Factors and Geographies Most Influencing Water Temperatures in Local Waters throughout the Watershed

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U.S. EPA Chesapeake Bay Program Office-Retired

Based on Contributions from
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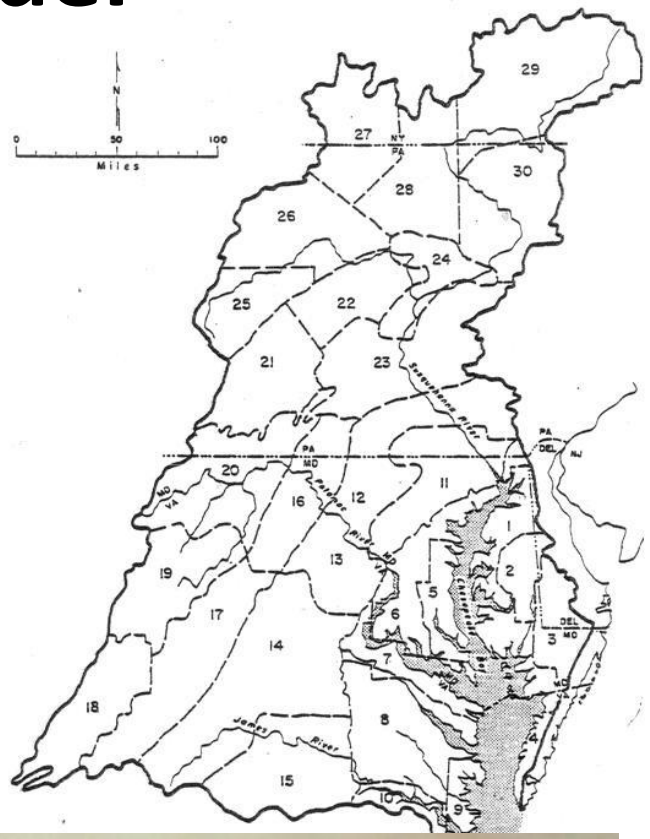
First Version of the Chesapeake Bay Watershed Model

- Completed in ~~1882~~ 1982
  - 30 segments (now 2000)
  - 2 years of simulation (now 30)
  - 5 land uses (now 50)
- IBM mainframe platform
  - (Now in the cloud)

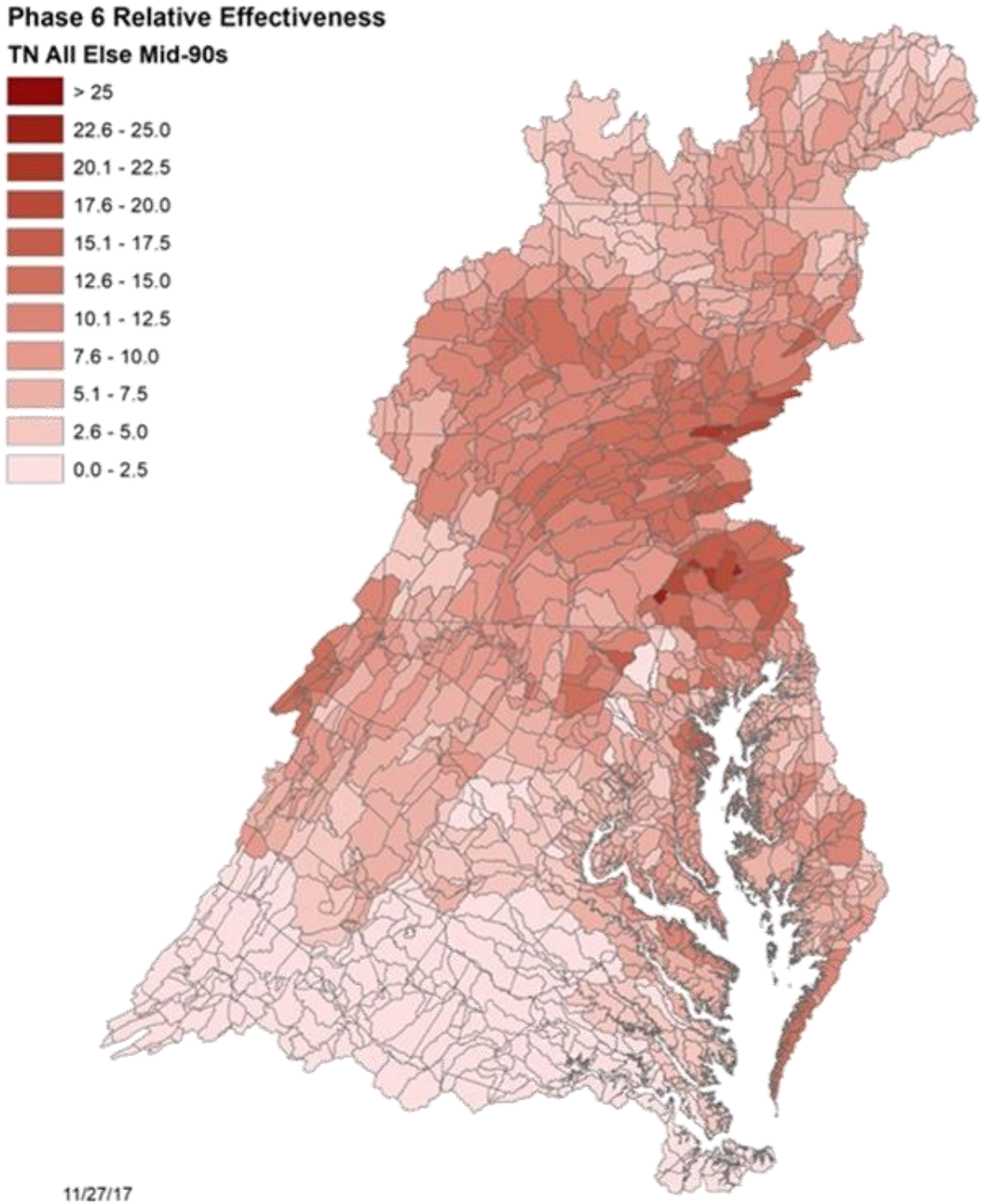


Northern Virginia Planning District Commission
7630 Little River Turnpike
Annandale, Virginia 22003

January 1983

We Have Come a Long Way

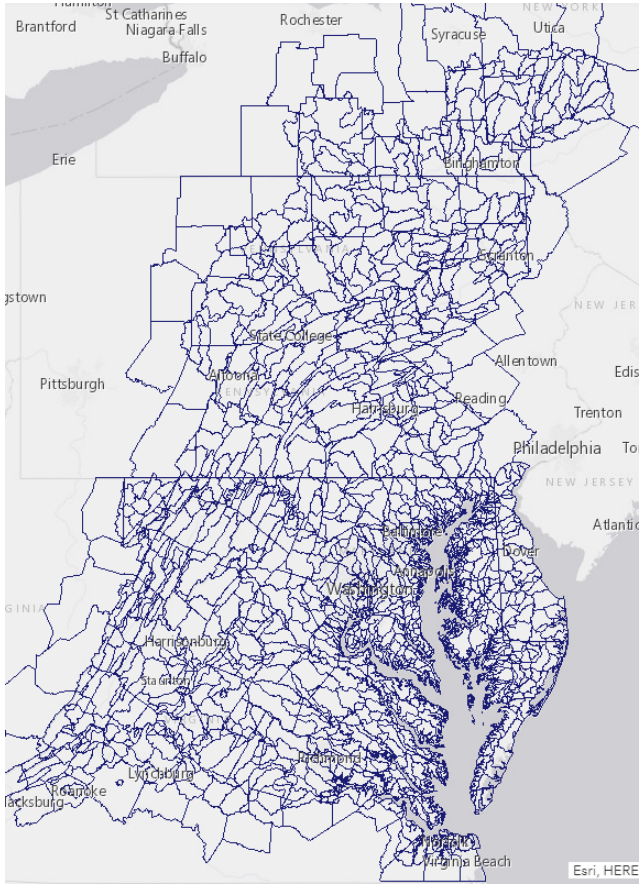
…since the early 1980s in simulating the 64,000 square mile Chesapeake Bay watershed….but we are still not simulating at the very local geographic scale necessary to simulate stream temperature responses to very local land uses and topography



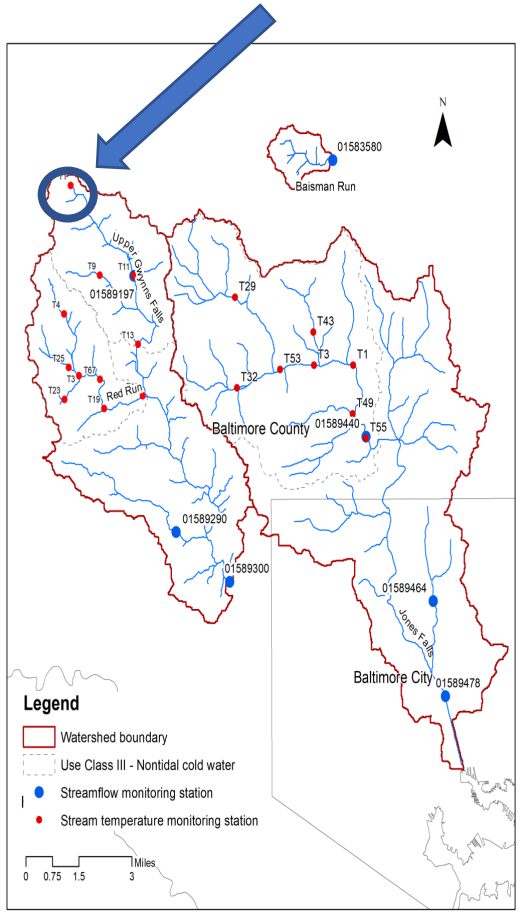
Spatial Scale

The CBP Phase 6 Watershed Model simulates streams greater than 100cfs

Phase 6 scale

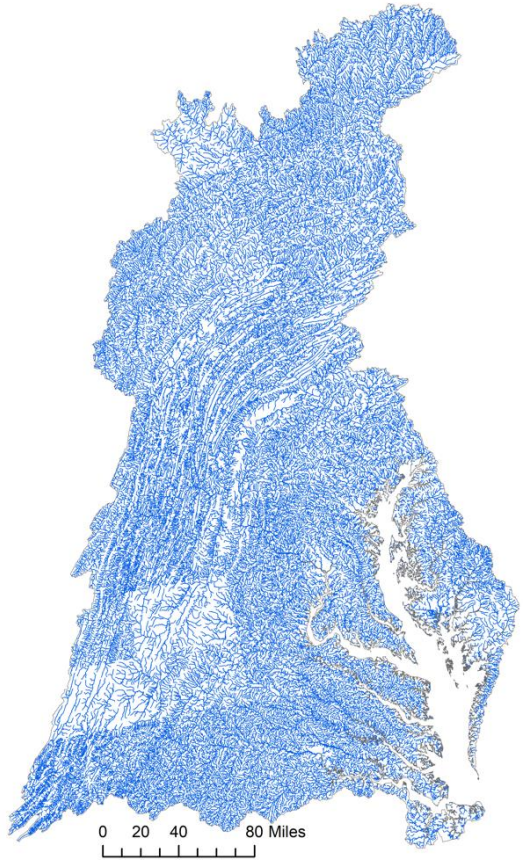


Many temperature-sensitive species live in the smaller streams

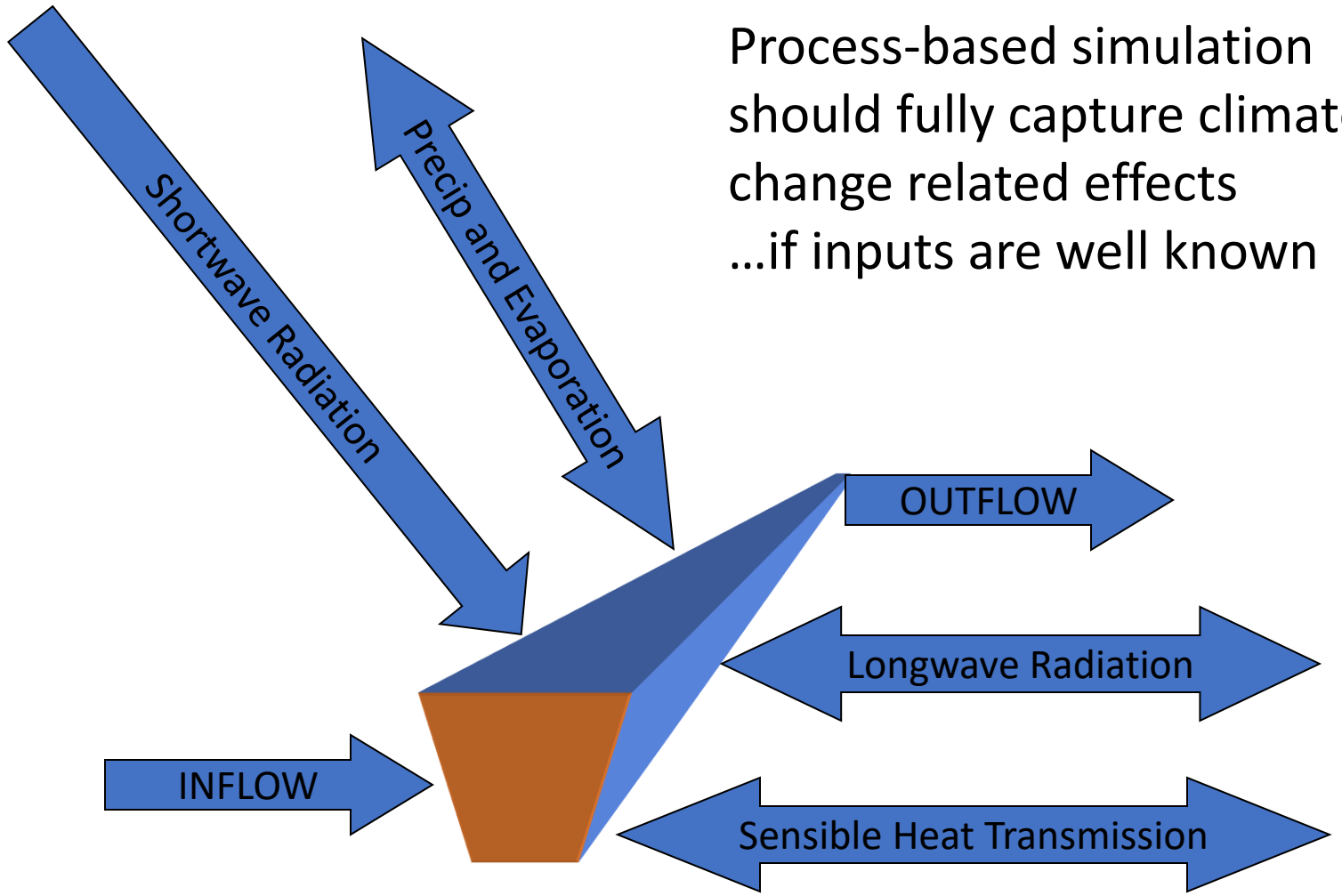


Phase 7 (2025) will likely be at the NHD 100k scale

NHD 100k scale

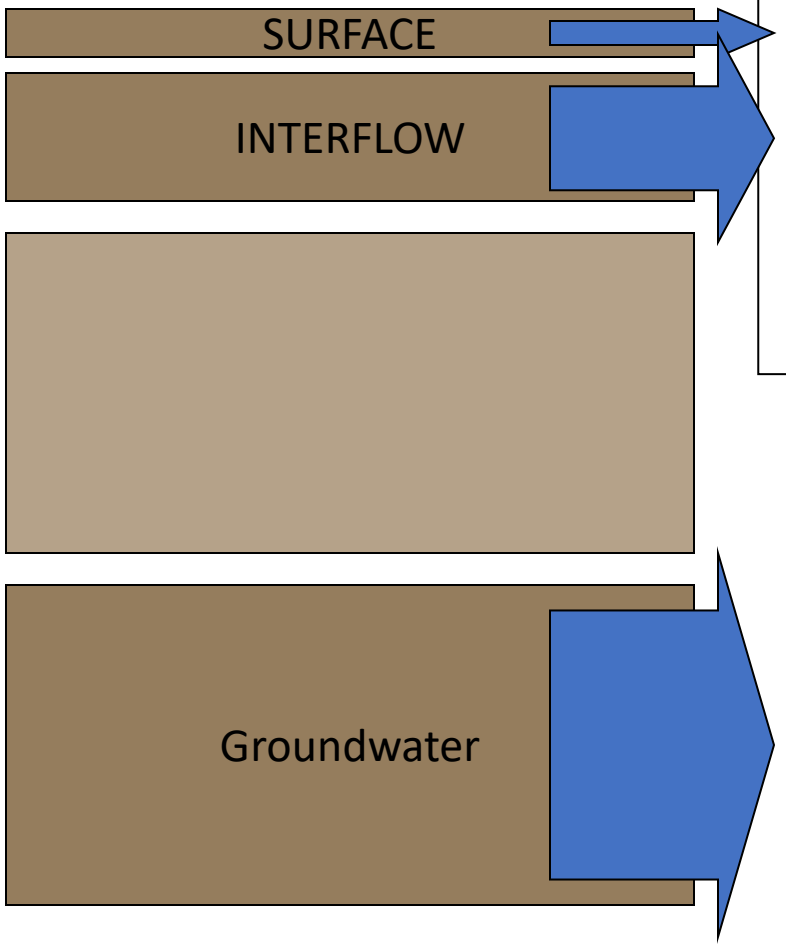


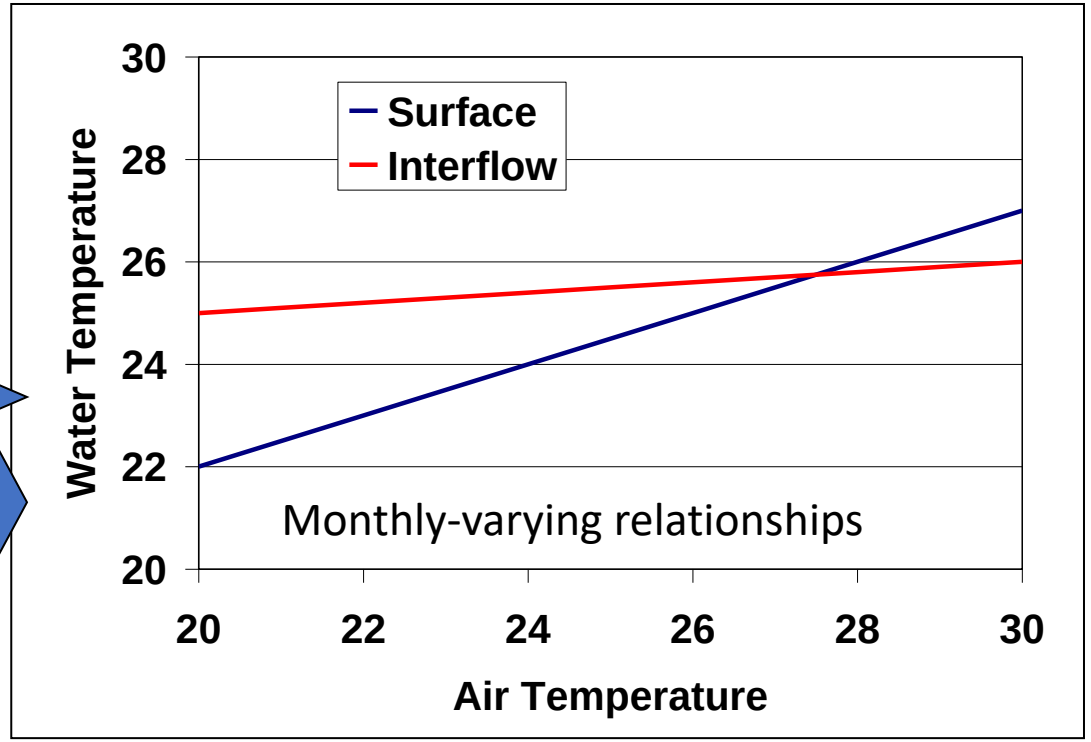
River Heat Processes

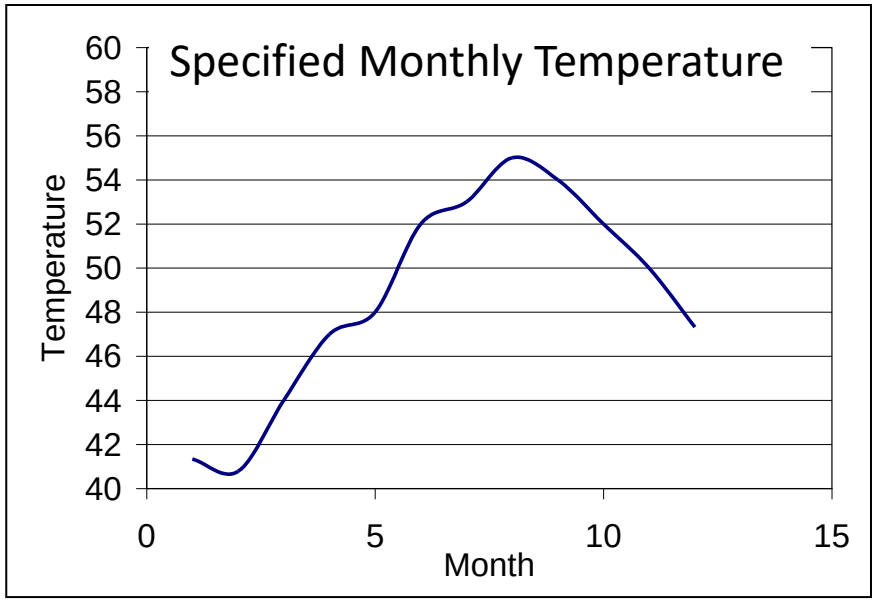


Process-based simulation should fully capture climate change related effects
…if inputs are well known

Phase 6 WSM Land Temperature Estimation

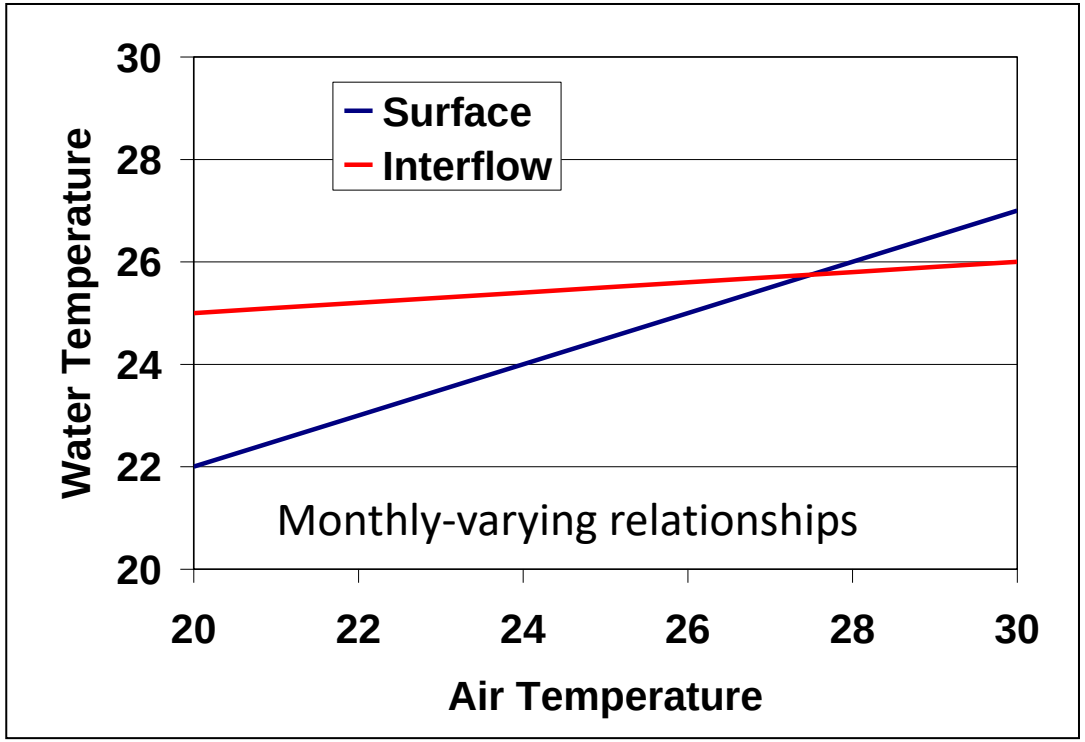




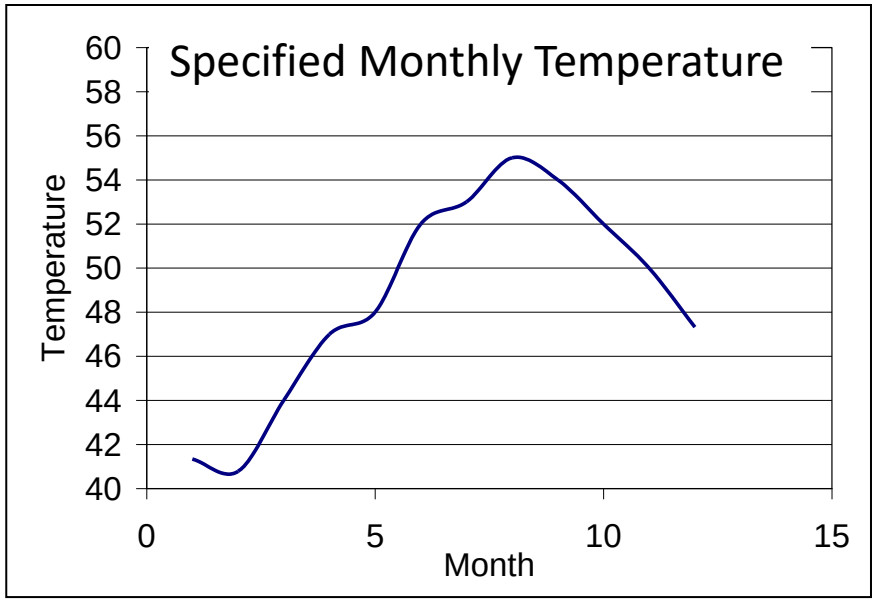


Phase 6 WSM Land Temperature Estimation

Monthly relationships are fixed and may not be appropriate for climate change scenarios



The groundwater temperature is a specified constant and does not change for climate scenarios



Temperature Simulation in the CBP Phase 6 Watershed Model

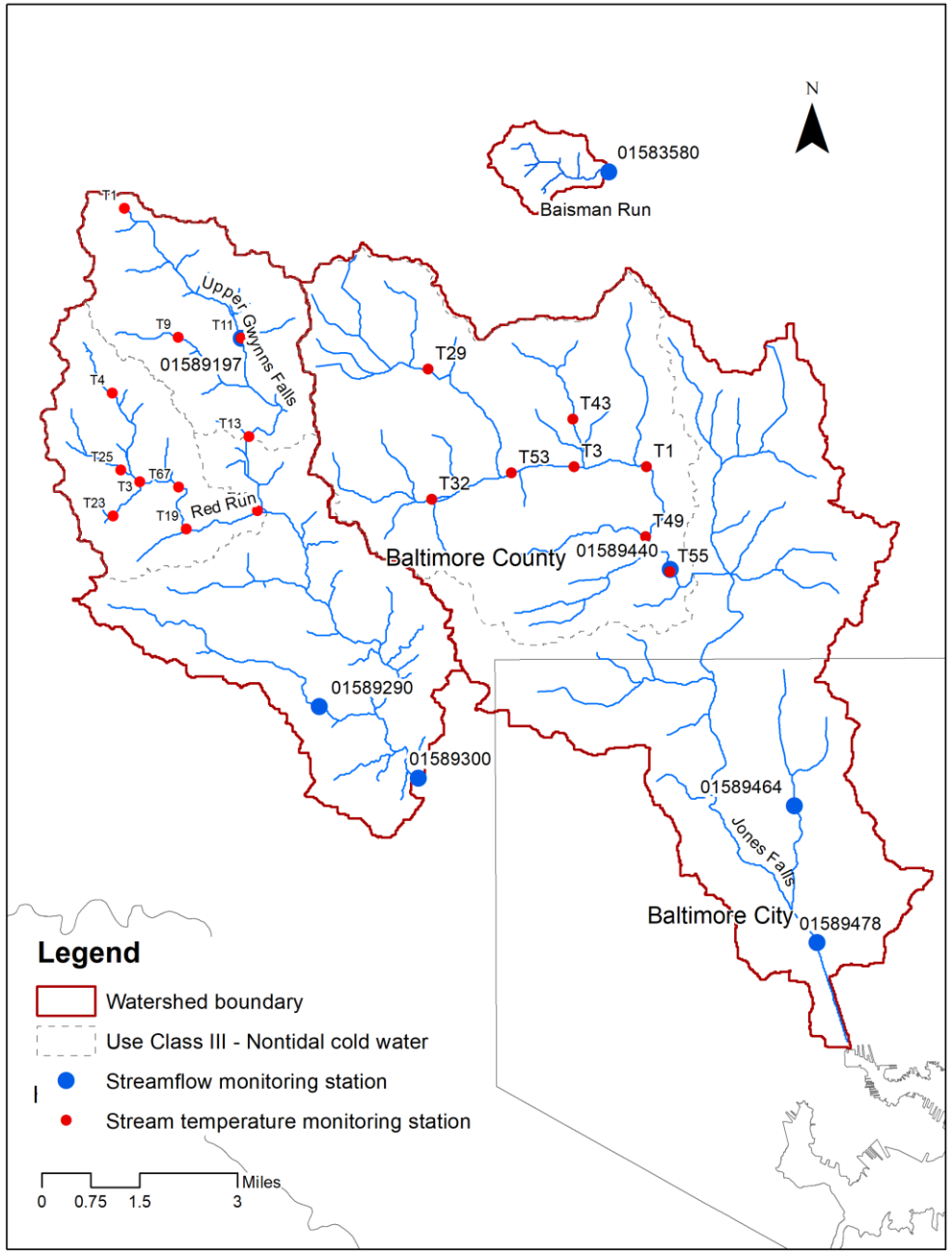
- Designed to support heat delivery to tidal waters and temperature-dependent rate processes in large rivers, not simulate local stream temperature responses to upstream landscape changes

- The current spatial scale does not meet the needs of many living resource models—example being brook trout

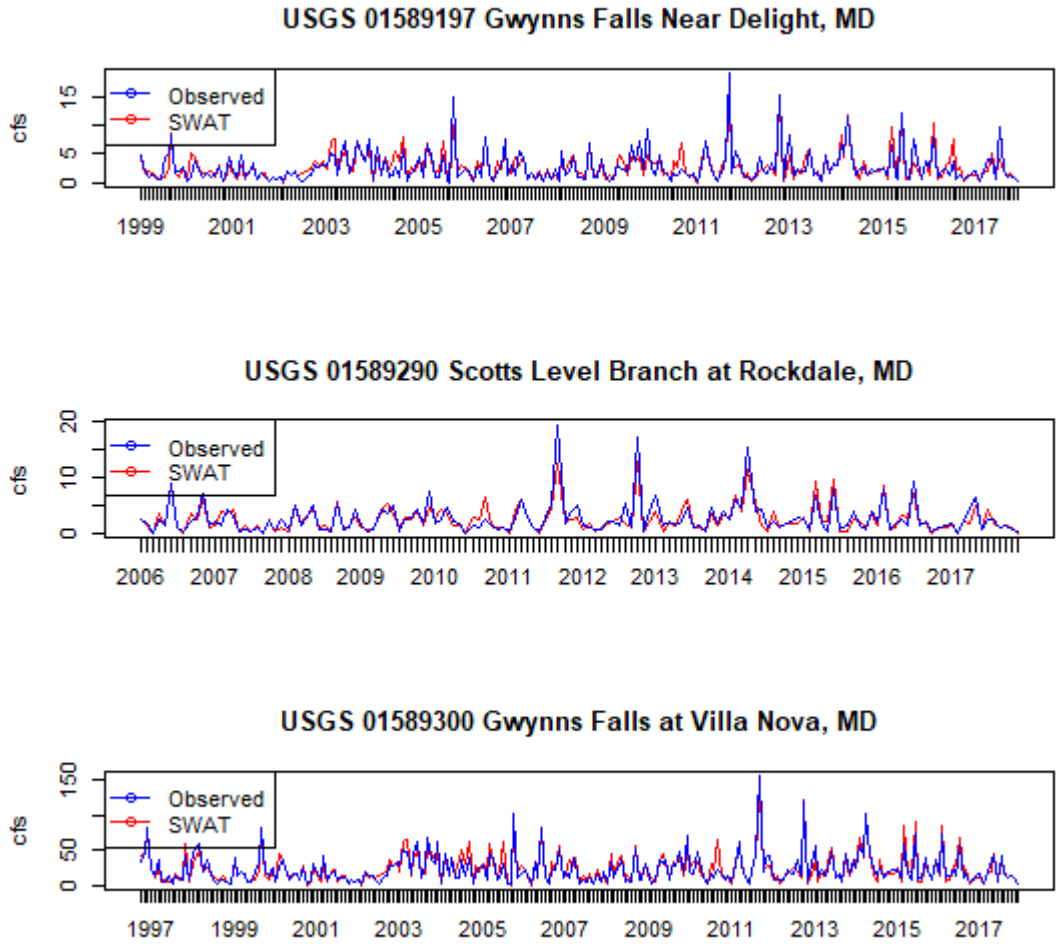
- The sensitivity to climate change is not fully developed—currently based on fixed monthly relationship and specified constants

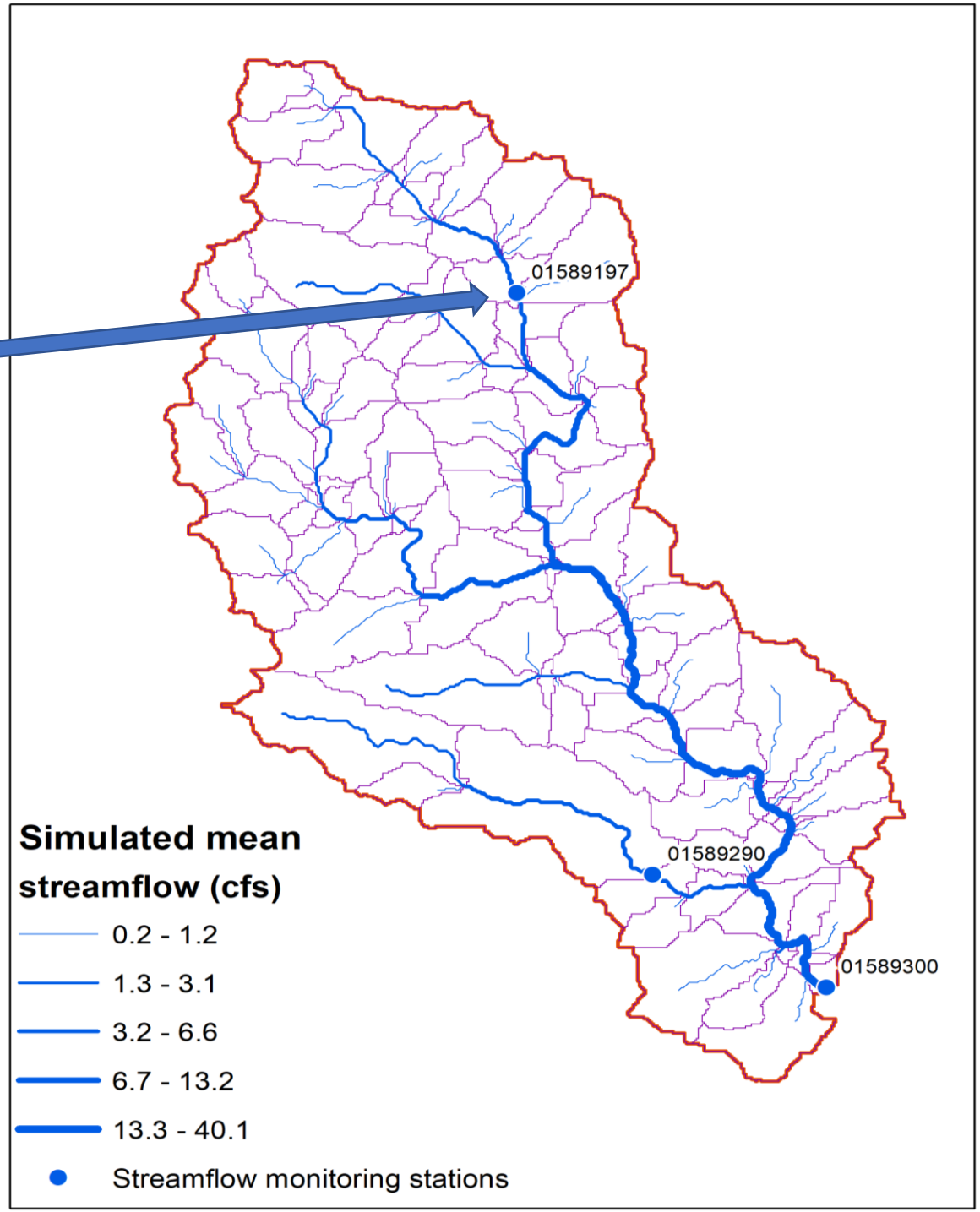
Good News

Our Maryland Department of the Environment Colleagues are breaking new ground in their development of water temperature TMDLs for cold water fishery designated streams



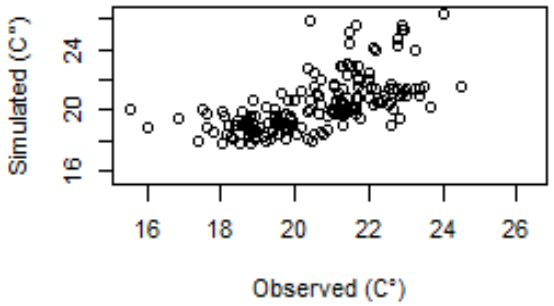
Gwynns Falls Stormflow Calibration

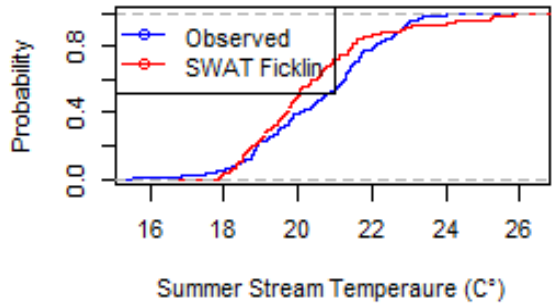




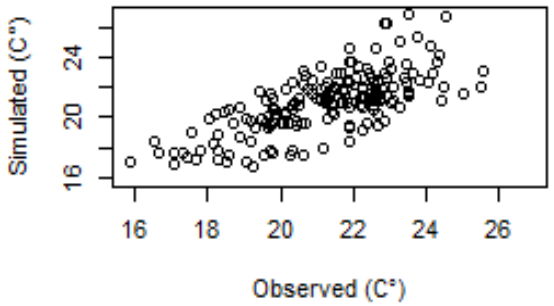
Red Run Temperature Calibration (Cont.)

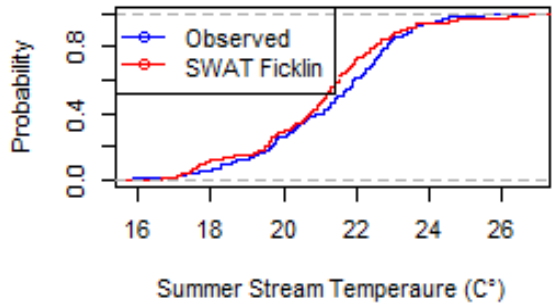
Station T3



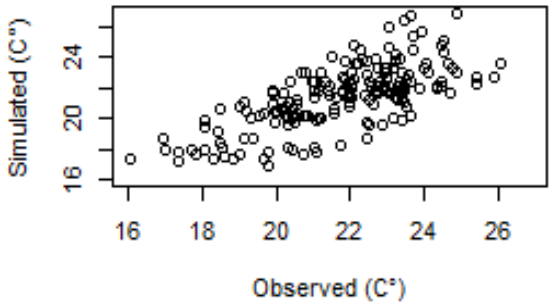


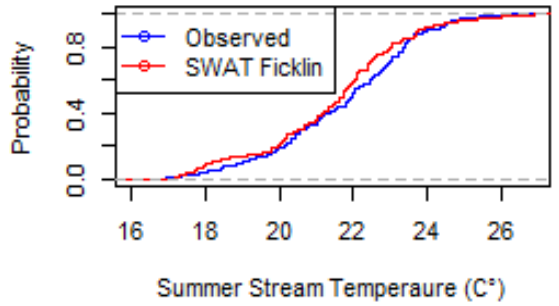
Station T67

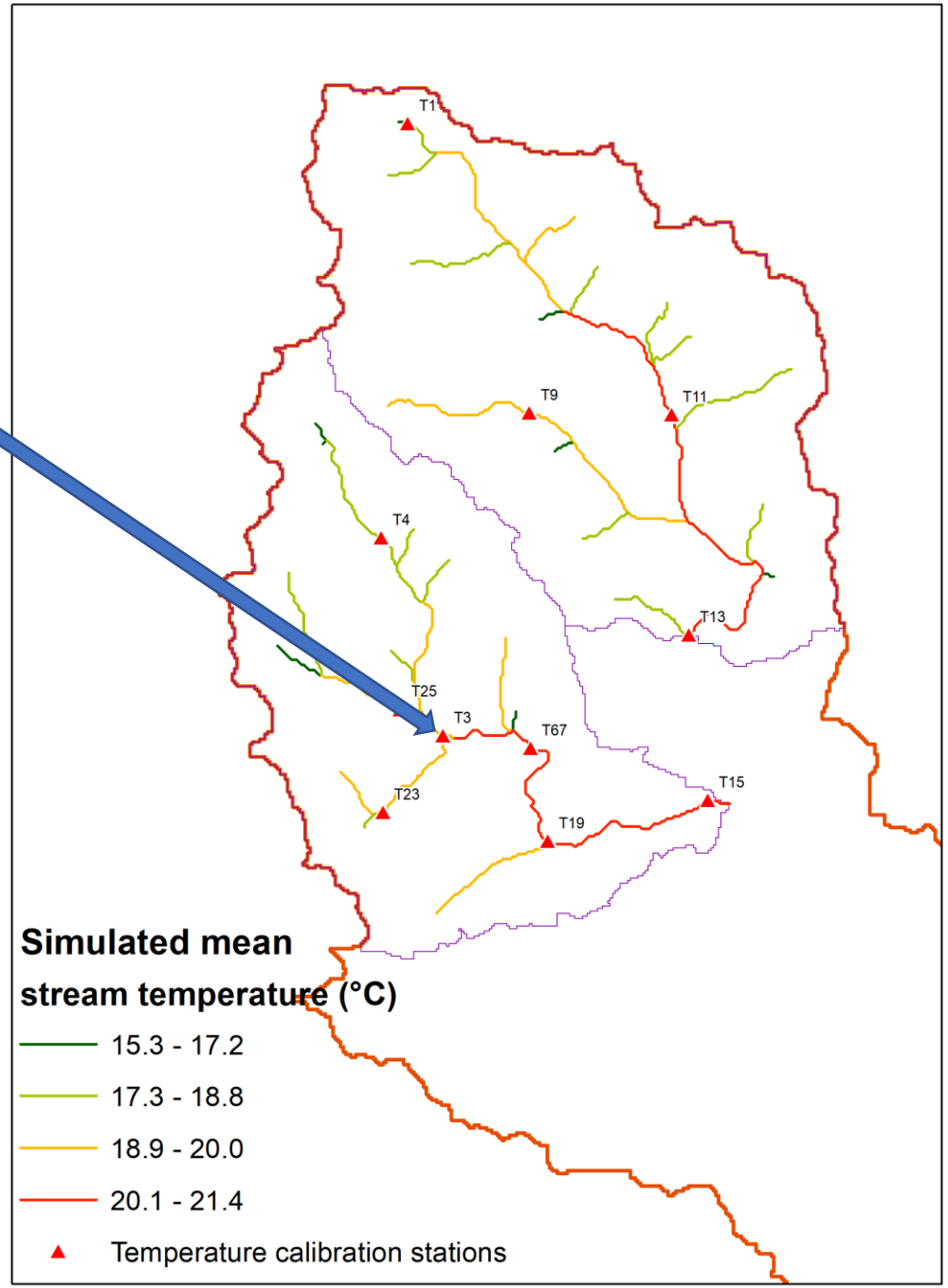




Station T19







Discussion Questions

What are the most critical management questions and needs for information about the factors and geographies most influencing water temperatures in local waters?

What are the scales of those management questions and information needs?