Temperature Sensing via Infrared Camera to Identify Groundwater Interactions with Streams

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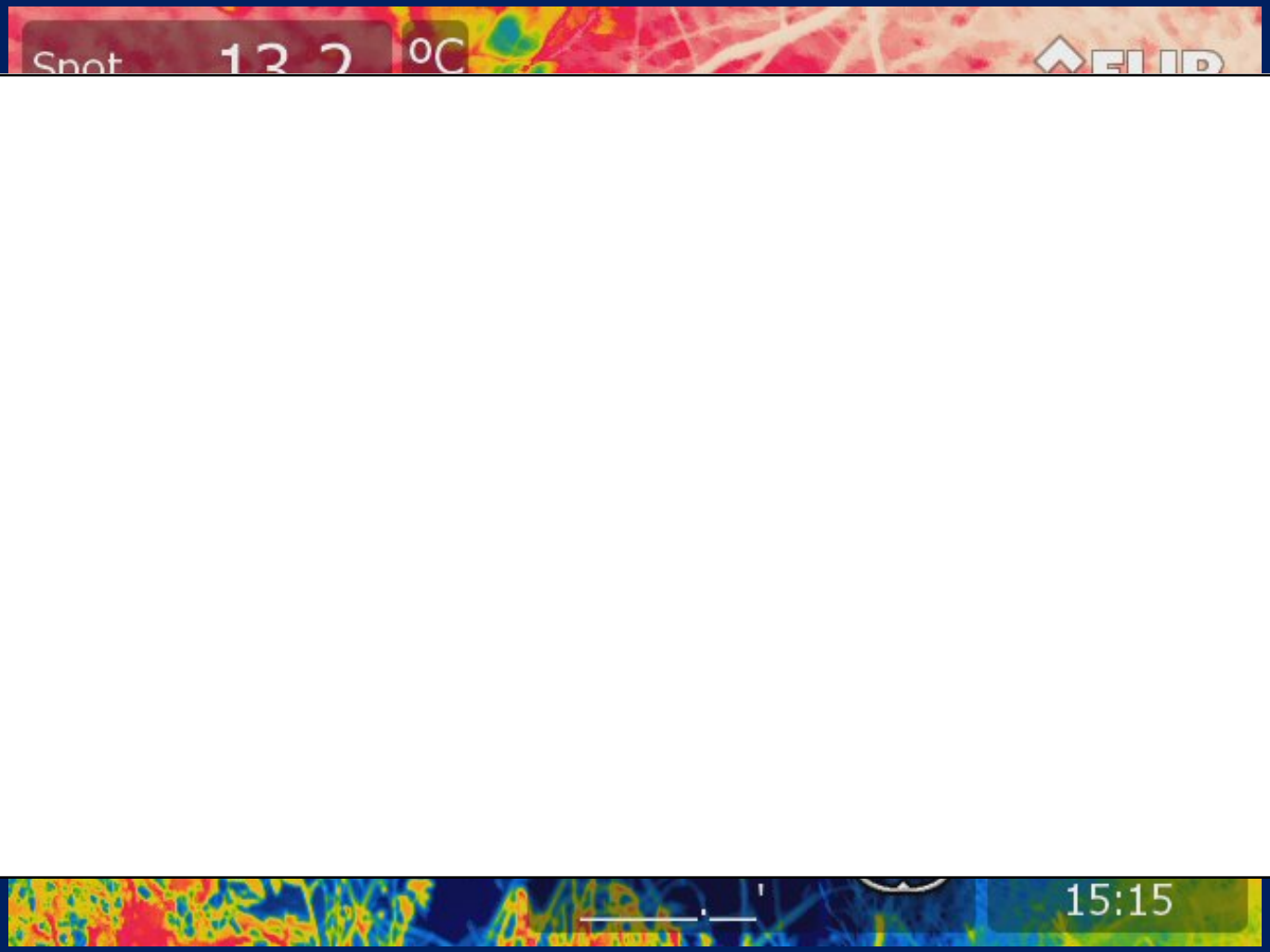
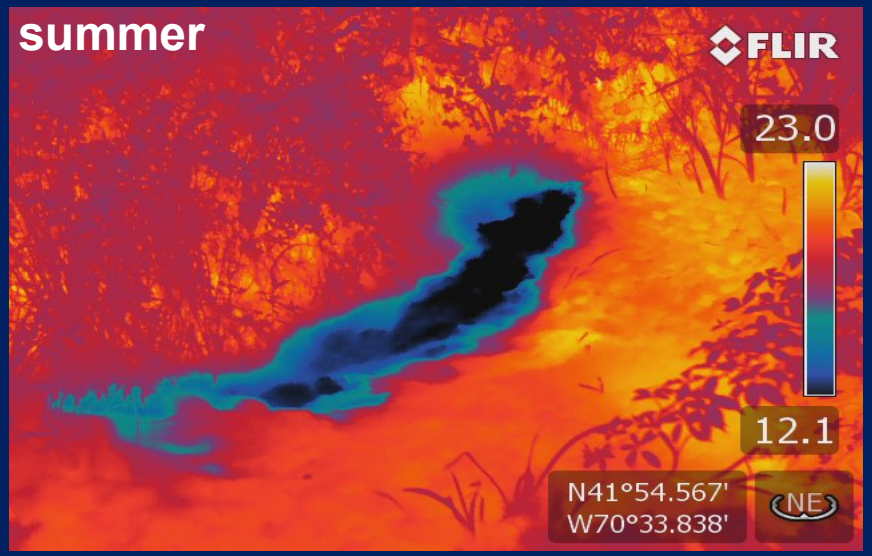
U.S. Department of the Interior
U.S. Geological Survey

The myth of spatially uniform/diffuse discharge

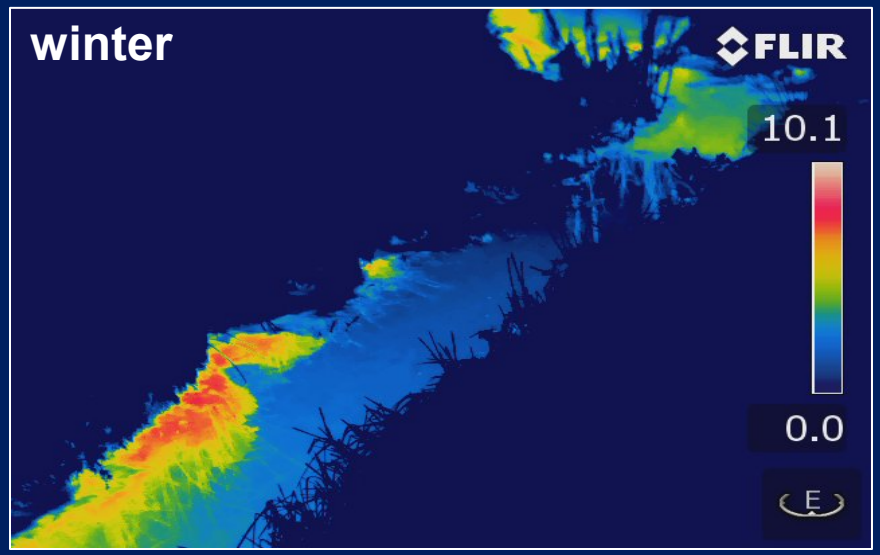


Remote sensing surface temperature

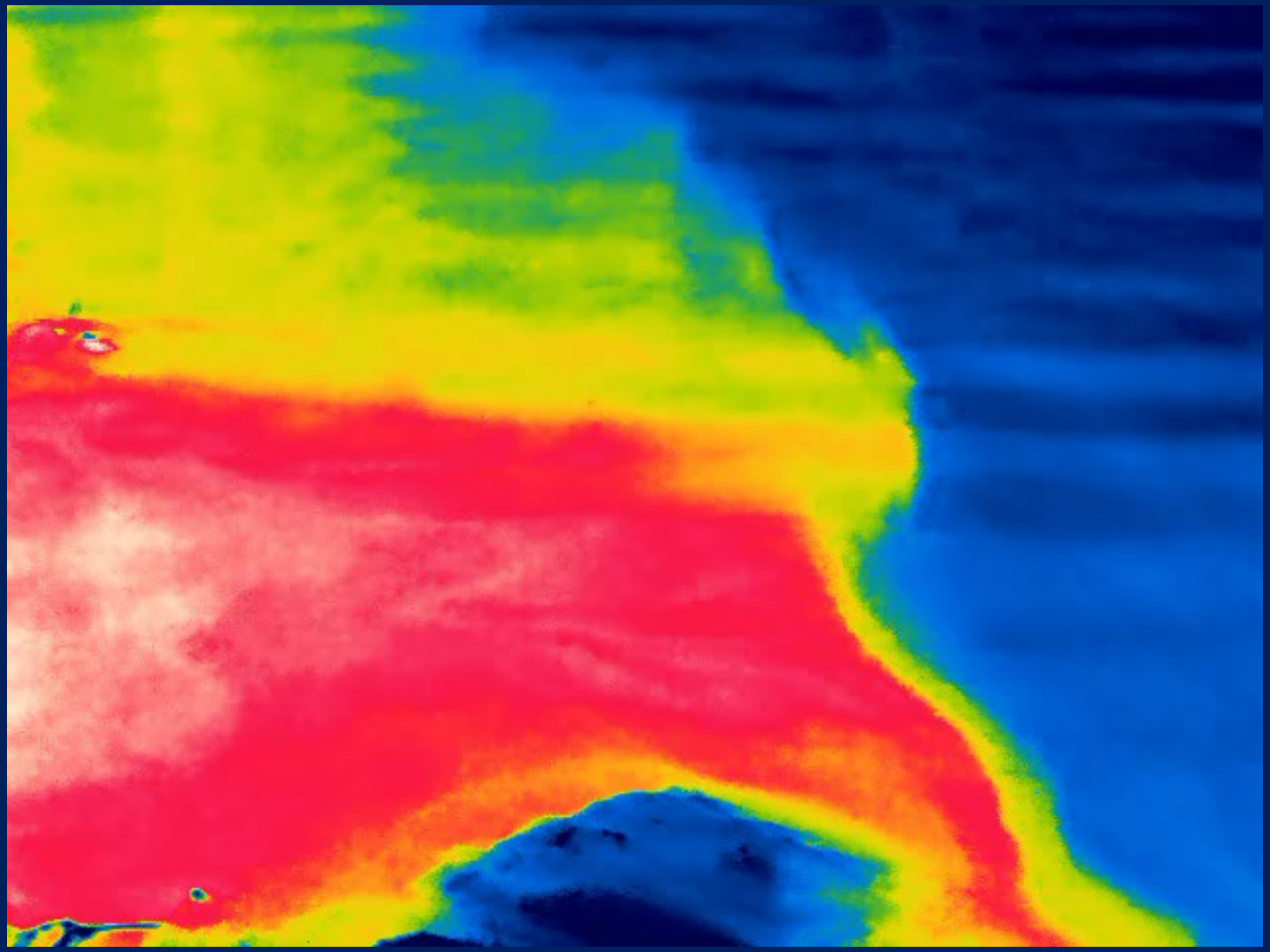


Groundwater temperature may be distinct from surface water, and therefore acts as a natural tracer that may be relatively cold and dense in summer…

…and relatively warm and buoyant in the winter, compared to surface water. Groundwater inflows can be identified quickly throughout aquatic systems if there is a ***surface*** temperature expression.



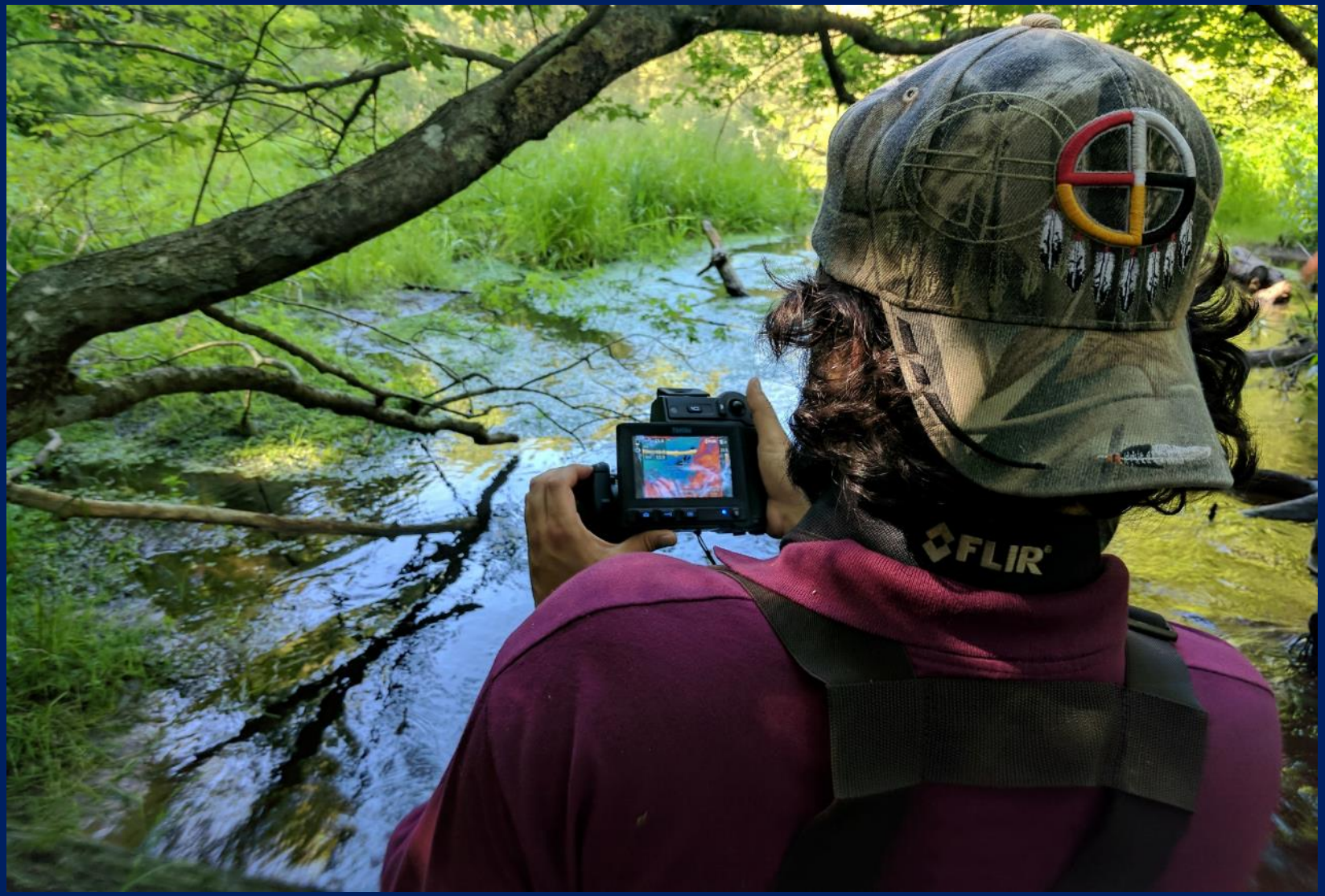
Remote sensing surface temperature



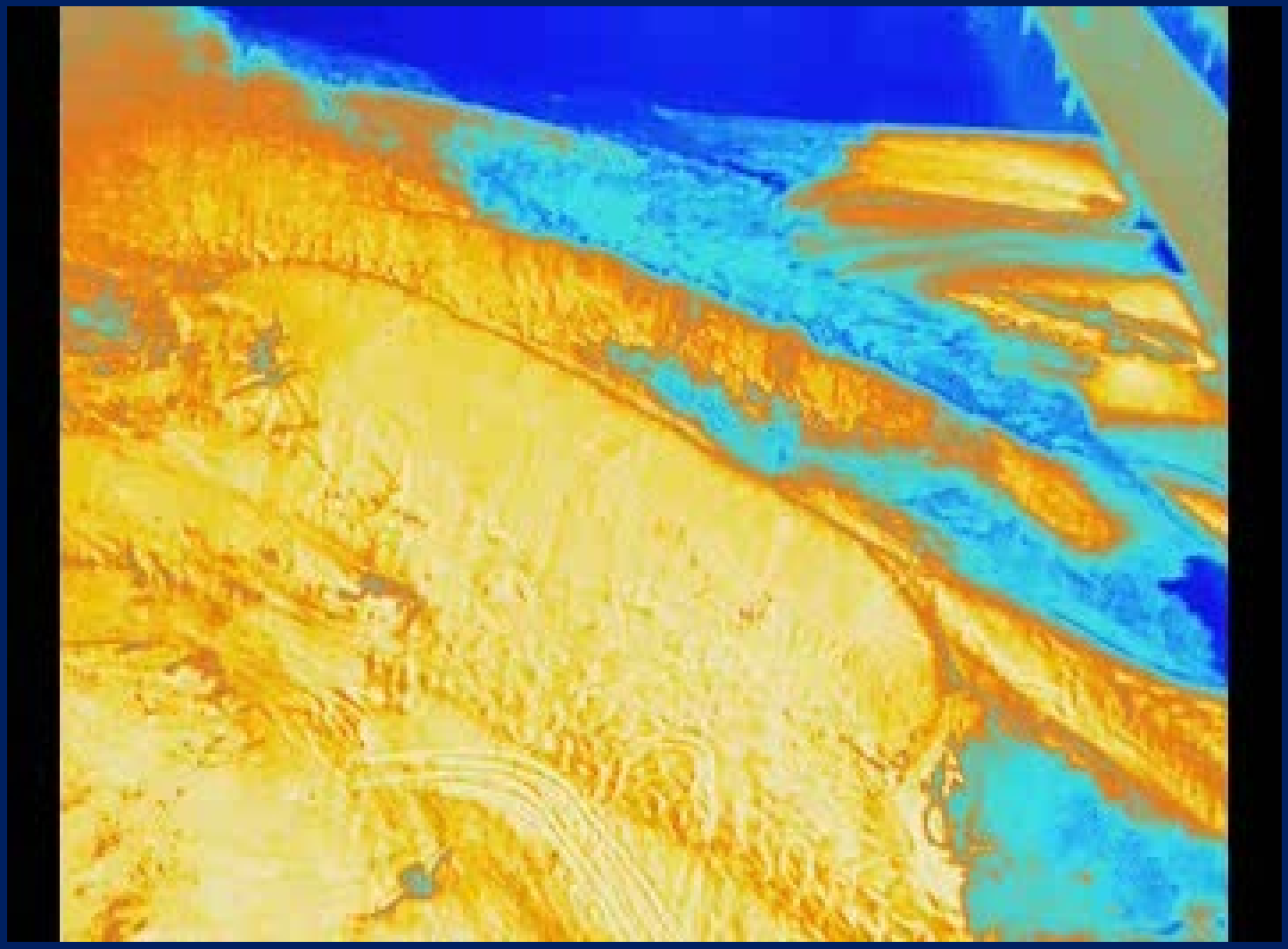
Boone aquifer/small tributary in eastern OK
Winter 2017-18

USGS

Seep hunting to guide real time sampling/measurements



Rapid advancements in thermal imaging from drones

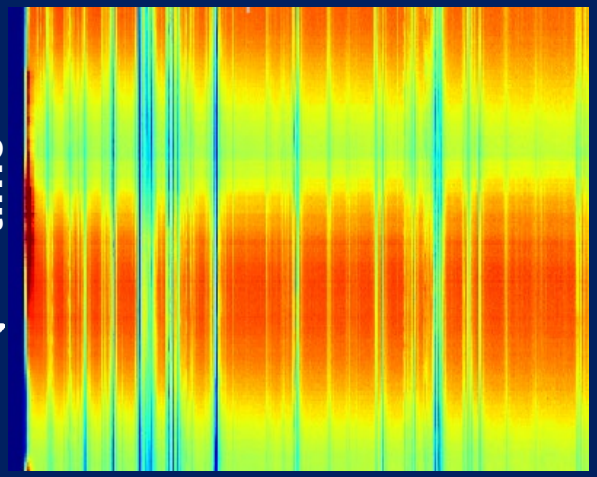


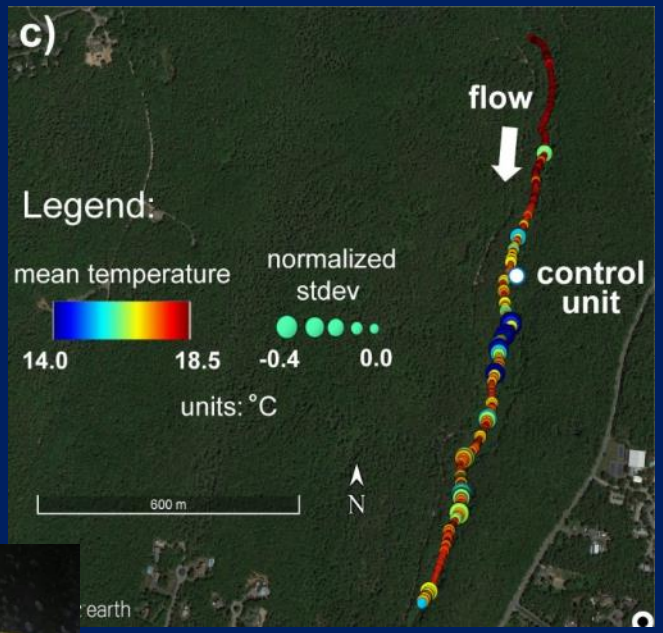
Cimarron River near Dover, OK (US HWY 81)
Summer 2018

Fiber-optic distributed temperature sensing

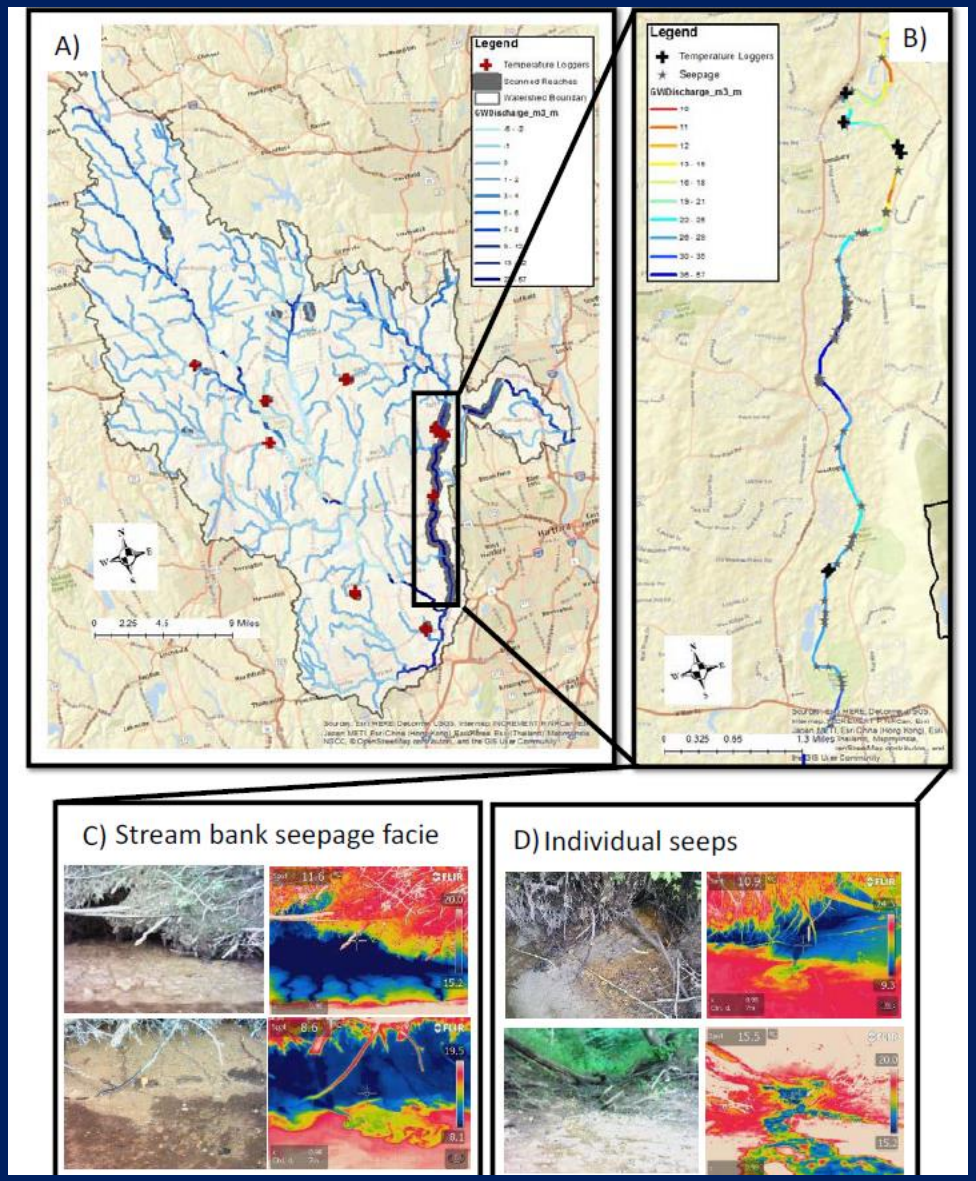
*Submeter-scale **direct contact** temperature measurements over km cables through time indicate seepage patterns and processes*

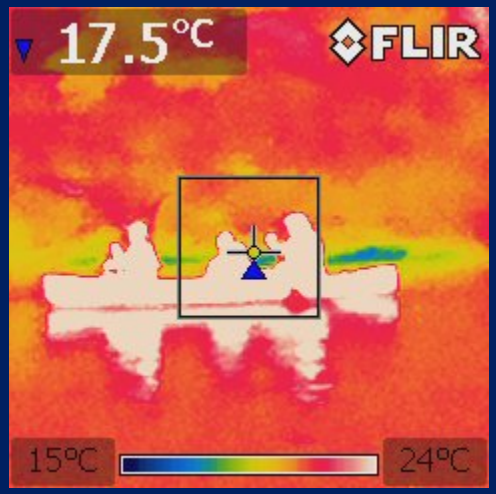
FO-DTS





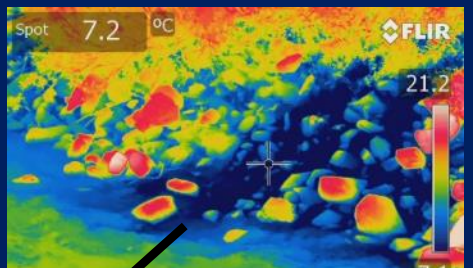
Comprehensive geolocation of preferential groundwater discharges

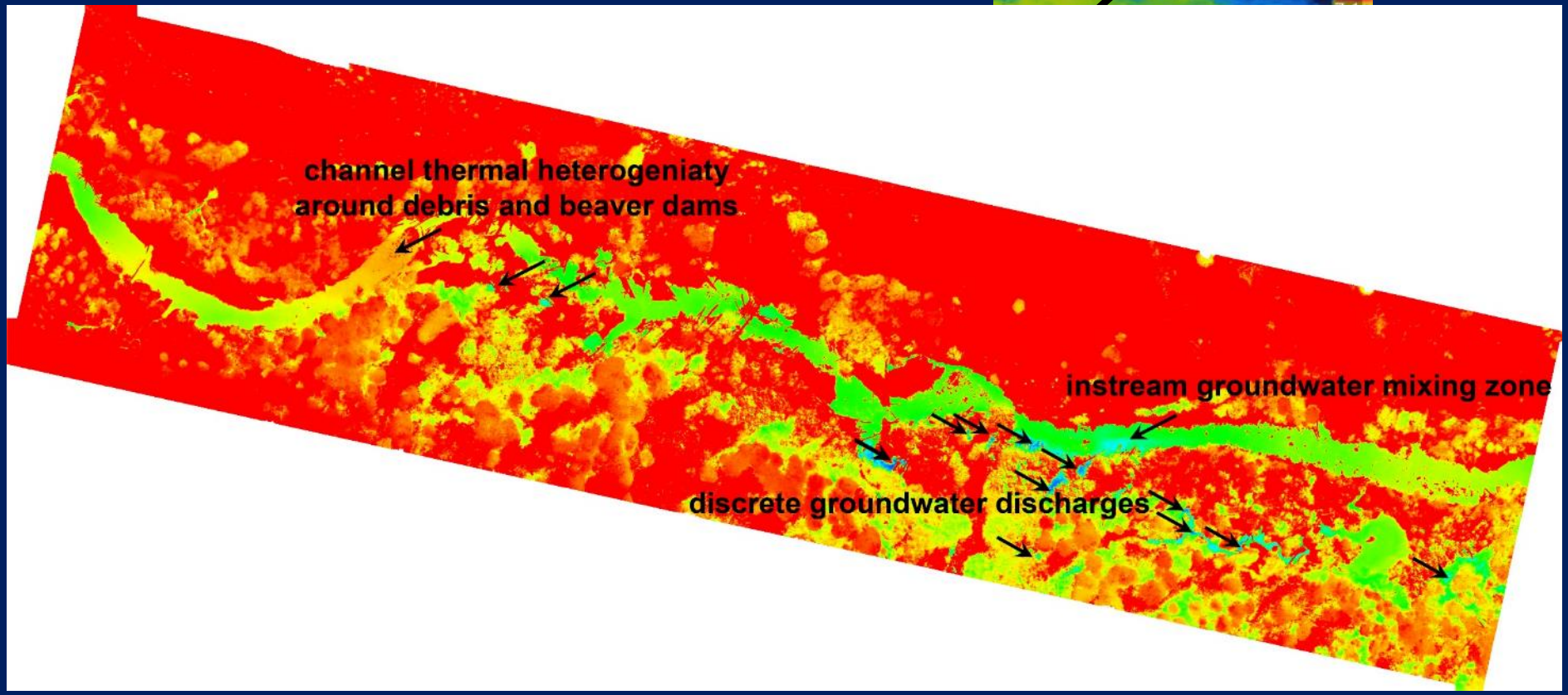




USGS

Infrared imaging of discharge: sUAS



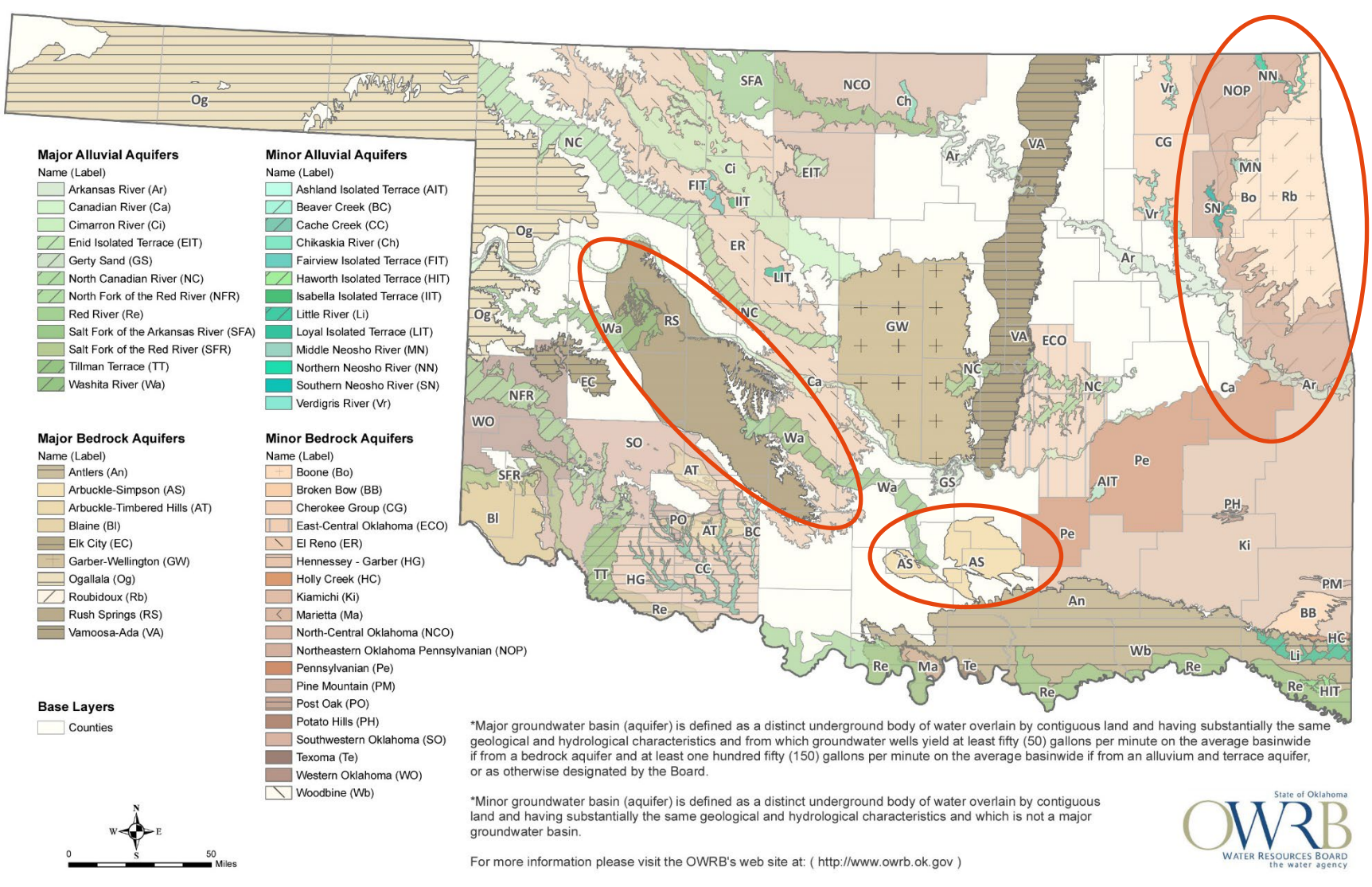


preliminary data, not reviewed

Concurrent, georeferenced data enable integrated analysis of multiple datasets.

Briggs et al. in-press

Planned Projects in Oklahoma with IR



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Questions

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