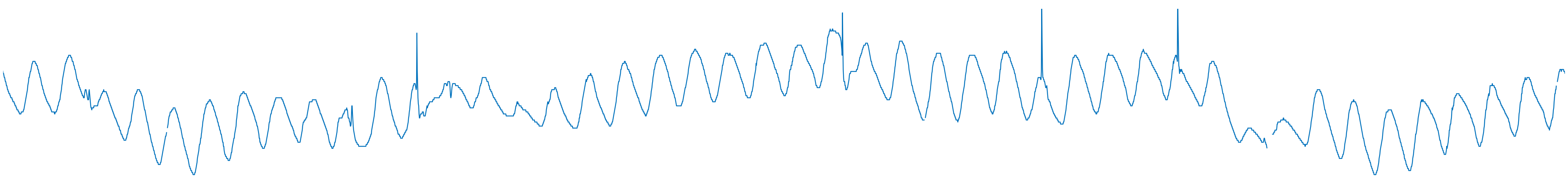
Differences between urban and natural stream temperatures across the eastern* United States

*working up to regional scale, but turns out there's lots to explore at city scales, first!



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Primary research questions:

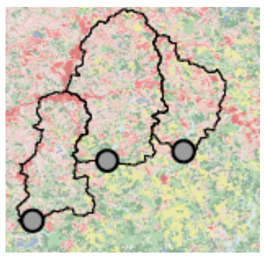
How do stream temperatures differ across proximal sites spanning a gradient of watershed imperviousness?

To what extent are the dynamics at one site and differences across sites driven by interactions between urban hydrologic processes, imperviousness, and other watershed features?

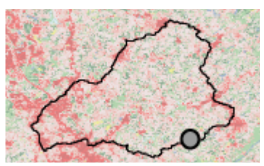
Why?

We know a lot about stream temperature dynamics in watersheds with limited human impact, but don’t know much about stream temperature behavior in urban areas.

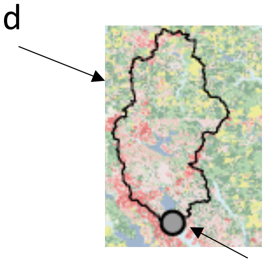
We are working to synthesize stream temperature observations from ~30 sites across a humid southern US city*



Sites are relatively proximal, spanning small to medium-sized watershed sizes (3 – 122 km^2) (three closely adjacent sites shown here)



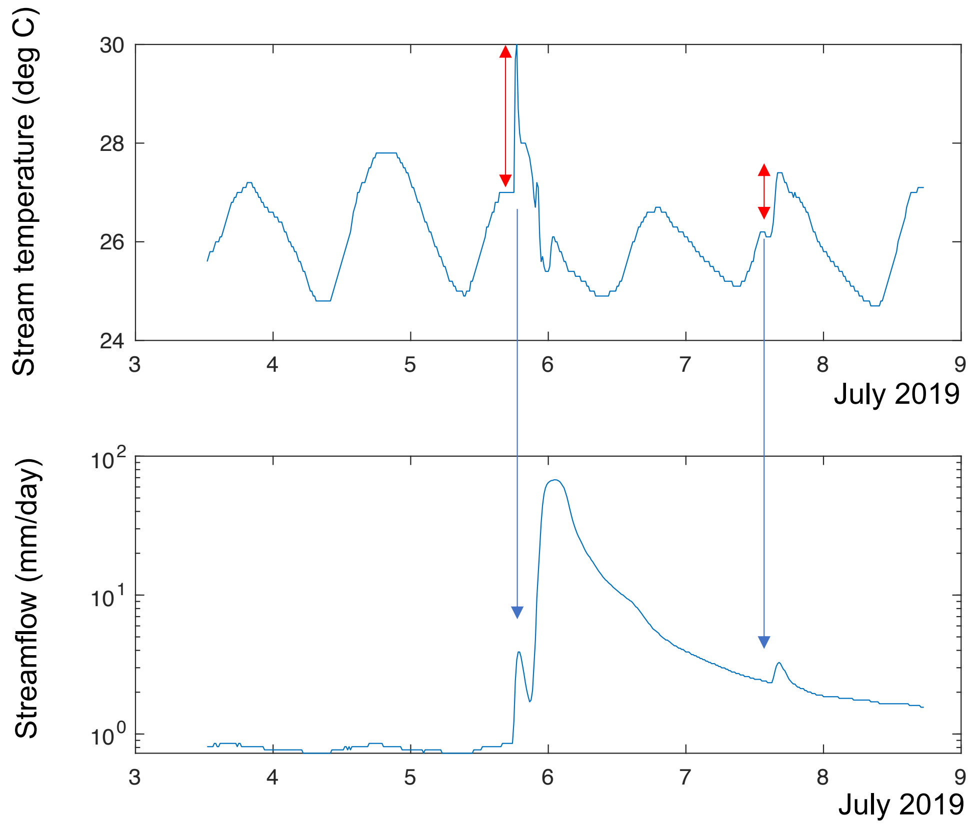
They range from heavily developed (95%) with high imperviousness (50%)…



… to less developed (20%) and low imperviousness (5%)

*Average annual air temperature: 16°C
Average annual precipitation: 120 cm

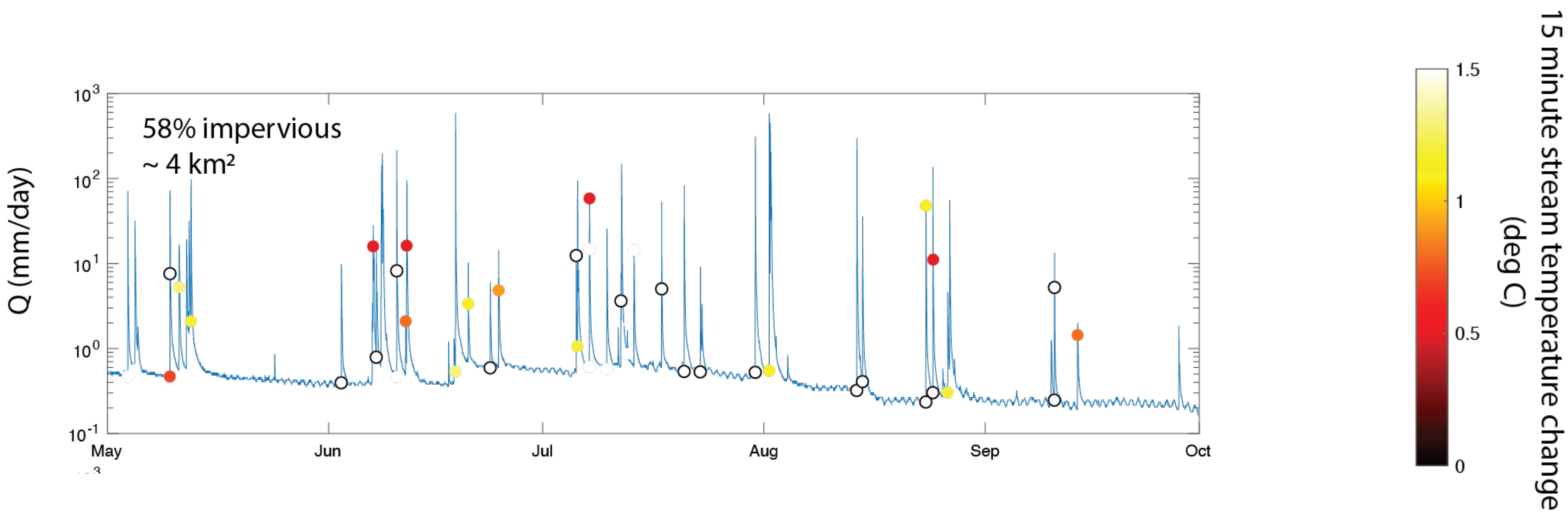
What are we seeing? Stream temperature behavior during summer storms differs from site to site



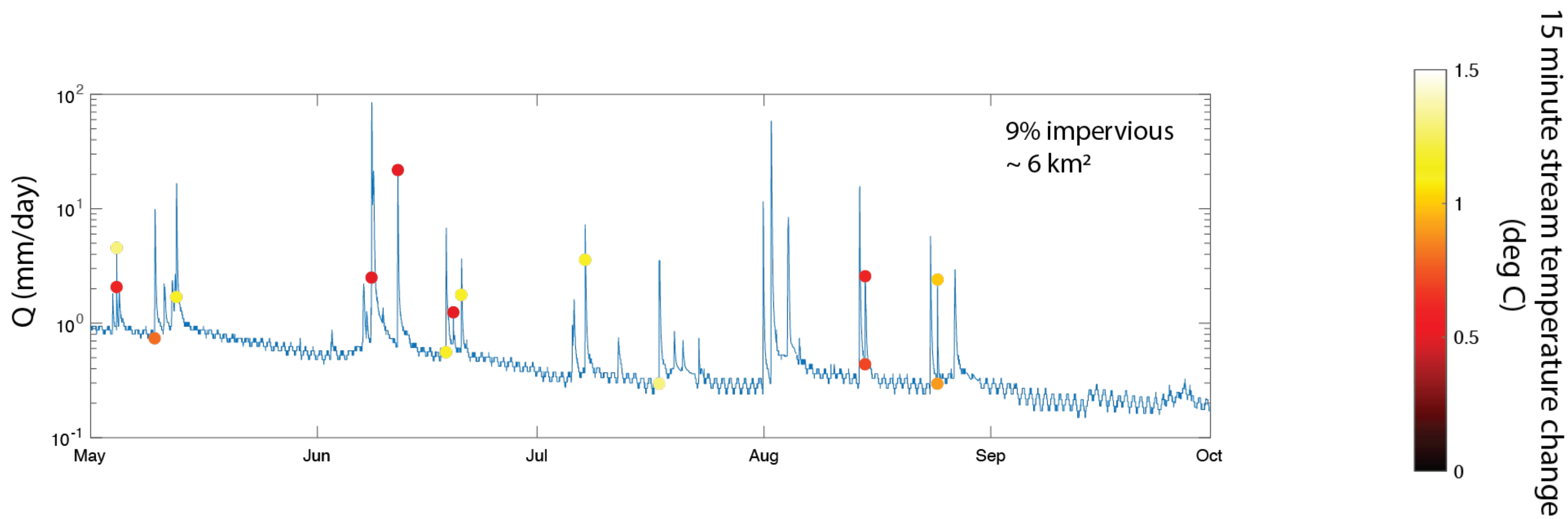
Using 15-minute observations from summer 2019, we are detecting the timing, frequency, and magnitude of heat pulses across sites

Pulses are coincident with summer storms and subsequent variations in streamflow

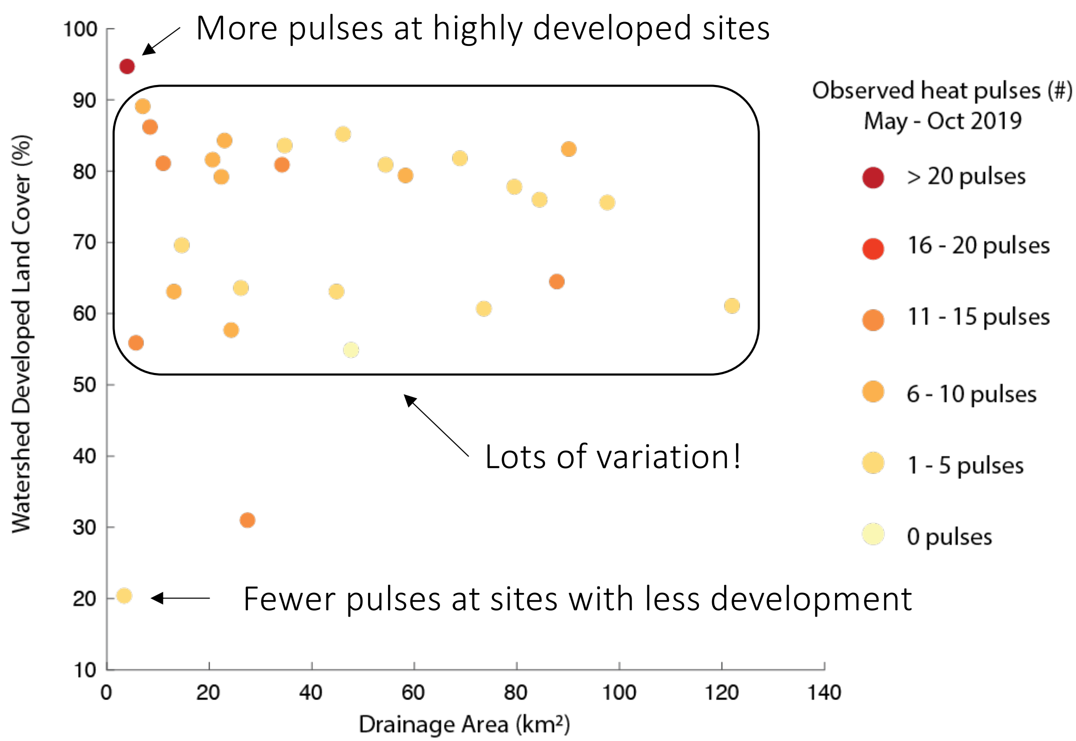
Heat pulses are frequent and high magnitude at some sites ….



… less frequent with smaller magnitude at others …



At a first cut, frequency of heat pulses is organized by land cover and watershed size, but much work left to do



Things we are still thinking about:

- Why do pulses occur for some storms but not others?
- What does the "timing" of the pulse tell us about its source?
- Are whole watershed descriptors the "right" explanatory variable for empirical analysis?