18

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:500,000  
 Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	21
Form 5001-B (24-hour " " " " )-----	0
Form 5001-D ( " " " " " " )-----	27
Misc. precip. records, meteorological data, etc.-----	
Form 5002 (Mass rainfall curves)-----	56

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:500,000  
 Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	6
Form S-11 (Depth-area data from isohyetal map)-----	2
Form S-12 (Maximum depth-duration data)-----	10
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours										
	6	12	18	24	30	36	48	60	72	96	120
Max Station	17.5	22.2	23.8	29.2	30.8	32.0	35.0	35.0	35.0	35.0	35.0
10	16.0	20.1	22.5	26.7	30.7	32.0	31.6	31.6	31.6	31.6	31.6
100	12.6	16.5	19.7	23.6	27.6	29.2	31.5	31.5	31.5	31.5	31.5
200	10.9	14.9	18.6	22.5	25.9	27.5	29.5	29.5	29.5	29.5	29.5
500	8.4	12.0	16.6	20.5	23.0	24.5	26.3	26.3	26.3	26.3	26.3
1,000	6.6	9.7	14.6	18.4	20.1	21.5	23.0	23.0	23.0	23.0	23.0
2,000	4.8	7.5	11.8	14.7	16.1	17.6	19.4	19.4	19.4	19.4	19.4
5,000	2.8	4.9	7.4	8.9	10.4	11.9	13.7	14.3	14.3	14.3	14.3
10,000	1.7	3.2	4.7	5.7	7.1	8.0	9.8	10.4	10.5	10.5	10.5
20,000	1.2	2.0	2.8	3.6	4.5	5.2	6.5	7.0	7.2	7.2	7.2
27,900	1.0	1.6	2.3	2.9	3.6	4.1	5.2	5.7	5.8	5.8	5.8

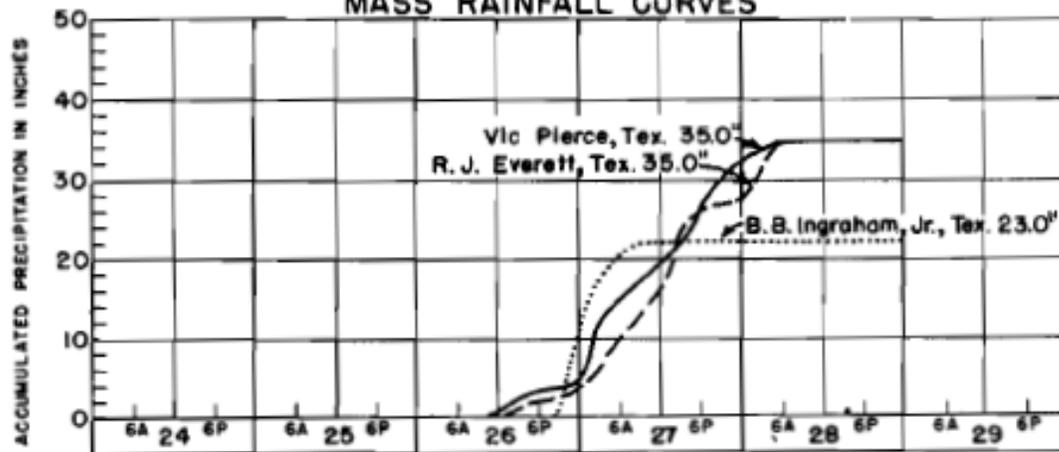
DEPARTMENT OF THE ARMY CORPS OF ENGINEERS

### STORM STUDIES - ISOHYETAL MAP

Storm of 23-28 June 1954 Assignment SW 3-22  
 Study Prepared by: Albuquerque, N. Mex. District  
Southwestern Division

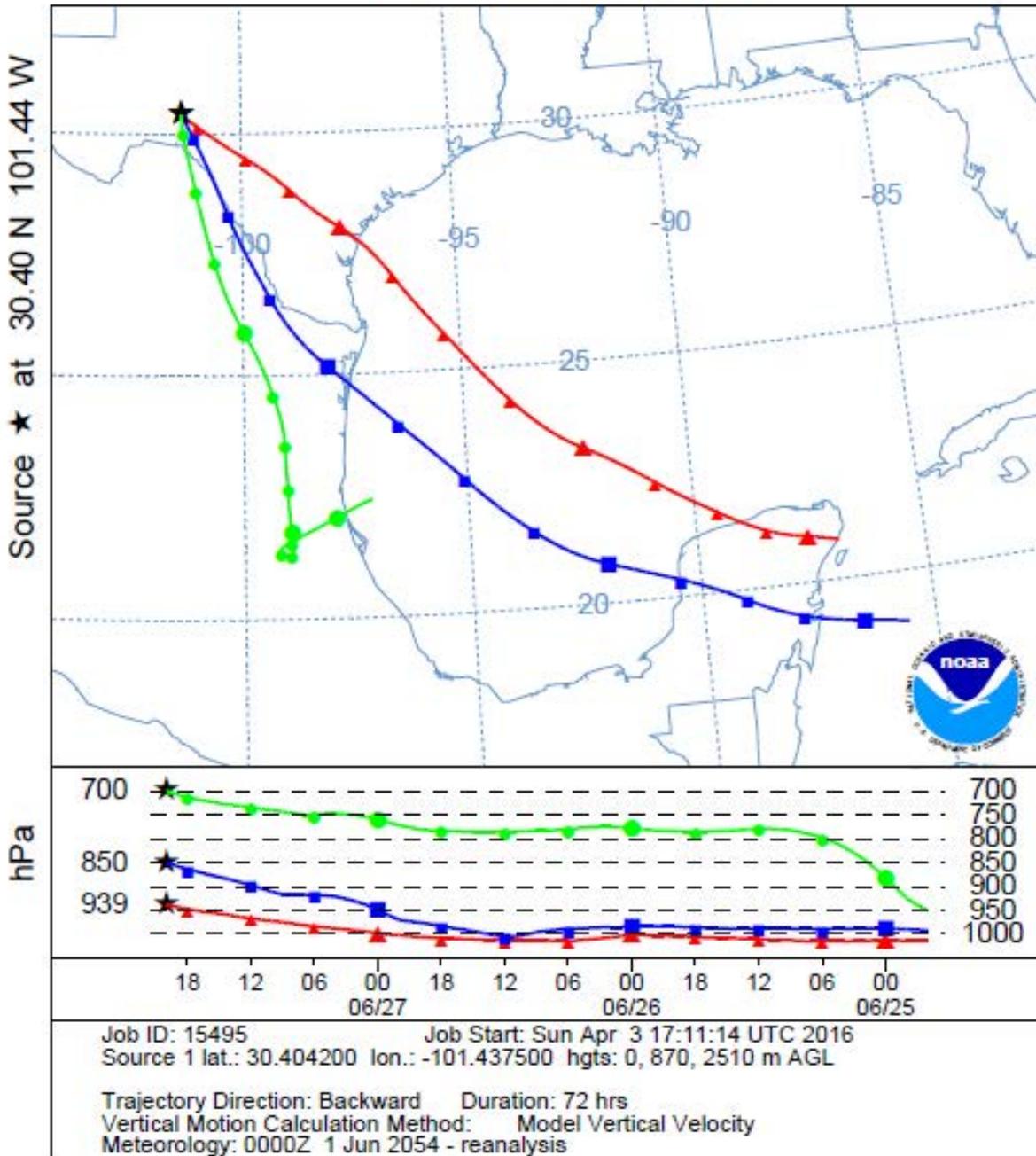


### MASS RAINFALL CURVES

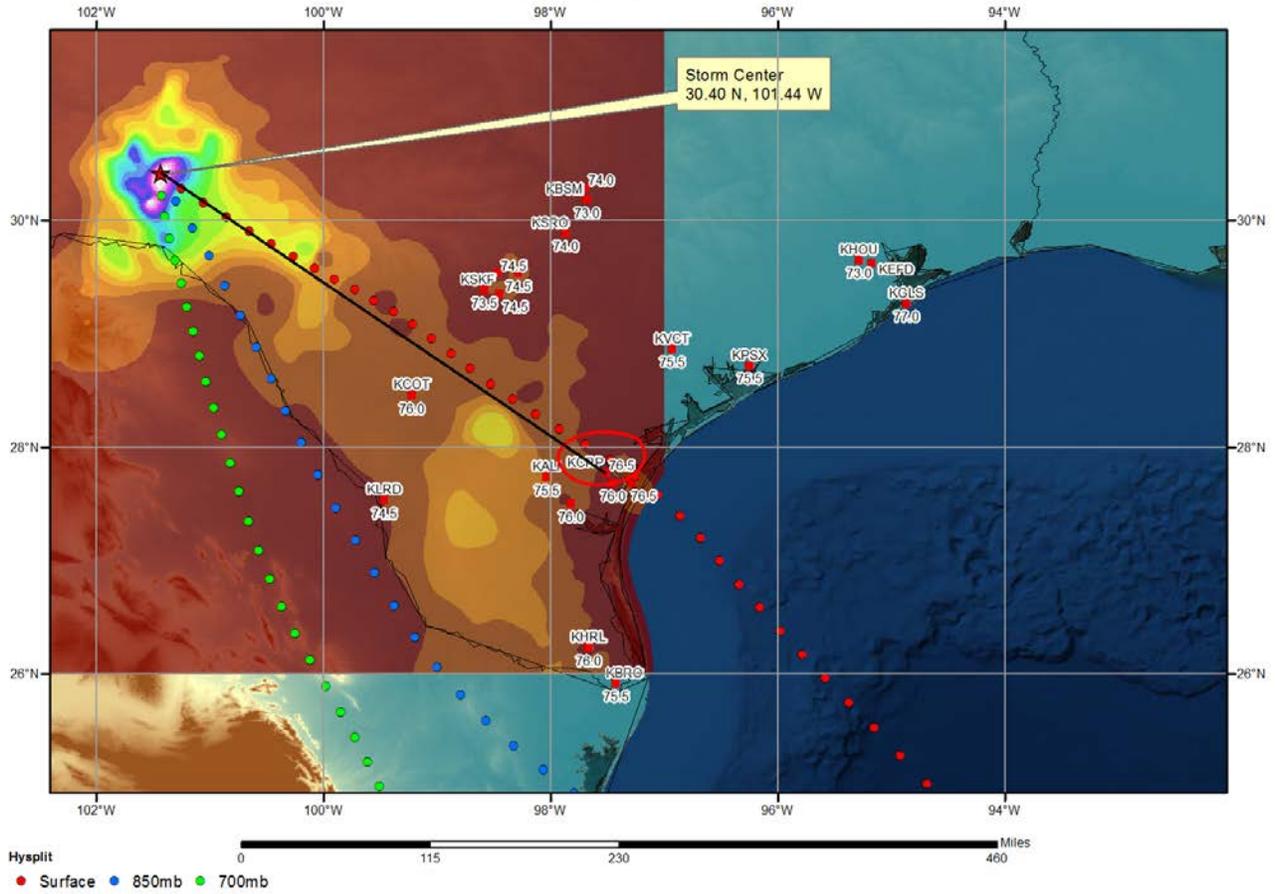


FORM 8-3W

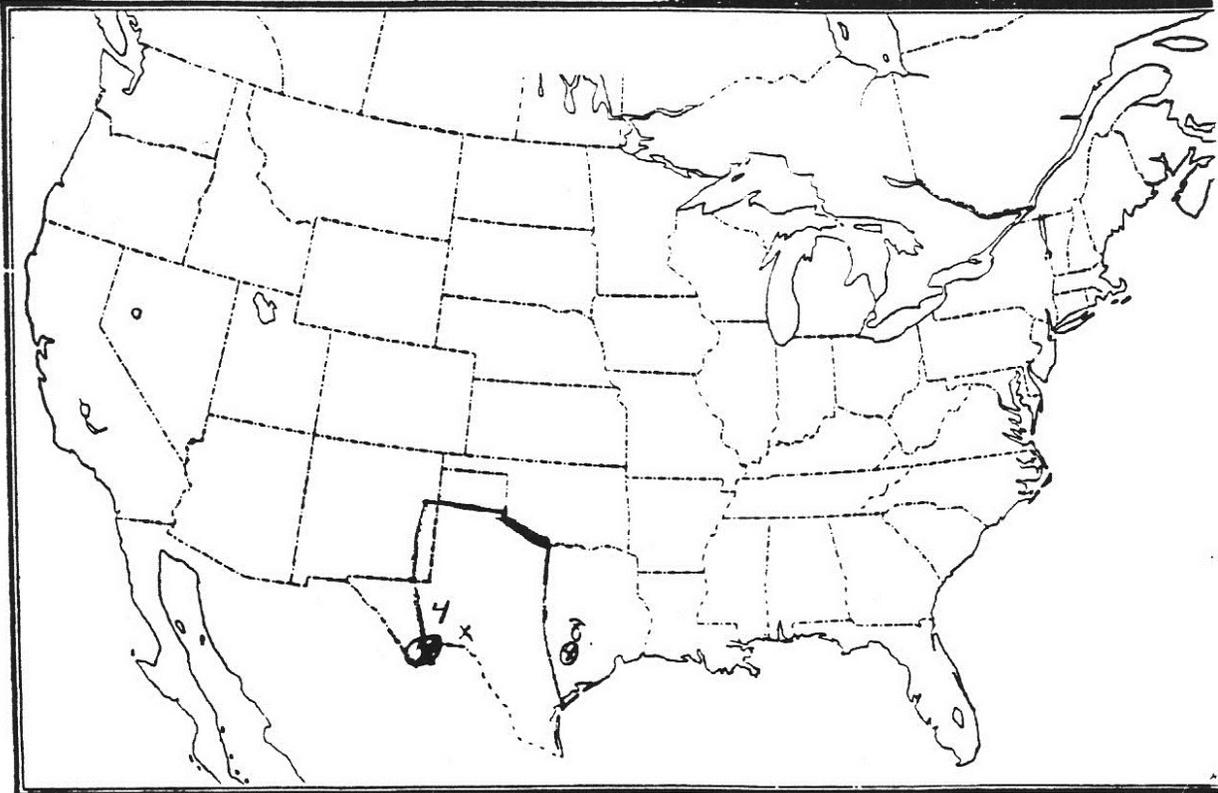
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 2000 UTC 27 Jun 54  
 CDC1 Meteorological Data



### SPAS 1602 Vic Pierce, TX Storm Analysis June 25-28, 1954



SW 3-22 June 23-28, 1954  
Vic Pierce, Texas  $30^{\circ}22' 101^{\circ}23'$   
12hr Td =  $75^{\circ}\text{F}$ , 2508E,  $78^{\circ}\text{F}$  116%



## Storm Precipitation Analysis System (SPAS) For Storm #1226\_1

**General Storm Location:** College Hill, OH

**Storm Dates:** June 4 (0600) - June 5 (0600), 1963

**Event:** Convective

### DAD Zone 1

**Latitude:** 40.0854

**Longitude:** -81.6479

**Max. Grid/Radar Rainfall Amount:** 19.39"

**Max. Observed Rainfall Amount:** 19.37"

**Number of Stations:** 132 (53 Daily, 15 Hourly, 6 Hourly Pseudo, 1 Hourly Estimated, 57 Supplemental)

**SPAS Version:** 9.0

**Base Map Used:** A basemap/grid was created based on USGS isohyetal.

**Spatial resolution:** 15 seconds\*

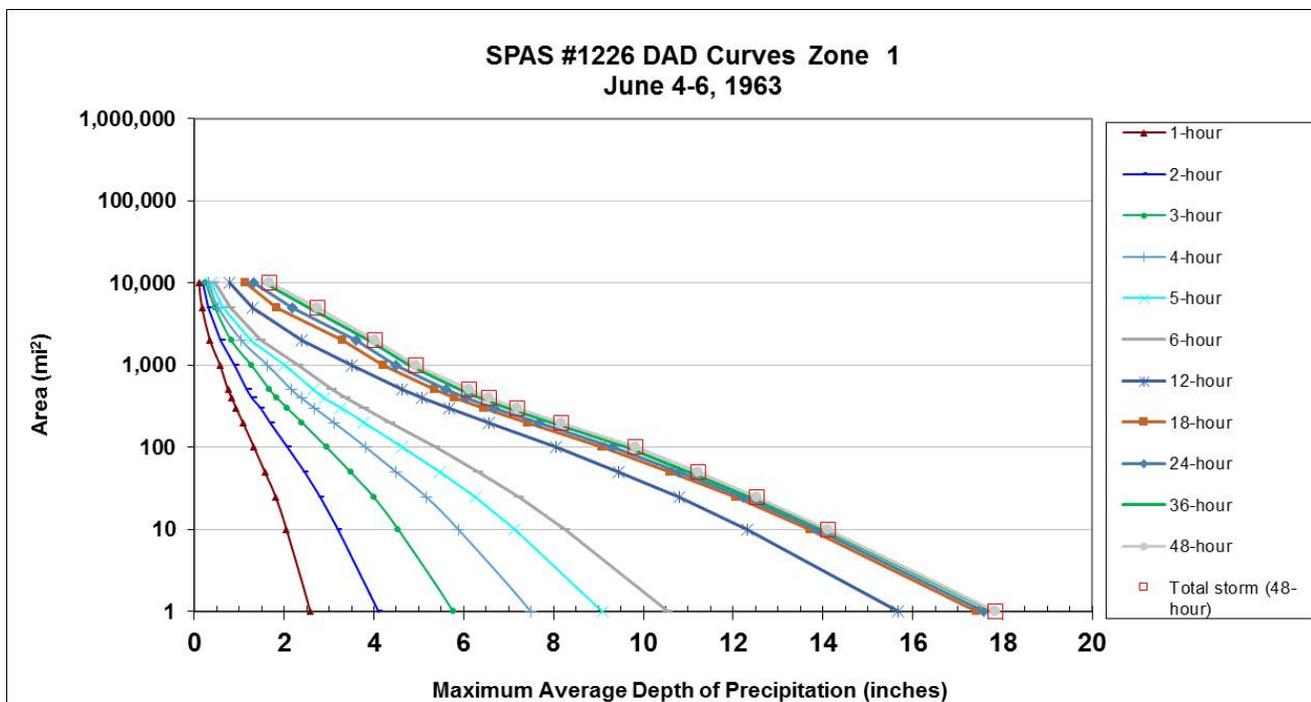
**Radar Included:** No

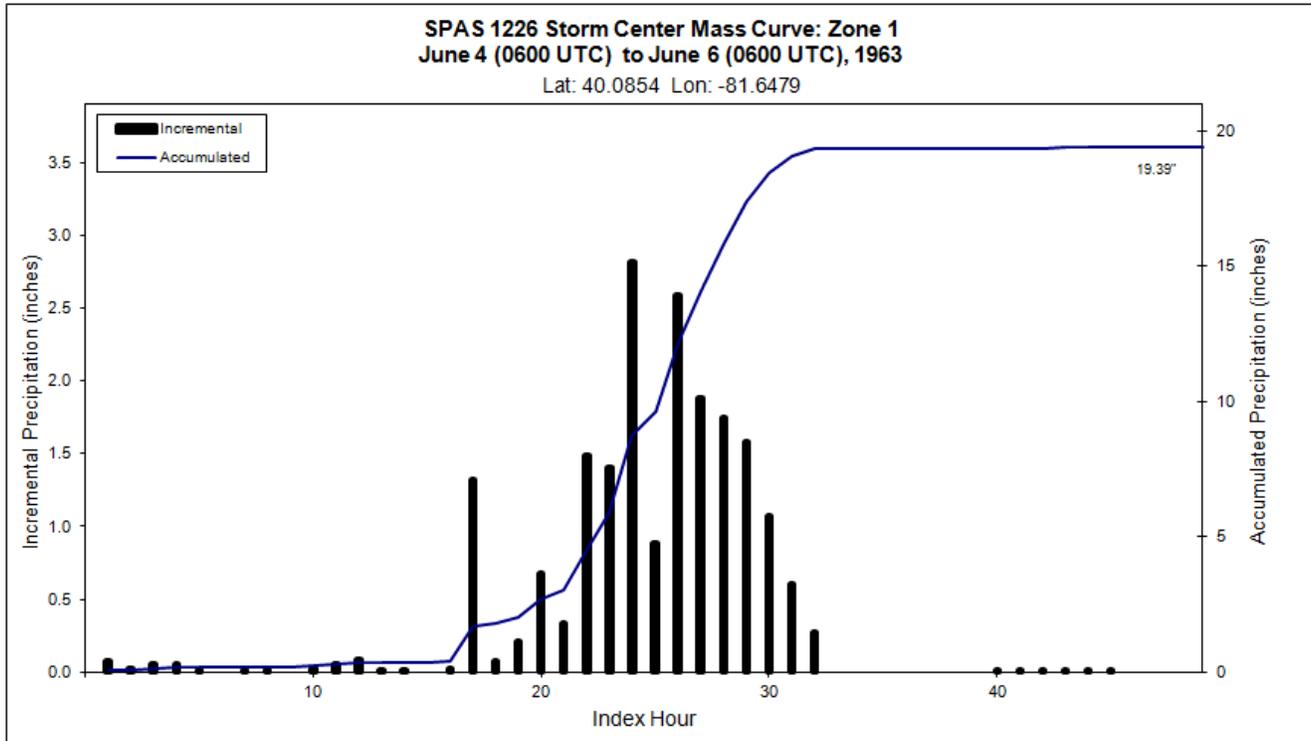
**Depth-Area-Duration (DAD) analysis:** Yes

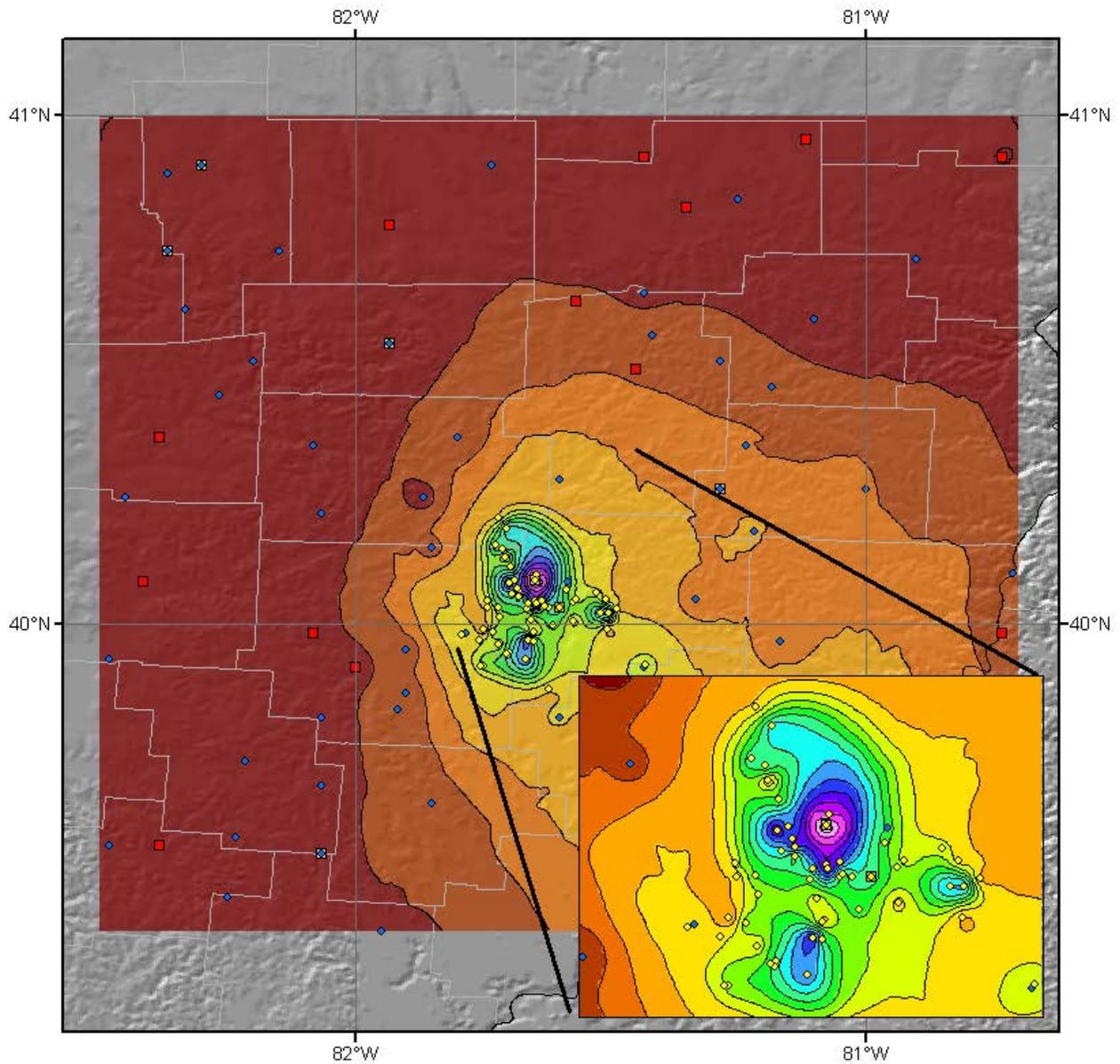
\*A higher spatial resolution (15-sec vs. 30-sec) was used in this analysis to better capture the spatial details.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1226_1	-81.648	40.085	974	1,000	68.50	2.10	0.21	59	1.890	77.18	77.0	3.14	0.27	76	2.870	1.500

Storm 1226 - June 4 (0600 UTC) - June 6 (0600 UTC), 1963												
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)												
Area (mi <sup>2</sup> )	Duration (hours)											
	1	2	3	4	5	6	12	18	24	36	48	Total
0.4	2.71	4.30	6.02	7.86	9.51	11.06	16.37	18.20	18.38	18.58	18.63	18.63
1	2.58	4.10	5.76	7.49	9.10	10.54	15.67	17.43	17.59	17.79	17.83	17.83
10	2.05	3.19	4.54	5.88	7.13	8.26	12.32	13.72	13.87	14.04	14.12	14.12
25	1.81	2.79	3.99	5.16	6.25	7.24	10.81	12.06	12.22	12.39	12.53	12.53
50	1.57	2.44	3.48	4.50	5.46	6.33	9.46	10.59	10.80	11.02	11.22	11.22
100	1.33	2.07	2.95	3.82	4.64	5.38	8.05	9.07	9.31	9.62	9.83	9.83
200	1.08	1.69	2.40	3.11	3.77	4.38	6.56	7.43	7.69	7.99	8.18	8.18
300	0.93	1.46	2.07	2.68	3.26	3.79	5.68	6.44	6.68	6.99	7.20	7.20
400	0.83	1.29	1.84	2.38	2.90	3.37	5.07	5.80	6.04	6.36	6.57	6.57
500	0.75	1.18	1.68	2.17	2.65	3.07	4.63	5.36	5.61	5.92	6.13	6.13
1,000	0.57	0.89	1.27	1.63	2.00	2.32	3.51	4.20	4.49	4.78	4.94	4.94
2,000	0.35	0.59	0.82	1.05	1.26	1.49	2.39	3.29	3.60	3.88	4.02	4.02
5,000	0.17	0.30	0.46	0.53	0.64	0.80	1.30	1.83	2.18	2.55	2.73	2.73
10,000	0.10	0.18	0.25	0.32	0.38	0.45	0.78	1.13	1.31	1.56	1.66	1.66

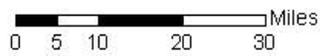






**Total Precipitation (48 hours)**  
**SPAS #1226**  
**6/04/1963 0600 UTC - 6/06/1963 0600 UTC**

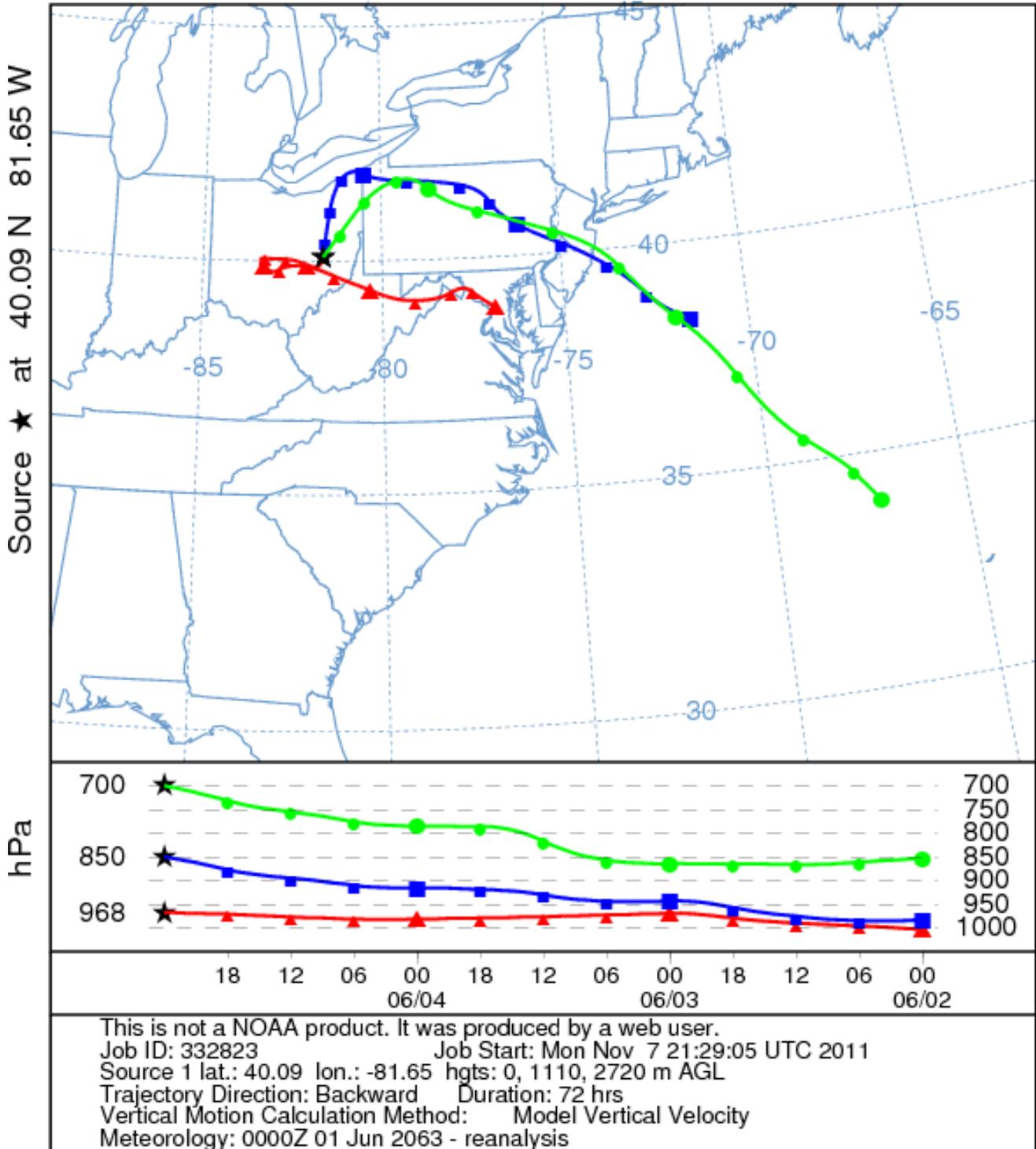
- ◆ Daily
- Hourly
- Hourly Estimated
- Hourly Pseudo
- ◆ Supplemental



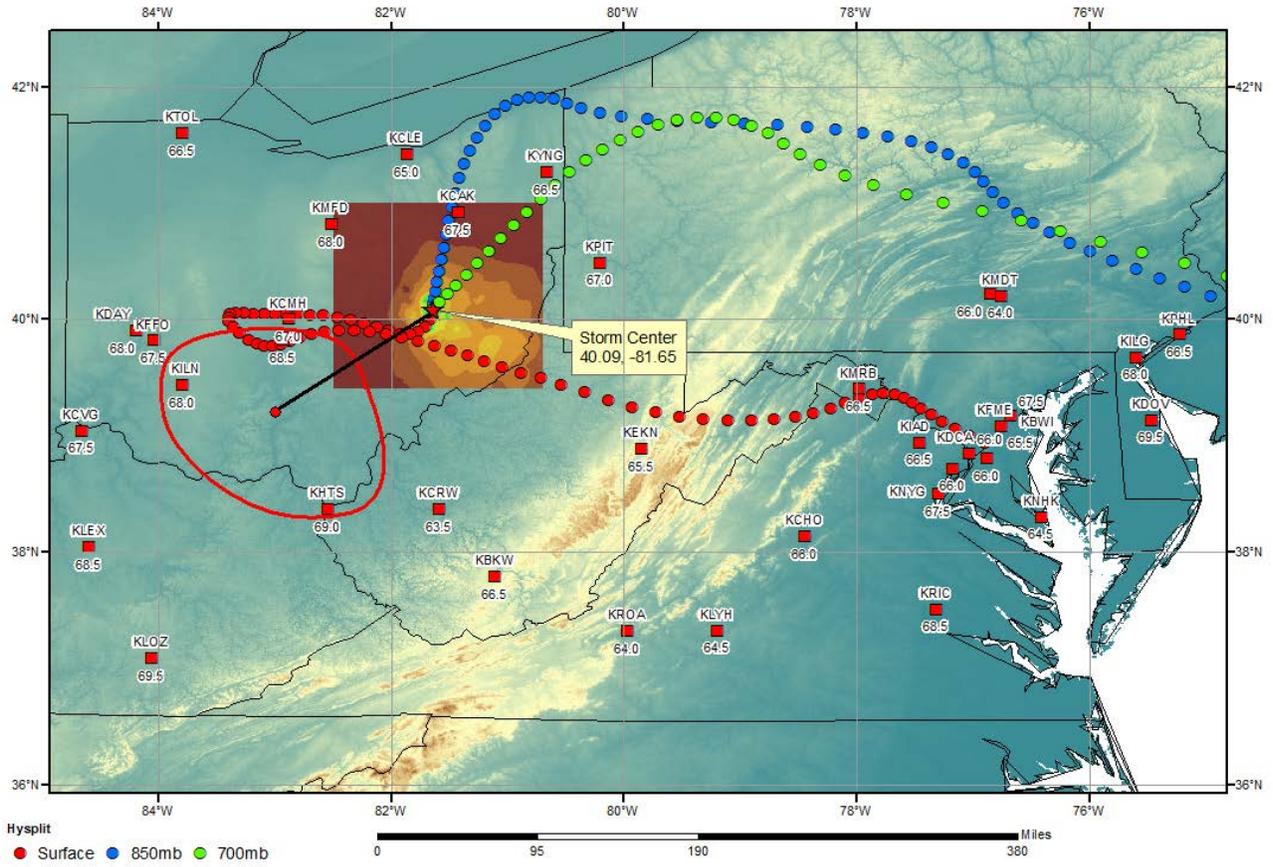
**Precipitation (inches)**



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 05 Jun 63  
 CDC1 Meteorological Data



### College Hill, OH Storm Analysis June 1-5, 1963



## Storm Precipitation Analysis System (SPAS) For Storm #1030\_1

**General Storm Location:** Wahoo, NE

**Storm Dates:** June 22-24, 1963

**Event:** Thunderstorm, possibly associated with a mesoscale convective complex (MCC)

### DAD Zone 1

**Latitude:** 41.2132

**Longitude:** -97.0710

**Rainfall Amount:** 15.98 inches

**Number of Stations:** 222

**SPAS Version:** 2.0

**Base Map Used:** No

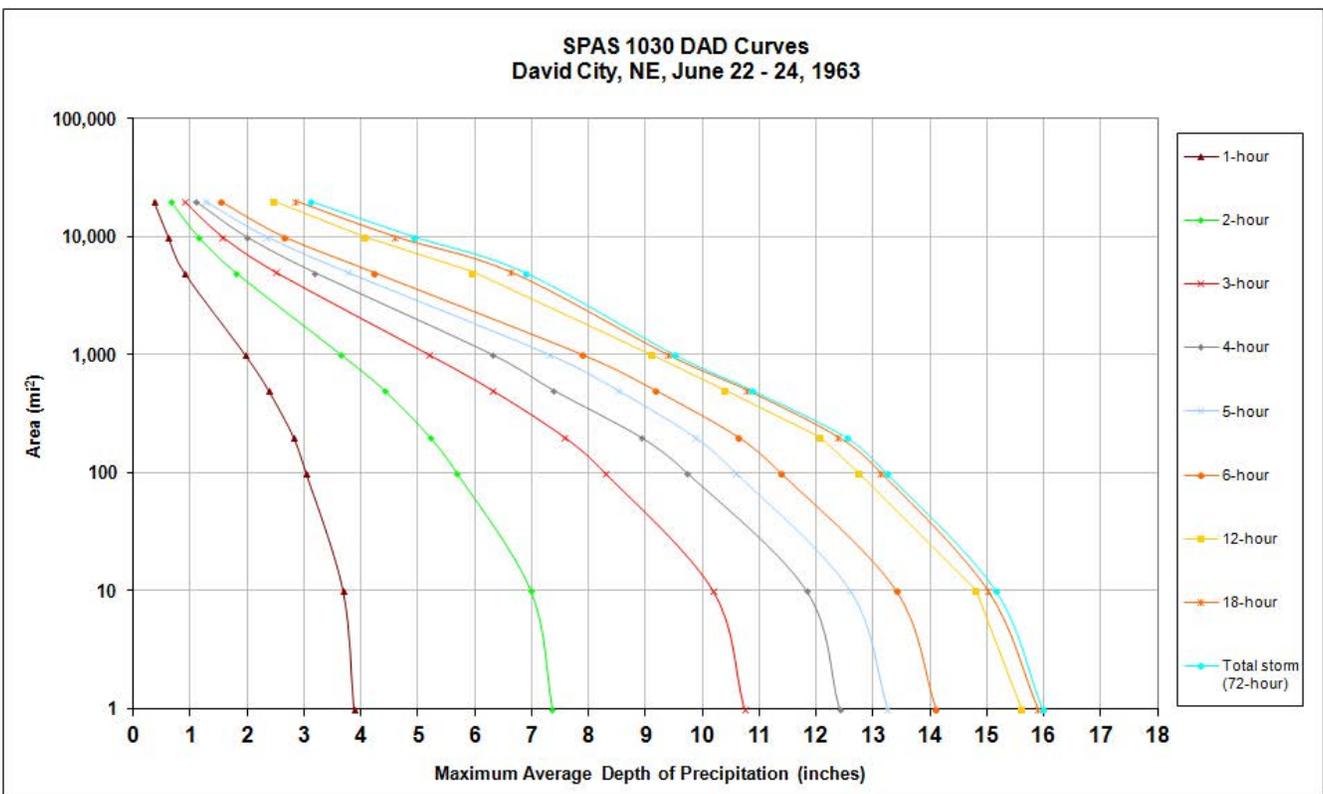
**Radar Included:** No

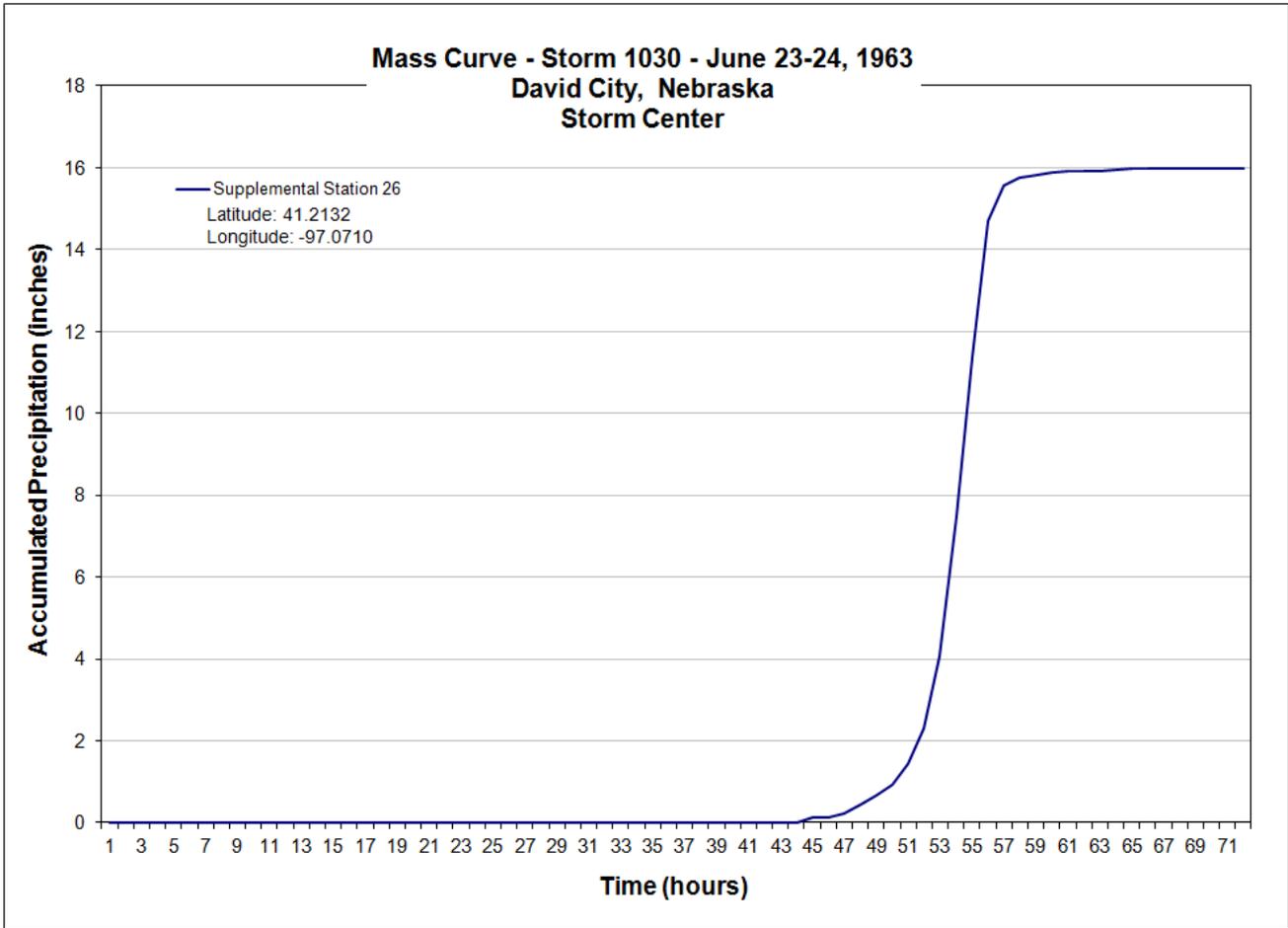
**Depth-Area-Duration (DAD) analysis:** Yes, 1, 2, 3, 4, 5, 6, 12, 18, 24, 36, 48, and 72 hours

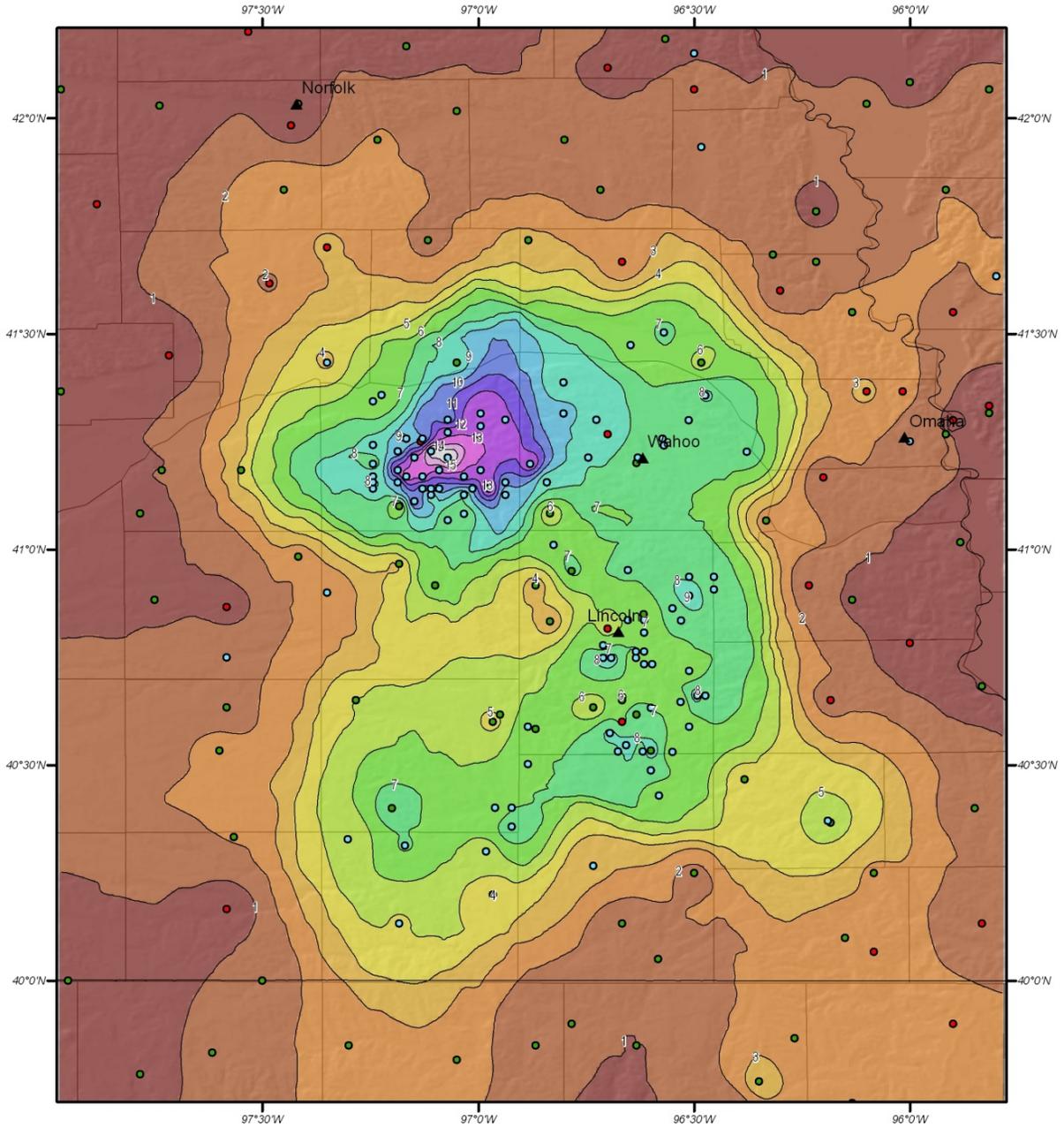
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1030_1	-97.071	41.213	1,626	1,600	73.50	2.67	0.38	69	2.290	82.00	82.0	3.95	0.48	86	3,470	1.500

**SPAS Storm 1030 - David City, NE, June 22 - 24, 1963**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)												
	1	2	3	4	5	6	12	18	24	36	48	72	total
1	3.87	7.36	10.73	12.40	13.26	14.10	15.61	15.90	15.98	15.98	15.98	15.98	15.98
10	3.68	6.98	10.18	11.82	12.60	13.40	14.80	15.02	15.15	15.13	15.13	15.16	15.16
100	3.03	5.68	8.28	9.72	10.59	11.37	12.75	13.14	13.23	13.23	13.23	13.23	13.23
200	2.81	5.21	7.57	8.91	9.87	10.63	12.07	12.39	12.49	12.49	12.50	12.52	12.52
500	2.37	4.41	6.30	7.38	8.52	9.17	10.39	10.79	10.82	10.84	10.86	10.87	10.87
1,000	1.96	3.65	5.19	6.31	7.32	7.89	9.10	9.39	9.45	9.47	9.48	9.51	9.51
5,000	0.89	1.80	2.50	3.18	3.77	4.22	5.96	6.64	6.80	6.83	6.87	6.87	6.87
10,000	0.61	1.15	1.56	1.99	2.35	2.65	4.07	4.60	4.84	4.91	4.92	4.93	4.93
20,000	0.36	0.66	0.89	1.09	1.27	1.53	2.46	2.85	3.04	3.09	3.10	3.10	3.10

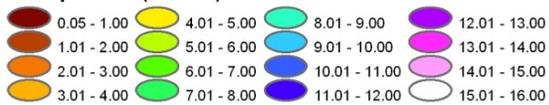






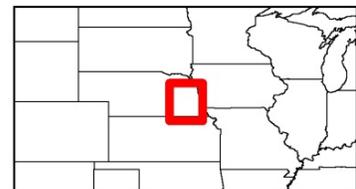
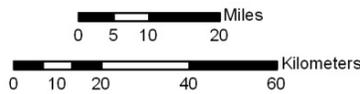
**SPAS Storm #1030 - June 22 to 24, 1963**  
**Total Rainfall (72-hours) - Wahoo, Nebraska**

**Precipitation (inches)**



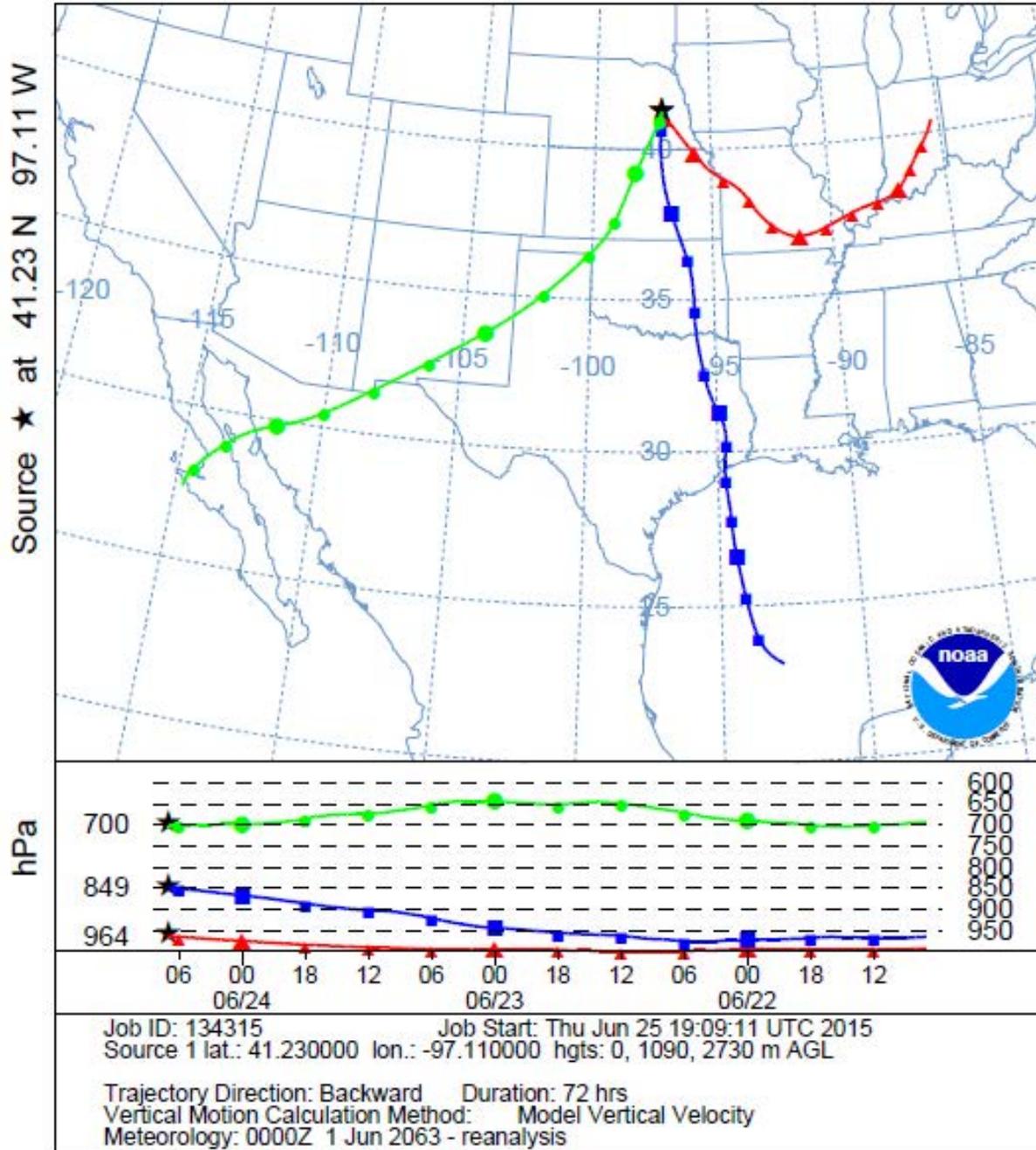
**Gauging Stations**

- Daily
- Hourly Pseudo
- Hourly
- Supplemental

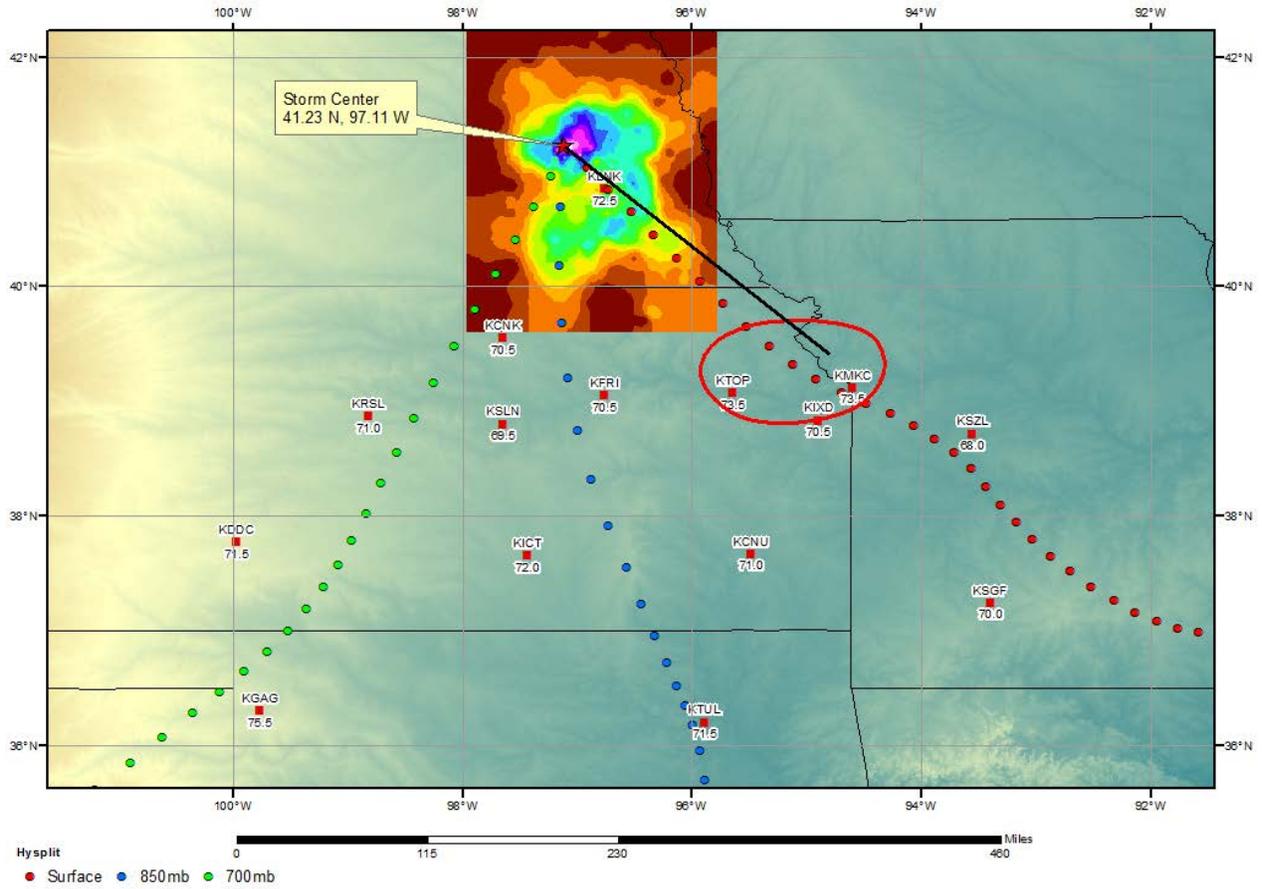


Coordinate system: GCS North American 1983  
 Scale: 1:44,522,173 Metstat/AWA March 1, 2007

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0700 UTC 24 Jun 63  
 CDC1 Meteorological Data



### SPAS 1030 David City, NE Storm Analysis June 21-24, 1963



## Storm Precipitation Analysis System (SPAS) For Storm #1293\_1 (Re-Run of SPAS #1009)

**General Storm Location:** Southeastern Colorado, extreme northeastern New Mexico and extreme eastern Kansas.

**Storm Dates:** June 14 – 19, 1965

**Event:** Thunderstorms and possible Mesoscale Convective Complex (MCC)

**DAD Zone 1 (Holly/Two Buttes, CO)**

**Latitude:** 37.7125

**Longitude:** -102.40416

**Max. Grid Rainfall Amount:** 19.18”

**Max. Observed Rainfall Amount:** 18.00”

**Number of Stations:** 414

**SPAS Version:** 9.5

**Base Map Used:** Modified USGS total precipitation map for the period June 13-20, 1965

**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** 1, 2, 3, 4, 5, 6, 12, 18, 24, 36, 48, 72, 96, 120, & 144 hr

**Confidence in results:** For reasons described below, the results of this analysis are markedly different than SPAS 1009, but are believed to be more accurate. A comprehensive bucket survey provides us with a moderate degree of confidence in the magnitudes; however exact storm patterns have a high degree of uncertainty. The temporal distributions are anchored on good, but sparse hourly data, therefore confidence is lower than normal with the timing.

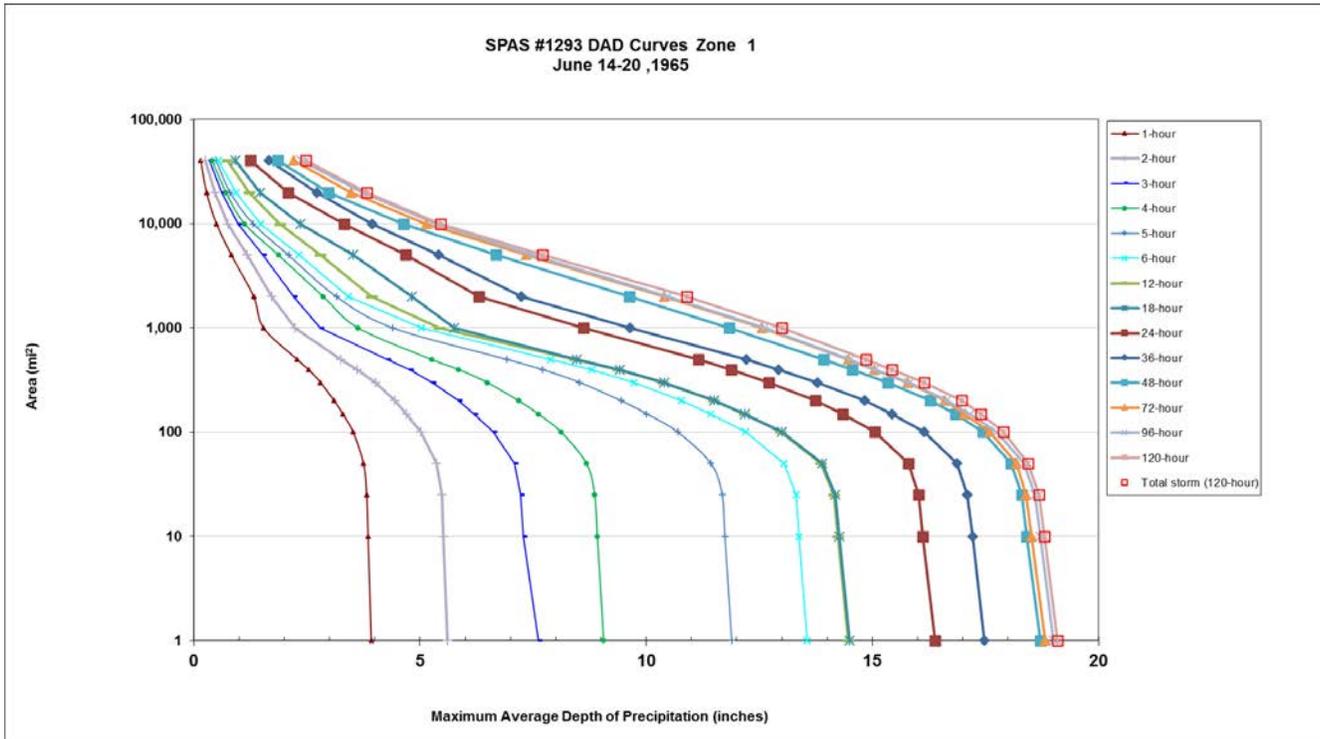
### Comments:

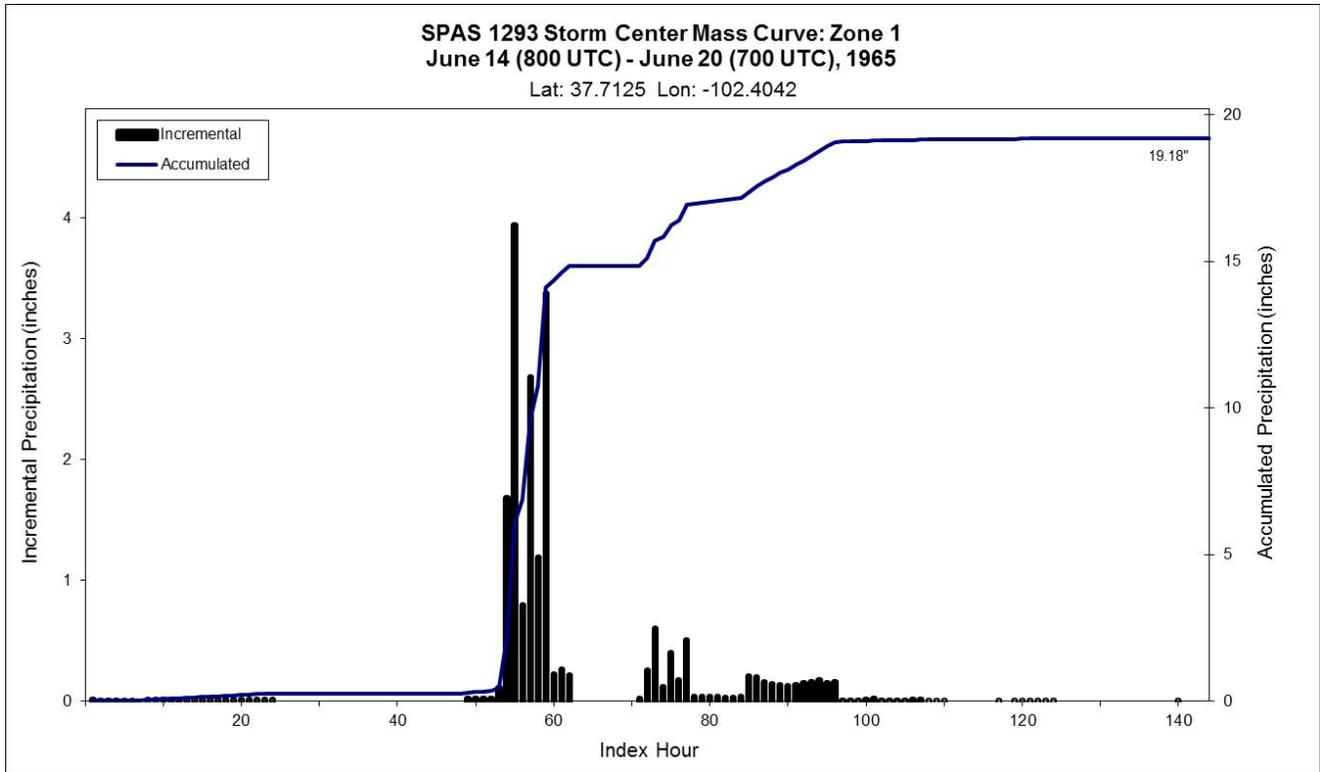
- This analysis was a re-analysis of SPAS #1009. Since then, several software enhancements have taken place. Plus, a large amount of additional data (Bucket Survey) was added, mainly to address the western storm centers (southeast of Denver). Also, a USGS isohyetal map was used as the basemap, which injected a great deal of information into the analysis versus the #1009 analysis. For these reasons, the results of this analysis are different than 1009, but are believed to be more accurate.
- 251 Bucket Survey amounts were added from the Colorado Climatological Data. After QC, a total of 224 remained in the data set.

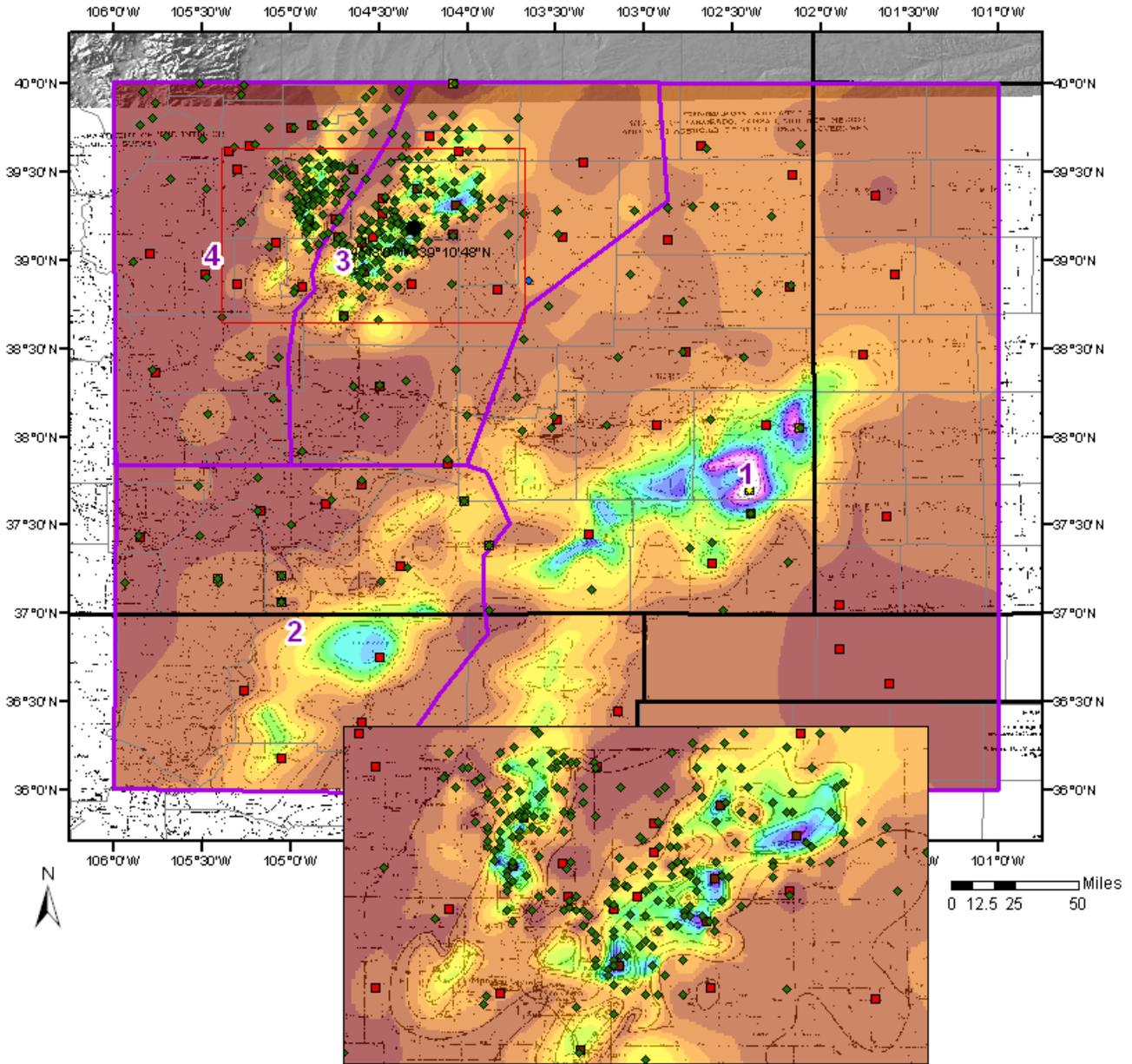
Unlike SPAS #1009 where the storm center was near Holly, SPAS #1293 has the storm center about 30 miles southwest of Holly (or 28 miles south –southeast of Lamar, CO). The USGS report stated intense rains began on June 16<sup>th</sup> in this area and dropped 15.5” of rain. Coupled with other rain showers during the June 14-19<sup>th</sup> period, the total storm center rainfall rose to 18” for the 144-hour period. Two Buttes, the closest hourly “station,” was based on a mass curve published in the USGS report (shown below). The USGS mass curve for Two Buttes looked to be estimated, so the final timing was also influenced by surrounding true hourly stations.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1293_1	-102.404	37.713	4,098	4,100	77.00	3.14	0.99	76	2.150	80.95	81.0	3.77	1.12	84	2.650	1.233

SPAS 1293 - June 14 (800 UTC) - June 20 (700 UTC), 1965															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.4	3.94	5.62	7.69	9.10	11.95	13.63	14.52	14.55	16.45	17.55	18.80	18.90	19.09	19.18	19.18
1	3.92	5.60	7.62	9.06	11.89	13.56	14.46	14.49	16.38	17.47	18.71	18.82	19.00	19.09	19.09
10	3.85	5.52	7.28	8.92	11.74	13.38	14.24	14.27	16.12	17.21	18.41	18.52	18.71	18.80	18.80
25	3.82	5.49	7.23	8.86	11.68	13.31	14.15	14.18	16.02	17.10	18.30	18.40	18.60	18.69	18.69
50	3.75	5.36	7.08	8.68	11.43	13.04	13.86	13.89	15.80	16.87	18.07	18.18	18.35	18.44	18.44
100	3.52	5.02	6.62	8.12	10.70	12.20	12.97	13.00	15.06	16.14	17.44	17.59	17.74	17.90	17.90
150	3.29	4.70	6.20	7.61	10.01	11.42	12.16	12.18	14.34	15.44	16.84	17.04	17.16	17.40	17.40
200	3.10	4.44	5.85	7.18	9.45	10.77	11.48	11.50	13.74	14.83	16.28	16.60	16.64	16.97	16.97
300	2.80	4.01	5.28	6.48	8.53	9.73	10.37	10.40	12.71	13.79	15.34	15.78	15.82	16.15	16.15
400	2.53	3.61	4.77	5.85	7.70	8.79	9.37	9.41	11.88	12.93	14.55	15.04	15.06	15.44	15.44
500	2.28	3.24	4.28	5.25	6.92	7.89	8.42	8.46	11.15	12.22	13.92	14.46	14.49	14.86	14.86
1,000	1.54	2.23	2.80	3.63	4.40	5.03	5.42	5.76	8.61	9.64	11.83	12.56	12.62	13.00	13.00
2,000	1.32	1.72	2.20	2.86	3.15	3.41	3.92	4.82	6.30	7.24	9.62	10.40	10.48	10.89	10.89
5,000	0.83	1.18	1.52	1.87	2.09	2.32	2.79	3.52	4.69	5.41	6.68	7.34	7.47	7.71	7.71
10,000	0.50	0.75	0.98	1.12	1.31	1.48	1.90	2.35	3.32	3.94	4.64	5.13	5.36	5.45	5.45
20,000	0.28	0.47	0.62	0.71	0.80	0.94	1.22	1.46	2.08	2.72	2.98	3.47	3.73	3.82	3.82
40,556	0.15	0.25	0.35	0.40	0.49	0.54	0.74	0.92	1.25	1.66	1.86	2.20	2.37	2.47	2.47

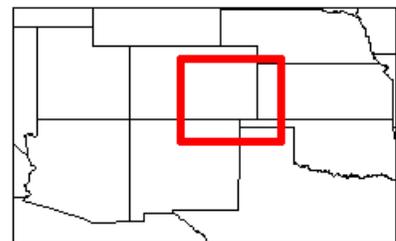






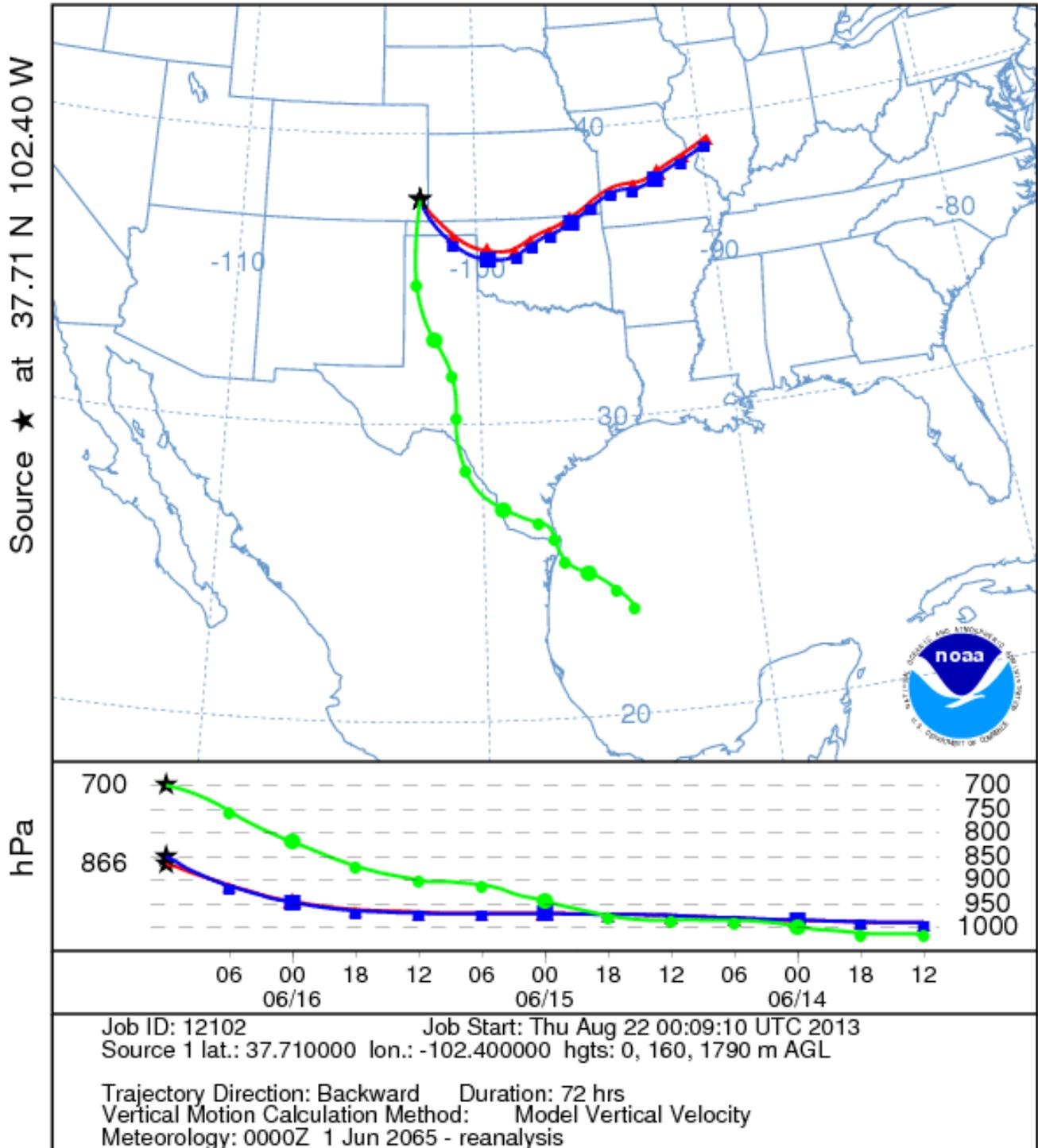
**Total 144-hour Precipitation (inches)**  
**06/14/1965 08 UTC - 06/20/1965 07 UTC**  
**SPAS #1293**

- | Precipitation (inches) |               |               | Stations           |  |
|------------------------|---------------|---------------|--------------------|--|
| 0.00 - 1.00            | 7.01 - 8.00   | 14.01 - 15.00 | Hourly             |  |
| 1.01 - 2.00            | 8.01 - 9.00   | 15.01 - 16.00 | Hourly Estimated   |  |
| 2.01 - 3.00            | 9.01 - 10.00  | 16.01 - 17.00 | Hourly Est. Pseudo |  |
| 3.01 - 4.00            | 10.01 - 11.00 | 17.01 - 18.00 | Hourly Pseudo      |  |
| 4.01 - 5.00            | 11.01 - 12.00 | 18.01 - 19.00 | Daily              |  |
| 5.01 - 6.00            | 12.01 - 13.00 |               | Supplemental       |  |
| 6.01 - 7.00            | 13.01 - 14.00 |               | Supplemental Est.  |  |

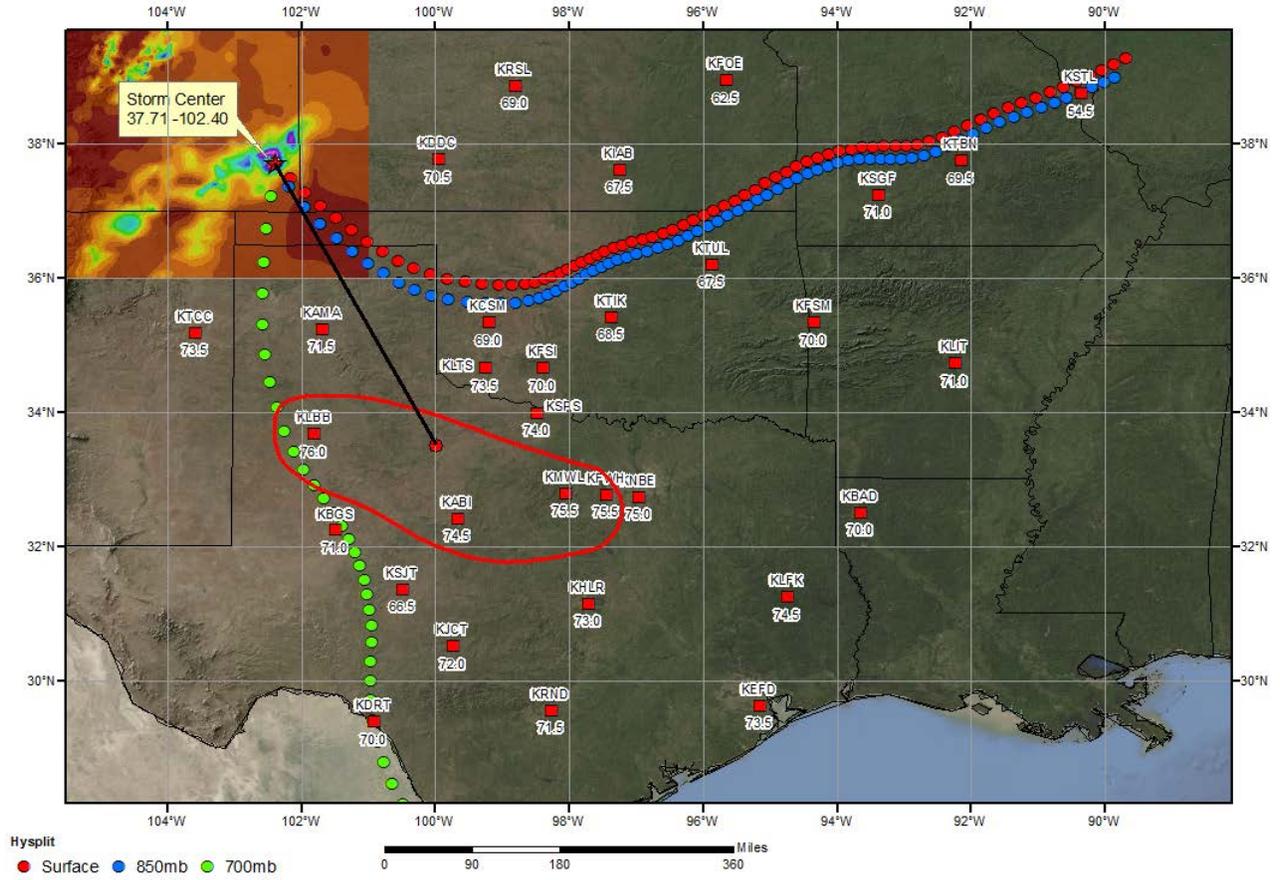


06/20/2013 6:12:12 AM

### NOAA HYSPLIT MODEL Backward trajectories ending at 1200 UTC 16 Jun 65 CDC1 Meteorological Data



### SPAS 1293 Holly, CO Storm Analysis June 13-16, 1965



## Storm Precipitation Analysis System (SPAS) For Storm #1034\_1

**General Storm Location:** Enid, OK (center: Boggy Creek, OK)

**Storm Dates:** October 10 – 12, 1973

**Event:** Thunderstorm, possibly associated with a mesoscale convective complex (MCC)

### DAD Zone 1

**Latitude:** 36.4000 (36.3805)

**Longitude:** -97.8833 (-97.8683)

**Rainfall Amount:** 15.68" (20.00") (Grid/Pixel = 19.45")

**Number of Stations:** 52 (d=38, h=4, hp=4, s=6)

**SPAS Version:** 2.0

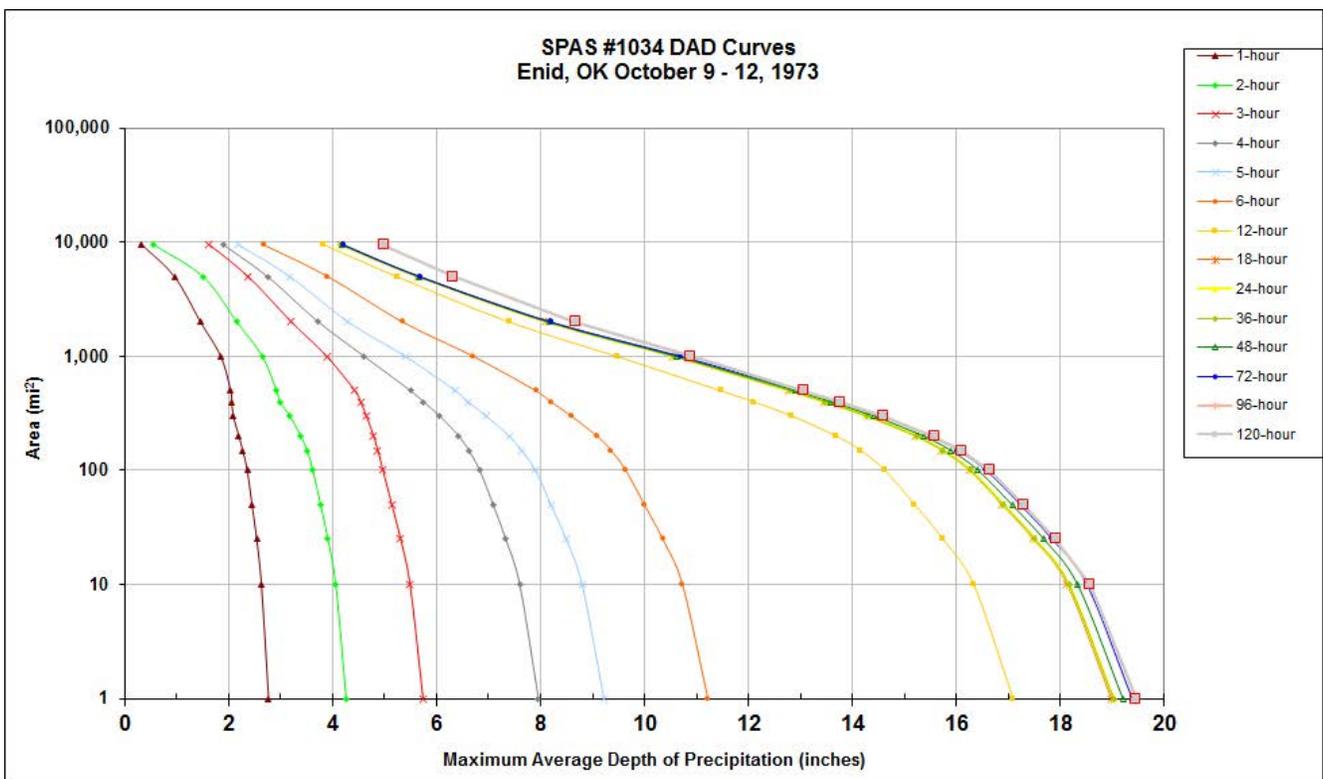
**Base Map Used:** No

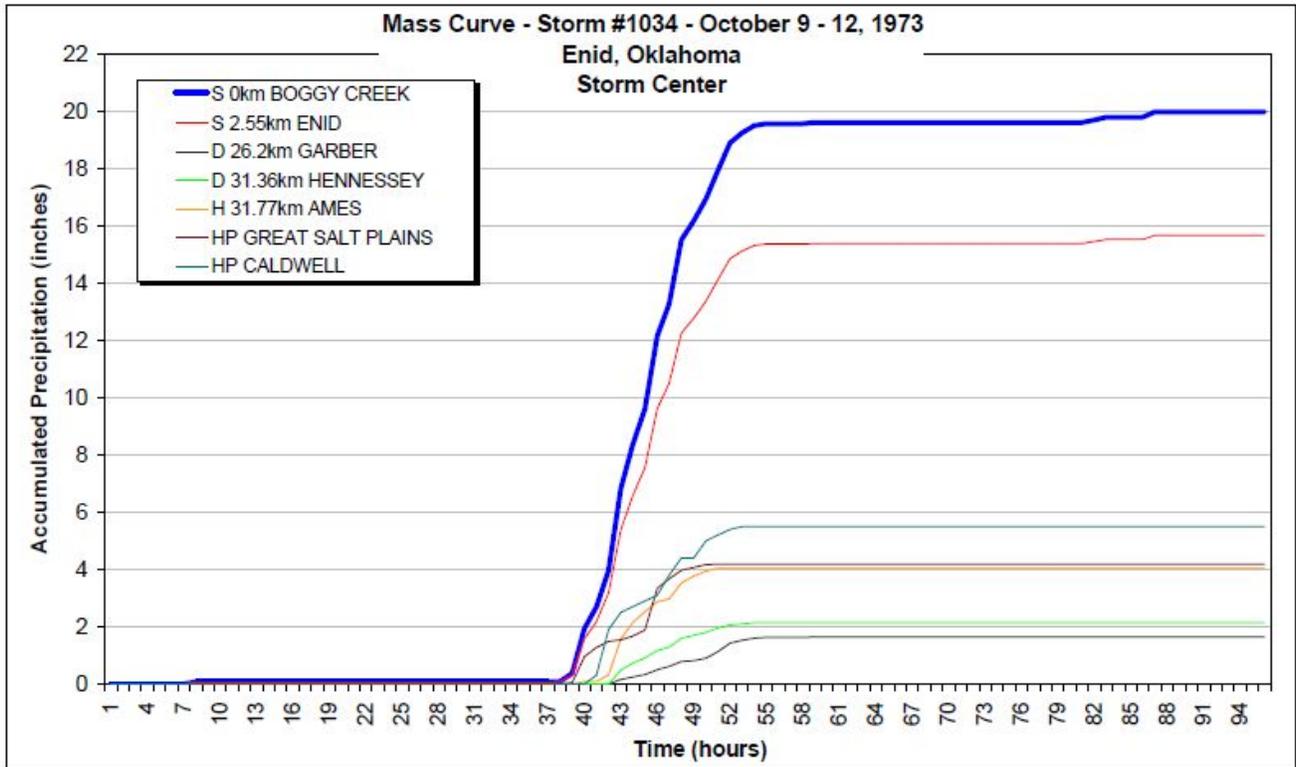
**Radar Included:** No

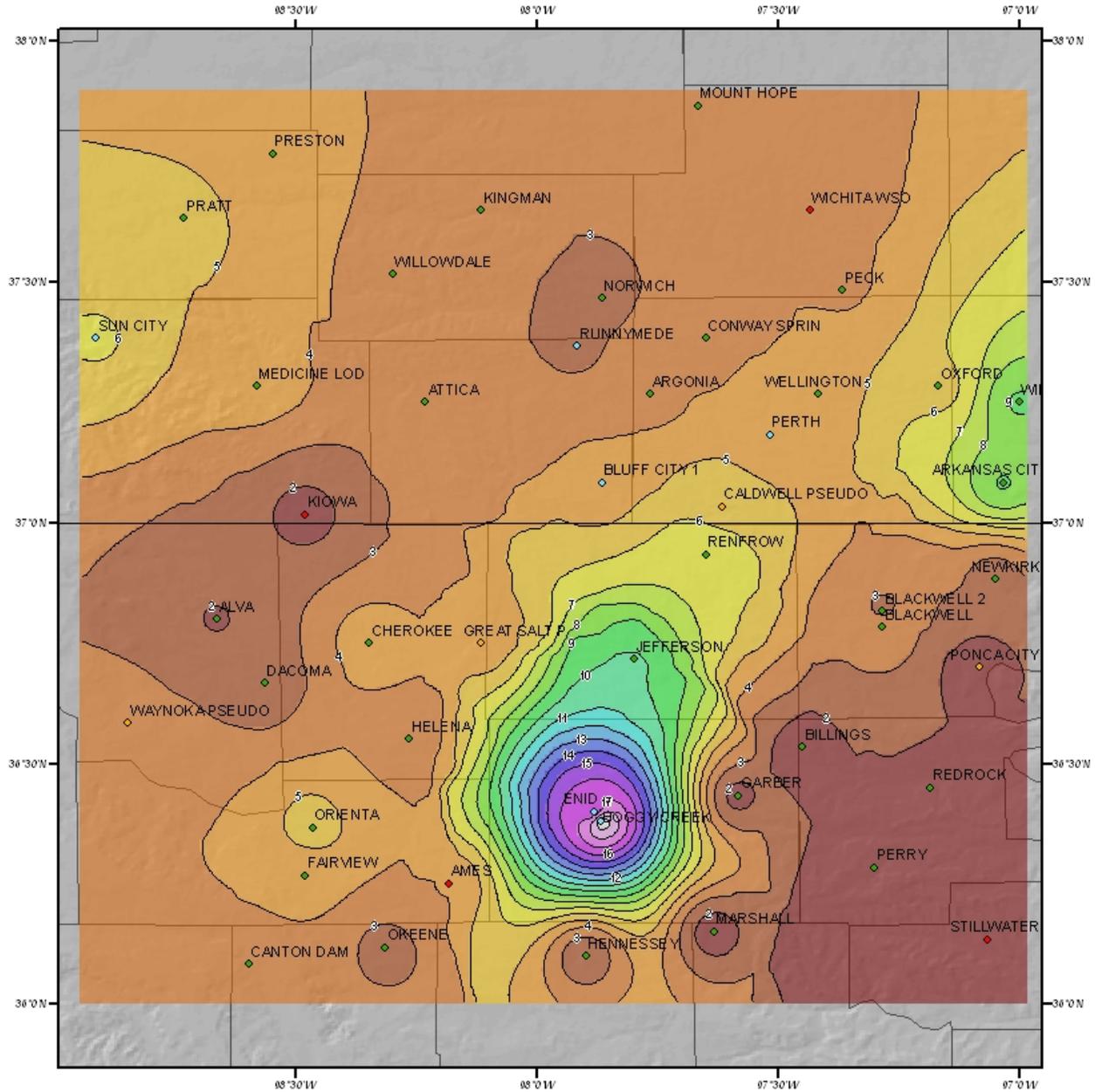
**Depth-Area-Duration (DAD) analysis:** Yes, 1, 2, 3, 4, 5, 6, 12, 18, 24, 36, 48, 72, and 96 hours

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1034_1	-97.868	36.381	1,206	1,200	75.00	2.85	0.30	72	2.550	77.95	78.0	3.29	0.33	78	2.960	1.161

Storm 1034 - Enid OK, October 9 - 12, 1973															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	total
1	2.77	4.26	5.74	7.96	9.22	11.22	17.09	18.98	19.02	19.02	19.20	19.38	19.45	19.45	19.45
10	2.63	4.06	5.49	7.60	8.80	10.73	16.33	18.13	18.16	18.16	18.33	18.51	18.57	18.57	18.57
25	2.54	3.91	5.31	7.33	8.49	10.35	15.74	17.48	17.51	17.51	17.68	17.84	17.91	17.91	17.91
50	2.45	3.77	5.14	7.09	8.20	10.00	15.20	16.88	16.91	16.91	17.07	17.23	17.29	17.29	17.29
100	2.36	3.62	4.97	6.83	7.90	9.64	14.63	16.25	16.27	16.27	16.42	16.57	16.64	16.64	16.64
150	2.27	3.51	4.87	6.62	7.64	9.36	14.16	15.72	15.74	15.74	15.89	16.03	16.09	16.09	16.09
200	2.20	3.39	4.79	6.43	7.40	9.09	13.69	15.21	15.23	15.23	15.37	15.51	15.57	15.57	15.57
300	2.09	3.18	4.65	6.06	6.95	8.59	12.84	14.27	14.29	14.29	14.41	14.54	14.60	14.60	14.60
400	2.06	2.99	4.54	5.75	6.61	8.20	12.10	13.45	13.47	13.47	13.58	13.70	13.75	13.75	13.75
500	2.04	2.92	4.43	5.50	6.36	7.91	11.47	12.78	12.80	12.80	12.90	13.00	13.06	13.06	13.06
1,000	1.85	2.65	3.89	4.61	5.40	6.71	9.47	10.55	10.57	10.57	10.63	10.70	10.89	10.89	10.89
2,000	1.46	2.16	3.21	3.73	4.30	5.35	7.40	8.11	8.13	8.13	8.17	8.20	8.67	8.67	8.67
5,000	0.96	1.51	2.38	2.75	3.18	3.91	5.24	5.64	5.65	5.65	5.67	5.68	6.32	6.32	6.32
9,524	0.33	0.56	1.63	1.90	2.19	2.67	3.83	4.15	4.16	4.16	4.19	4.20	4.98	4.98	4.98







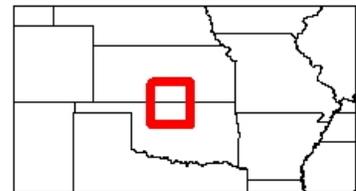
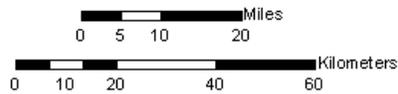
**SPAS Storm #1034 - October 9 to 12, 1973**  
**Total Rainfall (96-hours) - Enid, Oklahoma**

**Precipitation (inches)**

1.35 - 2.00	5.01 - 6.00	9.01 - 10.00	13.01 - 14.00	17.01 - 18.00
2.01 - 3.00	6.01 - 7.00	10.01 - 11.00	14.01 - 15.00	18.01 - 19.00
3.01 - 4.00	7.01 - 8.00	11.01 - 12.00	15.01 - 16.00	19.01 - 20.00
4.01 - 5.00	8.01 - 9.00	12.01 - 13.00	16.01 - 17.00	

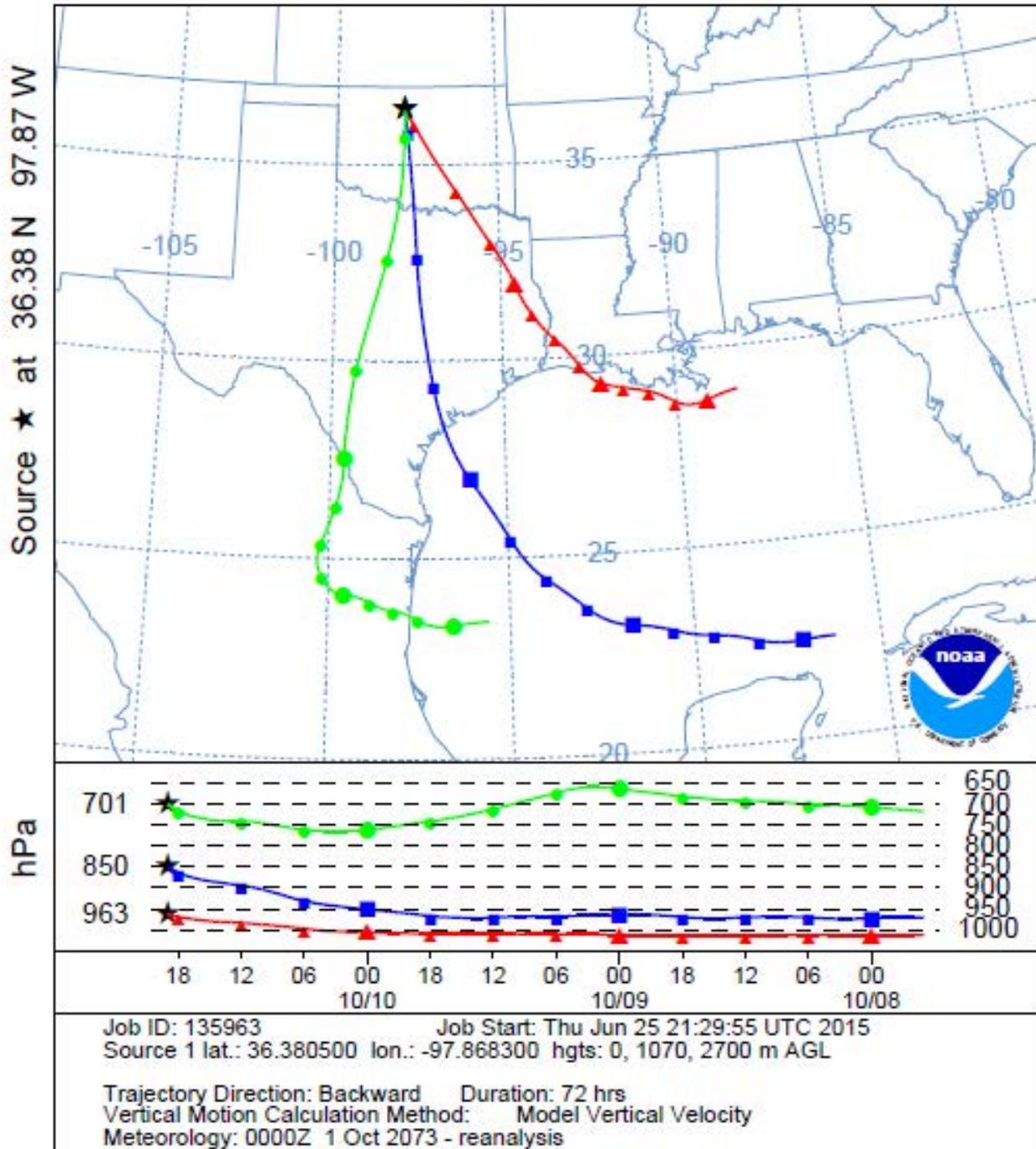
**Gauging Stations**

- Hourly
- Daily
- Hourly Pseudo
- Supplemental

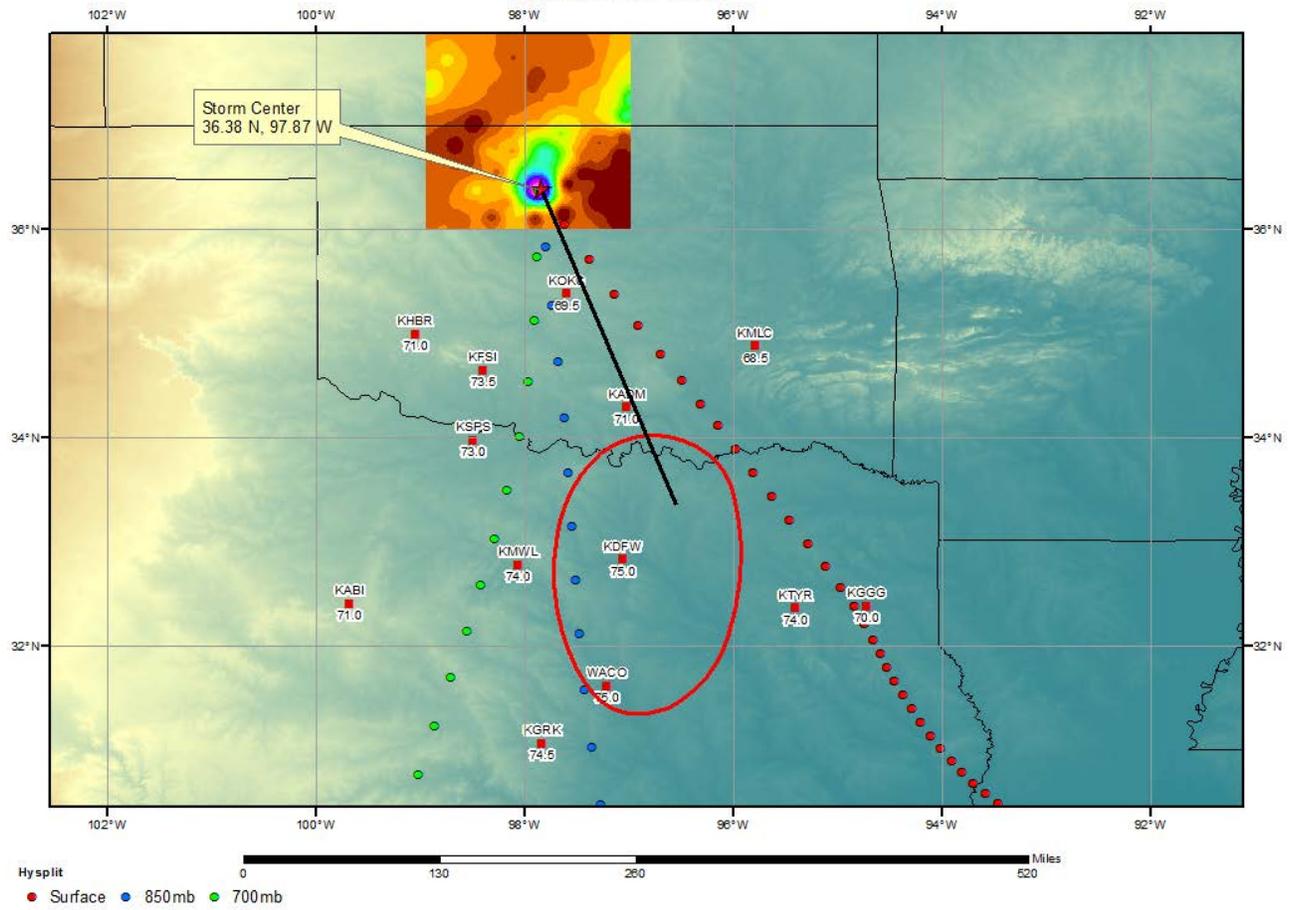


Coordinate system: GCS North American 1983  
 Scale: 1:1,210,722  
Map data from NOAA, April 9, 2007

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1900 UTC 10 Oct 73  
 CDC1 Meteorological Data



### SPAS 1034, Enid, OK Storm Analysis October 9-10, 1973



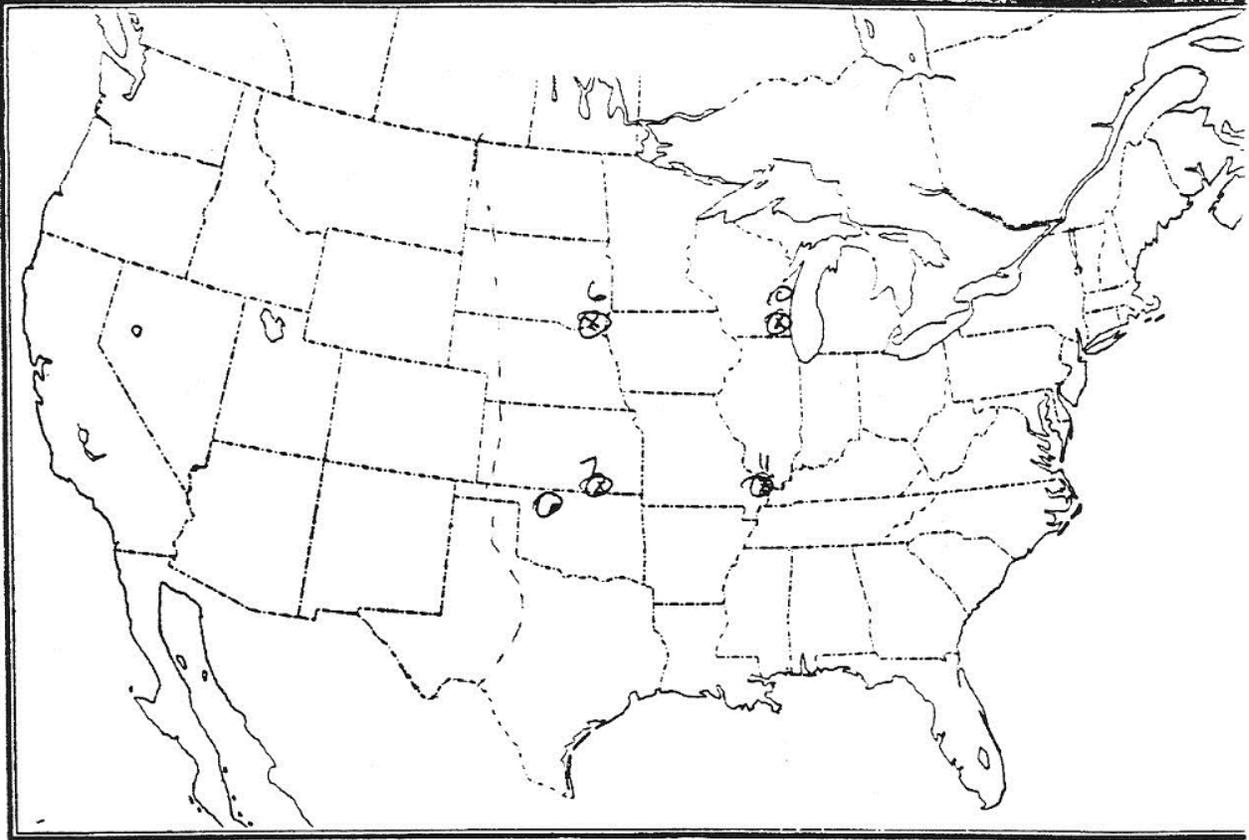
133 Hymenoptera Oct 11, 1973

~~Enid OK 1a (1245 fr)~~

Td = 74°F, 2255 26°25'975-

733 Hymenoptera OCT 21, 1977

~~Enid OK 1a (1245 fr)~~



## Storm Precipitation Analysis System (SPAS) For Storm #1247\_1

**General Storm Location:** Colorado

**Storm Dates:** July 2-5, 1981

**Event:** Thunderstorm

### DAD Zone 1

**Latitude:** 37.096

**Longitude:** -104.379

**Max. Grid Rainfall Amount:** 16.33”

**Max. Observed Rainfall Amount:** 16.00”

**Number of Stations:** 54 (23 Daily, 8 Hourly, 2 Hourly Pseudo, and 21 Supplemental)

**SPAS Version:** 9.5

**Basemap:** Blend of isohyetal from Bishop report and PRISM July 1981 precipitation

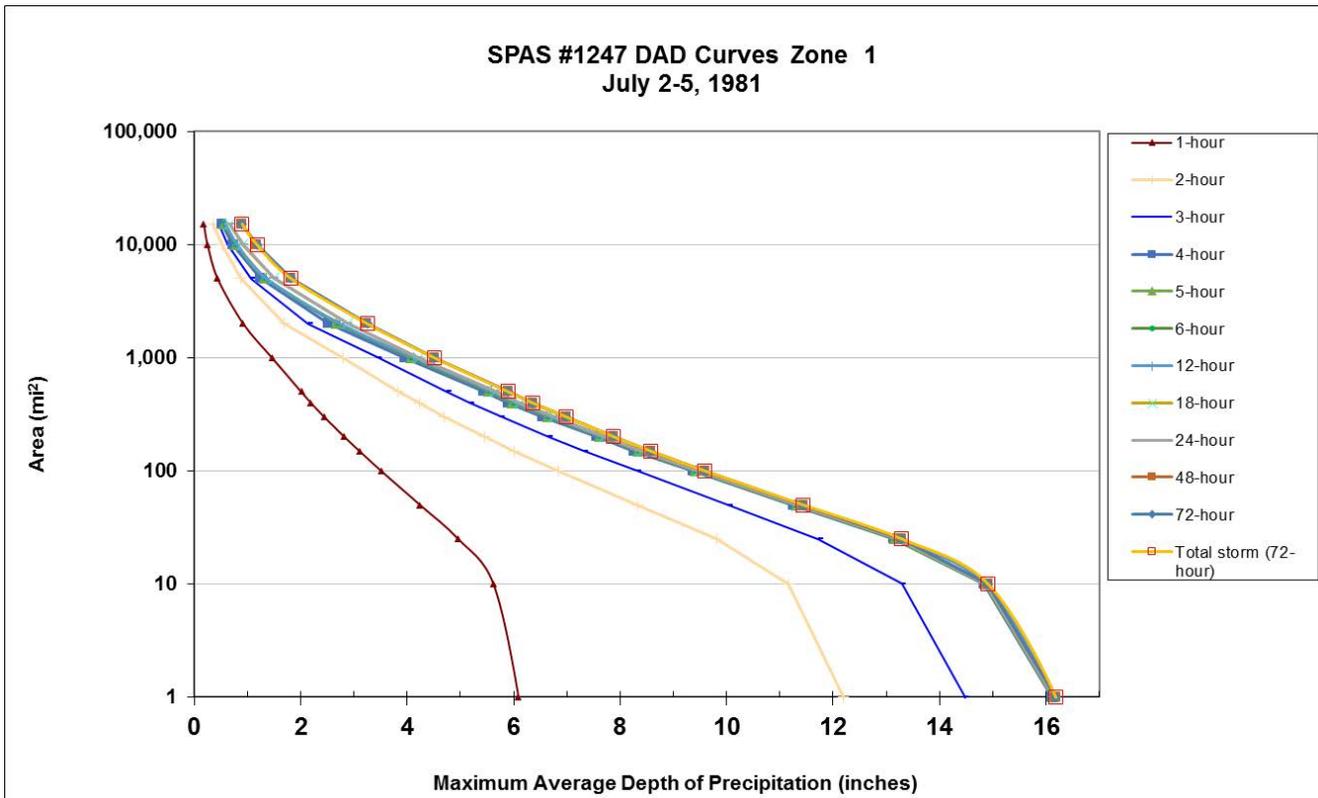
**Spatial resolution:** 00:00:30 (~ 0.30 mi<sup>2</sup>)

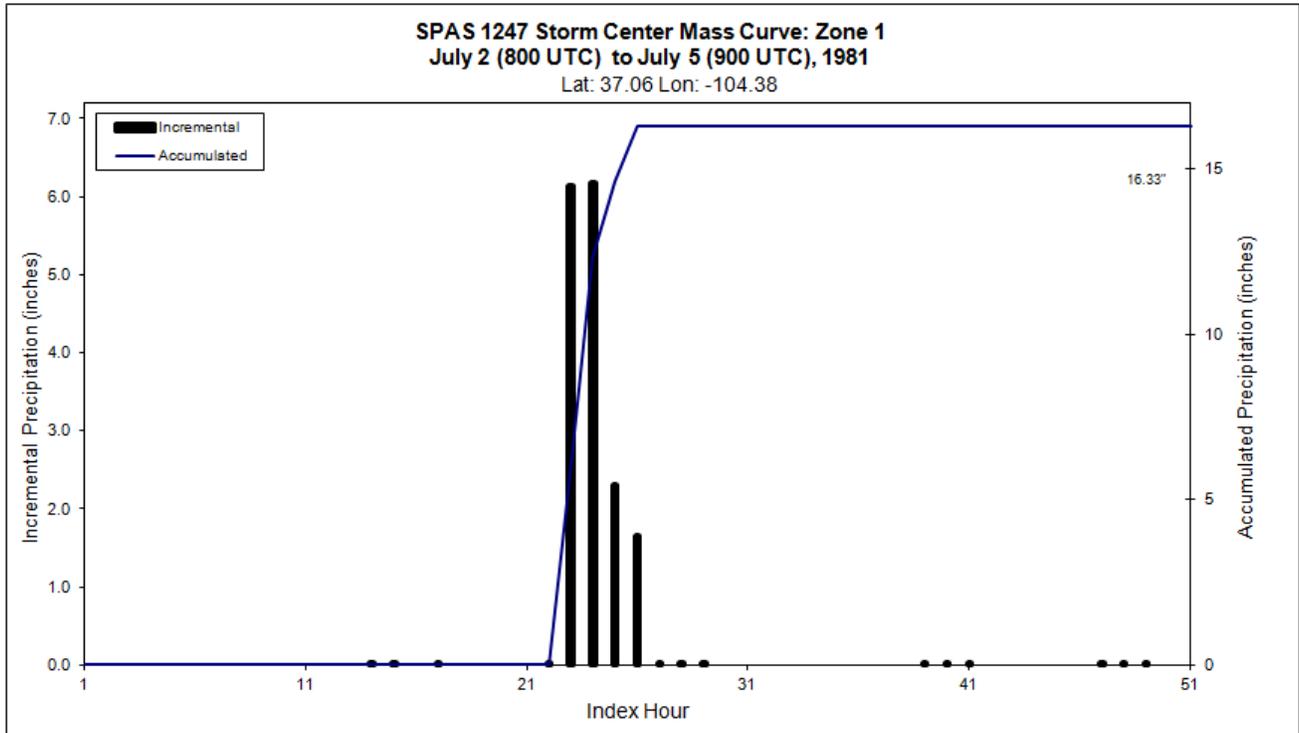
**Radar Included:** No

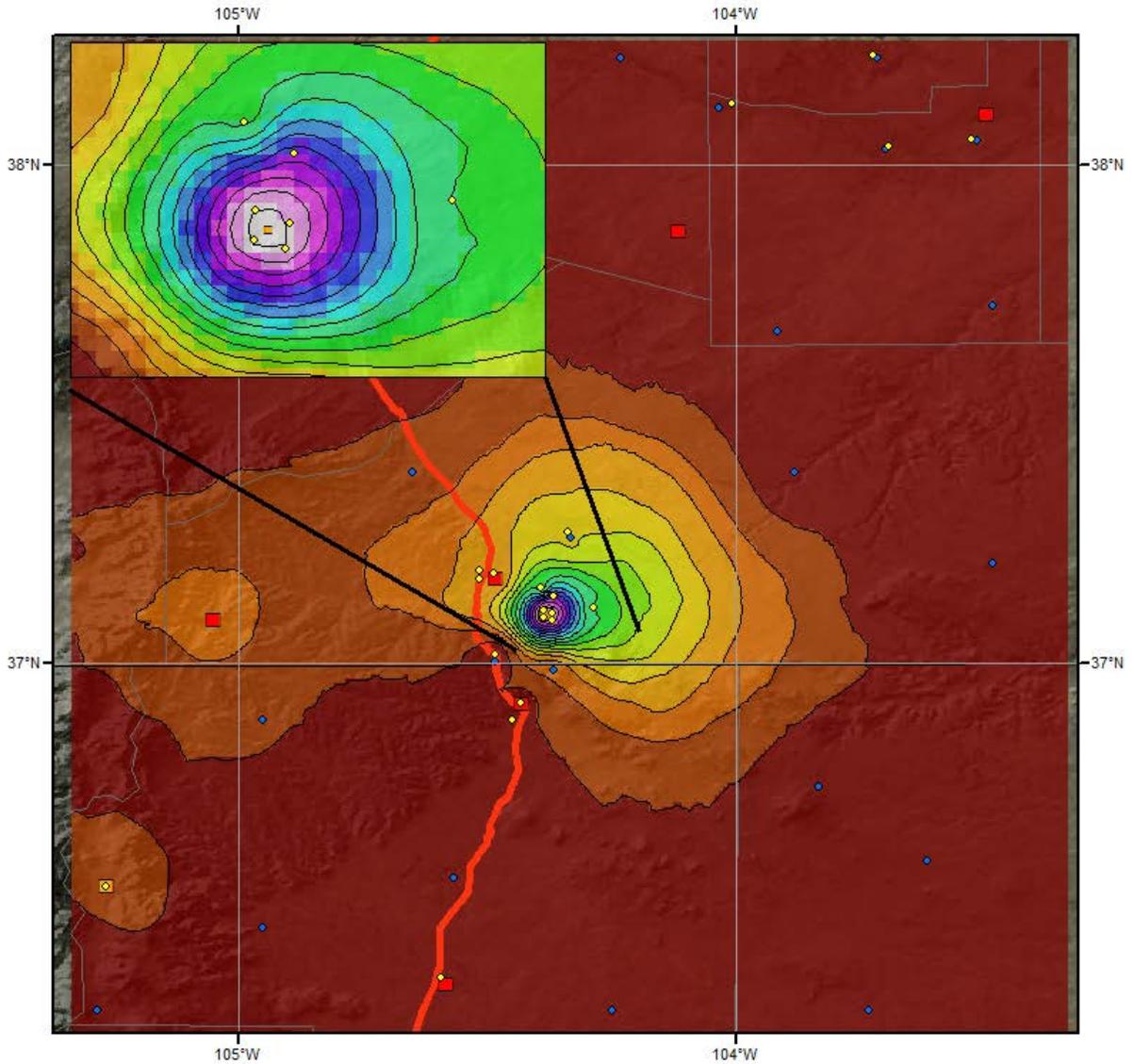
**Depth-Area-Duration (DAD) analysis:** Yes

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1247_1	-104.379	37.096	6,534	6,500	77.00	3.14	1.45	76	1.690	79.82	80.0	3.60	1.60	82	2.000	1.183

Storm 1247 - July 2 (8 UTC) - July 5 (7 UTC), 1981												
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)												
Area (mi <sup>2</sup> )	Duration (hours)											
	1	2	3	4	5	6	12	18	24	48	72	Total
0.3	6.14	12.26	14.56	16.21	16.22	16.23	16.23	16.25	16.25	16.28	16.28	16.28
1	6.09	12.19	14.47	16.11	16.12	16.12	16.13	16.14	16.14	16.18	16.18	16.18
10	5.62	11.16	13.29	14.83	14.85	14.85	14.86	14.87	14.87	14.91	14.91	14.91
25	4.96	9.82	11.73	13.13	13.16	13.17	13.18	13.22	13.22	13.29	13.29	13.29
50	4.24	8.34	10.03	11.26	11.30	11.30	11.32	11.34	11.34	11.44	11.44	11.44
100	3.51	6.84	8.31	9.37	9.41	9.42	9.44	9.48	9.48	9.59	9.59	9.59
150	3.10	6.00	7.31	8.27	8.33	8.35	8.37	8.41	8.41	8.57	8.57	8.57
200	2.82	5.45	6.66	7.55	7.62	7.63	7.66	7.71	7.71	7.88	7.88	7.88
300	2.44	4.70	5.75	6.55	6.64	6.66	6.70	6.76	6.76	6.99	6.99	6.99
400	2.19	4.23	5.17	5.89	5.98	6.01	6.05	6.11	6.11	6.35	6.35	6.35
500	2.01	3.83	4.75	5.43	5.52	5.54	5.59	5.66	5.66	5.90	5.90	5.90
1,000	1.46	2.79	3.45	3.96	4.06	4.08	4.13	4.21	4.21	4.51	4.51	4.51
2,000	0.92	1.69	2.14	2.52	2.66	2.70	2.74	2.88	2.88	3.23	3.25	3.25
5,000	0.44	0.87	1.07	1.25	1.32	1.34	1.36	1.50	1.50	1.82	1.82	1.82
10,000	0.25	0.52	0.63	0.73	0.78	0.79	0.81	0.92	0.93	1.17	1.18	1.18
15,206	0.18	0.35	0.46	0.53	0.56	0.57	0.59	0.67	0.67	0.90	0.90	0.90



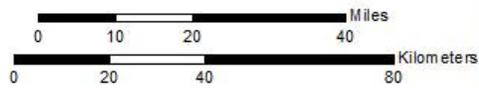




**Total Precipitation (72-hours)**  
**SPAS-Lite 1247 - Frijole Creek, CO**  
**7/02/1981 0800 GMT - 7/05/1981 0700 GMT**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Pseudo
- ◆ Supplemental



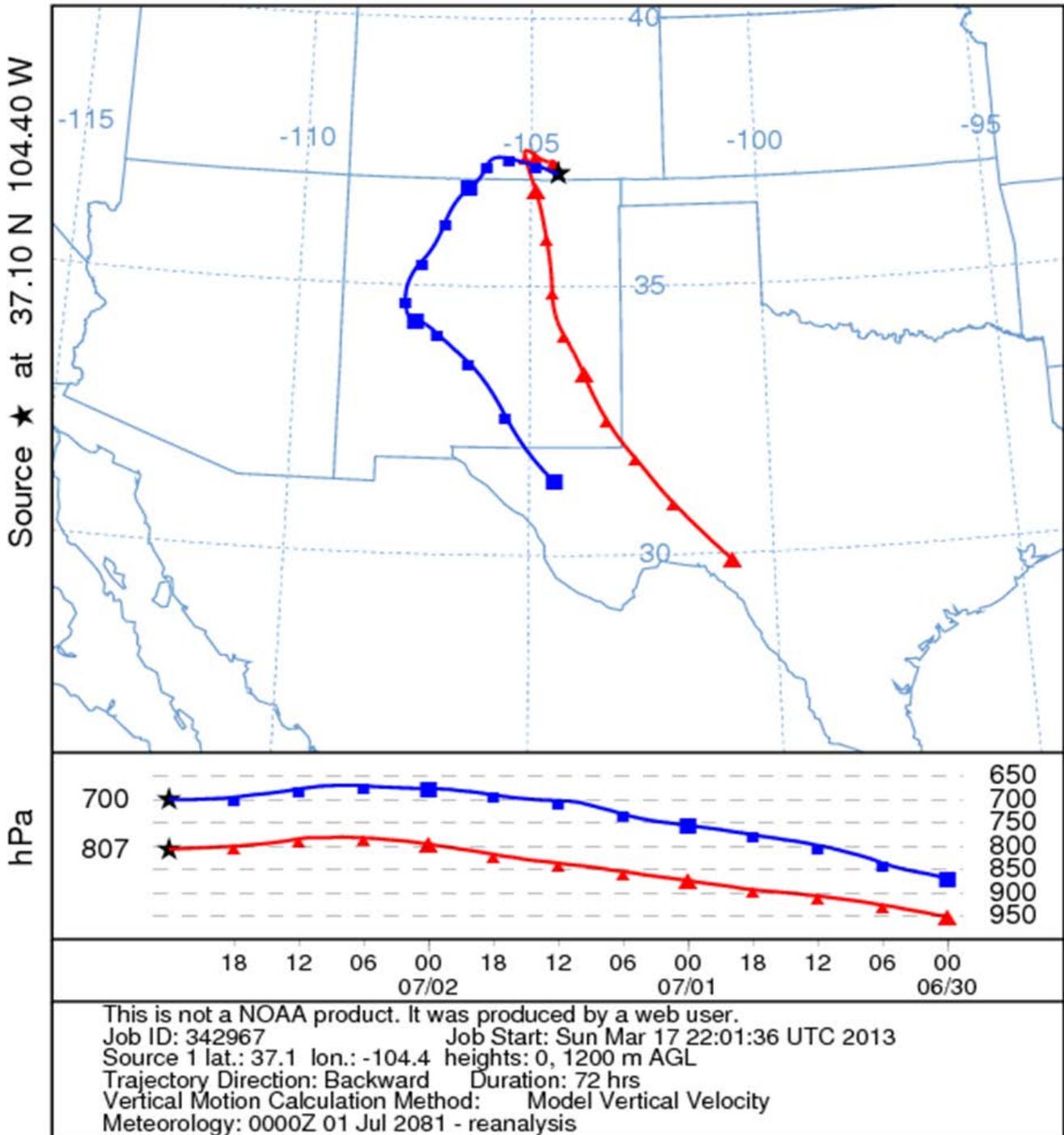
**Precipitation (inches)**

- |               |               |                 |                 |                 |
|---------------|---------------|-----------------|-----------------|-----------------|
| ■ 0.00 - 1.00 | ■ 4.01 - 5.00 | ■ 8.01 - 9.00   | ■ 12.01 - 13.00 | ■ 16.01 - 17.00 |
| ■ 1.01 - 2.00 | ■ 5.01 - 6.00 | ■ 9.01 - 10.00  | ■ 13.01 - 14.00 |                 |
| ■ 2.01 - 3.00 | ■ 6.01 - 7.00 | ■ 10.01 - 11.00 | ■ 14.01 - 15.00 |                 |
| ■ 3.01 - 4.00 | ■ 7.01 - 8.00 | ■ 11.01 - 12.00 | ■ 15.01 - 16.00 |                 |

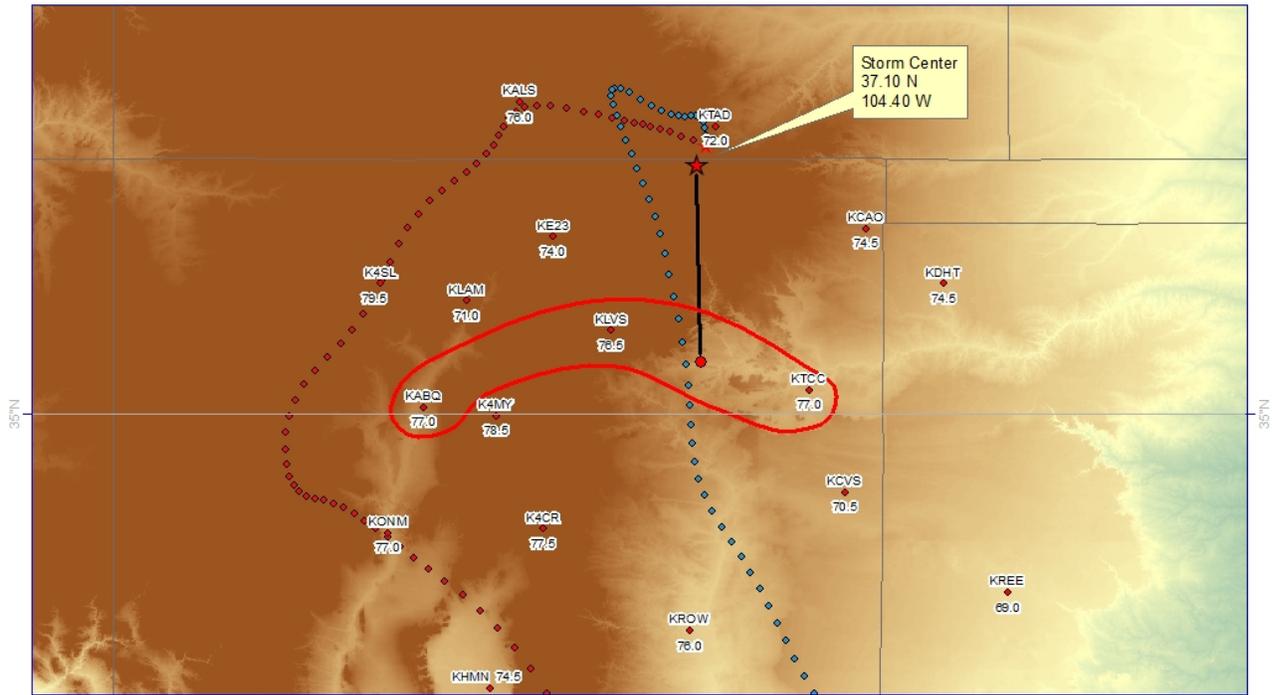


8/20/2012

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 03 Jul 81  
 CDC1 Meteorological Data

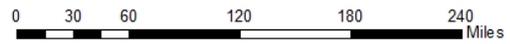


**SPAS 1247**  
July 2-5, 1981



**Hysplit**

- ◆ Surface
- ◆ 700 mb



## Storm Precipitation Analysis System (SPAS) For Storm #1185\_1

**General Storm Location:** Corrigan, TX

**Storm Dates:** October 15-18, 1994

**Event:** Tropical moisture & stationary front

**DAD Zone 1**

**Latitude:** 30.26

**Longitude:** -94.89

**Max. Grid Rainfall Amount:** 30.90"

**Max. Observed Rainfall Amount:** Liberty, TX (28.66")

**Number of Stations:** 233 (159 Daily, 15 Hourly, 10 Hourly Pseudo, 32 Supplemental, 3 Hourly Estimated and 14 Hourly Estimated Pseudo)

**SPAS Version:** 8.5

**Base Map Used:** Yes, conus\_prism\_ppt\_in\_1971\_2000\_10

**Spatial resolution:** 00:00:36 (0.4 sq. miles)

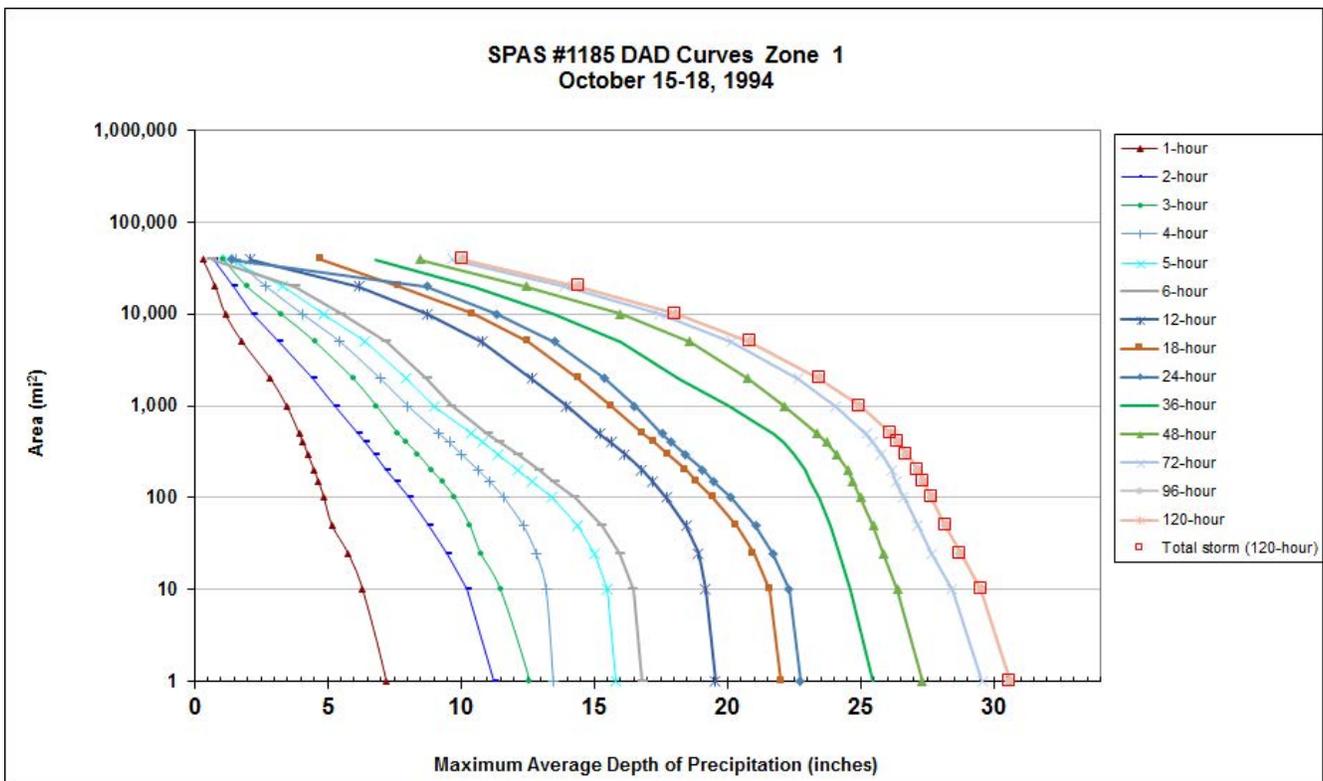
**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

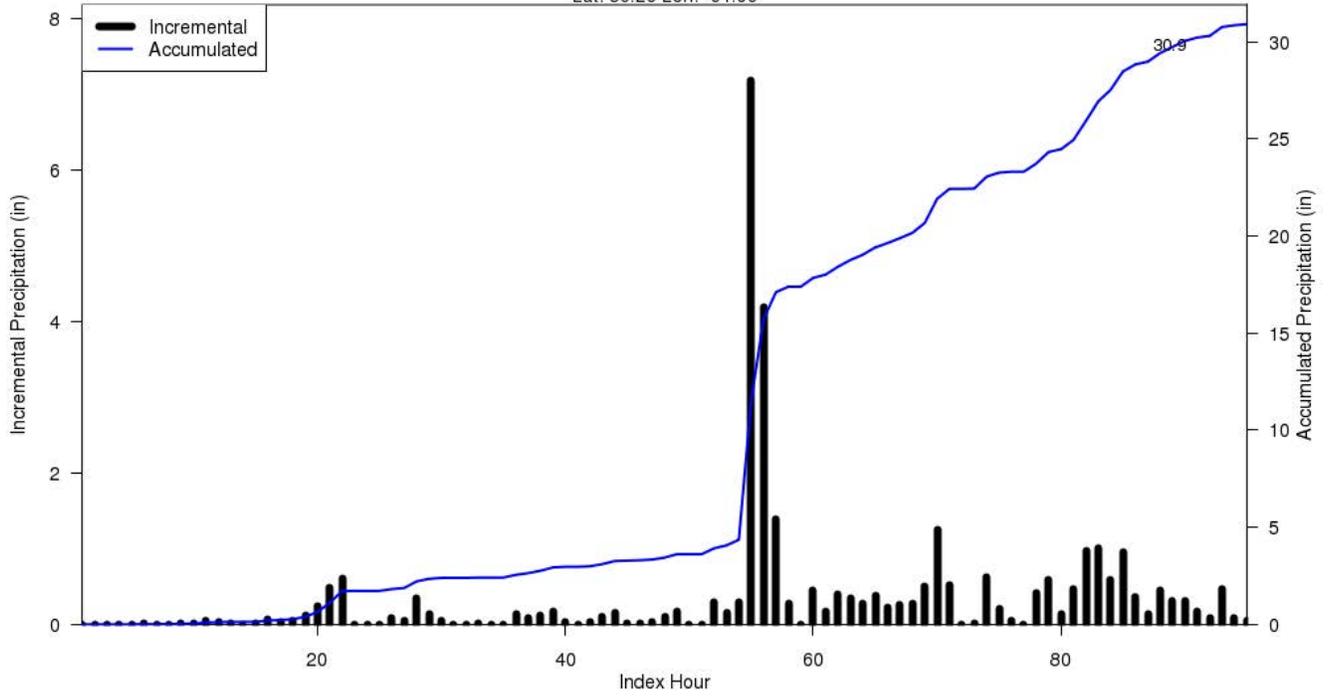
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1185_1	-94.890	30.260	125	100	82.00	3.95	0.03	86	3.920	84.20	84.0	4.30	0.04	90	4.260	1.087

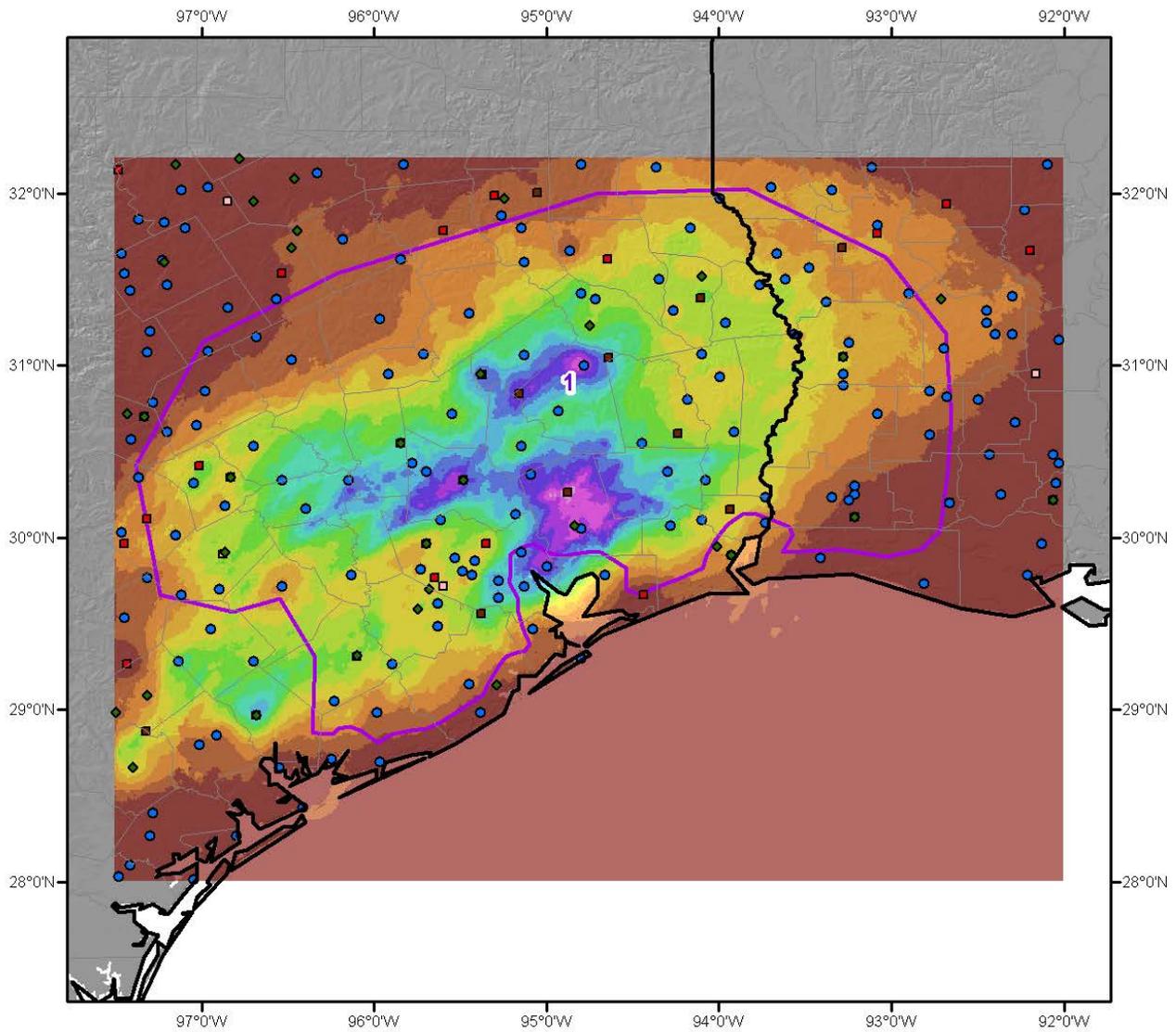
**Storm 1185- October 15 (0100 UTC) - October 18 (2300 UTC), 1994**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.4	7.32	11.37	12.75	13.58	15.94	16.93	19.71	22.16	22.91	25.68	27.56	29.82	30.90	30.90	30.90
1	7.21	11.25	12.59	13.47	15.82	16.80	19.56	22.01	22.75	25.44	27.30	29.57	30.62	30.62	30.62
10	6.32	10.24	11.49	13.20	15.50	16.46	19.19	21.60	22.32	24.61	26.38	28.42	29.51	29.51	29.51
25	5.77	9.50	10.74	12.82	15.00	15.97	18.90	20.98	21.71	24.18	25.86	27.67	28.74	28.74	28.74
50	5.17	8.81	10.34	12.34	14.36	15.31	18.45	20.35	21.07	23.86	25.48	27.14	28.19	28.19	28.19
100	4.87	8.03	9.77	11.62	13.42	14.28	17.72	19.46	20.13	23.44	25.01	26.63	27.66	27.66	27.66
150	4.67	7.55	9.31	11.09	12.69	13.51	17.21	18.87	19.51	23.13	24.71	26.34	27.36	27.36	27.36
200	4.50	7.21	8.91	10.66	12.14	12.93	16.79	18.43	19.07	22.91	24.51	26.16	27.14	27.14	27.14
300	4.26	6.76	8.39	10.02	11.38	12.13	16.14	17.76	18.40	22.48	24.09	25.76	26.72	26.72	26.72
400	4.09	6.40	7.97	9.57	10.80	11.48	15.64	17.26	17.91	22.13	23.73	25.45	26.40	26.40	26.40
500	3.94	6.14	7.65	9.19	10.37	11.03	15.22	16.85	17.56	21.73	23.37	25.20	26.15	26.15	26.15
1,000	3.47	5.28	6.84	8.02	9.00	9.67	13.97	15.63	16.51	20.04	22.13	24.04	24.96	24.96	24.96
2,000	2.85	4.44	5.96	6.97	7.97	8.73	12.67	14.42	15.40	18.20	20.78	22.66	23.47	23.47	23.47
5,000	1.80	3.16	4.53	5.47	6.42	7.21	10.81	12.52	13.51	16.01	18.60	20.15	20.86	20.86	20.86
10,000	1.17	2.20	3.27	4.06	4.84	5.52	8.74	10.45	11.34	13.44	16.00	17.45	18.06	18.06	18.06
20,000	0.79	1.44	1.98	2.70	3.31	3.80	6.19	7.69	8.72	10.47	12.46	13.92	14.43	14.43	14.43
39,064	0.33	0.73	1.11	1.55	1.26	0.69	2.11	4.76	1.39	6.83	8.47	9.69	10.08	10.08	10.08

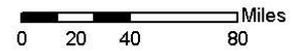


SPAS 1185 Storm Center Mass Curve Zone 1  
October 15 (100UTC) to October 18 (2300UTC), 1994  
Lat: 30.26 Lon: -94.89

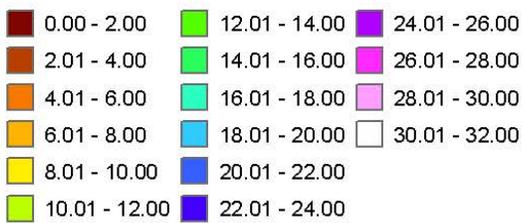




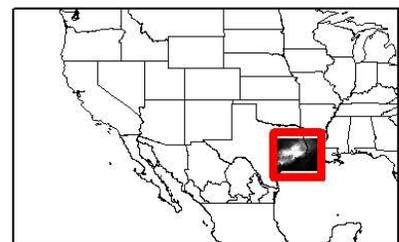
**Total Precipitation (95-hours)**  
**SPAS storm number: 1185**  
**October 15, 1994 (0100 UTC) - October 18, 1994 (2300 UTC)**



**Precipitation (inches)**

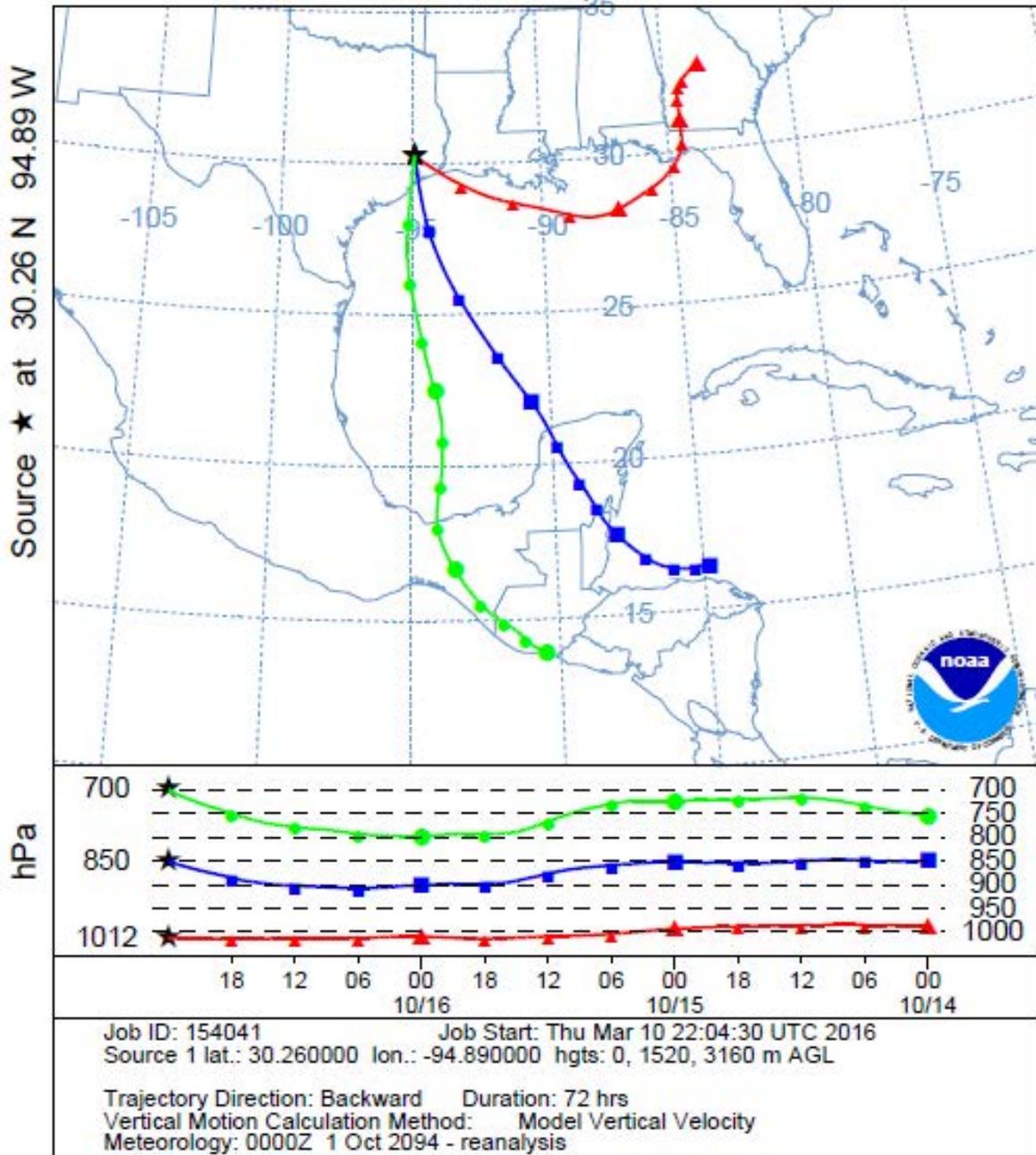


- Daily
- Hourly
- Hourly Estimated
- Hourly Estimated Pseudo
- Hourly Pseudo
- ◆ Supplemental

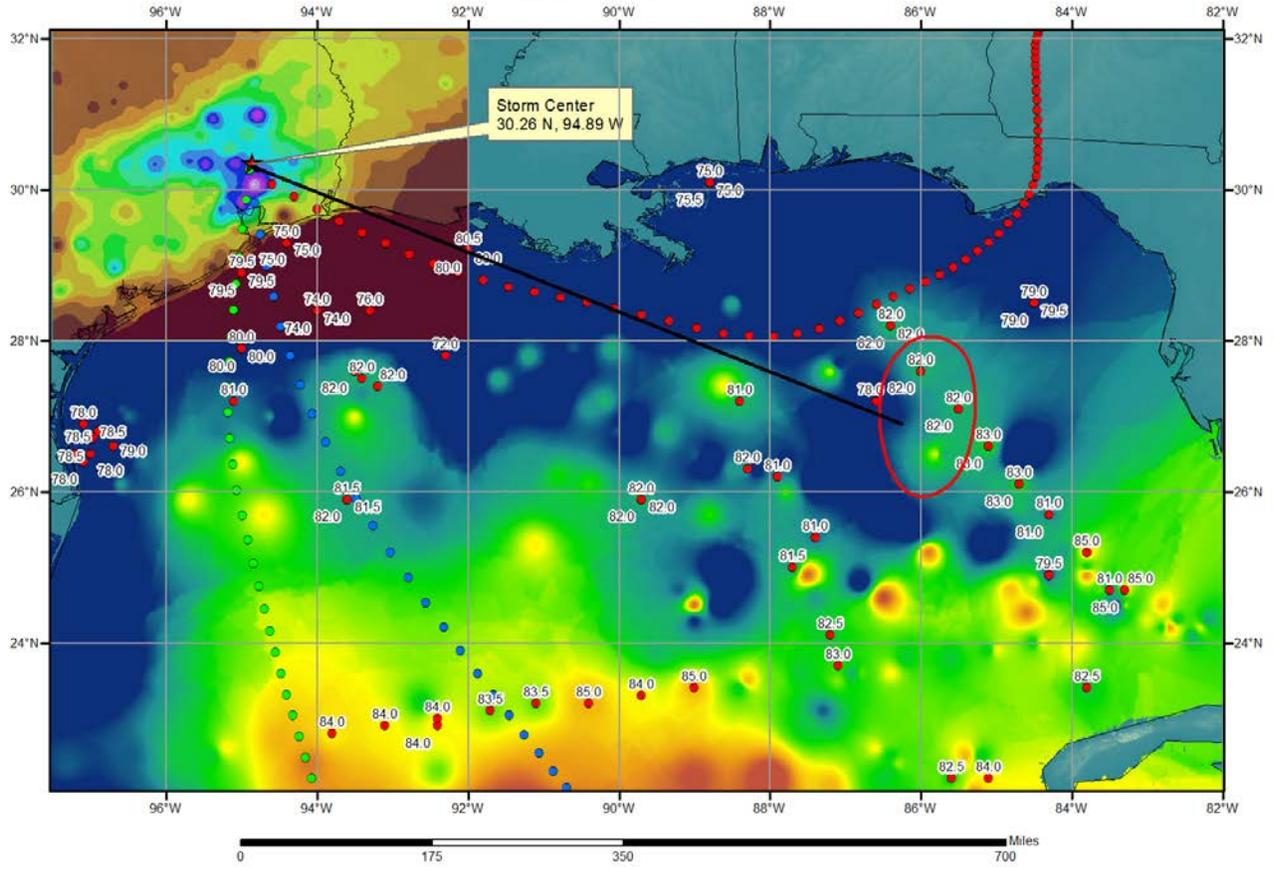


Metstat/AWA July 18, 2010

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 17 Oct 94  
 CDC1 Meteorological Data



### SPAS 1185 Corrigan, TX Sea Surface Temperatures (F) October 16, 1994



## Storm Precipitation Analysis System (SPAS) For Storm #1036\_1

**General Storm Location:** Pawnee Creek, CO

**Storm Dates:** July 29 (2000 Z) – 30 (1300 Z), 1997

**Event:** Convective Thunderstorm

### DAD Zone 1

**Latitude:** 40.7752

**Longitude:** -103.6253

**Rainfall Amount:** 13.58” (Grid/Pixel Point) in 12hours (but the total analysis window was 17hrs)

**Number of Stations:** 96 (15-hourly, 1-hourly pseudo, 24-daily, and 56-supplemental) gauging stations within the define search domain. 77 (6-hourly, 0-hourly pseudo, 15-daily, and 56-supplemental) stations within radar domain.

**SPAS Version:** 2.0

**Base Map Used:** No

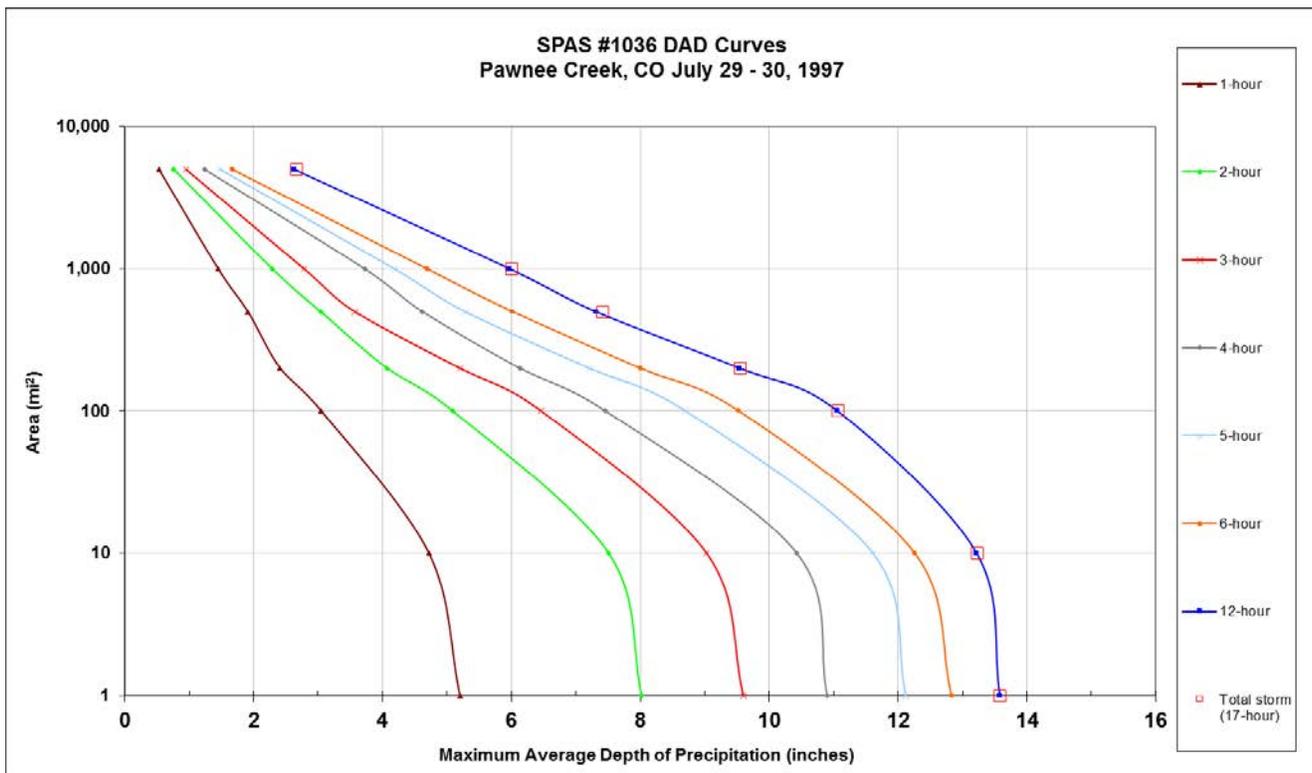
**Radar Included:** Yes

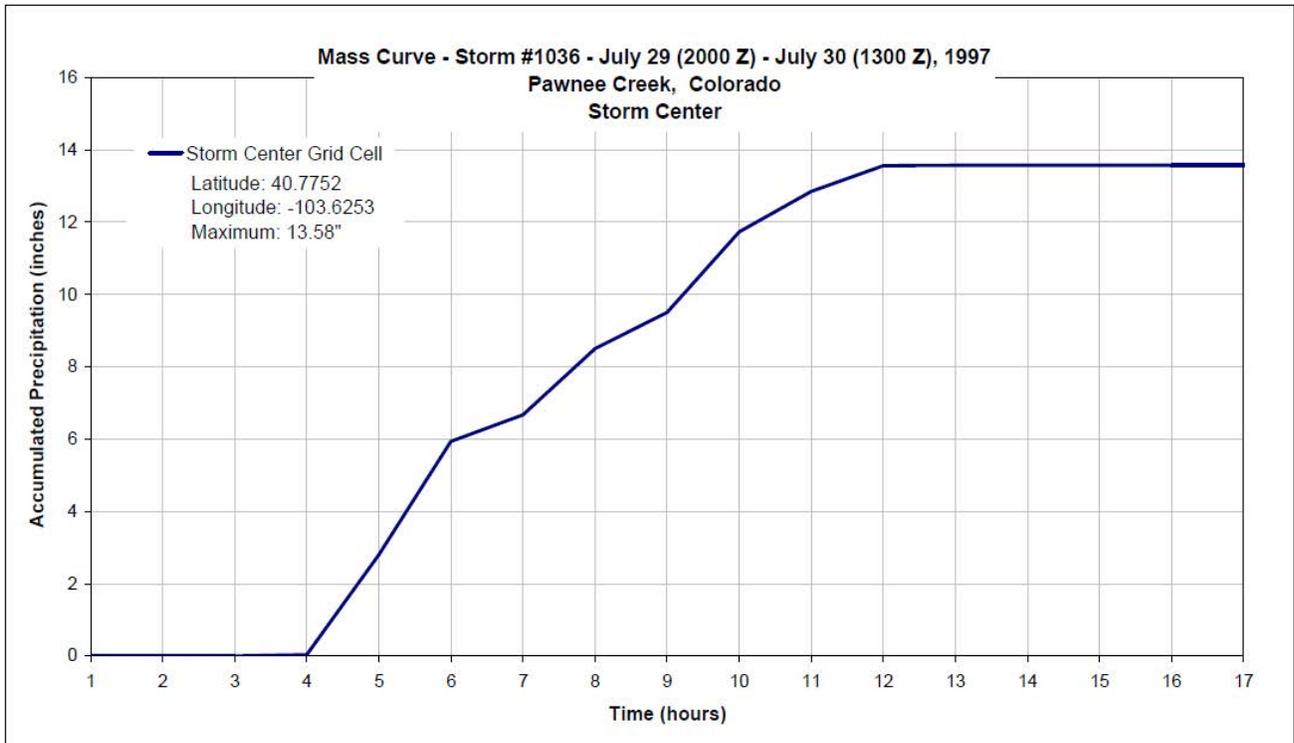
**Depth-Area-Duration (DAD) analysis:** Yes, 1, 2, 3, 4, 5, 6, 12, and 17 hours.

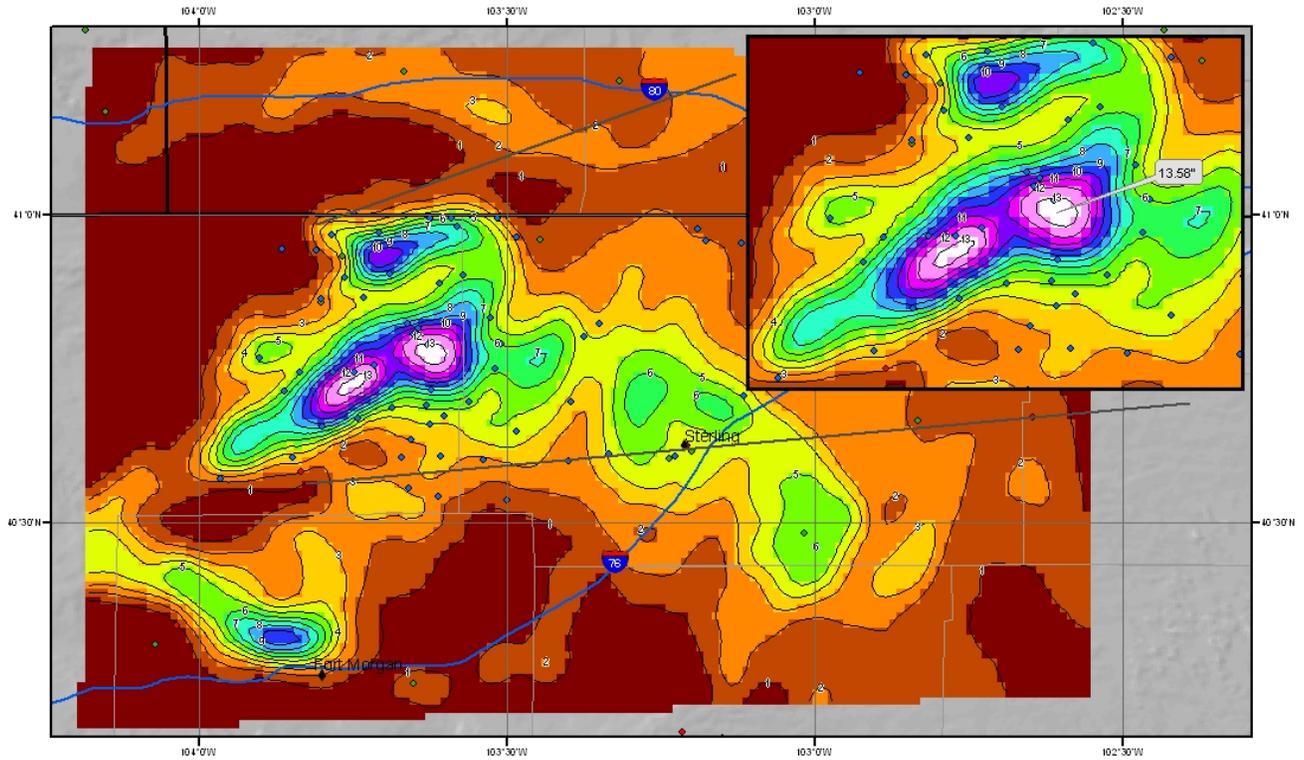
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1036_1	-103.625	40.775	4,497	4,500	75.50	2.92	1.02	73	1.900	81.70	81.5	3.86	1.24	85	2.620	1.379

**Storm 1036 - Pawnee Creek, CO July 29 - 30, 1997**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)								
	1	2	3	4	5	6	12	17	total
1	5.20	8.02	9.60	10.90	12.12	12.83	13.58	13.58	13.58
10	4.72	7.51	9.03	10.43	11.61	12.26	13.22	13.23	13.23
100	3.05	5.09	6.46	7.46	8.70	9.53	11.06	11.07	11.07
200	2.41	4.07	5.20	6.13	7.21	8.00	9.54	9.55	9.55
500	1.91	3.04	3.57	4.62	5.28	6.02	7.31	7.42	7.42
1,000	1.45	2.29	2.78	3.72	4.18	4.69	5.97	6.01	6.01
5,000	0.53	0.76	0.95	1.24	1.48	1.67	2.63	2.67	2.67







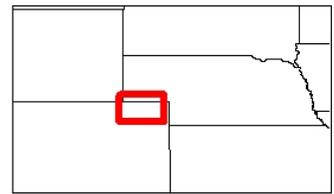
**SPAS Storm #1036 - July 29-30, 1997**  
**Total Rainfall (17-hours) - Pawnee Creek, Colorado**

**Gauging Stations**

- ◆ Daily
- ◆ Hourly
- ◆ Hourly Pseudo
- ◆ Supplemental

**Precipitation (inches)**

0.00 - 1.00	4.01 - 5.00	8.01 - 9.00	12.01 - 13.00
1.01 - 2.00	5.01 - 6.00	9.01 - 10.00	13.01 - 14.00
2.01 - 3.00	6.01 - 7.00	10.01 - 11.00	
3.01 - 4.00	7.01 - 8.00	11.01 - 12.00	

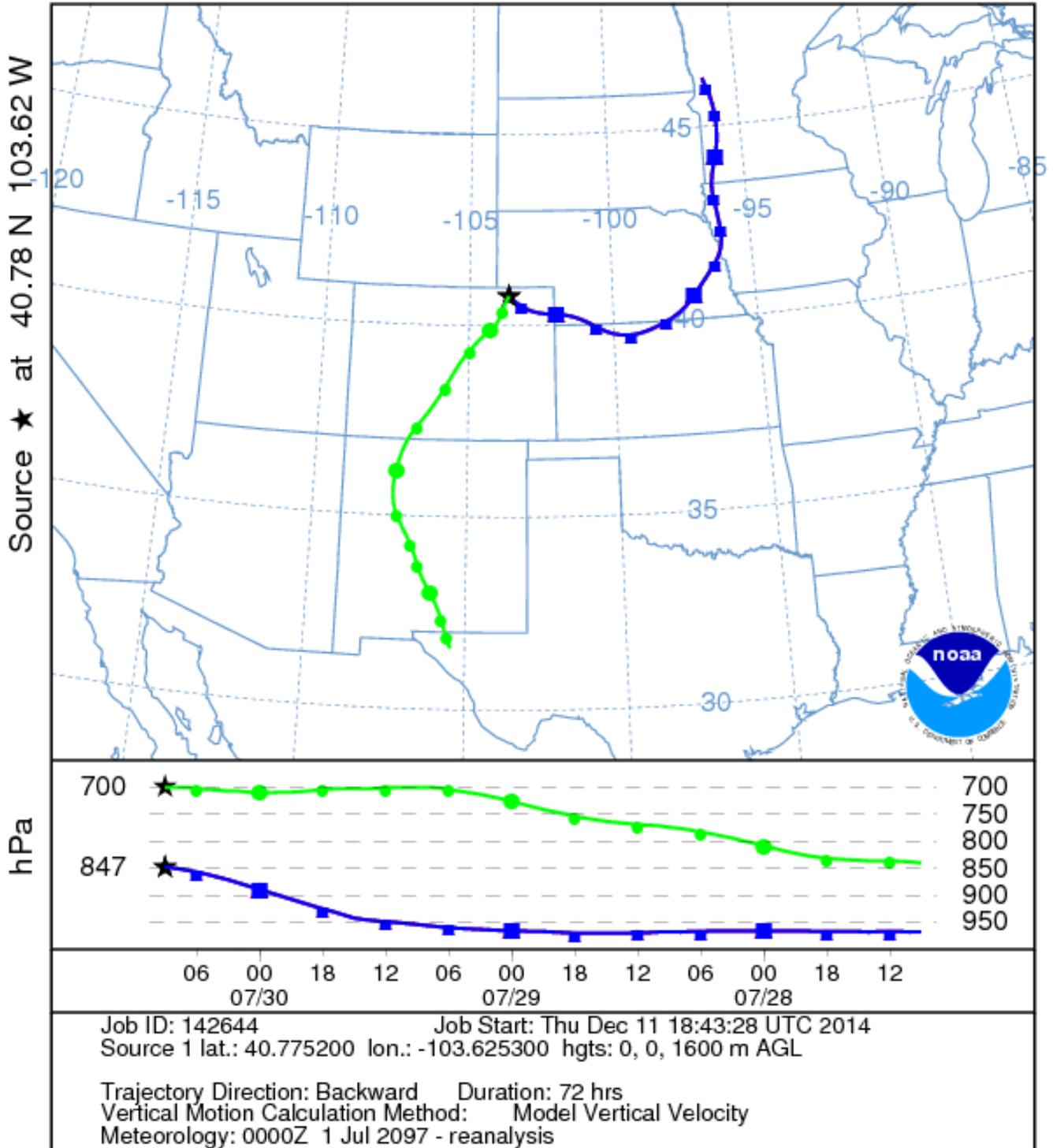


Coordinate system: GCS North American 1983  
 Scale: 1:841,717  
 MESA7AW June 3, 2007

# NOAA HYSPLIT MODEL

## Backward trajectories ending at 0900 UTC 30 Jul 97

### CDC1 Meteorological Data





## Storm Precipitation Analysis System (SPAS) For Storm #1662\_1

**General Storm Location:** Saguache, CO

**Storm Dates:** July 25-26, 1999

**Event:** Local

### DAD Zone 1

**Latitude:** 38.2150

**Longitude:** -106.2950

**Max. Grid/Radar Rainfall Amount:** 6.68"

**Max. Observed Rainfall Amount:** 5.00"

**Number of Stations:** 47

**SPAS Version:** 10.0

**Base Map Used:** "defaultP" (created from ippt\_allsites\_1662\_sum\_in)

**Spatial resolution:** 0.3752

**Radar Included:** Yes

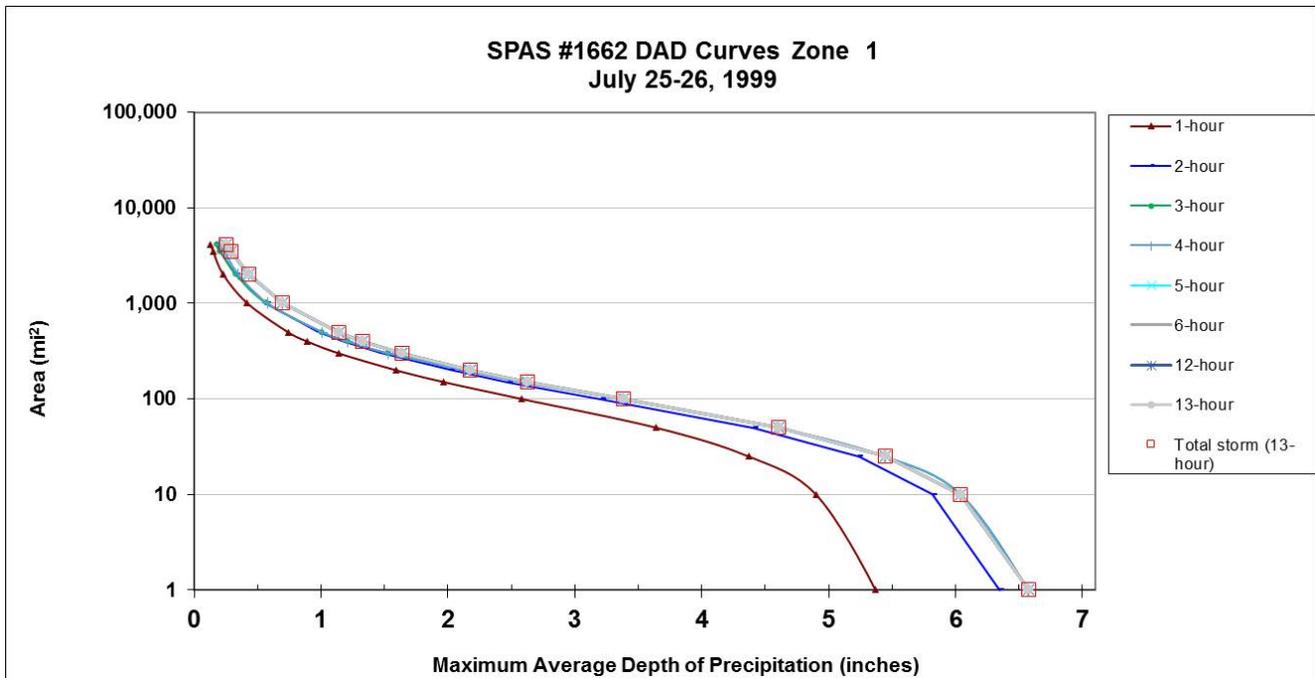
**Depth-Area-Duration (DAD) analysis:** Yes

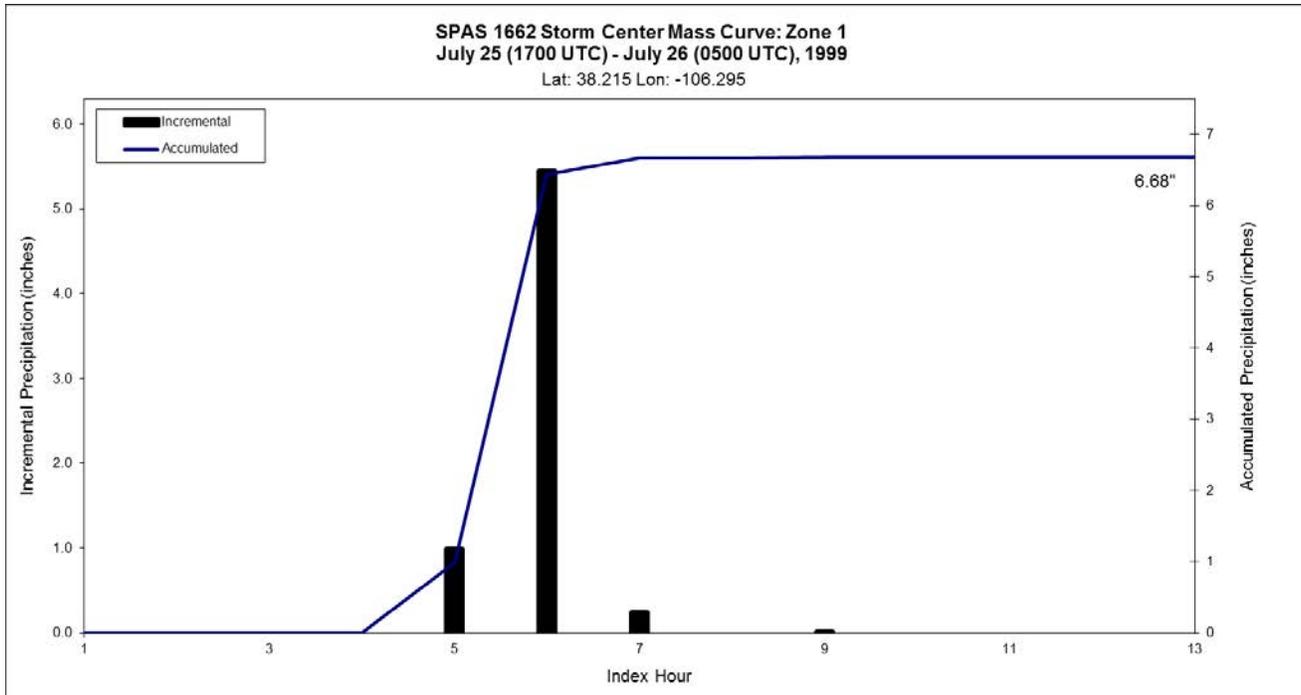
**Reliability of Results:** This analysis was based on 47 hourly stations, daily data, and supplemental station data and NEXRAD Radar. We have a good degree of confidence for the radar/station based storm total results. The spatial pattern is dependent on the radar data and basemap. Timing is based on the hourly and hourly pseudo stations, specifically HRLY 1 created from the information given in the NM EPAT report for storm ID 108. Several daily stations were moved to supplemental due to timing issues and to ensure data consistency.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1662_1	-106.295	38.215	8,900	9,000	76.00	2.99	1.78	74	1.210	79.56	79.5	3.52	2.02	81	1.505	1.244

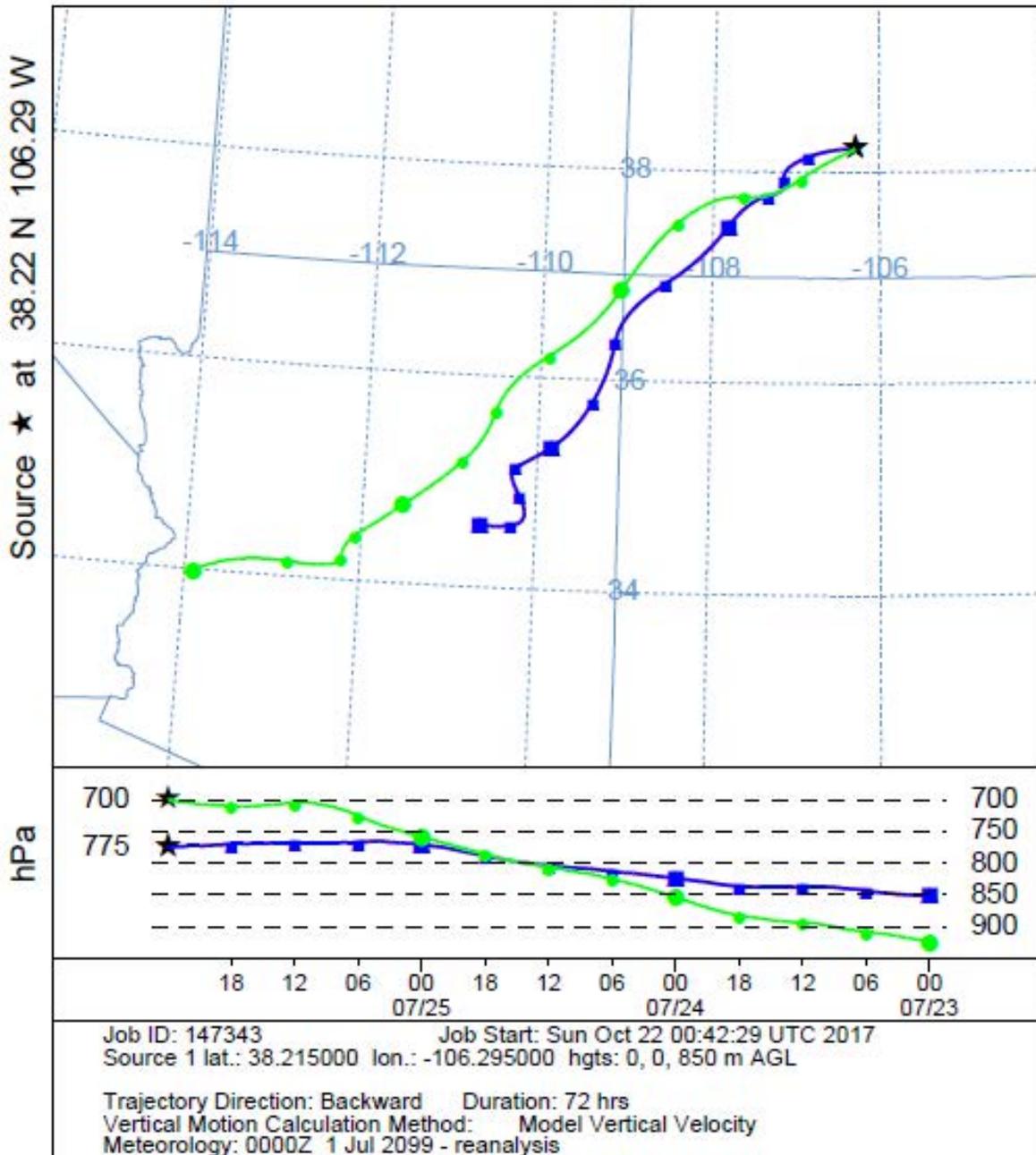


Storm 1662 - July 25 (1700 UTC) - July 26 (0500 UTC), 1999									
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)									
Area (mi <sup>2</sup> )	Duration (hours)								
	1	2	3	4	5	6	12	13	Total
0.4	5.44	6.43	6.66	6.66	6.67	6.67	6.67	6.67	6.67
1	5.37	6.35	6.57	6.57	6.58	6.58	6.58	6.58	6.58
10	4.90	5.82	6.04	6.04	6.04	6.04	6.04	6.04	6.04
25	4.37	5.24	5.44	5.44	5.45	5.45	5.45	5.45	5.45
50	3.64	4.41	4.59	4.59	4.61	4.61	4.61	4.61	4.61
100	2.58	3.21	3.36	3.36	3.38	3.38	3.38	3.38	3.38
150	1.97	2.48	2.59	2.59	2.63	2.63	2.63	2.63	2.63
200	1.59	2.02	2.13	2.13	2.18	2.18	2.18	2.18	2.18
300	1.14	1.47	1.53	1.53	1.63	1.64	1.64	1.64	1.64
400	0.89	1.17	1.21	1.21	1.33	1.33	1.33	1.33	1.33
500	0.74	0.98	1.01	1.01	1.14	1.14	1.14	1.14	1.14
1,000	0.42	0.57	0.57	0.58	0.70	0.70	0.70	0.70	0.70
2,000	0.23	0.33	0.33	0.35	0.42	0.43	0.43	0.43	0.43
3,500	0.15	0.20	0.21	0.24	0.29	0.29	0.29	0.29	0.29
4,137	0.13	0.17	0.18	0.21	0.25	0.25	0.25	0.25	0.25

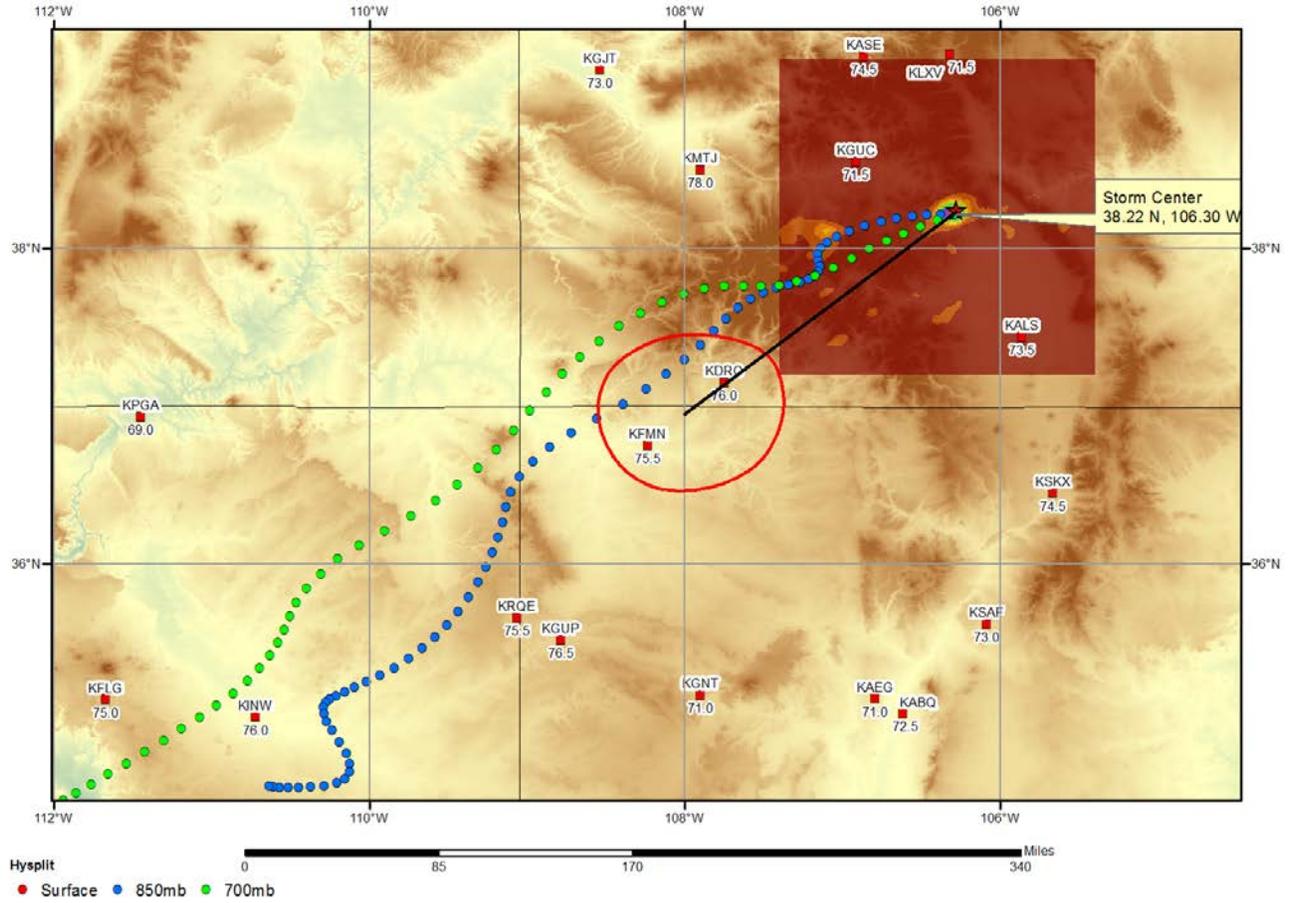




NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 26 Jul 99  
 CDC1 Meteorological Data



### SPAS 1662 Sagauche, CO Storm Analysis July 24-25, 1999



## Storm Precipitation Analysis System (SPAS) For Storm #1220\_1

**General Storm Location:** Eastern Iowa, Southwestern Wisconsin and Northwestern Illinois

**Storm Dates:** July 27, 2011 2100 UTC - July 28, 2011 2000 UTC

**Event:** Mesoscale Convective System (MCS) along a stalled front

### DAD Zone 1

**Latitude:** 42.44

**Longitude:** -90.75

**Max. Grid Rainfall Amount:** 15.14"

**Max. Observed Rainfall Amount:** 15.10" (2 miles SE of Julien, IA)

**Number of Stations:** 157 (25 Daily, 42 Hourly, 0 Hourly Estimated, 0 Hourly Estimated Pseudo, 14 Hourly Pseudo, 76 Supplemental, and 0 Supplemental Estimated)

**SPAS Version:** 9.0

**Basemap:** PRISM Mean (1971-2000) July precipitation

**Spatial resolution:** 36 seconds (~0.35 mi<sup>2</sup>)

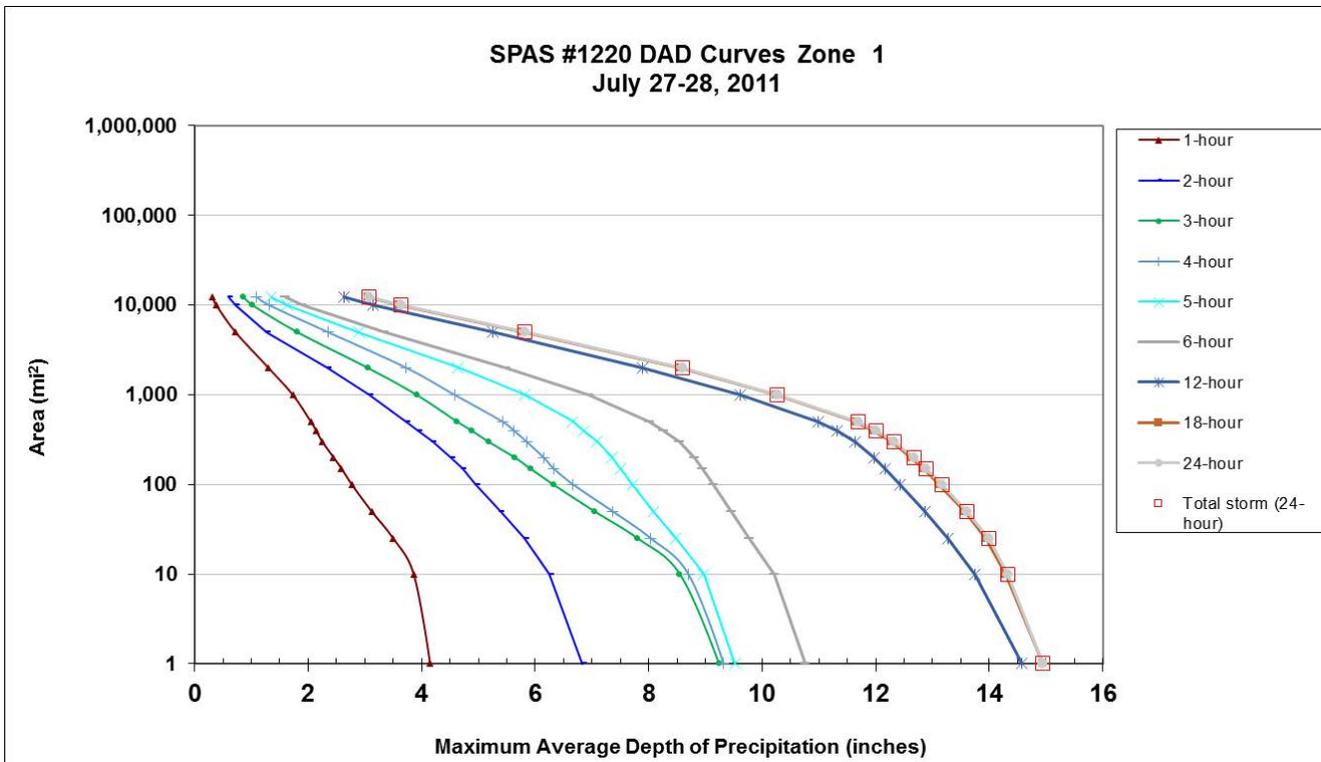
**Radar Included:** Yes

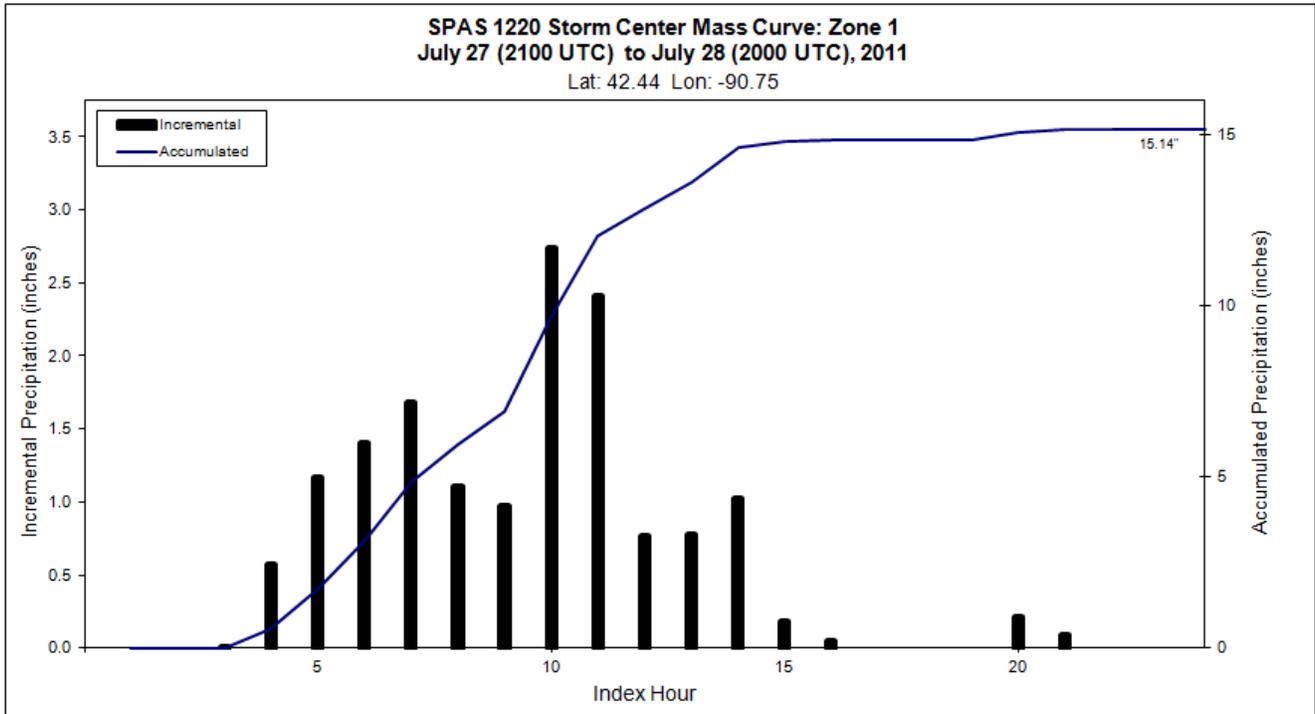
**Depth-Area-Duration (DAD) analysis:** Yes

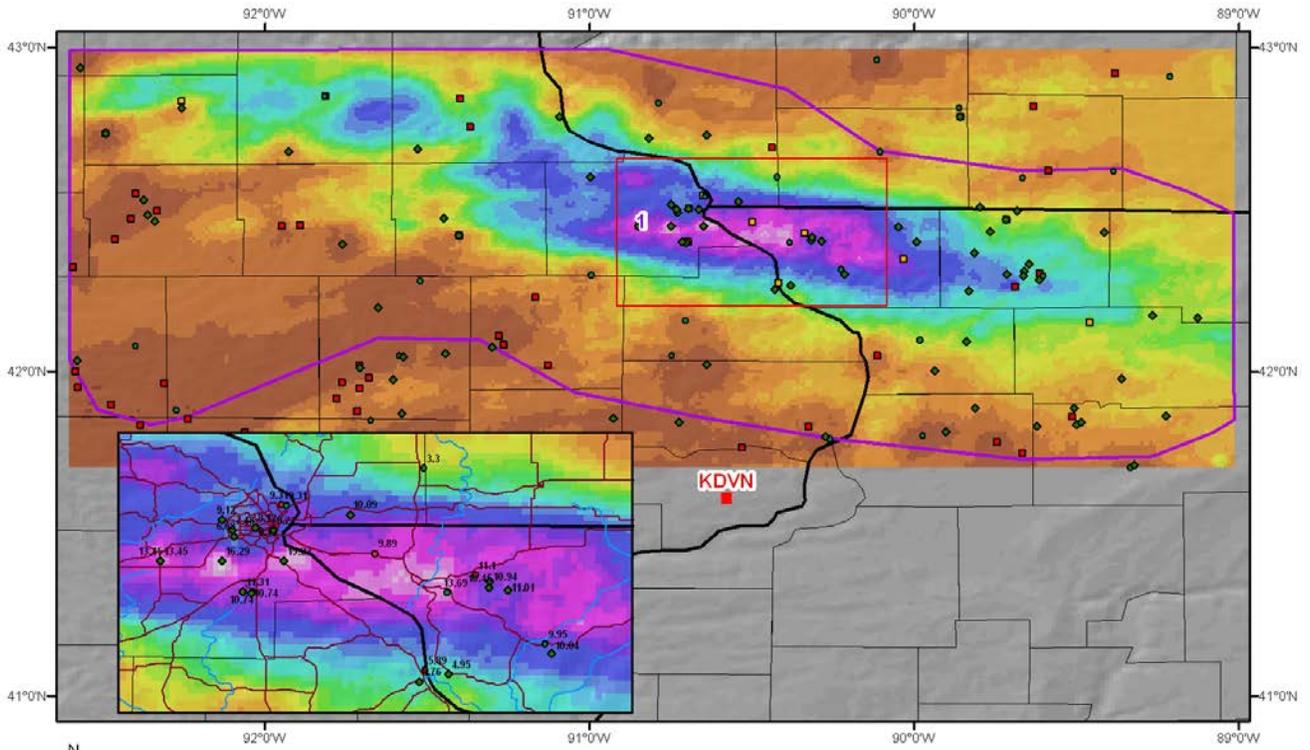
**Reliability of results:** Given the unblocked, clean and QC'ed radar data coupled with relatively extensive gauge data, we have a very high degree of confidence in the results. No supplemental estimated stations were warranted in this analysis.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1220_1	-90.750	42.440	906	900	79.00	3.44	0.26	80	3.180	82.21	82.0	3.95	0.27	86	3.680	1.157

Storm 1220 - July 27 (2100 UTC) - July 28 (2000 UTC), 2011										
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)										
Area (mi <sup>2</sup> )	Duration (hours)									
	1	2	3	4	5	6	12	18	24	Total
0.4	4.19	6.91	9.36	9.40	9.63	10.88	14.77	15.11	15.12	15.12
1	4.15	6.83	9.24	9.32	9.52	10.75	14.58	14.94	14.95	14.95
10	3.86	6.25	8.55	8.70	8.97	10.22	13.75	14.30	14.32	14.32
25	3.50	5.81	7.81	8.04	8.48	9.77	13.27	13.94	13.99	13.99
50	3.12	5.38	7.05	7.37	8.08	9.45	12.86	13.57	13.60	13.60
100	2.77	4.95	6.32	6.67	7.71	9.14	12.43	13.12	13.16	13.16
150	2.59	4.71	5.92	6.33	7.50	8.95	12.16	12.85	12.89	12.89
200	2.45	4.51	5.64	6.15	7.35	8.81	11.97	12.63	12.67	12.67
300	2.25	4.19	5.18	5.85	7.09	8.55	11.64	12.29	12.33	12.33
400	2.14	3.93	4.88	5.62	6.85	8.26	11.32	11.96	12.00	12.00
500	2.05	3.72	4.63	5.43	6.67	8.02	10.99	11.66	11.69	11.69
1,000	1.73	3.07	3.91	4.58	5.81	6.95	9.62	10.24	10.27	10.27
2,000	1.30	2.33	3.05	3.73	4.64	5.49	7.89	8.56	8.59	8.59
5,000	0.72	1.27	1.81	2.35	2.89	3.33	5.25	5.79	5.81	5.81
10,000	0.38	0.72	1.02	1.31	1.64	1.89	3.14	3.61	3.63	3.63
12,296	0.31	0.60	0.86	1.09	1.36	1.59	2.63	3.06	3.07	3.07

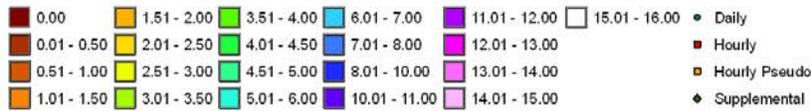






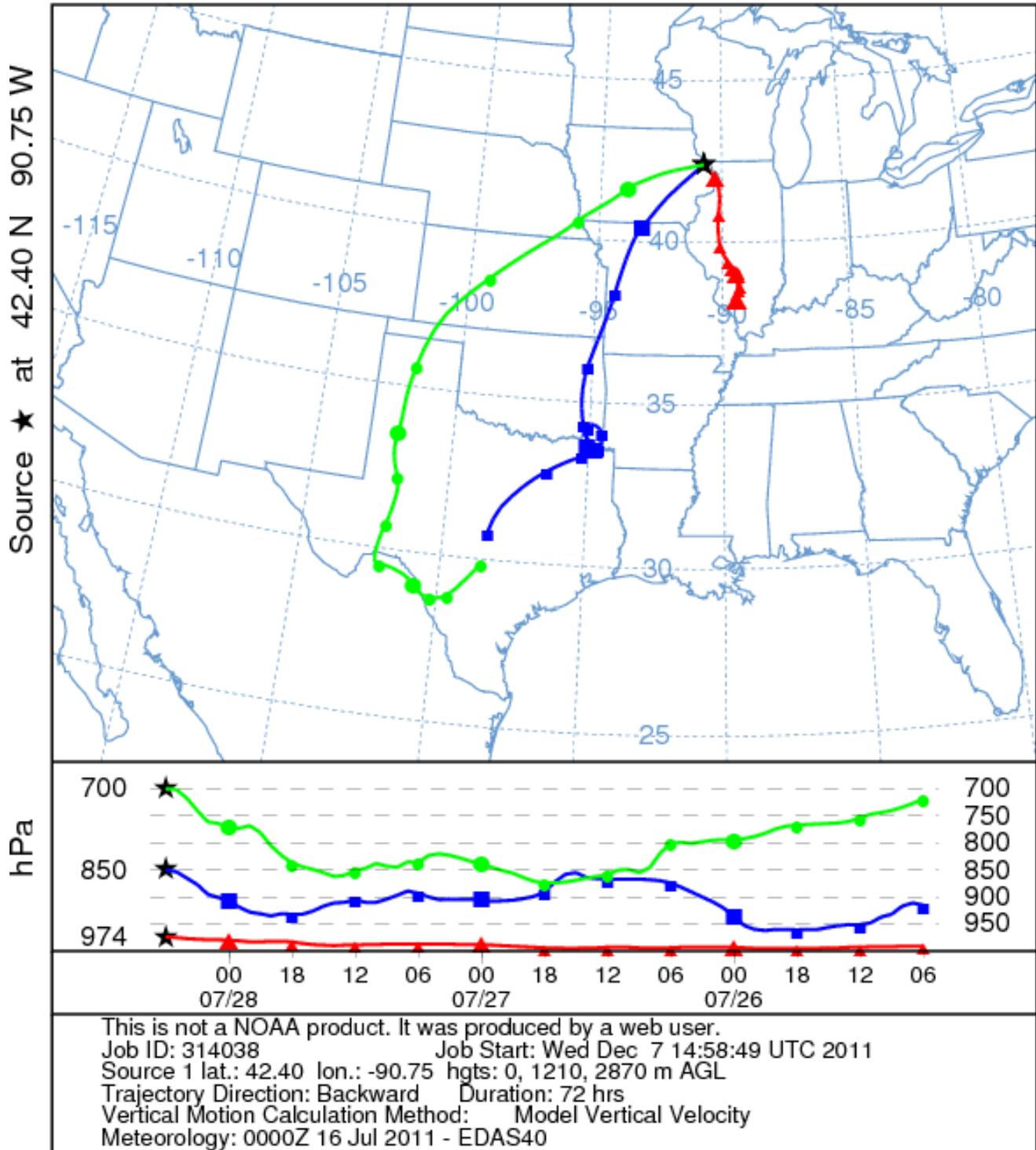
**Total 24-hour Precipitation**  
**July 27, 2011 2100 UTC - July 28, 2011 2000 UTC**  
**SPAS #1220**

**Precipitation (inches)**

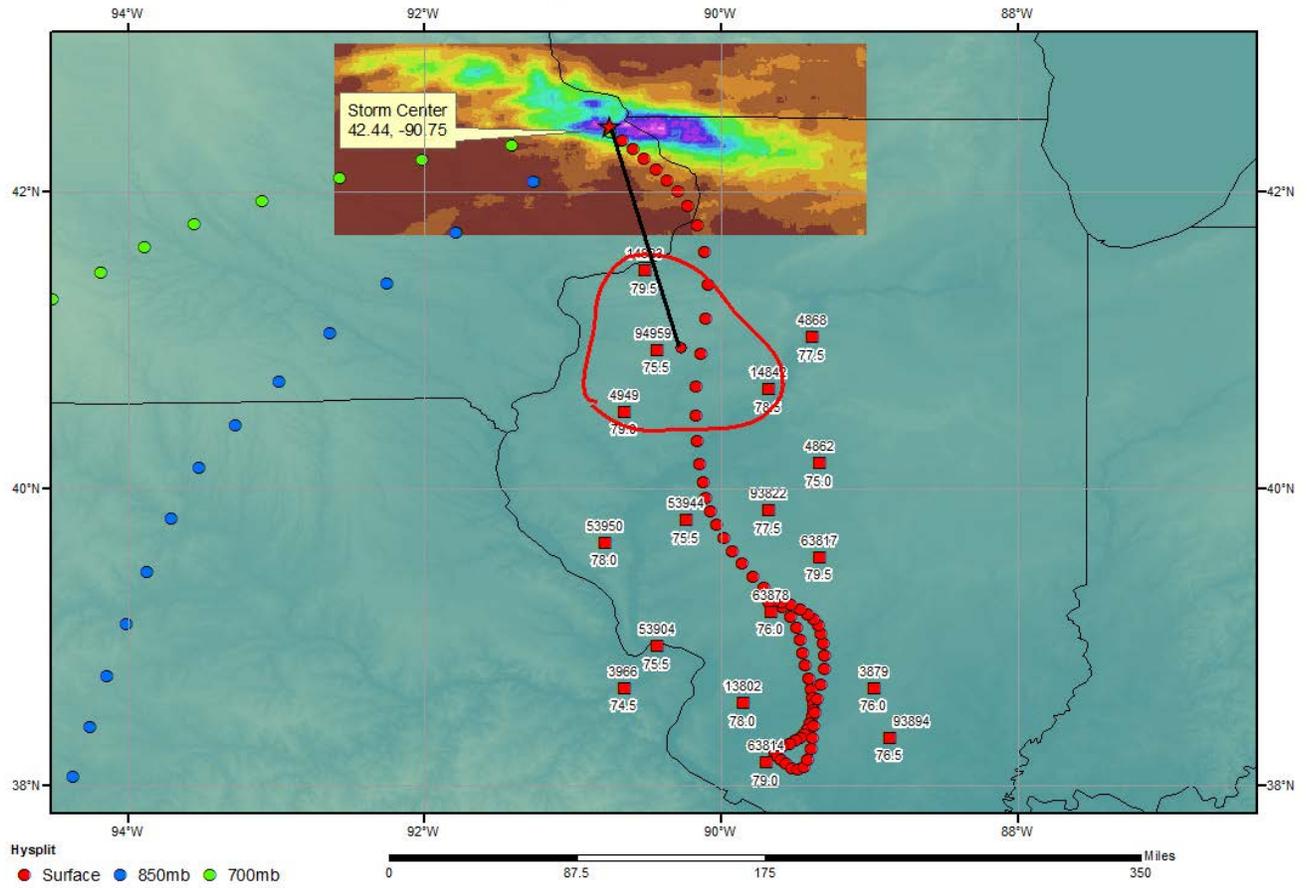


METSTAT  
1/16/2011

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0600 UTC 28 Jul 11  
 EDAS Meteorological Data



### SPAS 1220 - Dubuque, IA Storm Analysis July 25-28, 2011



## Storm Precipitation Analysis System (SPAS) For Storm #1590\_1

**General Storm Location:** Dawson, Texas (33.8, -98.5, 30.8, -94.5)

**Storm Dates:** October 23-26, 2015 (72-hours)

**Event:** Convective

### DAD Zone 1

**Latitude:** 31.895

**Longitude:** -96.645

**Max. Grid Rainfall Amount:** 32.92"

**Max. Observed Rainfall Amount:** 30.50"

**Number of Stations:** 458

**SPAS Version:** 10.0

**Basemap:** Blended basemap based on default ZR precipitation and conus\_prism\_ppt\_in\_1981\_2010\_10

**Spatial resolution:** 0.01 decimal degree (0.403-sqmi)

**Radar Included:** Yes

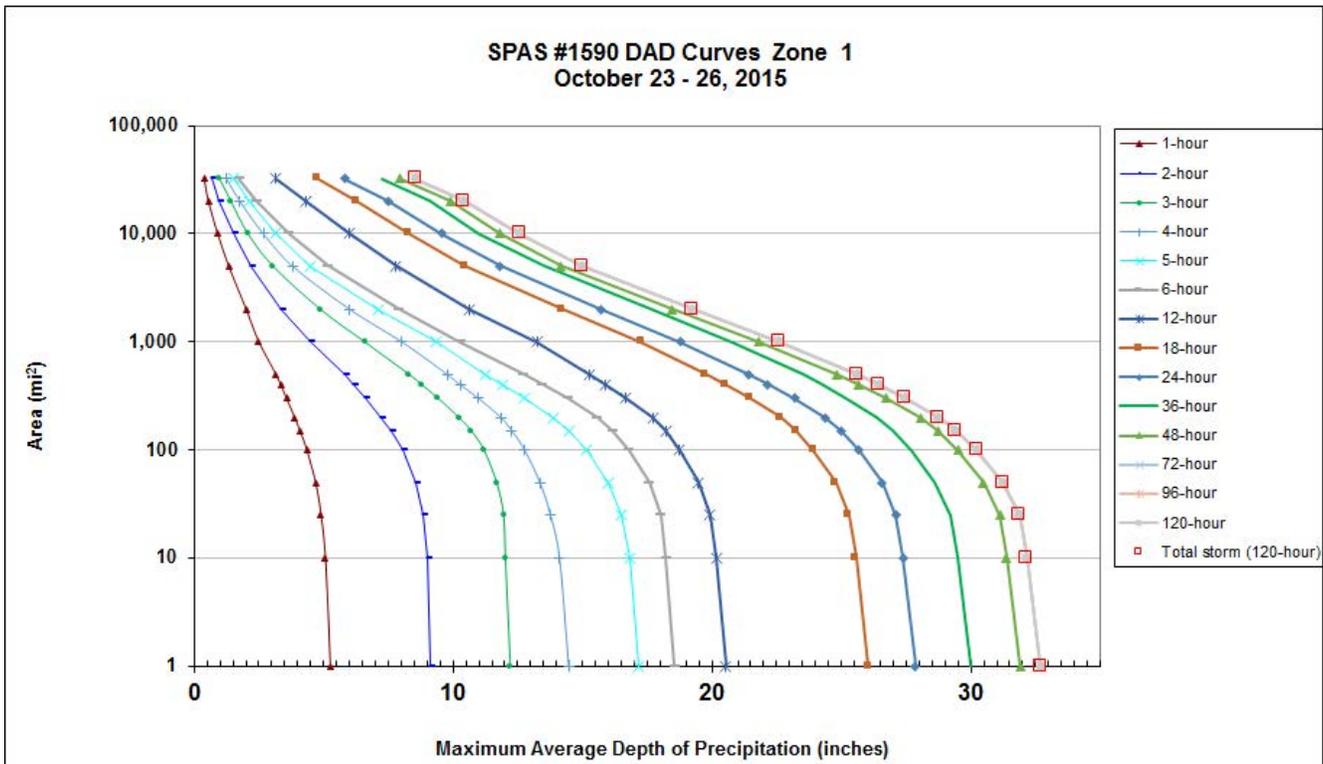
**Depth-Area-Duration (DAD) analysis:** Yes

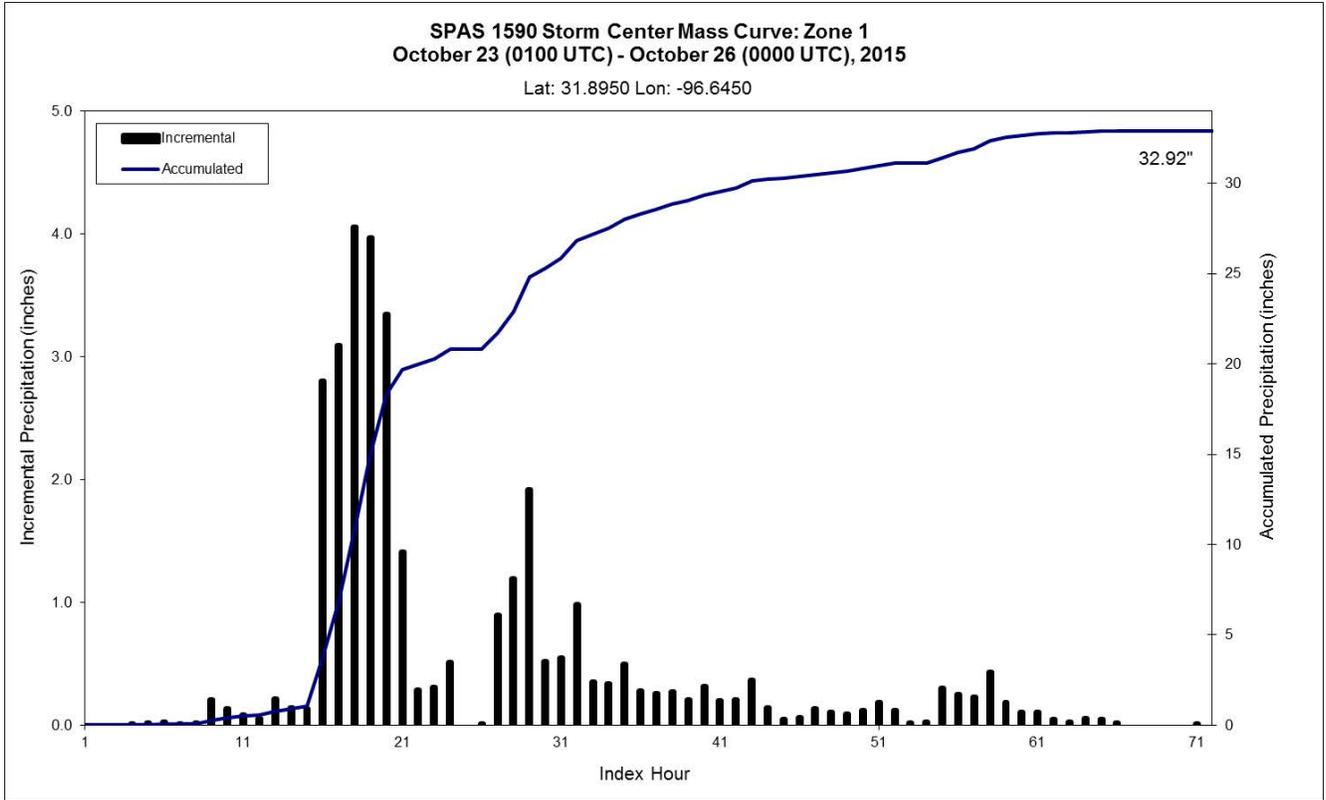
**Reliability of results:** This analysis was based on 458 hourly stations, daily data, supplemental station data (Dawson Treatment Plant), and radar data. We have a good degree of confidence for the station based storm total results. The spatial pattern is dependent on the radar data, gauge data, and basemap. There is a good degree of confidence with the timing based on the hourly stations near the storm center. Some daily stations were moved to supplemental due to timing issues.

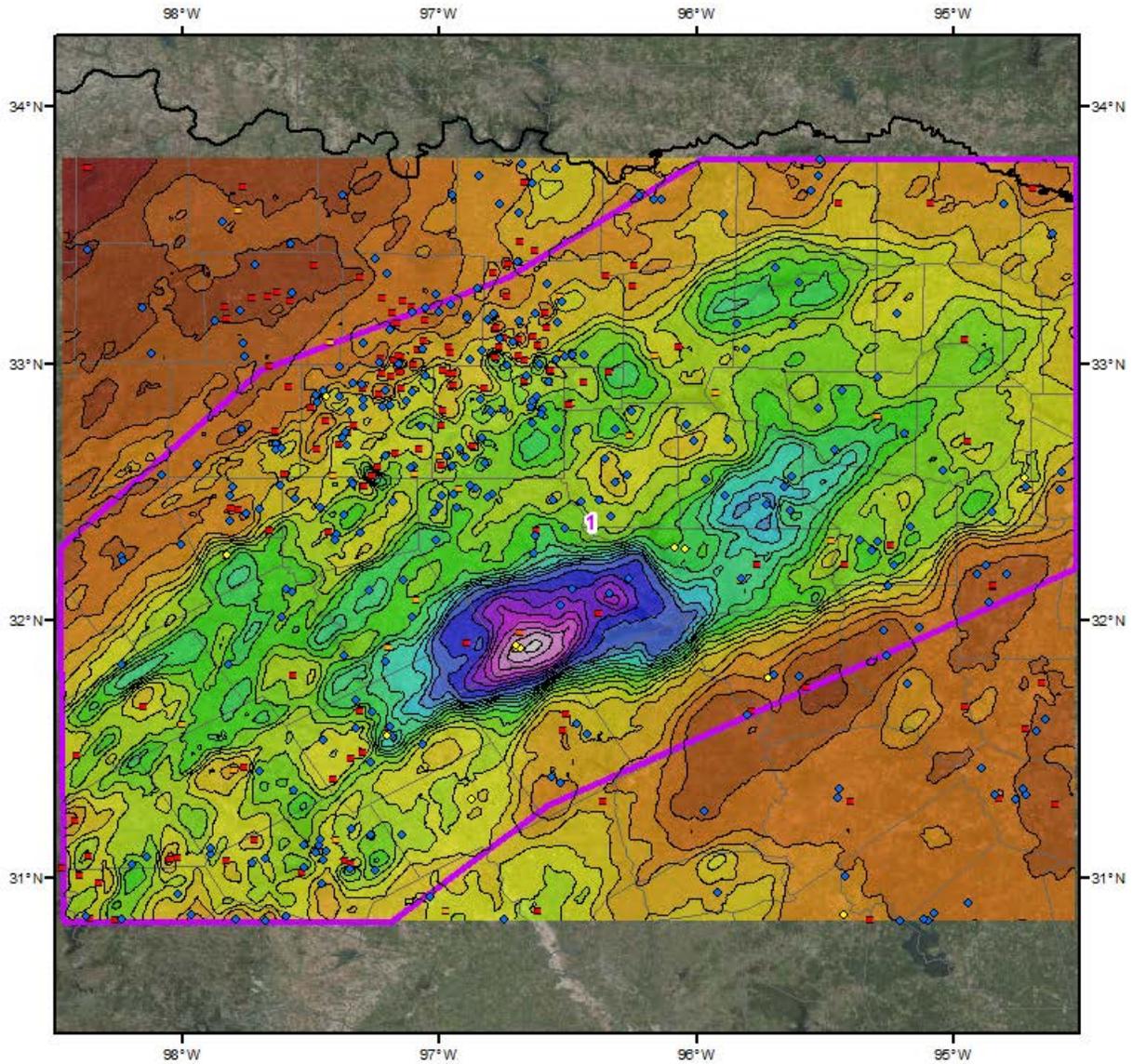
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1590_1	-96.645	31.895	450	500	76.00	2.99	0.13	74	2.860	77.97	78.0	3.29	0.14	78	3.150	1.101

**Storm 1590 - October 23 (0100 UTC) - October 26 (0000 UTC), 2015**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.4	5.31	9.19	12.28	14.60	17.28	18.67	20.71	26.22	28.05	30.22	32.12	32.92	32.92	32.92	32.92
1	5.26	9.13	12.21	14.46	17.16	18.55	20.55	26.04	27.86	30.02	31.91	32.70	32.70	32.70	32.70
10	5.07	8.99	12.02	14.11	16.86	18.23	20.16	25.57	27.39	29.51	31.38	32.17	32.17	32.17	32.17
25	4.90	8.85	11.95	13.76	16.48	18.02	19.91	25.29	27.10	29.20	31.13	31.88	31.88	31.88	31.88
50	4.69	8.59	11.68	13.35	15.98	17.57	19.47	24.77	26.56	28.62	30.49	31.24	31.24	31.24	31.24
100	4.35	8.08	11.19	12.76	15.15	16.79	18.76	23.92	25.67	27.69	29.50	30.23	30.23	30.23	30.23
150	4.09	7.64	10.71	12.27	14.48	16.15	18.23	23.26	24.99	27.00	28.73	29.43	29.43	29.43	29.43
200	3.88	7.22	10.22	11.84	13.89	15.56	17.72	22.65	24.37	26.37	28.04	28.74	28.74	28.74	28.74
300	3.57	6.59	9.43	10.98	12.76	14.45	16.68	21.49	23.19	25.18	26.75	27.46	27.46	27.46	27.46
400	3.34	6.17	8.80	10.28	11.89	13.45	15.87	20.50	22.17	24.25	25.65	26.43	26.43	26.43	26.43
500	3.16	5.82	8.30	9.77	11.24	12.70	15.25	19.76	21.39	23.50	24.81	25.60	25.60	25.60	25.60
1,000	2.50	4.51	6.59	8.02	9.35	10.28	13.24	17.27	18.77	20.76	21.83	22.61	22.61	22.61	22.61
2,000	2.01	3.36	4.88	6.01	7.10	7.92	10.61	14.21	15.69	17.65	18.48	19.24	19.24	19.24	19.24
5,000	1.34	2.21	3.06	3.81	4.51	5.16	7.80	10.45	11.82	13.51	14.16	14.99	14.99	14.99	14.99
10,000	0.91	1.55	2.08	2.67	3.15	3.66	6.02	8.29	9.55	11.02	11.82	12.58	12.58	12.58	12.58
20,000	0.55	0.97	1.42	1.77	2.13	2.40	4.29	6.27	7.49	9.10	9.88	10.42	10.42	10.42	10.42
32,245	0.39	0.69	0.99	1.25	1.52	1.74	3.17	4.78	5.81	7.23	7.96	8.55	8.55	8.55	8.55







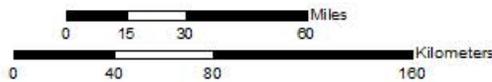
**Total Storm (72-hr) Precipitation (inches)**  
**10/23/2015 0100 UTC - 10/26/2015 0000 UTC**  
**SPAS-NEXRAD #1590**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Est. Pseudo
- Hourly Pseudo
- ◆ Supplemental

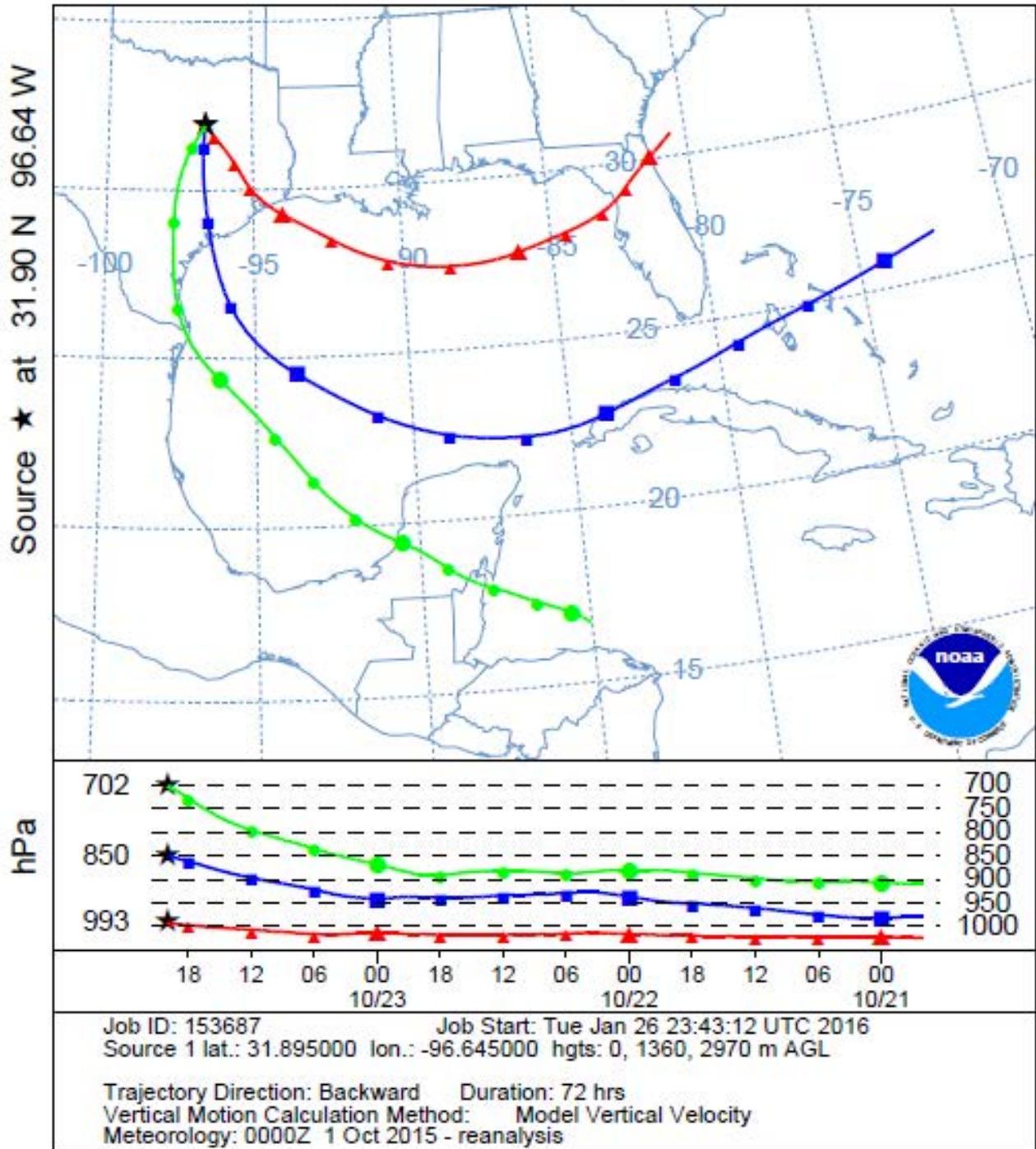
**Precipitation (inches)**

0.18 - 1.00	5.01 - 6.00	10.01 - 11.00	15.01 - 16.00	24.01 - 26.00
1.01 - 2.00	6.01 - 7.00	11.01 - 12.00	16.01 - 18.00	26.01 - 28.00
2.01 - 3.00	7.01 - 8.00	12.01 - 13.00	18.01 - 20.00	28.01 - 30.00
3.01 - 4.00	8.01 - 9.00	13.01 - 14.00	20.01 - 22.00	30.01 - 32.00
4.01 - 5.00	9.01 - 10.00	14.01 - 15.00	22.01 - 24.00	32.01 - 34.00

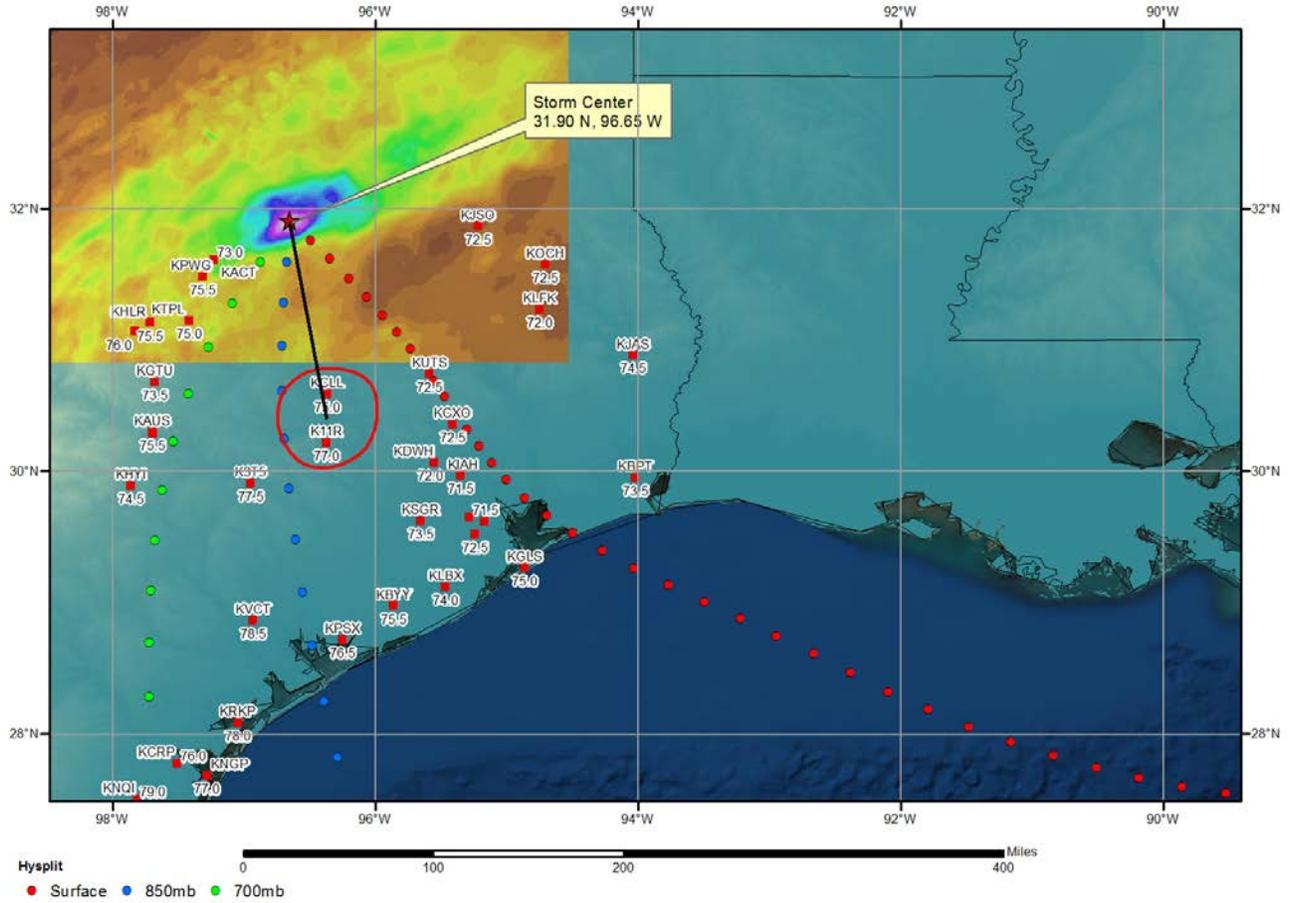


1/22/2016

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 2000 UTC 23 Oct 15  
 CDC1 Meteorological Data



### SPAS 1590 Dawson, TX Storm Analysis October 21 - 24, 2015



## **Tropical Storms**

## Storm Precipitation Analysis System (SPAS) For Storm #1591\_1

**General Storm Location:** Hearne, TX

**Storm Dates:** June 26 – July 1, 1899

**Event:** Tropical Storm One

### DAD Zone 1

**Latitude:** 30.8458

**Longitude:** -96.5708

**Max. Grid/Radar Rainfall Amount:** 34.53”

**Max. Observed Rainfall Amount:** 34.43”

**Number of Stations:** 54 Stations

**SPAS Version:** 10.0

**Base Map Used:** USDA Weather Bureau Isohyetal Image

**Spatial resolution:** 0.2839

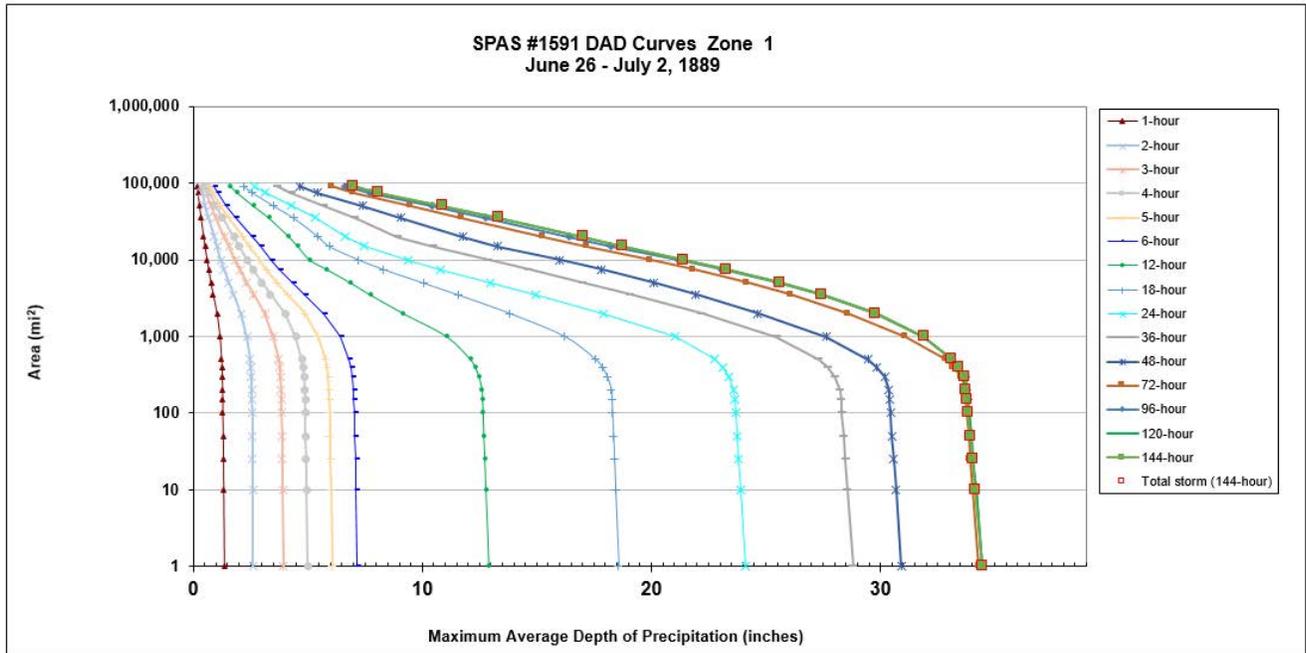
**Radar Included:** No

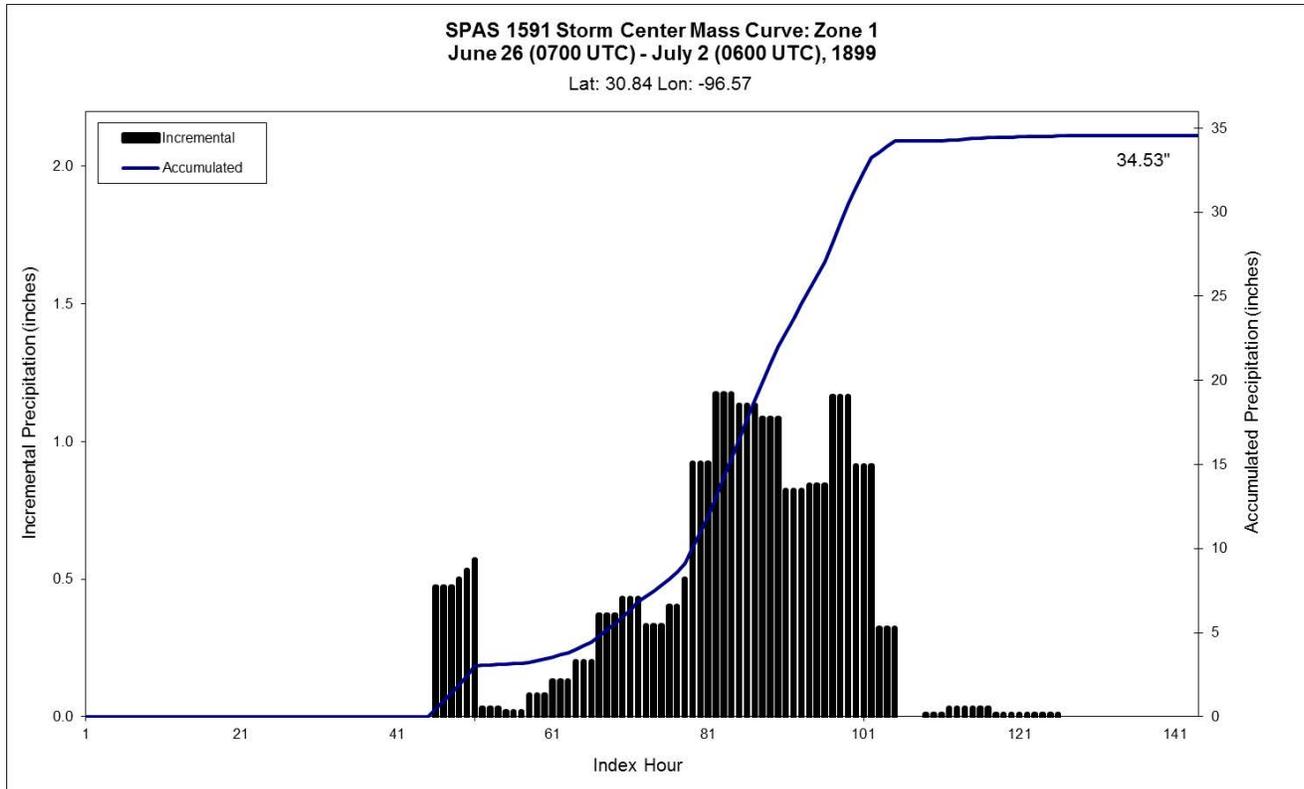
**Depth-Area-Duration (DAD) analysis:** Yes

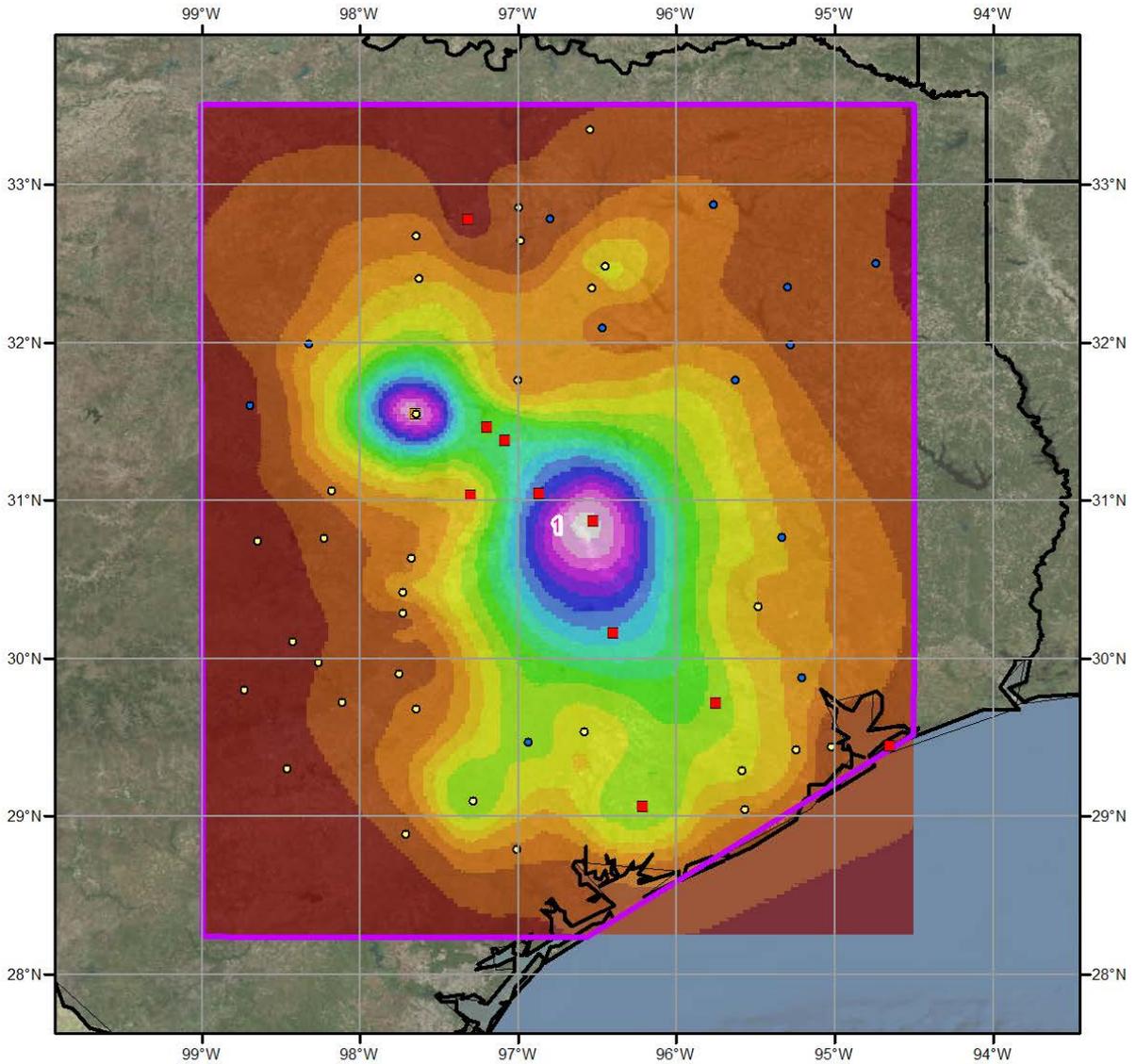
**Reliability of Results:** This analysis was based on hourly data, daily data, and supplemental station data. We have a high degree of confidence in the station based storm total results. The spatial pattern is dependent on the USDA Isohyetal basemap, and the timing is based on hourly and hourly pseudo stations. An additional 31 supplemental stations were created to ensure data consistency.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1591_1	-96.570	30.840	276	300	83.50	4.21	0.10	89	4.110	86.13	86.0	4.67	0.11	94	4.560	1.109

Storm 1591 - June 26 (0700 UTC) - July 2 (0600 UTC), 1899																
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																
Area (mi <sup>2</sup> )	Duration (hours)															
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	144	Total
0.4	1.37	2.63	3.94	5.02	6.11	7.19	12.93	18.63	24.15	28.86	31.02	34.40	34.53	34.53	34.53	34.53
1	1.36	2.62	3.93	5.00	6.08	7.17	12.93	18.57	24.10	28.80	30.92	34.29	34.45	34.45	34.45	34.45
10	1.33	2.60	3.90	4.95	6.02	7.10	12.80	18.43	23.89	28.56	30.68	34.03	34.16	34.16	34.15	34.15
25	1.32	2.59	3.89	4.93	6.00	7.08	12.75	18.38	23.81	28.46	30.59	33.92	34.04	34.04	34.03	34.03
50	1.31	2.58	3.88	4.91	5.98	7.06	12.71	18.34	23.74	28.39	30.51	33.85	33.95	33.95	33.93	33.93
100	1.29	2.58	3.87	4.90	5.96	7.04	12.68	18.29	23.68	28.32	30.44	33.77	33.87	33.87	33.84	33.84
150	1.29	2.57	3.86	4.89	5.95	7.02	12.65	18.27	23.64	28.28	30.40	33.72	33.82	33.82	33.79	33.79
200	1.28	2.56	3.84	4.88	5.95	7.02	12.64	18.25	23.62	28.25	30.37	33.69	33.78	33.78	33.75	33.75
300	1.27	2.53	3.80	4.85	5.89	6.94	12.50	18.06	23.39	28.00	30.18	33.55	33.73	33.73	33.70	33.70
400	1.26	2.51	3.77	4.80	5.83	6.87	12.33	17.85	23.11	27.68	29.82	33.16	33.40	33.41	33.41	33.41
500	1.24	2.48	3.72	4.75	5.78	6.81	12.13	17.57	22.75	27.31	29.47	32.86	33.12	33.13	33.13	33.13
1,000	1.17	2.34	3.50	4.48	5.45	6.40	11.09	16.23	21.02	25.45	27.63	31.10	31.90	31.91	31.91	31.91
2,000	1.04	2.09	3.13	4.01	4.88	5.72	9.20	13.83	17.91	22.19	24.66	28.58	29.75	29.79	29.79	29.79
3,500	0.88	1.75	2.63	3.37	4.12	4.84	7.76	11.57	14.97	19.07	21.95	26.08	27.38	27.44	27.44	27.44
5,000	0.78	1.55	2.33	3.00	3.66	4.32	6.90	10.04	12.97	16.98	20.10	24.19	25.49	25.60	25.60	25.60
7,500	0.68	1.35	2.03	2.60	3.19	3.78	5.86	8.32	10.78	14.66	17.82	21.85	23.08	23.26	23.27	23.27
10,000	0.61	1.22	1.82	2.35	2.89	3.43	5.11	7.23	9.39	12.90	16.02	19.97	21.18	21.39	21.39	21.39
15,000	0.52	1.04	1.56	2.01	2.46	2.94	4.59	5.94	7.45	10.48	13.29	17.19	18.24	18.76	18.77	18.77
20,000	0.46	0.91	1.37	1.77	2.17	2.58	4.20	5.45	6.61	8.92	11.77	15.29	16.39	17.02	17.03	17.03
35,000	0.35	0.66	0.99	1.28	1.56	1.85	3.34	4.39	5.31	7.06	9.07	11.73	12.75	13.32	13.33	13.33
50,000	0.28	0.51	0.78	0.98	1.19	1.42	2.67	3.53	4.27	5.72	7.39	9.50	10.44	10.88	10.89	10.89
75,000	0.21	0.39	0.59	0.72	0.87	1.04	1.95	2.59	3.13	4.28	5.41	7.00	7.70	8.08	8.10	8.10
91,238	0.18	0.33	0.50	0.62	0.75	0.90	1.66	2.20	2.67	3.66	4.65	6.04	6.63	6.97	6.98	6.98







**Total Storm (144-hours) Precipitation (inches)**  
**June 26 - July 1, 1899**  
**SPAS 1591 - Hearne, TX**



**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Supplemental

**Precipitation (inches)**

■ 0.00 - 2.00	■ 14.01 - 16.00	■ 30.01 - 32.00
■ 2.01 - 4.00	■ 16.01 - 18.00	■ 32.01 - 34.00
■ 4.01 - 6.00	■ 18.01 - 20.00	■ 34.01 - 36.00
■ 6.01 - 8.00	■ 20.01 - 22.00	
■ 8.01 - 10.00	■ 22.01 - 24.00	
■ 10.01 - 12.00	■ 24.01 - 26.00	
■ 12.01 - 14.00	■ 26.01 - 28.00	
	■ 28.01 - 30.00	



4/3/2015

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 27 June-1 July 1899

Assignment GI 3-4

Location Texas

Study Prepared by:

Southwestern Division

Galveston District Office

Part I Reviewed by H. M. Sec. of  
Weather Bureau, 10/1/46

Part II Approved by Office, Chief  
of Engineers for Distribution  
of Factual Data, 5/12/47

Remarks: Center at Hearne and  
Turneraville, Texas

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:2,500,000

Precipitation data and mass curves:

(Number of Sheets)

Form 5001-C (Hourly precip. data)-----	2
Form 5001-B (24-hour " " " " )-----	21
Form 5001-D ( " " " " " " )-----	-
Misc. precip. records, meteorological data, etc.-----	22
Form 5002 (Mass rainfall curves)-----	21

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	2
Form S-11 (Depth-area data from isohyetal map)-----	1
Form S-12 (Maximum depth-duration data)-----	5
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	2

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours										
	6	12	18	24	30	36	48	60	72	96	108
10	6.9	12.6	18.6	24.1	26.4	29.0	30.8	34.0	34.5	34.5	34.5
100	6.3	12.1	18.1	23.3	25.7	28.2	30.0	32.8	33.6	33.6	33.6
200	6.2	11.8	17.8	23.0	25.3	27.8	29.5	32.2	33.1	33.1	33.1
500	5.8	11.3	17.2	22.2	24.5	26.9	28.5	31.2	32.0	32.0	32.0
1,000	5.5	10.8	16.3	21.1	23.1	25.6	27.1	29.7	30.4	30.5	30.5
2,000	5.1	9.8	14.6	19.0	20.8	23.1	24.8	27.4	28.1	28.5	28.5
5,000	4.2	7.8	11.4	14.7	16.4	18.7	20.7	23.6	24.4	25.1	25.3
10,000	3.5	6.0	8.7	11.2	13.1	15.1	17.4	20.5	21.3	22.1	22.5
20,000	2.8	4.5	6.3	8.2	9.7	11.6	13.8	16.5	17.6	18.6	19.0
50,000	1.9	2.7	3.7	4.8	5.6	6.9	8.5	9.9	11.0	12.0	12.4
78,000	1.2	1.9	2.5	3.2	3.8	4.5	5.9	6.8	7.6	8.7	9.1

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

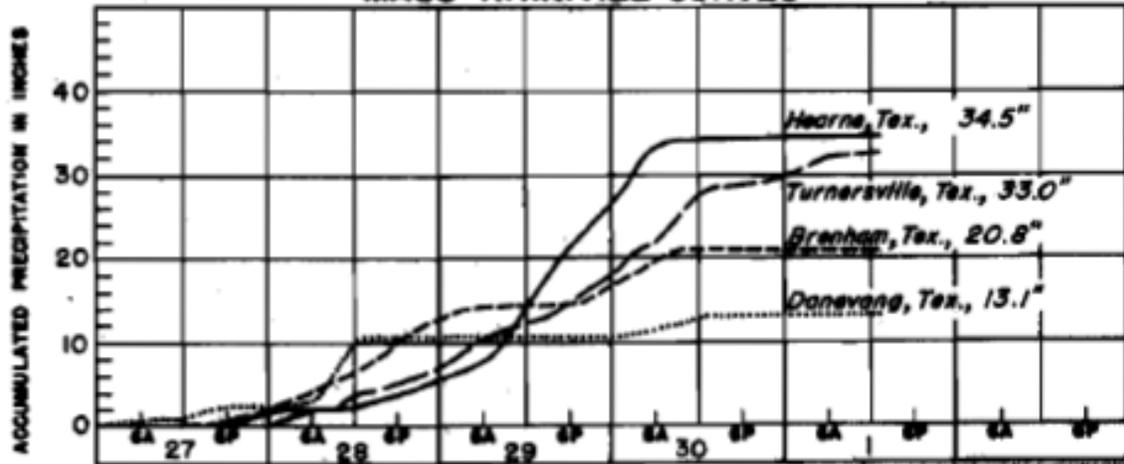
**STORM STUDIES - ISOHYETAL MAP**

Storm of June 27-July 1, 1899 Assignment GI 3-4

Study Prepared by: Galveston, Tex. District  
Southwestern Division

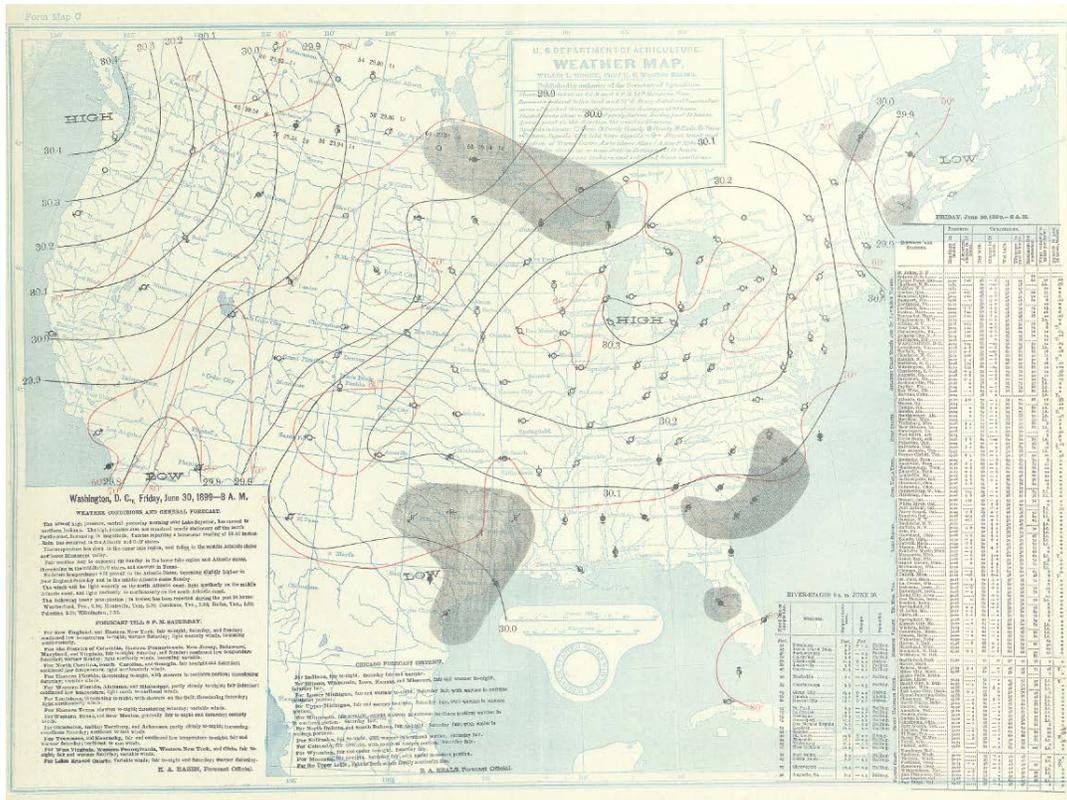
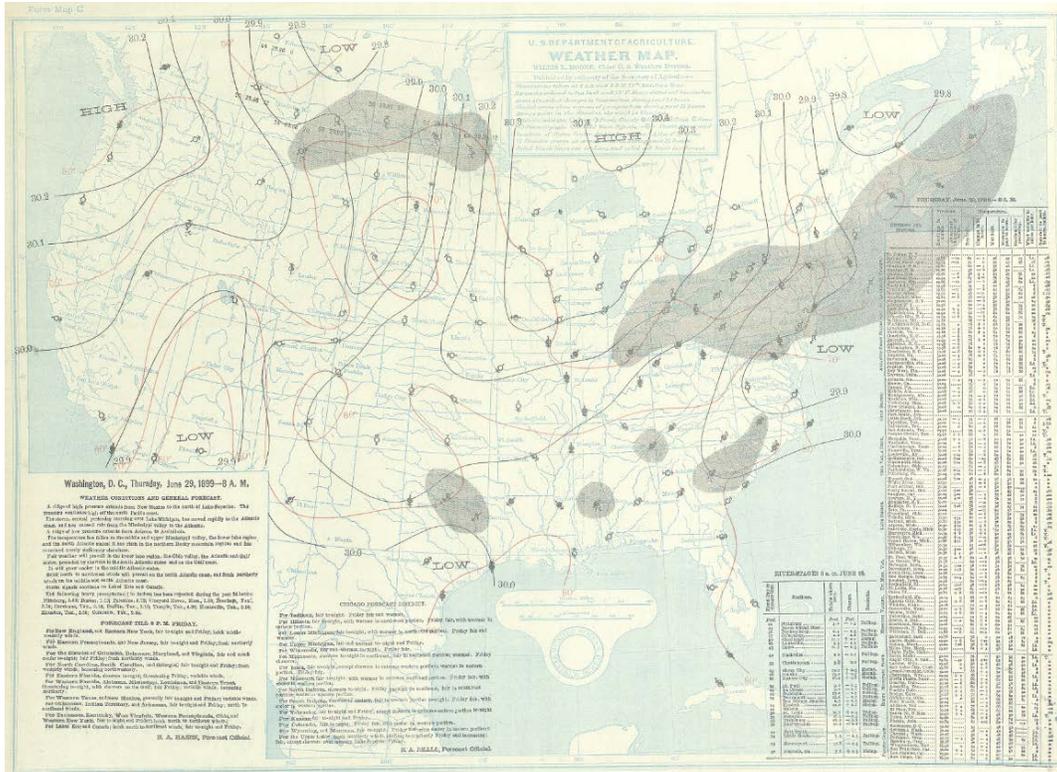


**MASS RAINFALL CURVES**



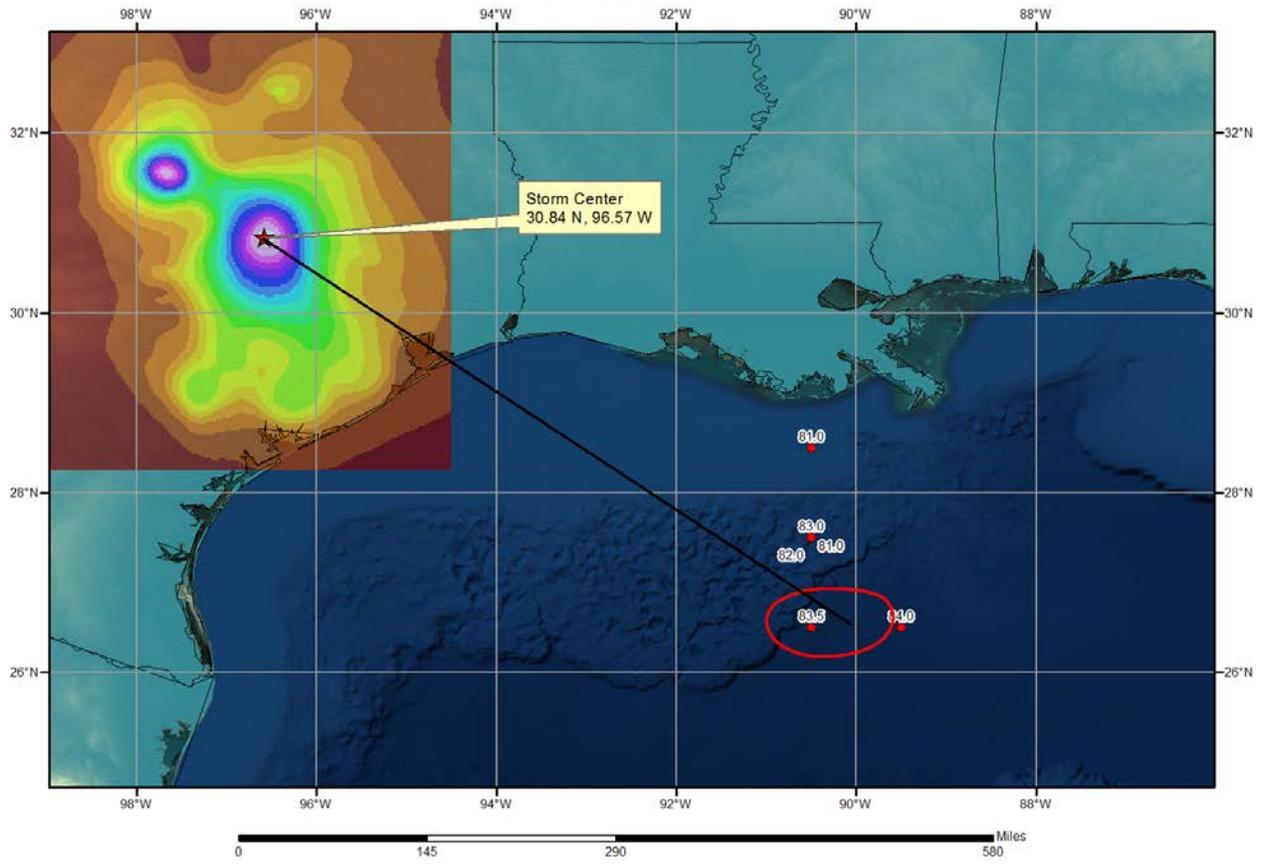






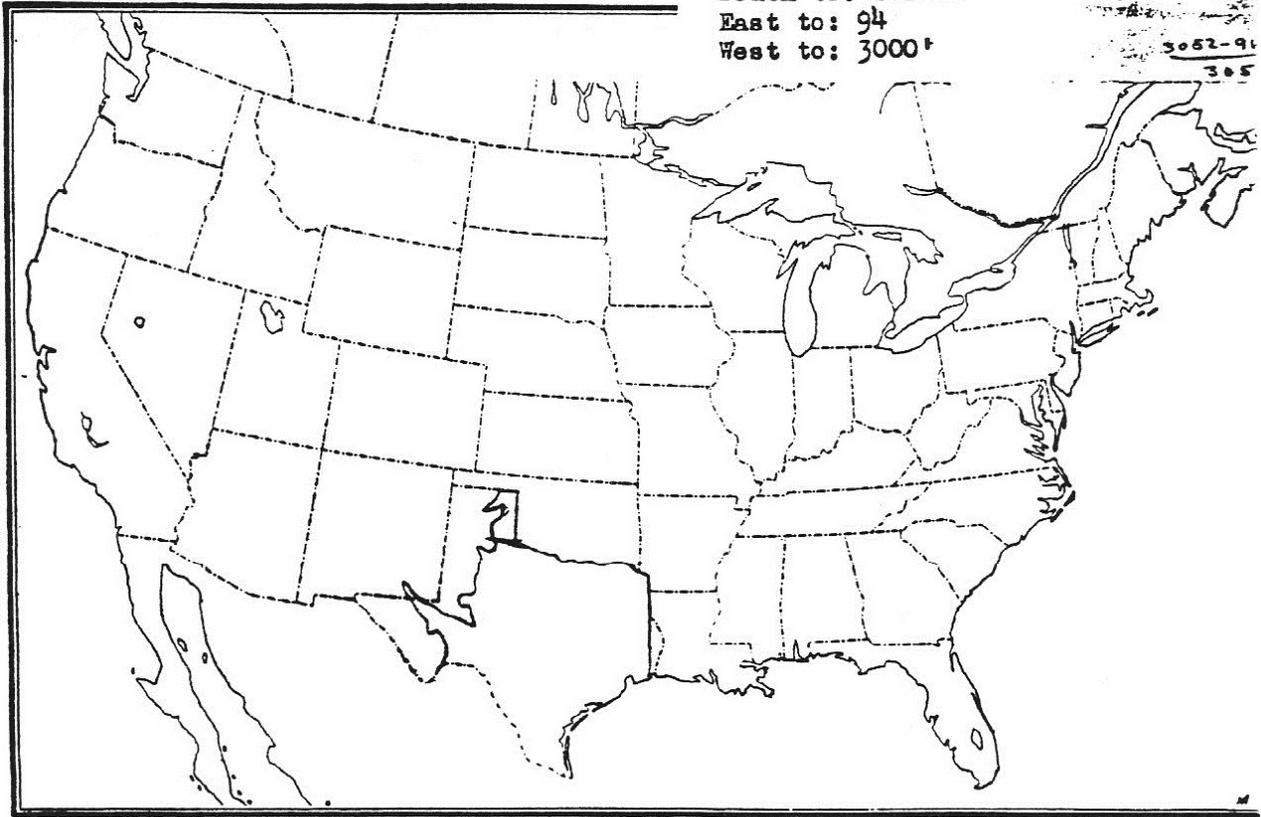


### SPAS 1591 Hearne, TX Sea Surface Temperatures (F) June 28, 1899



GM 3-4...June 27-July 1, 1954, Eastern  
12-hr. rfd 75(29th)..125 800 to 781  
North to: Texas border  
South to: border  
East to: 94  
West to: 3000'

3052-91  
305



## Storm Precipitation Analysis System (SPAS) For Storm #1582\_1

**General Storm Location:** Texas, Oklahoma (35.2 -102.5 29.0 -96.0)

**Storm Dates:** September 14-17, 1936 (96-hours)

**Event:** Broome, TX (GM 5-7)

### DAD Zone 1

**Latitude:** 31.788

**Longitude:** -100.854

**Max. Grid Rainfall Amount:** 30.34” Broome, TX

**Max. Observed Rainfall Amount:** 30.00”

**Number of Stations:** 213

**SPAS Version:** 10.0

**Basemap:** conus\_prism\_ppt\_in\_1971\_2000\_09

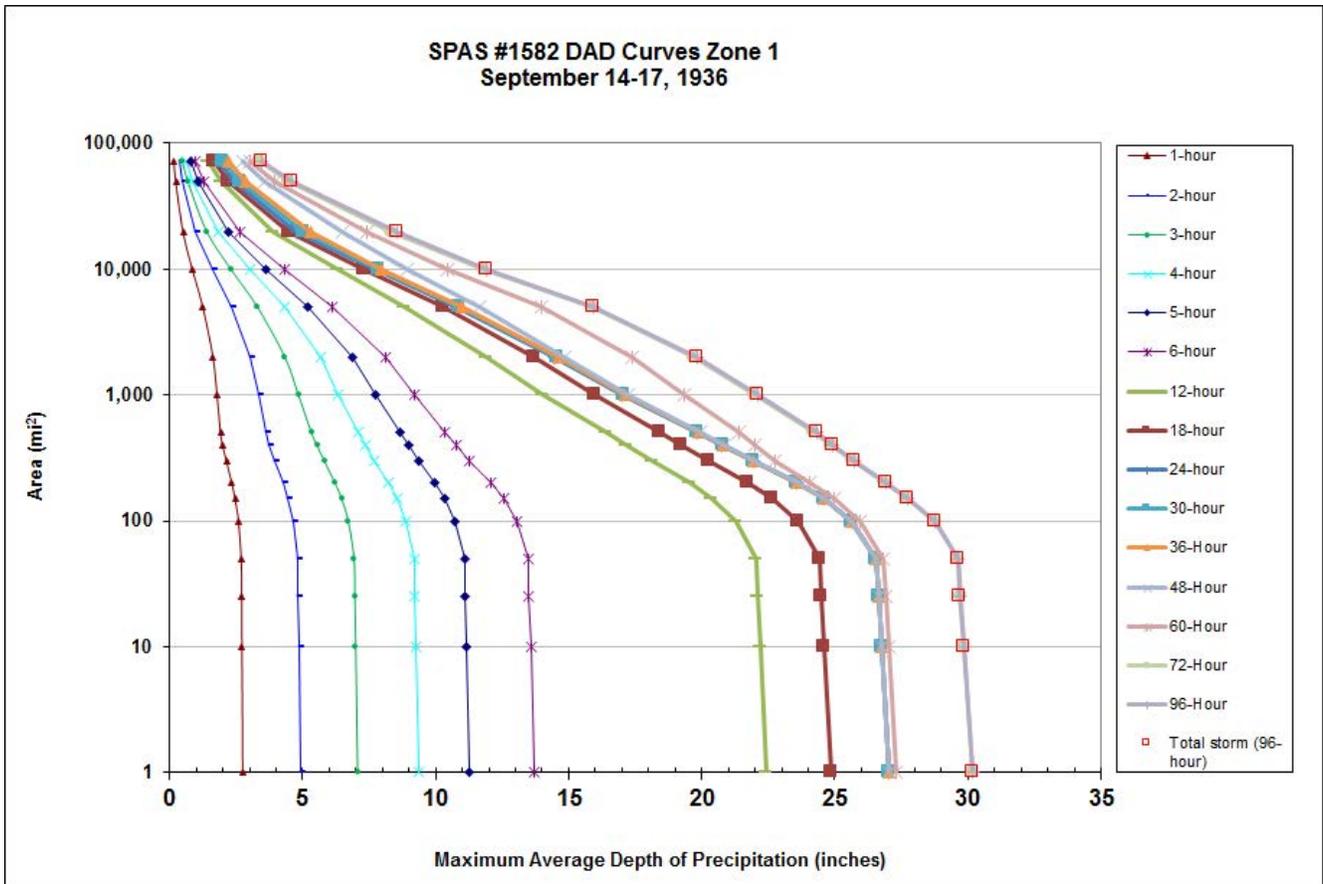
**Radar Included:** No

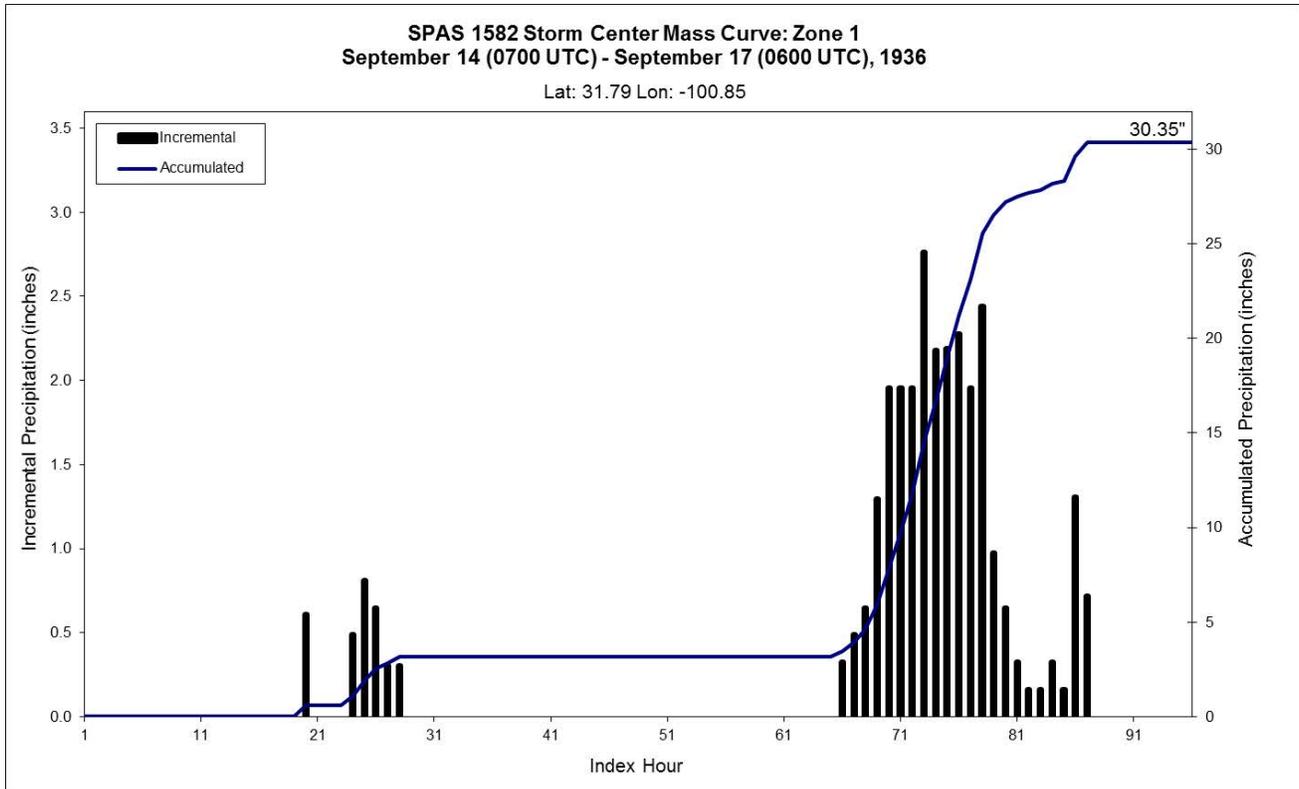
**Depth-Area-Duration (DAD) analysis:** Yes

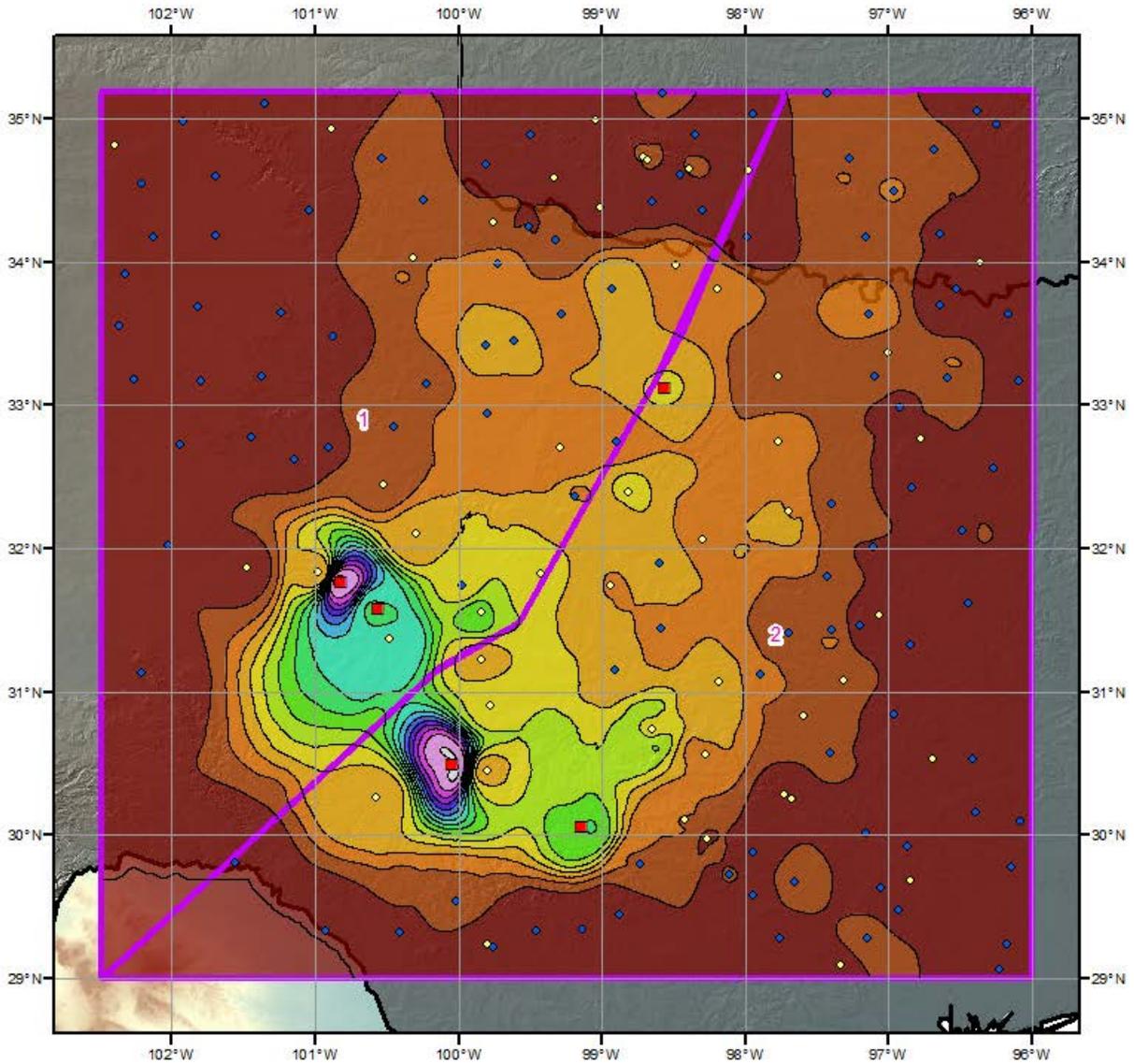
**Reliability of results:** This analysis was based on hourly data (H), daily data (D) and supplemental data (S). We have a good degree of confidence in the station based storm total results. The spatial pattern is dependent on basemap and the timing is based on five hourly stations.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1582_1	-100.854	31.788	2,260	2,300	84.00	4.30	0.72	90	3.580	86.00	86.0	4.67	0.76	94	3,910	1.092

Storm 1582 Zone 1 - Sep. 14 (0700 UTC) - Sep. 17 (0600 UTC), 1936																
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																
areasqmi	Duration (hours)															
	1	2	3	4	5	6	12	18	24	30	36	48	60	72	96	Total
0.3	2.76	4.93	7.11	9.39	11.34	13.77	22.53	24.96	27.14	27.14	27.14	27.14	27.44	30.29	30.29	30.29
1	2.75	4.90	7.08	9.35	11.29	13.71	22.43	24.86	27.02	27.03	27.03	27.03	27.32	30.16	30.16	30.16
10	2.72	4.85	7.01	9.26	11.17	13.57	22.19	24.60	26.74	26.75	26.74	26.74	27.03	29.84	29.84	29.84
25	2.71	4.82	6.98	9.22	11.12	13.51	22.10	24.49	26.63	26.64	26.63	26.63	26.92	29.72	29.71	29.71
50	2.69	4.80	6.95	9.18	11.08	13.47	22.03	24.42	26.54	26.54	26.54	26.54	26.83	29.62	29.62	29.62
100	2.59	4.65	6.73	8.88	10.74	13.03	21.27	23.60	25.63	25.63	25.63	25.64	25.97	28.75	28.76	28.76
150	2.46	4.45	6.48	8.55	10.34	12.54	20.39	22.66	24.57	24.59	24.59	24.60	24.99	27.75	27.76	27.76
200	2.34	4.26	6.23	8.22	9.97	12.06	19.55	21.75	23.56	23.58	23.58	23.60	24.04	26.89	26.92	26.92
300	2.14	3.94	5.83	7.70	9.37	11.29	18.16	20.27	21.93	21.95	21.96	21.99	22.73	25.68	25.75	25.75
400	1.99	3.72	5.55	7.34	8.97	10.76	17.19	19.22	20.74	20.78	20.79	20.83	21.97	24.86	24.93	24.93
500	1.92	3.64	5.35	7.07	8.68	10.36	16.40	18.43	19.80	19.85	19.87	19.92	21.38	24.23	24.31	24.31
1,000	1.79	3.34	4.86	6.32	7.73	9.19	14.04	15.98	16.99	17.07	17.12	17.25	19.34	21.98	22.08	22.08
2,000	1.64	3.03	4.35	5.66	6.86	8.12	11.91	13.72	14.45	14.55	14.62	14.84	17.37	19.72	19.82	19.82
5,000	1.26	2.32	3.32	4.34	5.20	6.14	8.85	10.28	10.80	10.89	11.02	11.65	13.97	15.86	15.95	15.95
10,000	0.87	1.61	2.32	3.01	3.64	4.33	6.31	7.30	7.72	7.83	7.98	8.94	10.45	11.78	11.93	11.93
20,000	0.52	0.99	1.41	1.83	2.22	2.63	3.87	4.48	4.78	5.05	5.32	6.52	7.40	8.35	8.54	8.54
50,000	0.25	0.47	0.70	0.88	1.07	1.29	1.92	2.21	2.41	2.63	2.87	3.56	3.94	4.48	4.60	4.60
71,713	0.18	0.35	0.50	0.66	0.81	0.95	1.45	1.68	1.83	2.01	2.19	2.73	3.00	3.39	3.48	3.48







**Total Storm (96-hours) Precipitation (inches)**  
**September 14-17, 1936**  
**SPAS 1582 Broome, TX (GM 5-7)**

**Gauges**

- ◆ Daily
- Hourly
- ◇ Supplemental



**Precipitation (inches)**

0.00 - 2.00	8.01 - 10.00	16.01 - 18.00	24.01 - 26.00
2.01 - 4.00	10.01 - 12.00	18.01 - 20.00	26.01 - 28.00
4.01 - 6.00	12.01 - 14.00	20.01 - 22.00	28.01 - 30.00
6.01 - 8.00	14.01 - 16.00	22.01 - 24.00	30.01 - 32.00



DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - PERTINENT DATA SHEET (REV.)**



Storm of 14-18 September 1936  
 Assignment GM 5-7  
 Location Texas- Oklahoma  
 Study Prepared by:  
 Southwestern Division  
 Galveston District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 6/26/44  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 6/14/46

Remarks: Centers at  
 Broome and Roosevelt, Texas  
 Dewpt. 77° - Ref. Pt. 350 SSE  
 Grid I-17

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:1,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data)-----	47
Form 5001-B (24-hour " " " " )-----	138
Form 5001-D ( " " " " " )-----	-
Misc. precip. records, meteorological data, etc.-----	35
Form 5002 (Mass rainfall curves)-----	85

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves)-----	5
Form S-11 (Depth-area data from isohyetal map)-----	2
Form S-12 (Maximum depth-duration data)-----	8
Maximum duration-depth-area curves-----	1
Data relating to periods of maximum rainfall-----	3

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours									
	6	12	18	24	30	36	48	60	72	96
10	16.0	22.0	24.1	26.0	26.0	26.0	27.6	28.0	30.0	30.0
100	10.9	15.4	18.3	20.4	21.0	21.7	23.5	25.8	28.6	28.6
200	9.5	13.6	16.5	18.5	19.3	20.0	21.4	24.5	27.7	27.7
500	7.7	11.2	14.0	15.8	16.8	17.2	18.2	22.1	25.7	25.7
1,000	6.4	9.5	12.0	13.8	14.5	14.8	15.4	19.9	23.6	23.7
2,000	5.2	7.9	9.9	11.6	11.9	12.3	13.0	17.1	20.9	21.0
5,000	3.7	5.8	7.3	8.7	8.9	9.4	10.2	13.5	16.5	16.7
10,000	2.7	4.3	5.5	6.7	6.9	7.4	8.4	11.1	13.2	13.6
20,000	1.9	3.0	3.9	4.9	5.2	5.8	6.8	8.9	10.4	11.0
50,000	1.1	1.8	2.4	3.1	3.4	4.0	4.7	6.2	7.2	7.9
70,000	0.8	1.4	2.0	2.6	2.9	3.3	3.9	5.2	6.1	6.7

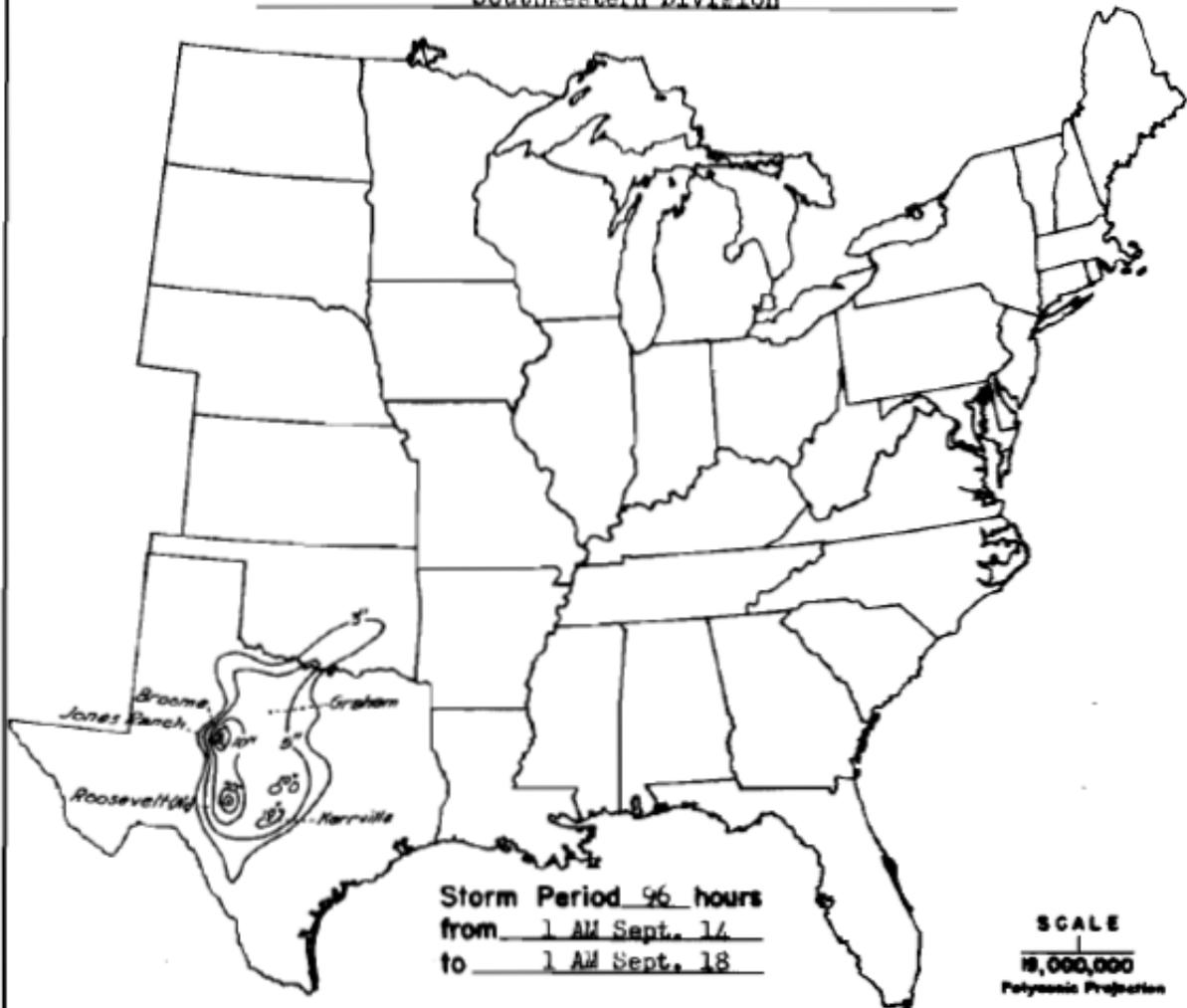
Form S-2

DEPARTMENT OF THE ARMY

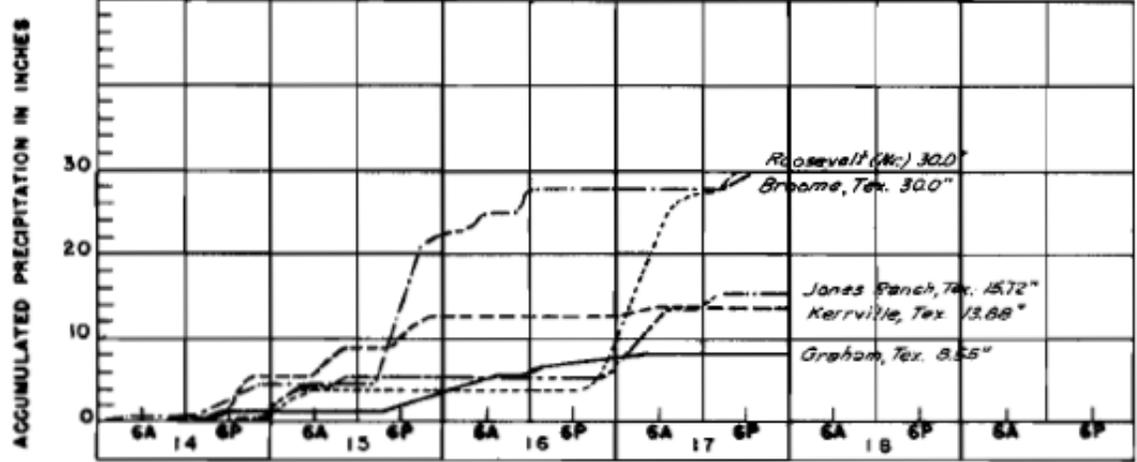
CORPS OF ENGINEERS

**STORM STUDIES - ISOHYETAL MAP**

Storm of September 14-18, 1936 Assignment GM 5-7  
 Study Prepared by: Gulveston, Texas District  
Southwestern Division



**MASS RAINFALL CURVES**

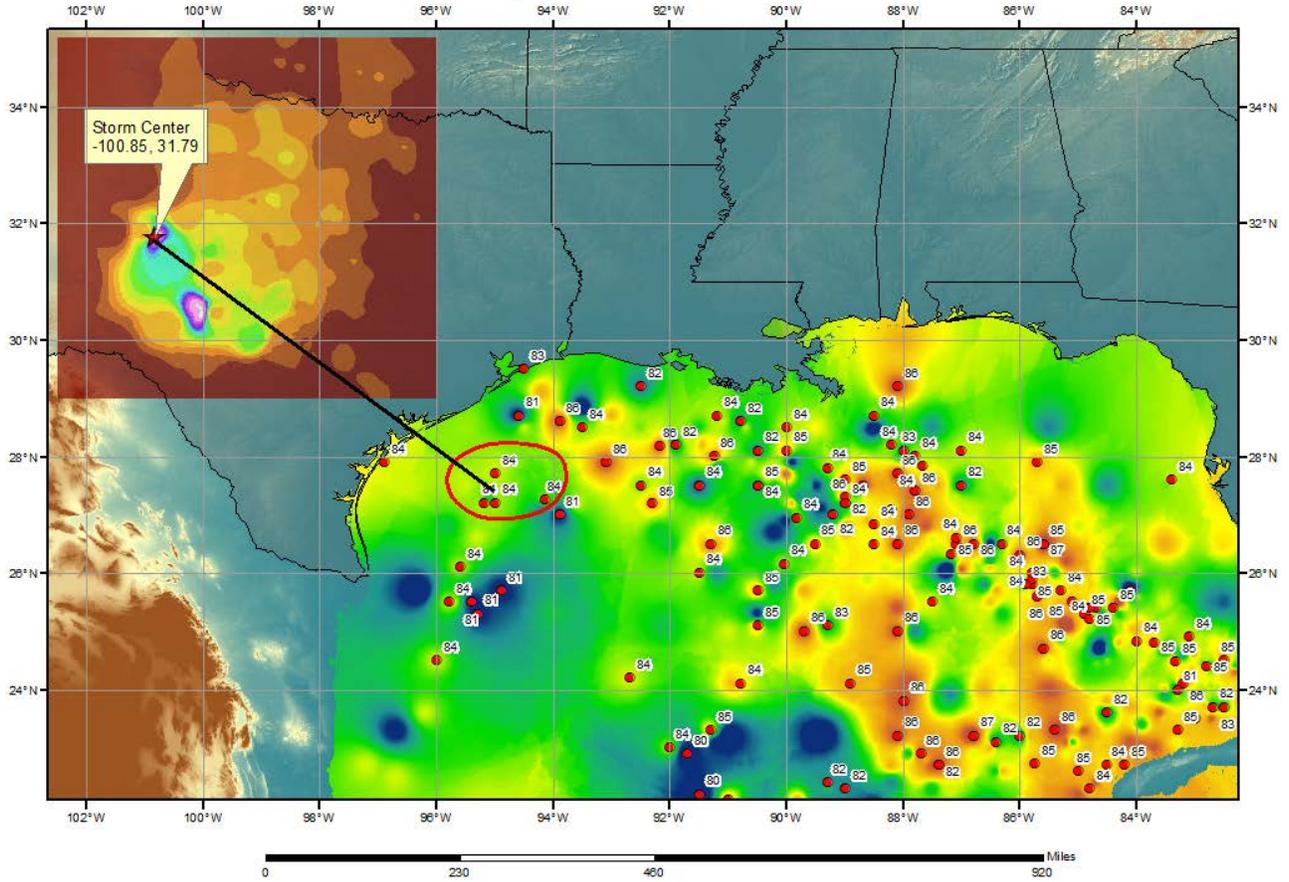






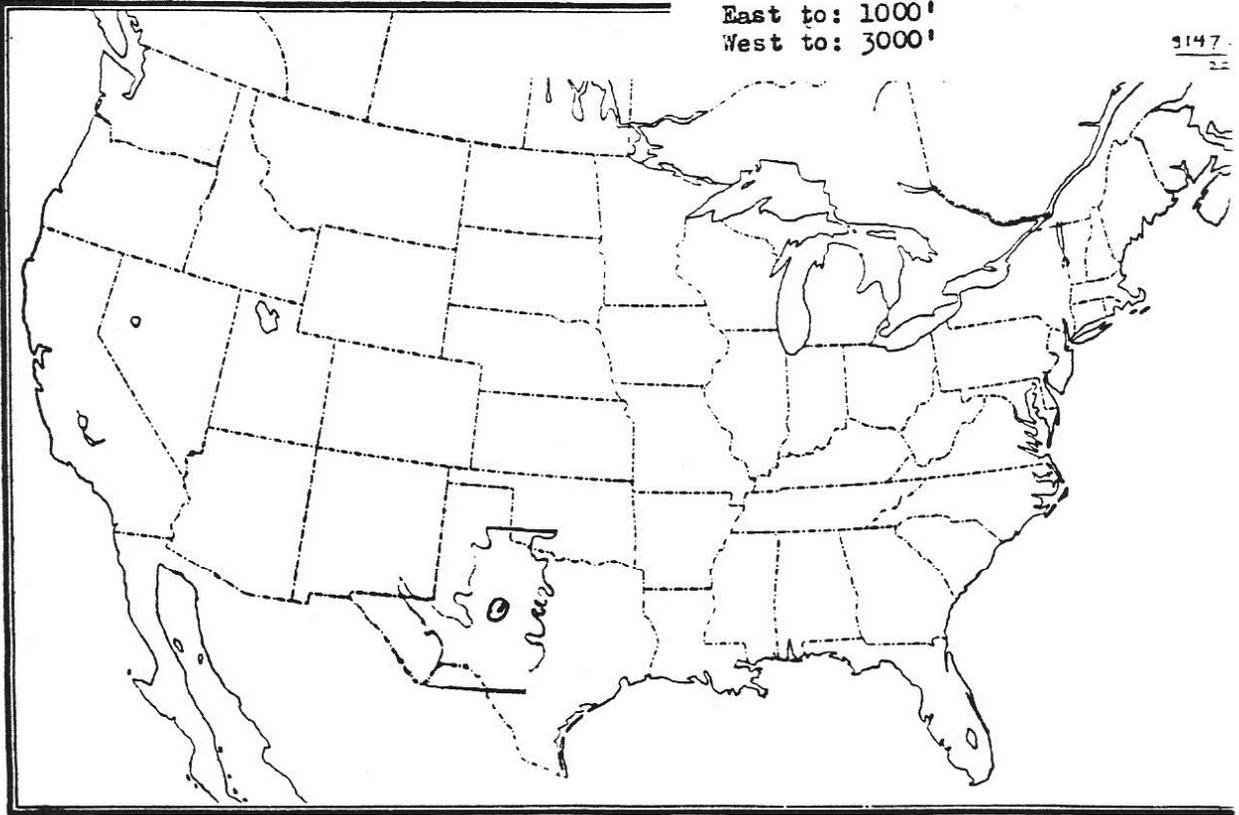


### SPAS 1582 Broome, TX (GM 5-7) Storm Analysis Zone 1 September 13-14, 1936



GM 5-7..Sept. 14-18, 1936..Broome.  
12-hr. rTd 77(14th)..350 SSE..to  
North to: 35  
South to: 29  
East to: 1000'  
West to: 3000'

3147  
22



## Storm Precipitation Analysis System (SPAS) For Storm #1596\_1

**General Storm Location:** Louisiana Coast (32.9, -95.25, 28.95, -88.95)

**Storm Dates:** August 5-10, 1940

**Event:** Tropical

### DAD Zone 1

**Latitude:** 29.8542

**Longitude:** -92.2458

**Max. Grid Rainfall Amount:** 37.85” Miller Island, LA

**Max. Observed Rainfall Amount:** 37.53”

**Number of Stations:** 174

**SPAS Version:** 10.0

**Basemap:** USACE Isohyetal Image provided by Lower Mississippi Valley Division

**Radar Included:** No

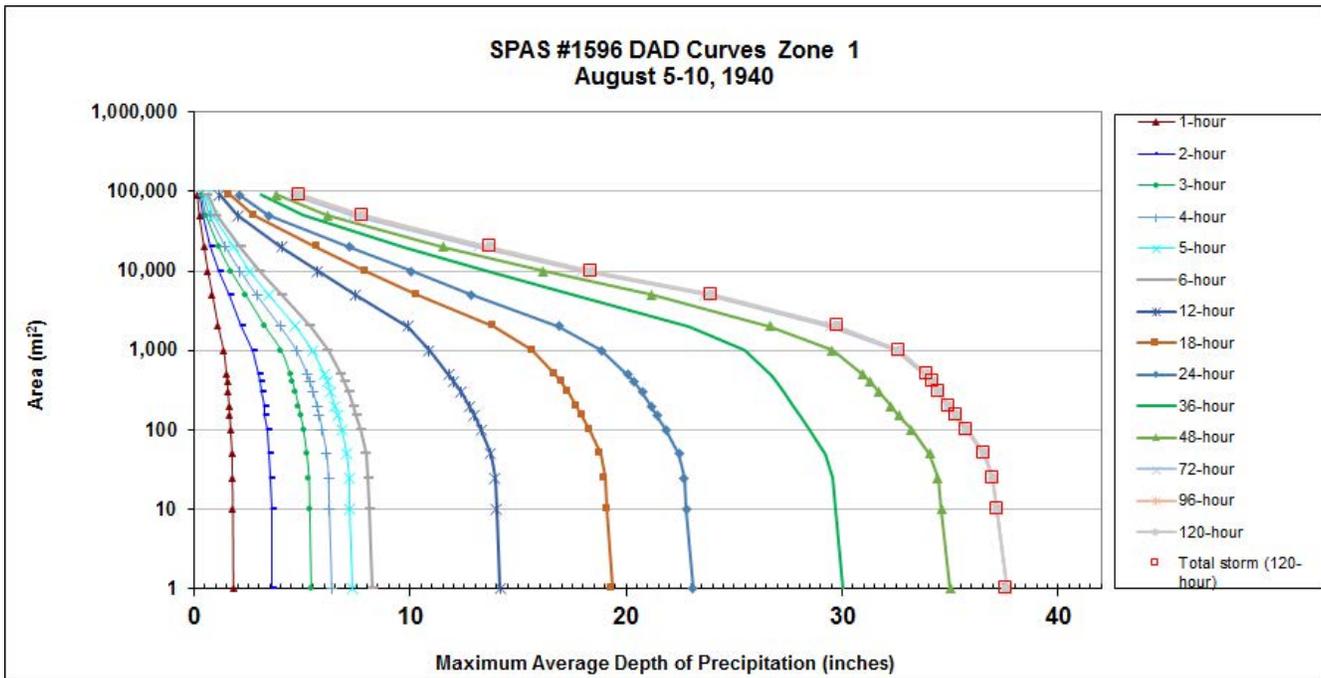
**Depth-Area-Duration (DAD) analysis:** Yes

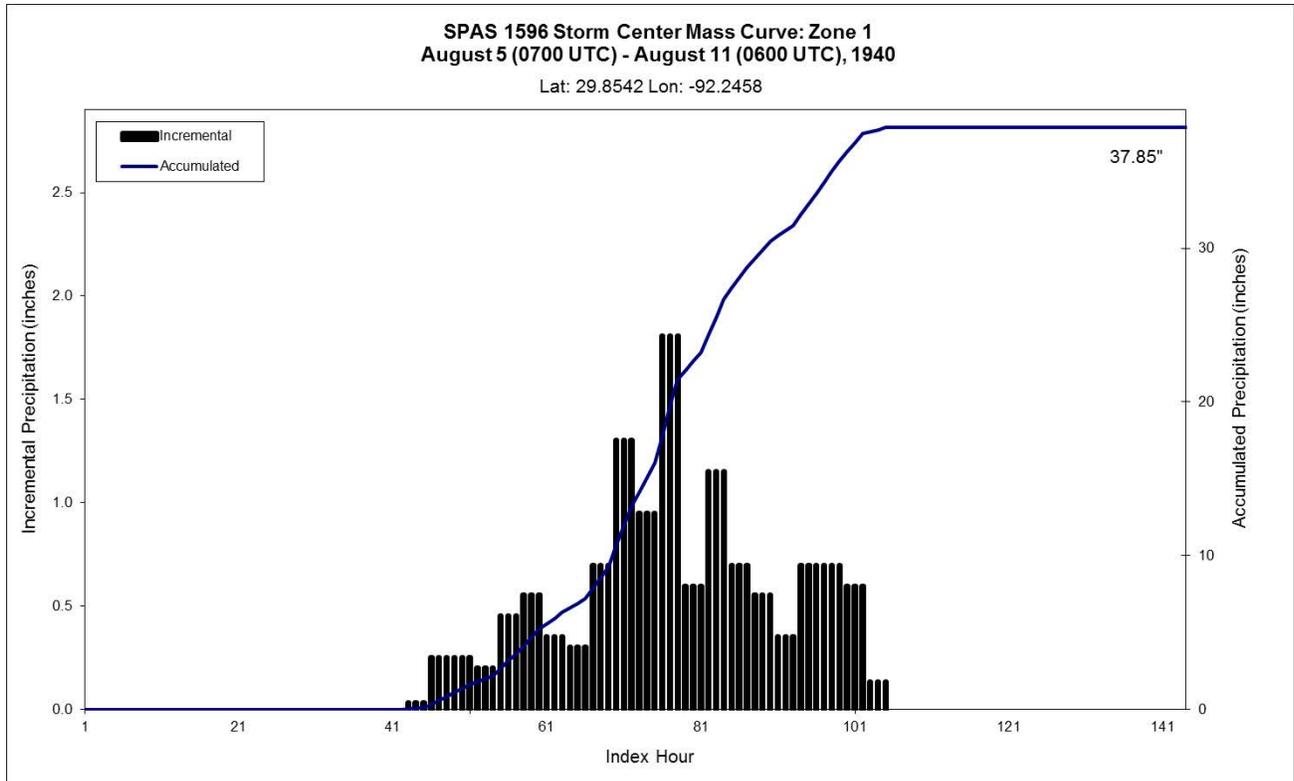
**Reliability of results:** This analysis was based on 174 hourly stations, daily data, and supplemental station data. We have a good degree of confidence for the station based storm total results. The spatial pattern is dependent heavily on the basemap created from the USACE Isohyetal image provided by the Lower Mississippi Valley Division. Timing is based on the hourly and hourly pseudo stations near the storm center. Several daily stations were moved to supplemental due to timing issues and to ensure data consistency.

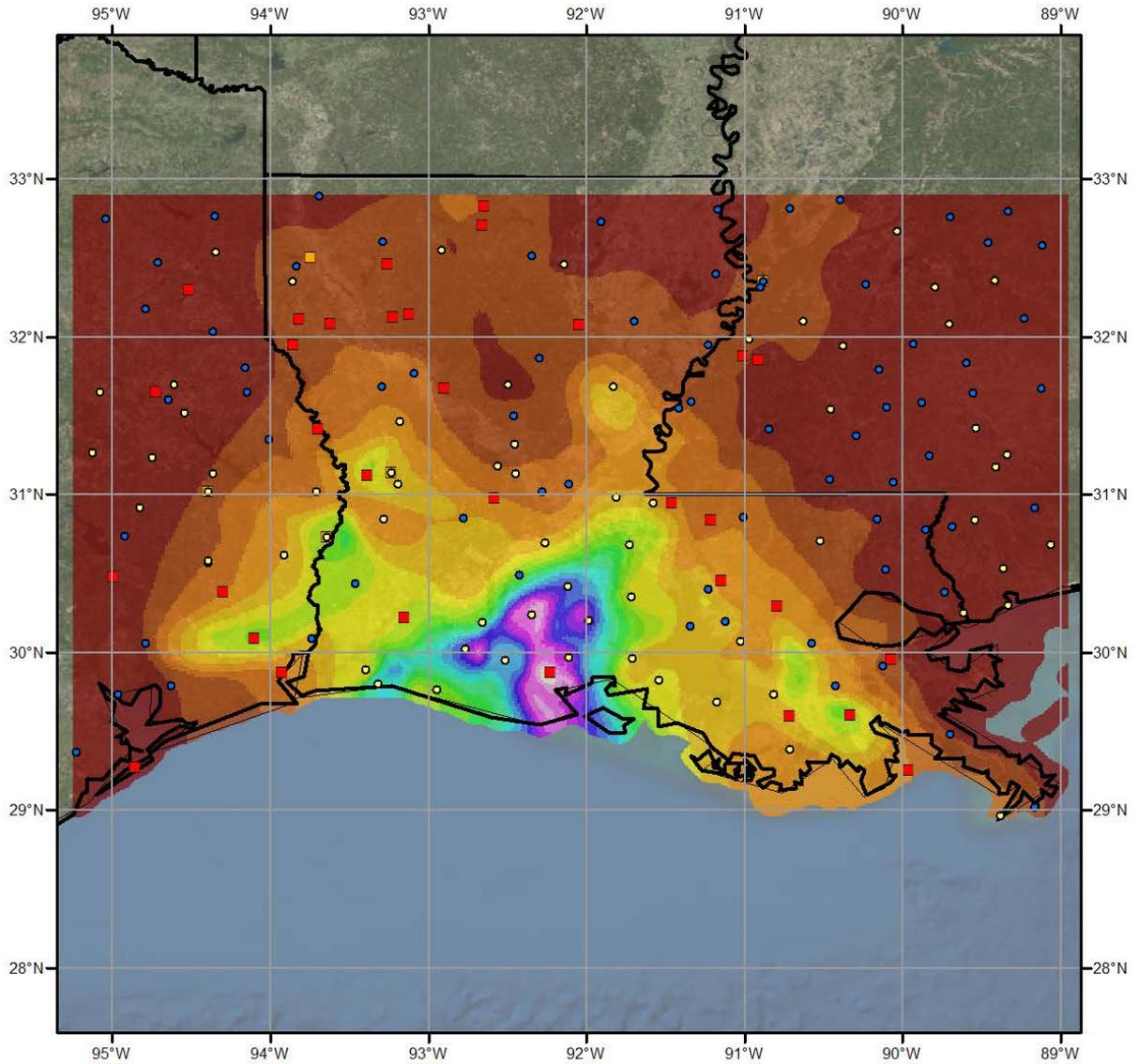
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1596_1	-92.246	29.854	2	0	85.50	4.58	0.00	93	4.580	87.00	87.0	4.86	0.00	96	4.860	1.061

**Storm 1596 - August 5 (0700 UTC) - August 11 (0600 UTC), 1940**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	1.80	3.61	5.42	6.36	7.31	8.26	14.23	19.45	23.20	30.21	35.19	37.79	37.79	37.85	37.85
1	1.80	3.59	5.41	6.36	7.30	8.25	14.15	19.36	23.08	30.06	35.02	37.61	37.61	37.61	37.61
10	1.78	3.56	5.34	6.25	7.20	8.11	13.98	19.12	22.80	29.69	34.59	37.16	37.17	37.17	37.17
25	1.76	3.55	5.31	6.21	7.16	8.06	13.91	19.02	22.69	29.55	34.42	36.99	36.99	36.99	36.99
50	1.74	3.48	5.21	6.13	7.04	7.95	13.72	18.80	22.43	29.22	34.04	36.58	36.59	36.59	36.59
100	1.68	3.36	5.05	5.93	6.82	7.70	13.29	18.31	21.84	28.49	33.19	35.73	35.76	35.77	35.77
150	1.64	3.28	4.93	5.79	6.66	7.52	12.98	17.95	21.44	28.05	32.64	35.25	35.28	35.30	35.30
200	1.61	3.22	4.83	5.68	6.53	7.38	12.74	17.71	21.15	27.74	32.25	34.91	34.95	34.97	34.97
300	1.56	3.12	4.68	5.50	6.33	7.16	12.37	17.33	20.74	27.31	31.70	34.44	34.49	34.51	34.51
400	1.52	3.04	4.55	5.35	6.16	6.96	12.04	17.01	20.37	27.01	31.32	34.12	34.16	34.19	34.19
500	1.49	2.96	4.44	5.22	6.02	6.81	11.78	16.72	20.06	26.73	30.95	33.86	33.91	33.94	33.94
1,000	1.36	2.68	4.02	4.73	5.48	6.20	10.88	15.64	18.86	25.45	29.53	32.51	32.60	32.64	32.64
2,000	1.11	2.18	3.28	3.97	4.66	5.37	9.90	13.87	16.88	22.93	26.64	29.45	29.72	29.80	29.80
5,000	0.84	1.62	2.38	2.88	3.43	4.06	7.43	10.29	12.81	17.44	21.15	23.63	23.87	23.96	23.96
10,000	0.63	1.16	1.69	2.12	2.60	3.04	5.71	7.92	10.07	13.53	16.16	17.94	18.17	18.37	18.37
20,000	0.45	0.77	1.14	1.45	1.82	2.16	4.05	5.67	7.21	9.74	11.55	13.18	13.54	13.73	13.73
50,000	0.23	0.40	0.54	0.71	0.88	1.03	2.01	2.75	3.45	5.05	6.16	7.32	7.67	7.81	7.81
90,974	0.14	0.24	0.34	0.43	0.51	0.61	1.17	1.65	2.08	3.11	3.80	4.51	4.79	4.89	4.89





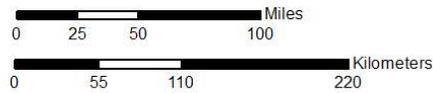


**Total Storm (144-hours) Precipitation (inches)  
August 5-10, 1940**

**SPAS 1596 - Miller Island, LA**

**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Supplemental



**Precipitation (inches)**

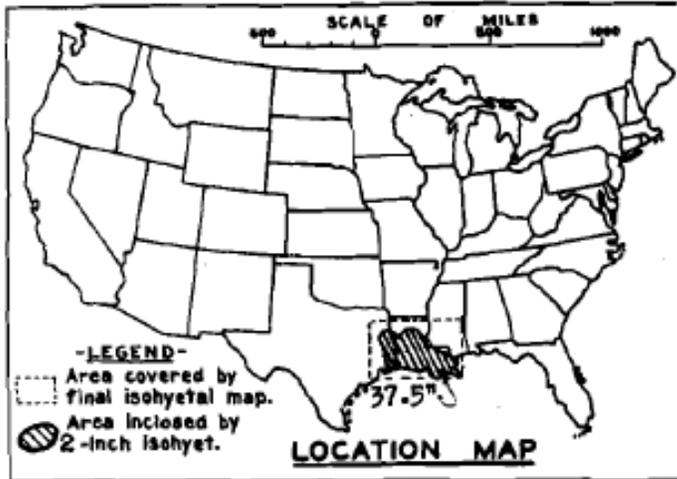
8.01 - 10.00	18.01 - 20.00	28.01 - 30.00
0.00 - 2.00	10.01 - 12.00	20.01 - 22.00
2.01 - 4.00	12.01 - 14.00	22.01 - 24.00
4.01 - 6.00	14.01 - 16.00	24.01 - 26.00
6.01 - 8.00	16.01 - 18.00	26.01 - 28.00
		30.01 - 32.00
		32.01 - 34.00
		34.01 - 36.00
		36.01 - 38.00



WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of August 6 - 9, 1940  
 Assignment L M V 4 - 24  
 Location Louisiana and Texas  
 Study Prepared by:  
 Lower Mississippi Valley  
 Division  
 New Orleans District Office  
 Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 3/7/42  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 12/30/43  
 Remarks: Centers at:  
 Miller Island, La., Beaumont,  
 Texas, Caney, La., and Delta  
 Farms, La.

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary Isohyetal map, in 2 sheet, scale 1 : 2,500,000  
 Precipitation data and mass curves: (Number of Sheets)  
 Form 5001-C (Hourly precip. data)----- 60  
 Form 5001-B (24-hour " " )----- -  
 Form 5001-D ( " " " " )----- 21  
 Misc. precip. records, meteorological data, etc. (Copies of Climatological Data)  
 Form 5002 (Mass rainfall curves)----- 56

**PART II**

Final Isohyetal maps, in 1 sheet, scale 1 : 1,000,000  
 Data and computation sheets:  
 Form S-10 (Data from mass rainfall curves)----- 4  
 Form S-11 (Depth-area data from isohyetal map)----- 2  
 Form S-12 (Maximum depth-duration data)----- 6  
 Maximum duration-depth-area curves----- 1  
 Data relating to periods of maximum rainfall----- 1

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours									
	6	12	18	24	30	36	48	60	72	84
Max. Station	8.8	16.8	19.6	23.8	26.3	29.7	35.0	37.5	37.5	37.5
10	8.5	15.8	19.3	22.1	25.6	28.5	34.8	37.3	37.3	37.3
20	8.4	15.5	19.1	21.7	25.2	28.1	34.1	36.8	36.8	36.8
100	8.0	14.5	18.4	20.7	24.1	27.1	32.6	35.2	35.2	35.2
200	7.8	13.4	17.8	20.3	23.5	26.5	31.9	34.5	34.5	34.5
500	6.9	12.0	16.2	19.4	22.7	25.6	30.3	33.5	33.6	33.6
1,000	6.0	10.9	14.5	18.4	21.7	24.6	28.8	31.9	32.2	32.2
2,000	5.0	8.9	12.6	16.7	19.9	22.7	26.3	29.2	29.5	29.5
5,000	3.7	6.4	9.1	12.3	14.9	17.1	20.3	22.6	22.9	22.9
10,000	2.6	4.6	6.3	8.5	10.5	12.1	15.0	16.8	17.2	17.2
20,000	1.5	3.0	4.1	5.5	6.6	7.6	10.1	11.7	12.6	12.7
36,200	1.0	2.0	3.0	4.0	4.8	5.6	7.3	8.4	9.0	9.1

WAR DEPARTMENT

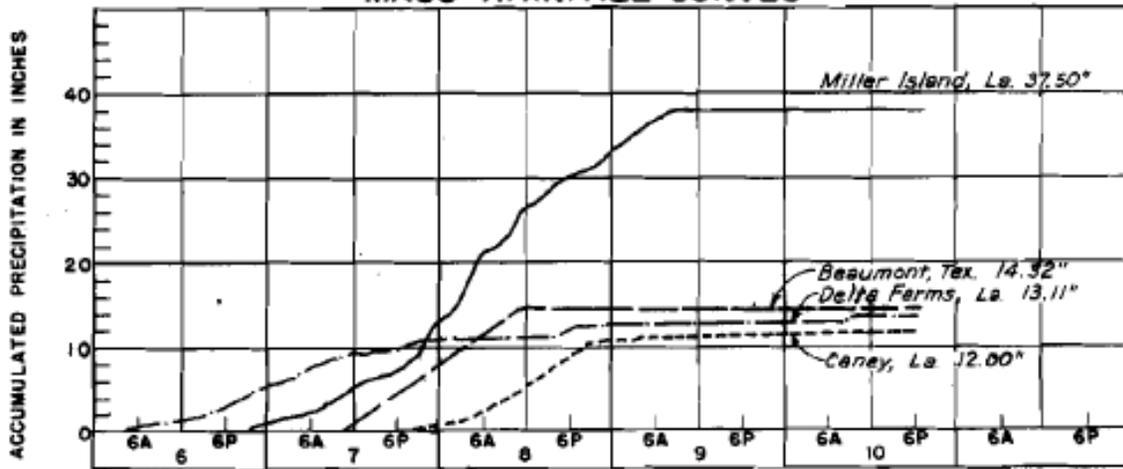
CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - ISOHYETAL MAP**

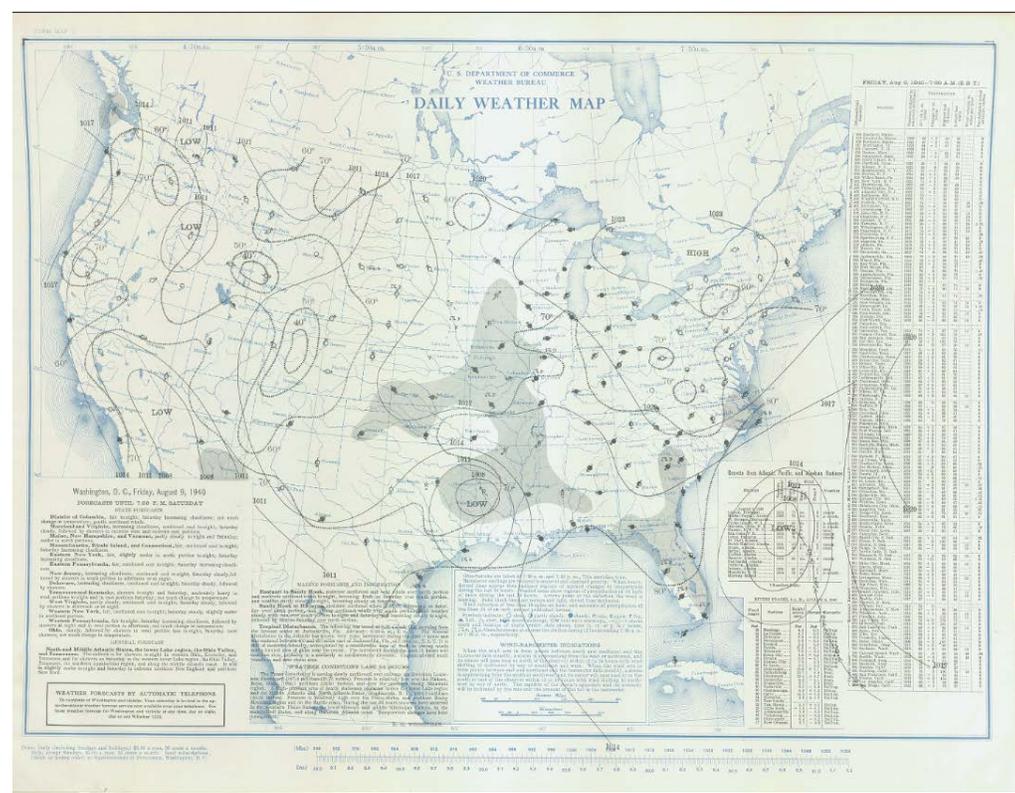
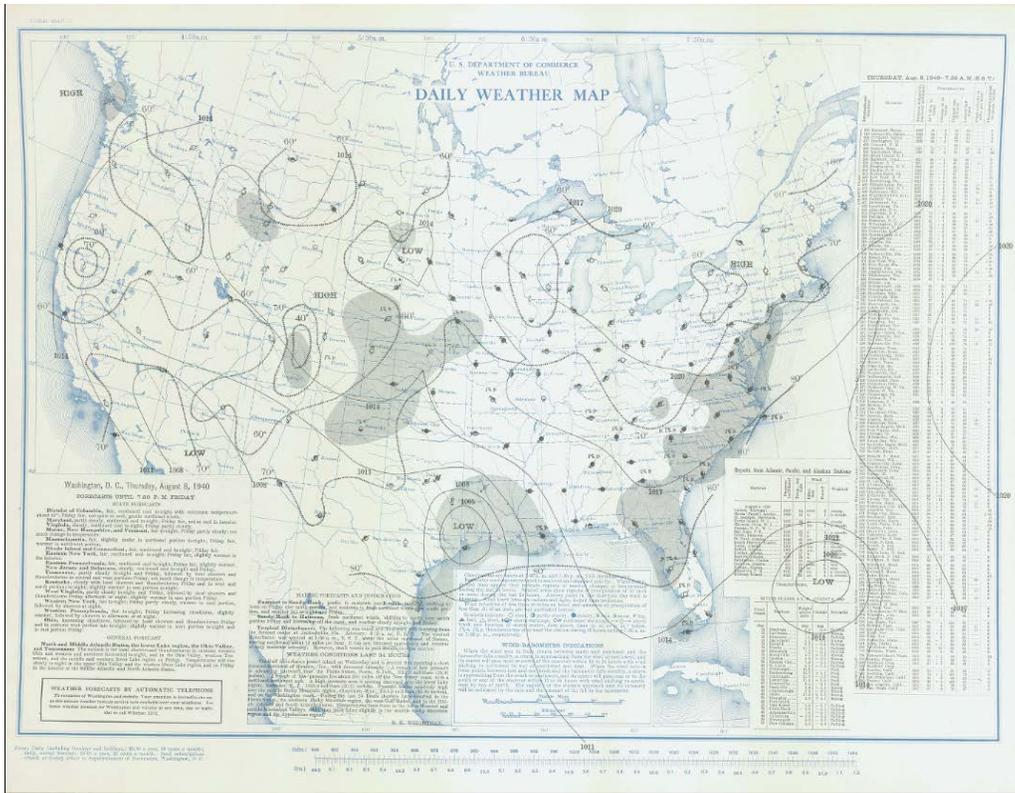
Storm of August 6-9, 1940 Assignment LMV 4-24  
 Study Prepared by: New Orleans, La. District  
Lower Mississippi Valley Division



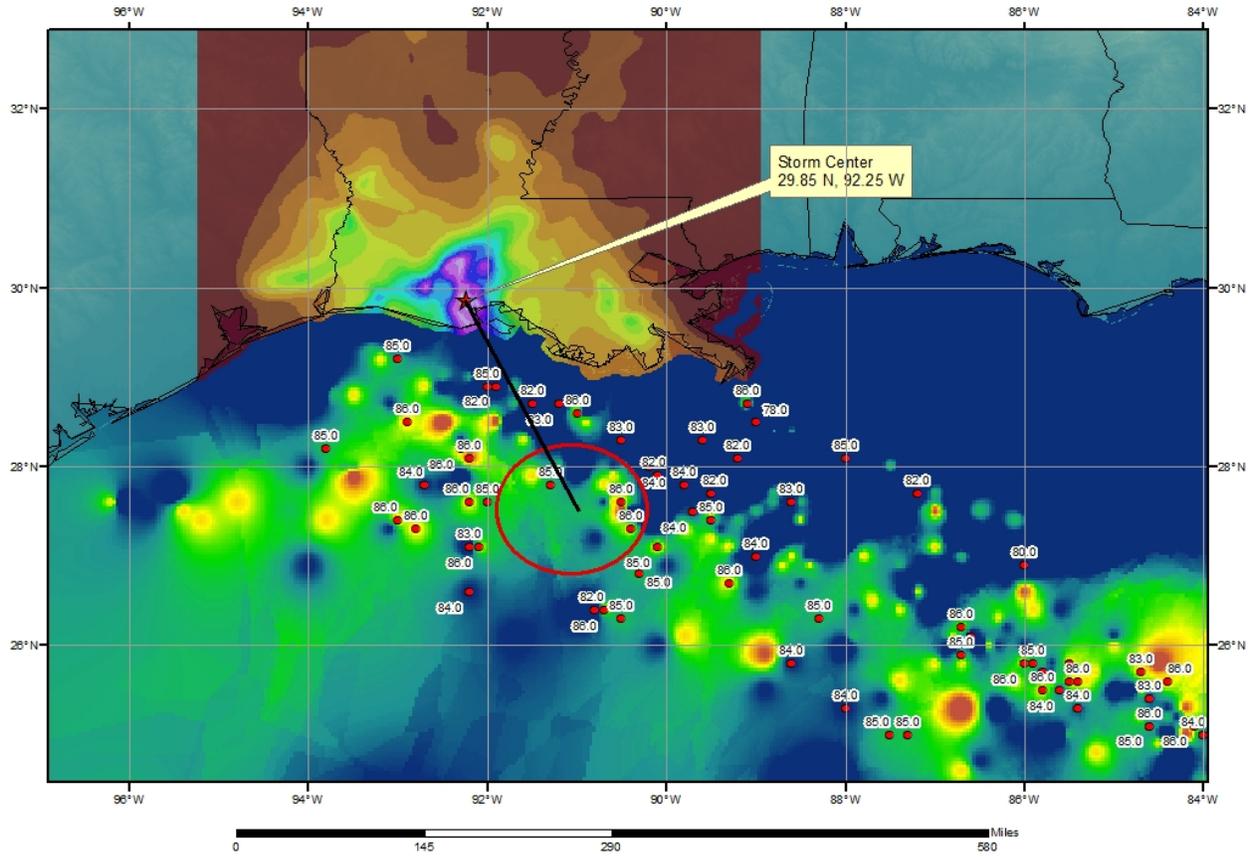
**MASS RAINFALL CURVES**







### SPAS 1596 Miller Island, LA Sea Surface Temperatures (F) August 7, 1940



## Storm Precipitation Analysis System (SPAS) For Storm #1519\_1

**General Storm Location:** Florida, Georgia, South Carolina (-83.7, 33.2, 25.7, -79.8)

**Storm Dates:** September 3 – September 7, 1950

**Event:** Hurricane Beulah

### DAD Zone 1

**Latitude:** 29.0292

**Longitude:** -82.7208

**Max. Grid Rainfall Amount:** 45.18”

**Max. Observed Rainfall Amount:** 45.25”

**Number of Stations:** 214

**SPAS Version:** 10.0

**Basemap:** Manually contoured basemap based off USACE isohyetal map

**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

**Reliability of results:** In addition to the NCDC hourly stations, two hourly stations were estimated from the U.S. Army Corp of Engineers (USACE) mass rainfall curves for the storm center in Yankeetown and Cedar Key, FL. Over 60 supplemental stations were also added, mainly throughout and to the south of the storm center, from the USACE isohyetal maps. In order to maintain spatial consistency between station locations on the USACE produced map and the MetStat database, some MetStat originated station locations were moved slightly in order to more closely match the map location. In a few cases, stations outside the storm center have a high ( $>|0.5|$  inch), quality-controlled observation vs. SPAS value ( $\Delta P$ ). This is due to the difference between the amount of precipitation reported by the USACE station and MetStat database gauge observations between September 4-7, 1950; any stations remaining in the analysis with a large  $\Delta P$  have resulting SPAS precipitation comparable to USACE station report. Reports indicate that storm center precipitation largely occurred over a 24-hour period, with over 38 inches falling at Yankeetown, FL. Our analysis resulted in a 24-hour max intensity of 38.9 inches surrounding Yankeetown, FL, comparable to reports.

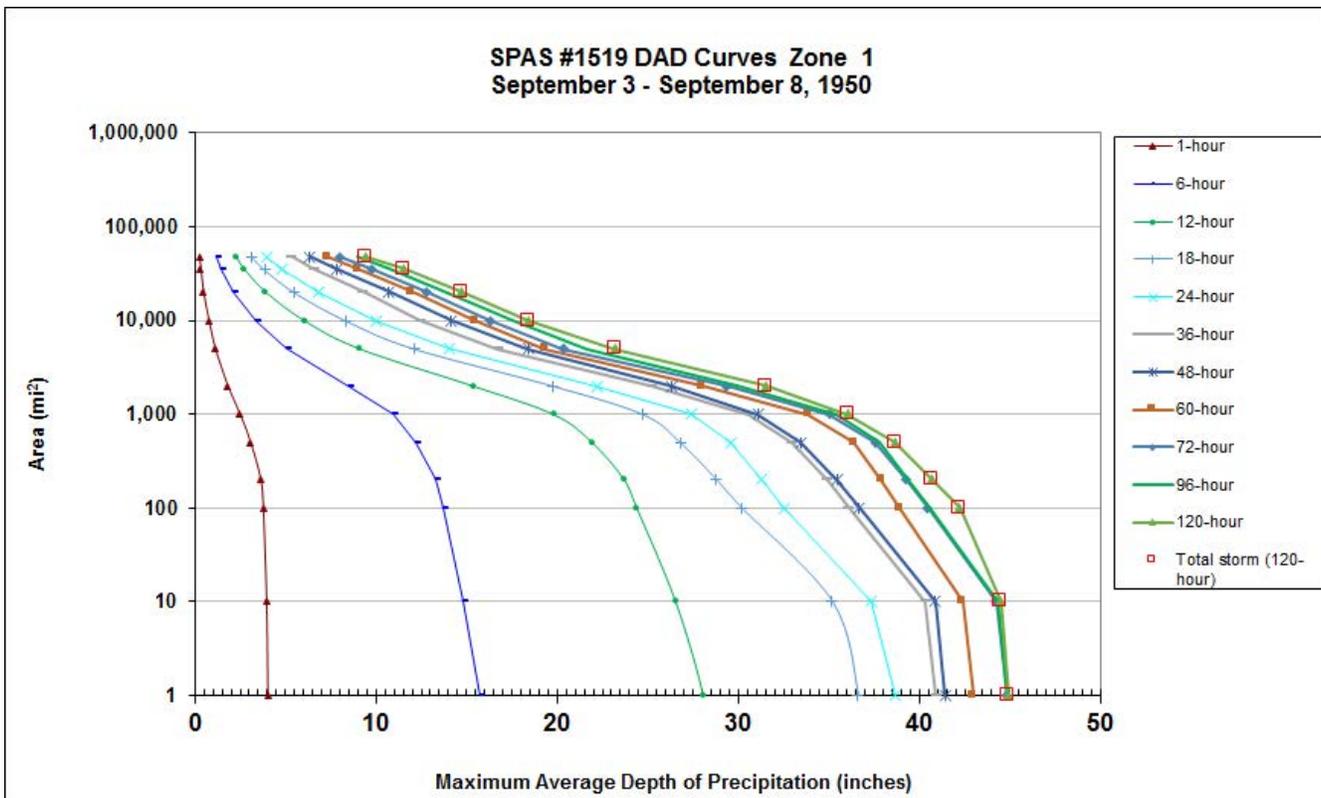
Extensive efforts were done to match the SPAS DAD to the USACE DAD as close as possible, this includes extending precipitation off the coast and using the same size/shape DAD zone. At the smallest areas sizes, results are comparable, however, given discrepancies between the USACE DAD analysis,

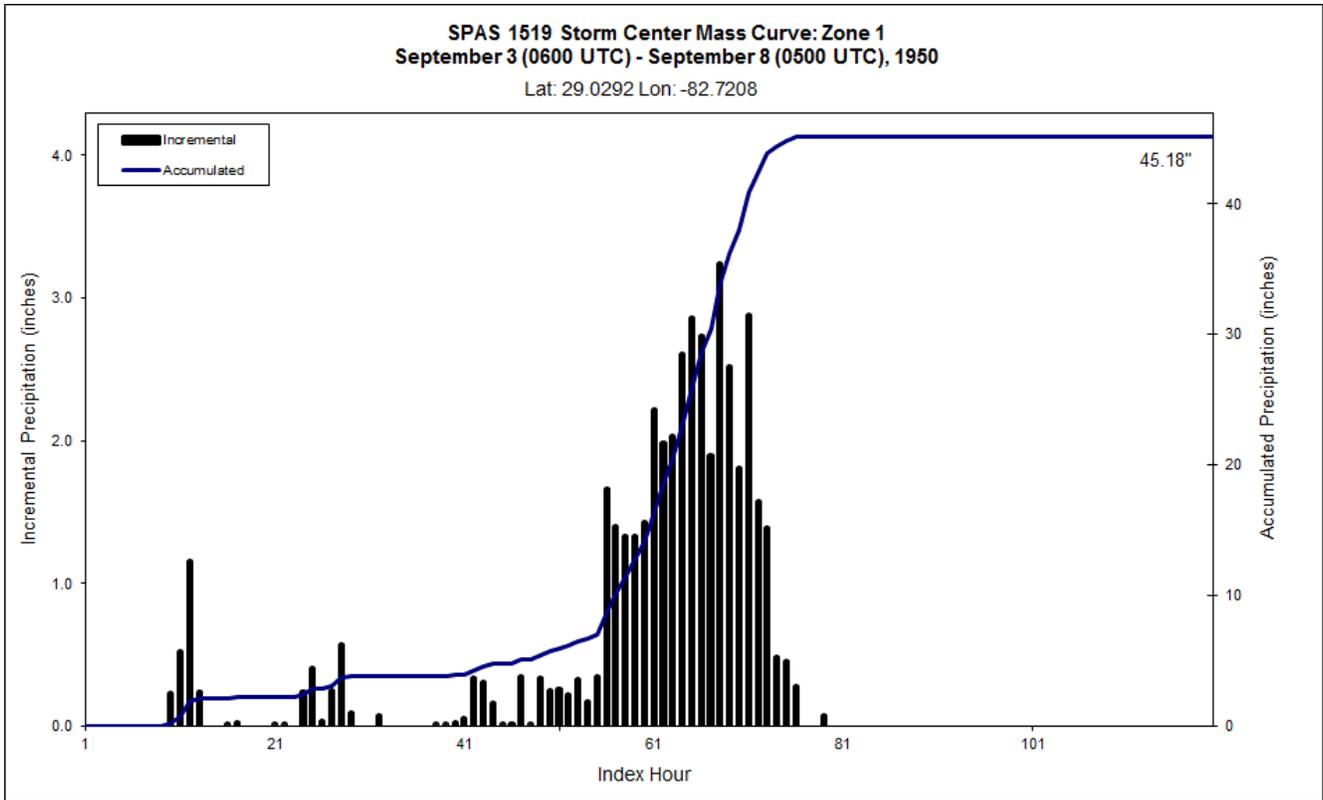
mass curves and isohyetal map, a complete match between SPAS and USACE analysis is not feasible. Given that the pattern of the storm center matches closely to the USACE isohyetal map and timing is aligned, this analysis is still deemed reasonable. Any further analysis of this storm would require part I of USACE document, which is not currently known to be available.

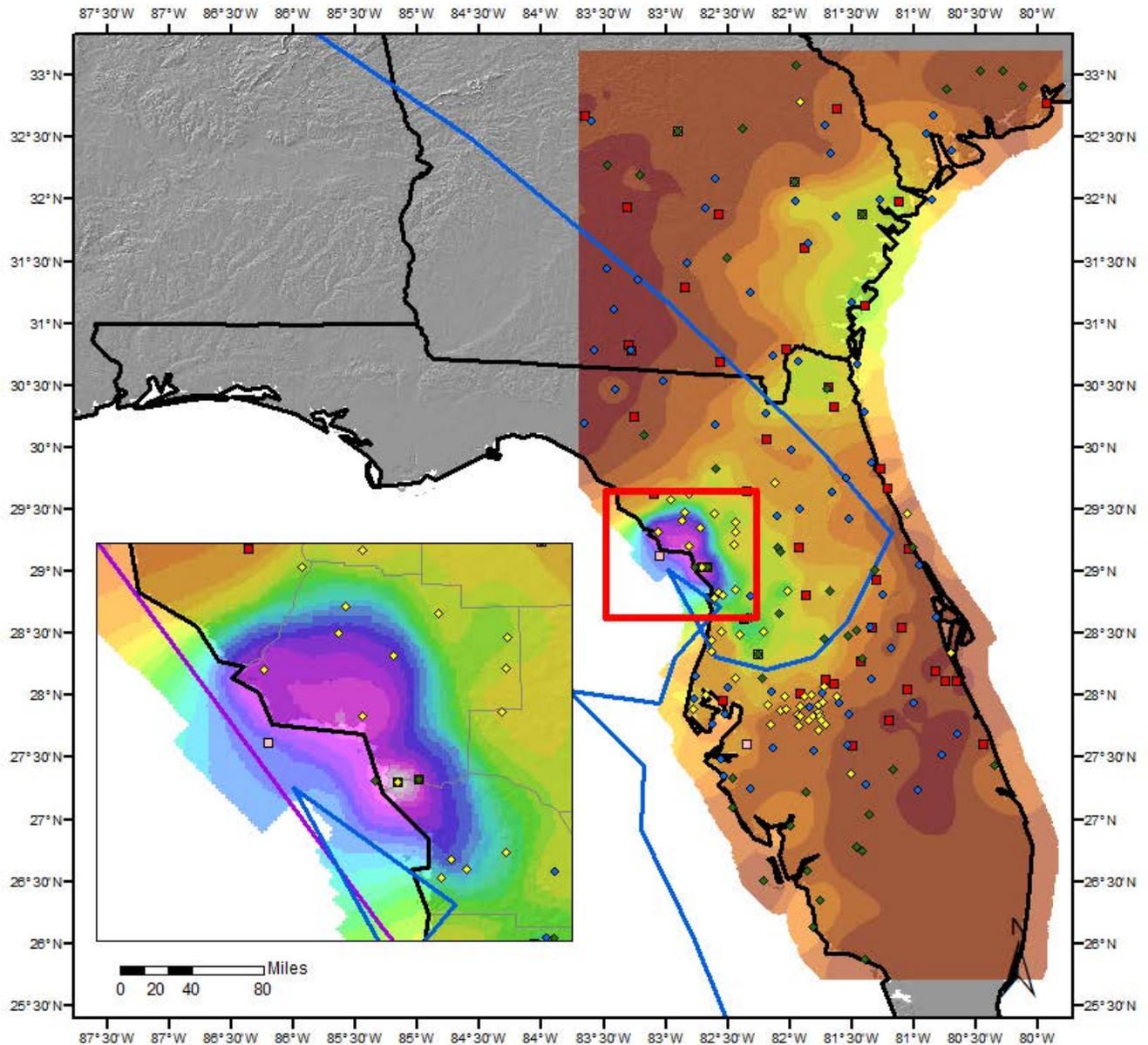
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1519_1	-82.721	29.029	5	0	84.00	4.30	0.00	90	4.300	86.50	86.5	4.77	0.00	95	4.770	1.109

**Storm 1519 - September 3 (0600 UTC) - September 8 (0500 UTC), 1950**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)											
	1	6	12	18	24	36	48	60	72	96	120	Total
0.3	4.05	15.80	28.27	36.80	38.86	41.15	41.63	43.20	45.09	45.10	45.09	45.09
1	4.02	15.70	28.09	36.60	38.66	40.94	41.44	42.97	44.85	44.87	44.92	44.92
10	3.95	14.83	26.57	35.18	37.32	40.35	40.86	42.41	44.25	44.31	44.49	44.49
100	3.77	13.70	24.42	30.19	32.53	36.11	36.66	38.91	40.47	40.55	42.22	42.22
200	3.64	13.29	23.73	28.79	31.30	34.92	35.46	37.89	39.29	39.43	40.71	40.71
500	3.07	12.19	21.95	26.79	29.60	32.92	33.44	36.39	37.57	37.82	38.66	38.66
1000	2.49	10.92	19.82	24.72	27.43	30.53	31.09	33.87	35.06	35.42	36.03	36.03
2000	1.81	8.47	15.39	19.78	22.23	25.19	26.32	28.03	29.35	29.94	31.56	31.56
5000	1.11	5.05	9.10	12.11	14.07	16.74	18.41	19.31	20.33	21.64	23.18	23.18
10000	0.75	3.34	6.03	8.33	10.04	12.45	14.16	15.48	16.30	17.57	18.41	18.41
20000	0.45	2.10	3.92	5.51	6.83	9.29	10.72	11.99	12.78	13.80	14.72	14.72
35,000	0.30	1.43	2.73	3.86	4.81	6.55	7.82	8.97	9.73	10.72	11.54	11.54
47,854	0.23	1.16	2.25	3.16	3.96	5.35	6.36	7.31	7.98	8.95	9.40	9.40

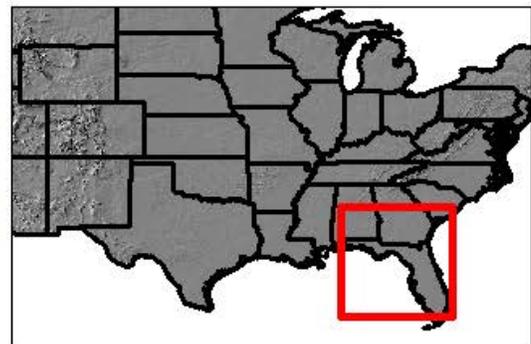






**Total 120-hour Precipitation (inches)**  
**September 3, 1950 (0600 UTC) - September 8, 1950 (0500 UTC)**  
**SPAS #1519 - Hurricane "Easy"**

Station	Precipitation (inches)					
◆ Daily	0.56 - 2.00	16.01 - 18.00	32.01 - 34.00			
■ Hourly	2.01 - 4.00	18.01 - 20.00	34.01 - 36.00			
□ Hourly Estimated	4.01 - 6.00	20.01 - 22.00	36.01 - 38.00			
■ Hourly Estimated Pseudo	6.01 - 8.00	22.01 - 24.00	38.01 - 40.00			
■ Hourly Pseudo	8.01 - 10.00	24.01 - 26.00	40.01 - 42.00			
◆ Supplemental	10.01 - 12.00	26.01 - 28.00	42.01 - 44.00			
◆ Supplemental Estimated	12.01 - 14.00	28.01 - 30.00	44.01 - 45.20			
	14.01 - 16.00	30.01 - 32.00				
— Easy Storm Track						

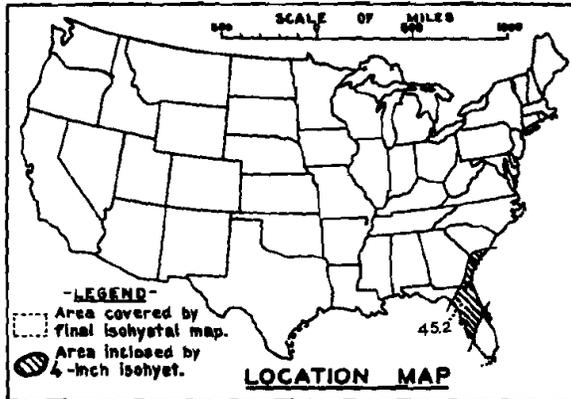


ADH 3/27/15

DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 3-7 September 1950  
 Assignment SA 5-8  
 Location Florida  
 Study Prepared by:  
 South Atlantic Division  
 Jacksonville District Office

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 2/19/53  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 4/16/57  
 Remarks: Center at Yankeetown,  
 Florida.  
 Dewpoint 76°, Ref. Pt. 134 SE  
 Grid J-8

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 2 sheets, scale 1:1,000,000 & 1:500,000  
 Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	44
Form 5001-B (24-hour " " " " ).....	0
Form 5001-D ( " " " " " " ).....	14
Misc. precip. records, meteorological data, etc.....	49
Form 5002 (Mass rainfall curves).....	33

**PART II**

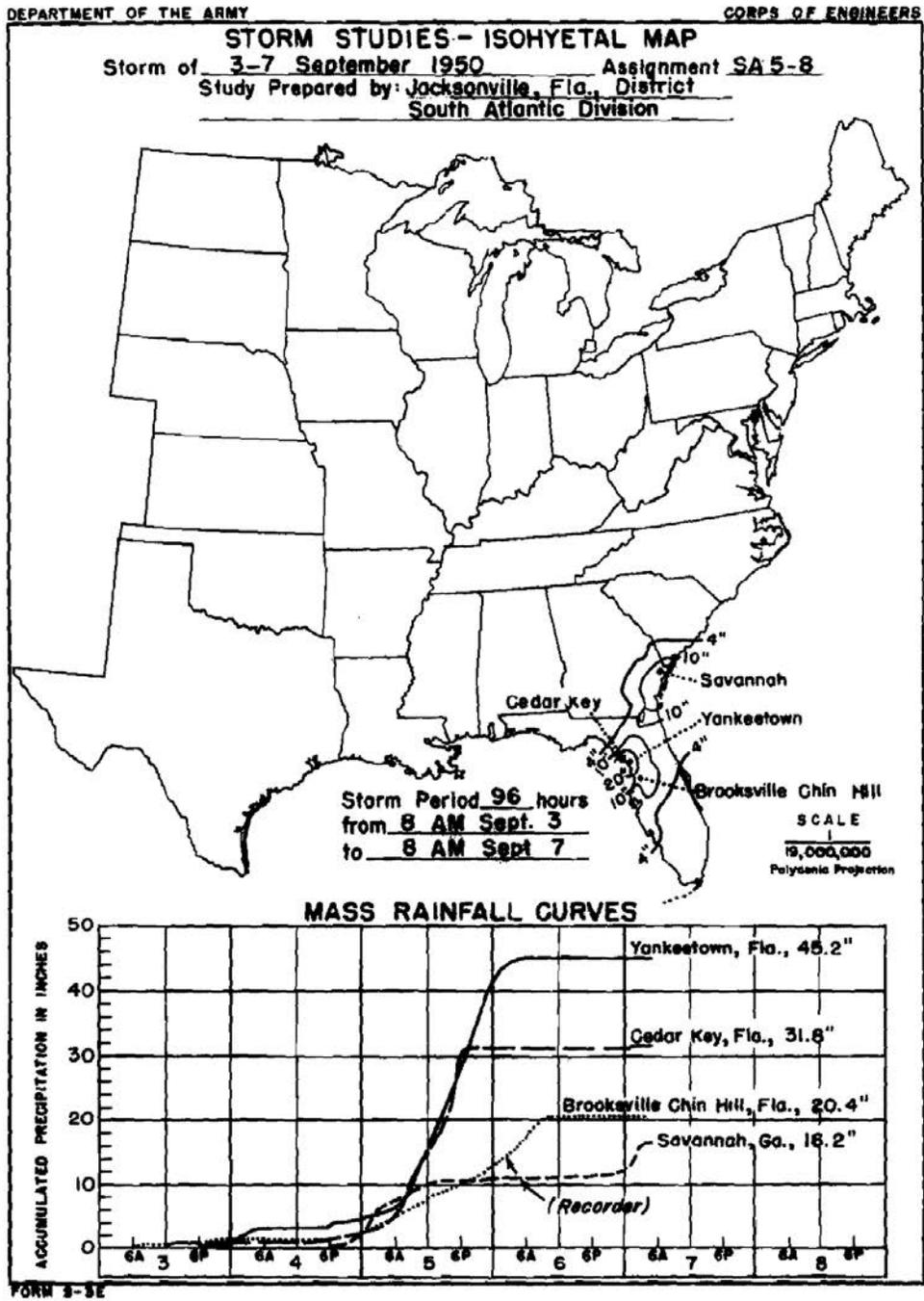
Final isohyetal maps, in 2 sheets, scale 1:1,000,000 & 1:500,000  
 Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	5
Form S-11 (Depth-area data from isohyetal map).....	4
Form S-12 (Maximum depth-duration data).....	41
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	3

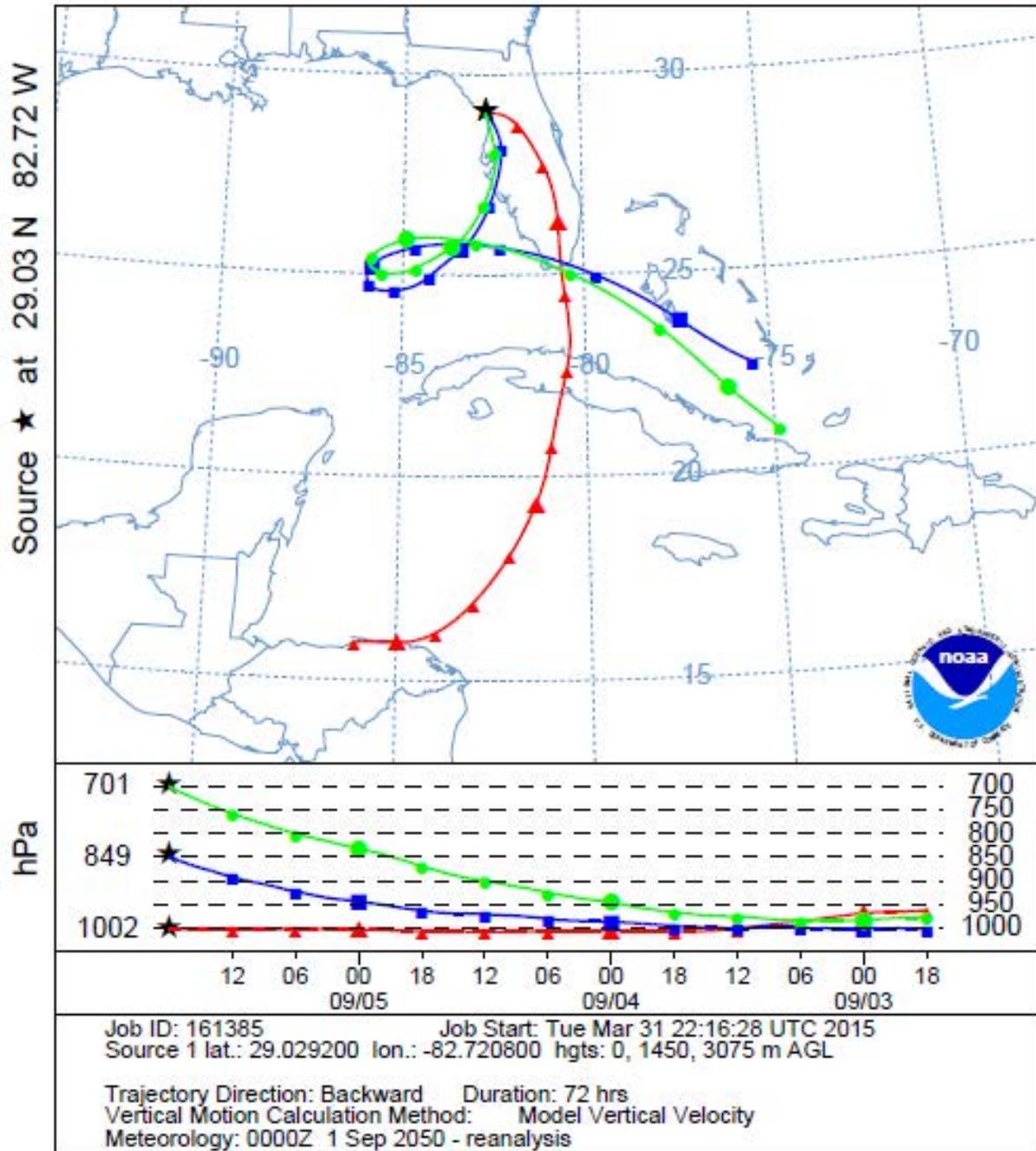
**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours									
	6	12	18	24	30	36	48	60	72	96
10	16.0	28.6	36.3	38.7	40.6	41.8	43.1	44.7	45.2	45.2
100	14.0	26.3	32.5	35.2	36.5	37.9	38.9	40.2	40.6	40.8
200	13.4	25.6	31.4	34.2	35.3	36.7	37.7	38.8	39.2	39.6
500	12.5	24.6	29.7	32.7	33.6	35.0	36.0	36.9	37.3	37.7
1,000	11.2	22.6	27.4	30.2	31.6	32.9	33.7	34.4	34.9	35.4
2,000	9.4	17.7	22.5	24.8	26.3	27.3	28.4	29.2	29.7	30.5
5,000	5.4	9.7	13.3	15.5	17.5	18.4	19.7	20.2	21.0	21.8
10,000	3.3	6.6	8.6	10.6	12.1	13.1	14.7	15.6	16.4	17.3
20,000	2.3	4.3	5.8	7.5	8.8	9.6	11.2	12.5	13.5	14.2
43,500	1.2	2.3	3.4	4.4	5.3	5.9	7.1	8.2	8.9	9.9

Form S-2



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1800 UTC 05 Sep 50  
 CDC1 Meteorological Data





## Storm Precipitation Analysis System (SPAS) For Storm #1601\_1

**General Storm Location:** Nuevo León, Texas (30.5, -12.0, 24.5, -94.0)

**Storm Dates:** September 19 (0700 UTC) – 24 (0600 UTC), 1967 (144-hours)

**Event:** Hurricane Beulah (USACE SW 3-24)

### DAD Zone 1

**Latitude:** 26.2792

**Longitude:** -99.9208

**Max. Grid Rainfall Amount:** 35.87” Sombreretillo, N.L., MX

**Max. Observed Rainfall Amount:** 34.86”

**Number of Stations:** 362

**SPAS Version:** 10.0

**Basemap:** Us\_ppt\_in\_map\_1961\_1990\_usda\_northamerica

**Radar Included:** No

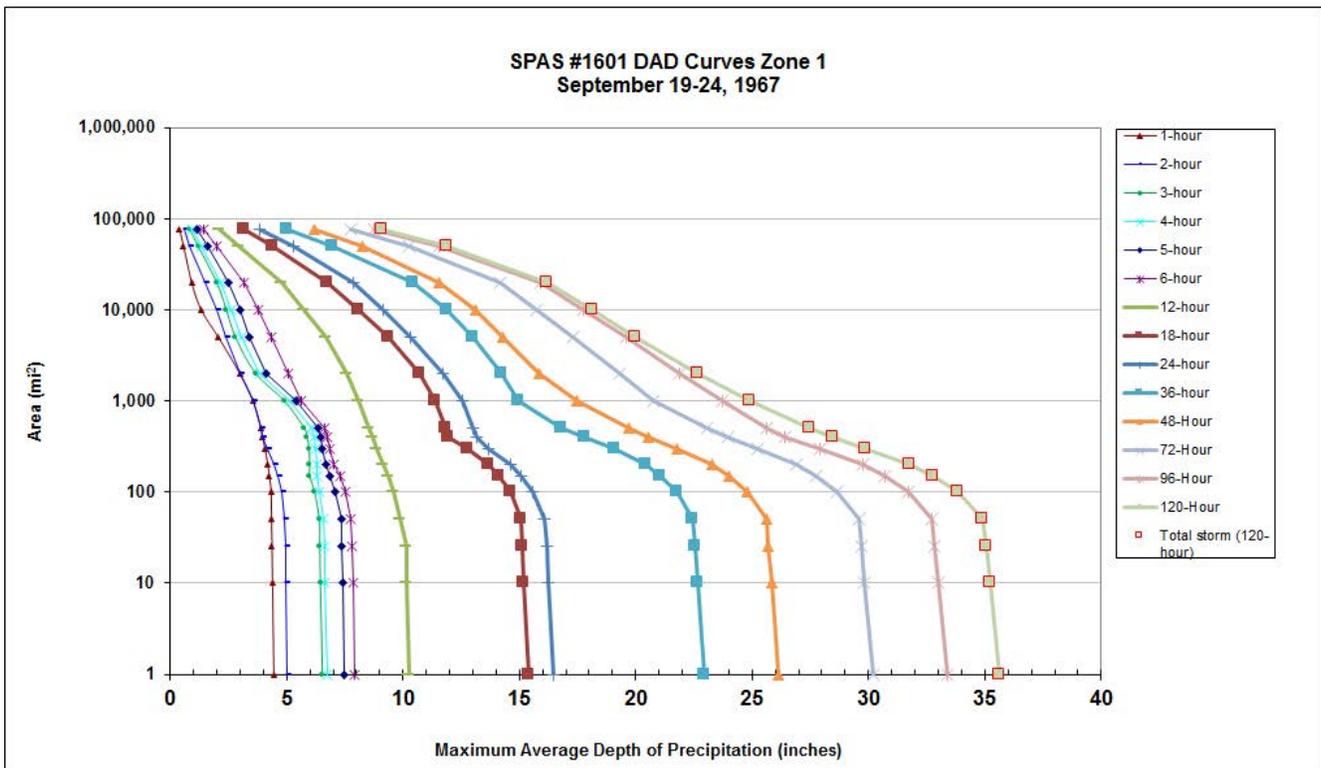
**Depth-Area-Duration (DAD) analysis:** Yes

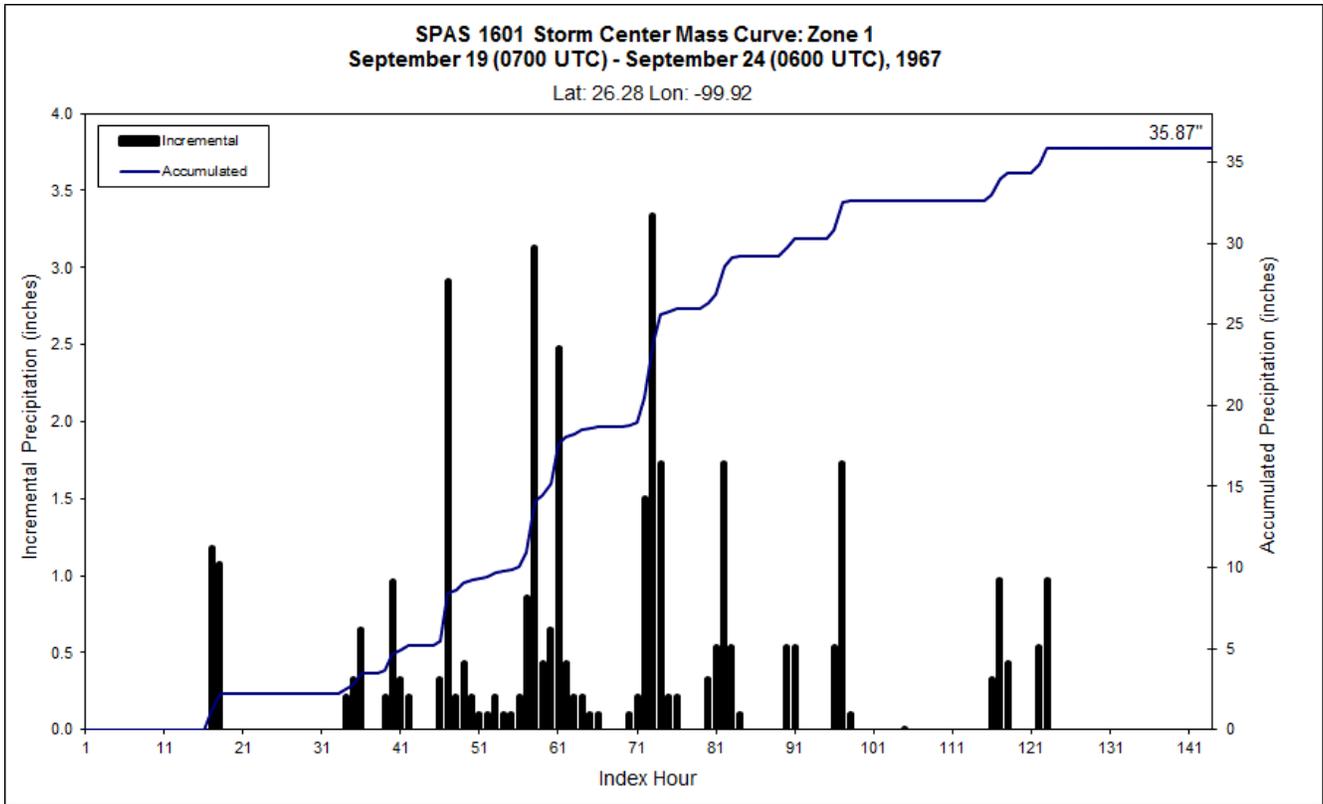
**Reliability of results:** This analysis was based on hourly data (H), hourly estimated pseudo data (HEP), hourly pseudo data (HP), daily data (D) and supplemental data (S). We have a high degree of confidence in the station based storm total results, the spatial pattern is dependent on basemap and the timing is based on hourly, hourly estimated pseudo and hourly pseudo stations.

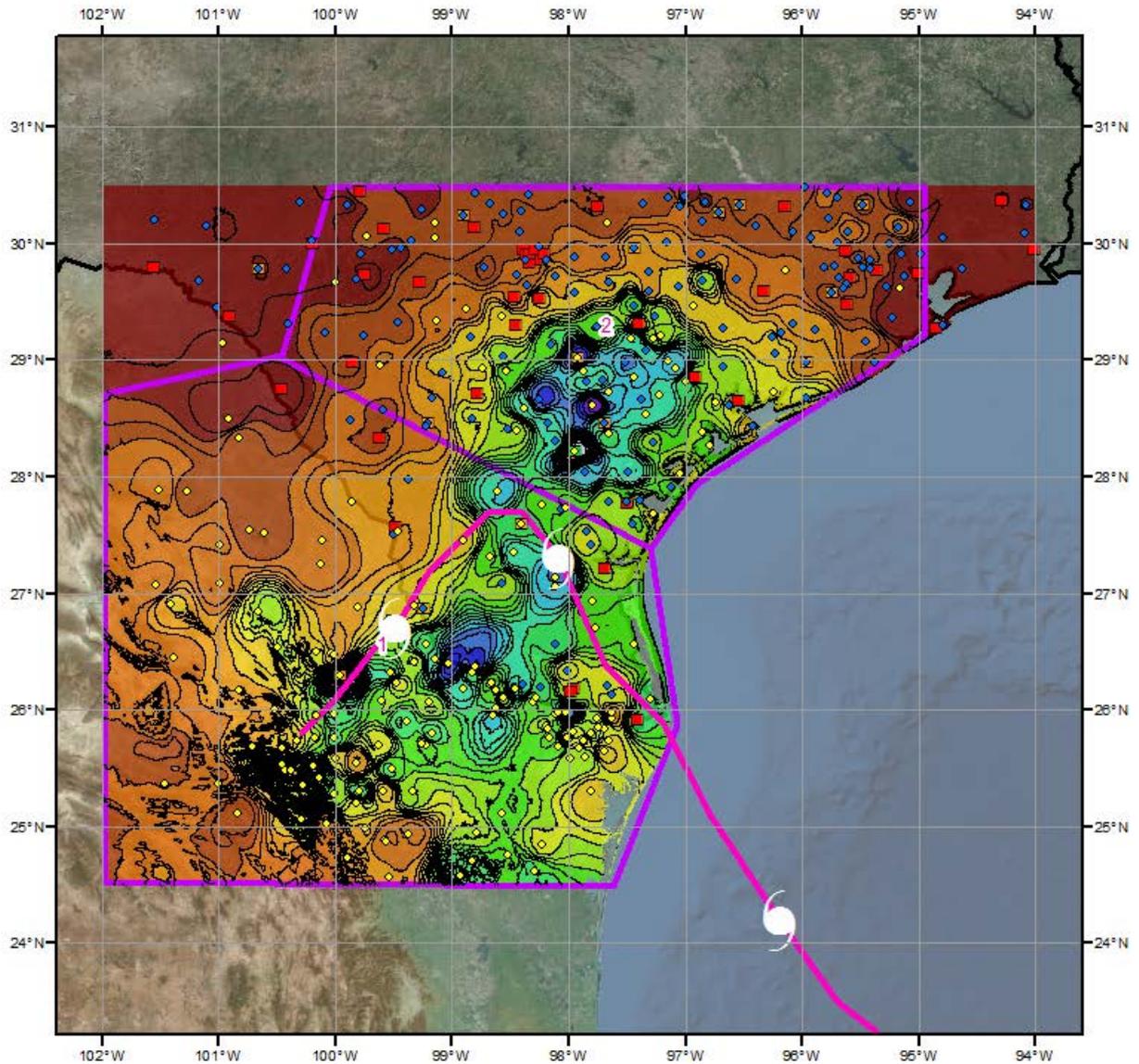
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1601_1	-99.921	26.279	1,425	1,400	82.00	3.95	0.42	86	3.530	86.00	86.0	4.67	0.50	94	4.170	1.181

**Storm 1601 Zone 1 - Sep. 19 (0700 UTC) - Sep. 24 (0600 UTC), 1967**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

areasqmi	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.4	4.47	5.06	6.56	6.77	7.53	7.96	10.32	15.47	16.51	23.05	26.26	30.33	33.56	35.87	35.87
1	4.45	5.04	6.53	6.74	7.50	7.93	10.28	15.39	16.44	22.95	26.14	30.19	33.40	35.65	35.65
10	4.39	4.98	6.45	6.66	7.41	7.84	10.17	15.20	16.24	22.68	25.83	29.83	33.02	35.23	35.23
25	4.37	4.96	6.42	6.63	7.38	7.80	10.13	15.13	16.17	22.57	25.71	29.69	32.86	35.06	35.06
50	4.35	4.92	6.40	6.60	7.34	7.75	9.89	15.08	16.09	22.47	25.60	29.57	32.71	34.92	34.92
100	4.33	4.77	6.20	6.39	7.11	7.52	9.57	14.60	15.59	21.77	24.81	28.66	31.71	33.85	33.85
150	4.26	4.62	5.99	6.30	6.88	7.28	9.35	14.13	15.09	21.07	24.02	27.74	30.70	32.78	32.78
200	4.19	4.47	5.99	6.29	6.67	7.05	9.15	13.69	14.62	20.42	23.27	26.89	29.76	31.77	31.77
300	4.07	4.18	5.96	6.25	6.55	6.85	8.88	12.76	13.68	19.10	21.79	25.22	27.89	29.87	29.87
400	3.97	3.98	5.88	6.18	6.47	6.76	8.68	11.93	13.16	17.81	20.53	23.93	26.39	28.47	28.47
500	3.90	3.91	5.77	6.06	6.35	6.64	8.52	11.81	13.01	16.79	19.73	23.08	25.62	27.46	27.46
1,000	3.56	3.56	4.91	5.15	5.40	5.65	8.09	11.38	12.53	14.98	17.45	20.77	23.72	24.89	24.89
2,000	2.99	3.00	3.67	3.86	4.10	5.06	7.60	10.73	11.74	14.23	15.86	19.32	21.87	22.67	22.67
5,000	2.07	2.41	2.81	3.05	3.42	4.34	6.71	9.37	10.35	12.99	14.30	17.28	19.58	20.01	20.01
10,000	1.33	2.02	2.41	2.62	3.00	3.77	5.77	8.08	9.15	11.87	13.09	15.75	17.76	18.15	18.15
20,000	0.92	1.51	2.00	2.17	2.53	3.18	4.77	6.74	7.89	10.46	11.55	14.20	15.91	16.19	16.19
50,000	0.57	0.83	1.20	1.33	1.62	2.00	2.95	4.38	5.31	6.95	8.23	10.24	11.54	11.90	11.90
76,659	0.40	0.60	0.85	0.95	1.17	1.42	2.10	3.16	3.87	5.02	6.18	7.77	8.77	9.10	9.10







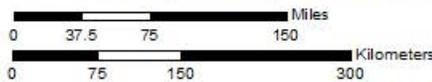
**Total Storm (144-hours) Precipitation (inches)**

**September 19-24, 1967**

**SPAS 1601 Sombretillo, N.L., Mexico (SW 3-24)**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Estimated Pseudo
- Hourly Pseudo
- ◆ Supplemental



**Precipitation (inches)**

■ 0.00 - 2.00	■ 8.01 - 10.00	■ 18.01 - 20.00	■ 28.01 - 30.00
■ 2.01 - 4.00	■ 10.01 - 12.00	■ 20.01 - 22.00	■ 30.01 - 32.00
■ 4.01 - 6.00	■ 12.01 - 14.00	■ 22.01 - 24.00	■ 32.01 - 34.00
■ 6.01 - 8.00	■ 14.01 - 16.00	■ 24.01 - 26.00	■ 34.01 - 36.00
	■ 16.01 - 18.00	■ 26.01 - 28.00	



WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of September 19-24 1967  
 Assignment SW 3-24  
 Location Texas and Mexico  
 Study Prepared by:  
Southwestern Division  
Fort Worth District

Part I Reviewed by Hydromet.  
 Sec. of Weather Bureau, 2-26-69  
 Part II Approved by Office, Chief  
 of Engineers for distribution  
 of factual data, 2-3-70  
 Remarks \_\_\_\_\_

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary Isohyetal map, in 1 sheet scale 1:1,374,400  
 Precipitation data and mass curves: (Number of Sheets)  
 Form 5001-C (Hourly precip. data) ..... 32  
~~Form 5001-B (Hourly precip. data) ..... 7~~  
 Form 5001-D ( " " " " ) ..... 20  
 Misc. precip. records, meteorological data, etc. .... 2  
 Form 5002 (Mass rainfall curves) ..... 68

**PART II**

Final isohyetal maps, in 1 sheet scale 1:1,000,000  
 Data and computation sheets:  
 Form S-10 (Data from mass rainfall curves) ..... 7  
 Form S-11 (Depth-area data from isohyetal map) ..... 1  
 Form S-12 (Maximum depth-duration data) ..... 13  
 Maximum duration-depth-area curves ..... 1  
 Data relating to periods of maximum rainfall ..... 4

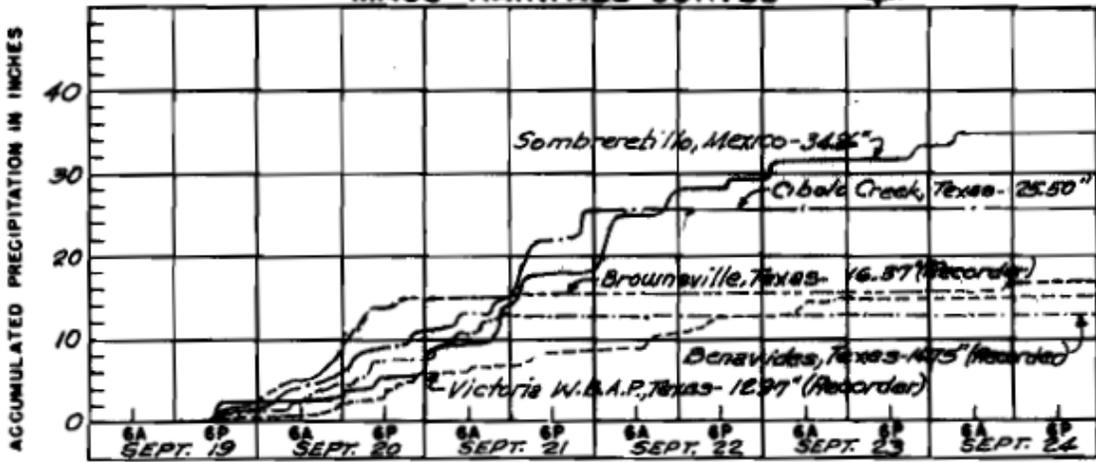
**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Miles	Duration of Rainfall in Hours											
	6	12	18	24	30	36	48	60	72	96	126	
Station P 10	9.2	12.2	15.2	18.7	21.8	24.8	26.2	32.0	32.0	32.5	34.9	
100	7.3	10.4	13.2	17.6	20.7	21.7	23.9	30.0	30.0	30.9	34.0	
200	6.7	9.7	12.3	16.4	19.2	20.3	23.0	28.8	28.8	29.9	33.0	
500	5.9	8.7	11.1	14.0	16.3	18.3	21.5	26.1	26.8	27.8	30.6	
1,000	5.3	7.9	10.0	11.9	14.4	16.8	20.3	23.8	25.1	26.0	27.2	
2,000	4.6	7.0	9.0	10.4	12.7	15.2	19.0	21.6	23.2	24.0	24.8	
5,000	3.7	5.8	7.6	8.9	10.8	13.1	17.2	19.2	20.7	21.7	22.4	
10,000	3.1	4.9	6.5	7.8	9.5	11.4	15.2	17.3	18.5	20.0	20.5	
20,000	2.4	4.0	5.4	6.7	8.1	9.8	13.0	15.0	16.3	18.2	18.7	
40,000	1.7	3.0	4.2	5.5	6.8	8.2	10.7	12.7	13.9	16.1	16.8	
60,000	1.2	2.5	3.6	4.8	6.0	7.2	9.3	11.3	12.5	14.9	15.5	

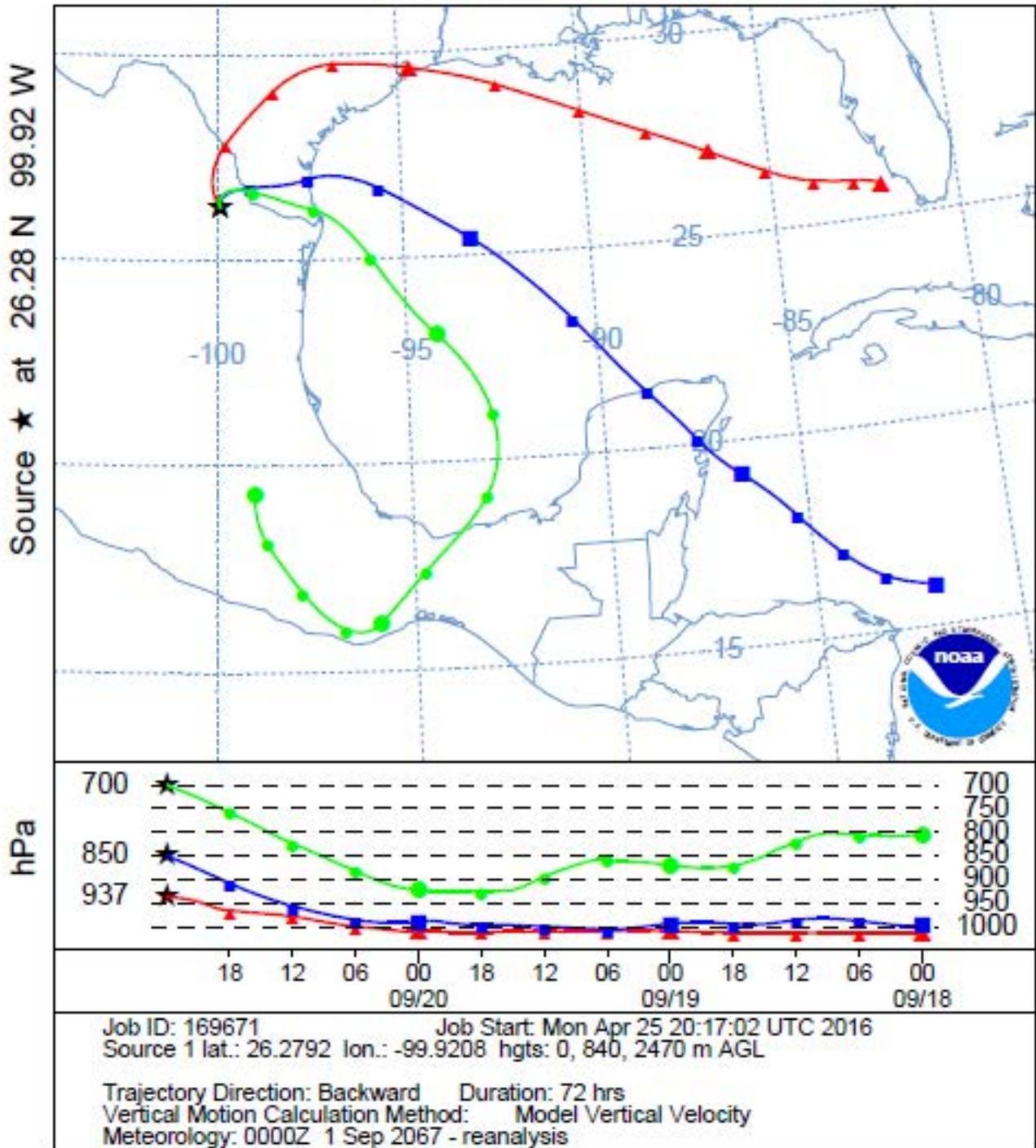
**STORM STUDIES - ISOHYETAL MAP**  
 Storm of SEPTEMBER 19-24, 1967 Assignment SW 3-24  
 Study Prepared by: Southwestern Division  
Fort Worth District



**MASS RAINFALL CURVES**

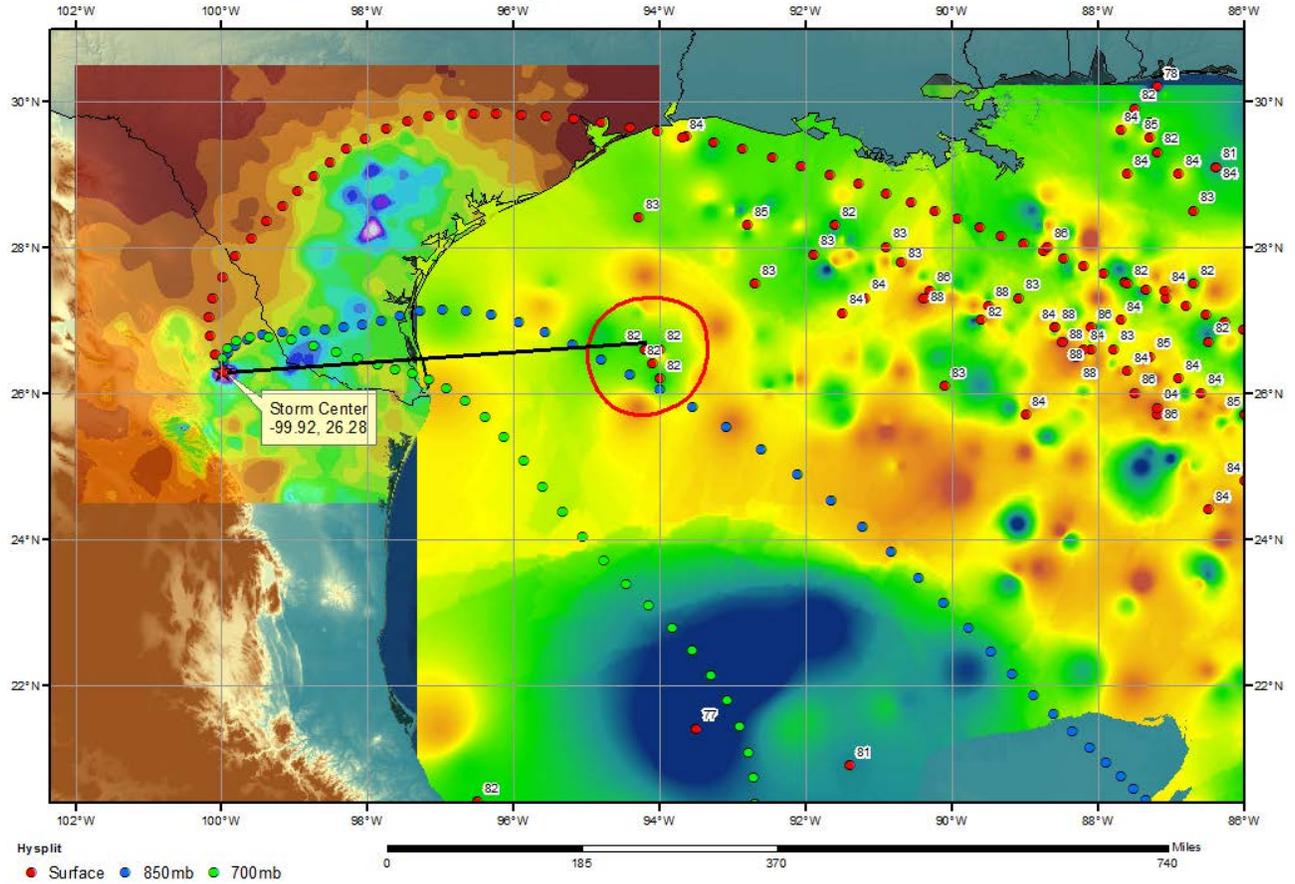


NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 21 Sep 67  
 CDC1 Meteorological Data



### SPAS 1601 Sombretillo, N.L., Mexico Storm Analysis Zone 1 (SW 3-24)

September 20, 1967



## Storm Precipitation Analysis System (SPAS) For Storm #1601\_2

**General Storm Location:** Nuevo León, Texas (30.5, -12.0, 24.5, -94.0)

**Storm Dates:** September 19 (0700 UTC) – 24 (0600 UTC), 1967 (144-hours)

**Event:** Hurricane Beulah (USACE SW 3-24)

### DAD Zone 2

**Latitude:** 28.2542

**Longitude:** -97.9042

**Max. Grid Rainfall Amount:** 35.01” Dinero 1 S, TX

**Max. Observed Rainfall Amount:** 34.00”

**Number of Stations:** 362

**SPAS Version:** 10.0

**Basemap:** Us\_ppt\_in\_map\_1961\_1990\_usda\_northamerica

**Radar Included:** No

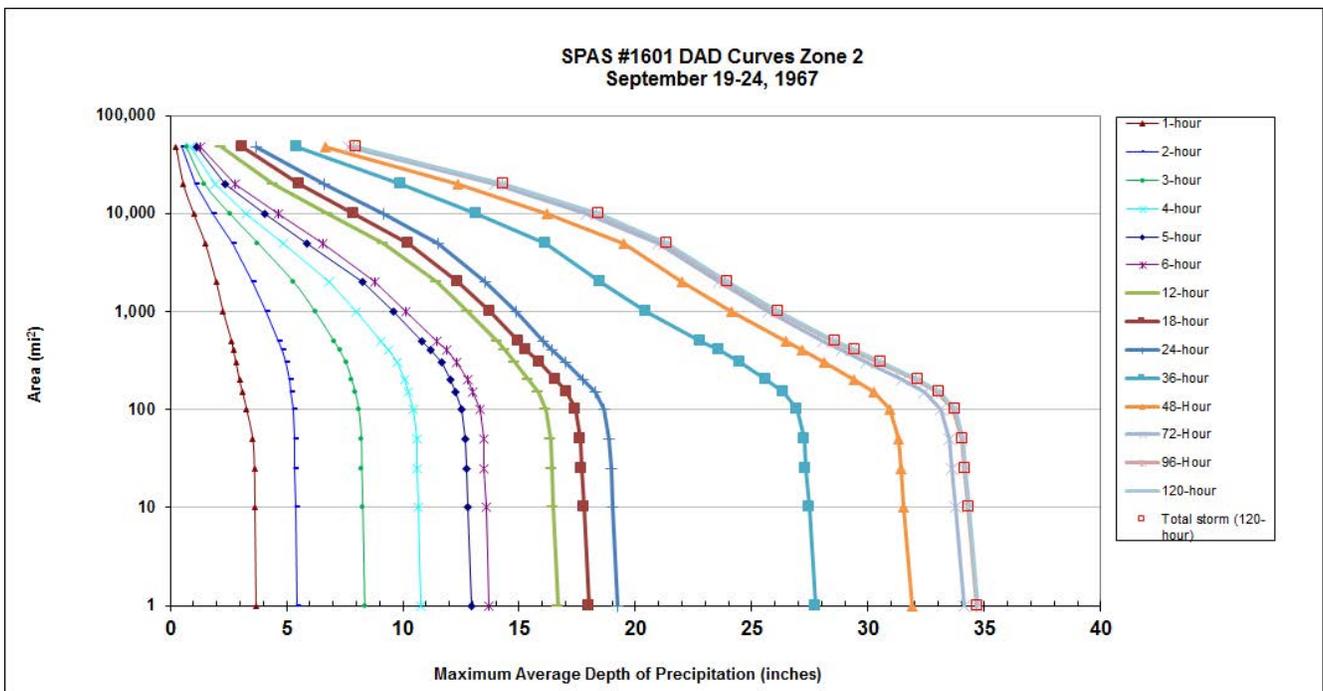
**Depth-Area-Duration (DAD) analysis:** Yes

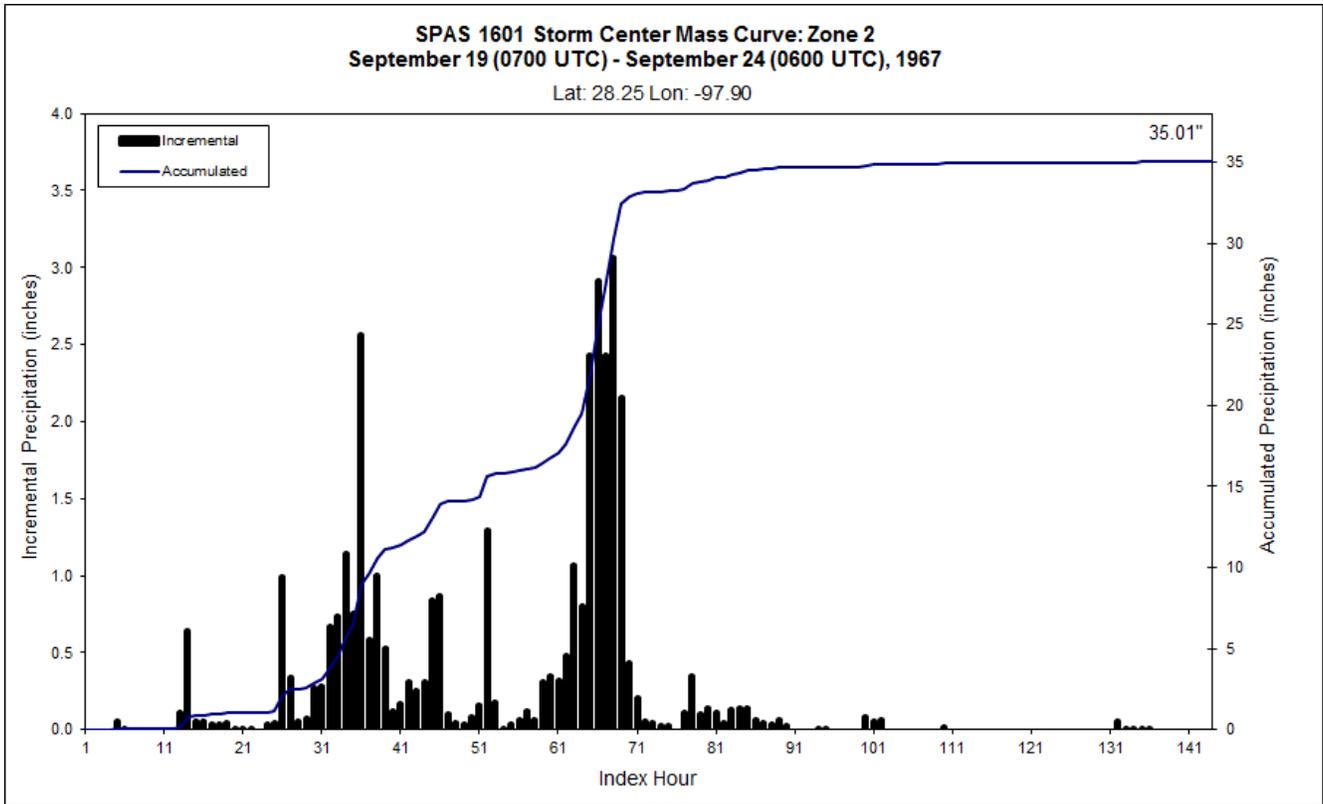
**Reliability of results:** This analysis was based on hourly data (H), hourly estimated pseudo data (HEP), hourly pseudo data (HP), daily data (D) and supplemental data (S). We have a high degree of confidence in the station based storm total results, the spatial pattern is dependent on basemap and the timing is based on hourly, hourly estimated pseudo and hourly pseudo stations.

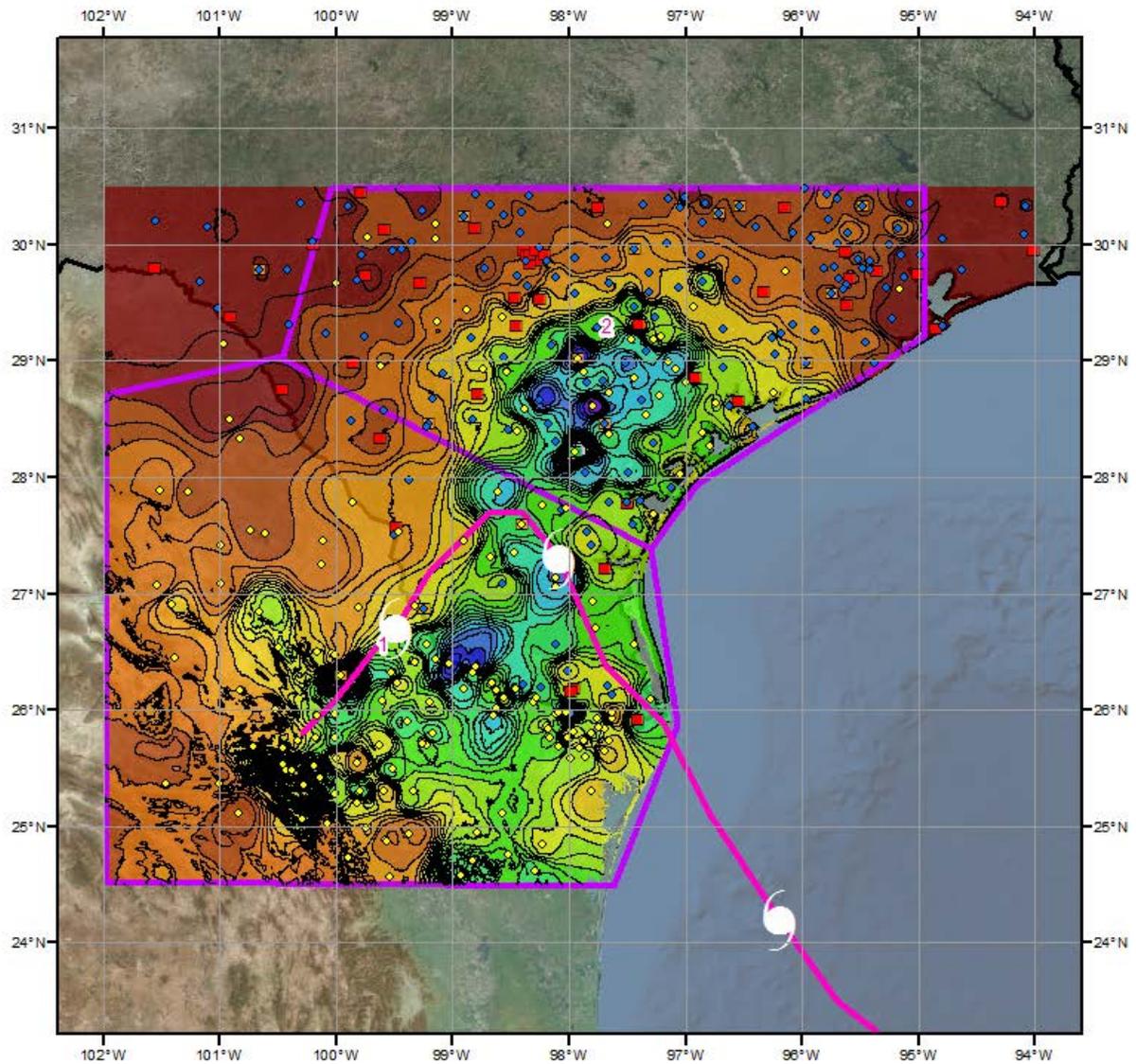
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1601_2	-97.904	28.254	217	200	82.00	3.95	0.06	86	3.890	86.00	86.0	4.67	0.07	94	4.600	1.183

**Storm 1601 Zone 2 - Sep. 19 (0700 UTC) - Sep. 24 (0600 UTC), 1967**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

areasqmi	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	3.71	5.49	8.40	10.83	12.98	13.78	16.74	18.06	19.33	27.88	32.01	34.25	34.80	35.01	35.01
1	3.69	5.46	8.36	10.78	12.93	13.72	16.66	17.98	19.25	27.76	31.88	34.10	34.65	34.72	34.72
10	3.64	5.40	8.28	10.67	12.78	13.57	16.48	17.79	19.03	27.45	31.53	33.73	34.28	34.34	34.34
25	3.62	5.37	8.24	10.63	12.73	13.51	16.41	17.71	18.95	27.33	31.40	33.58	34.13	34.19	34.19
50	3.55	5.35	8.22	10.59	12.68	13.46	16.36	17.65	18.88	27.24	31.30	33.47	34.02	34.07	34.07
100	3.29	5.30	8.11	10.45	12.54	13.31	16.16	17.44	18.67	26.95	30.93	33.11	33.65	33.76	33.76
150	3.11	5.20	7.95	10.25	12.28	13.03	15.80	17.05	18.25	26.35	30.25	32.40	32.95	33.07	33.07
200	2.98	5.12	7.81	10.08	12.05	12.77	15.38	16.58	17.75	25.63	29.40	31.46	32.03	32.17	32.17
300	2.83	4.96	7.56	9.75	11.65	12.32	14.79	15.88	16.98	24.50	28.10	29.93	30.42	30.56	30.56
400	2.72	4.79	7.29	9.39	11.22	11.87	14.38	15.31	16.40	23.59	27.18	28.87	29.31	29.44	29.44
500	2.64	4.63	7.04	9.08	10.85	11.47	14.06	14.98	16.06	22.81	26.45	28.07	28.46	28.58	28.58
1,000	2.28	4.10	6.23	8.03	9.59	10.13	12.81	13.76	14.87	20.43	24.14	25.72	26.05	26.15	26.15
2,000	1.98	3.53	5.31	6.84	8.25	8.82	11.44	12.35	13.53	18.49	21.99	23.57	23.84	23.94	23.94
5,000	1.50	2.66	3.77	4.84	5.88	6.58	9.15	10.22	11.49	16.12	19.50	20.97	21.26	21.34	21.34
10,000	1.01	1.81	2.56	3.28	4.09	4.68	6.78	7.88	9.16	13.15	16.19	17.91	18.33	18.44	18.44
20,000	0.57	1.07	1.48	1.92	2.38	2.81	4.45	5.57	6.63	9.92	12.37	13.97	14.28	14.36	14.36
47,522	0.26	0.49	0.70	0.90	1.14	1.31	2.20	3.09	3.68	5.44	6.68	7.71	7.89	7.98	7.98



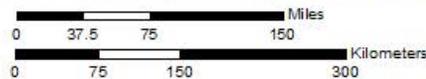




**Total Storm (144-hours) Precipitation (inches)**  
**September 19-24, 1967**  
**SPAS 1601 Sombreretillo, N.L., Mexico (SW 3-24)**

**Gauges**

- ◆ Daily
- Hourly
- Hourly Estimated Pseudo
- Hourly Pseudo
- ◆ Supplemental



**Precipitation (inches)**

■ 0.00 - 2.00	■ 8.01 - 10.00	■ 18.01 - 20.00	■ 28.01 - 30.00
■ 2.01 - 4.00	■ 10.01 - 12.00	■ 20.01 - 22.00	■ 30.01 - 32.00
■ 4.01 - 6.00	■ 12.01 - 14.00	■ 22.01 - 24.00	■ 32.01 - 34.00
■ 6.01 - 8.00	■ 14.01 - 16.00	■ 24.01 - 26.00	■ 34.01 - 36.00
■ 16.01 - 18.00	■ 26.01 - 28.00		



WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of September 19-24 1967  
 Assignment SW 3-24  
 Location Texas and Mexico  
 Study Prepared by:  
Southwestern Division  
Fort Worth District

Part I Reviewed by Hydromet.  
 Sec. of Weather Bureau, 2-26-69  
 Part II Approved by Office, Chief  
 of Engineers for distribution  
 of factual data, 2-3-70  
 Remarks \_\_\_\_\_

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary Isohyetal map, in 1 sheet scale 1:1,374,400

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	32
<del>Form 5001-B (Hourly precip. data).....</del> Form <u>SW 418-C</u> .....	7
Form 5001-D ( " " " " ).....	20
Misc. precip. records, meteorological data, etc.....	2
Form 5002 (Mass rainfall curves).....	68

**PART II**

Final isohyetal maps, in 1 sheet scale 1:1,000,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	7
Form S-11 (Depth-area data from isohyetal map).....	1
Form S-12 (Maximum depth-duration data).....	13
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	4

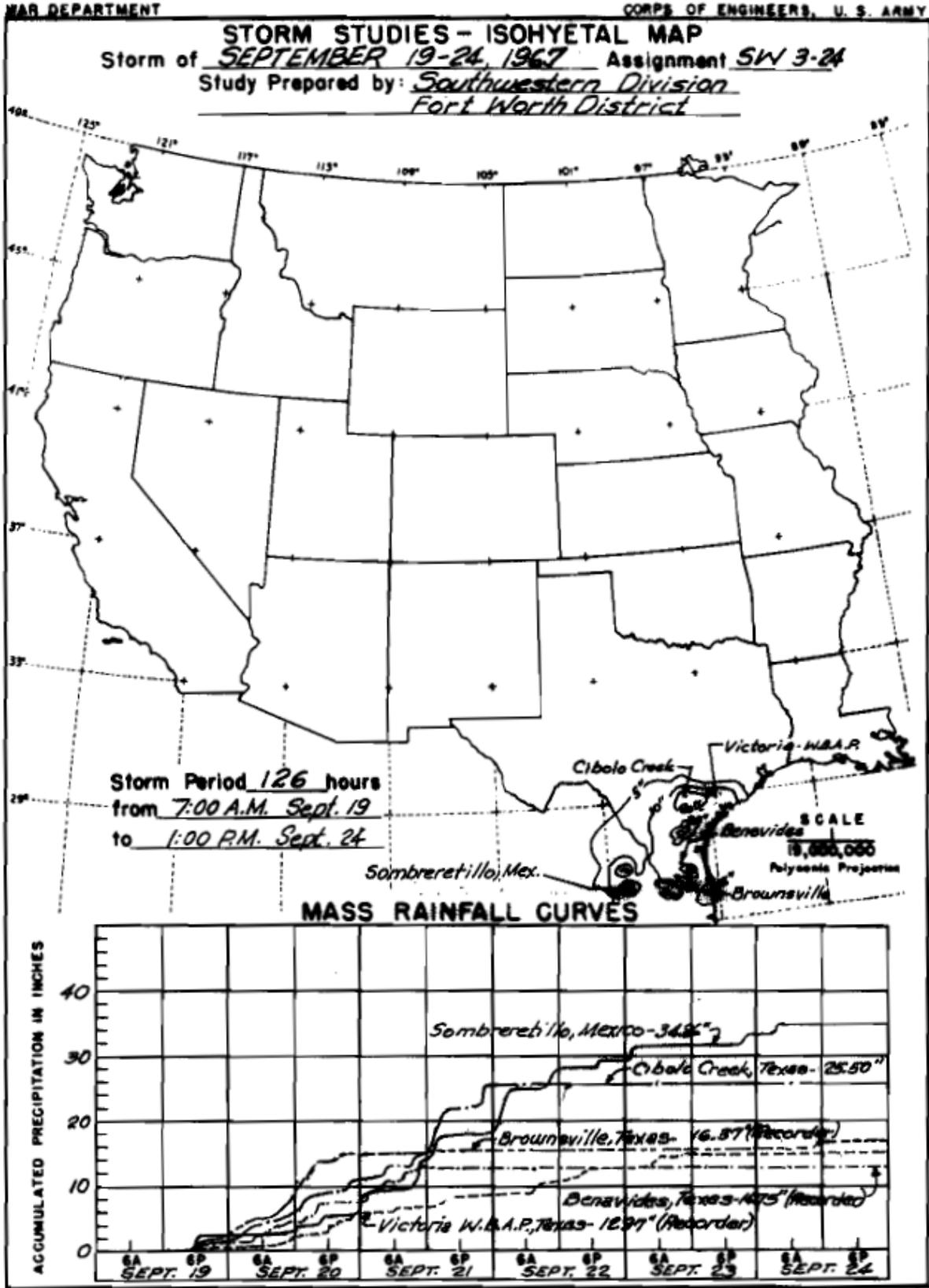
**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Miles	Duration of Rainfall in Hours										
	6	12	18	24	30	36	48	60	72	96	126
Station P 10	9.2	12.2	15.2	18.7	21.8	24.8	26.2	32.0	32.0	32.5	34.9
100	7.3	10.4	13.2	17.6	20.7	21.7	23.9	30.0	30.0	30.9	34.0
200	6.7	9.7	12.3	16.4	19.2	20.3	23.0	28.8	28.8	29.9	33.0
500	5.9	8.7	11.1	14.0	16.3	18.3	21.5	26.1	26.8	27.8	30.6
1,000	5.3	7.9	10.0	11.9	14.4	16.8	20.3	23.8	25.1	26.0	27.2
2,000	4.6	7.0	9.0	10.4	12.7	15.2	19.0	21.6	23.2	24.0	24.8
5,000	3.7	5.8	7.6	8.9	10.8	13.1	17.2	19.2	20.7	21.7	22.4
10,000	3.1	4.9	6.5	7.8	9.5	11.4	15.2	17.3	18.5	20.0	20.5
20,000	2.4	4.0	5.4	6.7	8.1	9.8	13.0	15.0	16.3	18.2	18.7
40,000	1.7	3.0	4.2	5.5	6.8	8.2	10.7	12.7	13.9	16.1	16.8
60,000	1.2	2.5	3.6	4.8	6.0	7.2	9.3	11.3	12.5	14.9	15.5

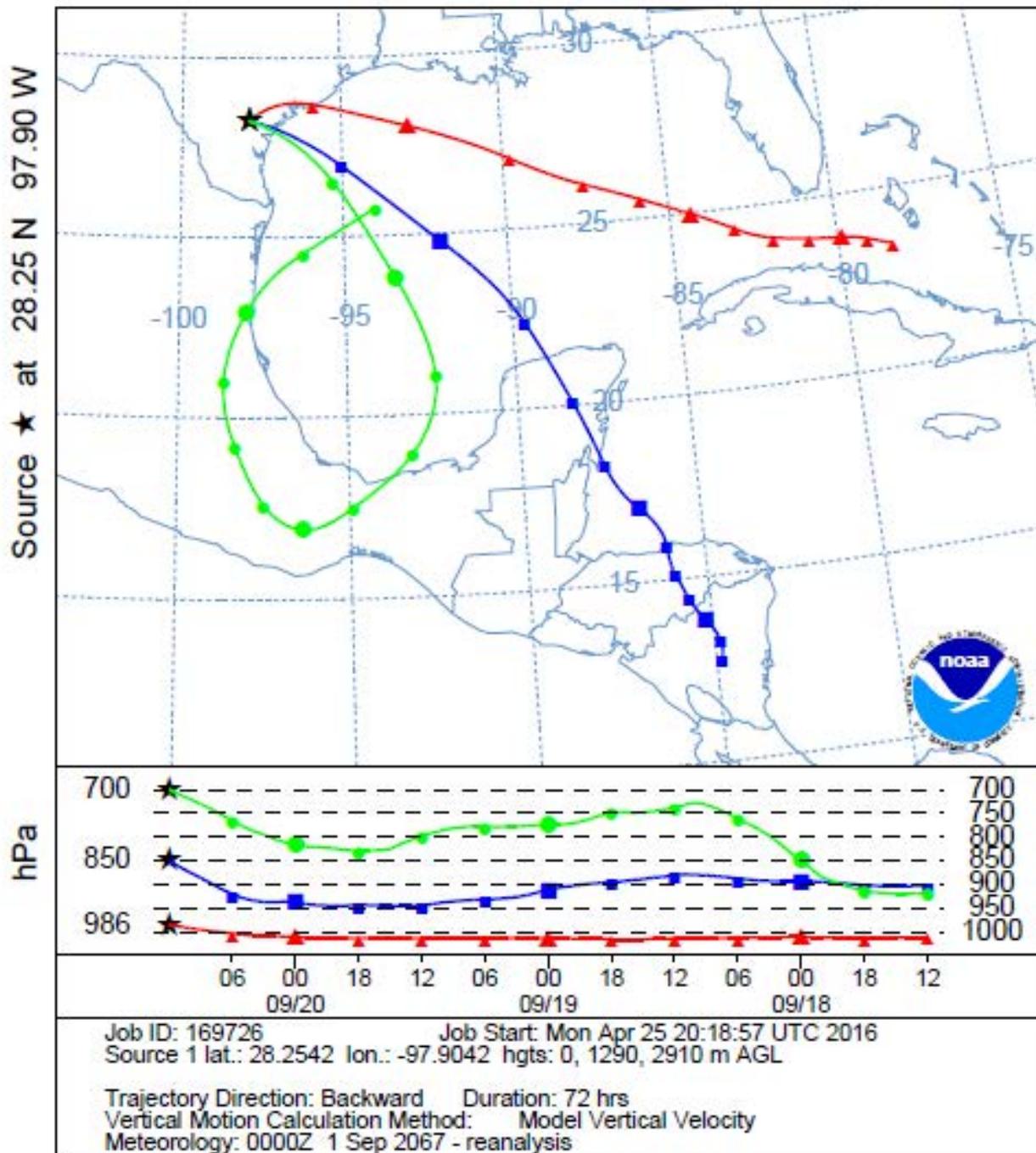
FORM 8-2

11-5888-100

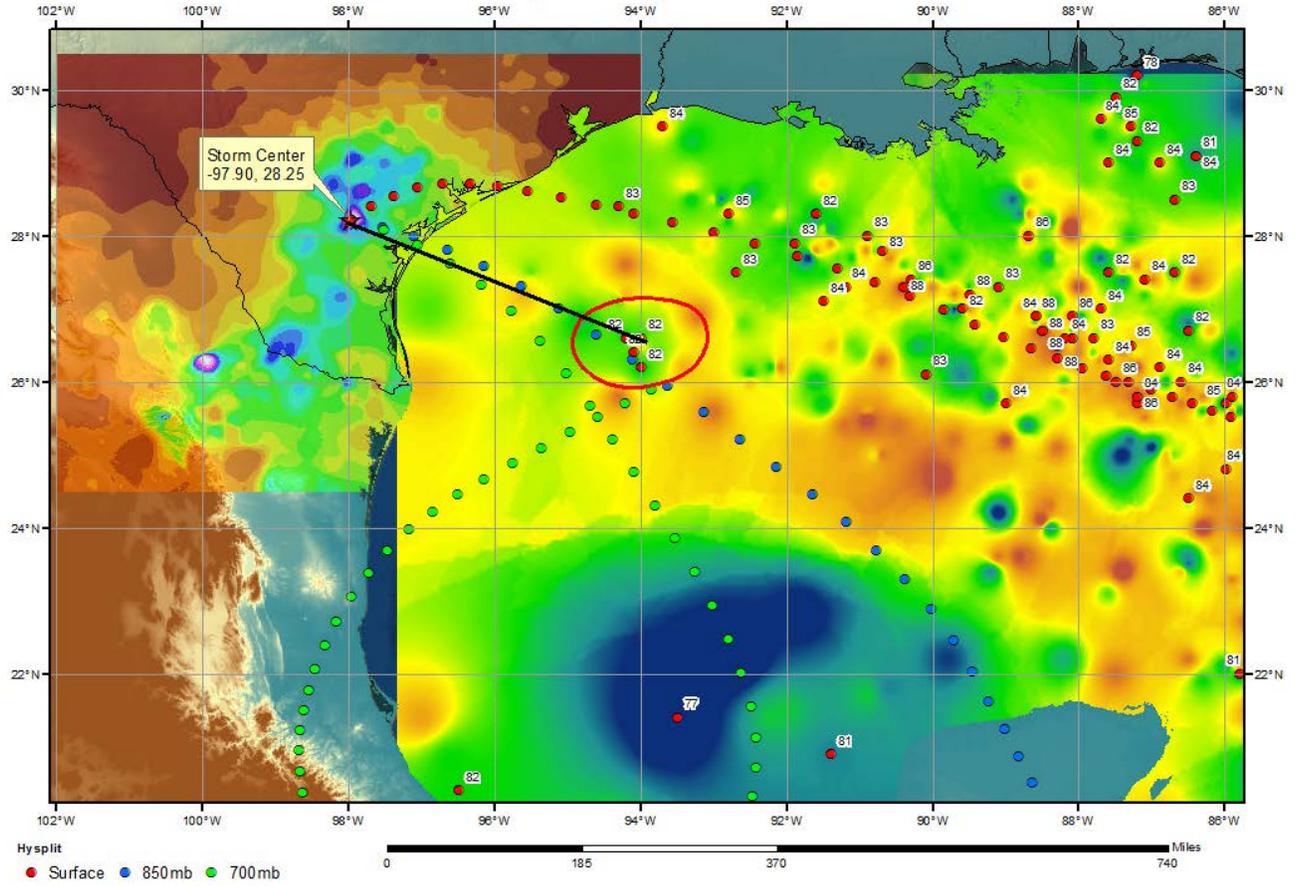
P. 34



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 20 Sep 67  
 CDC1 Meteorological Data



### SPAS 1601 Dinero, TX Storm Analysis Zone 2 (SW 3-24) September 20, 1967



## Storm Precipitation Analysis System (SPAS) For Storm #1179\_1

**General Storm Location:** Albany, Texas

**Storm Dates:** July 31 - August 6, 1978

**Event:** Tropical Storm Remnants

**DAD Zone 1**

**Latitude:** 32.7375

**Longitude:** -99.3292

**Max. Grid Rainfall Amount:** 32.51”

**Max. Observed Rainfall Amount:** 32.50” at 3W ALBANY TX

**Number of Stations:** 94 (35 Daily, 29 Hourly, 6 Hourly Pseudo, and 24 Supplemental)

**SPAS Version:** 8.5

**Base Map Used:** Yes, basemap was based off of isohyetal: SPAS\_1179\_total\_Storm\_Basemap

**Spatial resolution:** 00:00:30 (0.3 sq. miles)

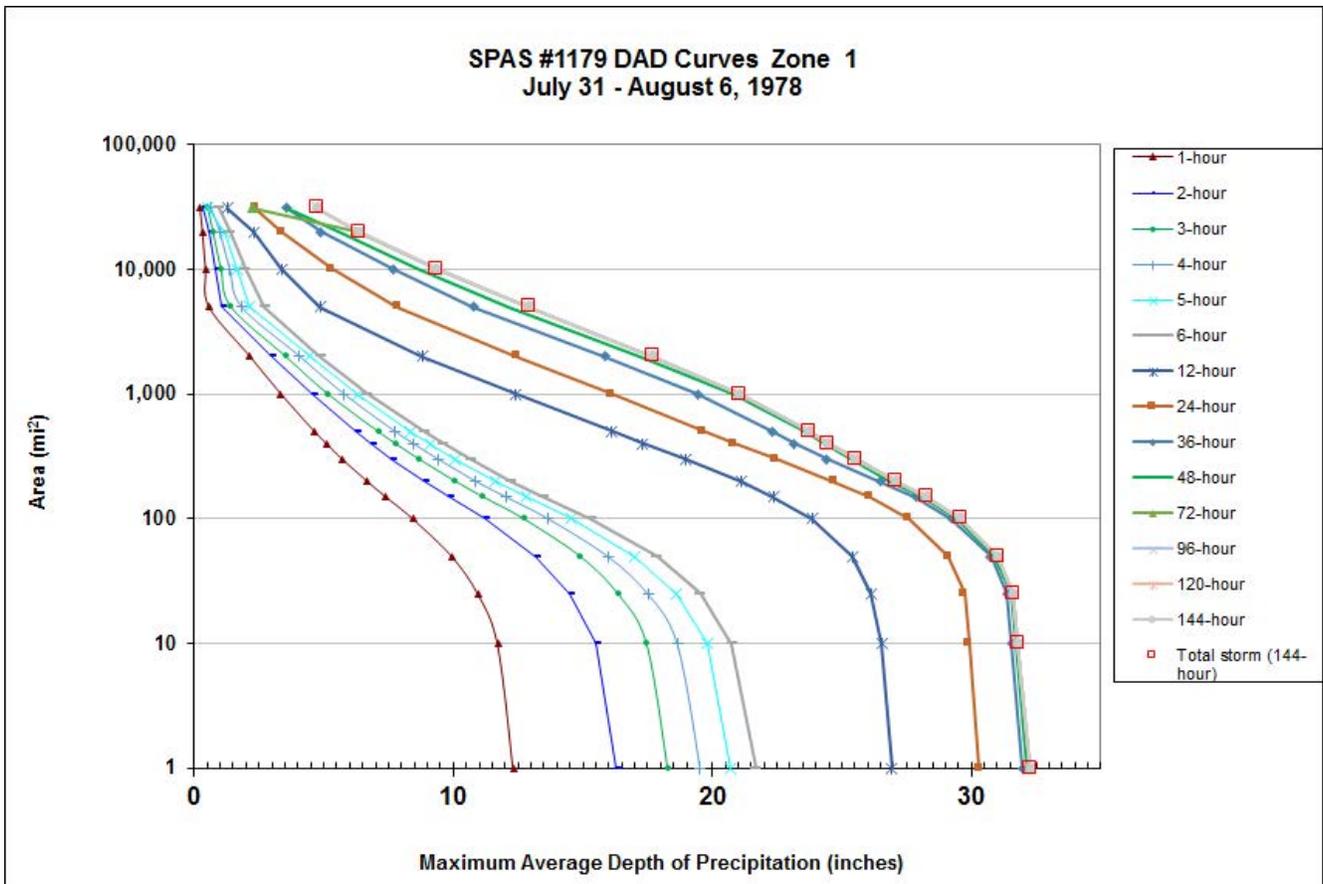
**Radar Included:** No

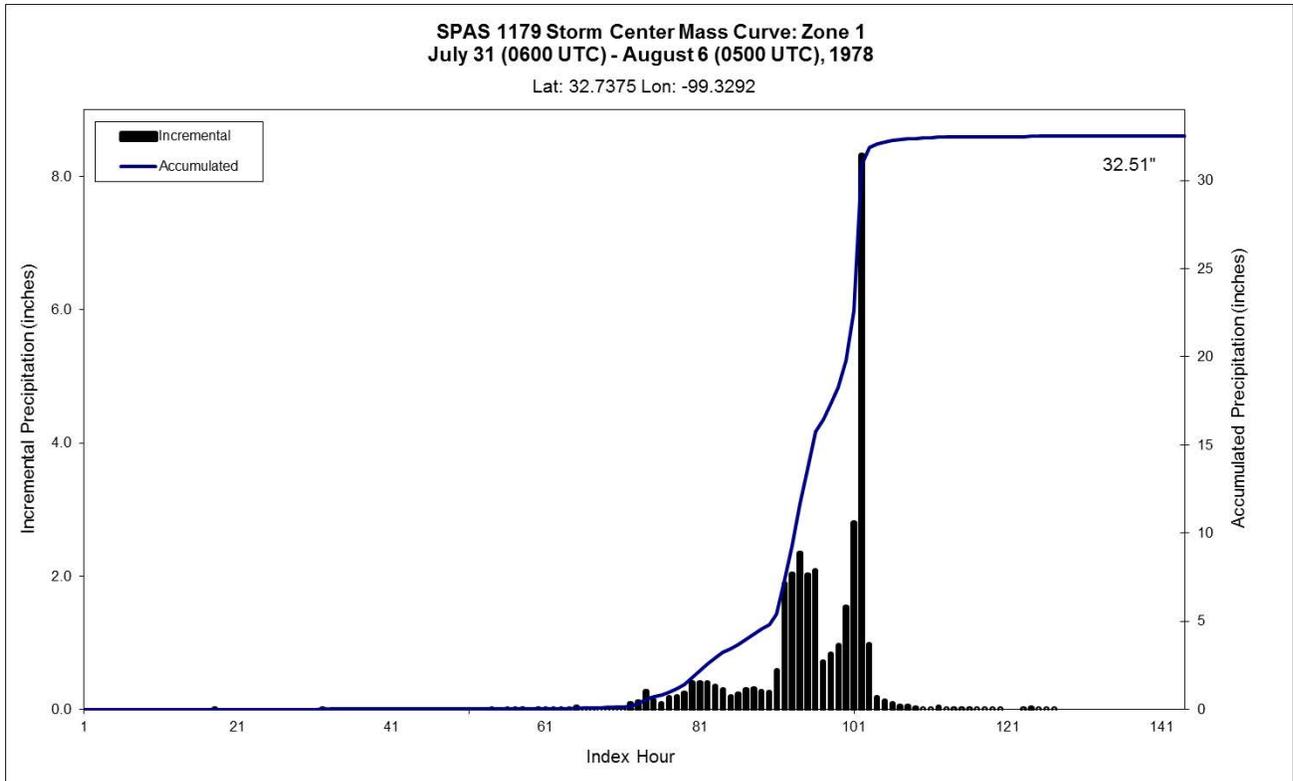
**Depth-Area-Duration (DAD) analysis:** Yes

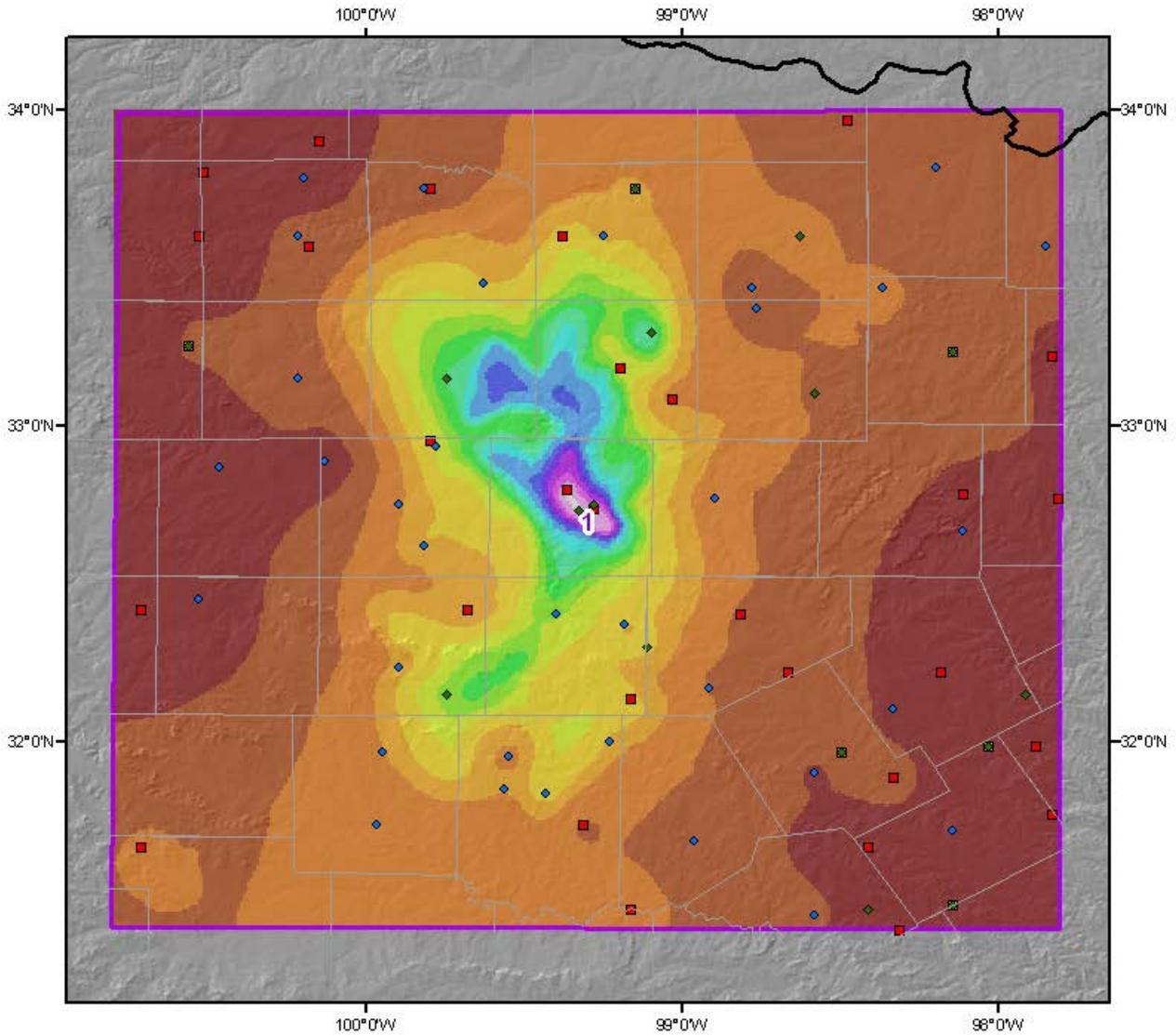
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1179_1	-99.350	32.726	1,500	1,500	78.00	3.29	0.41	78	2.880	80.80	81.0	3.77	0.45	84	3.320	1.153

**Storm 1179 - July 31 (0600 UTC) - August 6 (0500 UTC), 1978**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

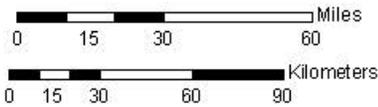
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	24	36	48	72	96	120	144	Total
0.4	12.43	16.42	18.46	19.70	20.87	21.86	27.09	30.47	32.15	32.33	32.43	32.44	32.44	32.44	32.44
1	12.32	16.29	18.29	19.53	20.68	21.66	26.93	30.31	31.98	32.15	32.25	32.25	32.26	32.26	32.26
10	11.72	15.50	17.48	18.65	19.80	20.75	26.53	29.90	31.55	31.71	31.79	31.80	31.80	31.80	31.80
25	10.96	14.52	16.38	17.51	18.59	19.51	26.12	29.74	31.38	31.53	31.62	31.62	31.62	31.62	31.62
50	9.95	13.20	14.92	15.96	16.99	17.84	25.41	29.11	30.74	30.91	31.01	31.02	31.02	31.02	31.02
100	8.44	11.23	12.74	13.66	14.57	15.32	23.85	27.57	29.23	29.44	29.56	29.57	29.57	29.57	29.57
150	7.40	9.86	11.17	12.02	12.81	13.49	22.37	26.10	27.84	28.12	28.28	28.28	28.29	28.29	28.29
200	6.68	8.90	10.10	10.87	11.61	12.25	21.12	24.69	26.49	26.90	27.10	27.10	27.11	27.11	27.11
300	5.72	7.65	8.71	9.42	10.09	10.65	18.95	22.44	24.41	25.35	25.56	25.51	25.52	25.52	25.52
400	5.11	6.84	7.79	8.46	9.09	9.61	17.32	20.85	23.17	24.31	24.51	24.45	24.45	24.45	24.45
500	4.65	6.27	7.12	7.76	8.36	8.85	16.12	19.64	22.29	23.53	23.73	23.71	23.72	23.72	23.72
1,000	3.35	4.56	5.18	5.78	6.29	6.69	12.42	16.11	19.43	20.78	21.03	21.05	21.05	21.05	21.05
2,000	2.15	2.95	3.54	4.07	4.47	4.86	8.80	12.46	15.84	17.22	17.67	17.69	17.70	17.70	17.70
5,000	0.56	1.06	1.43	1.82	2.15	2.71	4.87	7.84	10.77	12.14	12.88	12.90	12.91	12.91	12.91
10,000	0.43	0.82	1.05	1.37	1.67	1.97	3.36	5.32	7.67	8.59	9.31	9.35	9.37	9.37	9.37
20,000	0.31	0.60	0.74	0.98	1.17	1.36	2.31	3.37	4.89	5.57	6.26	6.33	6.35	6.35	6.35
31,010	0.22	0.31	0.54	0.64	0.49	0.95	1.27	2.35	3.57	3.62	4.74	4.74	4.75	4.75	4.75





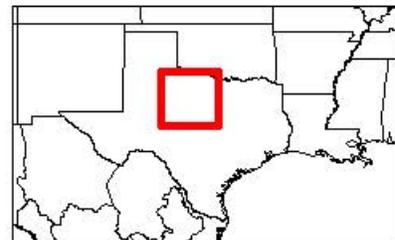


**Total Precipitation (144-hours)**  
**SPAS storm number: 1179**  
**July 31, 1978 (0600 UTC) - August 6, 1978 (0500 UTC)**



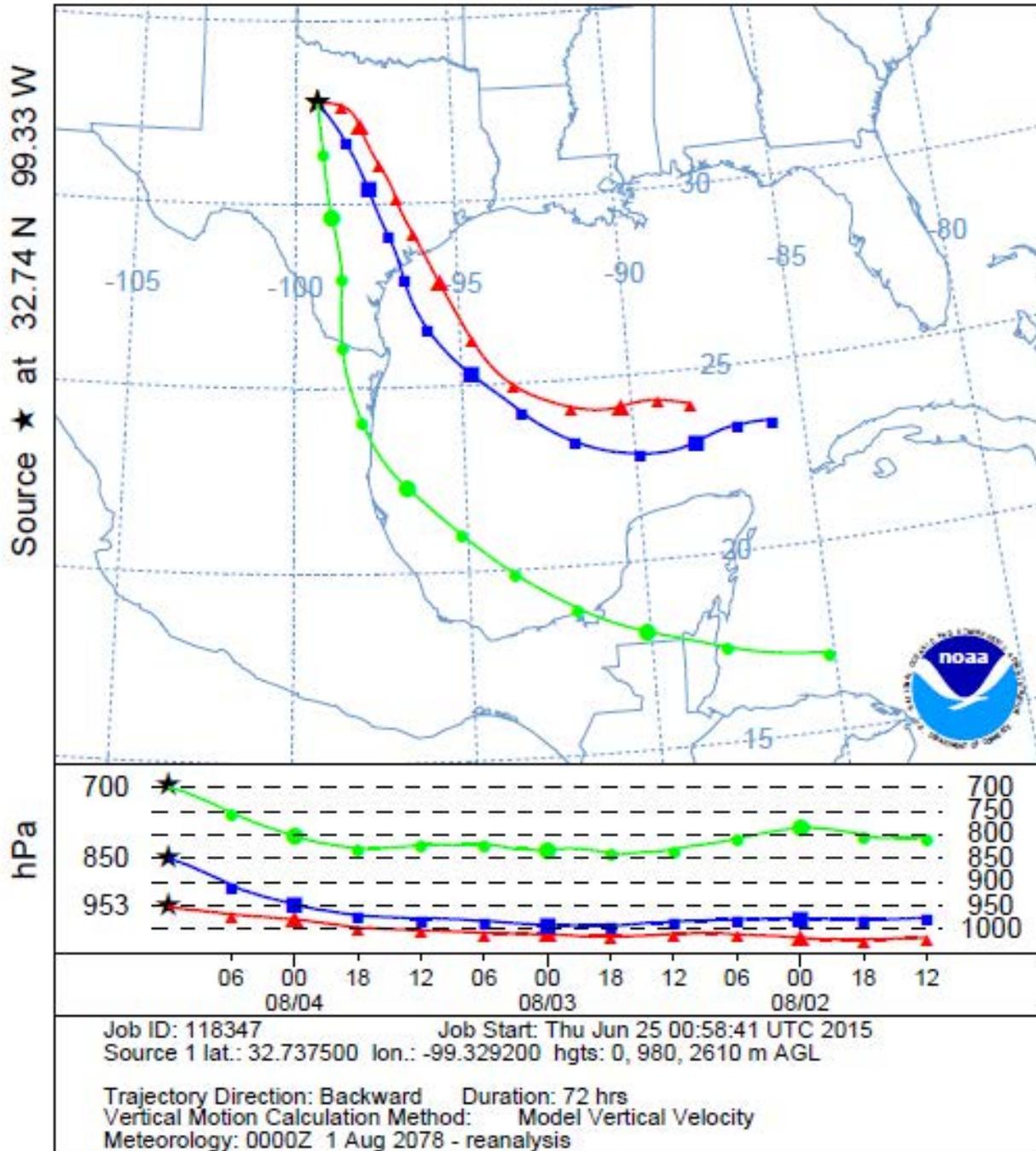
**Precipitation (inches)**

0.05 - 2.00	12.01 - 14.00	24.01 - 26.00	Daily
2.01 - 4.00	14.01 - 16.00	26.01 - 28.00	Hourly
4.01 - 6.00	16.01 - 18.00	28.01 - 30.00	Hourly Pseudo
6.01 - 8.00	18.01 - 20.00	30.01 - 32.00	Supplemental
8.01 - 10.00	20.01 - 22.00	32.01 - 34.00	
10.01 - 12.00	22.01 - 24.00		

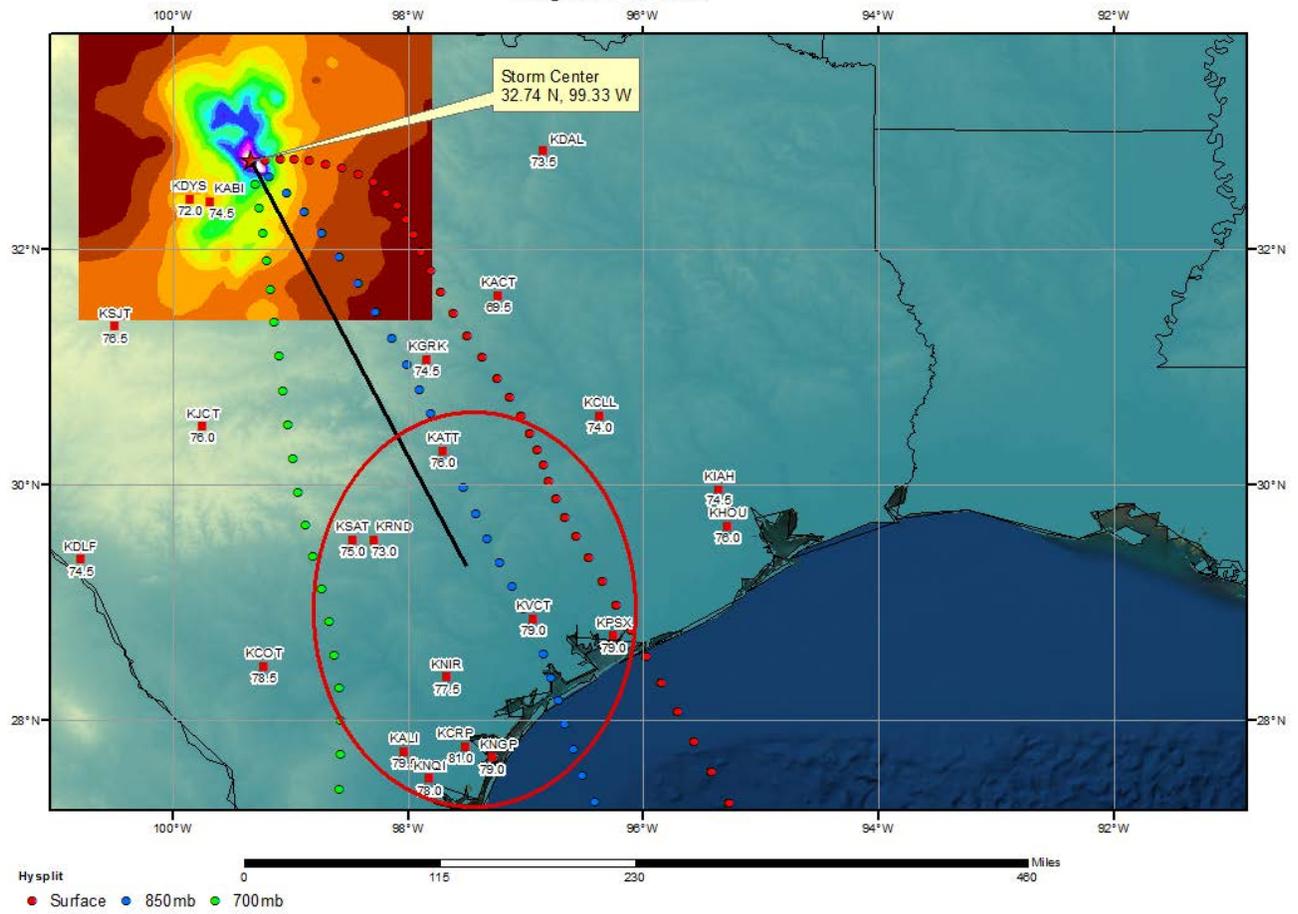


MesaZANA May 18, 2010

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 04 Aug 78  
 CDC1 Meteorological Data



### SPAS 1179 Albany, TX Storm Analysis August 1-4, 1978



## Storm Precipitation Analysis System (SPAS) For Storm #1463\_1

**General Storm Location:** Alvin, TX (Tropical Storm Claudette)

**Storm Dates:** July 23-27, 1979

**Event:** Tropical Storm Claudette

### DAD Zone 1

**Latitude:** 29.4292

**Longitude:** -95.2708

**Max. Grid Rainfall Amount:** 45.49"

**Max. Observed Rainfall Amount:** 45.00"

**Number of Stations:** 560 (299 Daily, 80 Hourly, 18 Hourly Pseudo, and 163 Supplemental)

**SPAS Version:** 10.0

**Basemap:** Blended NWS total storm map and PRISM July 1971-2000 Precipitation Climatology

**Spatial resolution:** 0:00:30 second (~ 0.3 mi<sup>2</sup>)

**Radar Included:** No

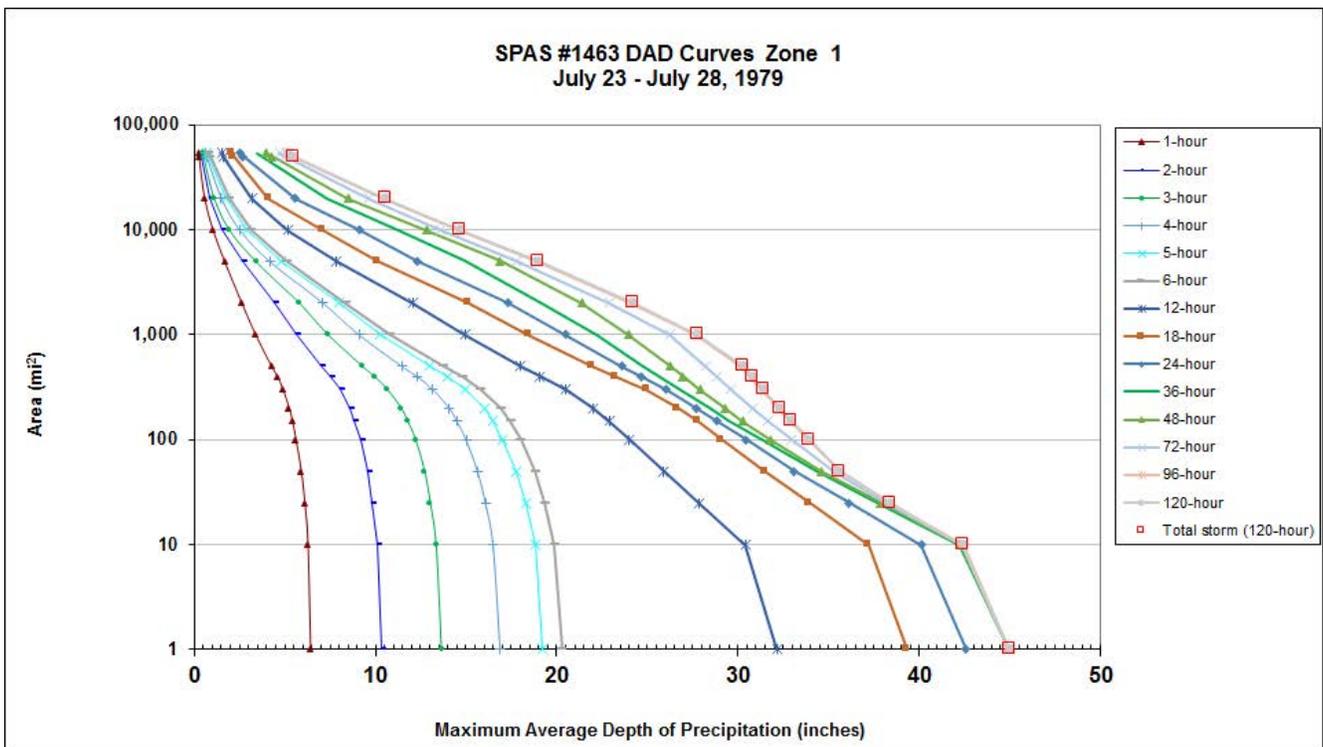
**Depth-Area-Duration (DAD) analysis:** Yes

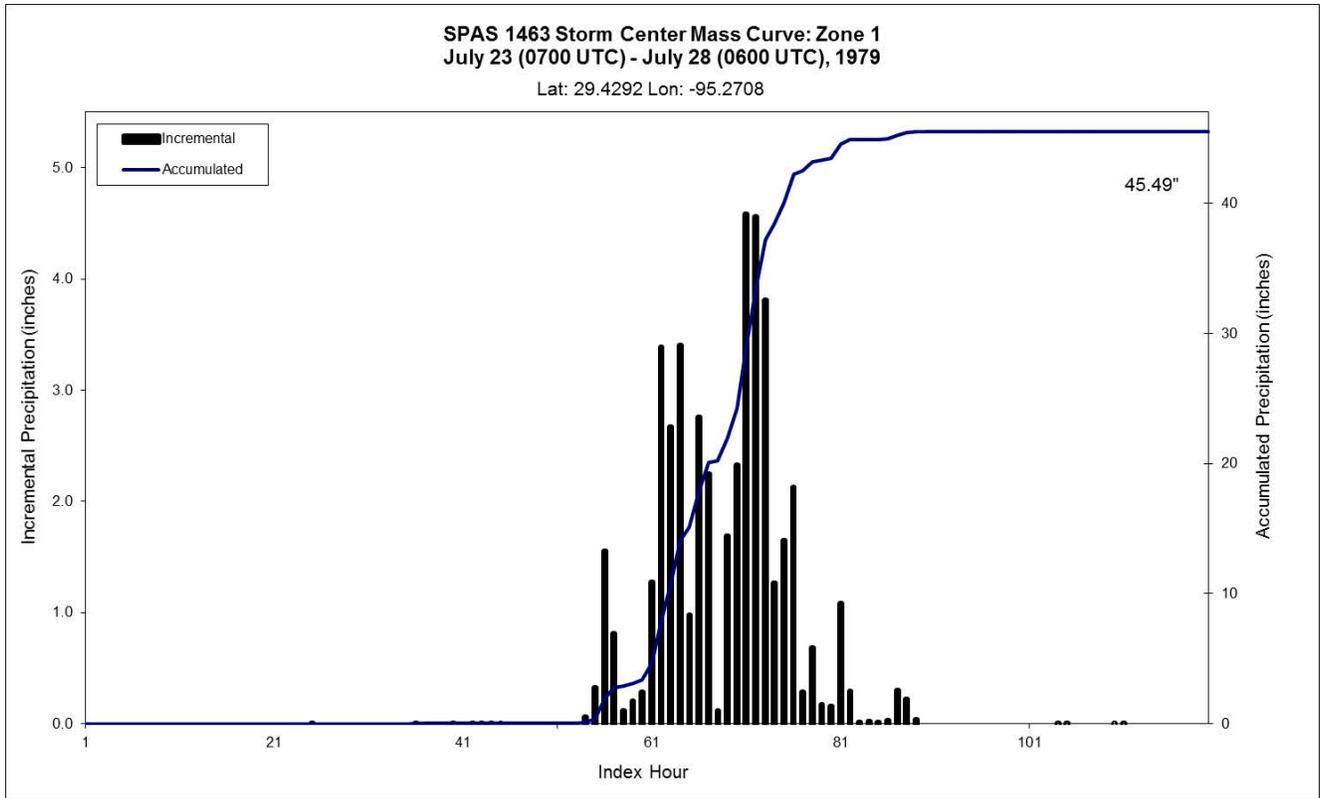
**Reliability of results:** This analysis was based on hourly data, daily data, supplemental station data and bucket survey data. Hourly station FM528 Clear Creek near Friendswood was digitized from the NWS report. Bucket survey rainfall timing and magnitude at the storm center (Alvin, TX) were diligently recorded and utilized in the SPAS storm analysis. We have a good degree of confidence in the station based storm total results, the spatial pattern is dependent on the station data and the NWS basemap, the timing is based on hourly and hourly pseudo stations.

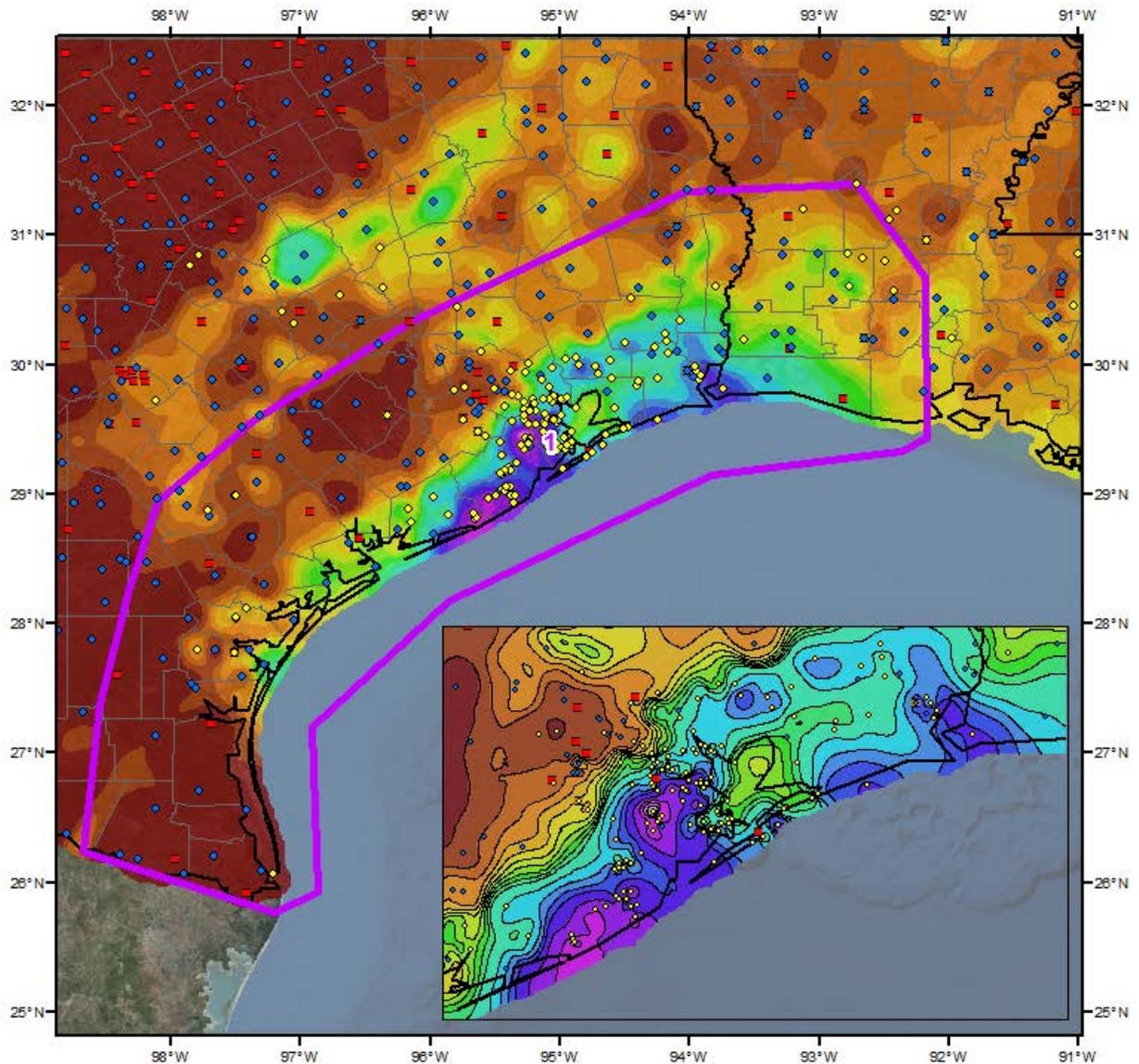
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1463_1	-95.271	29.429	62	100	85.00	4.48	0.04	92	4.440	86.40	86.5	4.77	0.04	95	4.730	1.065

**Storm 1463 - July 23 (0700 UTC) - July 28 (0600 UTC), 1979**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.4	6.44	10.43	13.75	17.03	19.39	20.46	32.42	39.67	42.95	45.33	45.33	45.34	45.35	45.35	45.35
1	6.39	10.35	13.64	16.89	19.23	20.30	32.15	39.34	42.58	44.95	44.95	44.95	44.97	44.97	44.97
10	6.25	10.11	13.35	16.50	18.81	19.86	30.42	37.19	40.13	42.24	42.30	42.38	42.42	42.40	42.40
25	6.08	9.84	13.03	16.08	18.32	19.35	27.85	33.93	36.14	37.69	37.88	38.17	38.37	38.38	38.38
50	5.88	9.56	12.72	15.64	17.79	18.80	25.92	31.46	33.12	34.34	34.59	35.22	35.60	35.62	35.62
100	5.59	9.17	12.22	15.01	17.05	18.03	24.01	29.10	30.45	31.33	31.77	32.94	33.86	33.93	33.93
150	5.40	8.86	11.79	14.51	16.48	17.43	22.91	27.79	28.86	29.60	30.27	31.67	32.88	32.97	32.97
200	5.22	8.60	11.43	14.08	15.99	16.91	22.00	26.65	27.69	28.42	29.27	30.80	32.20	32.31	32.31
300	4.88	8.05	10.68	13.18	14.98	15.83	20.53	24.94	26.06	26.80	27.91	29.62	31.27	31.40	31.40
400	4.57	7.52	9.97	12.30	13.99	14.78	19.08	23.22	24.65	25.63	26.98	28.81	30.63	30.78	30.78
500	4.25	7.03	9.30	11.47	13.03	13.77	18.01	21.97	23.61	24.76	26.28	28.21	30.14	30.30	30.30
1,000	3.37	5.62	7.40	9.09	10.27	10.82	14.96	18.42	20.50	22.23	23.97	26.23	27.64	27.78	27.78
2,000	2.61	4.44	5.81	7.11	7.96	8.36	12.06	15.12	17.35	19.17	21.38	22.91	24.09	24.22	24.22
5,000	1.66	2.67	3.41	4.16	4.82	5.08	7.81	10.10	12.28	14.96	16.88	17.75	18.83	18.95	18.95
10,000	1.02	1.51	1.95	2.50	2.93	3.17	5.17	7.08	9.13	11.27	12.81	13.63	14.60	14.68	14.68
20,000	0.56	0.85	1.12	1.50	1.78	1.95	3.19	4.11	5.57	7.37	8.49	9.65	10.48	10.54	10.54
50,000	0.25	0.40	0.53	0.68	0.79	0.88	1.60	2.15	2.69	3.74	4.30	4.99	5.40	5.45	5.45
53,986	0.24	0.37	0.50	0.63	0.73	0.82	1.51	2.04	2.55	3.47	3.98	4.72	5.10	5.15	5.15







**Total Storm (120-hr) Precipitation (inches)**  
**07/23/1979 0700 UTC - 07/28/1979 0600 UTC**  
**SPAS- #1463**

**Gauges**

- ◆ Daily
- Hourly
- ◻ Hourly/Pseudo
- ◇ Supplemental



**Precipitation (inches)**

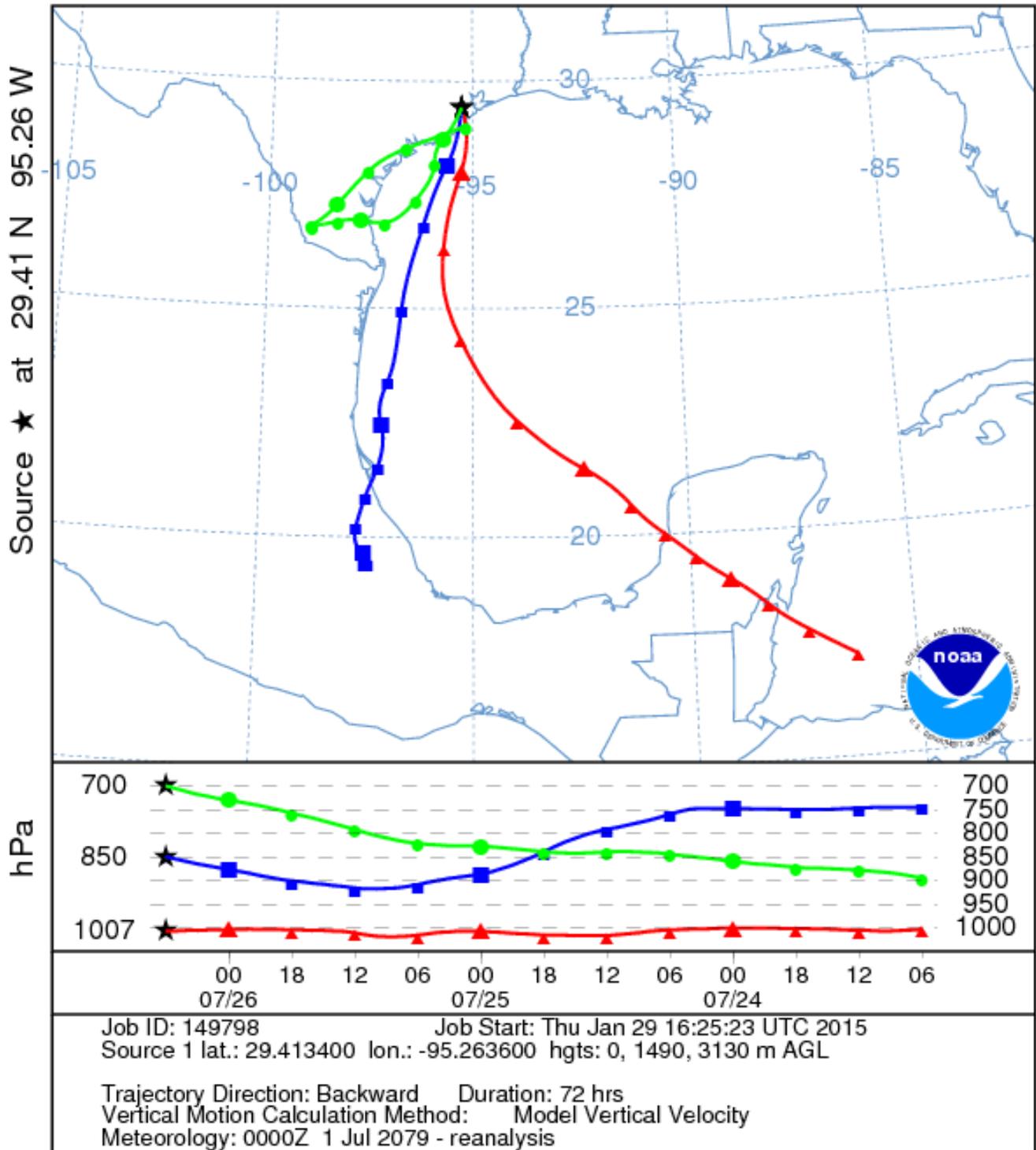
0.00 - 1.00	4.01 - 5.00	8.01 - 9.00	15.01 - 17.50	30.01 - 35.00
1.01 - 2.00	5.01 - 6.00	9.01 - 10.00	17.51 - 20.00	35.01 - 40.00
2.01 - 3.00	6.01 - 7.00	10.01 - 12.50	20.01 - 25.00	40.01 - 45.00
3.01 - 4.00	7.01 - 8.00	12.51 - 15.00	25.01 - 30.00	45.01 - 50.00



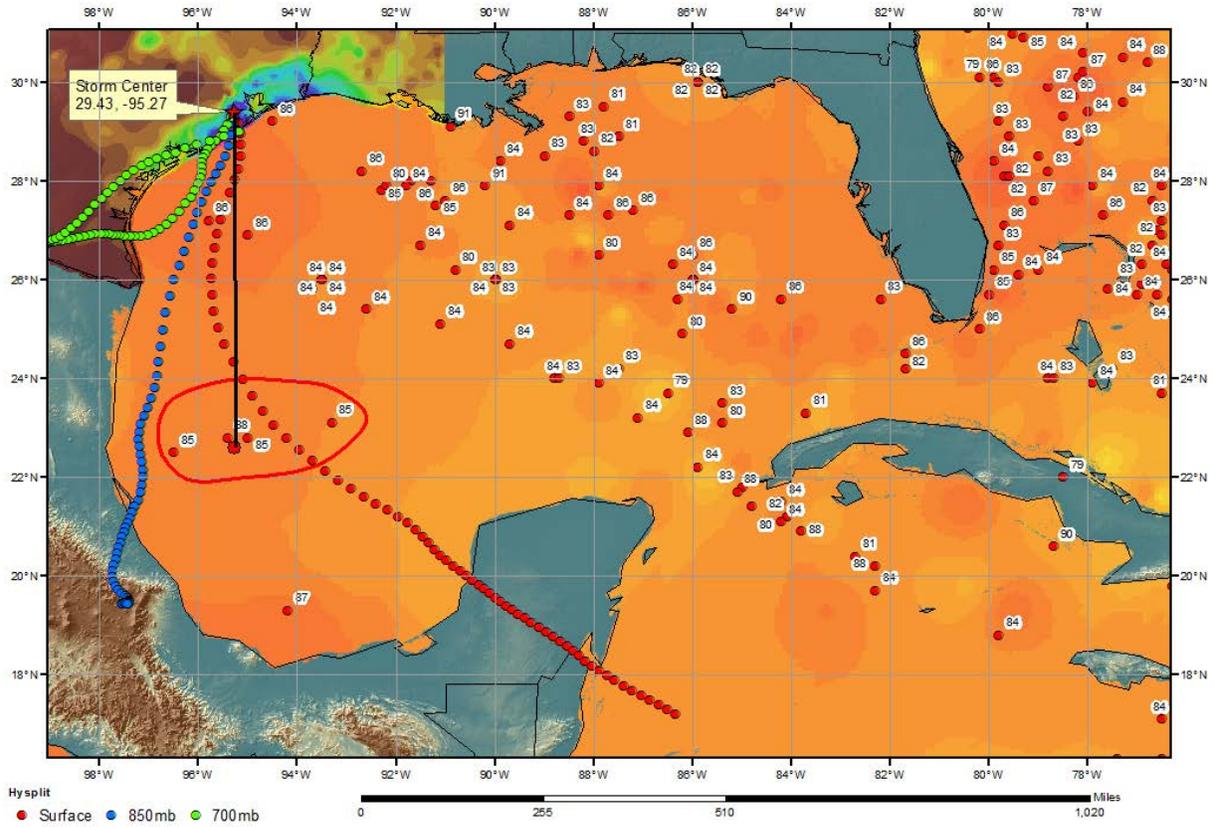
# NOAA HYSPLIT MODEL

## Backward trajectories ending at 0600 UTC 26 Jul 79

### CDC1 Meteorological Data



### SPAS 1463 Alvin, TX Storm Analysis July 24, 1979



## Storm Precipitation Analysis System (SPAS) For Storm #1184\_1

**General Storm Location:** North-central Texas and southeastern Oklahoma

**Storm Dates:** October 10 1400 UTC - October 14, 1981 1100 UTC (CPP: 93 hours)

**Event:** Synoptic + hurricane Norma remnants

### DAD Zone 1

**Latitude:** 32.479

**Longitude:** -99.479

**Max. Grid Rainfall Amount:** 23.00”

**Max. Observed Rainfall Amount:** 23.00”

**Number of Stations:** 500 (205 Daily, 93 Hourly, 1 Hourly Estimated, 25 Hourly Pseudo, and 170 Supplemental, 6 Supplemental estimated)

**SPAS Version:** 8.5

**Base Map Used:** Yes, conus\_prism\_ppt\_in\_1971\_2000\_10

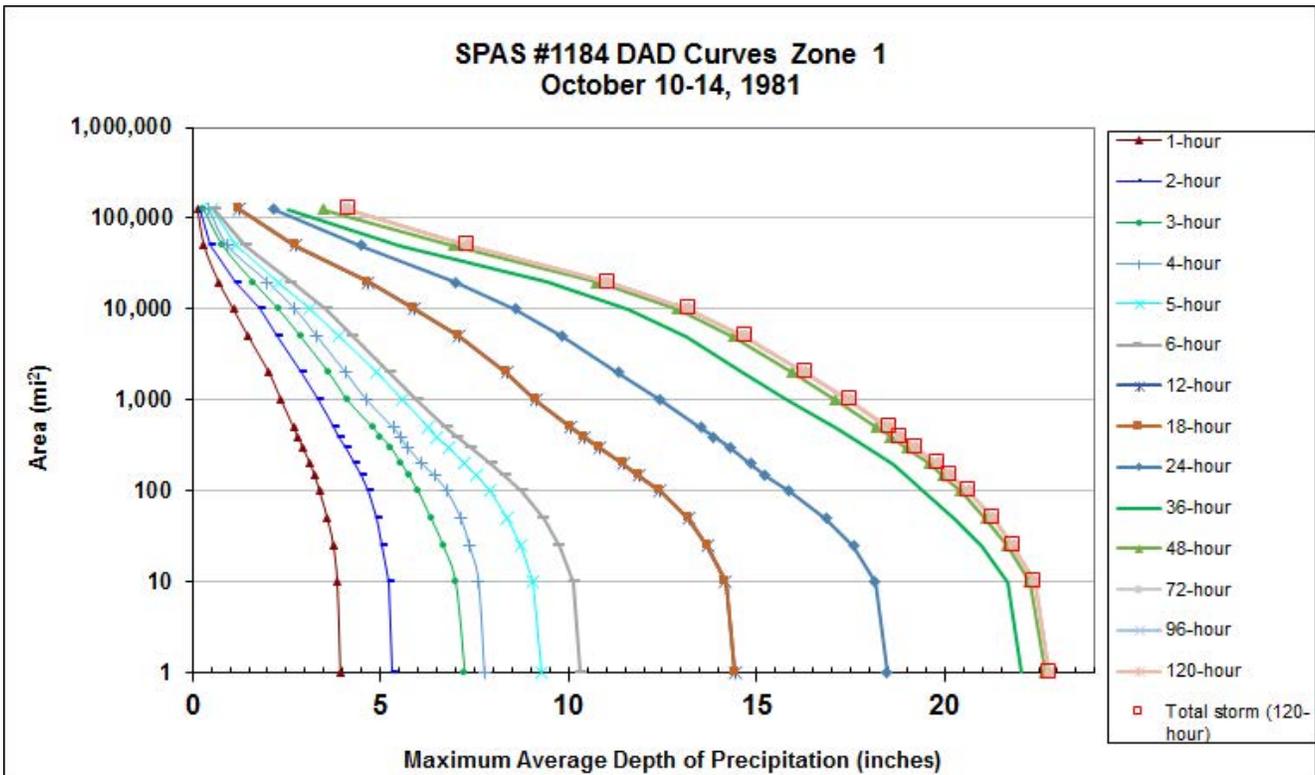
**Spatial resolution:** 00:00:30 decimal degrees

**Radar Included:** No

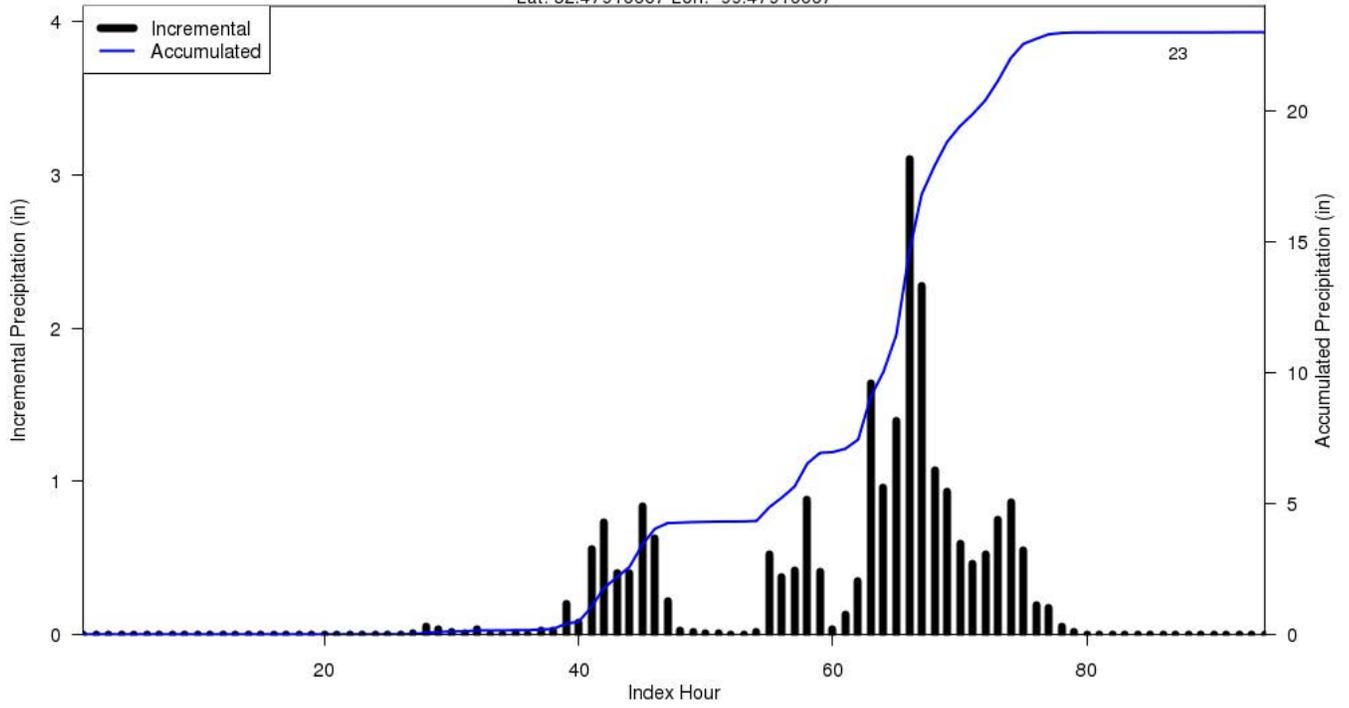
**Depth-Area-Duration (DAD) analysis:** Yes (1,2,3,4,5,6,12,24,36,48,72,93 hours)

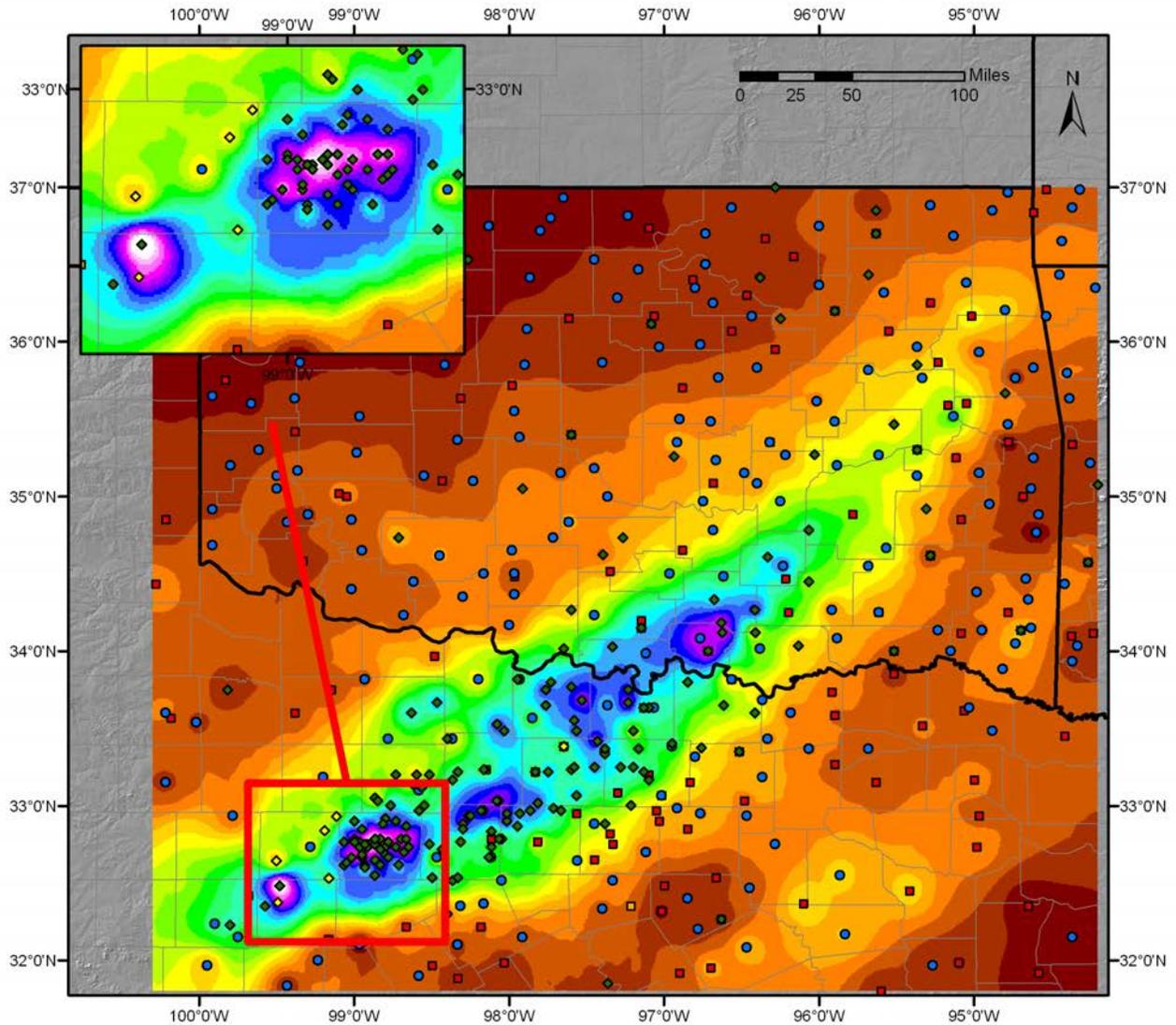
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1184_1	-99.479	32.479	2,000	2,000	76.00	2.99	0.50	74	2.490	77.70	77.5	3.22	0.53	77	2.690	1.080

Storm 1184 - October 10 (1400 UTC) - October 14 (1100 UTC), 1981															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	3.96	5.36	7.30	7.82	9.35	10.41	14.53	14.53	18.59	22.21	22.81	22.94	22.94	23.00	23.00
1	3.93	5.33	7.24	7.76	9.29	10.33	14.43	14.43	18.46	22.06	22.66	22.79	22.79	22.79	22.79
10	3.85	5.21	7.00	7.61	9.07	10.13	14.18	14.18	18.14	21.69	22.27	22.40	22.40	22.40	22.40
25	3.75	5.05	6.67	7.37	8.75	9.75	13.71	13.71	17.58	20.99	21.66	21.82	21.82	21.82	21.82
50	3.59	4.90	6.35	7.14	8.38	9.34	13.20	13.20	16.85	20.28	21.09	21.29	21.29	21.29	21.29
100	3.38	4.65	6.00	6.77	7.91	8.78	12.44	12.44	15.86	19.46	20.44	20.63	20.63	20.63	20.63
150	3.25	4.47	5.76	6.43	7.54	8.31	11.87	11.87	15.24	18.99	19.96	20.15	20.15	20.15	20.15
200	3.13	4.31	5.56	6.11	7.23	7.95	11.47	11.47	14.85	18.61	19.61	19.81	19.81	19.81	19.81
300	2.94	4.07	5.28	5.73	6.83	7.42	10.84	10.84	14.31	18.00	18.99	19.22	19.24	19.24	19.24
400	2.80	3.91	5.01	5.52	6.52	7.04	10.41	10.41	13.86	17.50	18.56	18.81	18.84	18.84	18.84
500	2.69	3.77	4.80	5.34	6.28	6.77	10.08	10.08	13.51	17.12	18.20	18.49	18.53	18.53	18.53
1,000	2.36	3.34	4.13	4.64	5.58	5.98	9.13	9.13	12.45	15.83	17.11	17.44	17.48	17.48	17.48
2,000	2.04	2.88	3.63	4.08	4.89	5.25	8.36	8.36	11.33	14.64	15.97	16.28	16.31	16.31	16.31
5,000	1.49	2.27	2.88	3.32	3.88	4.27	7.11	7.11	9.85	13.12	14.38	14.67	14.70	14.70	14.70
10,000	1.09	1.79	2.29	2.73	3.12	3.56	5.92	5.92	8.59	11.60	12.90	13.18	13.20	13.20	13.20
20,000	0.70	1.16	1.62	2.00	2.32	2.64	4.68	4.68	7.00	9.46	10.75	11.04	11.05	11.05	11.05
50,000	0.31	0.49	0.81	0.94	1.17	1.43	2.75	2.75	4.48	5.51	6.94	7.33	7.34	7.34	7.34
124,877	0.14	0.19	0.30	0.44	0.53	0.59	1.26	1.26	2.18	2.56	3.48	4.14	4.15	4.15	4.15



SPAS 1184 Storm Center Mass Curve Zone 1  
October 10 (1400UTC) to October 14 (1100UTC), 1981  
Lat: 32.47916667 Lon: -99.47916667

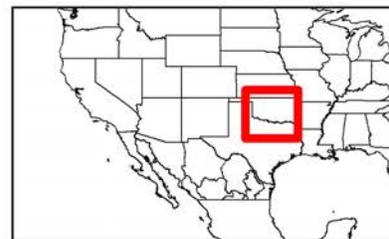




**Total Precipitation (inches)**  
**SPAS storm number: 1184 - Breckenridge, TX**  
**Lat/Lon box: 37.0 -100.3 31.8 -94.2**  
**October 10 1400 UTC - October 14, 1981 1100 UTC (CPP: 93 hours)**

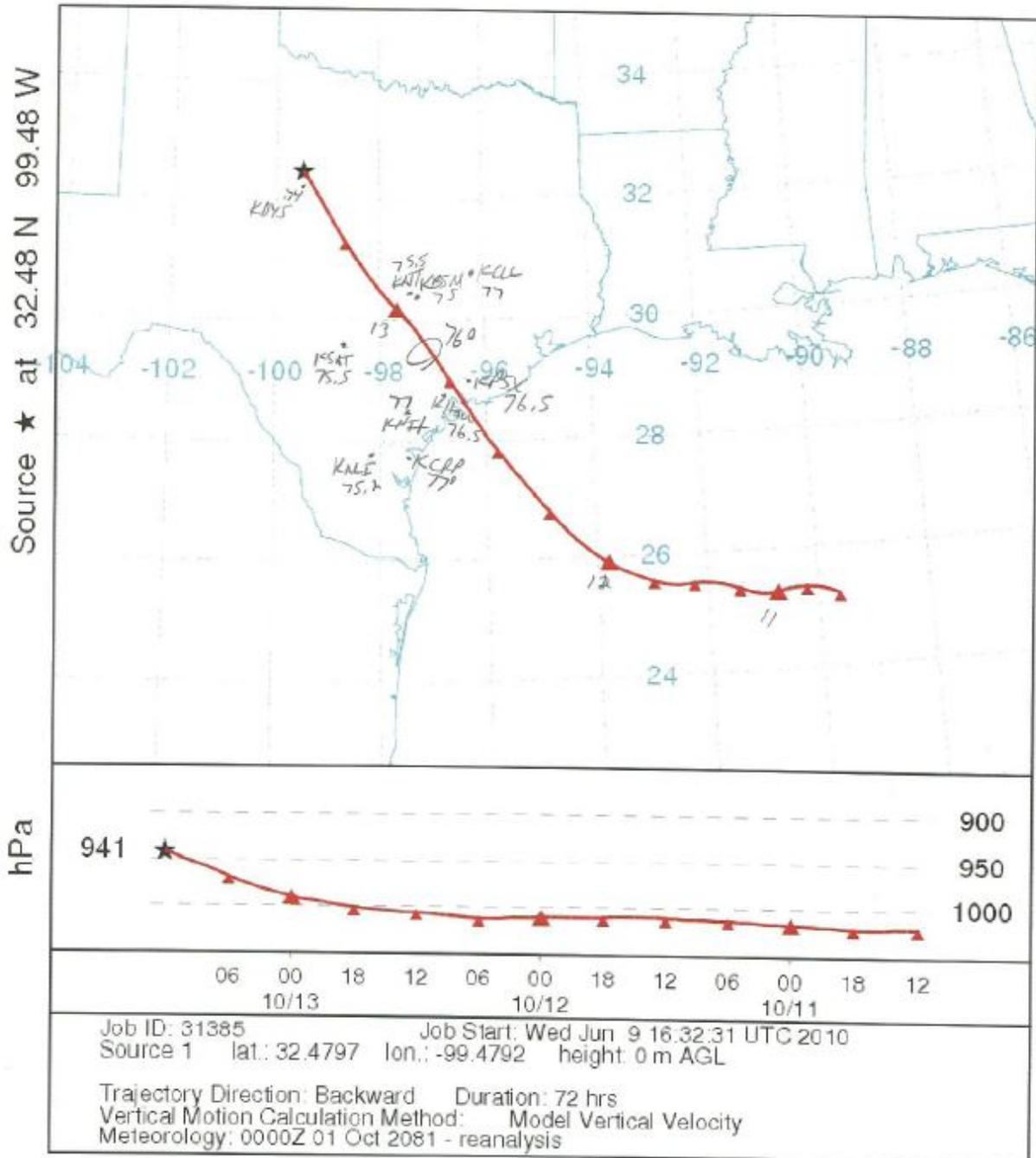
**Precipitation (inches)**

- |             |               |               |                           |
|-------------|---------------|---------------|---------------------------|
| 0.00 - 1.00 | 8.01 - 9.00   | 16.01 - 17.00 | ● Daily                   |
| 1.01 - 2.00 | 9.01 - 10.00  | 17.01 - 18.00 | ■ Hourly                  |
| 2.01 - 3.00 | 10.01 - 11.00 | 18.01 - 19.00 | ■ Hourly estimated pseudo |
| 3.01 - 4.00 | 11.01 - 12.00 | 19.01 - 20.00 | ■ Hourly pseudo           |
| 4.01 - 5.00 | 12.01 - 13.00 | 20.01 - 21.00 | ◆ Supplemental            |
| 5.01 - 6.00 | 13.01 - 14.00 | 21.01 - 22.00 | ◆ Supplemental estimated  |
| 6.01 - 7.00 | 14.01 - 15.00 |               |                           |
| 7.01 - 8.00 | 15.01 - 16.00 |               |                           |



Metstat/AWA May 13, 2010

NOAA HYSPLIT MODEL  
 Backward trajectory ending at 1200 UTC 13 Oct 81  
 CDC1 Meteorological Data



## Storm Precipitation Analysis System (SPAS) For Storm #1317\_1

**General Storm Location:** Americus, GA

**Storm Dates:** June 30-July 7, 1994

**Event:** Tropical Storm Alberto

### DAD Zone 1

**Latitude:** 32.0958

**Longitude:** -84.2292

**Max. Grid Rainfall Amount:** 28.09"

**Max. Observed Rainfall Amount:** 27.85"

**Number of Stations:** 272 stations (189 daily, 44 hourly, 13 hourly pseudo, and 26 supplemental)

**SPAS Version:** 9.5

**Base Map Used:** Digitized NWS Isohyetal Map (storm total Jun 30 - Jul 8, 1994)

**Spatial resolution:** 30 seconds

**Radar Included:** No

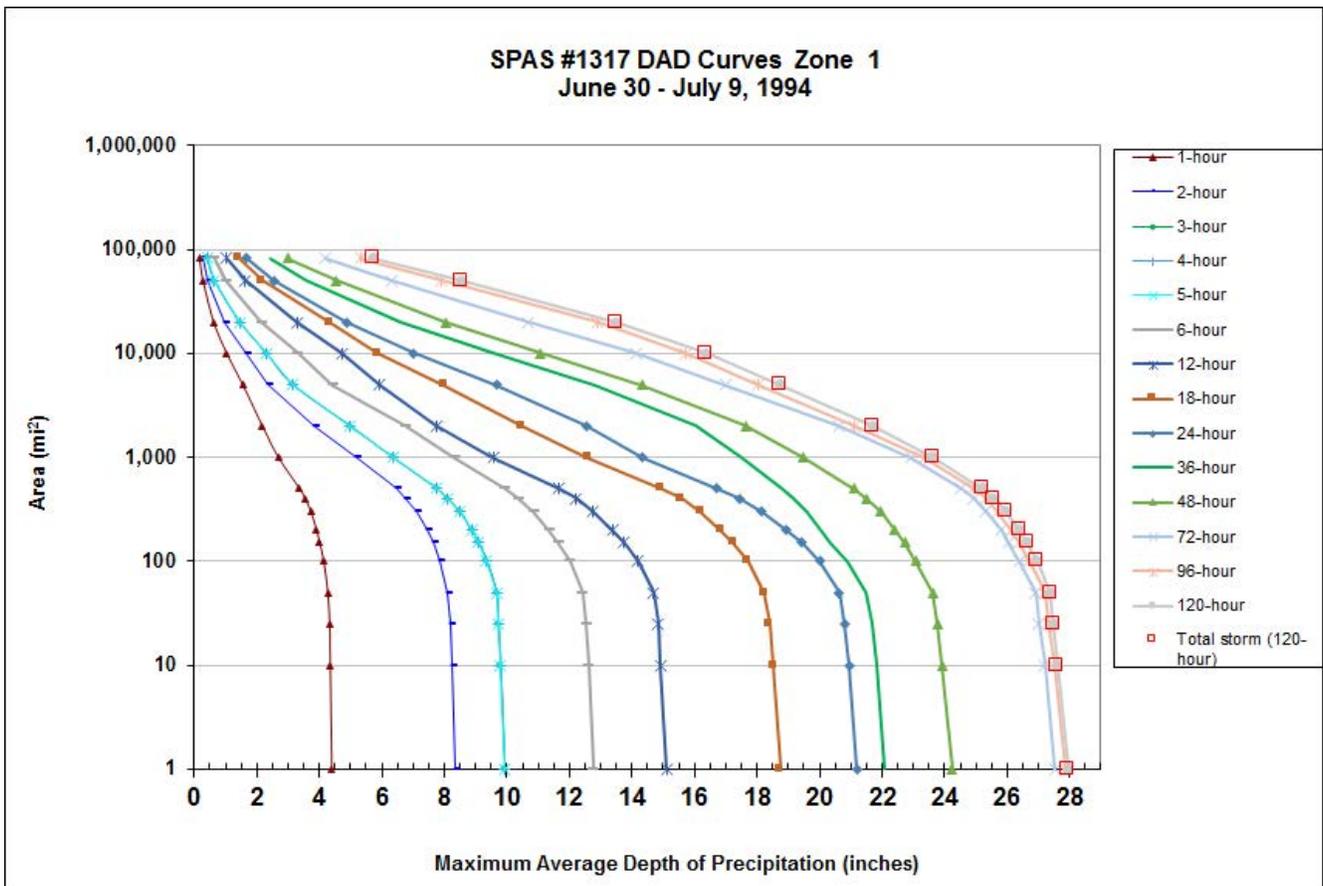
**Depth-Area-Duration (DAD) analysis:** Yes

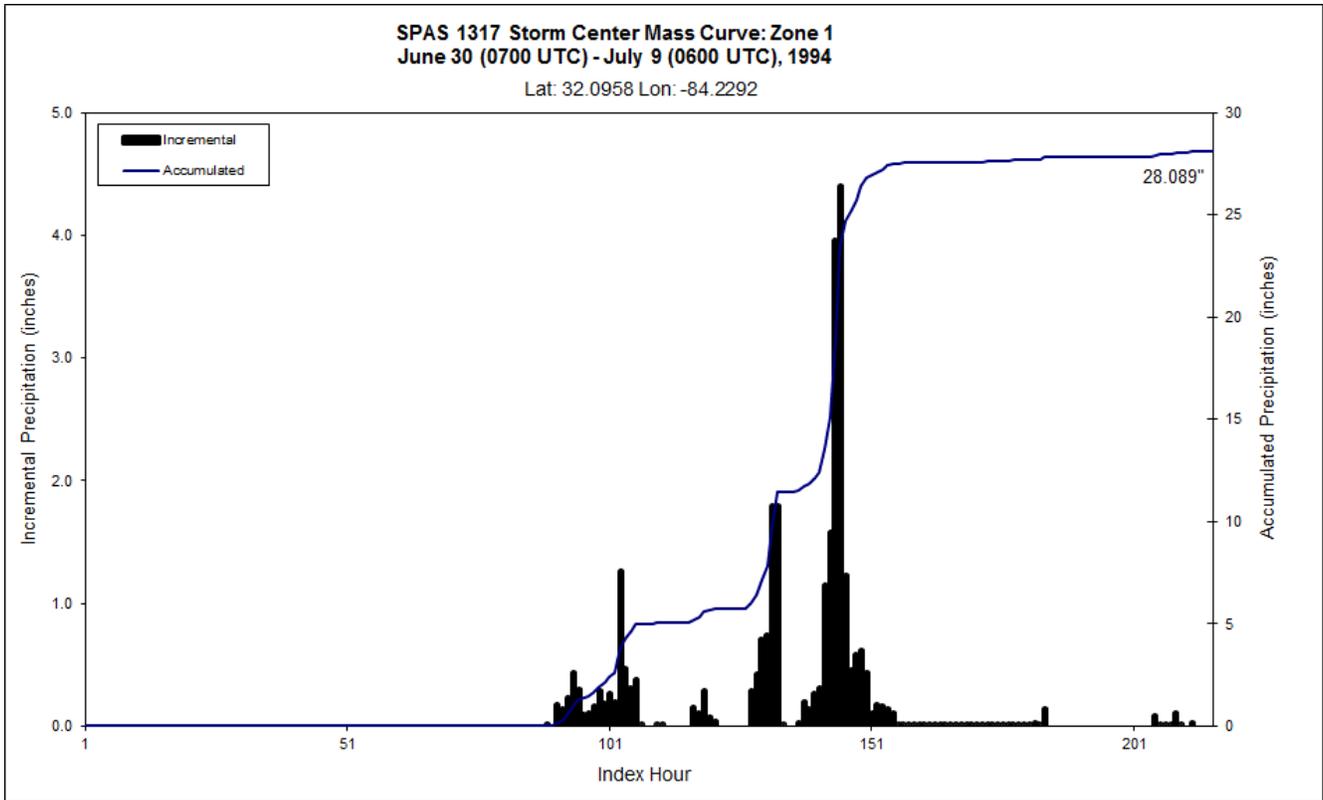
**Reliability of Results:** This analysis was based on hourly data, daily data, supplemental station data and NWS total storm basemap. We have a good level of confidence in the station based storm total results, the spatial pattern is dependent on the station data and NWS basemap. The timing is based on hourly and hourly pseudo stations.

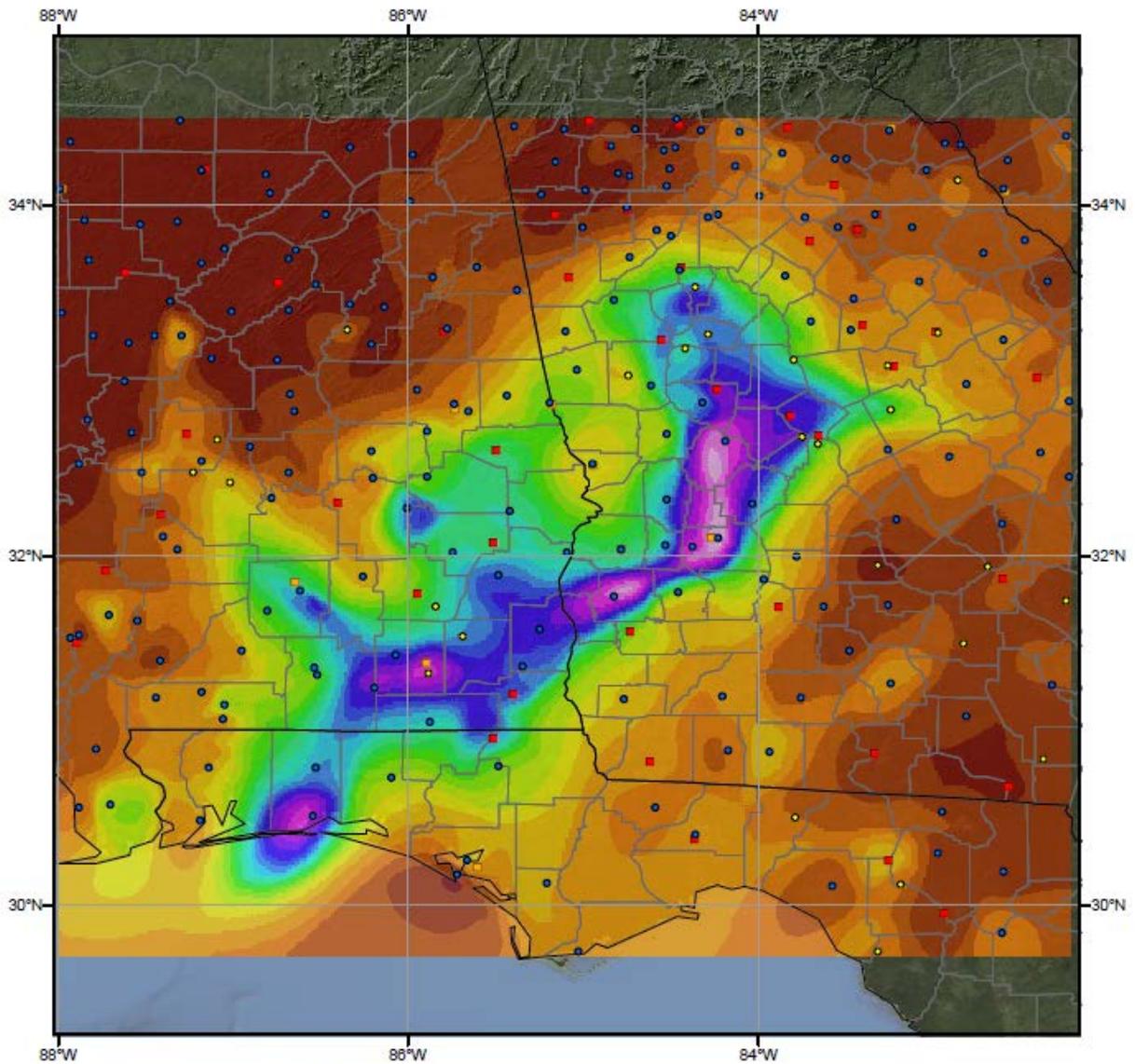
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1317_1	-84.229	32.096	466	500	76.00	2.99	0.13	74	2.860	80.88	81.0	3.77	0.15	84	3.620	1.266

**Storm 1317 - June 30 (0700 UTC) - July 9 (0600 UTC), 1994**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	4.41	8.35	9.93	9.93	9.93	12.76	15.11	18.74	21.20	22.08	24.23	27.53	27.85	28.09	28.09
1	4.40	8.35	9.93	9.93	9.93	12.76	15.11	18.74	21.20	22.08	24.23	27.53	27.85	27.96	27.96
10	4.35	8.24	9.80	9.80	9.80	12.61	14.92	18.52	20.95	21.81	23.91	27.20	27.51	27.61	27.61
25	4.33	8.19	9.73	9.73	9.73	12.53	14.83	18.40	20.81	21.67	23.76	27.02	27.34	27.48	27.48
50	4.27	8.12	9.67	9.67	9.67	12.41	14.68	18.24	20.64	21.50	23.63	26.90	27.21	27.37	27.37
100	4.14	7.86	9.36	9.36	9.36	12.02	14.20	17.71	20.01	20.88	23.07	26.38	26.72	26.97	26.97
150	4.01	7.63	9.10	9.10	9.10	11.66	13.74	17.24	19.44	20.35	22.74	26.05	26.38	26.63	26.63
200	3.91	7.44	8.87	8.87	8.87	11.36	13.38	16.84	18.95	20.03	22.42	25.82	26.14	26.39	26.39
300	3.73	7.10	8.49	8.49	8.49	10.86	12.77	16.19	18.16	19.58	21.97	25.32	25.71	25.96	25.96
400	3.55	6.78	8.11	8.11	8.11	10.37	12.21	15.59	17.43	19.18	21.50	24.94	25.32	25.57	25.57
500	3.37	6.45	7.76	7.76	7.76	9.94	11.67	14.95	16.72	18.81	21.10	24.53	24.94	25.21	25.21
1,000	2.69	5.17	6.35	6.35	6.35	8.33	9.58	12.60	14.35	17.53	19.49	22.94	23.37	23.65	23.65
2,000	2.18	3.84	5.00	5.00	5.00	6.76	7.74	10.47	12.54	16.06	17.64	20.60	21.10	21.69	21.69
5,000	1.55	2.35	3.16	3.16	3.16	4.42	5.93	7.99	9.67	12.83	14.33	17.00	18.06	18.74	18.74
10,000	1.04	1.66	2.32	2.32	2.32	3.31	4.73	5.85	7.02	9.54	11.07	14.11	15.71	16.37	16.37
20,000	0.62	0.97	1.46	1.46	1.46	2.15	3.28	4.32	4.88	6.59	8.04	10.69	12.91	13.49	13.49
50,000	0.28	0.45	0.65	0.65	0.65	1.02	1.62	2.17	2.54	3.58	4.55	6.30	7.91	8.52	8.52
81,682	0.17	0.28	0.42	0.42	0.42	0.64	1.04	1.44	1.69	2.43	2.98	4.20	5.32	5.74	5.74



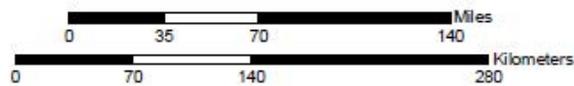




**Total Storm (216-hr) Precipitation (inches)**  
**June 30 - July 8, 1994**  
**SPAS 1317**

**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Supplemental



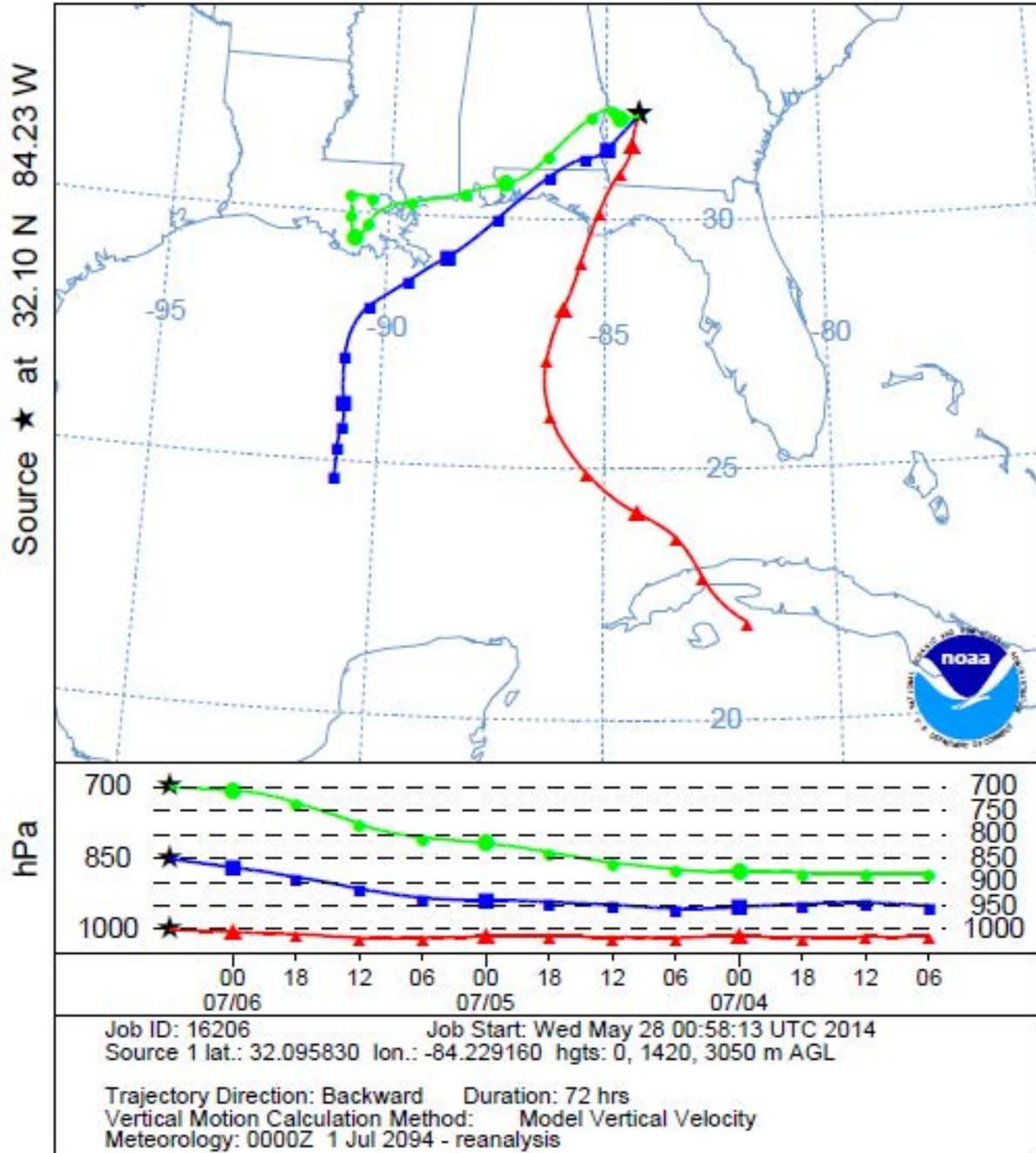
**Precipitation (inches)**

0.15 - 1	5.01 - 6	10.01 - 11	15.01 - 16	24.01 - 26
1.01 - 2	6.01 - 7	11.01 - 12	16.01 - 18	26.01 - 28
2.01 - 3	7.01 - 8	12.01 - 13	18.01 - 20	28.01 - 29
3.01 - 4	8.01 - 9	13.01 - 14	20.01 - 22	
4.01 - 5	9.01 - 10	14.01 - 15	22.01 - 24	

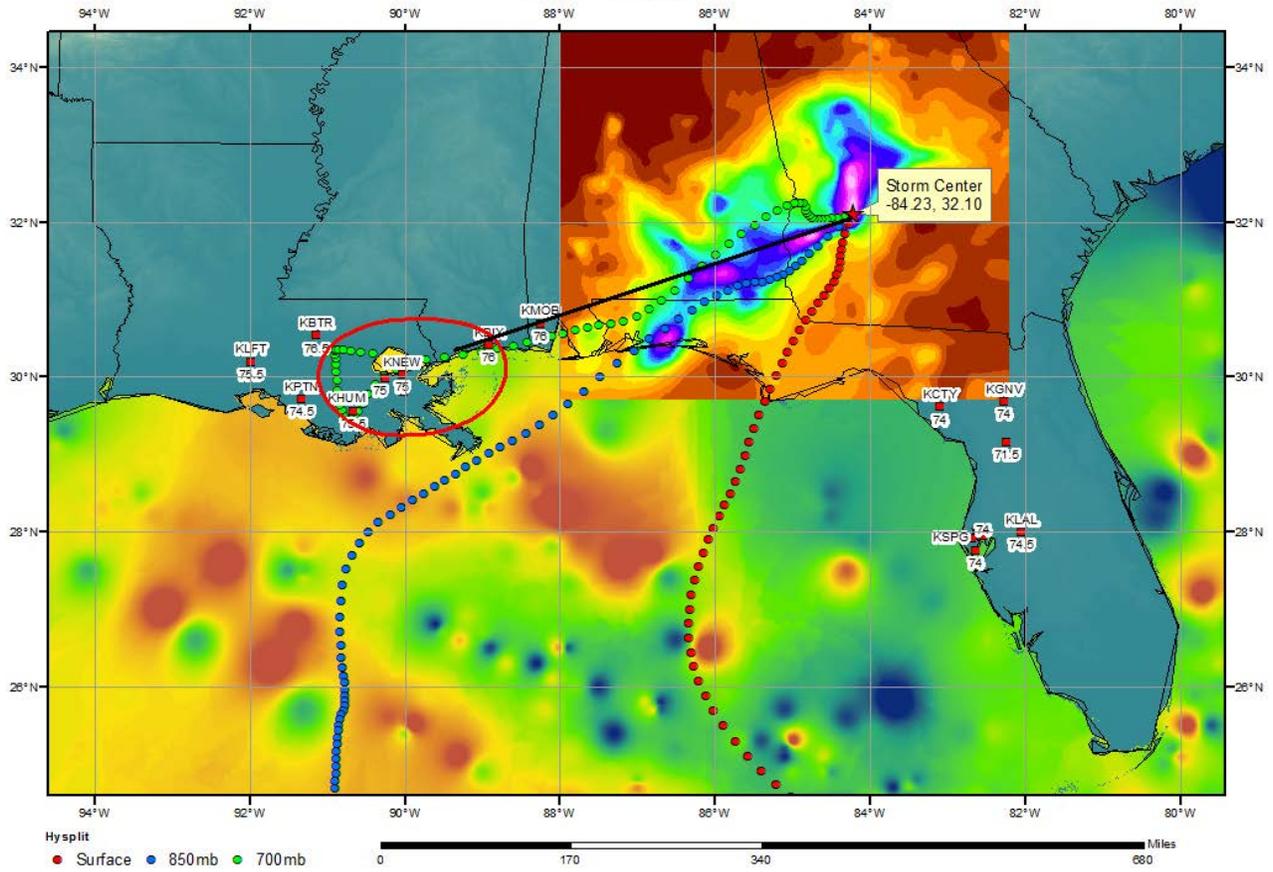


12/22/2013

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0600 UTC 06 Jul 94  
 CDC1 Meteorological Data



### SPAS 1317 Americas, GA Storm Analysis July 4 - 6, 1994



## Storm Precipitation Analysis System (SPAS) For Storm #1569\_1

**General Storm Location:** Alabama, Mississippi, Florida, Louisiana (32.5, -90.0, 28.0, -85.0)

**Storm Dates:** July 18-20, 1997 (72-hours)

**Event:** Hurricane Danny

### DAD Zone 1

**Latitude:** 30.315

**Longitude:** -88.035

**Max. Grid Rainfall Amount:** 45.27” Dauphin Island, AL

**Max. Observed Rainfall Amount:** 42.12”

**Number of Stations:** 132

**SPAS Version:** 10.0

**Base Map Used:** Conus\_prism\_ppt\_in\_1981\_2010\_07 and default\_zr\_ppt

**Spatial resolution:** 00:00:36

**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

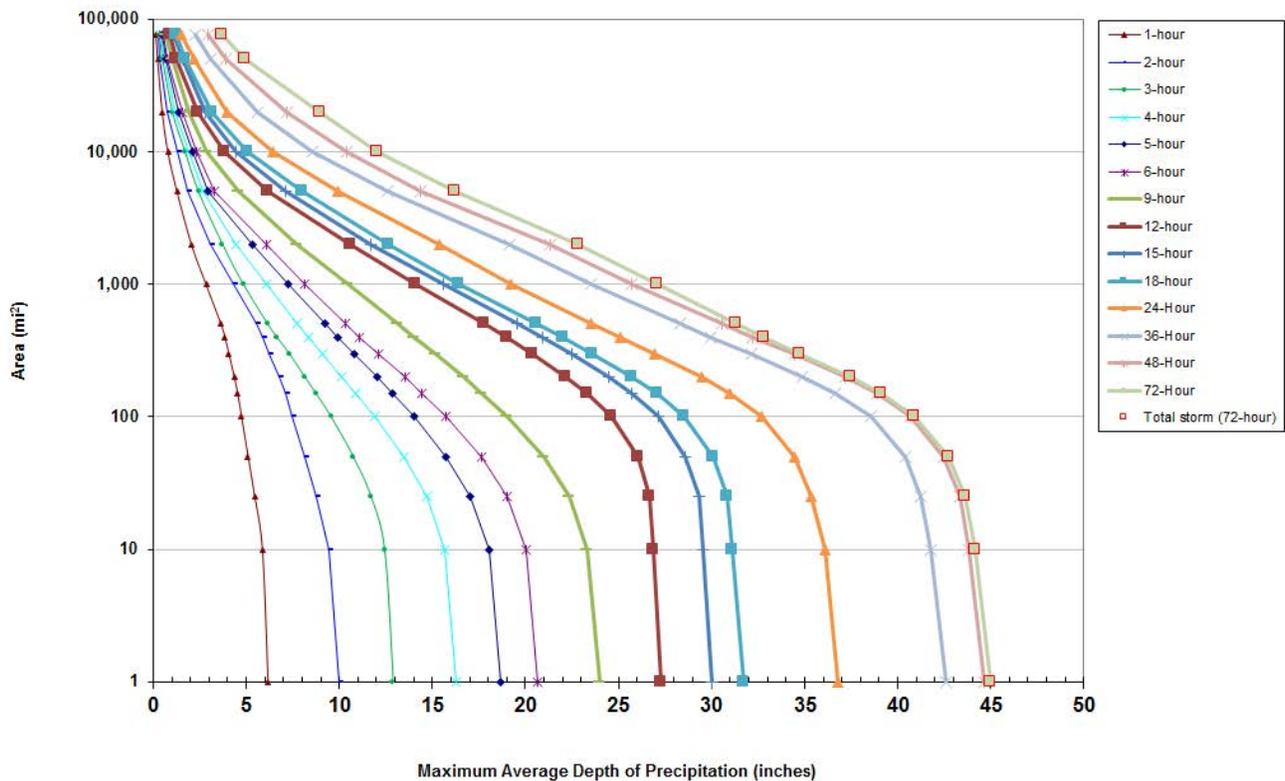
**Reliability of Results:** This analysis was based on hourly data, hourly pseudo data, daily data, supplemental data, and supplemental estimated station data. We have a high degree of confidence in the station based storm total results, the spatial pattern is dependent on basemap, and the timing is based on hourly and hourly pseudo stations. Radar data was used for this event and had good coverage throughout the storm.

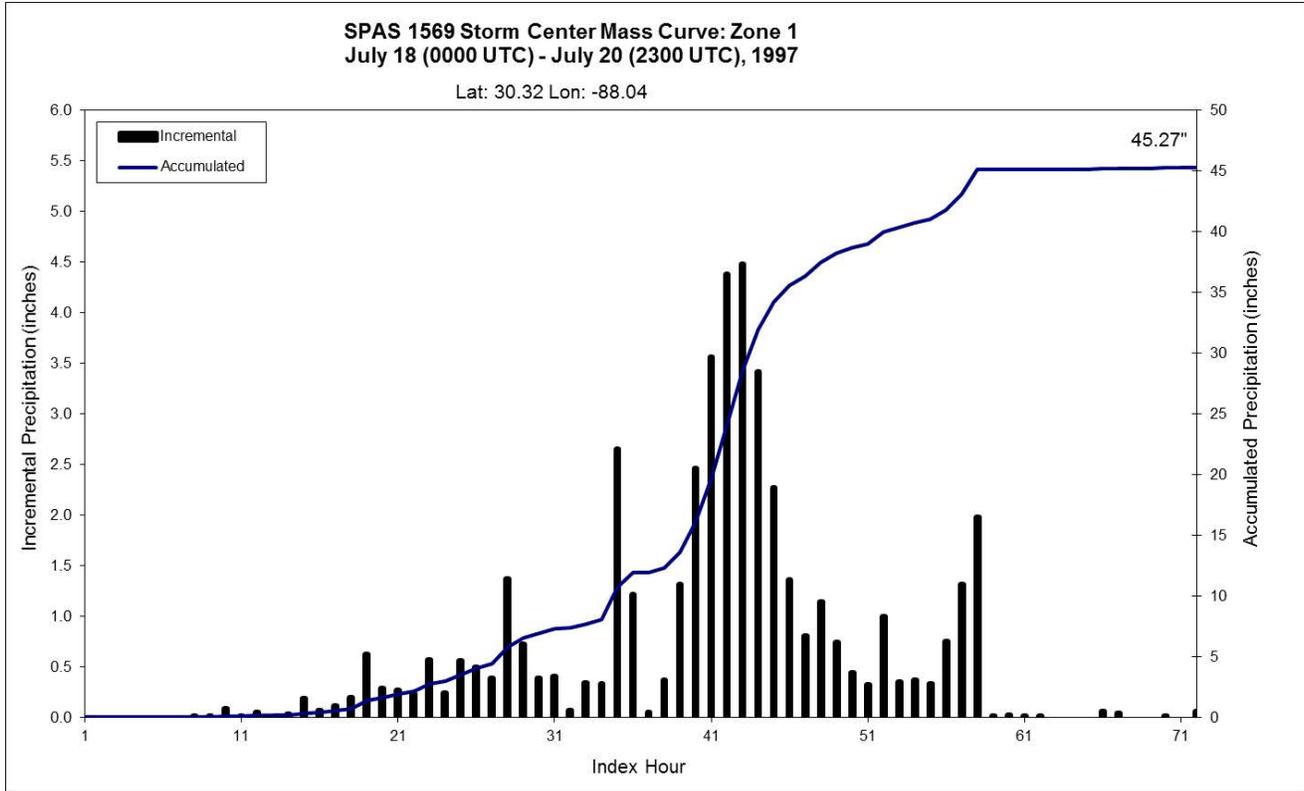
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1569_1	-88.035	30.315	0	0	85.50	4.58	0.00	93	4.580	86.86	87.0	4.86	0.00	96	4.860	1.061

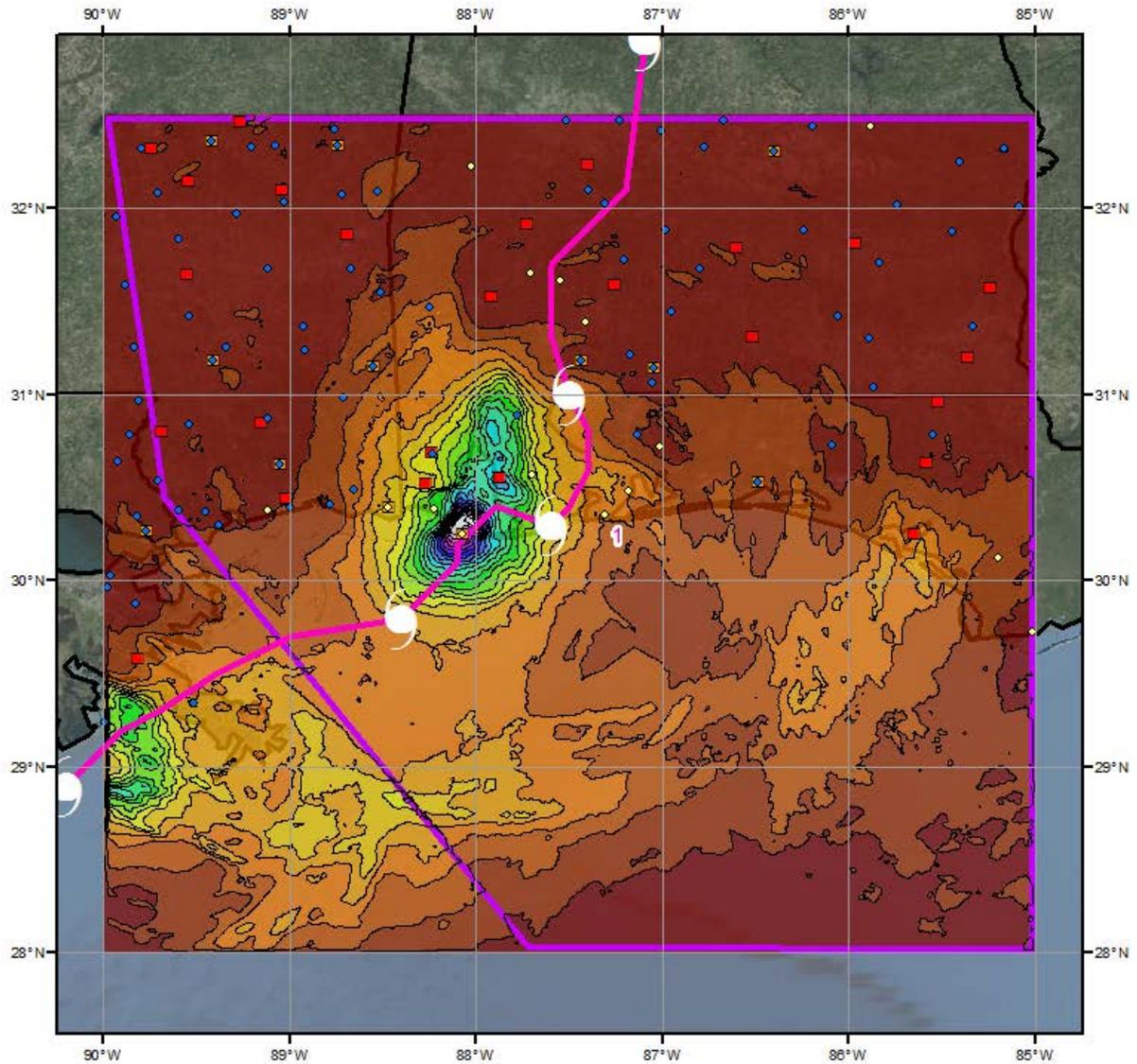
**Storm 1569 Zone 1 - Jul. 18 (0000 UTC) - Jul. 20 (2300 UTC), 1997**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

areasqmi	Duration (hours)														
	1	2	3	4	5	6	9	12	15	18	24	36	48	72	Total
0.4	6.22	10.10	12.98	16.37	18.83	20.75	24.13	27.49	30.17	31.94	37.07	42.90	44.97	45.27	45.27
1	6.16	9.99	12.88	16.25	18.69	20.62	23.97	27.31	29.99	31.71	36.80	42.58	44.66	44.96	44.96
10	5.86	9.41	12.42	15.67	18.07	20.03	23.35	26.86	29.52	31.14	36.12	41.77	43.85	44.15	44.15
25	5.45	8.77	11.69	14.73	17.06	19.04	22.37	26.69	29.32	30.86	35.37	41.23	43.32	43.61	43.61
50	5.10	8.11	10.74	13.49	15.75	17.66	21.02	26.03	28.61	30.10	34.46	40.42	42.48	42.74	42.74
100	4.75	7.48	9.55	11.88	14.00	15.73	19.03	24.63	27.13	28.54	32.68	38.54	40.66	40.90	40.90
150	4.54	7.10	8.74	10.88	12.86	14.43	17.61	23.32	25.71	27.05	30.99	36.65	38.87	39.12	39.12
200	4.36	6.75	8.14	10.12	12.03	13.51	16.71	22.16	24.46	25.70	29.49	34.90	37.20	37.49	37.49
300	4.07	6.26	7.31	9.08	10.82	12.08	15.21	20.37	22.47	23.61	26.96	32.12	34.46	34.76	34.76
400	3.86	5.86	6.64	8.33	9.90	11.08	14.05	18.98	20.93	21.99	25.10	29.96	32.23	32.81	32.81
500	3.65	5.57	6.16	7.76	9.22	10.34	13.16	17.75	19.59	20.60	23.53	28.32	30.57	31.34	31.34
1,000	2.85	4.34	4.85	6.11	7.26	8.14	10.46	14.12	15.57	16.44	19.19	23.52	25.69	27.10	27.10
2,000	2.07	3.08	3.73	4.48	5.37	6.06	7.72	10.57	11.71	12.63	15.36	19.15	21.34	22.85	22.85
5,000	1.30	1.88	2.44	2.70	2.96	3.28	4.56	6.15	7.14	8.00	9.94	12.57	14.38	16.20	16.20
10,000	0.81	1.30	1.72	1.92	2.10	2.35	2.91	3.82	4.47	5.04	6.41	8.54	10.40	12.07	12.07
20,000	0.51	0.76	1.04	1.18	1.36	1.56	1.94	2.38	2.83	3.12	3.96	5.59	7.17	8.98	8.98
50,000	0.26	0.38	0.51	0.61	0.68	0.76	1.04	1.27	1.56	1.69	2.20	3.05	3.92	4.94	4.94
76,822	0.17	0.27	0.35	0.41	0.46	0.54	0.71	0.88	1.08	1.24	1.54	2.24	2.95	3.69	3.69

**SPAS #1569 DAD Curves Zone 1**  
**July 18-20, 1997**

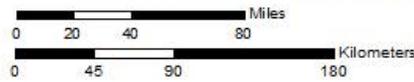






**Total Storm (72-hours) Precipitation (inches)**  
**July 18-20, 1997**  
**SPAS 1569 Hurricane Danny**

- Gauges**
- ◆ Daily
  - Hourly
  - Hourly Pseudo
  - ◇ Supplemental
  - Hurricane Danny Track

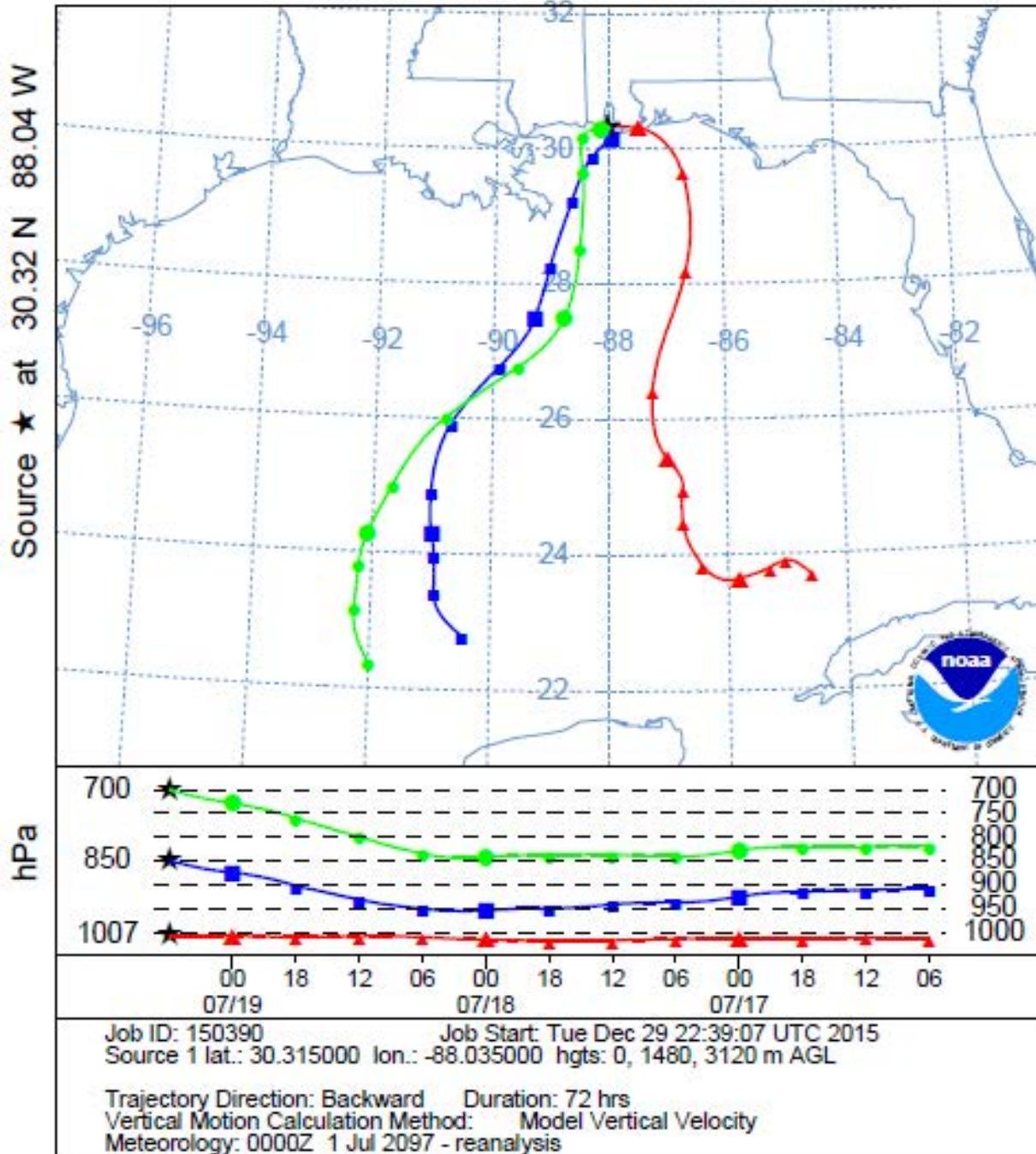


**Precipitation (inches)**

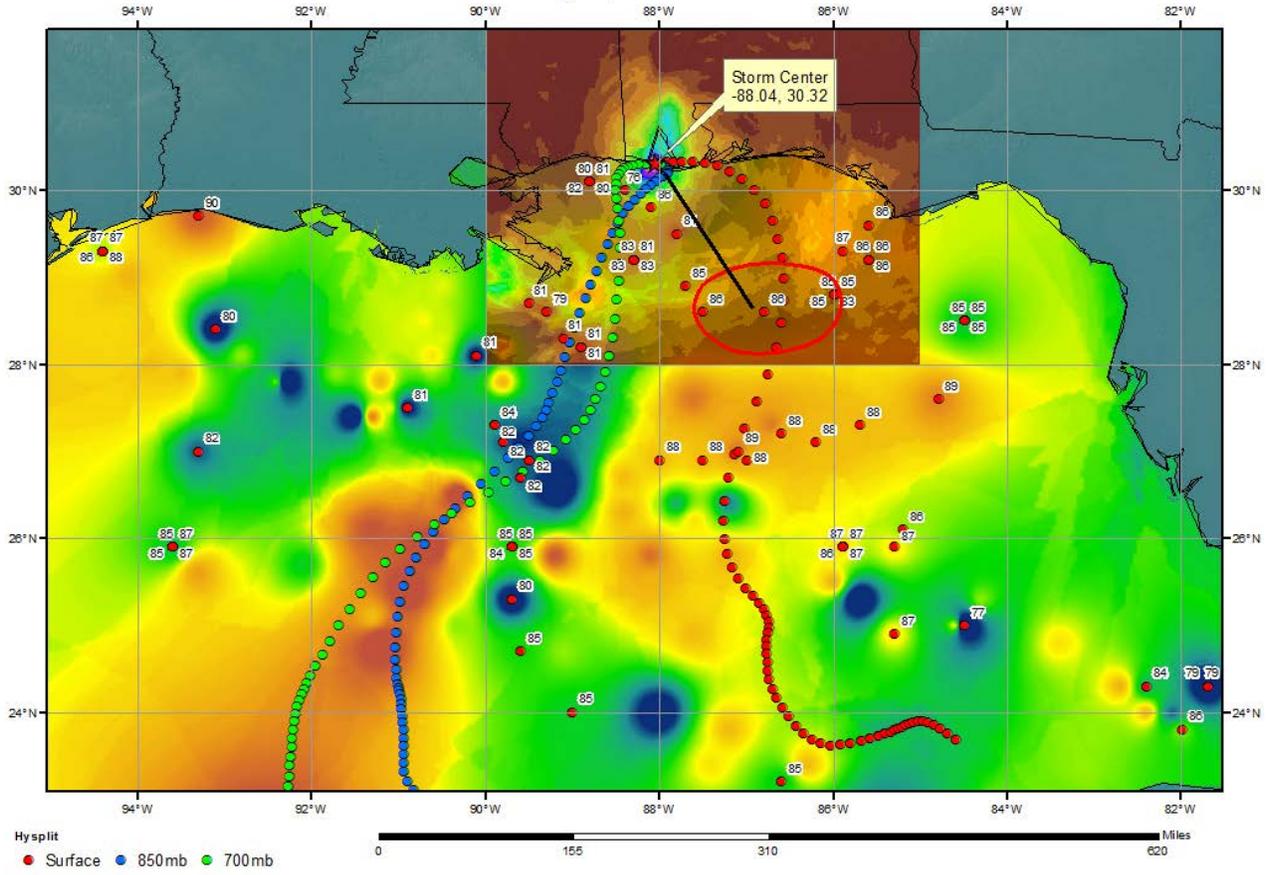
0.00 - 2.00	10.01 - 12.00	20.01 - 22.00	30.01 - 32.00	40.01 - 42.00
2.01 - 4.00	12.01 - 14.00	22.01 - 24.00	32.01 - 34.00	42.01 - 44.00
4.01 - 6.00	14.01 - 16.00	24.01 - 26.00	34.01 - 36.00	
6.01 - 8.00	16.01 - 18.00	26.01 - 28.00	36.01 - 38.00	
8.01 - 10.00	18.01 - 20.00	28.01 - 30.00	38.01 - 40.00	



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0600 UTC 19 Jul 97  
 CDC1 Meteorological Data



### SPAS 1569 Hurricane Danny Storm Analysis July 18, 1997



## Storm Precipitation Analysis System (SPAS) For Storm #1593\_1

**General Storm Location:** Alabama, Mississippi, Florida, Louisiana (33.5, -90.0, 29.0, -84.5)

**Storm Dates:** September 27-30, 1998 (84-hours)

**Event:** Hurricane Georges

### DAD Zone 1

**Latitude:** 30.855

**Longitude:** -87.725

**Max. Grid Rainfall Amount:** 24.92" Andalusia, AL

**Max. Observed Rainfall Amount:** 24.06"

**Number of Stations:** 229

**SPAS Version:** 10.0

**Base Map Used:** conus\_prism\_ppt\_in\_1981\_2010\_09 and basemap\_ippt\_ppt (50/50 ippt, ppt blend with ppt over ocean)

**Spatial resolution:** 00:00:36

**Radar Included:** Yes

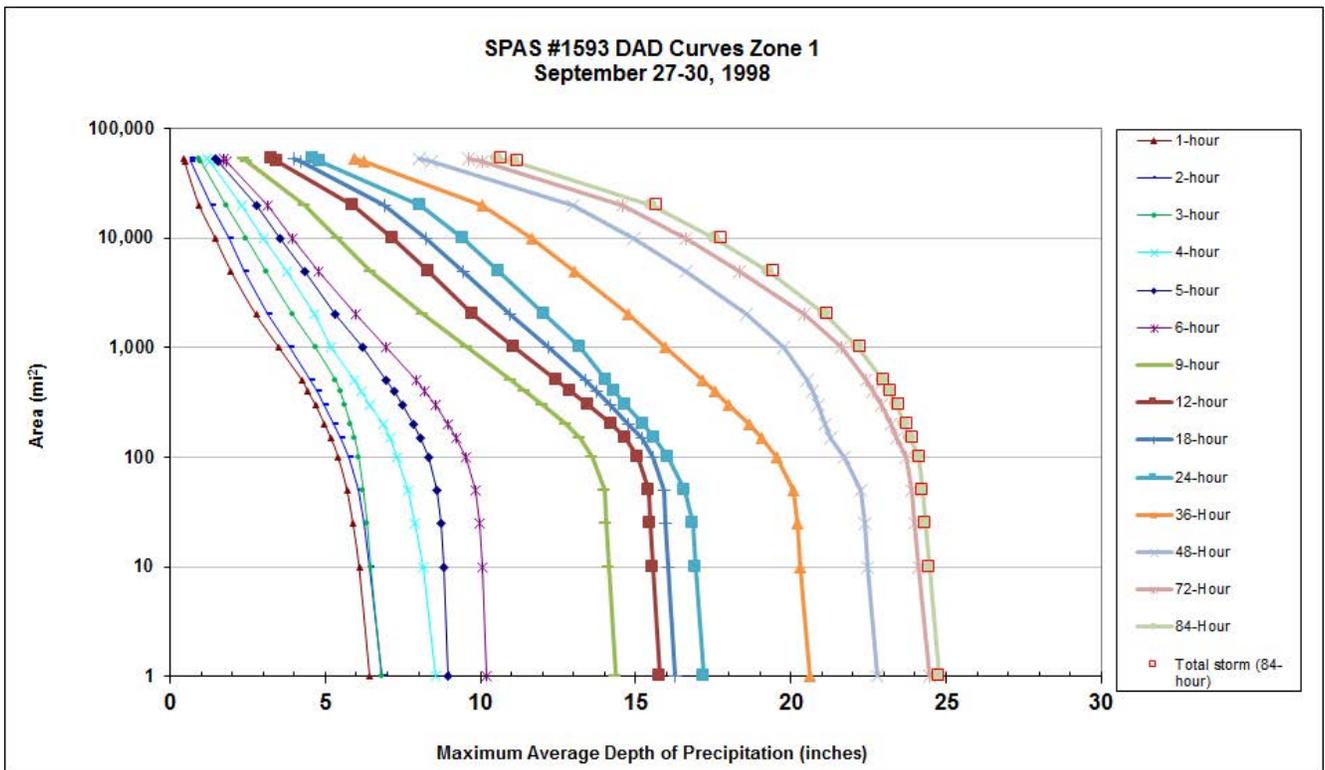
**Depth-Area-Duration (DAD) analysis:** Yes

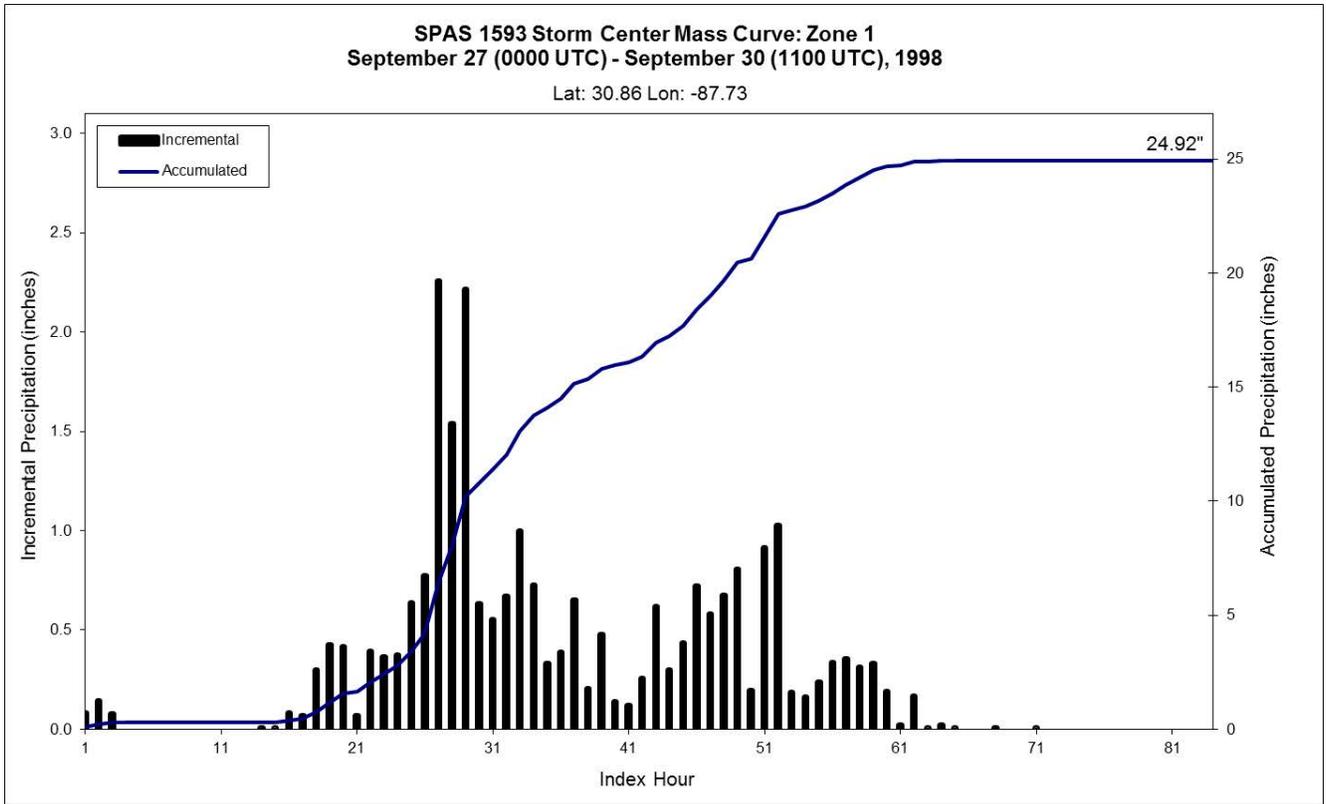
**Reliability of Results:** This analysis was based on hourly data (H), hourly estimated pseudo data (HEP), hourly pseudo data (HP), daily data (D) and supplemental data (S). We have a high degree of confidence in the station based storm total results, the spatial pattern is dependent on basemap which is a 50/50 blend between ippt and ppt, and the timing is based on hourly, hourly estimated pseudo and hourly pseudo stations. Radar data was used for this event and had good coverage despite KEVX missing in FL.

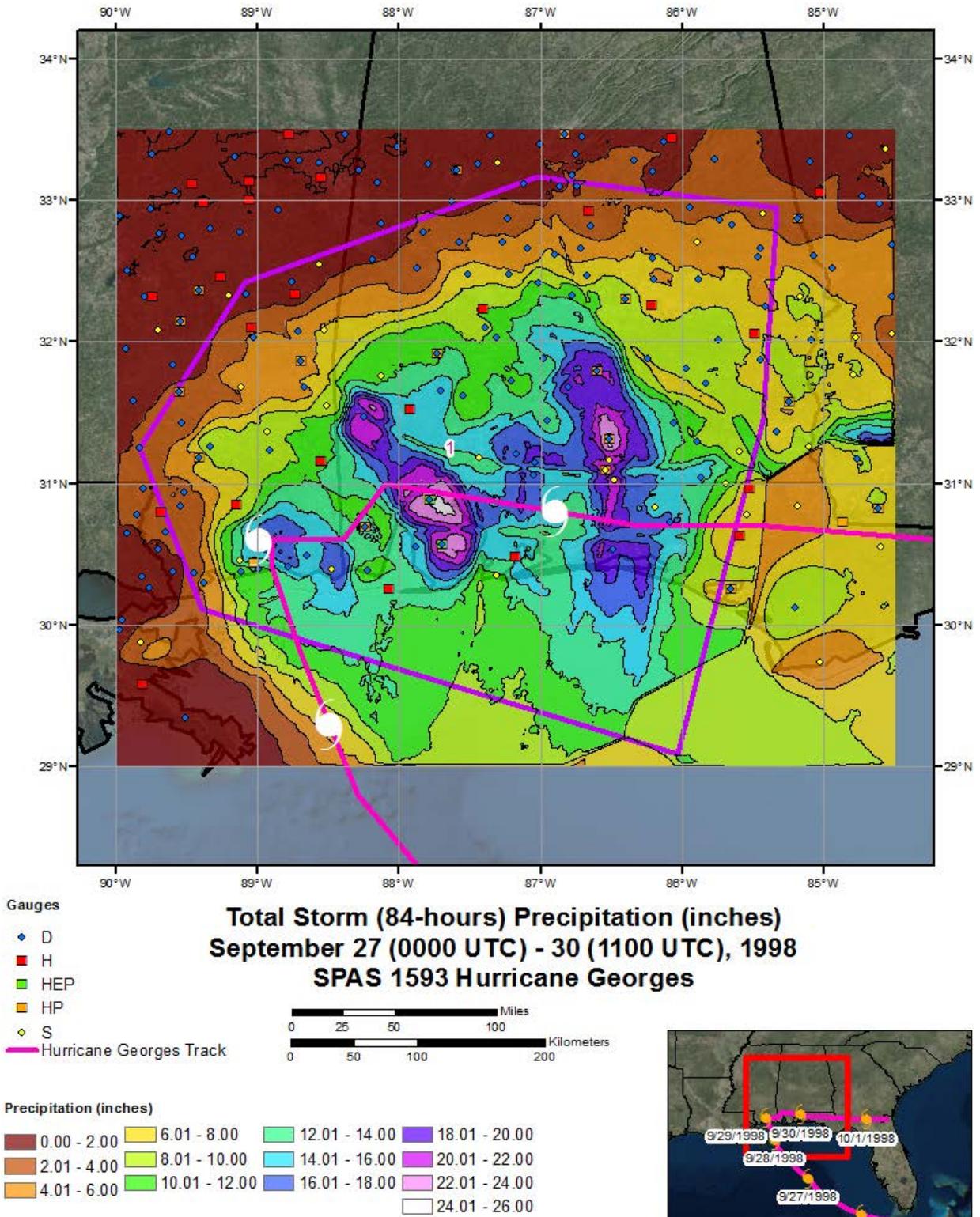
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1593_1	-87.725	30.855	220	200	82.50	4.03	0.06	87	3.970	85.86	86.0	4.67	0.07	94	4,600	1.159

**Storm 1593 Zone 1 - Sep. 27 (0000 UTC) - Sep. 30 (1100 UTC), 1998**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

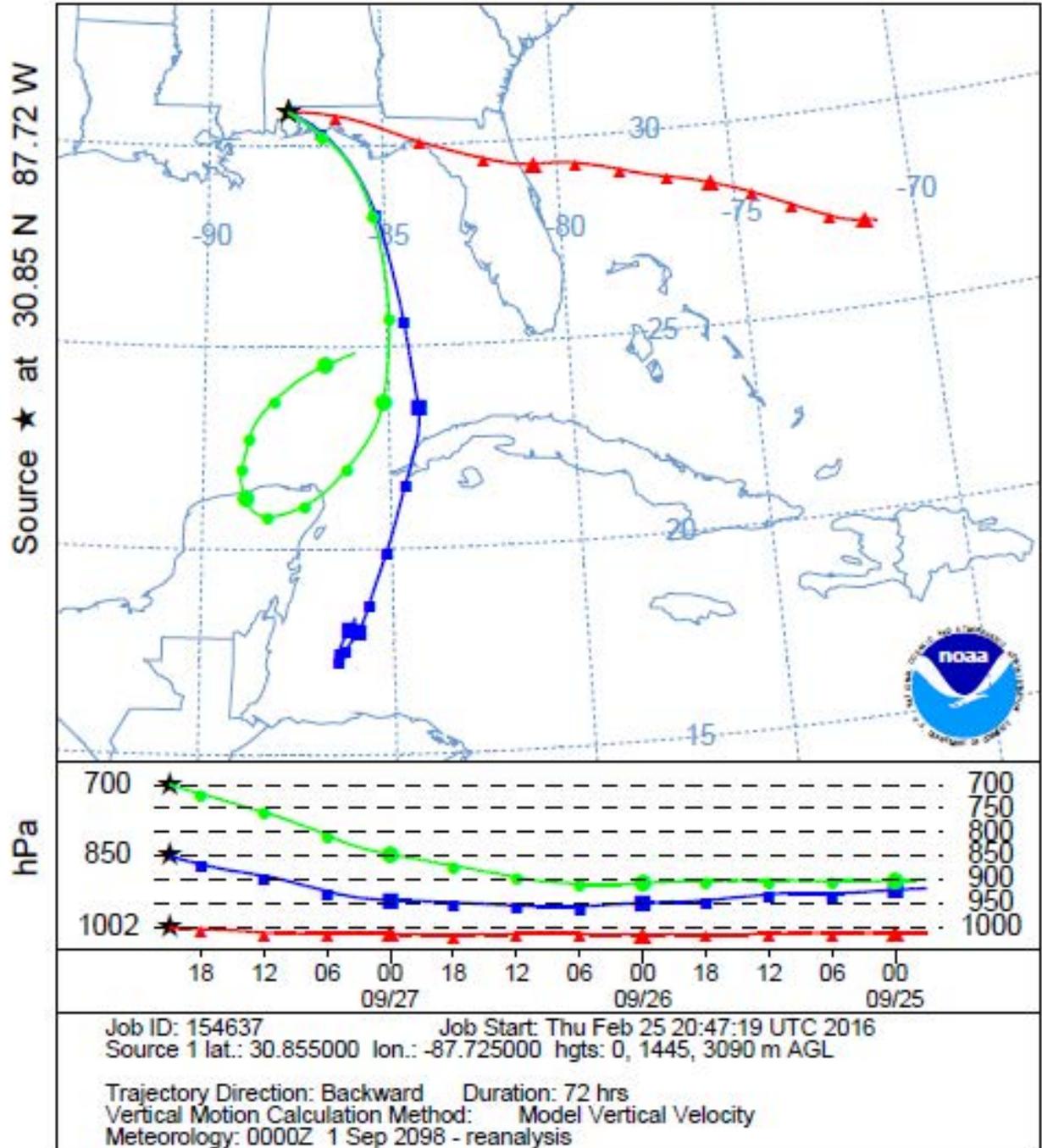
areasqmi	Duration (hours)														
	1	2	3	4	5	6	9	12	18	24	36	48	72	84	Total
0.4	6.52	6.90	6.91	8.66	9.03	10.27	14.43	15.85	16.35	17.27	20.69	22.89	24.59	24.92	24.92
1	6.43	6.80	6.80	8.55	8.97	10.21	14.35	15.77	16.27	17.18	20.59	22.78	24.45	24.79	24.79
10	6.09	6.44	6.46	8.14	8.81	10.04	14.15	15.56	16.05	16.94	20.32	22.49	24.11	24.46	24.48
25	5.89	6.25	6.34	7.89	8.75	9.97	14.07	15.48	15.96	16.85	20.21	22.37	23.98	24.34	24.35
50	5.70	6.06	6.22	7.66	8.58	9.83	13.99	15.42	15.90	16.57	20.09	22.26	23.88	24.24	24.26
100	5.42	5.75	6.07	7.31	8.31	9.53	13.61	15.06	15.57	16.03	19.56	21.71	23.70	24.12	24.17
150	5.18	5.51	5.94	7.09	8.05	9.22	13.20	14.65	15.19	15.60	19.07	21.26	23.42	23.85	23.93
200	4.98	5.28	5.81	6.85	7.82	8.95	12.77	14.23	14.78	15.25	18.65	21.09	23.22	23.67	23.74
300	4.69	4.98	5.62	6.44	7.49	8.55	12.02	13.47	14.17	14.68	18.01	20.87	22.93	23.42	23.48
400	4.44	4.73	5.47	6.14	7.21	8.21	11.45	12.91	13.74	14.32	17.53	20.71	22.63	23.17	23.24
500	4.26	4.53	5.33	5.92	6.96	7.92	10.99	12.46	13.39	14.05	17.16	20.51	22.41	22.95	23.02
1,000	3.51	3.84	4.68	5.18	6.20	6.97	9.56	11.08	12.17	13.19	15.94	19.76	21.62	22.18	22.25
2,000	2.77	3.14	3.95	4.67	5.33	5.99	8.17	9.74	10.96	12.07	14.77	18.55	20.42	21.09	21.20
5,000	1.96	2.38	3.08	3.75	4.33	4.80	6.47	8.33	9.42	10.60	13.04	16.61	18.33	19.26	19.45
10,000	1.45	1.88	2.44	3.00	3.52	3.93	5.40	7.17	8.22	9.45	11.66	14.92	16.62	17.53	17.77
20,000	0.93	1.34	1.79	2.29	2.80	3.12	4.33	5.87	6.89	8.08	10.07	12.98	14.58	15.49	15.71
50,000	0.46	0.68	0.98	1.26	1.56	1.79	2.48	3.44	4.19	4.84	6.24	8.40	10.05	11.07	11.20
52,972	0.44	0.64	0.92	1.20	1.47	1.70	2.38	3.28	4.00	4.61	5.94	8.01	9.60	10.55	10.68



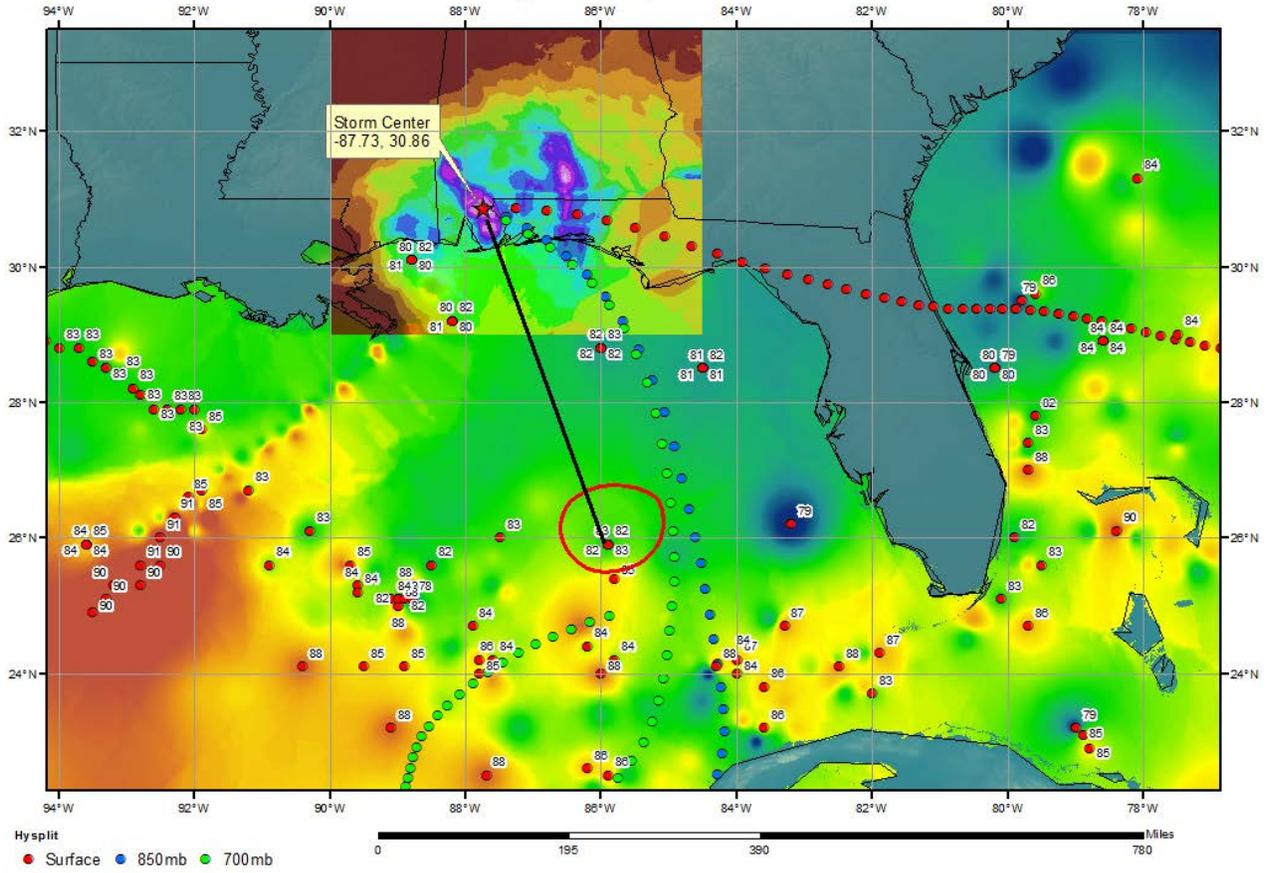




NOAA HYSPLIT MODEL  
 Backward trajectories ending at 2100 UTC 27 Sep 98  
 CDC1 Meteorological Data



### SPAS 1593 Hurricane Georges Storm Analysis September 27, 1998



## Storm Precipitation Analysis System (SPAS) For Storm #1464\_1

**General Storm Location:** Tropical Storm Allison, TX and Louisiana (34.0, -97.0, 28.0, -86.5)

**Storm Dates:** June 5 – 11, 2001 (144-hours)

**Event:** Land falling TS

### DAD Zone 1

**Latitude:** 29.755

**Longitude:** -95.275

**Max. Grid Rainfall Amount:** 40.97”

**Max. Observed Rainfall Amount:** 39.25”

**Number of Stations:** 547

**SPAS Version:** 10.0

**Base Map Used:** Total Ppt with a default Z-R relationship

**Spatial resolution:** 00:00:36

**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

**Reliability of Results:** This analysis was based on hourly data, daily data and supplemental station data paired with SPAS-NEXRAD. We have a high degree of confidence for the radar and station based storm total results. The spatial pattern dependent on the basemap and radar data with a high degree of confidence with the timing based on hourly and hourly pseudo stations (see below). The basemap used was Total Ppt with a default Z-R relationship for continuity over the ocean. An hourly estimated pseudo station was created for Salt Point (6; 29.5685, -91.5384) due to the ZR Outlier Frequency Table Freq % being over 10%. This improved the amount of time Salt Point was an outlier. Next, Friendswood (29.98” to 27.5”), Heights (32” to 33.5”) and Houston-Port (36.99” to 38.5”) were adjusted in SPAS general so the CPP\_SPASppt was close to the observed value. Lastly, over the ocean during two hours of the storm, there were very high Pgrid maximums. To reduce these bulls-eyes, the ratio between the basemap and observations by nearby coastal stations were averaged to create a supplemental value to place at these centers over the ocean.

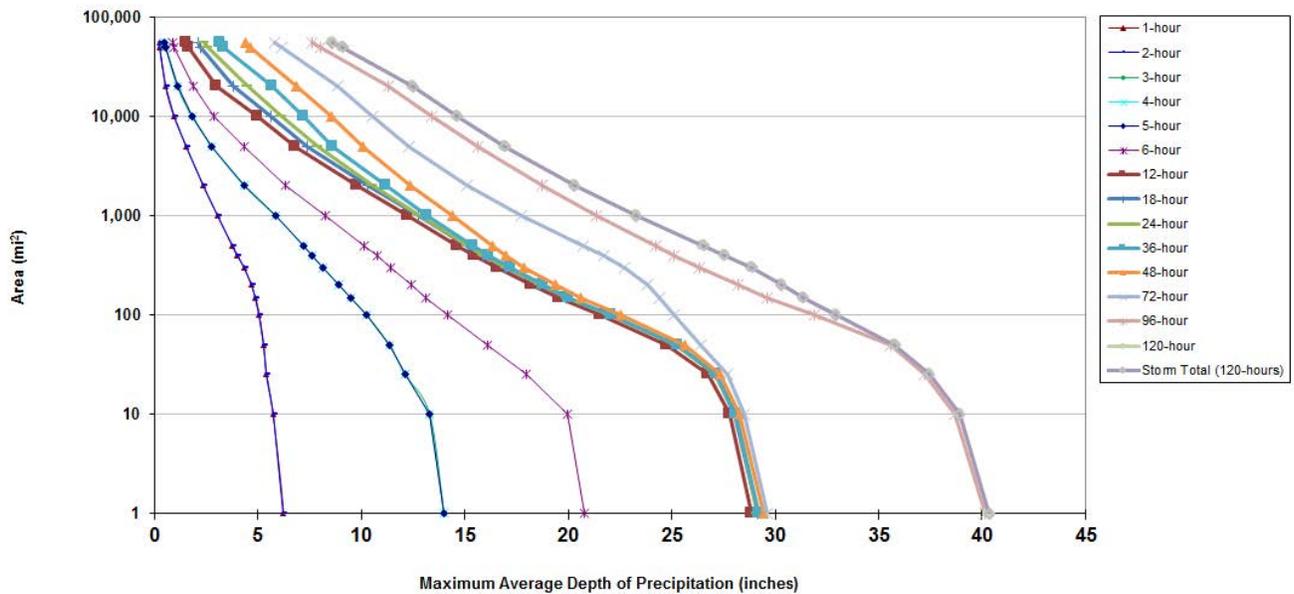
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1464_1	-95.275	29.755	53	100	82.50	4.03	0.03	87	4.000	84.54	84.5	4.39	0.04	91	4.350	1.088

**Storm 1464 - June 5 (1200 UTC) - June 11 (1100 UTC), 2001**

**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

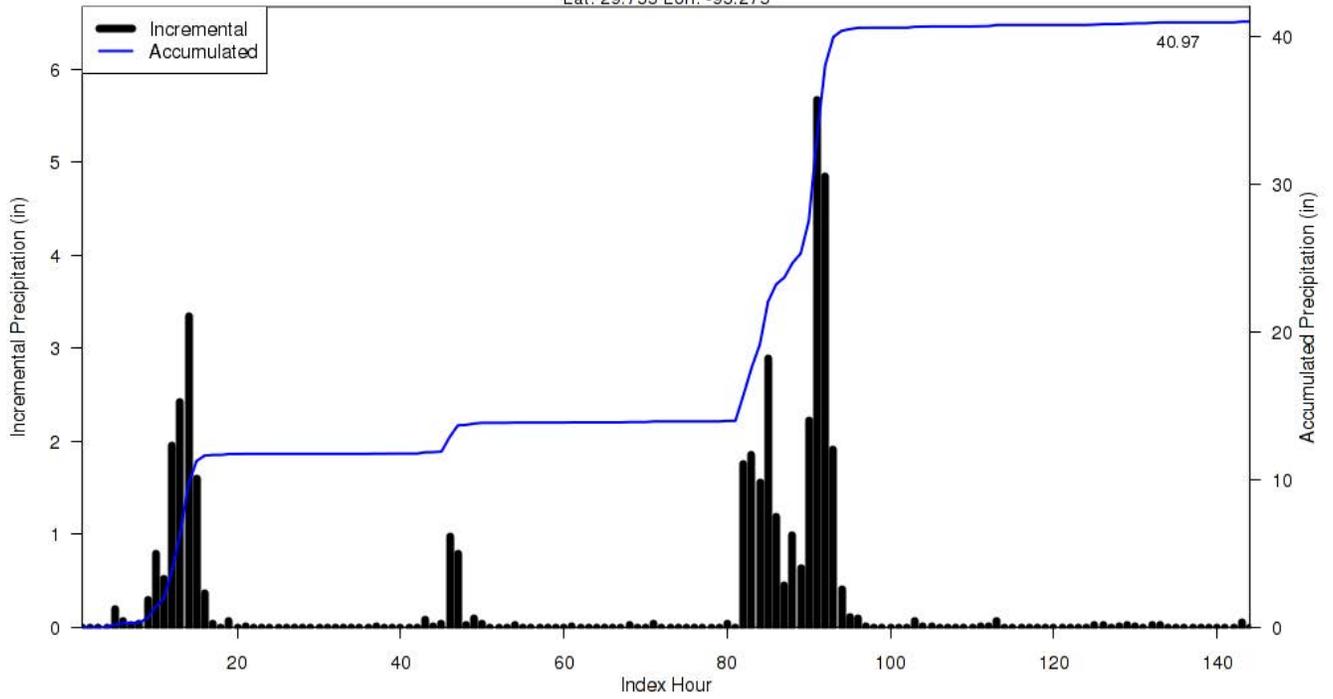
areasqmi	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.4	6.28	6.28	14.09	14.09	14.09	20.98	29.17	29.39	29.41	29.53	29.71	29.89	40.56	40.97	40.97
1	6.24	6.24	13.97	13.97	13.97	20.78	28.88	29.12	29.14	29.23	29.43	29.59	40.15	40.34	40.34
10	5.73	5.73	13.30	13.30	13.30	19.94	27.79	28.04	28.07	28.11	28.30	28.50	38.67	38.90	38.90
25	5.42	5.42	12.12	12.12	12.12	18.00	26.75	27.10	27.12	27.15	27.31	27.66	37.23	37.43	37.43
50	5.27	5.27	11.35	11.35	11.35	16.08	24.75	25.21	25.24	25.30	25.63	26.41	35.60	35.78	35.78
100	5.07	5.07	10.26	10.26	10.26	14.17	21.57	21.99	22.02	22.08	22.53	25.12	31.88	32.93	32.93
150	4.87	4.87	9.46	9.46	9.46	13.14	19.53	19.93	19.96	20.04	20.58	24.39	29.63	31.35	31.35
200	4.68	4.68	8.90	8.90	8.90	12.42	18.23	18.62	18.66	18.79	19.37	23.80	28.22	30.30	30.30
300	4.32	4.32	8.14	8.14	8.14	11.44	16.55	16.97	17.01	17.22	17.85	22.73	26.35	28.87	28.87
400	4.01	4.01	7.60	7.60	7.60	10.77	15.45	15.89	15.93	16.18	16.97	21.72	25.13	27.54	27.54
500	3.77	3.77	7.21	7.21	7.21	10.16	14.61	15.10	15.14	15.42	16.33	20.70	24.24	26.52	26.52
1,000	3.04	3.04	5.84	5.84	5.84	8.27	12.25	12.79	12.84	13.15	14.40	17.73	21.39	23.28	23.28
2,000	2.36	2.36	4.33	4.33	4.33	6.32	9.80	10.33	10.53	11.19	12.35	15.10	18.72	20.31	20.31
5,000	1.53	1.53	2.78	2.78	2.78	4.33	6.82	7.38	7.92	8.64	10.06	12.29	15.63	16.93	16.93
10,000	0.94	0.94	1.81	1.81	1.81	2.86	4.99	5.64	6.16	7.18	8.53	10.57	13.41	14.62	14.62
20,000	0.53	0.53	1.10	1.10	1.10	1.91	3.01	3.81	4.49	5.70	6.86	8.83	11.33	12.49	12.49
50,000	0.25	0.25	0.54	0.54	0.54	0.97	1.64	2.25	2.60	3.37	4.63	6.15	8.03	9.10	9.10
54,779	0.23	0.23	0.50	0.50	0.50	0.90	1.54	2.10	2.43	3.16	4.39	5.82	7.62	8.59	8.59

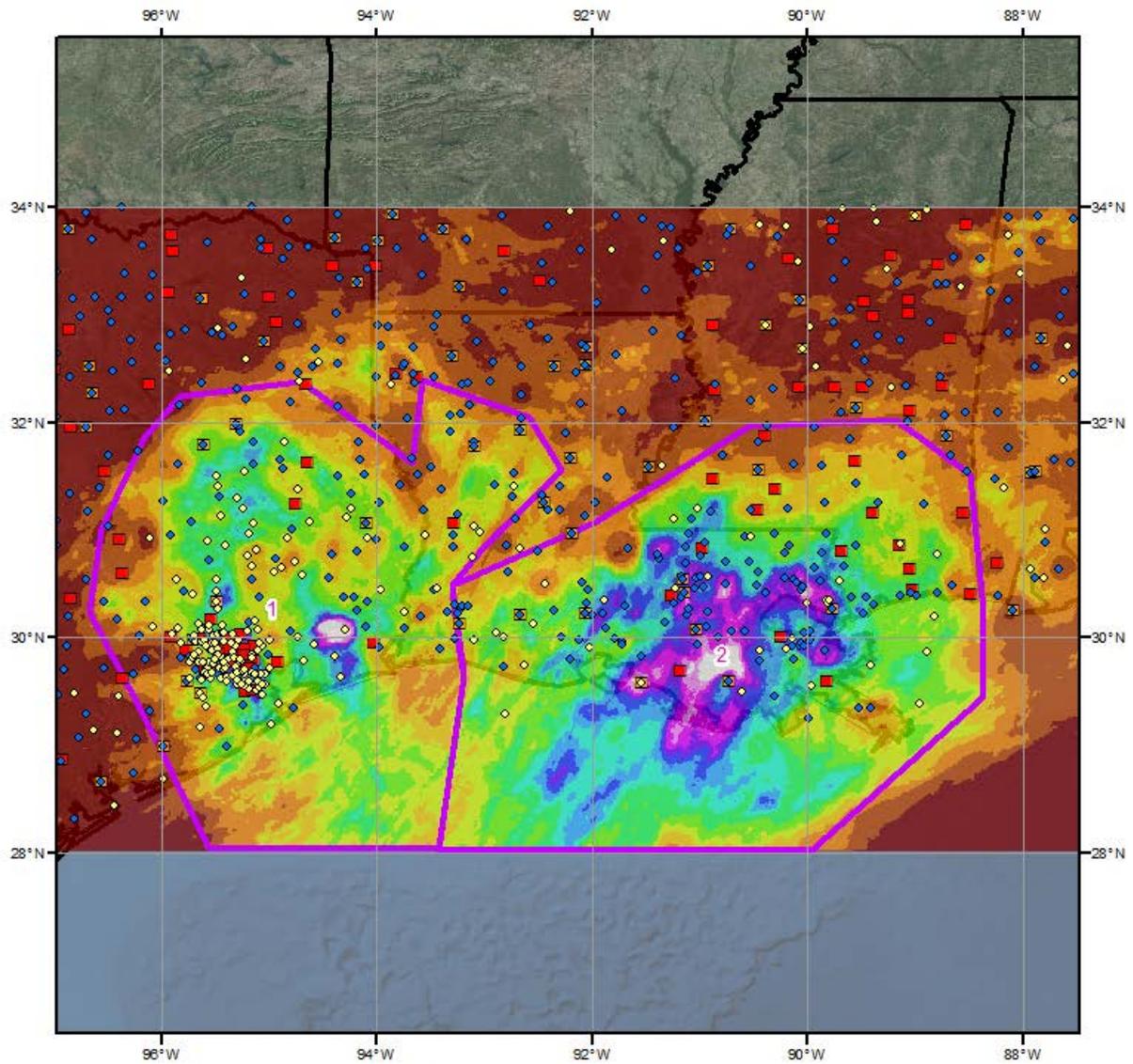
**SPAS #1464 DAD Curves Zone 1  
June 5-11, 2001**



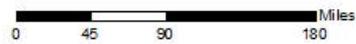
SPAS 1464 Storm Center Mass Curve Zone 1  
June 5 (1200UTC) to June 11 (1100UTC), 2001

Lat: 29.755 Lon: -95.275





**Total Storm (144-hours) Precipitation (inches)  
 June 5 (1200 UTC) - June 11 (11 UTC), 2001  
 SPAS #1464 TS Allison**



**Gauges**

- ◆ Daily
- Hourly
- Hourly Pseudo
- ◇ Supplemental

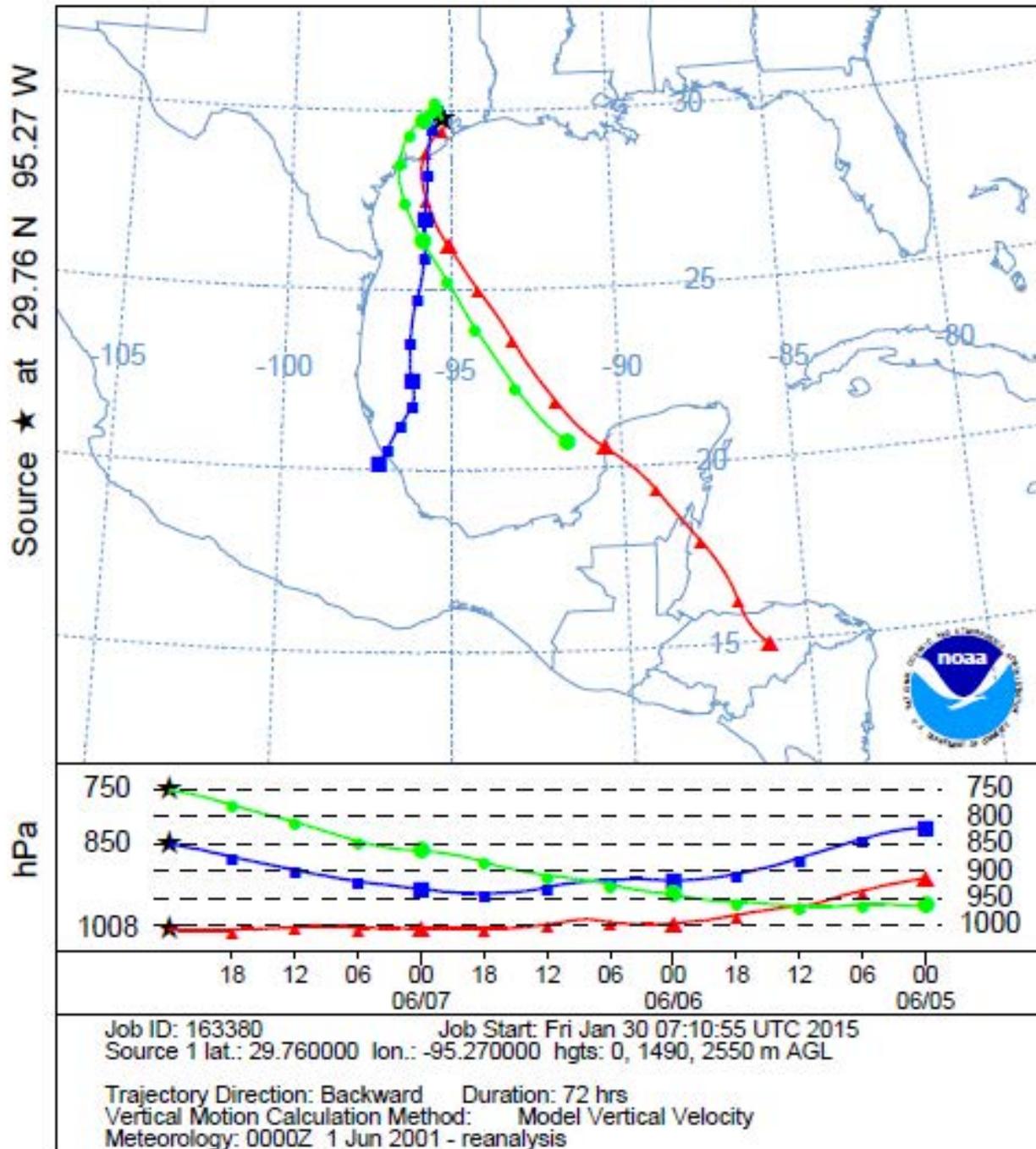
**Precipitation**

0 - 2	8.000000001 - 10	18.00000001 - 20
2.000000001 - 4	10.00000001 - 12	20.00000001 - 22
4.000000001 - 6	12.00000001 - 14	22.00000001 - 24
6.000000001 - 8	14.00000001 - 16	24.00000001 - 26
	16.00000001 - 18	26.00000001 - 28

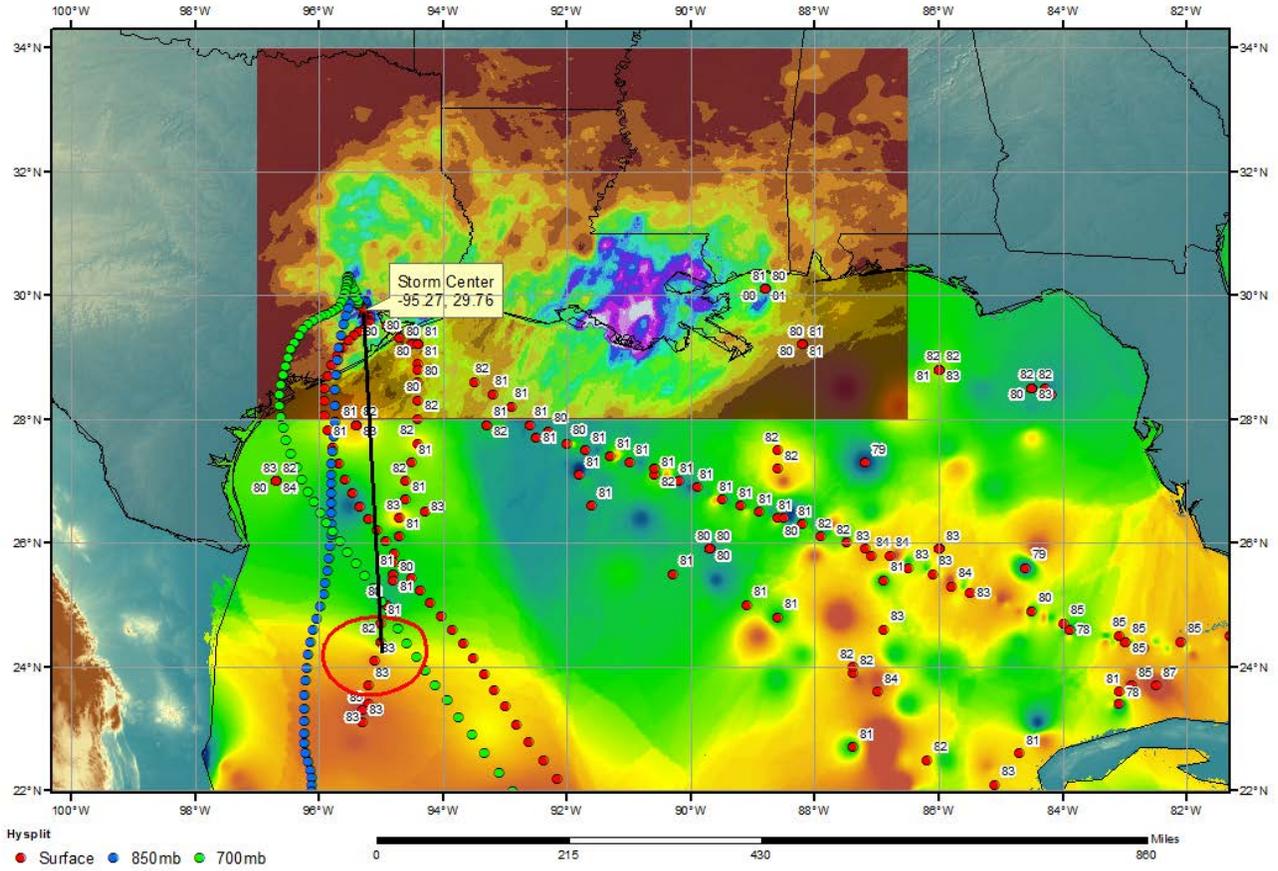


2/11/2015

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0000 UTC 08 Jun 01  
 CDC1 Meteorological Data



### SPAS 1464 TS Allison Storm Analysis Zone 1 June 8, 2001



## Storm Precipitation Analysis System (SPAS) For Storm #1631\_1

**General Storm Location:** Louisiana (32.0, -93.6, 28.5, -89.0)

**Storm Dates:** August 10 (0700 UTC) – August 14 5 (0600 UTC), 2016 (96-hours)

**Event:** Synoptic

### DAD Zone 1

**Latitude:** 30.555

**Longitude:** -90.965

**Max. Grid Rainfall Amount:** 34.65”

**Max. Observed Rainfall Amount:** 31.39”

**Number of Stations:** 278

**SPAS Version:** 10.0

**Basemap:** conus\_prism\_ppt\_in\_1981\_2010\_06 and P\_default

**Spatial resolution:** 00:00:36

**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

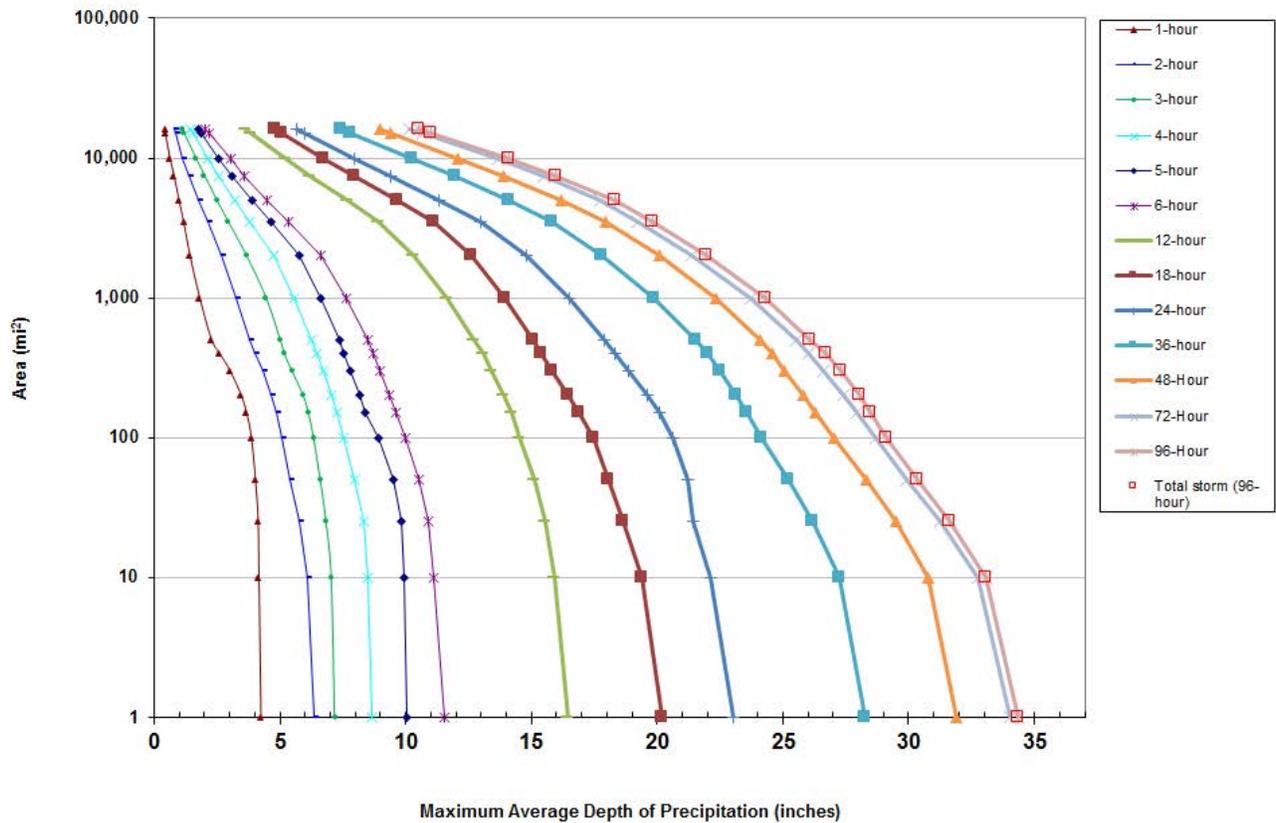
**Reliability of results:** This analysis was based on hourly data (H), hourly estimated pseudo data (HEP), hourly pseudo data (HP), daily data (D), supplemental data (S) and supplemental estimated data (SE). We have a high degree of confidence in the station based storm total results, the spatial pattern is dependent on basemap (especially weighting) and the timing is based on hourly, hourly estimated pseudo and hourly pseudo stations. Radar data was used for this event and had excellent coverage but often had different timing than observed hourly data.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1631_1	-90.965	30.555	50	100	86.50	4.77	0.04	95	4.730	87.50	87.5	4.96	0.04	97	4.920	1.040

**Storm 1631 Zone 1 - Aug. 10 (0700 UTC) - Aug. 14 (0600 UTC), 2016**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

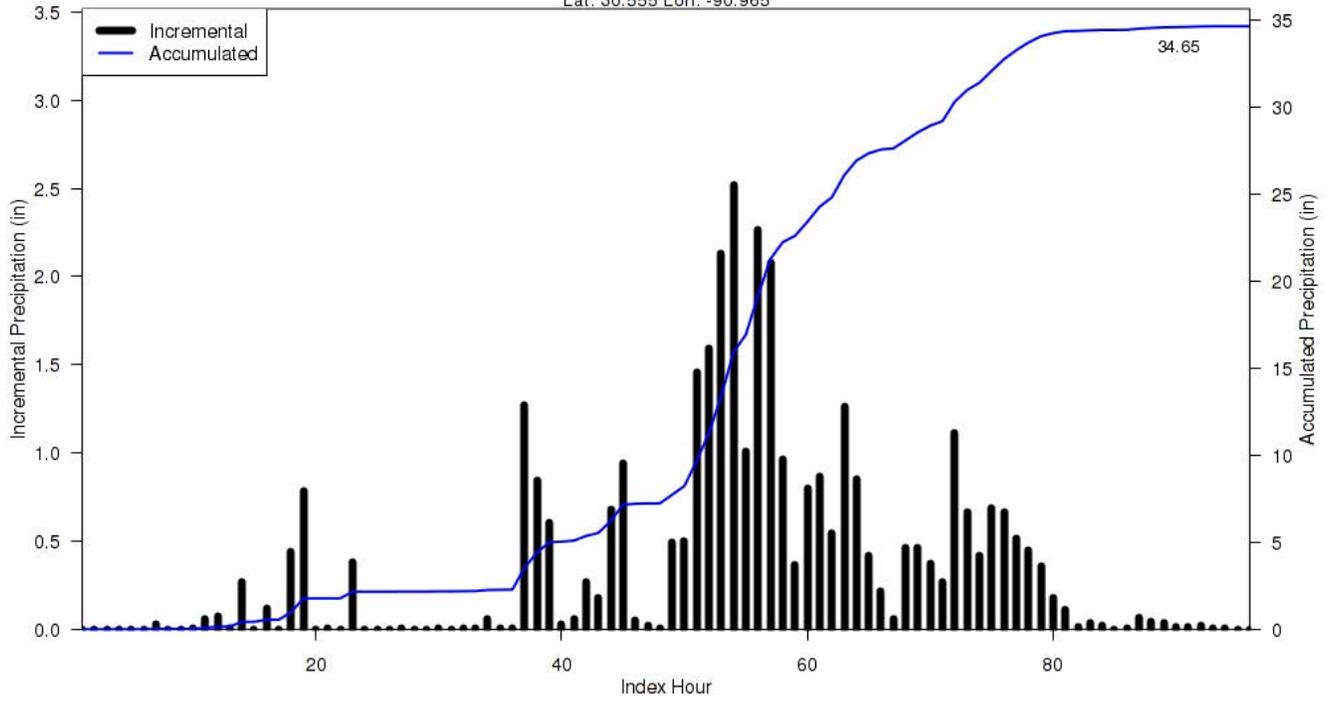
areasqmi	Duration (hours)													
	1	2	3	4	5	6	12	18	24	36	48	72	96	Total
0.4	4.25	6.39	7.24	8.71	10.11	11.64	16.59	20.36	23.25	28.53	32.17	34.35	34.65	34.65
1	4.22	6.34	7.19	8.65	10.06	11.54	16.43	20.18	23.05	28.29	31.90	34.06	34.35	34.35
10	4.14	6.07	7.06	8.50	9.93	11.12	15.92	19.38	22.14	27.25	30.77	32.74	33.08	33.08
25	4.11	5.75	6.85	8.32	9.83	10.88	15.53	18.63	21.44	26.19	29.47	31.26	31.62	31.62
50	4.00	5.40	6.62	7.98	9.52	10.52	15.10	18.07	21.19	25.23	28.31	29.94	30.34	30.34
100	3.84	5.05	6.35	7.53	8.90	9.97	14.55	17.46	20.64	24.17	27.05	28.68	29.14	29.14
150	3.65	4.84	6.15	7.27	8.40	9.60	14.22	16.91	20.10	23.56	26.31	27.97	28.49	28.49
200	3.44	4.66	5.94	7.06	8.16	9.35	13.90	16.47	19.60	23.14	25.80	27.42	28.05	28.05
300	3.00	4.34	5.49	6.72	7.79	8.98	13.43	15.83	18.87	22.47	25.08	26.63	27.30	27.30
400	2.58	4.03	5.18	6.46	7.55	8.71	13.07	15.38	18.35	21.99	24.57	26.02	26.69	26.69
500	2.26	3.78	5.02	6.25	7.35	8.50	12.74	15.05	17.91	21.55	24.08	25.52	26.09	26.09
1,000	1.79	3.25	4.46	5.58	6.64	7.66	11.66	13.95	16.50	19.85	22.31	23.72	24.31	24.31
2,000	1.41	2.67	3.68	4.74	5.75	6.60	10.33	12.63	14.82	17.81	20.07	21.39	21.95	21.95
3,500	1.15	2.14	2.95	3.81	4.63	5.35	8.92	11.12	13.01	15.79	17.94	19.25	19.83	19.83
5,000	0.97	1.77	2.49	3.22	3.89	4.51	7.71	9.68	11.31	14.13	16.21	17.74	18.30	18.30
7,500	0.77	1.41	2.00	2.57	3.09	3.59	6.20	7.94	9.40	11.97	13.91	15.49	15.99	15.99
10,000	0.61	1.14	1.65	2.14	2.59	3.02	5.23	6.73	7.95	10.27	12.10	13.66	14.09	14.09
15,000	0.43	0.83	1.19	1.54	1.89	2.20	3.85	5.05	5.96	7.80	9.41	10.69	11.03	11.03
16,075	0.41	0.78	1.11	1.44	1.76	2.05	3.61	4.79	5.66	7.41	8.95	10.16	10.50	10.50

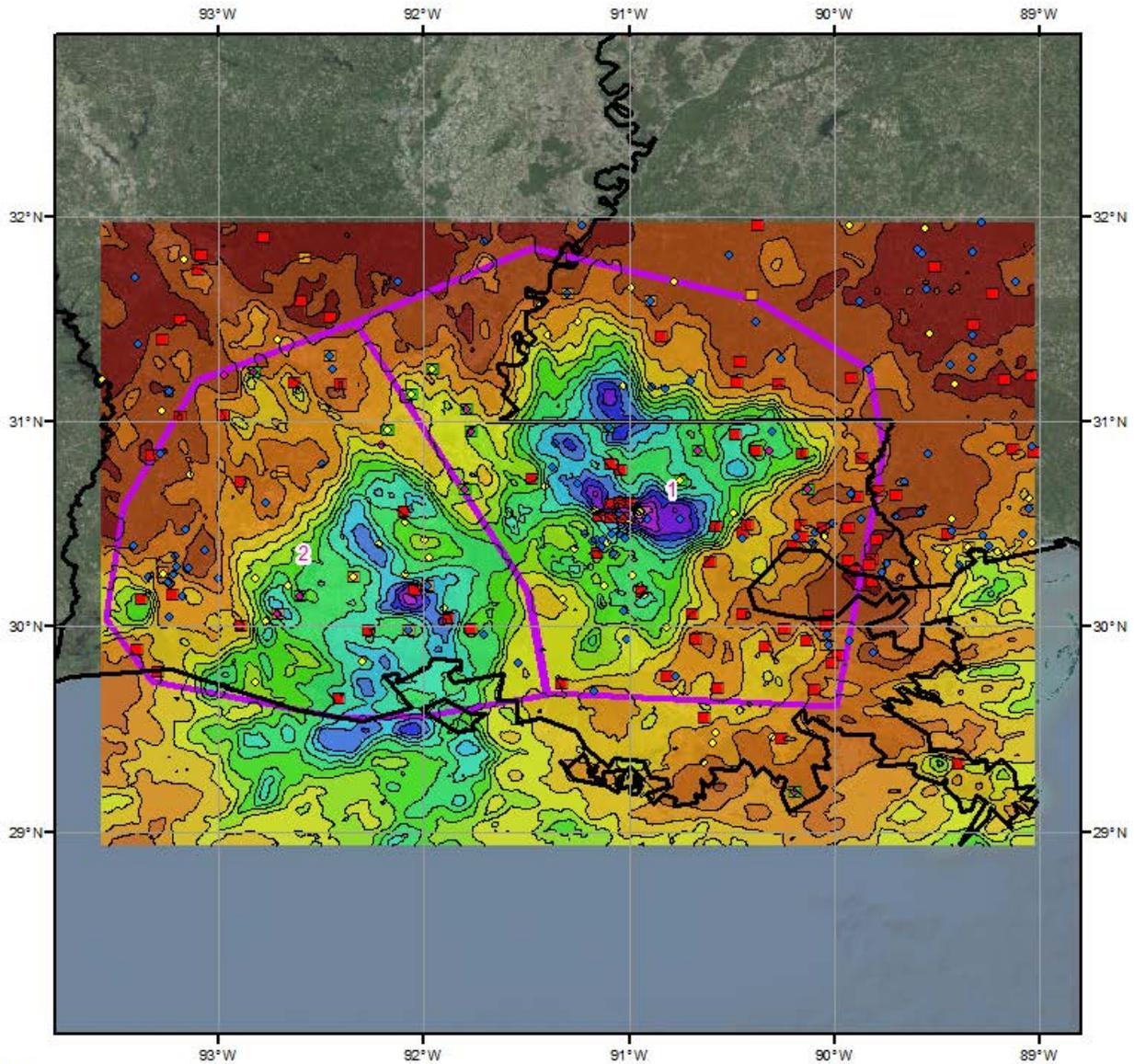
**SPAS #1631 DAD Curves Zone 1**  
**August 10-14, 2016**



SPAS 1631 Storm Center Mass Curve Zone 1  
August 10 (0700UTC) to August 14 (0600UTC), 2016

Lat: 30.555 Lon: -90.965

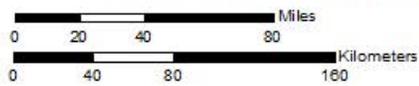




**Total Storm (96-hours) Precipitation (inches)**  
**August 10 (0700 UTC) - 14 (0600 UTC), 2005**  
**SPAS 1631 Watson, LA**

**Gauges**

- ◆ D
- H
- HEP
- HP
- ◆ S
- ◆ SE

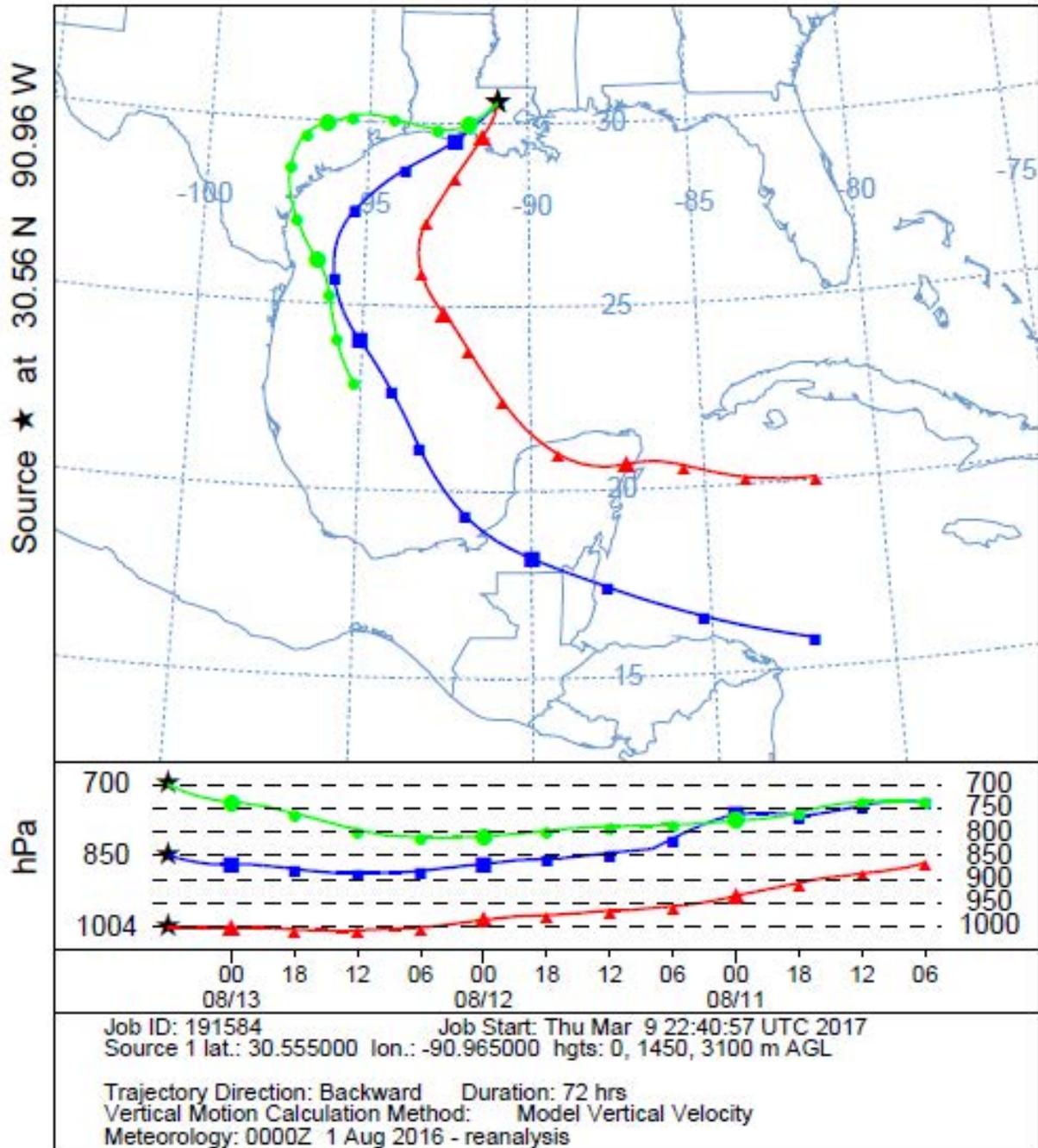


**Precipitation (inches)**

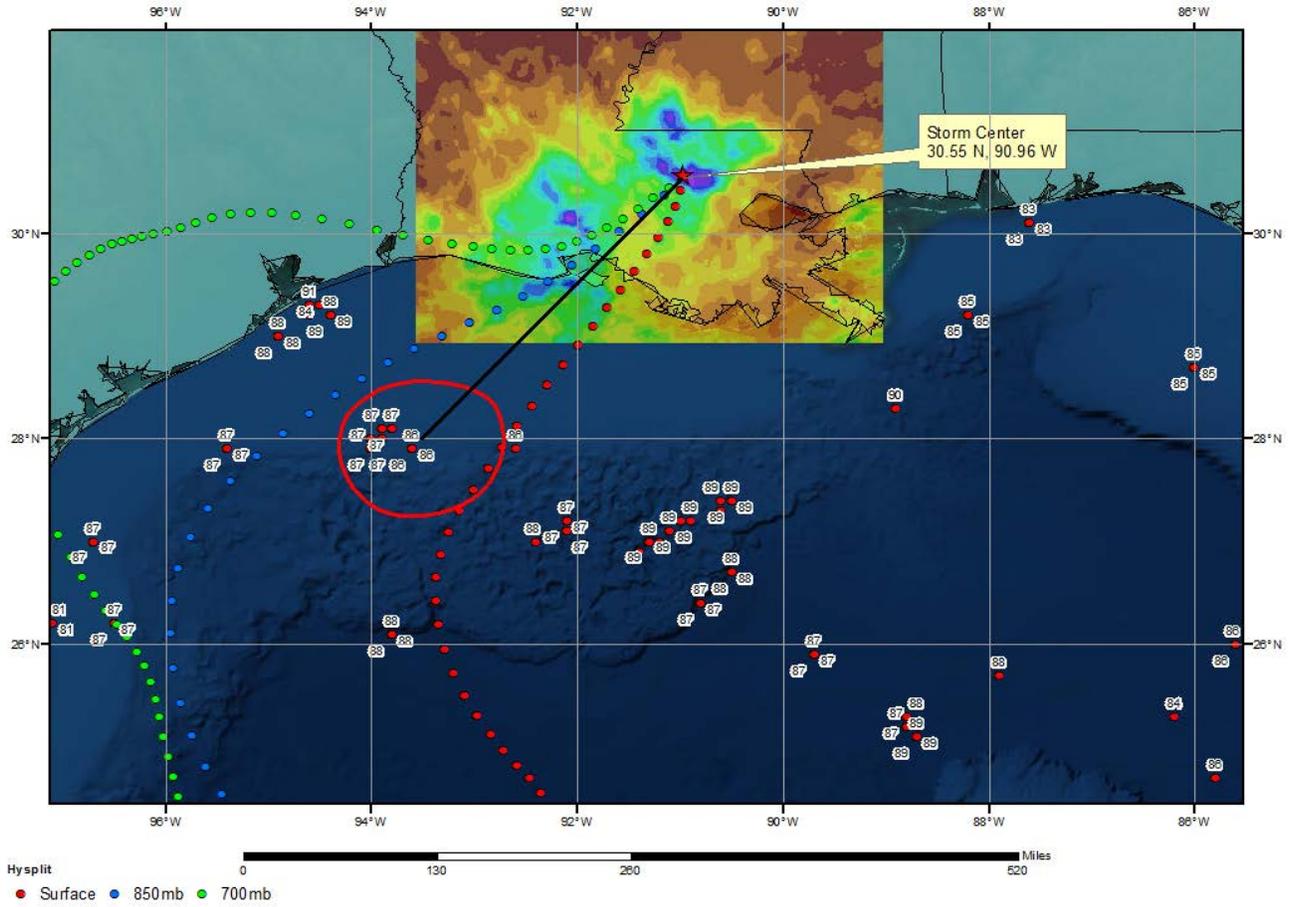
■ 0.00 - 2.00	■ 10.01 - 12.00	■ 20.01 - 22.00	■ 30.01 - 32.00
■ 2.01 - 4.00	■ 12.01 - 14.00	■ 22.01 - 24.00	■ 32.01 - 34.00
■ 4.01 - 6.00	■ 14.01 - 16.00	■ 24.01 - 26.00	■ 34.01 - 36.00
■ 6.01 - 8.00	■ 16.01 - 18.00	■ 26.01 - 28.00	
■ 8.01 - 10.00	■ 18.01 - 20.00	■ 28.01 - 30.00	



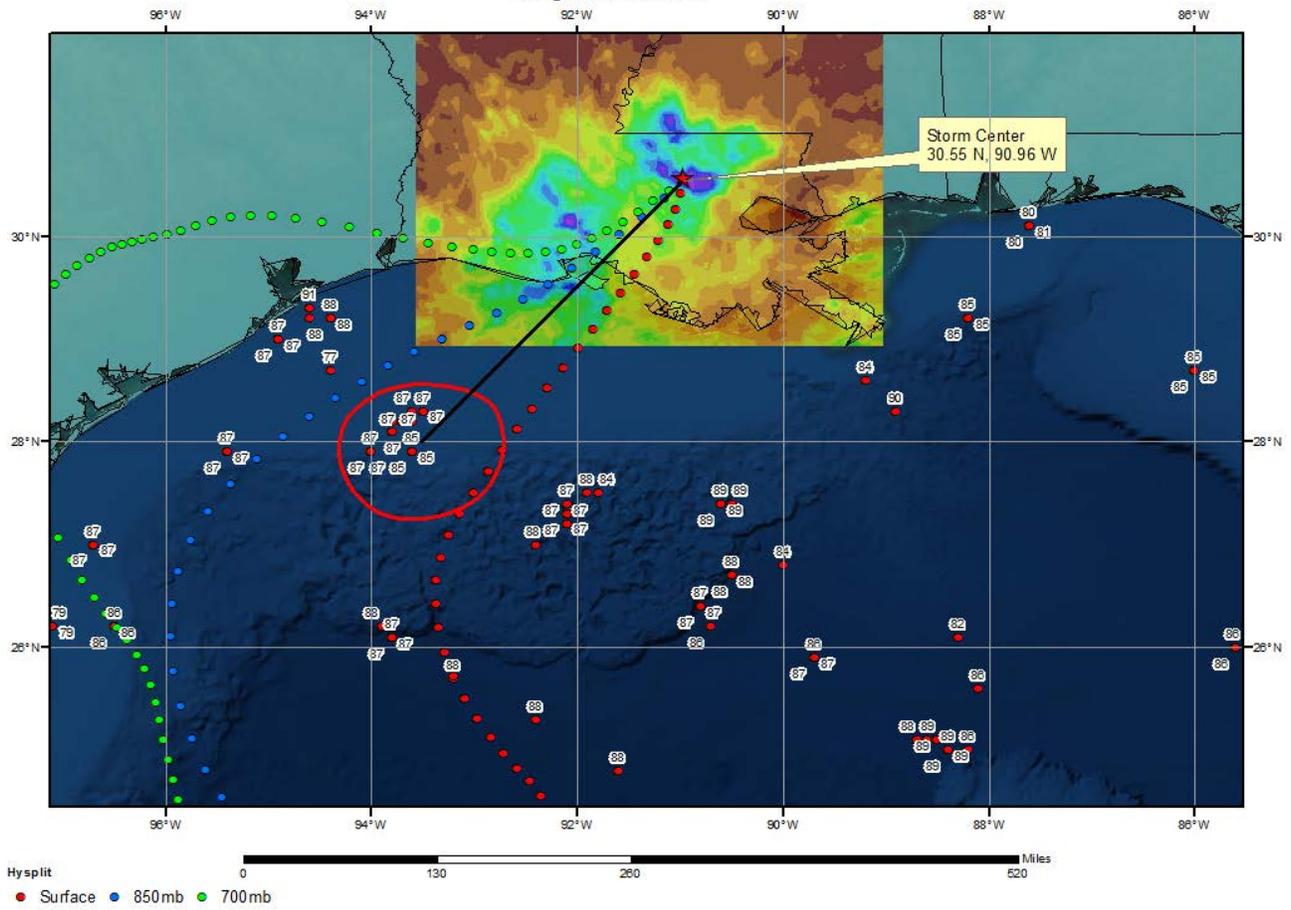
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0600 UTC 13 Aug 16  
 CDC1 Meteorological Data



### SPAS 1631 Watson, LA Storm Analysis Zone 1 August 11, 2016



### SPAS 1631 Watson, LA Storm Analysis Zone 1 August 12, 2016



## Storm Precipitation Analysis System (SPAS) For Storm #1631\_2

**General Storm Location:** Louisiana (32.0, -93.6, 28.5, -89.0)

**Storm Dates:** August 10 (0700 UTC) – August 14 5 (0600 UTC), 2016 (96-hours)

**Event:** Synoptic

### DAD Zone 2

**Latitude:** 30.145

**Longitude:** -92.085

**Max. Grid Rainfall Amount:** 28.74”

**Max. Observed Rainfall Amount:** 19.69”

**Number of Stations:** 278

**SPAS Version:** 10.0

**Basemap:** conus\_prism\_ppt\_in\_1981\_2010\_06 and P\_default

**Spatial resolution:** 00:00:36

**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

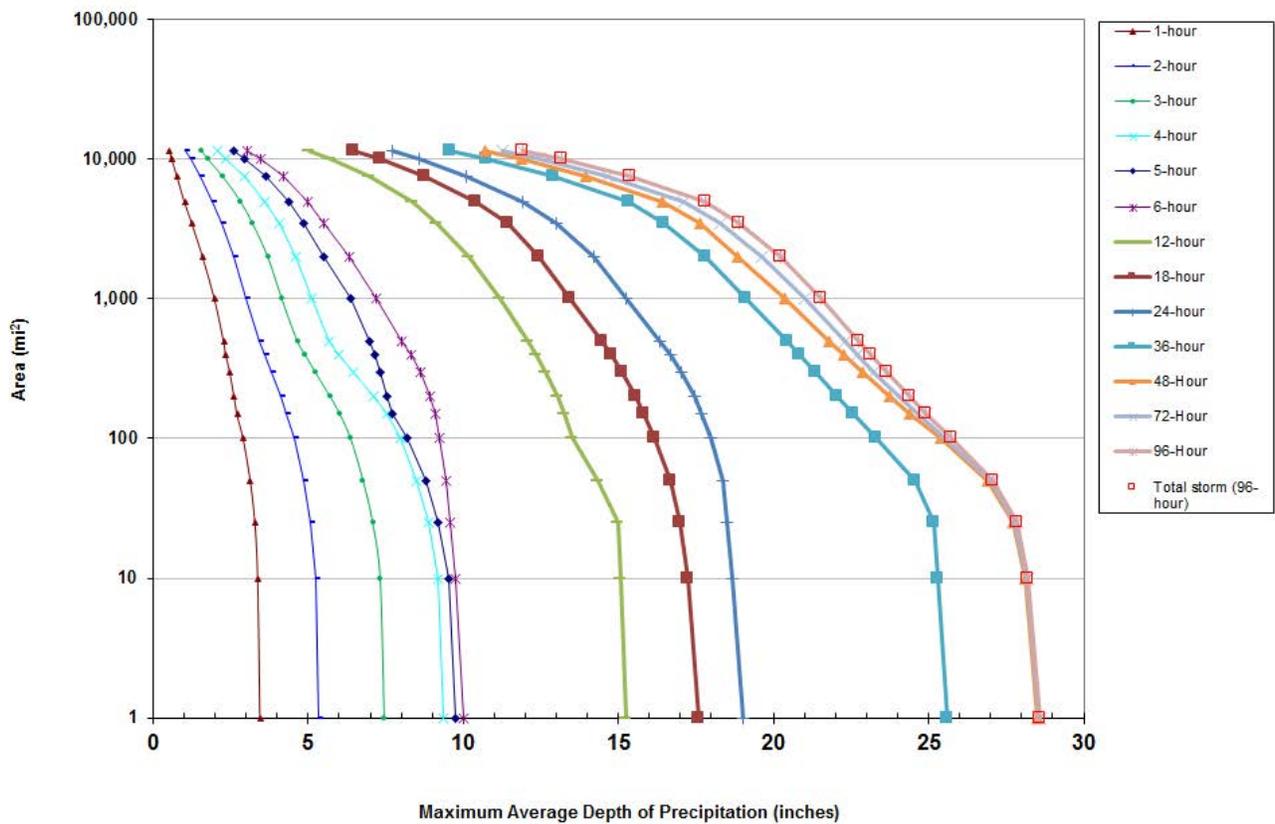
**Reliability of results:** This analysis was based on hourly data (H), hourly estimated pseudo data (HEP), hourly pseudo data (HP), daily data (D), supplemental data (S) and supplemental estimated data (SE). We have a high degree of confidence in the station based storm total results, the spatial pattern is dependent on basemap (especially weighting) and the timing is based on hourly, hourly estimated pseudo and hourly pseudo stations. Radar data was used for this event and had excellent coverage but often had different timing than observed hourly data.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1631_2	-92.085	30.145	26	0	86.50	4.77	0.00	95	4.770	87.50	87.5	4.96	0.00	97	4.960	1.040

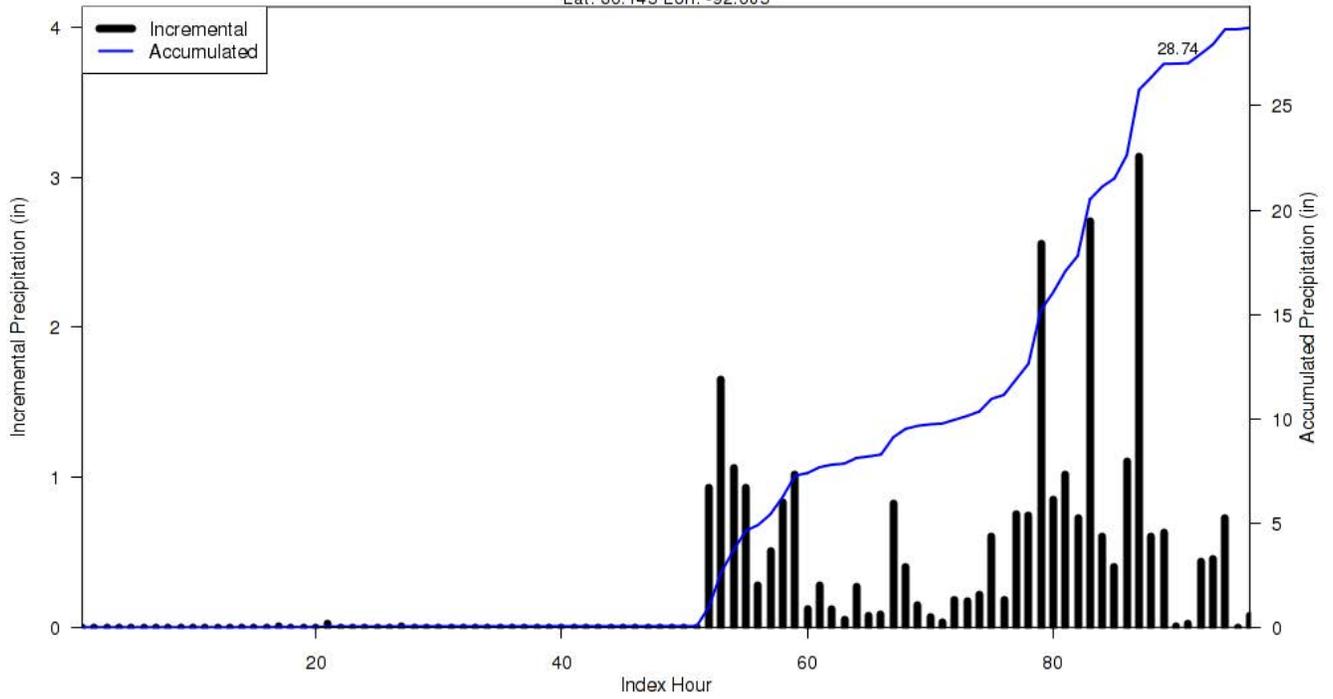
**Storm 1631 Zone 2 - Aug. 10 (0700 UTC) - Aug. 14 (0600 UTC), 2016**  
**MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)**

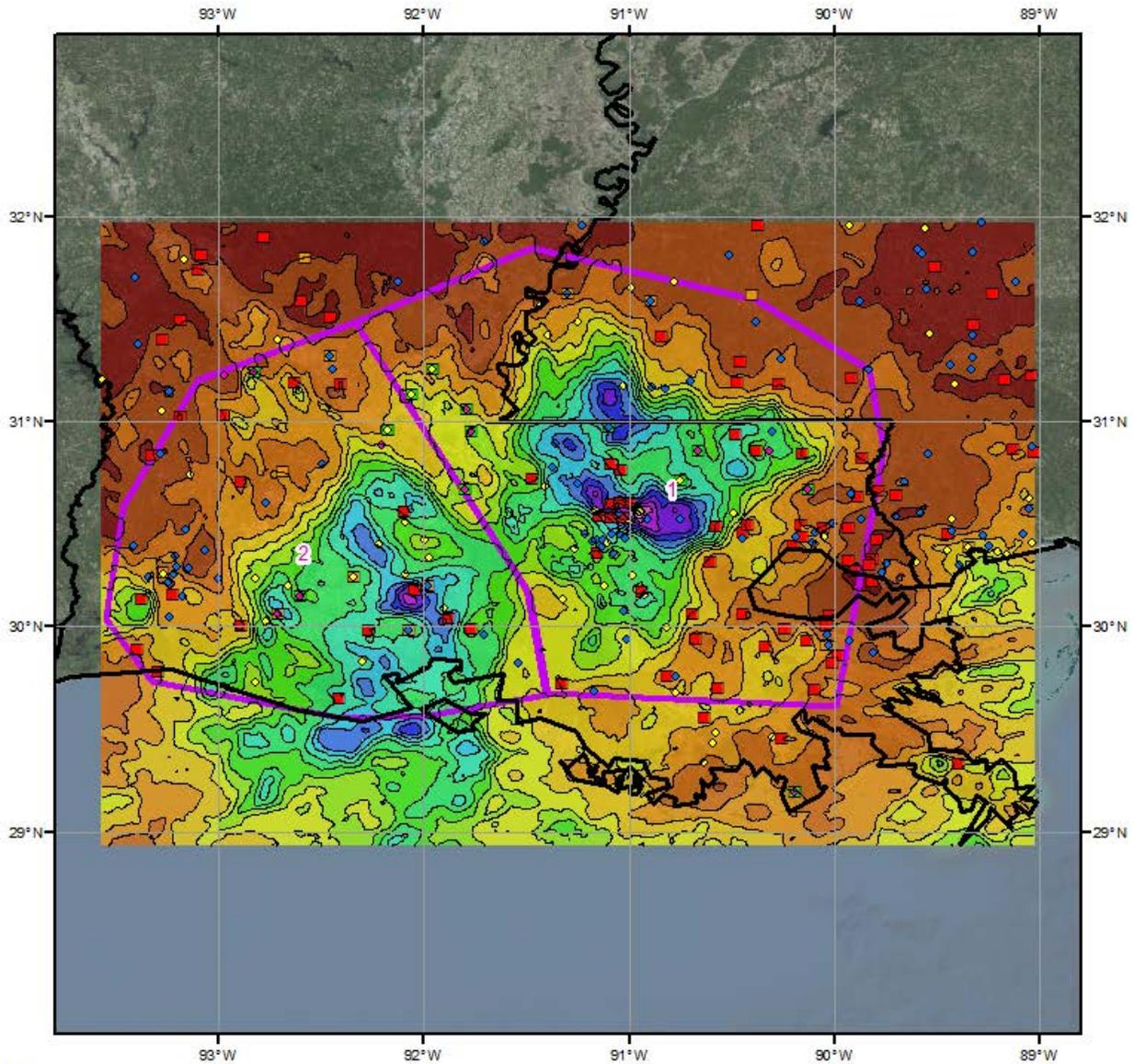
areasqmi	Duration (hours)													
	1	2	3	4	5	6	12	18	24	36	48	72	96	Total
0.4	3.48	5.38	7.51	9.41	9.81	10.07	15.30	17.73	19.16	25.73	28.68	28.70	28.74	28.74
1	3.45	5.34	7.46	9.35	9.73	10.00	15.23	17.60	19.02	25.60	28.52	28.55	28.59	28.59
10	3.38	5.23	7.33	9.18	9.51	9.73	15.07	17.25	18.66	25.28	28.12	28.17	28.20	28.20
25	3.29	5.09	7.09	8.89	9.19	9.56	14.97	17.00	18.49	25.15	27.74	27.78	27.84	27.84
50	3.14	4.85	6.78	8.50	8.79	9.43	14.33	16.68	18.35	24.57	26.92	26.97	27.08	27.08
100	2.91	4.54	6.38	7.98	8.20	9.23	13.53	16.15	17.97	23.31	25.38	25.50	25.72	25.72
150	2.71	4.30	6.03	7.52	7.69	9.08	13.26	15.82	17.69	22.57	24.39	24.63	24.92	24.92
200	2.62	4.10	5.72	7.10	7.55	8.94	13.03	15.55	17.44	22.06	23.73	24.03	24.38	24.38
300	2.48	3.80	5.24	6.46	7.34	8.63	12.65	15.11	17.02	21.37	22.86	23.24	23.64	23.64
400	2.35	3.59	4.91	6.00	7.15	8.30	12.33	14.76	16.66	20.85	22.25	22.70	23.14	23.14
500	2.28	3.43	4.66	5.66	6.98	8.01	12.07	14.46	16.32	20.44	21.77	22.29	22.75	22.75
1,000	1.99	3.00	4.16	5.13	6.35	7.21	11.18	13.45	15.27	19.10	20.34	21.03	21.52	21.52
2,000	1.61	2.60	3.71	4.61	5.49	6.33	10.19	12.44	14.22	17.79	18.86	19.61	20.21	20.21
3,500	1.26	2.20	3.21	4.06	4.85	5.50	9.12	11.42	12.99	16.47	17.65	18.30	18.90	18.90
5,000	1.02	1.90	2.83	3.61	4.39	5.00	8.34	10.41	11.93	15.32	16.40	17.10	17.81	17.81
7,500	0.79	1.52	2.27	2.96	3.66	4.21	6.97	8.75	10.09	12.92	13.94	14.63	15.39	15.39
10,000	0.62	1.20	1.79	2.35	2.95	3.47	5.73	7.31	8.56	10.74	11.85	12.46	13.19	13.19
11,596	0.54	1.04	1.57	2.06	2.59	3.04	5.02	6.44	7.70	9.59	10.69	11.25	11.93	11.93

**SPAS #1631 DAD Curves Zone 2**  
**August 10-14, 2016**



SPAS 1631 Storm Center Mass Curve Zone 2  
August 10 (0700UTC) to August 14 (0600UTC), 2016  
Lat: 30.145 Lon: -92.085

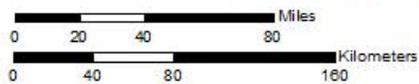




**Total Storm (96-hours) Precipitation (inches)**  
**August 10 (0700 UTC) - 14 (0600 UTC), 2005**  
**SPAS 1631 Watson, LA**

**Gauges**

- ◆ D
- H
- HEP
- HP
- ◆ S
- ◆ SE

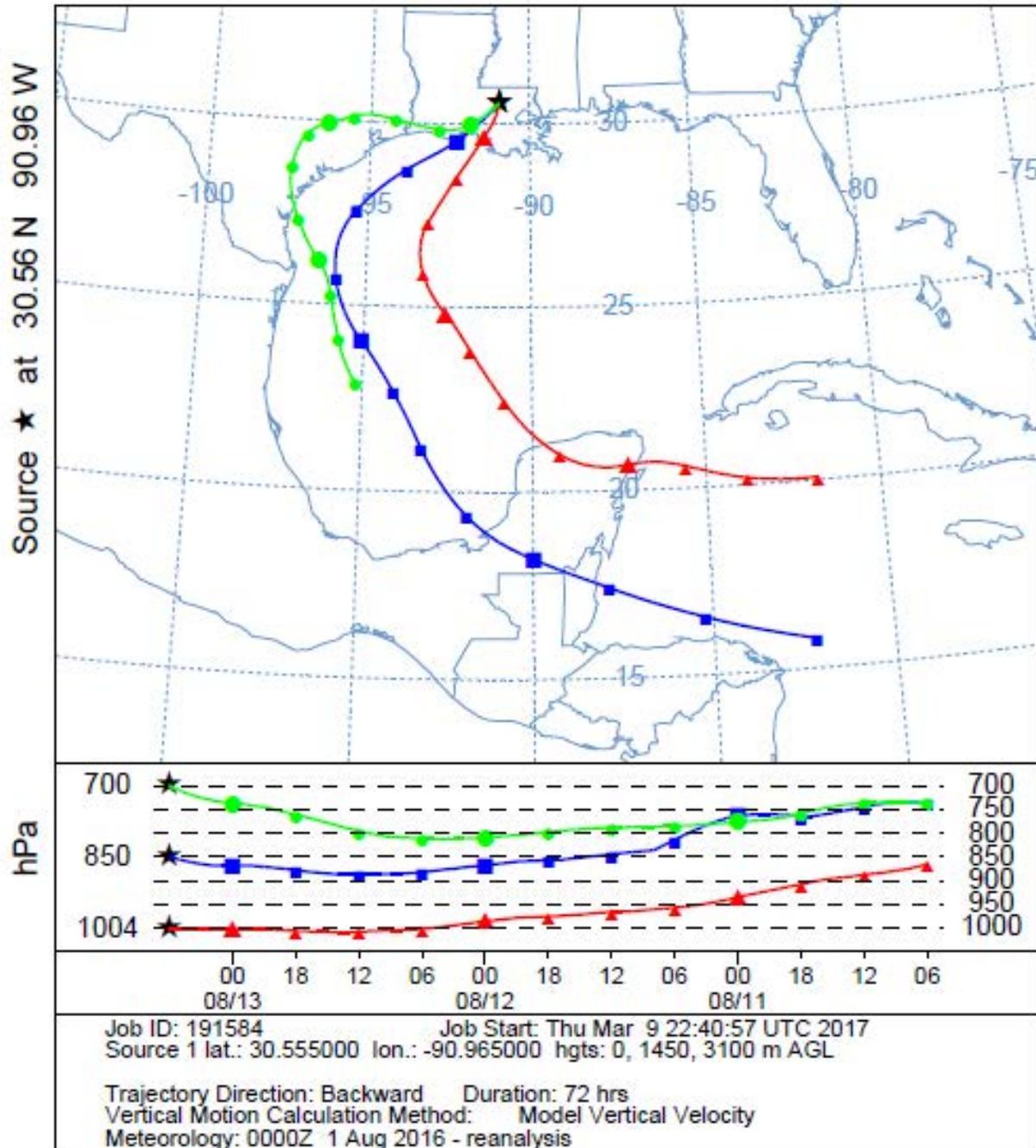


**Precipitation (inches)**

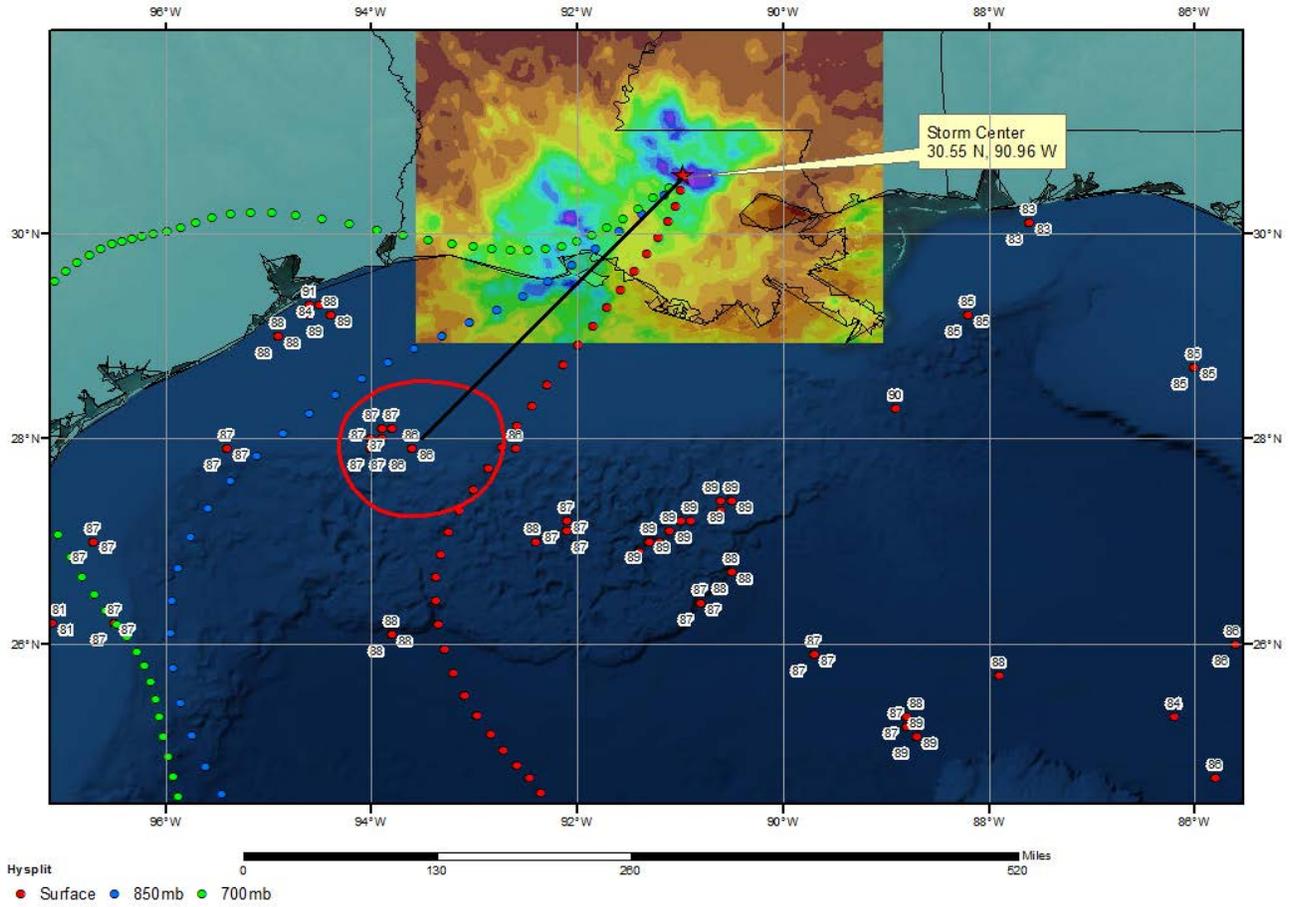
0.00 - 2.00	10.01 - 12.00	20.01 - 22.00	30.01 - 32.00
2.01 - 4.00	12.01 - 14.00	22.01 - 24.00	32.01 - 34.00
4.01 - 6.00	14.01 - 16.00	24.01 - 26.00	34.01 - 36.00
6.01 - 8.00	16.01 - 18.00	26.01 - 28.00	
8.01 - 10.00	18.01 - 20.00	28.01 - 30.00	



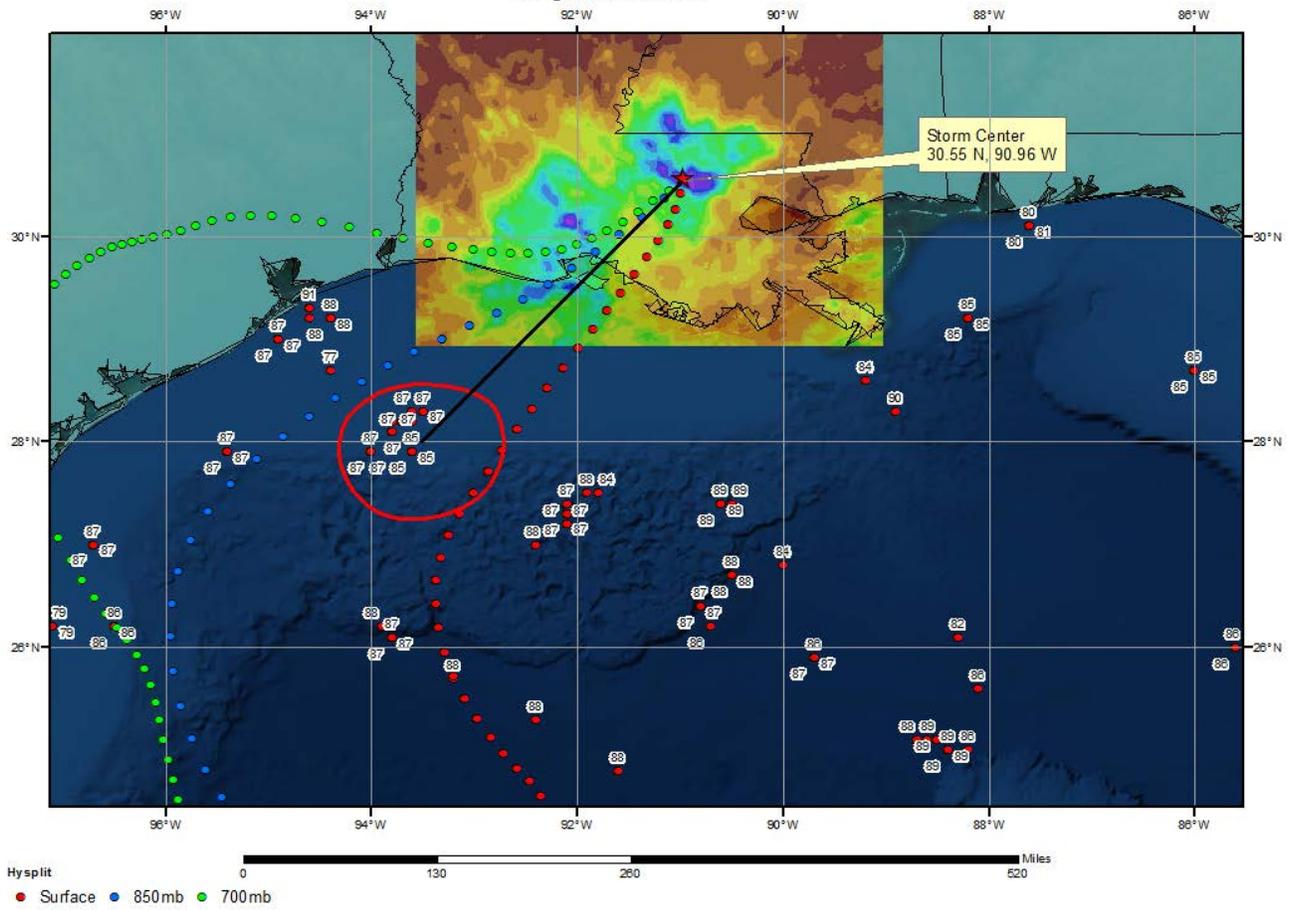
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0600 UTC 13 Aug 16  
 CDC1 Meteorological Data



### SPAS 1631 Watson, LA Storm Analysis Zone 1 August 11, 2016



### SPAS 1631 Watson, LA Storm Analysis Zone 1 August 12, 2016



## Storm Precipitation Analysis System (SPAS) For Storm #1667\_1

**General Storm Location:** Nederland, TX

**Storm Dates:** August 25-31, 2017 (156-hours)

**Event:** Hurricane Harvey

### DAD Zone 1

**Latitude:** 29.9650

**Longitude:** -93.9150

**Max. Grid Rainfall Amount:** 61.10"

**Max. Observed Rainfall Amount:** 60.56"

**Number of Stations:** 1302

**SPAS Version:** 10.0

**Basemap:** Default ZR Total Precipitation

**Spatial resolution:** 0.01 dd

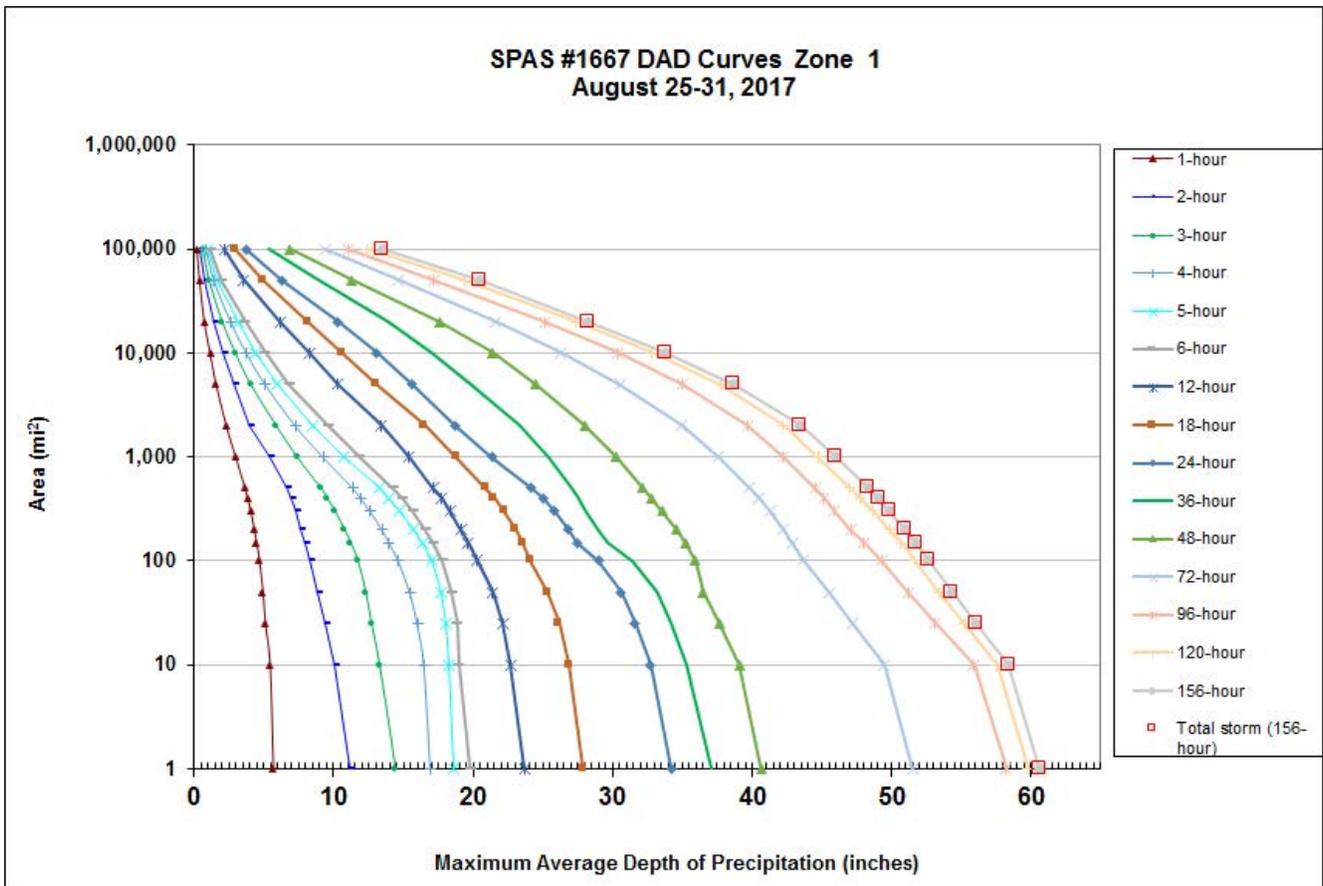
**Radar Included:** Yes

**Depth-Area-Duration (DAD) analysis:** Yes

**Reliability of results:** This analysis was based on 1302 hourly stations, daily data, supplemental station data, and radar data. We have a good degree of confidence for the station based storm total results. The spatial pattern is dependent on the radar data, gauge data, and basemap. There is a good degree of confidence with the timing based on the hourly stations near the storm center. Some daily stations were moved to supplemental due to timing issues.

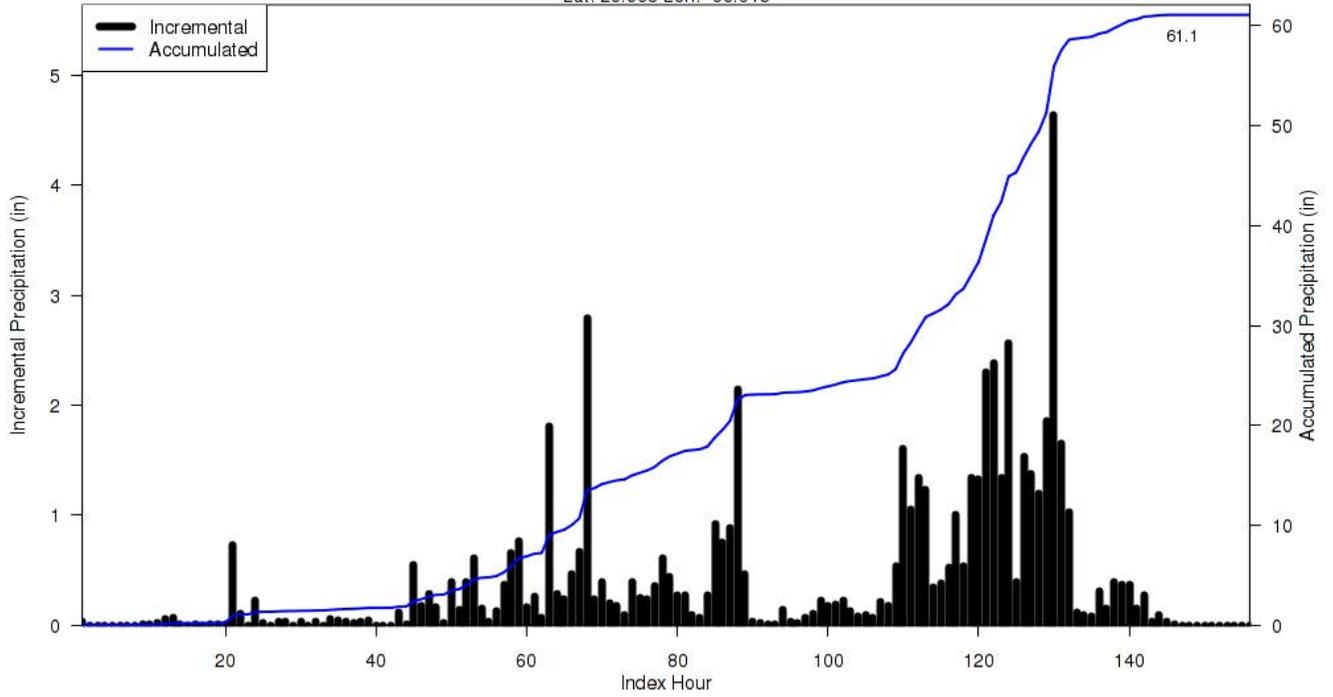
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1667_1	-93.915	29.965	30	0	86.00	4.67	0.00	94	4.670	87.08	87.0	4.86	0.00	96	4.860	1.041

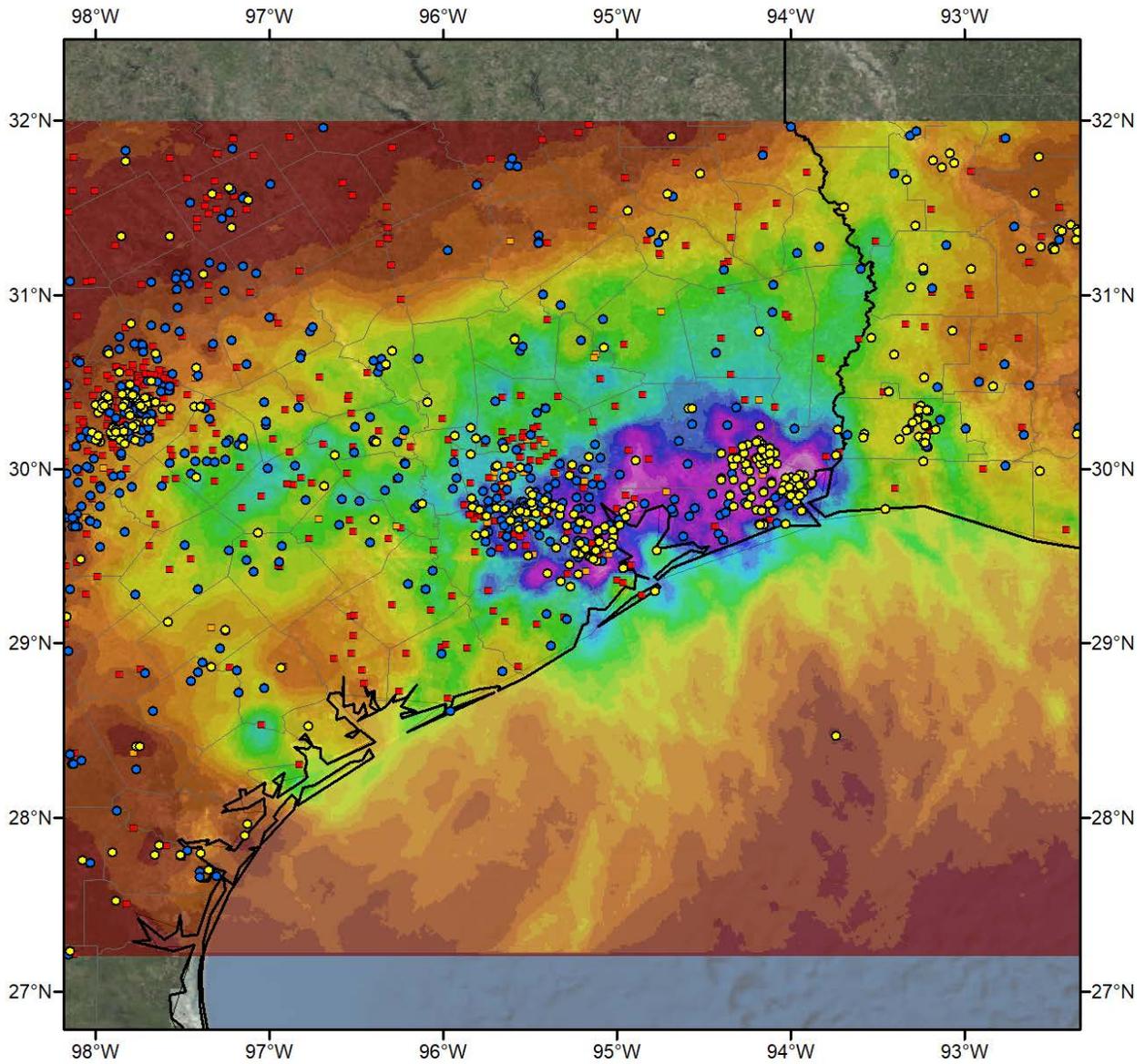
Storm 1667 - August 25 (0700 UTC) - August 31 (1800 UTC), 2017																
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)																
Area (mi <sup>2</sup> )	Duration (hours)															
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	156	Total
0.4	5.80	11.47	14.56	17.08	18.76	19.93	23.92	28.16	34.52	37.39	40.95	51.84	58.62	60.25	61.11	61.11
1	5.64	11.18	14.38	16.94	18.63	19.76	23.67	27.88	34.19	37.04	40.61	51.48	58.23	59.78	60.62	60.62
10	5.40	10.04	13.25	16.48	18.28	18.98	22.68	26.86	32.72	35.34	39.07	49.43	55.91	57.53	58.36	58.36
25	5.07	9.37	12.68	15.99	18.03	18.85	22.11	26.19	31.60	34.18	37.64	47.20	53.09	55.15	56.06	56.06
50	4.90	8.84	12.27	15.46	17.68	18.47	21.37	25.35	30.62	33.17	36.49	45.49	51.16	53.37	54.31	54.31
100	4.65	8.25	11.71	14.64	17.01	17.79	20.29	24.09	28.98	31.40	35.93	43.68	49.29	51.66	52.67	52.67
150	4.45	7.92	11.20	13.98	16.34	17.13	19.64	23.56	27.45	29.59	35.19	42.85	48.01	50.68	51.73	51.73
200	4.28	7.67	10.77	13.46	15.73	16.58	19.12	23.06	26.81	28.97	34.57	42.27	47.04	49.83	51.01	51.01
300	4.03	7.24	10.09	12.64	14.74	15.67	18.35	22.22	25.81	28.13	33.54	41.28	45.90	48.66	49.86	49.86
400	3.81	6.95	9.54	11.94	13.99	14.91	17.71	21.52	24.98	27.55	32.75	40.47	45.10	47.75	49.06	49.06
500	3.63	6.61	9.08	11.39	13.27	14.22	17.14	20.88	24.18	27.07	32.15	39.80	44.50	47.01	48.34	48.34
1,000	2.96	5.40	7.36	9.23	10.76	11.88	15.42	18.81	21.34	25.41	30.24	37.57	42.27	44.73	46.03	46.03
2,000	2.30	4.00	5.87	7.24	8.55	9.57	13.40	16.53	18.70	23.35	27.98	34.95	39.66	42.23	43.44	43.44
5,000	1.57	2.82	4.03	5.06	5.98	6.82	10.33	13.10	15.65	19.87	24.52	30.54	35.04	37.73	38.71	38.71
10,000	1.14	2.04	2.92	3.71	4.43	5.08	8.23	10.59	13.06	17.01	21.37	26.28	30.36	32.83	33.77	33.77
20,000	0.73	1.37	1.99	2.59	3.15	3.63	6.13	8.16	10.29	13.90	17.59	21.62	25.09	27.36	28.23	28.23
50,000	0.39	0.70	1.03	1.37	1.68	1.96	3.52	4.94	6.28	8.93	11.31	14.62	17.14	19.33	20.46	20.46
100,000	0.20	0.40	0.59	0.81	0.99	1.17	2.17	2.95	3.70	5.36	6.85	9.34	11.03	12.43	13.44	13.44



SPAS 1667 Storm Center Mass Curve Zone 1  
August 25 (0700UTC) to August 31 (1800UTC), 2017

Lat: 29.965 Lon: -93.915

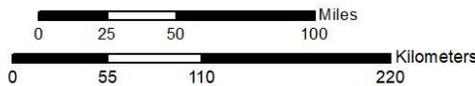




**Total Storm (156-hr) Precipitation (inches)**  
**8/25/2017 0700 UTC - 8/31/2017 1800 UTC**  
**SPAS-NEXRAD 1667**

**Gauges**

- Daily
- Hourly
- Hourly Est. Pseudo
- Hourly Pseudo
- Supplemental



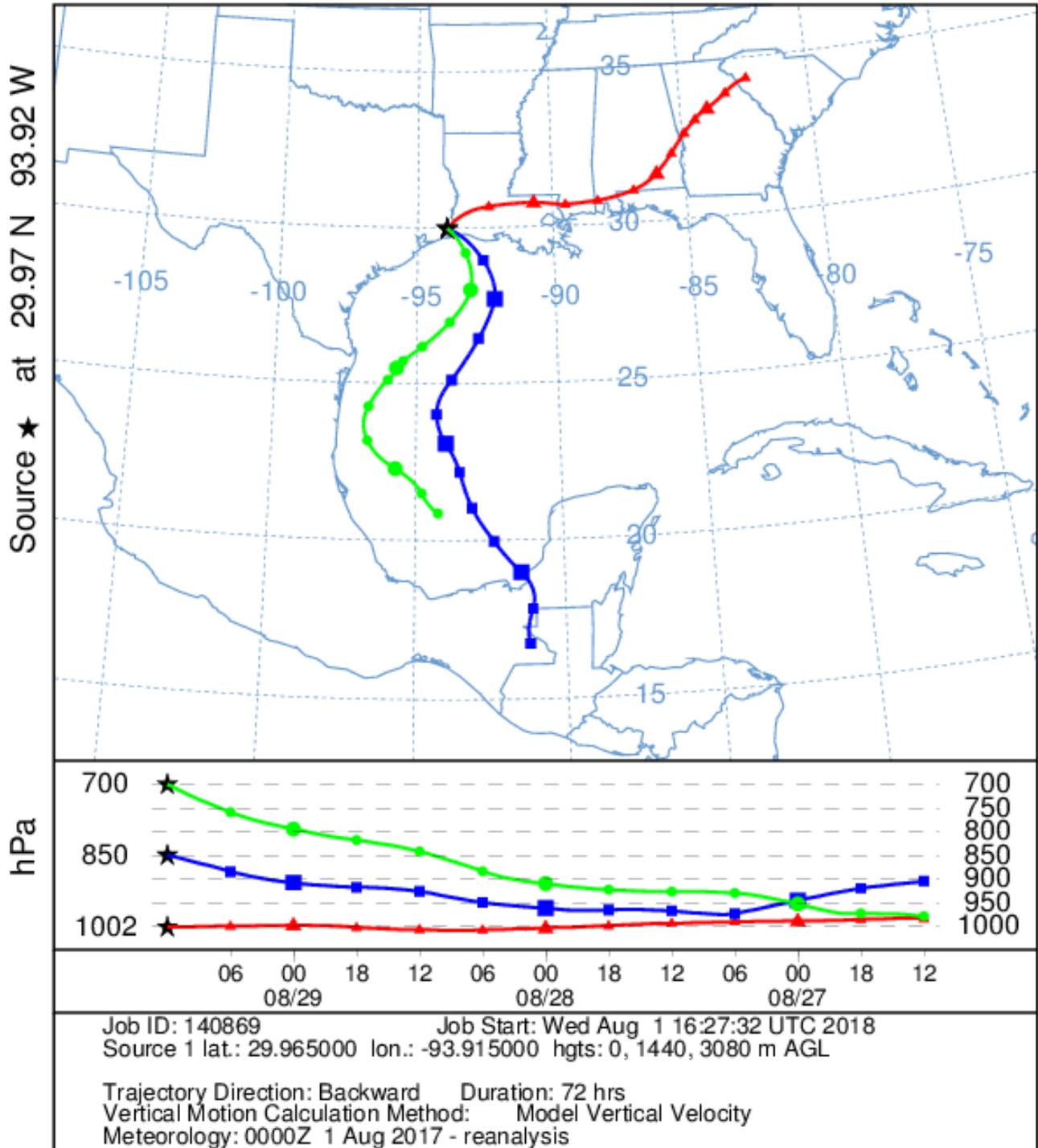
**Precipitation (inches)**

0.00 - 2.00	10.01 - 12.00	20.01 - 22.00	30.01 - 32.00	40.01 - 45.00
2.01 - 4.00	12.01 - 14.00	22.01 - 24.00	32.01 - 34.00	45.01 - 50.00
4.01 - 6.00	14.01 - 16.00	24.01 - 26.00	34.01 - 36.00	50.01 - 55.00
6.01 - 8.00	16.01 - 18.00	26.01 - 28.00	36.01 - 38.00	55.01 - 60.00
8.01 - 10.00	18.01 - 20.00	28.01 - 30.00	38.01 - 40.00	60.01 - 62.00

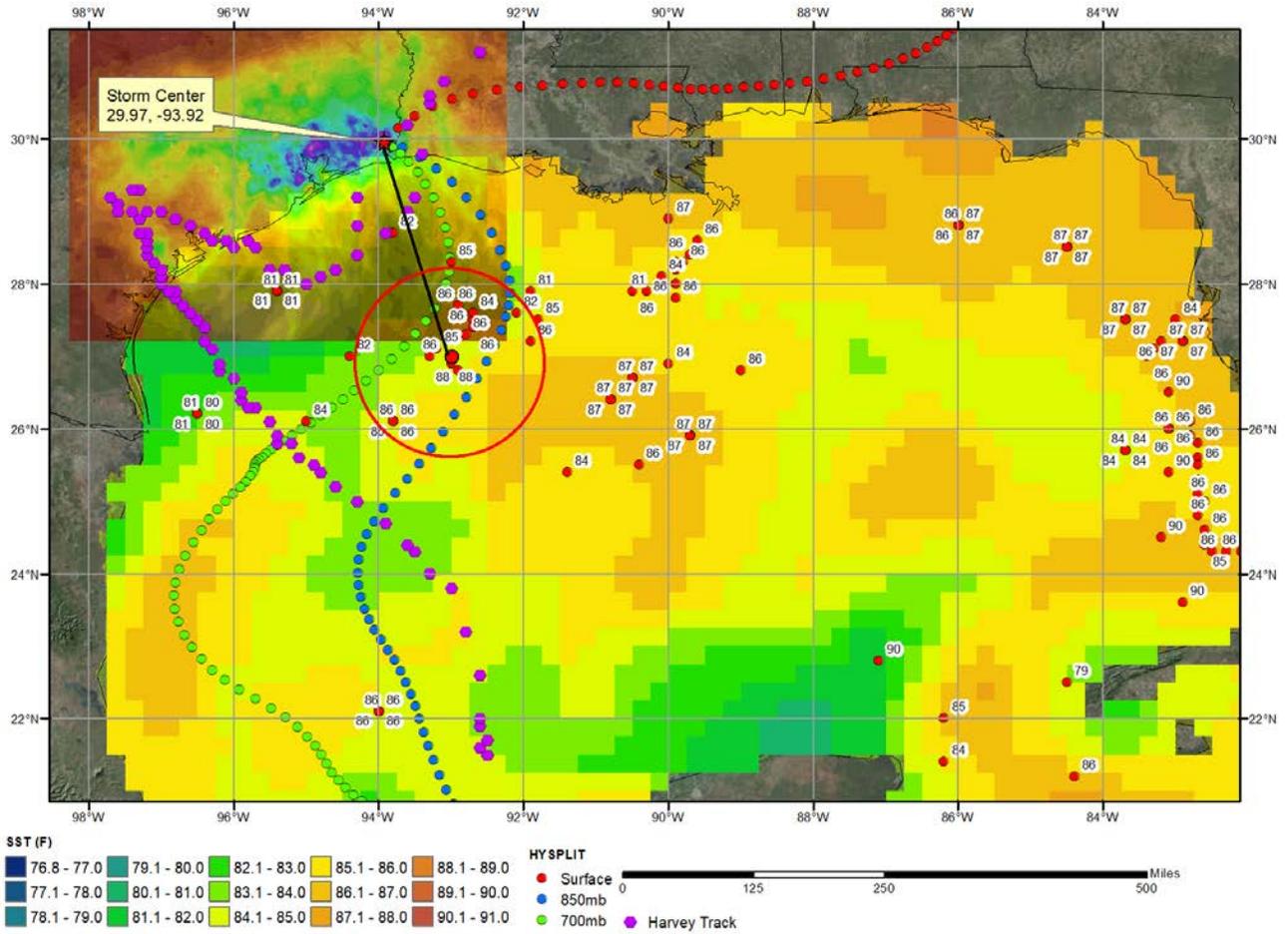


7/20/2018

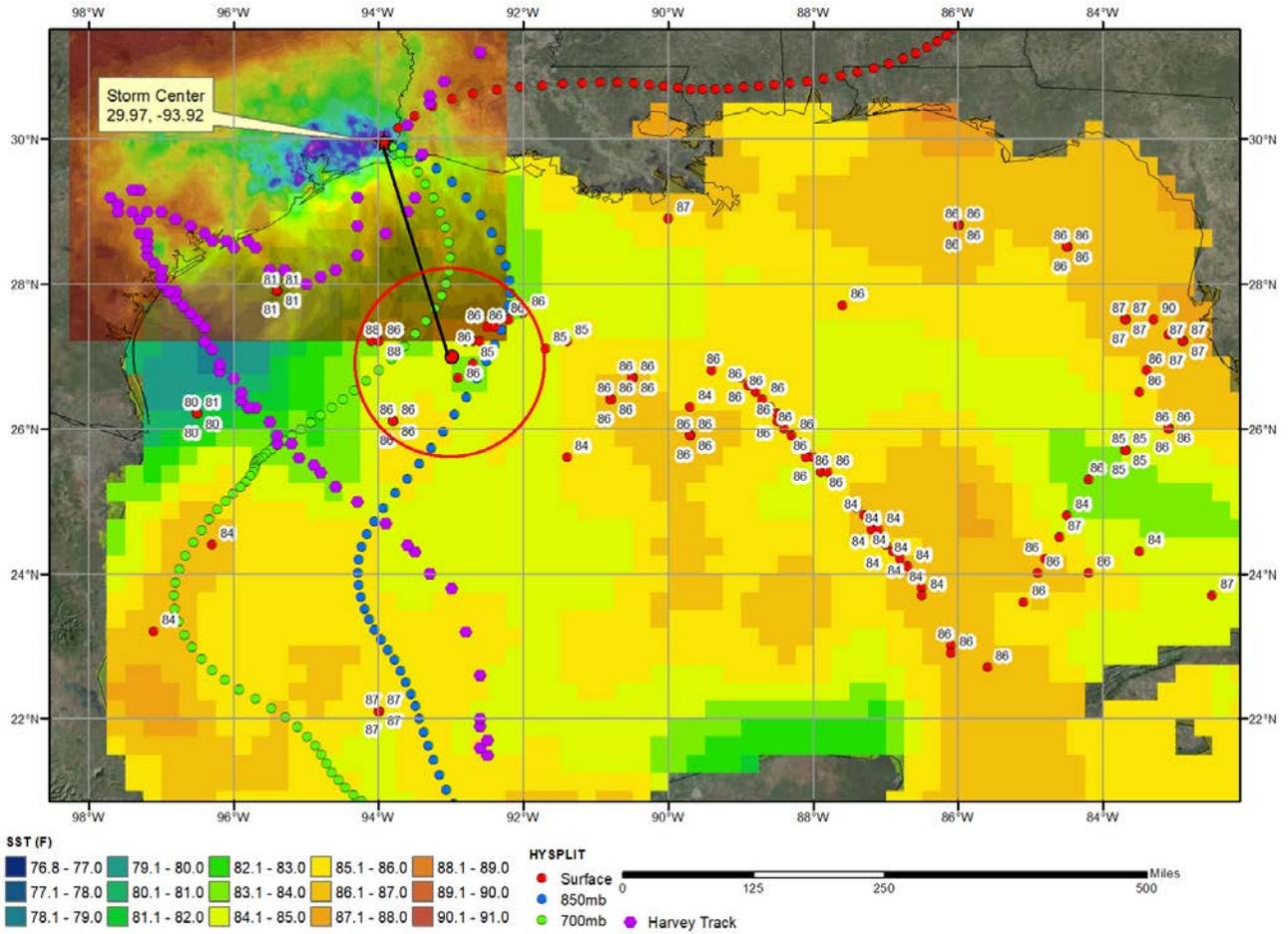
NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 29 Aug 17  
 CDC1 Meteorological Data



### SPAS 1667 Harvey, TX Storm Analysis August 28, 2017



### SPAS 1667 Harvey, TX Storm Analysis August 29, 2017



## **Hybrid Storms**

## Storm Precipitation Analysis System (SPAS) For Storm #1294\_1

### A re-run of SPAS #1008

\*\*\* Update addressed excess precipitation above 7500ft, created 2 DAD zones based on 7500ft elevation.

**General Storm Location:** Colorado Front Range, adjacent high plains and extreme northeastern New Mexico.

**Storm Dates:** June 3-4, 1921 (24-hours)

**Event:** Thunderstorm “cloudburst”

#### DAD Zone 1 (<7500ft)

**Latitude:** 38.4638

**Longitude:** -105.0705

**Max. Grid Rainfall Amount:** 12.19”

**Max. Observed Rainfall Amount:** 12.00” (Penrose, CO)

**Number of Stations:** 76 (0 Daily, 1 Hourly, 0 Hourly Estimated, 0 Hourly Pseudo, 65 Supplemental, and 10 Supplemental Estimated)

**SPAS Version:** 9.5

**Basemap:** Final SPAS #1008 Precip Map, which used June 1965 Total Precipitation PRISM Grid

**Spatial resolution:** 30 seconds

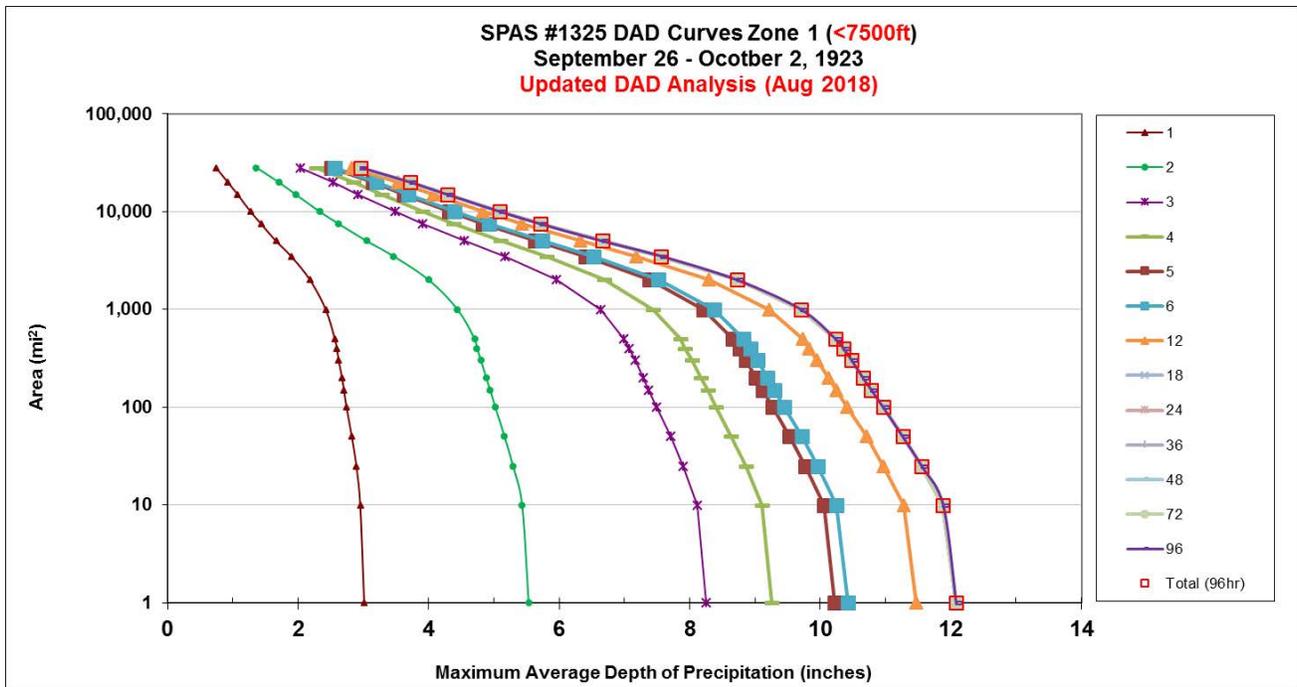
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

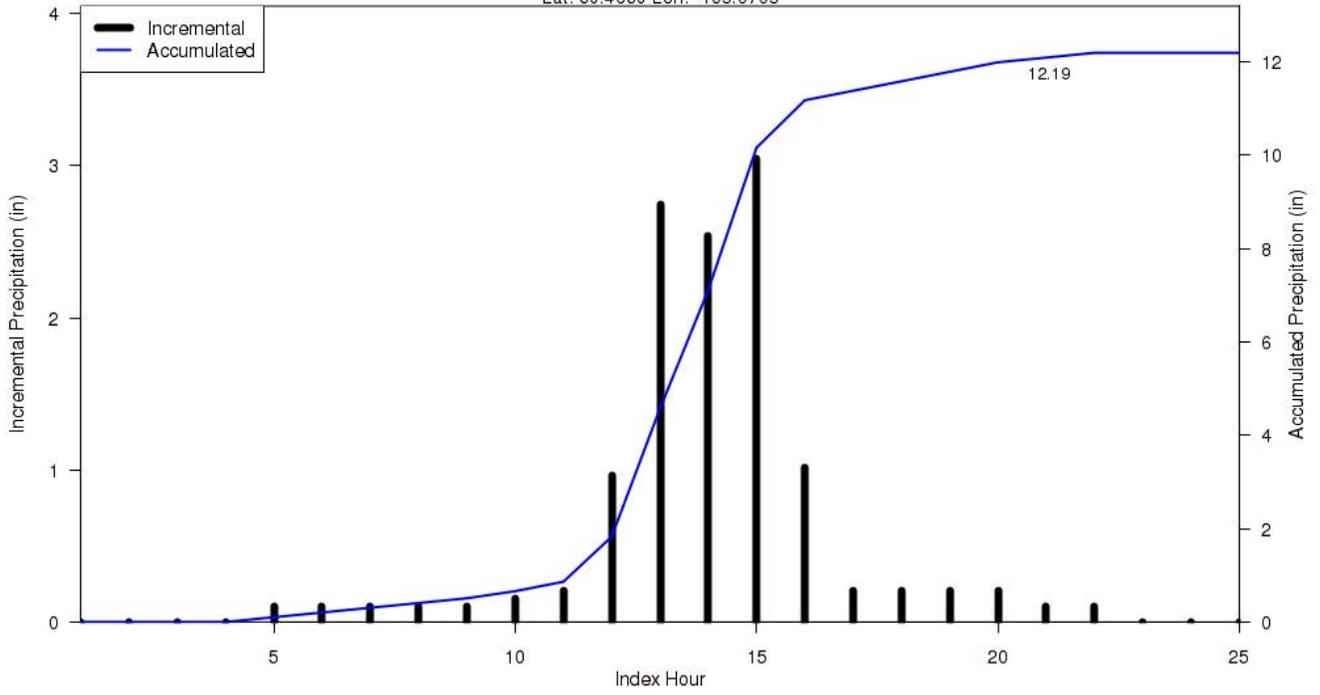
**Reliability of results:** This storm suffered from a severe lack of hourly data. In fact, only one hourly “station” was used at the storm center. The hourly data was gleaned from page 24 of HMR 55A; two other hourly stations were provided in the report, but were located beyond the analysis domain of this storm. Therefore, only the timing is reliable in/around the storm center. The storm magnitude is anchored by limited data, so it too is only reliable in/around the storm center.

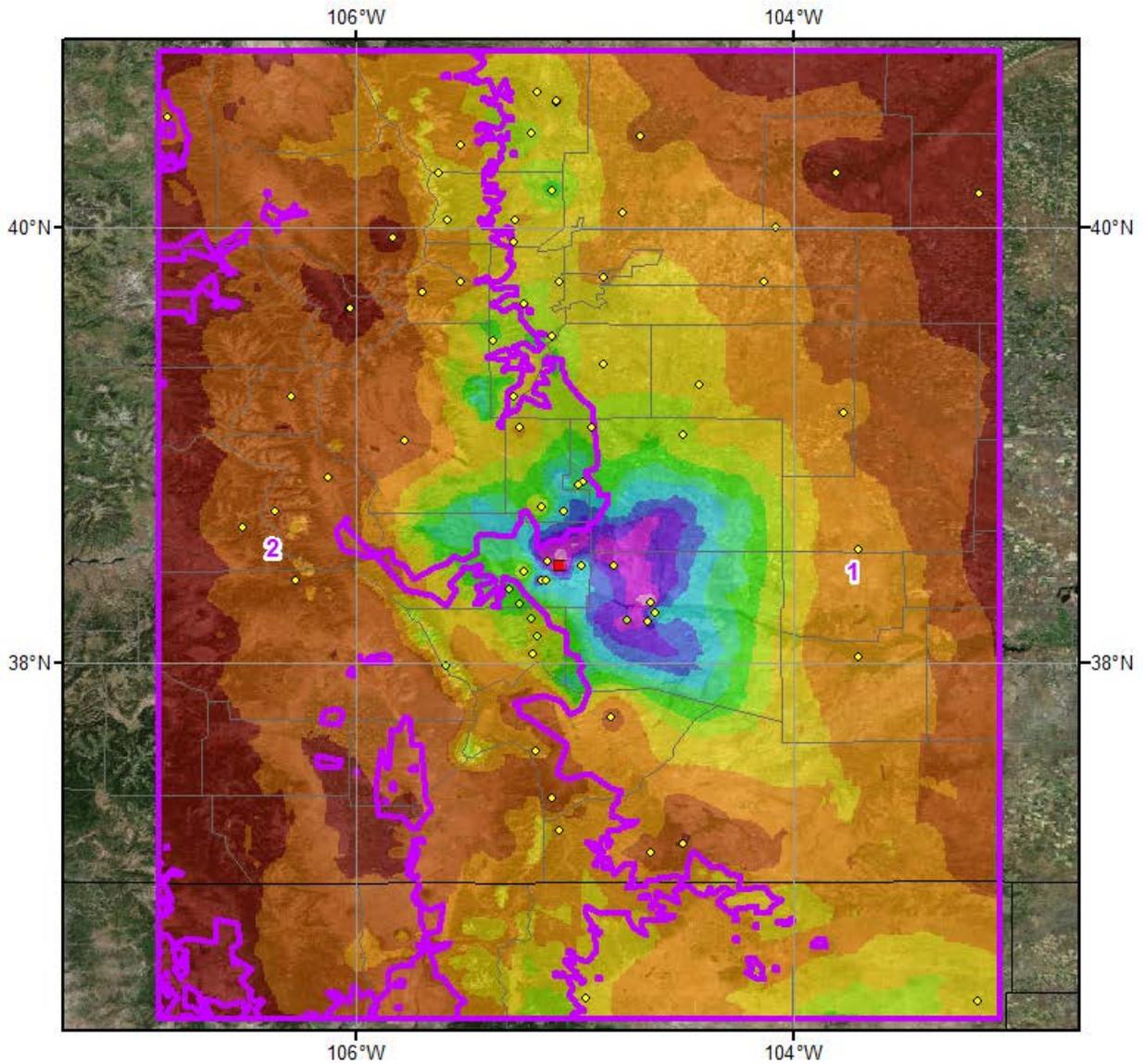
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1294_1_loc	-105.070	38.464	5,560	5,500	74.00	2.73	1.14	70	1.590	80.46	80.5	3.68	1.43	83	2.250	1.415

Storm 1294 Zone 1 - June 3 (1700 UTC) - June 4 (1700 UTC), 1921														
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES) Updated Analysis (<7500ft)														
areasqmi	Duration (hours)													Total (96hr)
	1	2	3	4	5	6	12	18	24	36	48	72	96	
0.4	3.04	5.57	8.31	9.32	10.28	10.49	11.55	12.16	12.16	12.16	12.16	12.16	12.16	12.16
1	3.01	5.53	8.25	9.26	10.22	10.42	11.47	12.08	12.08	12.08	12.08	12.08	12.08	12.08
10	2.95	5.43	8.12	9.10	10.05	10.25	11.27	11.88	11.88	11.88	11.88	11.88	11.88	11.88
25	2.89	5.29	7.89	8.86	9.77	9.96	10.97	11.55	11.55	11.55	11.55	11.55	11.55	11.55
50	2.82	5.16	7.70	8.63	9.53	9.71	10.70	11.26	11.26	11.26	11.26	11.26	11.26	11.26
100	2.74	5.02	7.49	8.40	9.27	9.45	10.41	10.96	10.96	10.96	10.96	10.96	10.96	10.96
150	2.70	4.94	7.37	8.27	9.12	9.30	10.24	10.78	10.78	10.78	10.78	10.78	10.78	10.78
200	2.67	4.88	7.28	8.17	9.01	9.19	10.12	10.65	10.65	10.65	10.65	10.65	10.65	10.65
300	2.62	4.80	7.16	8.03	8.86	9.04	9.95	10.48	10.48	10.48	10.48	10.48	10.48	10.48
400	2.59	4.74	7.07	7.93	8.76	8.93	9.83	10.35	10.35	10.35	10.35	10.35	10.35	10.35
500	2.56	4.70	6.99	7.85	8.66	8.82	9.73	10.23	10.23	10.23	10.23	10.23	10.23	10.23
1,000	2.42	4.44	6.63	7.44	8.21	8.37	9.21	9.70	9.70	9.70	9.70	9.70	9.70	9.70
2,000	2.18	4.00	5.96	6.69	7.38	7.52	8.29	8.72	8.72	8.72	8.72	8.72	8.72	8.72
3,500	1.89	3.46	5.17	5.80	6.40	6.53	7.18	7.56	7.56	7.56	7.56	7.56	7.56	7.56
5,000	1.66	3.05	4.55	5.10	5.63	5.74	6.32	6.66	6.66	6.66	6.66	6.66	6.66	6.66
7,500	1.43	2.62	3.90	4.38	4.83	4.93	5.43	5.71	5.71	5.71	5.71	5.71	5.71	5.71
10,000	1.27	2.33	3.48	3.90	4.31	4.39	4.83	5.09	5.09	5.09	5.09	5.09	5.09	5.09
15,000	1.07	1.96	2.92	3.28	3.62	3.69	4.07	4.28	4.28	4.28	4.28	4.28	4.28	4.28
20,000	0.92	1.70	2.54	2.85	3.14	3.20	3.52	3.71	3.71	3.71	3.71	3.71	3.71	3.71
28,202	0.74	1.36	2.03	2.27	2.51	2.56	2.82	2.96	2.96	2.96	2.96	2.96	2.96	2.96



SPAS 1294 Storm Center Mass Curve Zone 1  
June 3 (1700UTC) to June 4 (1700UTC), 1921  
Lat: 38.4638 Lon: -105.0705

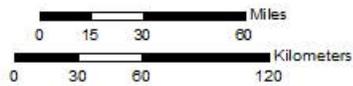




**Total Storm (24-hr) Precipitation (in)**  
**6/3/1921 1700 UTC - 6/04/1921 1800**  
**SPAS #1294**

**Gauges**

- Hourly
- ◆ Supplemental
- ◆ SE

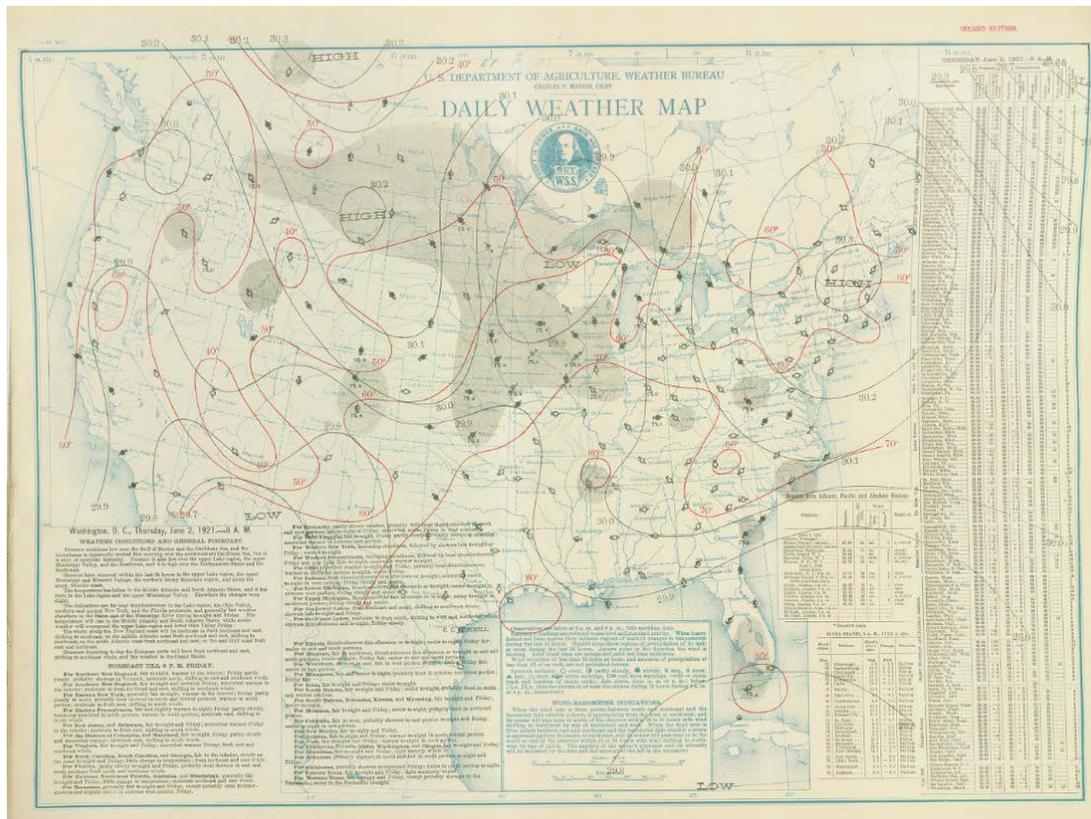
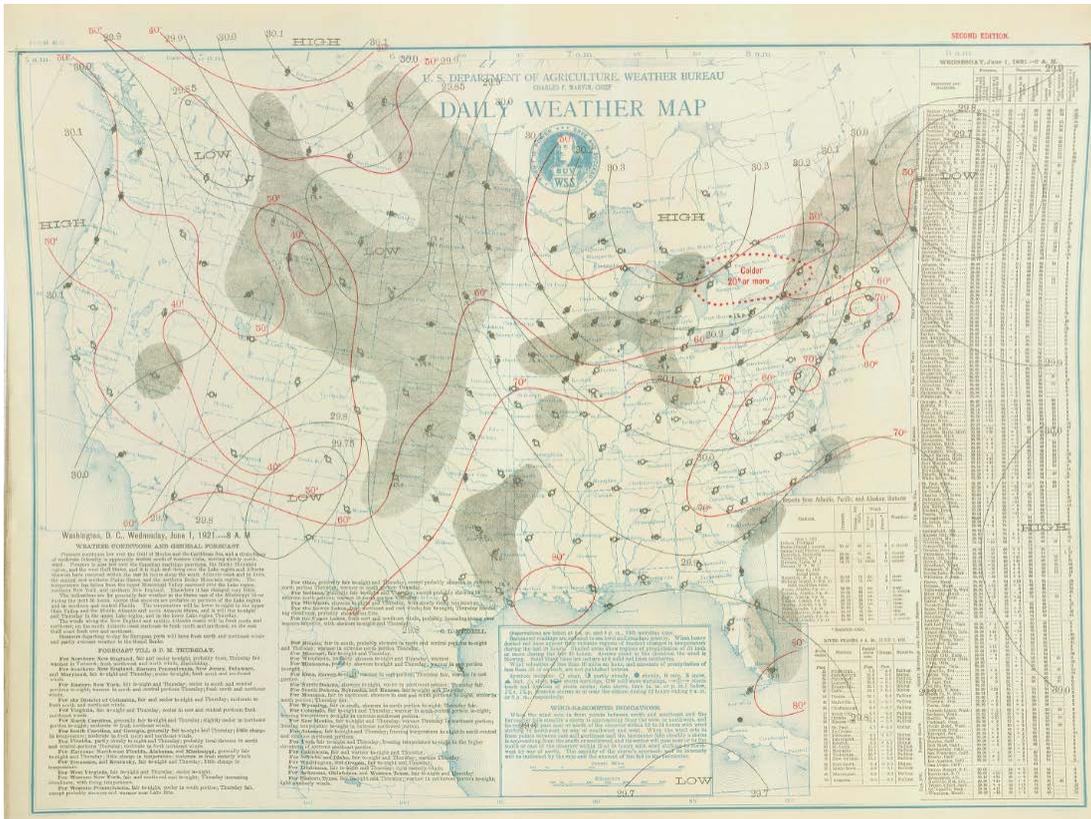


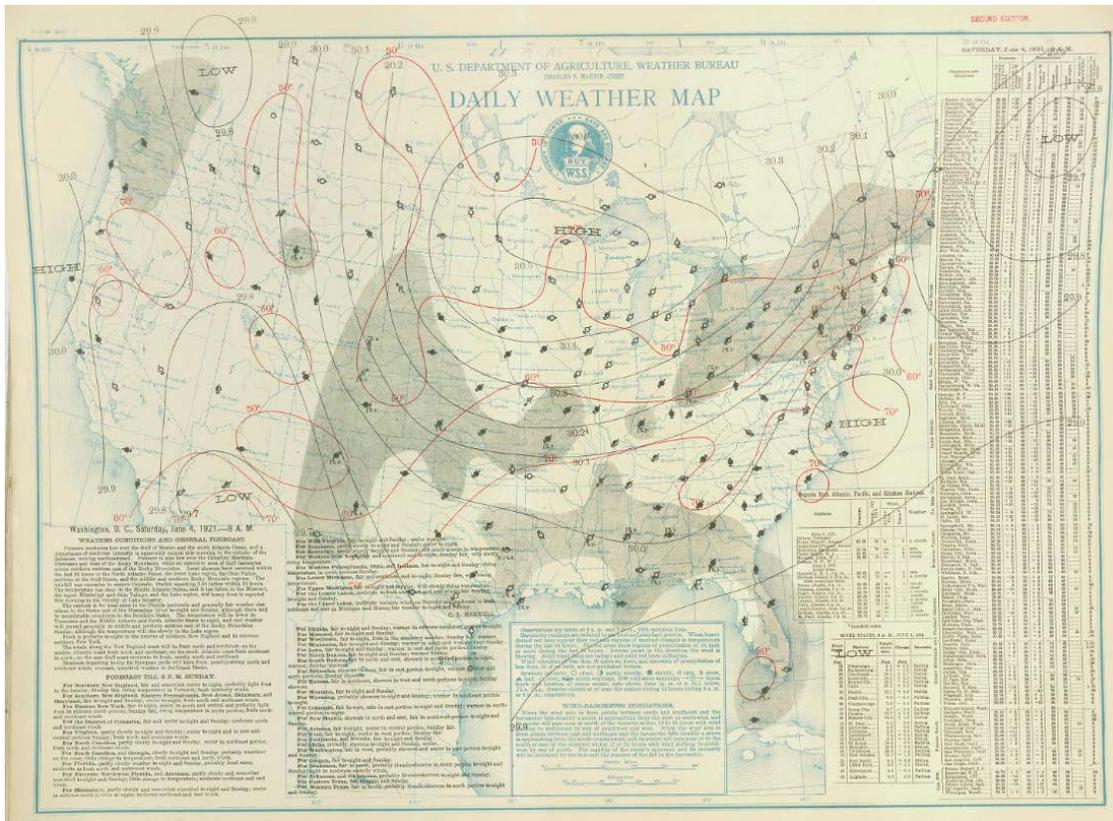
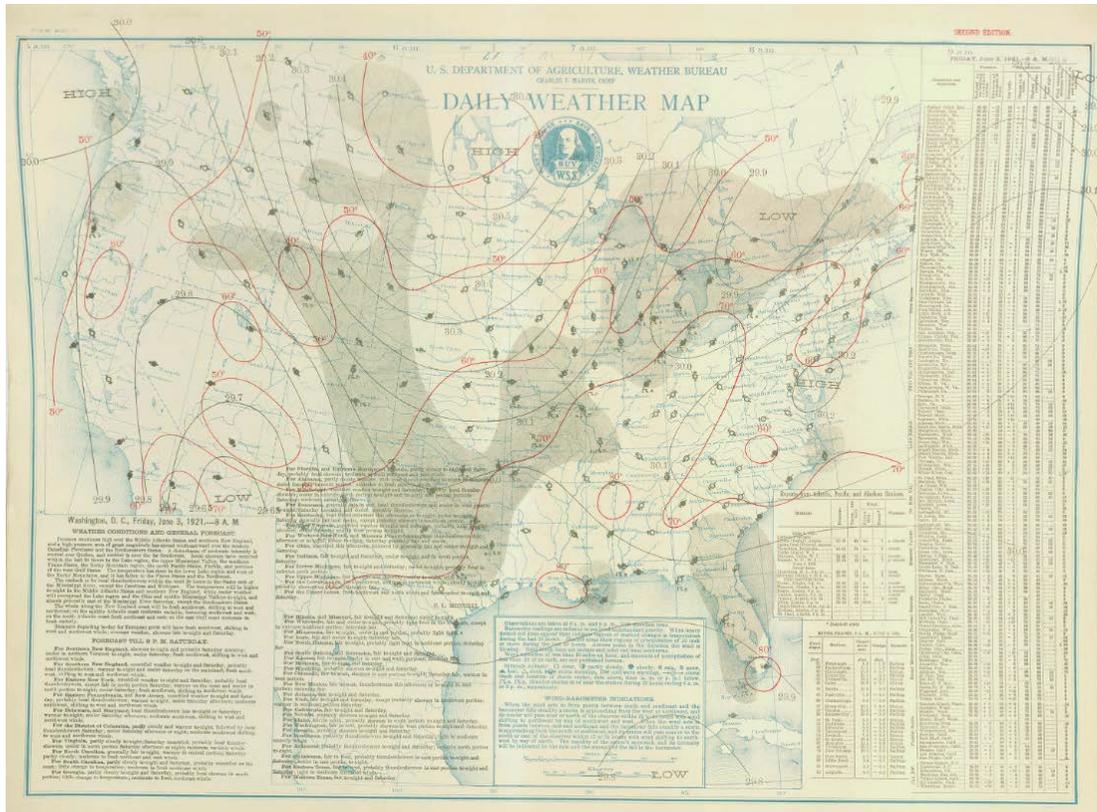
**Precipitation (inches)**

- |               |               |               |                 |                 |
|---------------|---------------|---------------|-----------------|-----------------|
| ■ 0.03 - 1.00 | ■ 3.01 - 4.00 | ■ 6.01 - 7.00 | ■ 9.01 - 10.00  | ■ 12.01 - 13.00 |
| ■ 1.01 - 2.00 | ■ 4.01 - 5.00 | ■ 7.01 - 8.00 | ■ 10.01 - 11.00 |                 |
| ■ 2.01 - 3.00 | ■ 5.01 - 6.00 | ■ 8.01 - 9.00 | ■ 11.01 - 12.00 |                 |



3/1/2018

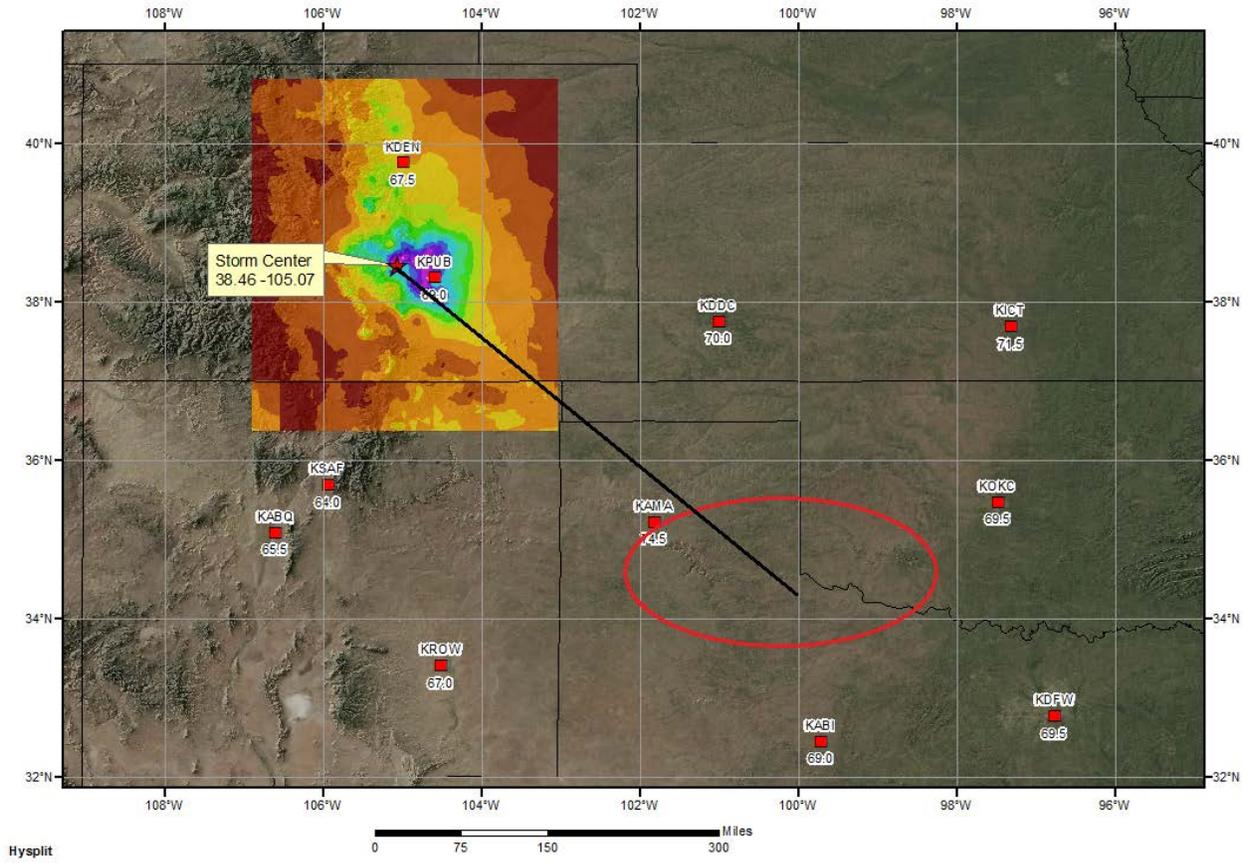




**Table 5.1.--Representative persisting 12-hr 1000-mb storm and maximum dew points for important storms in and near study region**

Storm No.	Name	Storm T <sub>d</sub>			Ref. Old	Loc. New	Max. T <sub>d</sub>		Stations
		Old	New	Date+			Old	New	
1.	Ward District, CO	62	64	30	325SE	350SE	75	77	AMA, DDC
6.	Boxelder, CO	60	60	4	350SE	320SE	72	74	DEN, PUB, DDC, OKC, ICT
8.	Rociada, NM	72	72	28	170SSE	300ESE	76	77	ABI, AMA
10.	Warrick, MT	64	64	6	380ESE	380ESE	73	75	ISN, PIR
13.	Evans, MT	65	65	4	510ESE	510ESE	75	76	BIS, RAP, PIR, VTN, HON
86.	May Valley, CO	67	67	18	450SSE	450SSE	76	76	AMA, ABI, FTW, SAT
20.	Clayton, NM	68	69	1	550SE	560SSE	76	77	SAT, DRT, CRP
23.	Tajique, NM	69	69	21	80SE	160SSE	77	78	ELP, ROW
25.	Lakewood, NM	-	76	7	-	350SE	-	79	DRT, SAT
27.	Meek, NM	72	72	15	390ESE	400ESE	78	79	AMA, ABI, FTW, OKC, SAT, GBK
30.	Fry's Ranch, CO	56	63	15	550ESE	700SE	71	74	FWH, DAL
31.	Penrose, CO	67	70	4	400SE	350SE	77	77	AMA, OKC
32.	Springbrook, MT	71	72	18	500ESE	370ESE	76	77	PIR, HON, FAR
35.	Virsylvania, NM (Cerro)	-	66	17	-	120SW	-	77	ABQ
38.	Savageton, WY	68	72	28	550SE	530SE	75	76	FRI, CNK
44.	Porter, NM	70	71	11	540SE	380SE	78	77	DRT, AUS, FTW, ABI
46.	Kassler, CO	71	66	10	440SE	420SE	77	77	OKC, DDC
47.	Cherry Creek, CO	72	71	30	540SE	560SE	76	79	ABI, ACT, FTW, SPS
101.	Hale, CO	72	71	30	540SE	560SE	76	79	ABI, ACT, FTW, SPS
48.	Las Cruces, NM*	-	71	30	-	-	-	78	ELP
105.	Broome, TX	77	77	14	350SSE	350SSE	78	80	CRP, BRO
53.	Loveland, CO	71	71	1	180SE	210SE	76	76	PUB, GLD
55.	Masonville, CO*	-	65	10	-	-	-	74	AKO
108.	Snyder, TX	73	75	19	100SE	340SSE	78	79	SAT, CRP
56.	Prairieview, NM	70	73	20	390SE	370SE	77	78	SAT, AUS
58.	McColleum Ranch, NM	72	72	21	50SE	300SE	77	79	ELP, DRT, SAT, CRP
60.	Rancho Grande, NM	74	75	31	250SE	250SE	77	78	LBB, BGS, ABI
66.	Ft. Collins, CO	66	67	30	570SE	600SE	78	78	GAG, TUL
67.	Golden, CO*	65	65	7	-	-	76	75	AMA

### SPAS 1294 Penrose, CO Storm Analysis June 3-4, 1921



## Storm Precipitation Analysis System (SPAS) For Storm #1294\_2

### A re-run of SPAS #1008

\*\*\* Update addressed excess precipitation above 7500ft, created 2 DAD zones based on 7500ft elevation.

**General Storm Location:** Colorado Front Range, adjacent high plains and extreme northeastern New Mexico.

**Storm Dates:** June 3-4, 1921 (24-hours)

**Event:** Thunderstorm “cloudburst”

**DAD Zone 2 (>7500ft)**

**Latitude:** 38.6304

**Longitude:** -104.9622

**Max. Grid Rainfall Amount:** 9.27”

**Number of Stations:** 76 (0 Daily, 1 Hourly, 0 Hourly Estimated, 0 Hourly Pseudo, 65 Supplemental, and 10 Supplemental Estimated)

**SPAS Version:** 9.5

**Basemap:** Final SPAS #1008 Precip Map, which used June 1965 Total Precipitation PRISM Grid

**Spatial resolution:** 30 seconds

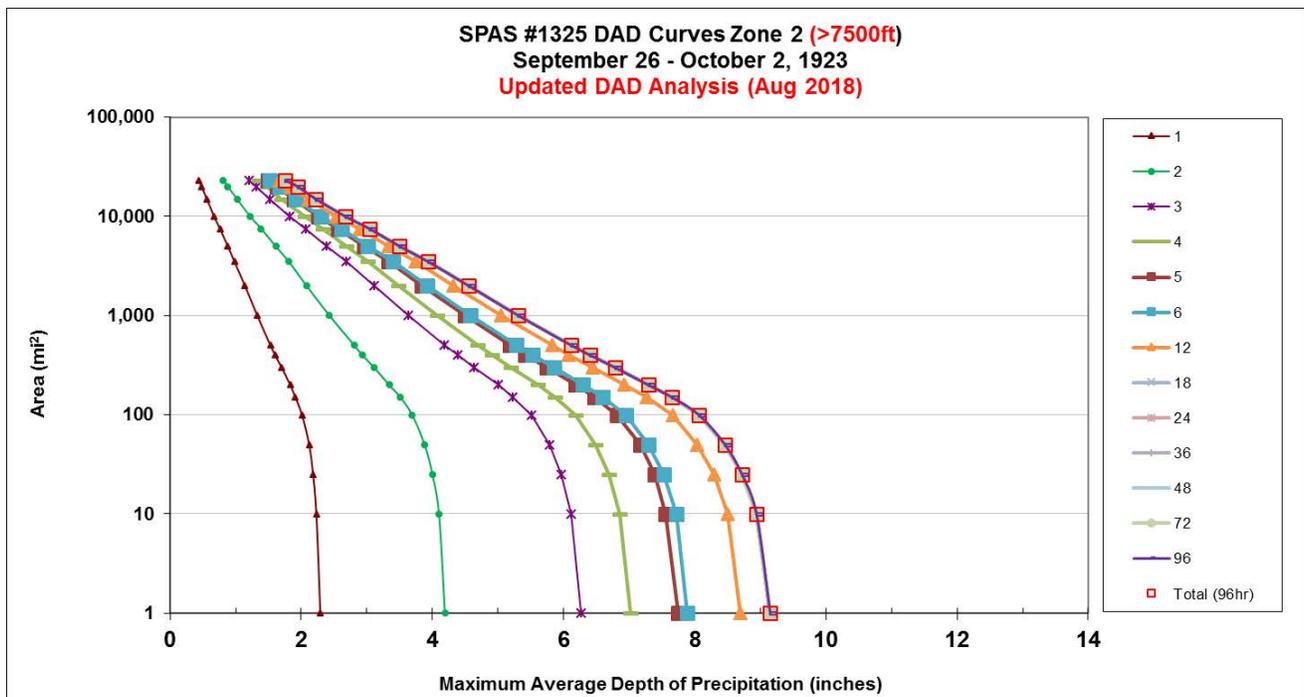
**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** Yes

**Reliability of results:** This storm suffered from a severe lack of hourly data. In fact, only one hourly “station” was used at the storm center. The hourly data was gleaned from page 24 of HMR 55A; two other hourly stations were provided in the report, but were located beyond the analysis domain of this storm. Therefore, only the timing is reliable in/around the storm center. The storm magnitude is anchored by limited data, so it too is only reliable in/around the storm center.

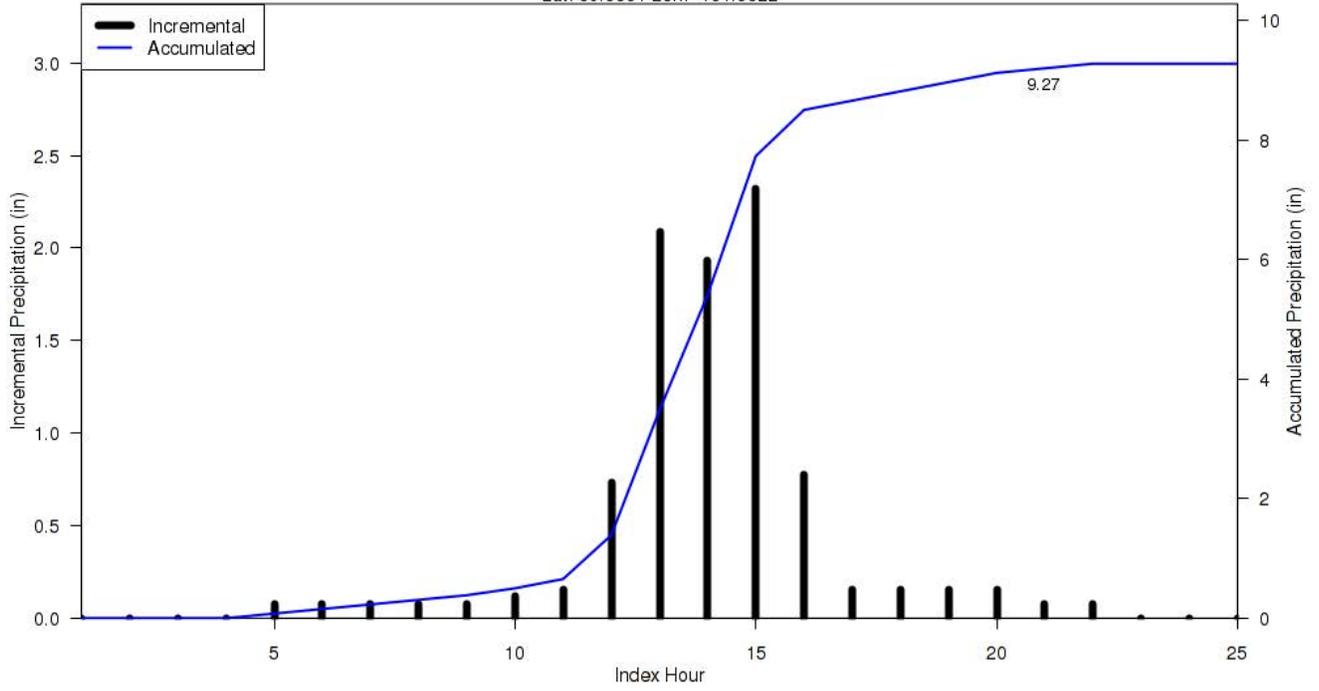
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1294_2_loc	-104.962	38.630	8,465	8,500	74.00	2.73	1.59	70	1.140	80.46	80.5	3.68	2.00	83	1.680	1.474

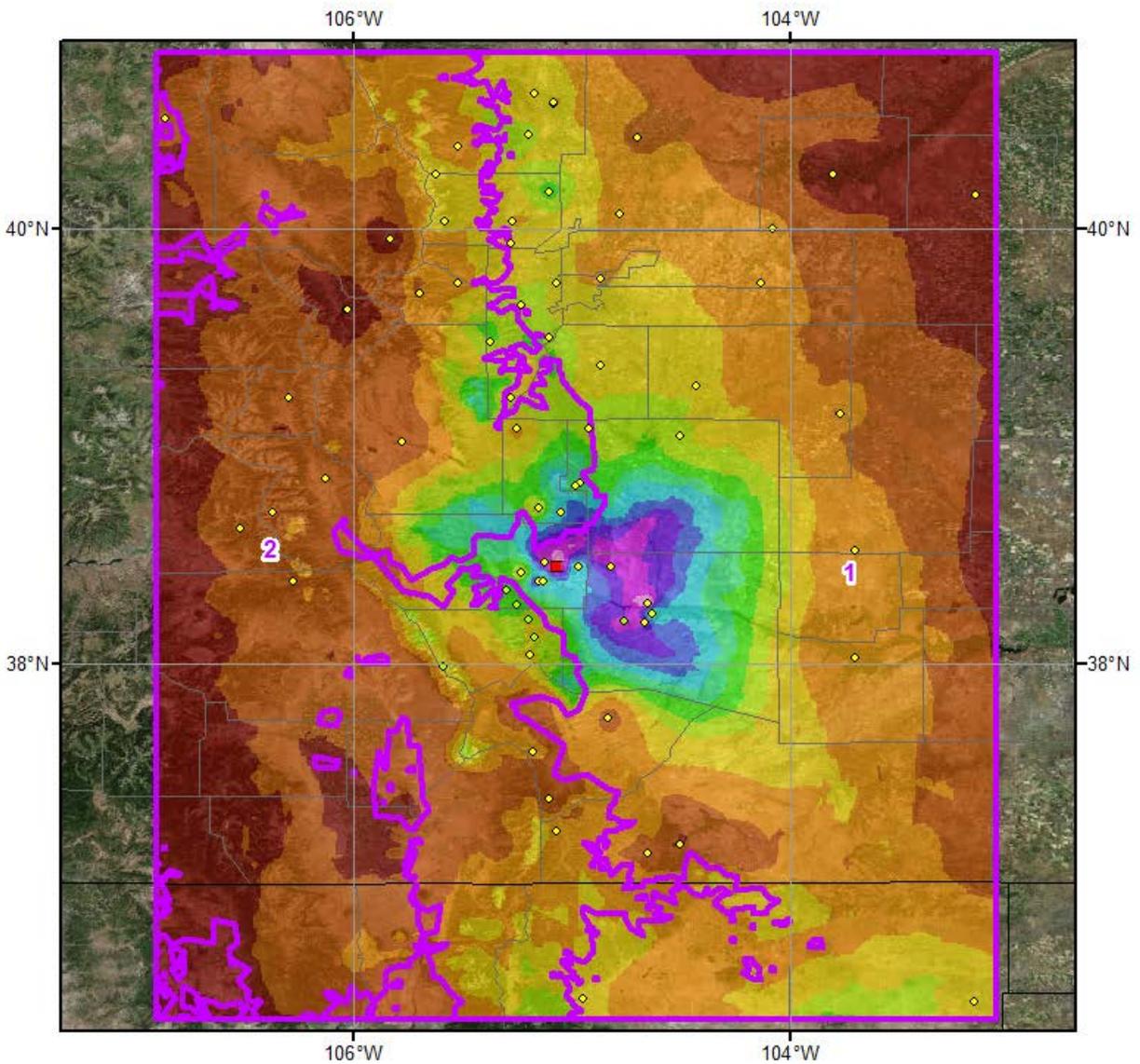
Storm 1294 Zone 2 - June 3 (1700 UTC) - June 4 (1700 UTC), 1921														
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES) Updated Analysis (>7500ft)														
areasqmi	Duration (hours)													
	1	2	3	4	5	6	12	18	24	36	48	72	96	Total (96hr)
0.4	2.31	4.23	6.31	7.08	7.81	7.97	8.77	9.23	9.23	9.23	9.23	9.23	9.23	9.23
1	2.29	4.19	6.26	7.02	7.75	7.89	8.69	9.15	9.15	9.15	9.15	9.15	9.15	9.15
10	2.23	4.10	6.12	6.86	7.55	7.72	8.50	8.94	8.94	8.94	8.94	8.94	8.94	8.94
25	2.18	4.00	5.97	6.69	7.39	7.53	8.29	8.72	8.72	8.72	8.72	8.72	8.72	8.72
50	2.12	3.88	5.79	6.49	7.17	7.30	8.04	8.46	8.46	8.46	8.46	8.46	8.46	8.46
100	2.01	3.69	5.51	6.18	6.82	6.95	7.66	8.06	8.06	8.06	8.06	8.06	8.06	8.06
150	1.91	3.51	5.23	5.87	6.47	6.60	7.27	7.65	7.65	7.65	7.65	7.65	7.65	7.65
200	1.83	3.34	5.00	5.61	6.19	6.29	6.93	7.29	7.29	7.29	7.29	7.29	7.29	7.29
300	1.70	3.11	4.64	5.20	5.74	5.85	6.45	6.78	6.78	6.78	6.78	6.78	6.78	6.78
400	1.60	2.93	4.38	4.91	5.41	5.52	6.08	6.40	6.40	6.40	6.40	6.40	6.40	6.40
500	1.53	2.81	4.18	4.69	5.18	5.28	5.82	6.12	6.12	6.12	6.12	6.12	6.12	6.12
1,000	1.33	2.43	3.63	4.07	4.49	4.58	5.05	5.31	5.31	5.31	5.31	5.31	5.31	5.31
2,000	1.14	2.08	3.11	3.48	3.84	3.92	4.32	4.55	4.55	4.55	4.55	4.55	4.55	4.55
3,500	0.98	1.81	2.69	3.02	3.33	3.40	3.74	3.93	3.93	3.93	3.93	3.93	3.93	3.93
5,000	0.88	1.61	2.39	2.68	2.96	3.02	3.33	3.50	3.50	3.50	3.50	3.50	3.50	3.50
7,500	0.76	1.39	2.07	2.33	2.56	2.62	2.89	3.04	3.04	3.04	3.04	3.04	3.04	3.04
10,000	0.67	1.22	1.82	2.05	2.26	2.30	2.54	2.67	2.67	2.67	2.67	2.67	2.67	2.67
15,000	0.56	1.02	1.52	1.70	1.89	1.92	2.11	2.22	2.22	2.22	2.22	2.22	2.22	2.22
20,000	0.48	0.88	1.32	1.48	1.63	1.67	1.84	1.94	1.94	1.94	1.94	1.94	1.94	1.94
23,121	0.44	0.81	1.20	1.35	1.49	1.52	1.67	1.76	1.76	1.76	1.76	1.76	1.76	1.76



SPAS 1294 Storm Center Mass Curve Zone 2  
June 3 (1700UTC) to June 4 (1700UTC), 1921

Lat: 38.6304 Lon: -104.9622

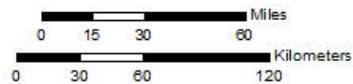




**Total Storm (24-hr) Precipitation (in)**  
**6/3/1921 1700 UTC - 6/041921 1800**  
**SPAS #1294**

**Gauges**

- Hourly
- ◆ Supplemental
- ◆ SE



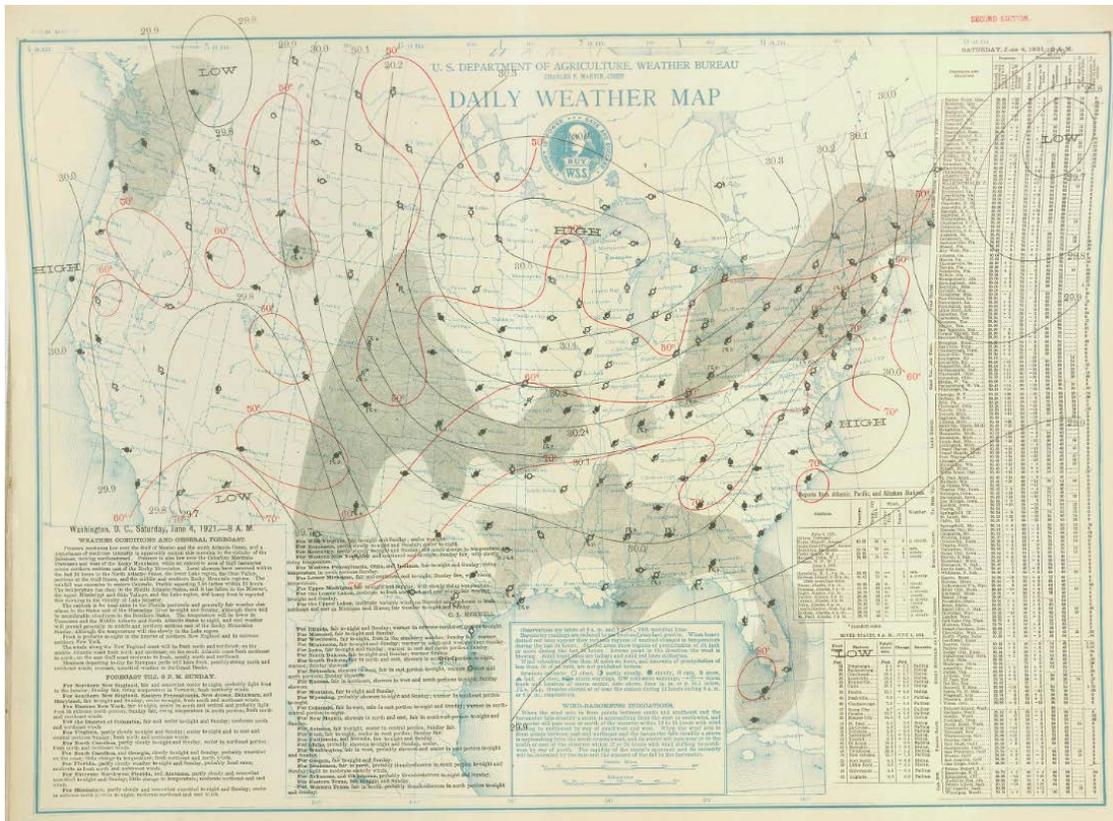
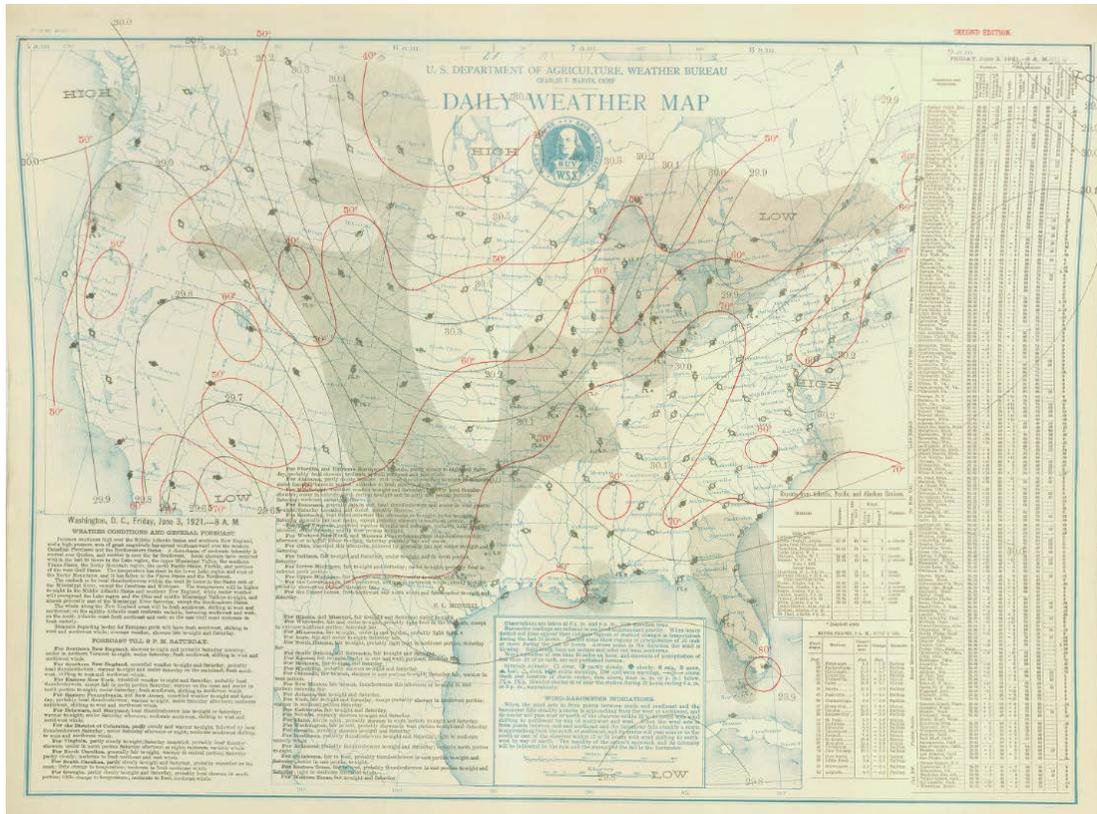
**Precipitation (inches)**

- |               |               |               |                 |                 |
|---------------|---------------|---------------|-----------------|-----------------|
| ■ 0.03 - 1.00 | ■ 3.01 - 4.00 | ■ 6.01 - 7.00 | ■ 9.01 - 10.00  | ■ 12.01 - 13.00 |
| ■ 1.01 - 2.00 | ■ 4.01 - 5.00 | ■ 7.01 - 8.00 | ■ 10.01 - 11.00 |                 |
| ■ 2.01 - 3.00 | ■ 5.01 - 6.00 | ■ 8.01 - 9.00 | ■ 11.01 - 12.00 |                 |



3/1/2018

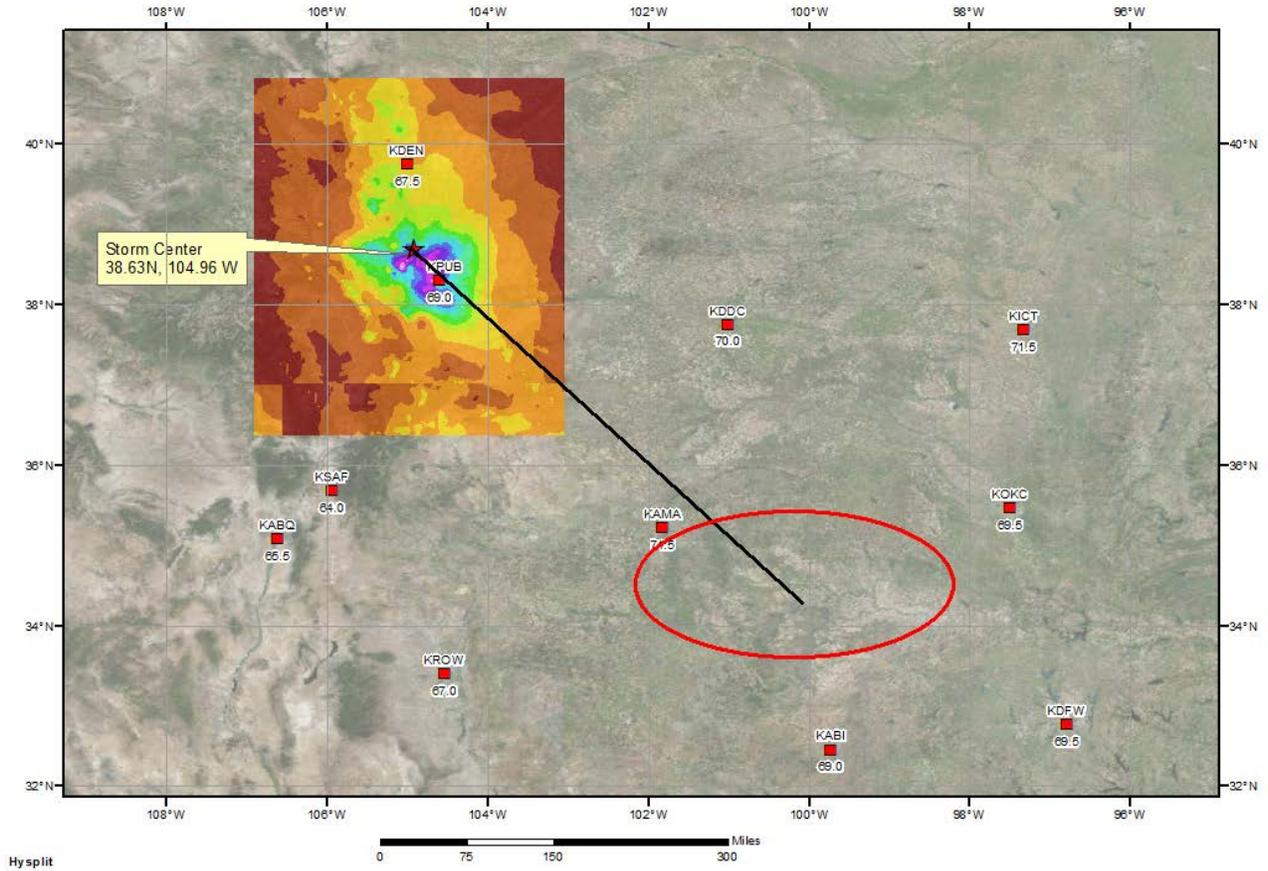




**Table 5.1.--Representative persisting 12-hr 1000-mb storm and maximum dew points for important storms in and near study region**

Storm No.	Name	Storm T <sub>d</sub>			Ref. Old	Loc. New	Max. T <sub>d</sub>		Stations
		Old	New	Date+			Old	New	
1.	Ward District, CO	62	64	30	325SE	350SE	75	77	AMA, DDC
6.	Boxelder, CO	60	60	4	350SE	320SE	72	74	DEN, PUB, DDC, OKC, ICT
8.	Rociada, NM	72	72	28	170SSE	300ESE	76	77	ABI, AMA
10.	Warrick, MT	64	64	6	380ESE	380ESE	73	75	ISN, PIR
13.	Evans, MT	65	65	4	510ESE	510ESE	75	76	BIS, RAP, PIR, VTN, HON
86.	May Valley, CO	67	67	18	450SSE	450SSE	76	76	AMA, ABI, FTW, SAT
20.	Clayton, NM	68	69	1	550SE	560SSE	76	77	SAT, DRT, CRP
23.	Tajique, NM	69	69	21	80SE	160SSE	77	78	ELP, ROW
25.	Lakewood, NM	-	76	7	-	350SE	-	79	DRT, SAT
27.	Meek, NM	72	72	15	390ESE	400ESE	78	79	AMA, ABI, FTW, OKC, SAT, GBK
30.	Fry's Ranch, CO	56	63	15	550ESE	700SE	71	74	FWH, DAL
31.	Penrose, CO	67	70	4	400SE	350SE	77	77	AMA, OKC
32.	Springbrook, MT	71	72	18	500ESE	370ESE	76	77	PIR, HON, FAR
35.	Virsylvania, NM (Cerro)	-	66	17	-	120SW	-	77	ABQ
38.	Savageton, WY	68	72	28	550SE	530SE	75	76	FRI, CNK
44.	Porter, NM	70	71	11	540SE	380SE	78	77	DRT, AUS, FTW, ABI
46.	Kassler, CO	71	66	10	440SE	420SE	77	77	OKC, DDC
47.	Cherry Creek, CO	72	71	30	540SE	560SE	76	79	ABI, ACT, FTW, SPS
101.	Hale, CO	72	71	30	540SE	560SE	76	79	ABI, ACT, FTW, SPS
48.	Las Cruces, NM*	-	71	30	-	-	-	78	ELP
105.	Broome, TX	77	77	14	350SSE	350SSE	78	80	CRP, BRO
53.	Loveland, CO	71	71	1	180SE	210SE	76	76	PUB, GLD
55.	Masonville, CO*	-	65	10	-	-	-	74	AKO
108.	Snyder, TX	73	75	19	100SE	340SSE	78	79	SAT, CRP
56.	Prairieview, NM	70	73	20	390SE	370SE	77	78	SAT, AUS
58.	McColleum Ranch, NM	72	72	21	50SE	300SE	77	79	ELP, DRT, SAT, CRP
60.	Rancho Grande, NM	74	75	31	250SE	250SE	77	78	LBB, BGS, ABI
66.	Ft. Collins, CO	66	67	30	570SE	600SE	78	78	GAG, TUL
67.	Golden, CO*	65	65	7	-	-	76	75	AMA

### SPAS 1294 Adelaide, CO Storm Analysis\_Zone 2 June 3-4, 1921



Hysplit

## Storm Precipitation Analysis System (SPAS) For Storm #1592\_1

**General Storm Location:** Thrall, TX (32.0,-100.0,26.0,-94.0)

**Storm Dates:** September 7-11, 1921

**Event:** Tropical Remnants

### DAD Zone 1

**Latitude:** 30.6292

**Longitude:** -97.3875

**Max. Grid Rainfall Amount:** 39.90" Thrall, TX

**Max. Observed Rainfall Amount:** 39.72"

**Number of Stations:** 103

**SPAS Version:** 10.0

**Basemap:** Blended Basemap of Weather Bureau Isohyetal Image (90%) and PRISM Mean September 1971-2000 Climatology (10%)

**Spatial resolution:** 0.2891

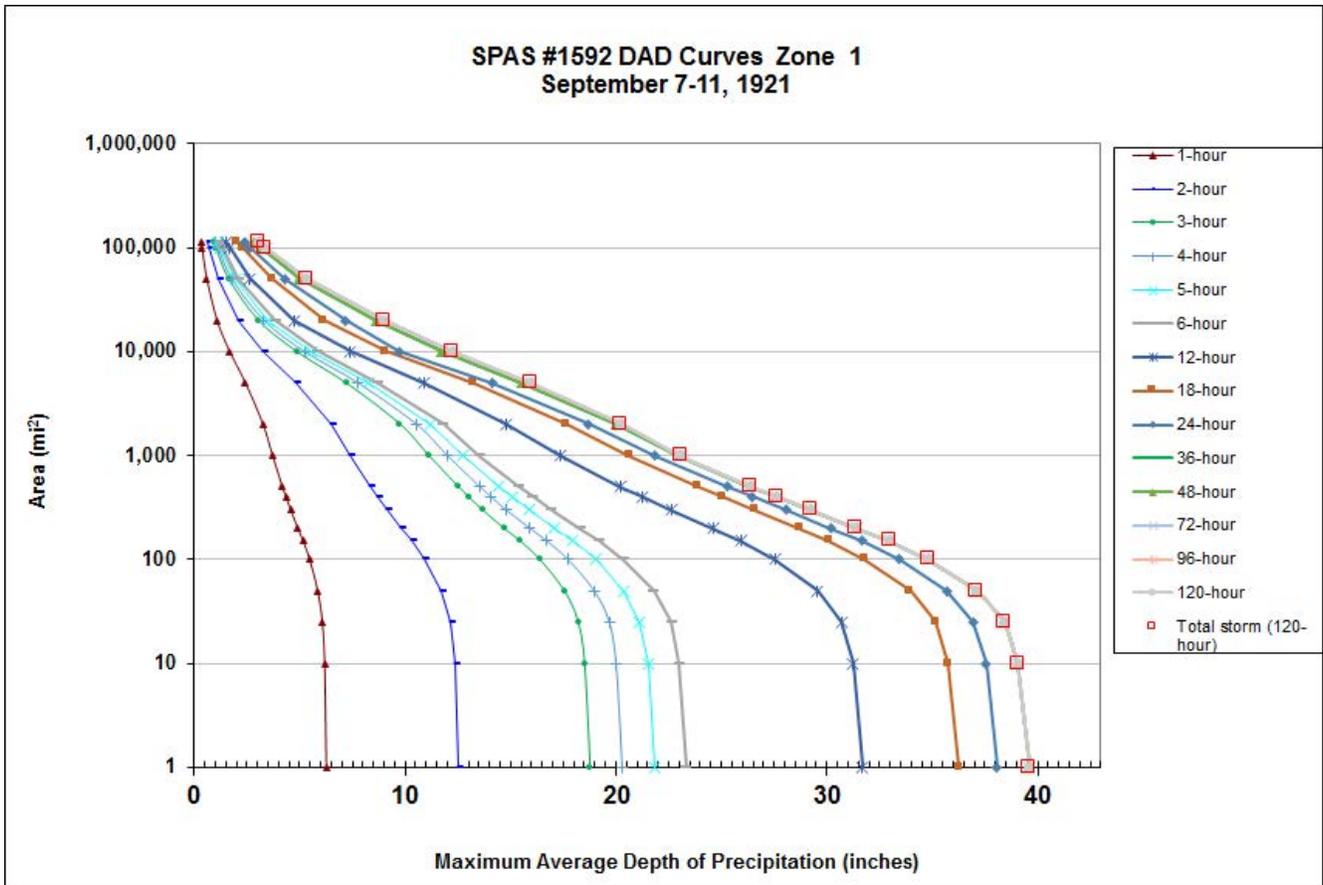
**Radar Included:** No

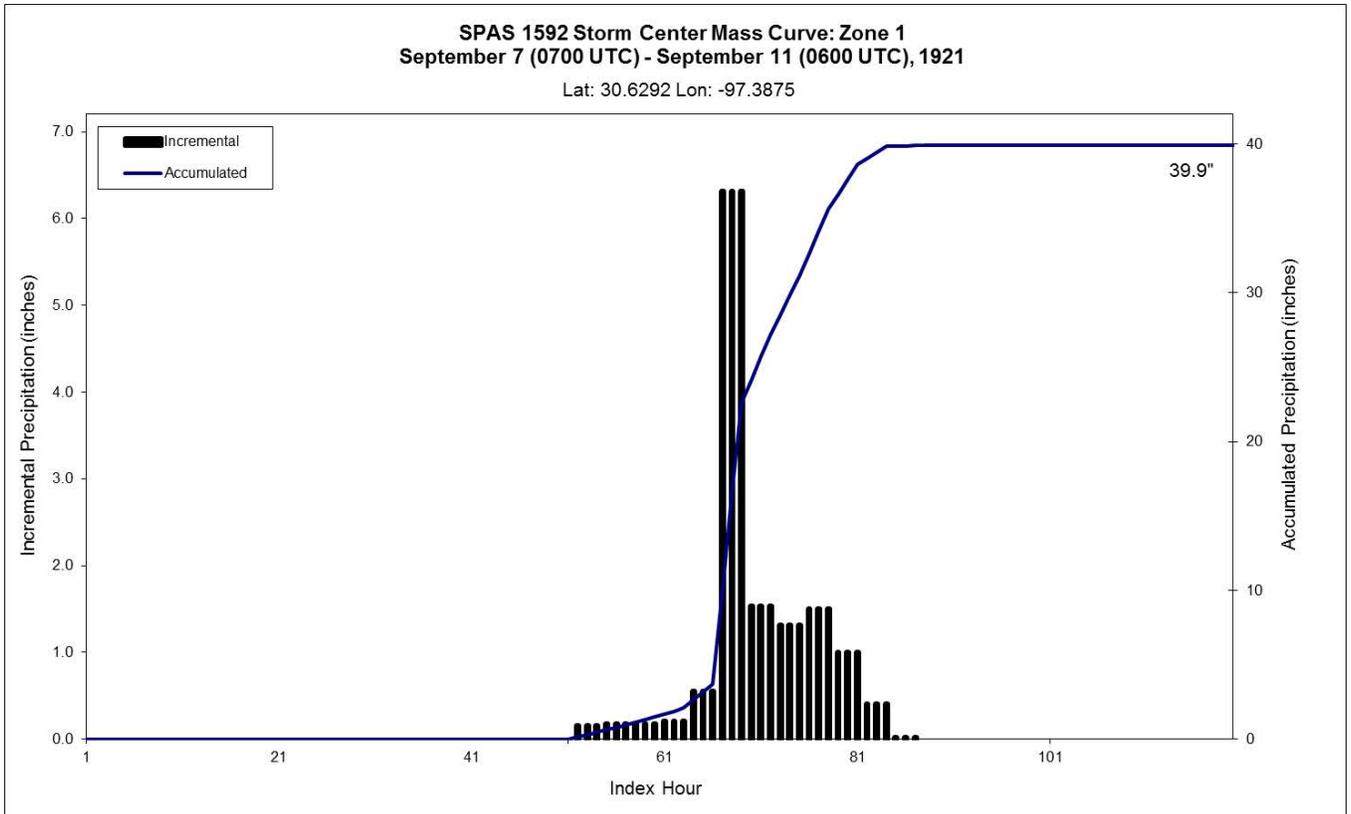
**Depth-Area-Duration (DAD) analysis:** Yes

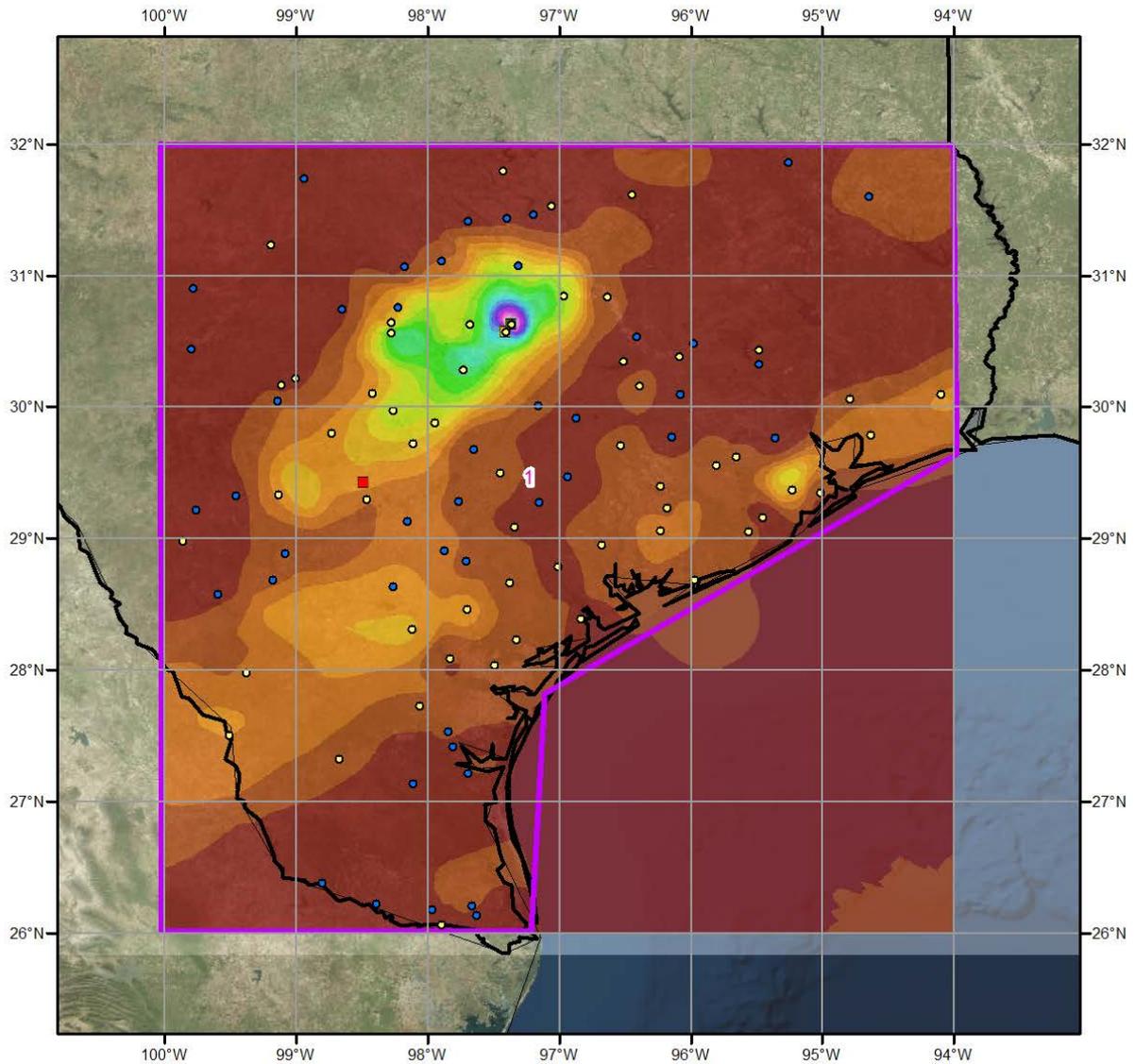
**Reliability of results:** This analysis was based on hourly data, daily data, and supplemental station data. We have a high degree of confidence in the station based storm total results. The spatial pattern is dependent heavily on the Weather Bureau Isohyetal basemap, and the timing is based on hourly, hourly pseudo, and hourly estimated pseudo stations. An additional 56 supplemental stations were created to ensure data consistency.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1592_1_loc	-97.388	30.629	600	600	79.00	3.44	0.17	80	3.270	81.33	81.5	3.86	0.18	85	3.680	1.125

Storm 1592 - September 7 (0700 UTC) - September 12 (0600 UTC), 1921															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	6.29	12.59	18.88	20.40	21.93	23.45	31.86	36.47	38.28	39.82	39.82	39.82	39.82	39.90	39.90
1	6.26	12.52	18.77	20.29	21.81	23.33	31.68	36.27	38.07	39.60	39.60	39.60	39.60	39.60	39.60
10	6.18	12.36	18.51	20.00	21.52	23.01	31.23	35.77	37.54	39.05	39.05	39.05	39.05	39.05	39.05
25	6.07	12.14	18.21	19.68	21.14	22.61	30.70	35.19	36.95	38.44	38.44	38.44	38.44	38.44	38.44
50	5.85	11.70	17.55	18.96	20.38	21.80	29.56	33.97	35.68	37.11	37.11	37.11	37.11	37.11	37.11
100	5.47	10.93	16.39	17.72	19.04	20.36	27.56	31.80	33.44	34.79	34.79	34.79	34.79	34.79	34.79
150	5.16	10.32	15.46	16.72	17.96	19.22	25.92	30.11	31.69	32.97	32.97	32.98	32.98	32.98	32.98
200	4.91	9.82	14.69	15.91	17.06	18.29	24.62	28.71	30.17	31.43	31.43	31.44	31.40	31.40	31.40
300	4.57	9.13	13.68	14.79	15.87	16.95	22.63	26.58	28.08	29.22	29.22	29.25	29.25	29.25	29.25
400	4.35	8.69	13.02	14.08	15.06	16.05	21.23	25.05	26.48	27.58	27.58	27.61	27.61	27.61	27.61
500	4.18	8.37	12.54	13.55	14.46	15.39	20.21	23.92	25.30	26.36	26.37	26.41	26.41	26.41	26.41
1,000	3.71	7.41	11.13	12.00	12.75	13.52	17.39	20.66	21.87	22.94	22.98	23.08	23.08	23.08	23.08
2,000	3.26	6.51	9.77	10.54	11.18	11.82	14.77	17.63	18.70	19.98	20.03	20.23	20.23	20.23	20.23
5,000	2.43	4.81	7.21	7.77	8.26	8.73	10.93	13.29	14.14	15.54	15.56	15.97	15.97	15.97	15.97
10,000	1.68	3.26	4.87	5.23	5.55	5.87	7.41	9.09	9.72	11.74	11.75	12.20	12.20	12.20	12.20
20,000	1.08	2.09	3.05	3.30	3.53	3.85	4.73	6.14	7.17	8.60	8.61	9.02	9.02	9.02	9.02
50,000	0.60	1.16	1.64	1.79	1.93	2.09	2.62	3.70	4.29	4.97	4.97	5.34	5.33	5.33	5.33
100,000	0.37	0.73	1.03	1.13	1.22	1.33	1.69	2.29	2.64	3.16	3.16	3.40	3.36	3.36	3.36
113,470	0.33	0.64	0.94	1.03	1.12	1.21	1.49	2.04	2.38	2.83	2.85	3.09	3.09	3.09	3.09







**Total Storm (120-hours) Precipitation (inches)**  
**September 7-11, 1921**  
**SPAS 1592 - Thrall, TX**

**Gauges**

- Daily
- Hourly
- HEP
- Hourly Pseudo
- Supplemental



**Precipitation (inches)**

0.00 - 2.00	8.01 - 10.00	18.01 - 20.00	28.01 - 30.00
2.01 - 4.00	10.01 - 12.00	20.01 - 22.00	30.01 - 32.00
4.01 - 6.00	12.01 - 14.00	22.01 - 24.00	32.01 - 34.00
6.01 - 8.00	14.01 - 16.00	24.01 - 26.00	34.01 - 36.00
	16.01 - 18.00	26.01 - 28.00	36.01 - 38.00
		38.01 - 40.00	



4/3/2015

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

**STORM STUDIES - PERTINENT DATA SHEET**



Storm of 8-10 Sept. 1921  
 Assignment GM 4-12  
 Location Central Texas  
 Study Prepared by:  
 Southwestern Division  
 Galveston District Office  
 & Hydrometeorological Section

Part I Reviewed by H. M. Sec. of  
 Weather Bureau, 8/20/45  
 Part II Approved by Office, Chief  
 of Engineers for Distribution  
 of Factual Data, 11/7/46

Remarks: Center near  
 Thrall (Taylor), Texas

**DATA AND COMPUTATIONS COMPILED**

**PART I**

Preliminary isohyetal map, in 1 sheet, scale 1:1,000,000

Precipitation data and mass curves: (Number of Sheets)

Form 5001-C (Hourly precip. data).....	7
Form 5001-B (24-hour " " " " ).....	23
Form 5001-D ( " " " " " " ).....	2
Misc. precip. records, meteorological data, etc.....	30
Form 5002 (Mass rainfall curves).....	35

**PART II**

Final isohyetal maps, in 1 sheet, scale 1:500,000

Data and computation sheets:

Form S-10 (Data from mass rainfall curves).....	2
Form S-11 (Depth-area data from isohyetal map).....	2
Form S-12 (Maximum depth-duration data).....	38
Maximum duration-depth-area curves.....	1
Data relating to periods of maximum rainfall.....	--

**MAXIMUM AVERAGE DEPTH OF RAINFALL IN INCHES**

Area in Sq. Mi.	Duration of Rainfall in Hours								
	6	12	18	24	30	36	48		
Max. Station	23.4	31.8	36.4	38.2	39.2	39.7	39.7		
10	22.4	29.8	35.0	36.5	37.2	37.6	37.6		
100	19.6	26.2	30.7	31.9	32.6	32.9	32.9		
200	17.9	24.3	28.7	29.7	30.4	30.7	30.8		
500	15.4	21.4	25.6	26.6	27.3	27.6	27.7		
1,000	13.4	18.8	22.9	24.0	24.6	24.9	25.1		
2,000	11.2	15.7	19.5	20.6	21.2	21.5	21.6		
5,000	8.1	11.1	14.1	15.0	15.9	16.2	16.3		
10,000	5.6	7.7	9.7	10.7	11.8	12.1	12.2		
12,500	4.7	6.7	8.4	9.4	10.3	10.7	10.9		

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

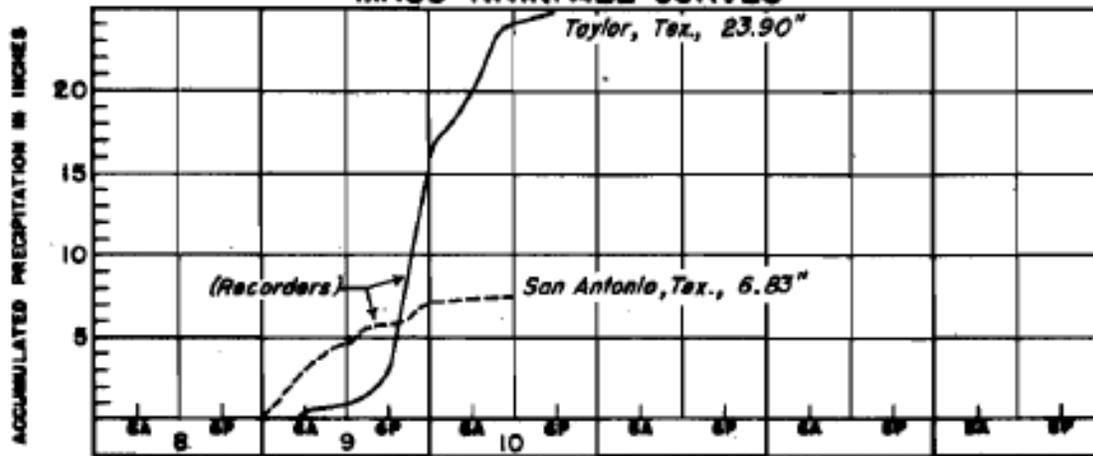
### STORM STUDIES - ISOHYETAL MAP

Storm of September 8-10, 1921 Assignment GM 4-12

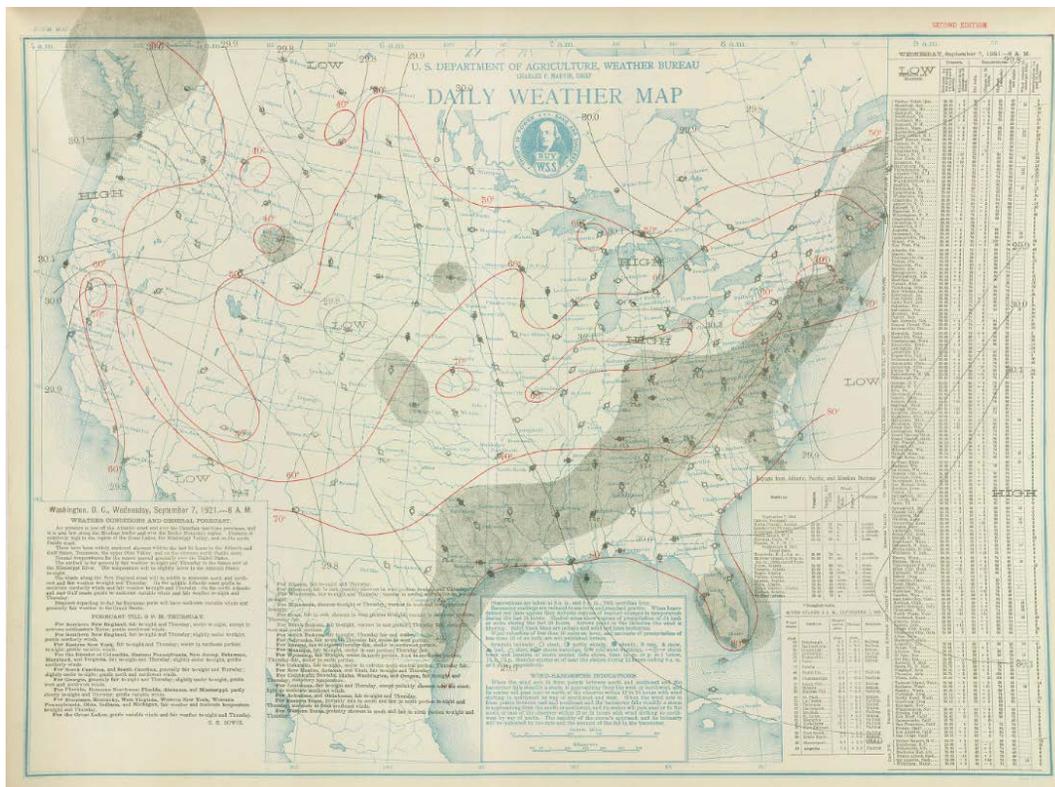
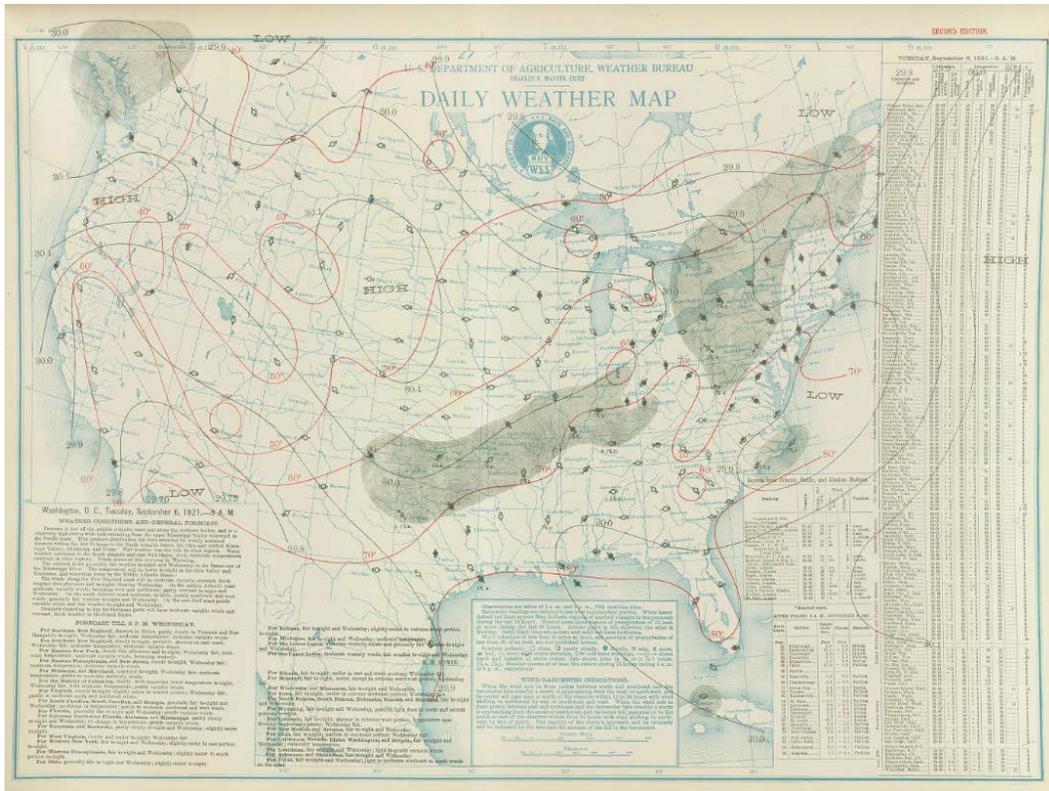
Study Prepared by: Galveston, Tex. District  
Southwestern Division & Hydrometeorological Section



### MASS RAINFALL CURVES



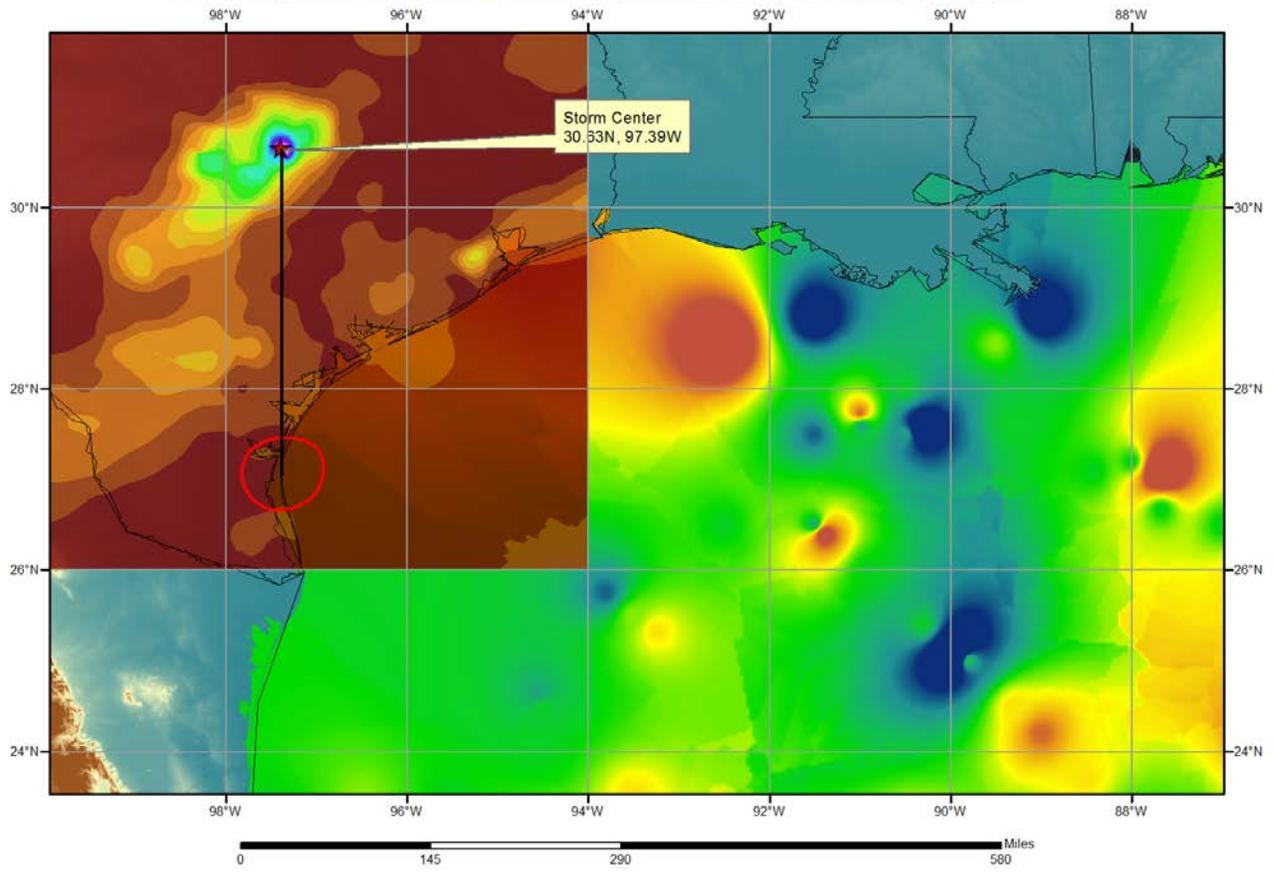
FORM 8-22



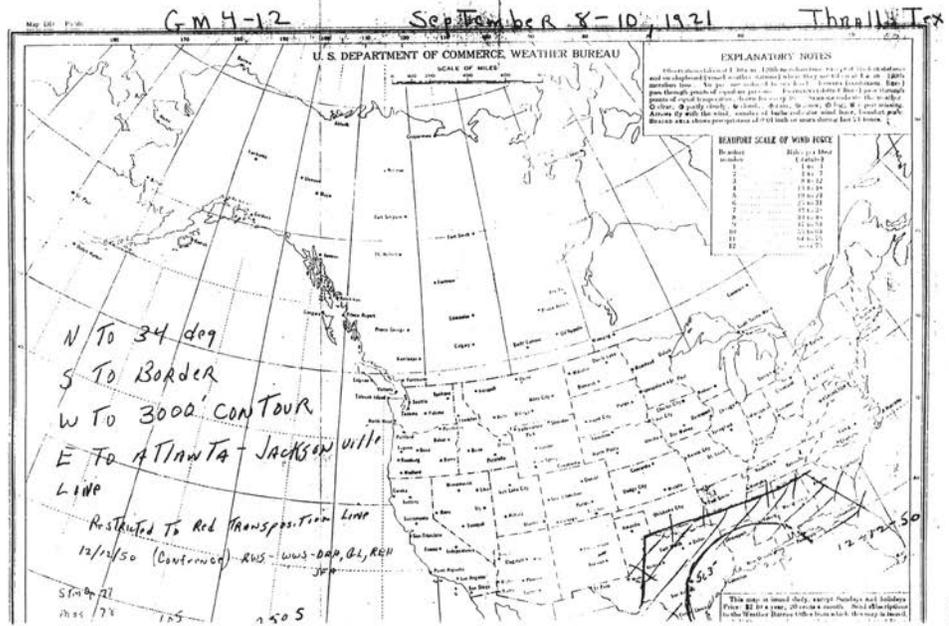




**SPAS 1592 Thrall, TX Storm Analysis**  
Storm Representative Dew Point from USACE and Lott, 1953 Surface Analysis



Storm Date	Assignment Number	Representative Storm Dewpoint	Reference Point
<u>1919 (cont.)</u>			
Sep 14-15	GM 5-15A	75	125 E of George West, Tex.
Sep 15-17	GM 5-15B	72	390 ESE of Meek, N. Mex.
Sep 16-19	MR 2-23	70	325 SE of Bruning, Nebr.
Sep 27-28	MR 5-24	41	450 ESE of Browning, Mont.
Oct 25-28	LMV 1-13A	70	125 SE of Steelville, Mo.
Oct 30-Nov 1	LMV 1-13B	67	150 SSE of Lottchfield, Ky.
Dec 6-10	GM 1-22	71	140 SSW of Selma, Ala.
<u>1920</u>			
Jan 21-24	OR 6-23	63	150 SE of Pontotoc, Miss.
May 10-13	MR 4-17	63	550 SE of Vale, S. Dak.
Jun 15-18	GL 1-18	69	200 SW of W. Newton, Pa.
Jul 16-17	MR 4-18	68	135 SSE of Oakdale, Nebr.
Aug 18	SA 1-8	66	50 SE of Lancaster, Pa.
Sep 5-7	UMV 3-7B	68	210 ESE of Alva, Okla.
Sep 6-9	UMV 3-7A	74	225 SW of Memphis, Tenn.
<u>1921</u>			
Mar 11-14	LMV 2-15	68	80 S of Magnolia, Miss.
Apr 14-16	MR 4-19	56	550 ESE of Fry's Ranch, Colo.
Apr 25-26	UMV 3-8	68	35 S of Marshall, Tex.
Jun 2-6	SW 1-23	67	400 SE of Penrose, Colo.
Jun 17-21	MR 4-21	71	500 ESE of Springbrook, Mont.
Sep 8-10	GM 4-12	77	250 S of Thrall, Tex.
Oct 29-Nov 2	OR 3-12	63	150 WSW of Marion, N. C.
Nov 16-19	SW 1-24	69	190 SW of Searcy, Ark.
<u>1922</u>			
Feb 19-23	GL 4-17	52	275 SW of West Branch, Mich.
Mar 23-25	MR 2-27	58	200 S of Strawn, Kans.
Apr 6-11	MR 2-28	(66	400 SSW of Warsaw, Mo.
		(68	400 SSW of Whitestown, Ind.
Apr 24-27	GM 4-15	73	340 SSE of Weatherford, Tex.
Jun 8-11	GL 2-21	70	130 SW of Wrightstown, Wis.
Jun 9-12	GL 1-19	71	255 SW of Syracuse, N. Y.
Jul 9-12	MR 2-29	72	250 SSE of Grant City, Mo.
Sep 1	UMV 3-9B	72	200 SSW of Jackson, Mo.
Sep 1-4	OR 1-27	73	100 SW of Oxford, Ohio.
Sep 2-3	UMV 3-9A	69	220 SW of Harrisonville, Mo.
Oct 9-10	SA 1-9	70	150 S of Baltimore, Md.
Nov 12-15	LMV 3-29	73	225 E of Lakeside, La.
Dec 27	UMV 3-10	57	250 SSW of Benton, Ill.



## Storm Precipitation Analysis System (SPAS) For Storm #1560\_1

**General Storm Location:** Texas/Oklahoma Panhandle (-103.5, 38.0, 33.5, -97.0)

**Storm Dates:** May 13-19, 1951

**Event:** Local

**DAD Zone 1**

**Latitude:** 35.2208

**Longitude:** -101.3958

**Max. Grid Rainfall Amount:** 15.21” Conway, TX

**Max. Observed Rainfall Amount:** 15.06”

**Number of Stations:** 393

**SPAS Version:** 10.0

**Basemap:** Blended Basemap of PRISM Mean May 1971-2000 Climatology and USGS Isohyetal Pattern

**Spatial resolution:** 0.2688

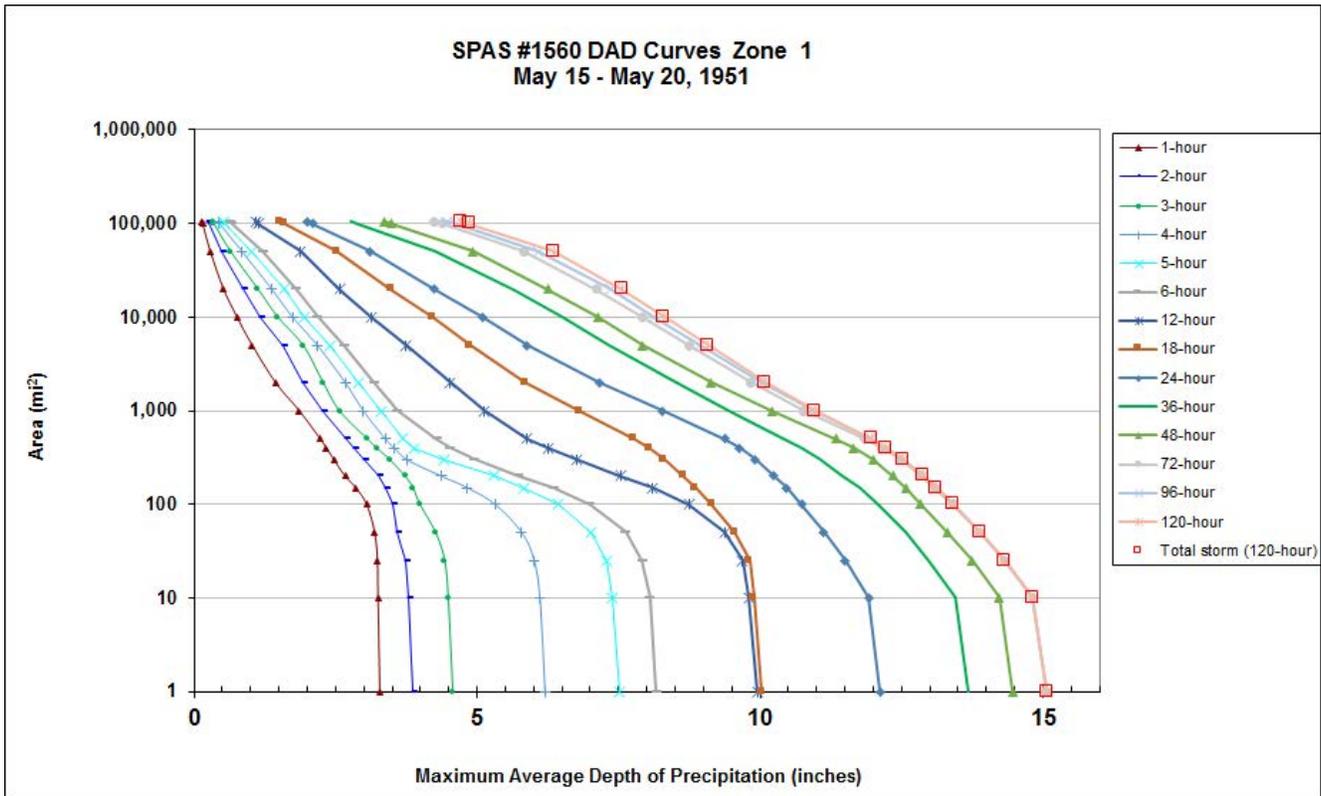
**Radar Included:** No

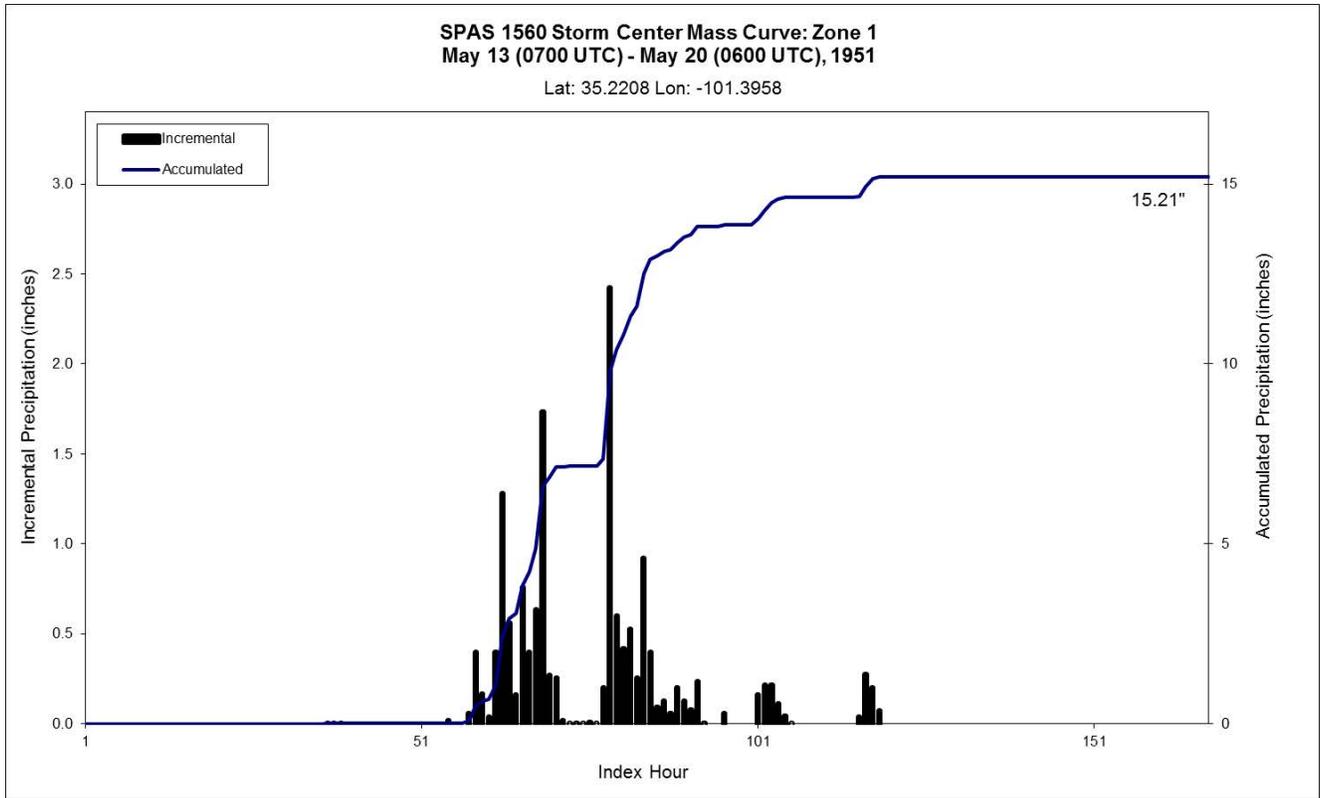
**Depth-Area-Duration (DAD) analysis:** Yes

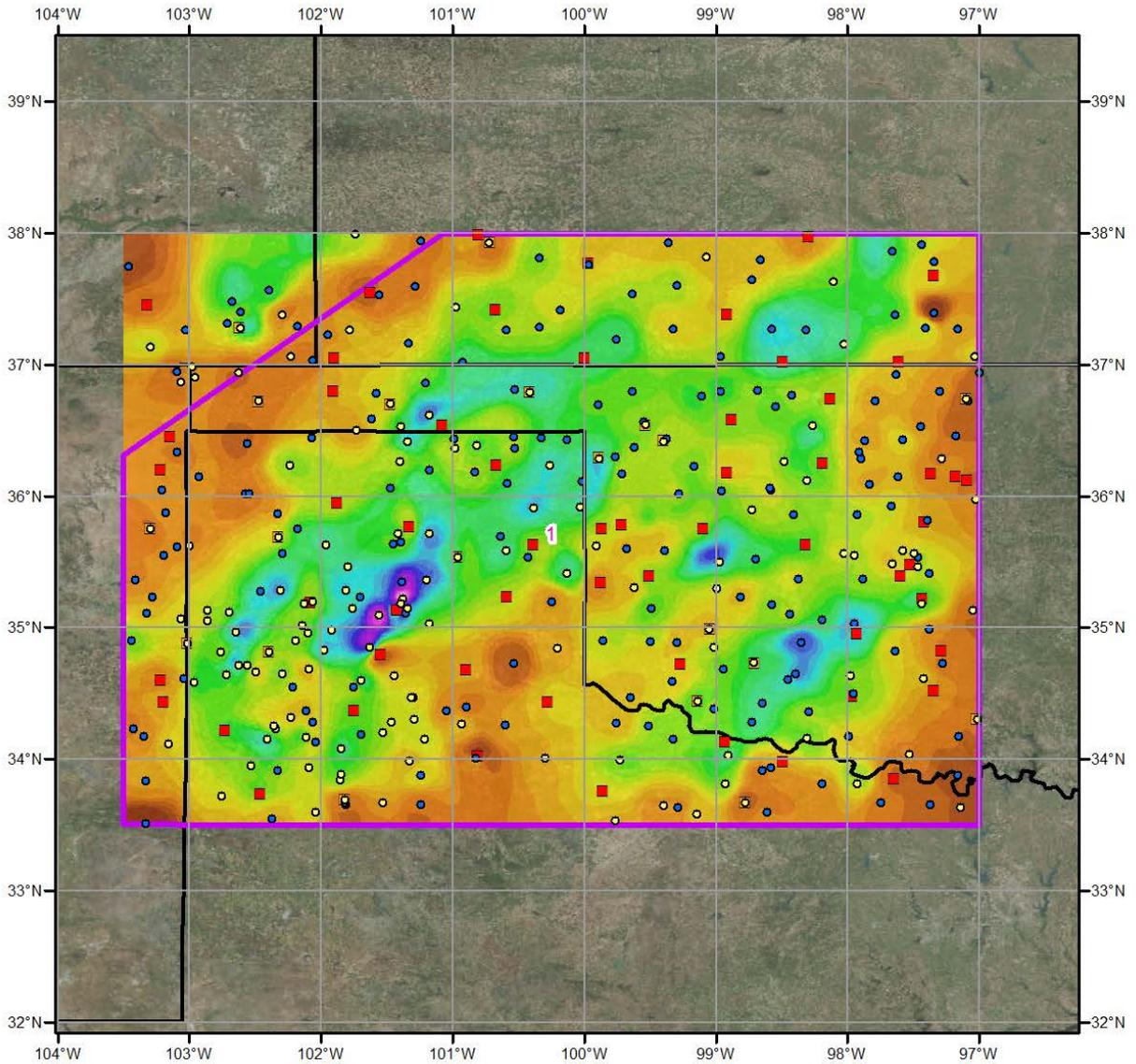
**Reliability of results:** This analysis was based on hourly data, daily data, and supplemental station data. We have a high degree of confidence in the station based storm total results. The spatial pattern is dependent on the blended basemap, and the timing is based on hourly and hourly pseudo stations. An additional 138 supplemental stations were created to ensure data consistency.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1560_1_loc	-101.396	35.221	3,450	3,500	71.50	2.42	0.72	65	1.700	78.18	78.0	3.29	0.89	78	2,400	1,412

Storm 1560 - May 13 (0700 UTC) - May 20 (0600 UTC), 1951															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	3.29	3.88	4.60	6.24	7.56	8.21	10.01	10.09	12.20	13.76	14.56	15.16	15.17	15.21	15.21
1	3.28	3.86	4.57	6.20	7.51	8.16	9.95	10.03	12.12	13.67	14.47	15.06	15.07	15.07	15.07
10	3.25	3.80	4.49	6.11	7.40	8.05	9.80	9.89	11.92	13.45	14.23	14.82	14.82	14.82	14.82
25	3.24	3.74	4.43	6.01	7.28	7.91	9.69	9.81	11.50	12.97	13.74	14.31	14.32	14.32	14.32
50	3.19	3.60	4.27	5.79	7.01	7.62	9.37	9.55	11.13	12.56	13.31	13.87	13.89	13.89	13.89
100	3.05	3.51	3.99	5.32	6.44	7.00	8.74	9.15	10.73	12.08	12.84	13.40	13.42	13.42	13.42
150	2.86	3.39	3.87	4.83	5.84	6.35	8.10	8.86	10.47	11.75	12.57	13.08	13.11	13.11	13.11
200	2.67	3.27	3.73	4.37	5.29	5.74	7.53	8.64	10.25	11.47	12.35	12.84	12.89	12.89	12.89
300	2.47	3.02	3.46	3.76	4.43	4.95	6.75	8.31	9.92	11.05	11.99	12.48	12.53	12.53	12.53
400	2.34	2.83	3.23	3.54	3.89	4.53	6.25	8.04	9.64	10.73	11.65	12.15	12.22	12.22	12.22
500	2.23	2.69	3.06	3.38	3.68	4.29	5.89	7.78	9.38	10.42	11.34	11.86	11.96	11.97	11.97
1,000	1.86	2.27	2.57	2.99	3.30	3.60	5.13	6.81	8.28	9.45	10.21	10.77	10.96	10.98	10.98
2,000	1.44	1.92	2.28	2.67	2.90	3.18	4.52	5.85	7.16	8.51	9.14	9.84	10.03	10.09	10.09
5,000	1.03	1.57	1.93	2.18	2.41	2.65	3.75	4.88	5.89	7.34	7.93	8.74	8.94	9.08	9.08
10,000	0.76	1.17	1.48	1.74	1.96	2.18	3.13	4.21	5.09	6.49	7.13	7.91	8.12	8.30	8.30
20,000	0.52	0.87	1.13	1.37	1.59	1.81	2.57	3.48	4.25	5.64	6.25	7.11	7.37	7.56	7.56
50,000	0.29	0.48	0.65	0.85	1.01	1.21	1.88	2.52	3.11	4.25	4.93	5.82	6.07	6.35	6.35
100,000	0.15	0.26	0.35	0.45	0.55	0.67	1.14	1.60	2.10	2.89	3.49	4.40	4.63	4.86	4.86
105,430	0.14	0.24	0.33	0.43	0.52	0.64	1.09	1.53	2.00	2.76	3.36	4.24	4.46	4.71	4.71







**Total Storm (168-hours) Precipitation (inches)**  
**May 13-19, 1951**

**SPAS 1560 - Conway, TX**

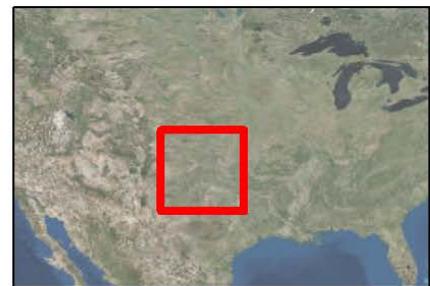


**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Supplemental

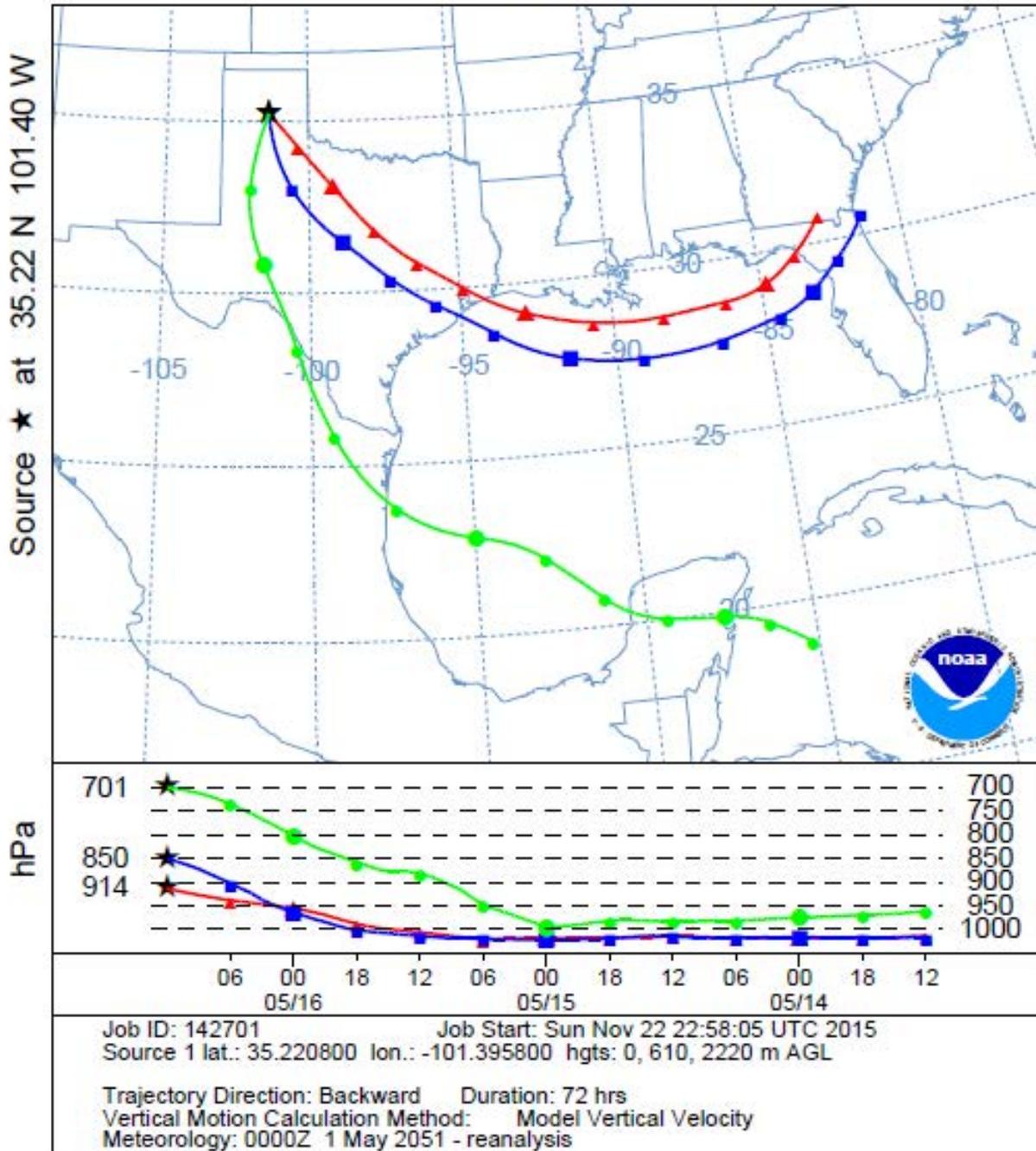
**Precipitation (inches)**

0.08 - 0.50	3.51 - 4.00	7.51 - 8.00	11.51 - 12.00
0.51 - 1.00	4.01 - 4.50	8.01 - 8.50	12.01 - 12.50
1.01 - 1.50	4.51 - 5.00	8.51 - 9.00	12.51 - 13.00
1.51 - 2.00	5.01 - 5.50	9.01 - 9.50	13.01 - 13.50
2.01 - 2.50	5.51 - 6.00	9.51 - 10.00	13.51 - 14.00
2.51 - 3.00	6.01 - 6.50	10.01 - 10.50	14.01 - 14.50
3.01 - 3.50	6.51 - 7.00	10.51 - 11.00	14.51 - 15.00
	7.01 - 7.50	11.01 - 11.50	15.01 - 15.50

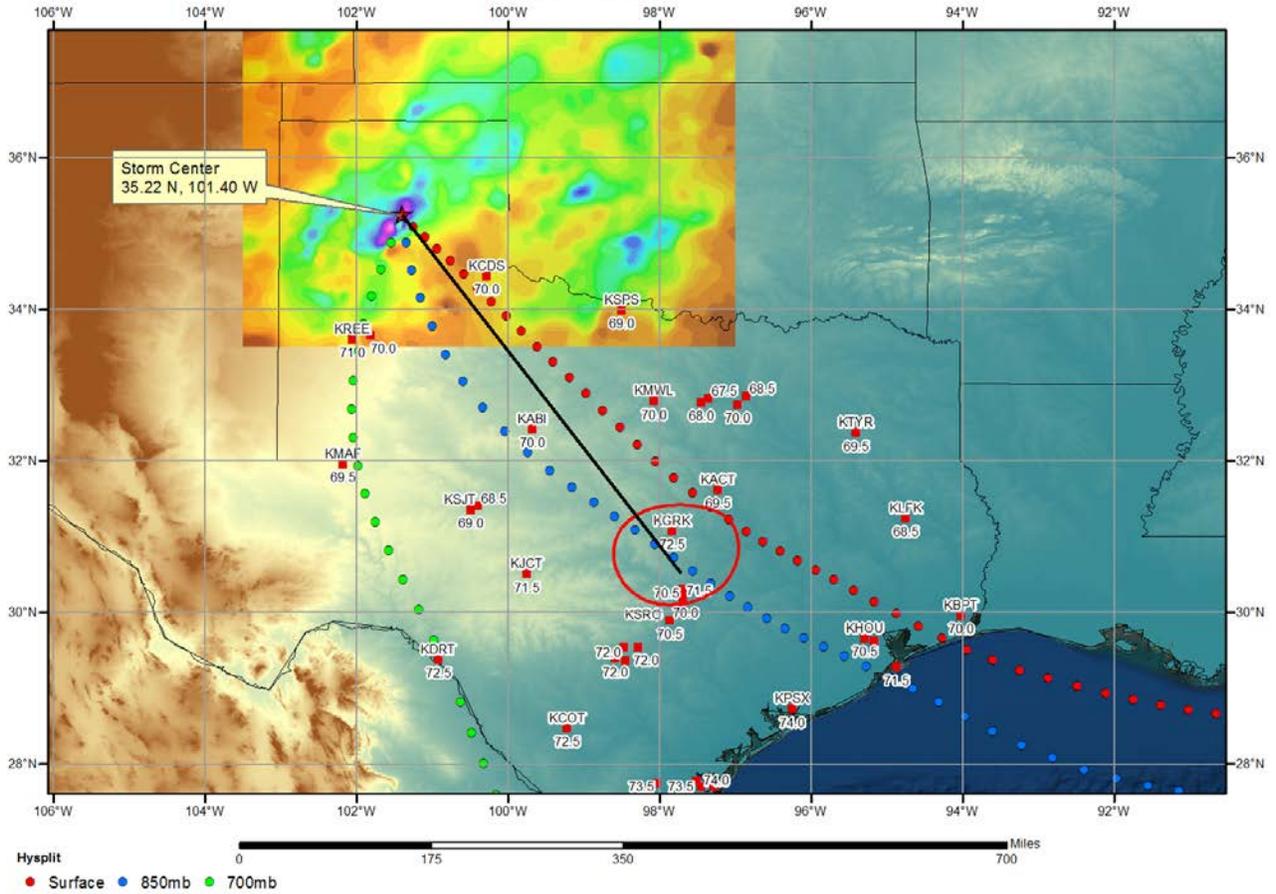


4/3/2015

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 16 May 51  
 CDC1 Meteorological Data



### SPAS 1560 Conway, TX Storm Analysis May 14-16, 1951



## **Storm Precipitation Analysis System (SPAS) For Storm #1293\_3 (Re-Run of SPAS #1009)**

**General Storm Location:** Southeastern Colorado, extreme northeastern New Mexico and extreme eastern Kansas.

**Storm Dates:** June 14 – 19, 1965

**Event:** Thunderstorms and possible Mesoscale Convective Complex (MCC)

**DAD Zone 3 (South of Denver, CO – Elbert, eastern El Paso, Teller, western Adams & eastern Arapahoe Counties)**

**Latitude:** 39.1875

**Longitude:** -104.29583

**Max. Grid Rainfall Amount:** 16.28”

**Max. Observed Rainfall Amount:** 14.00”

**Number of Stations:** 414

**SPAS Version:** 9.5

**Base Map Used:** Modified USGS total precipitation map for the period June 13-20, 1965

**Radar Included:** No

**Depth-Area-Duration (DAD) analysis:** 1, 2, 3, 4, 5, 6, 12, 18, 24, 36, 48, 72, 96, 120, & 144 hr

**Confidence in results:** For reasons described below, the results of this analysis are markedly different than SPAS 1009, but are believed to be more accurate. A comprehensive bucket survey provides us with a moderate degree of confidence in the magnitudes; however exact storm patterns have a high degree of uncertainty. The temporal distributions are anchored on good, but sparse hourly data, therefore confidence is lower than normal with the timing.

### **Comments:**

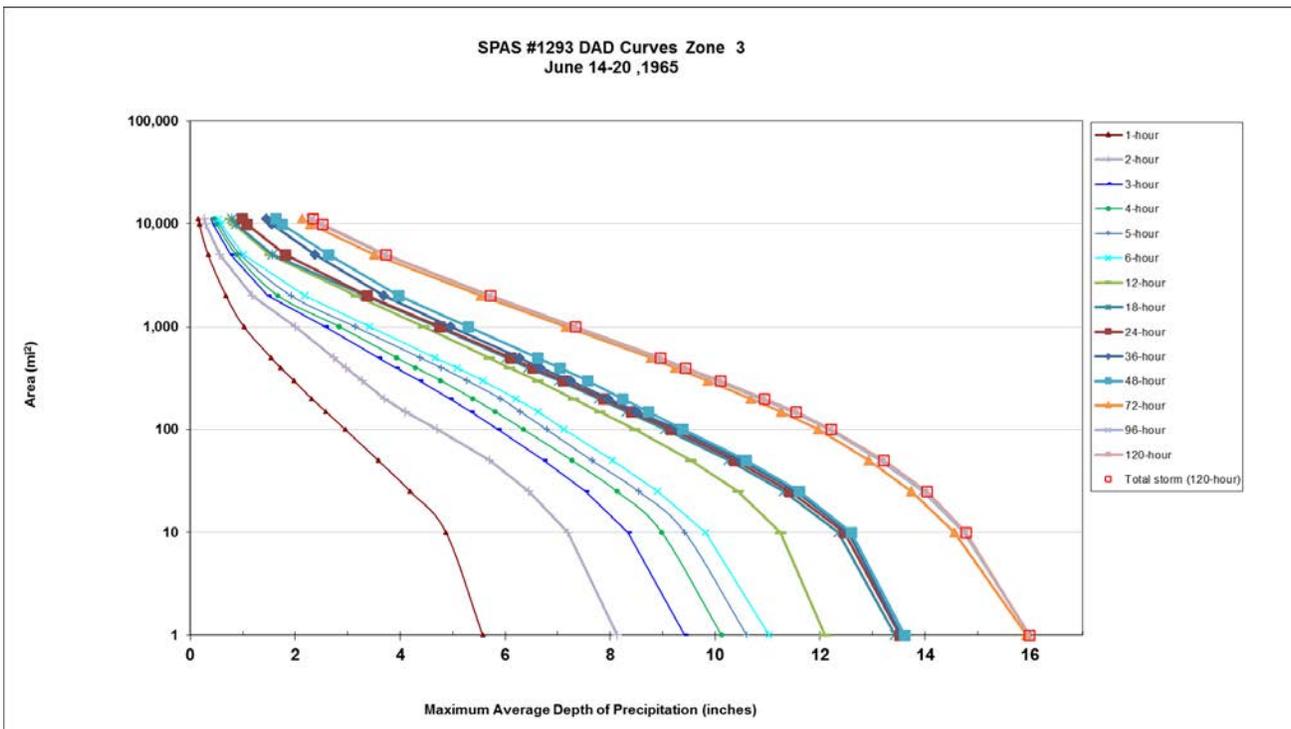
- This analysis was a re-analysis of SPAS #1009. Since then, several software enhancements have taken place. Plus, a large amount of additional data (Bucket Survey) was added, mainly to address the western storm centers (southeast of Denver). Also, a USGS isohyetal map was used as the basemap, which injected a great deal of information into the analysis versus the #1009 analysis. For these reasons, the results of this analysis are different than 1009, but are believed to be more accurate.

- 251 Bucket Survey amounts were added from the Colorado Climatological Data. After QC, a total of 224 remained in the data set.

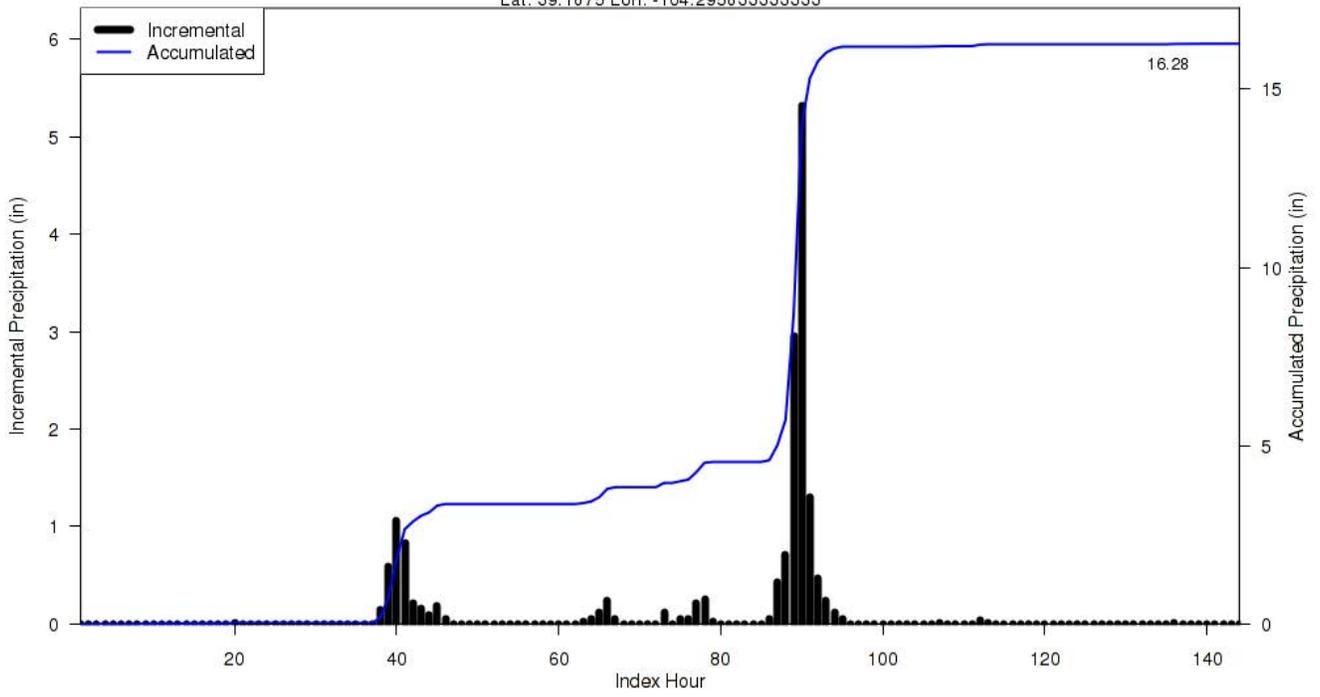
Unlike SPAS #1009 where the storm center was near Holly, SPAS #1293 has the storm center about 30 miles southwest of Holly (or 28 miles south –southeast of Lamar, CO). The USGS report stated intense rains began on June 16<sup>th</sup> in this area and dropped 15.5” of rain. Coupled with other rain showers during the June 14-19<sup>th</sup> period, the total storm center rainfall rose to 18” for the 144-hour period. Two Buttes, the closest hourly “station,” was based on a mass curve published in the USGS report (shown below). The USGS mass curve for Two Buttes looked to be estimated, so the final timing was also influenced by surrounding true hourly stations.

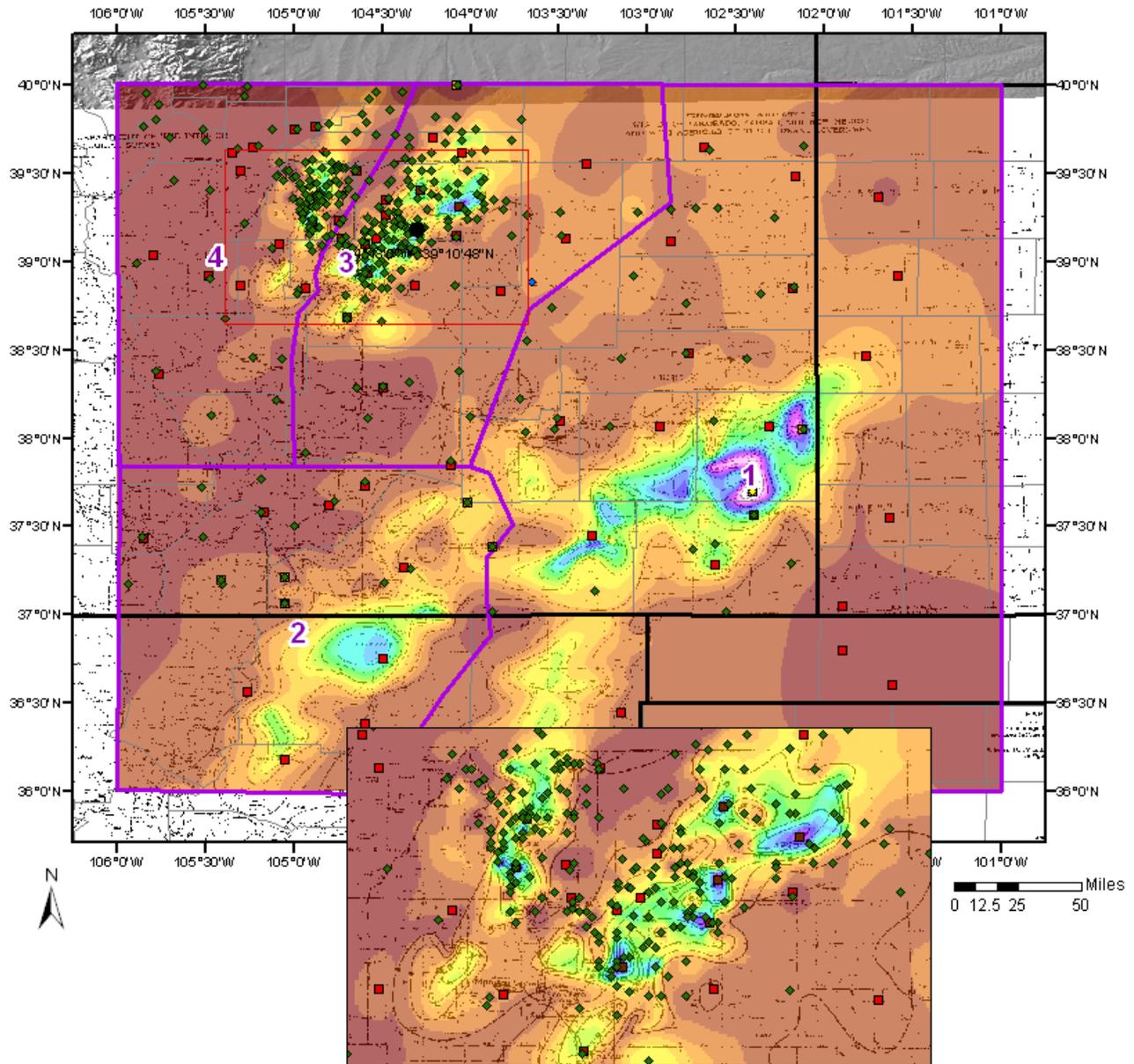
SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1293_3_loc	-104.296	39.188	6,215	6,000	77.00	3.14	1.36	76	1.780	80.95	81.0	3.77	1.57	84	2.200	1.236

SPAS 1293 - June 14 (800 UTC) - June 20 (700 UTC), 1965															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.4	5.65	8.23	9.53	10.24	10.71	11.14	12.25	13.61	13.71	13.73	13.76	16.1	16.16	16.17	16.17
1	5.57	8.13	9.42	10.12	10.6	11.02	12.09	13.43	13.52	13.54	13.61	15.93	15.99	15.99	15.99
10	4.87	7.19	8.34	8.98	9.42	9.81	11.24	12.35	12.46	12.54	12.59	14.56	14.74	14.78	14.78
25	4.19	6.45	7.53	8.13	8.54	8.9	10.43	11.3	11.42	11.54	11.6	13.74	13.96	14.03	14.03
50	3.58	5.7	6.73	7.27	7.65	8.04	9.53	10.25	10.37	10.48	10.59	12.92	13.13	13.21	13.21
100	2.95	4.7	5.86	6.35	6.79	7.12	8.47	9.05	9.16	9.27	9.38	11.96	12.17	12.21	12.21
150	2.58	4.09	5.34	5.8	6.28	6.63	7.8	8.31	8.4	8.51	8.72	11.25	11.46	11.54	11.54
200	2.31	3.7	4.95	5.38	5.91	6.21	7.3	7.78	7.87	7.96	8.24	10.68	10.86	10.93	10.93
300	1.97	3.27	4.37	4.77	5.27	5.57	6.62	7.02	7.1	7.24	7.56	9.86	10.02	10.1	10.10
400	1.72	2.97	3.91	4.29	4.78	5.09	6.08	6.44	6.52	6.67	7.04	9.24	9.37	9.43	9.43
500	1.54	2.73	3.58	3.93	4.38	4.66	5.69	6.03	6.1	6.27	6.62	8.78	8.89	8.95	8.95
1,000	1.02	2	2.57	2.84	3.14	3.41	4.44	4.7	4.75	4.96	5.29	7.15	7.29	7.33	7.33
2,000	0.68	1.18	1.48	1.67	1.92	2.18	3.16	3.33	3.36	3.68	3.97	5.53	5.68	5.71	5.71
5,000	0.34	0.56	0.77	0.88	0.96	1.01	1.51	1.57	1.81	2.37	2.63	3.5	3.69	3.72	3.72
10,000	0.17	0.29	0.43	0.5	0.55	0.59	0.83	0.87	1.07	1.55	1.75	2.29	2.47	2.52	2.52
11,201	0.15	0.26	0.39	0.45	0.49	0.54	0.75	0.79	0.98	1.45	1.63	2.13	2.3	2.34	2.34



SPAS 1293 Storm Center Mass Curve Zone 3  
June 14 (0800UTC) to June 20 (0700UTC), 1965  
Lat: 39.1875 Lon: -104.295833333333





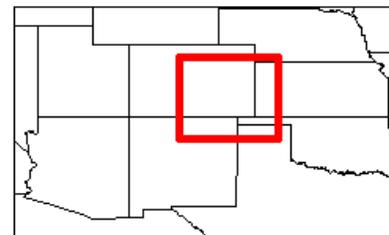
**Total 144-hour Precipitation (inches)**  
**06/14/1965 08 UTC - 06/20/1965 07 UTC**  
**SPAS #1293**

**Precipitation (inches)**

- |             |               |               |
|-------------|---------------|---------------|
| 0.00 - 1.00 | 7.01 - 8.00   | 14.01 - 15.00 |
| 1.01 - 2.00 | 8.01 - 9.00   | 15.01 - 16.00 |
| 2.01 - 3.00 | 9.01 - 10.00  | 16.01 - 17.00 |
| 3.01 - 4.00 | 10.01 - 11.00 | 17.01 - 18.00 |
| 4.01 - 5.00 | 11.01 - 12.00 | 18.01 - 19.00 |
| 5.01 - 6.00 | 12.01 - 13.00 |               |
| 6.01 - 7.00 | 13.01 - 14.00 |               |

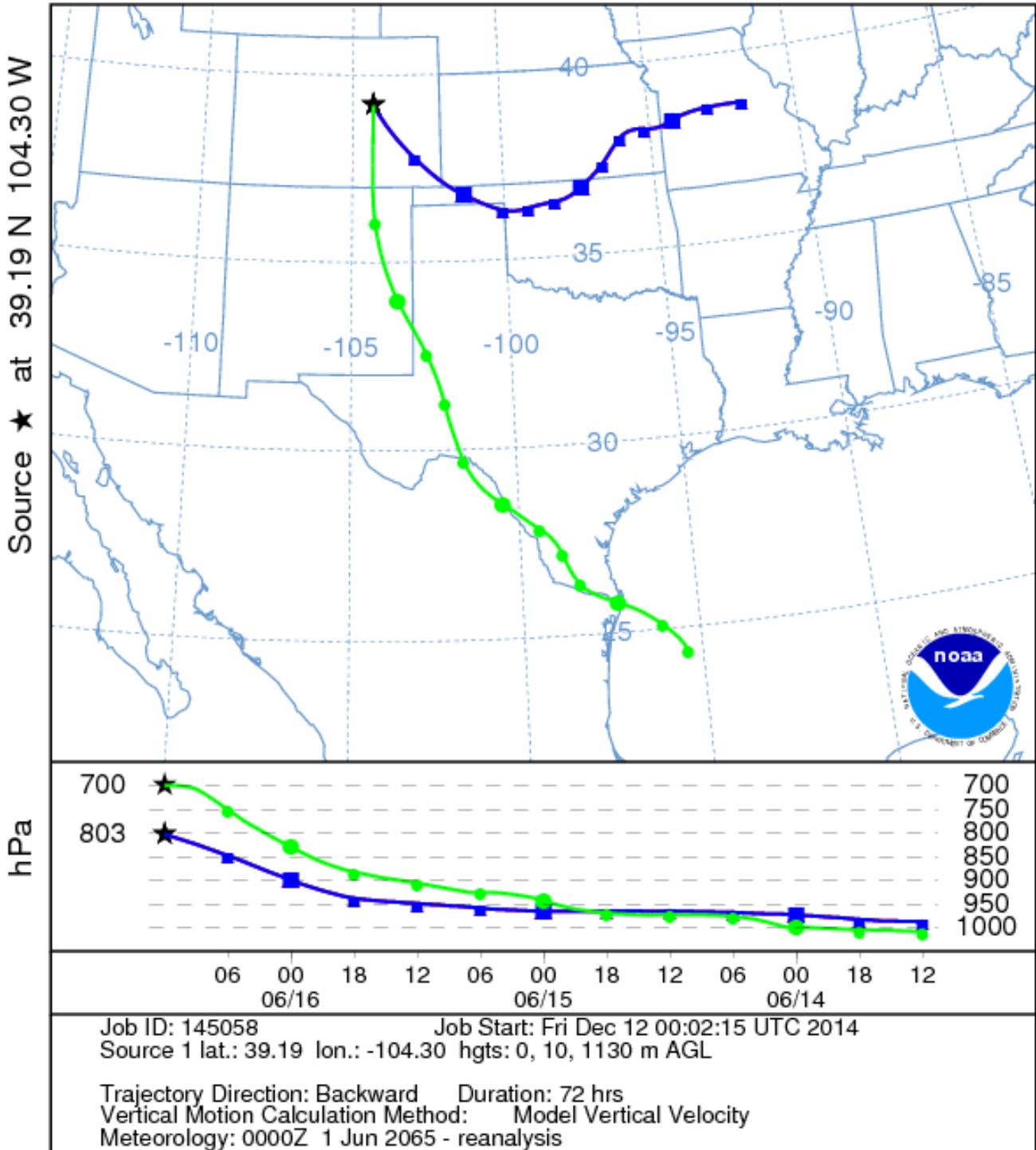
**Stations**

- Hourly
- Hourly Estimated
- Hourly Est. Pseudo
- Hourly Pseudo
- Daily
- Supplemental
- Supplemental Est.

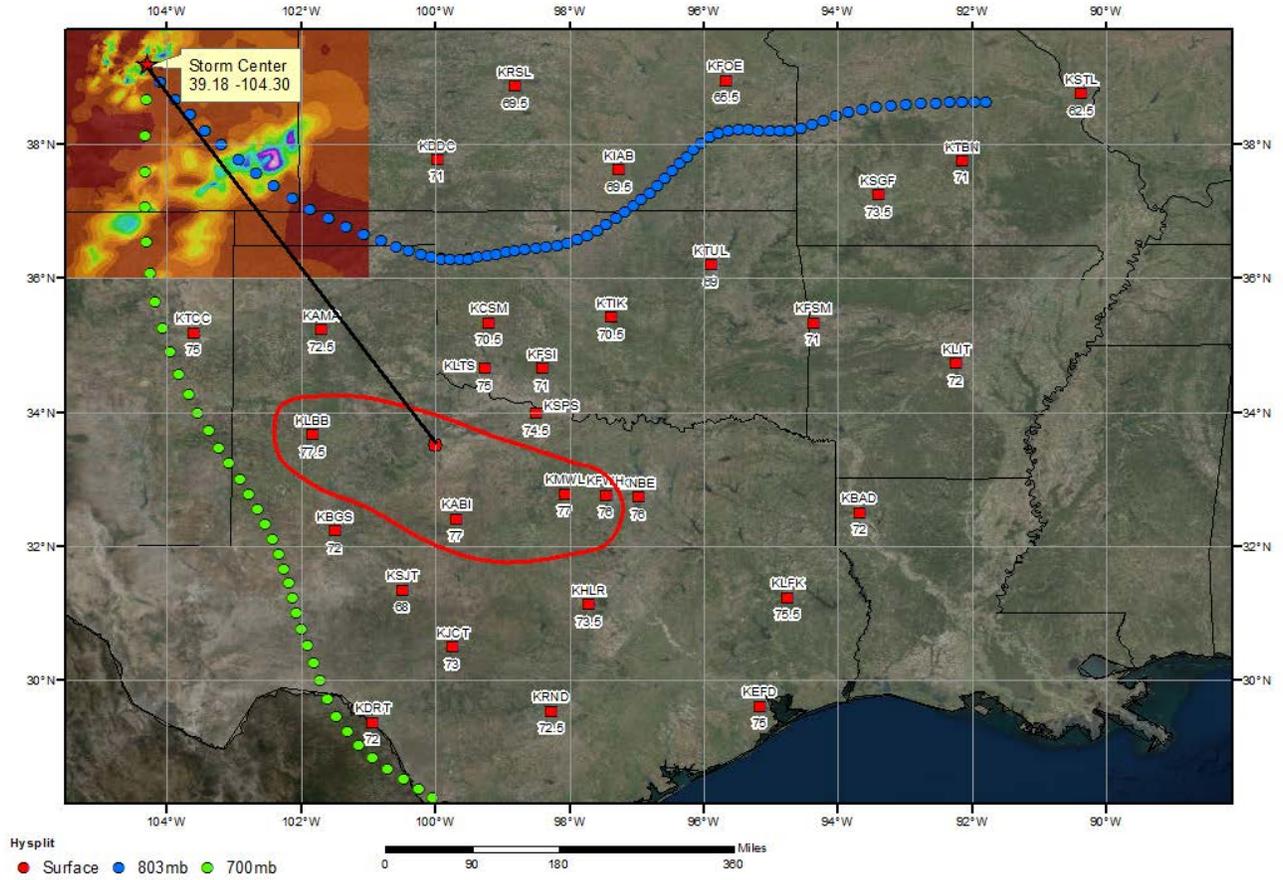


06/20/2013 (updated 12/9/13)

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 1200 UTC 16 Jun 65  
 CDC1 Meteorological Data



### SPAS 1293 Zone 3 Elbert, CO Storm Analysis June 13-16, 1965



## Storm Precipitation Analysis System (SPAS) For Storm #1568\_1

**General Storm Location:** Southeastern New Mexico/Southwestern Texas (33.25,-106.5,30.0,-103.25)

**Storm Dates:** August 21-24, 1966

**Event:** Synoptic

### DAD Zone 1

**Latitude:** 32.2542

**Longitude:** -104.6125

**Max. Grid Rainfall Amount:** 17.35” Carlsbad, NM

**Max. Observed Rainfall Amount:** 17.00”

**Number of Stations:** 64

**SPAS Version:** 10.0

**Basemap:** Blended Basemap of PRISM Mean August 1971-2000 Climatology and USACE Isohyetal Pattern.

**Spatial resolution:** 0.2819

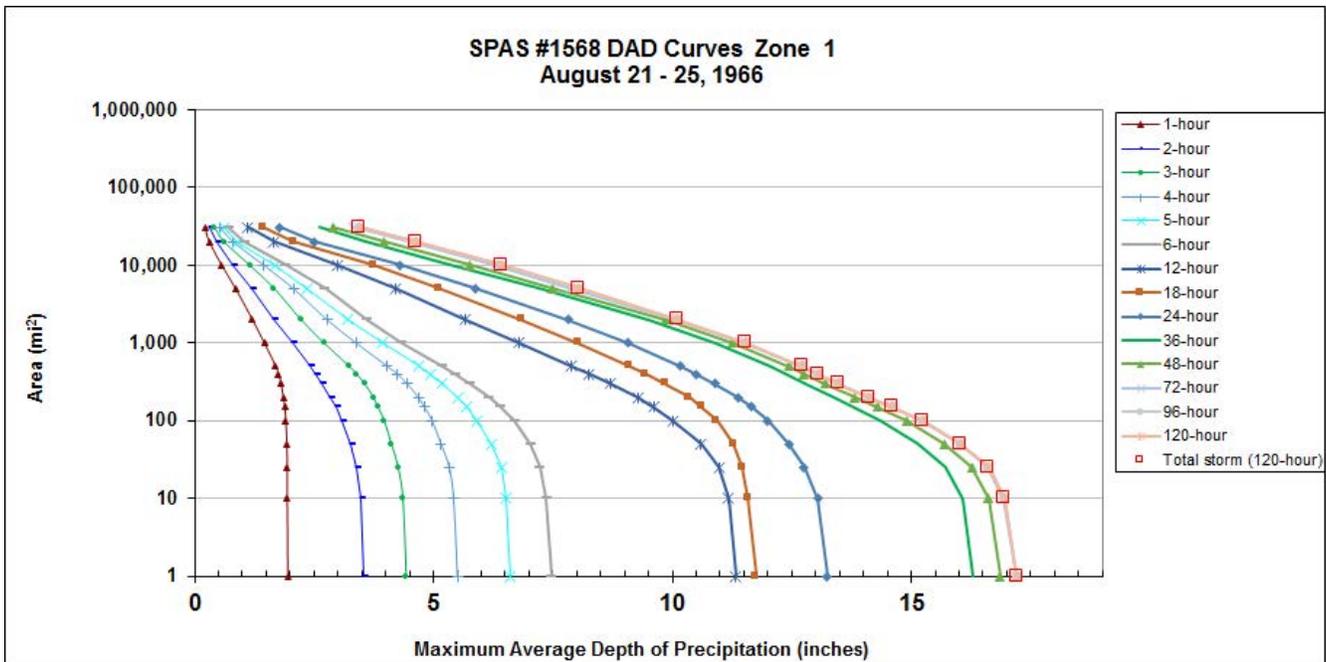
**Radar Included:** No

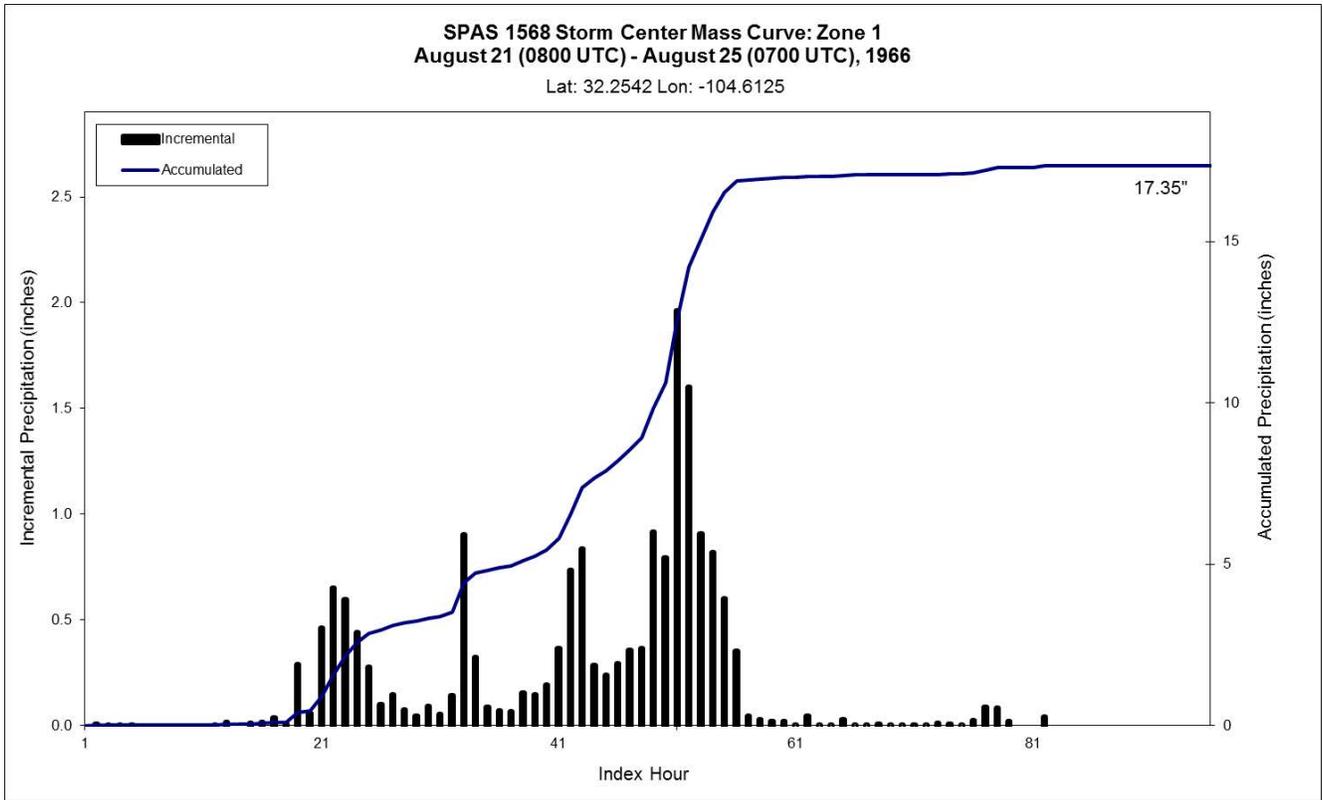
**Depth-Area-Duration (DAD) analysis:** Yes

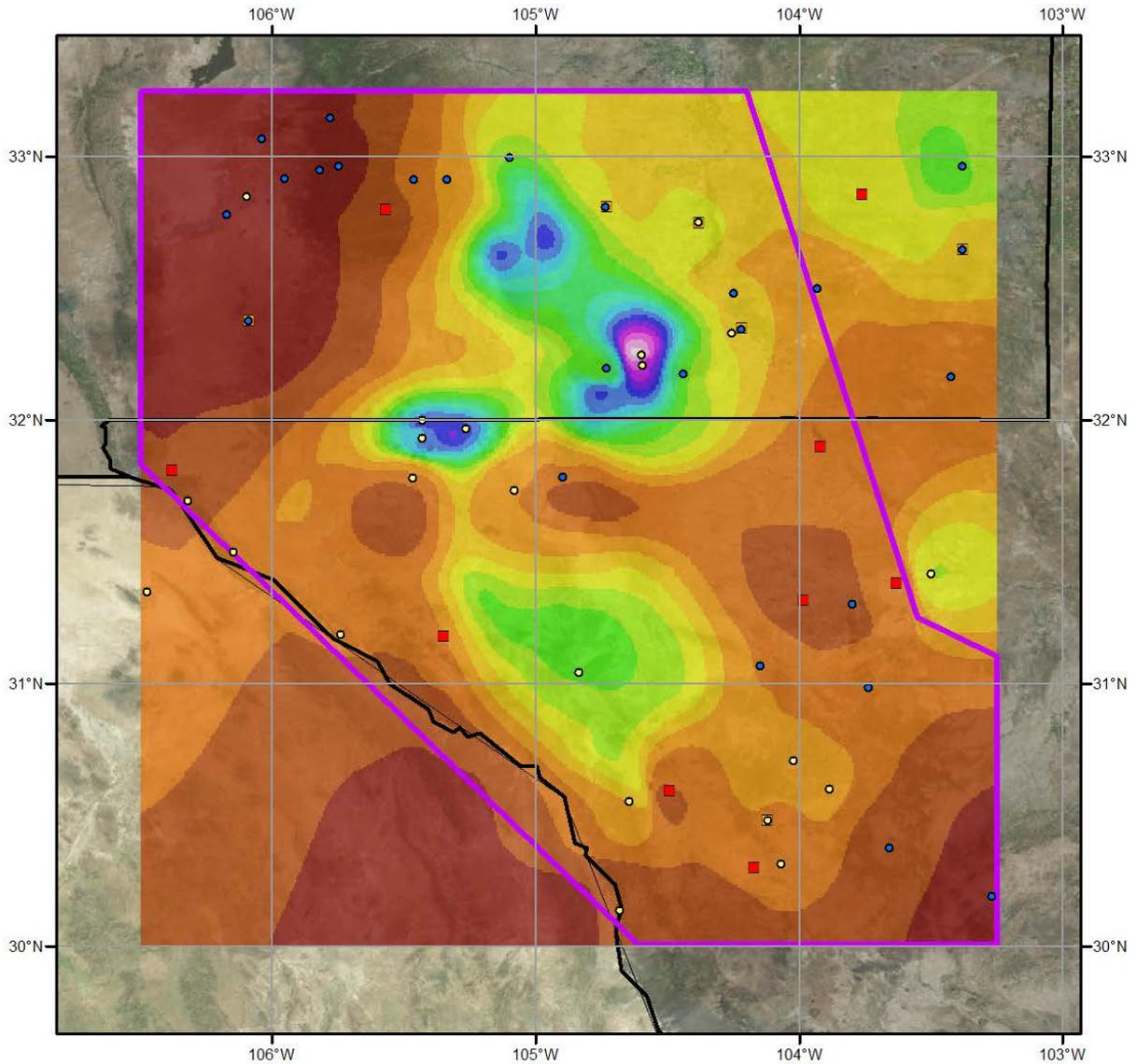
**Reliability of results:** This analysis was based on hourly data, daily data, and supplemental station data. We have a high degree of confidence in the station based storm total results. The spatial pattern is dependent on the blended basemap, and the timing is based on hourly and hourly pseudo stations. An additional 22 supplemental stations were created to ensure data consistency.

SPAS Storm ID	LON	LAT	ELEV	ELEV Round	Storm Rep. Dew Point					Climatological Max. Dew Point					IPMF	
					T <sub>d</sub>	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column	Avail. Moisture	T <sub>d</sub>	T <sub>d</sub> Round	Precip. Water @ 30,000 ft	Precip. Water @ Storm Elev.	PW Lookup Table Column		Avail. Moisture
1568_1_loc	-104.613	32.254	4,342	4,300	74.00	2.73	0.93	70	1.800	78.89	79.0	3.44	1.10	80	2.340	1.300

Storm 1568 - August 21 (0800 UTC) - August 25 (0700 UTC), 1966															
MAXIMUM AVERAGE DEPTH OF PRECIPITATION (INCHES)															
Area (mi <sup>2</sup> )	Duration (hours)														
	1	2	3	4	5	6	12	18	24	36	48	72	96	120	Total
0.3	1.96	3.56	4.46	5.53	6.66	7.50	11.40	11.81	13.32	16.38	16.95	17.29	17.31	17.35	17.35
1	1.95	3.53	4.43	5.50	6.62	7.46	11.33	11.75	13.24	16.29	16.85	17.19	17.21	17.21	17.21
10	1.94	3.48	4.36	5.42	6.52	7.36	11.17	11.59	13.05	16.07	16.62	16.94	16.95	16.95	16.95
25	1.94	3.40	4.26	5.33	6.42	7.22	10.97	11.47	12.75	15.70	16.26	16.59	16.61	16.61	16.61
50	1.93	3.27	4.12	5.16	6.22	7.02	10.60	11.28	12.44	15.14	15.69	16.01	16.02	16.02	16.02
100	1.91	3.09	3.97	4.97	5.92	6.69	10.01	10.93	11.99	14.35	14.90	15.21	15.23	15.23	15.23
150	1.89	2.95	3.84	4.81	5.70	6.40	9.61	10.62	11.66	13.80	14.29	14.58	14.59	14.59	14.59
200	1.86	2.84	3.74	4.68	5.51	6.16	9.27	10.36	11.37	13.38	13.82	14.10	14.11	14.11	14.11
300	1.81	2.66	3.56	4.45	5.18	5.77	8.71	9.86	10.88	12.80	13.19	13.45	13.47	13.47	13.47
400	1.76	2.53	3.39	4.24	4.93	5.45	8.26	9.44	10.49	12.38	12.76	13.02	13.04	13.04	13.04
500	1.70	2.41	3.24	4.04	4.68	5.19	7.90	9.11	10.17	12.06	12.43	12.69	12.71	12.71	12.71
1,000	1.46	2.05	2.71	3.38	3.92	4.34	6.80	8.03	9.08	10.90	11.26	11.52	11.54	11.54	11.54
2,000	1.21	1.67	2.23	2.77	3.21	3.61	5.68	6.84	7.81	9.52	9.87	10.10	10.11	10.11	10.11
5,000	0.86	1.21	1.67	2.07	2.37	2.73	4.20	5.12	5.87	7.20	7.48	7.85	8.04	8.04	8.04
10,000	0.57	0.81	1.16	1.45	1.68	1.91	2.99	3.75	4.31	5.36	5.76	6.27	6.44	6.44	6.44
20,000	0.31	0.47	0.62	0.81	0.91	1.04	1.67	2.07	2.51	3.58	3.97	4.50	4.63	4.63	4.63
30,587	0.22	0.31	0.42	0.53	0.62	0.71	1.11	1.44	1.78	2.62	2.90	3.34	3.45	3.45	3.45



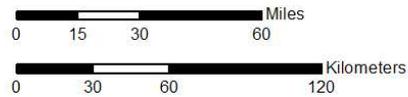




**Total Storm (96-hours) Precipitation (inches)**  
**August 21-24, 1966**  
**SPAS 1568 - Carlsbad, NM**

**Gauges**

- Daily
- Hourly
- Hourly Pseudo
- Supplemental

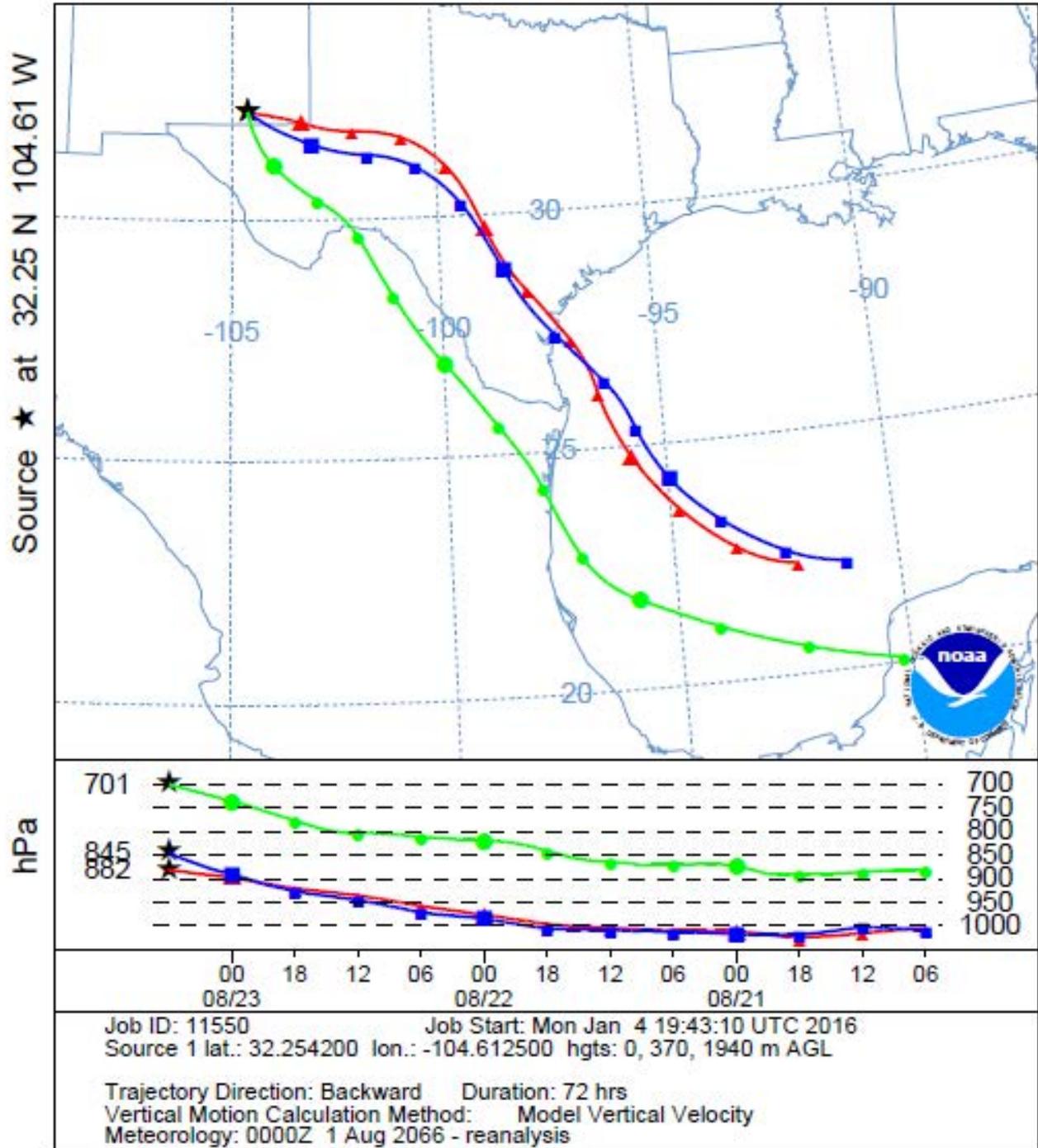


**Precipitation (inches)**

■ 0.00 - 1.00	■ 4.01 - 5.00	■ 9.01 - 10.00	■ 14.01 - 15.00
■ 1.01 - 2.00	■ 5.01 - 6.00	■ 10.01 - 11.00	■ 15.01 - 16.00
■ 2.01 - 3.00	■ 6.01 - 7.00	■ 11.01 - 12.00	■ 16.01 - 17.00
■ 3.01 - 4.00	■ 7.01 - 8.00	■ 12.01 - 13.00	■ 17.01 - 18.00
	■ 8.01 - 9.00	■ 13.01 - 14.00	



NOAA HYSPLIT MODEL  
 Backward trajectories ending at 0600 UTC 23 Aug 66  
 CDC1 Meteorological Data



### SPAS 1568 Carlsbad, NM Storm Analysis August 20-23, 1966

