FLAMe case study

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What do I do?

- Characterize within lake patterns of water chemistry
- Interpolate to generate spatially weighted distributions of water chemistry
- Automate these steps across multiple lakes and through time

Code reflects my progression performing spatial analyses in R

- Old code was long scripts, loops, copy/paste
- New code using functions/apply statements, but I have yet to go back and tidy old code.

Data example

- Methane measurements while boating around Little Satin Germain Lake.
- ~10,000 point observations distributed in grid like transects
- We can interpolate across the lake surface and estimate CO2 flux to the atmosphere for the entire lake?
- We also ask questions about the drivers and consequences of spatial heterogeneity within lakes

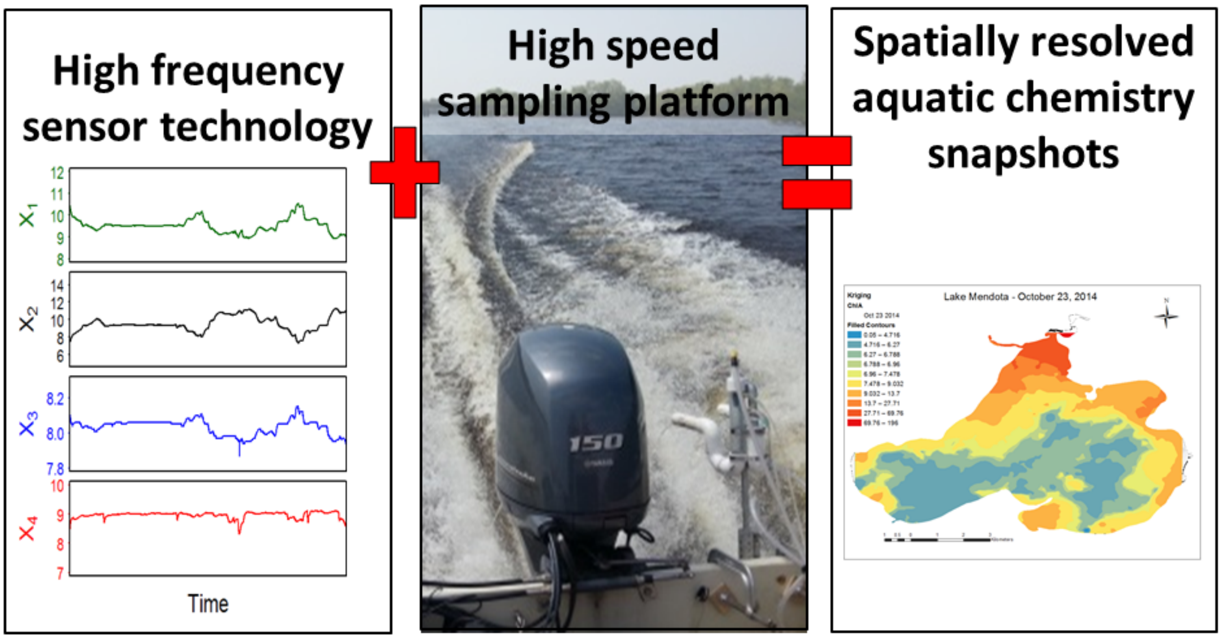
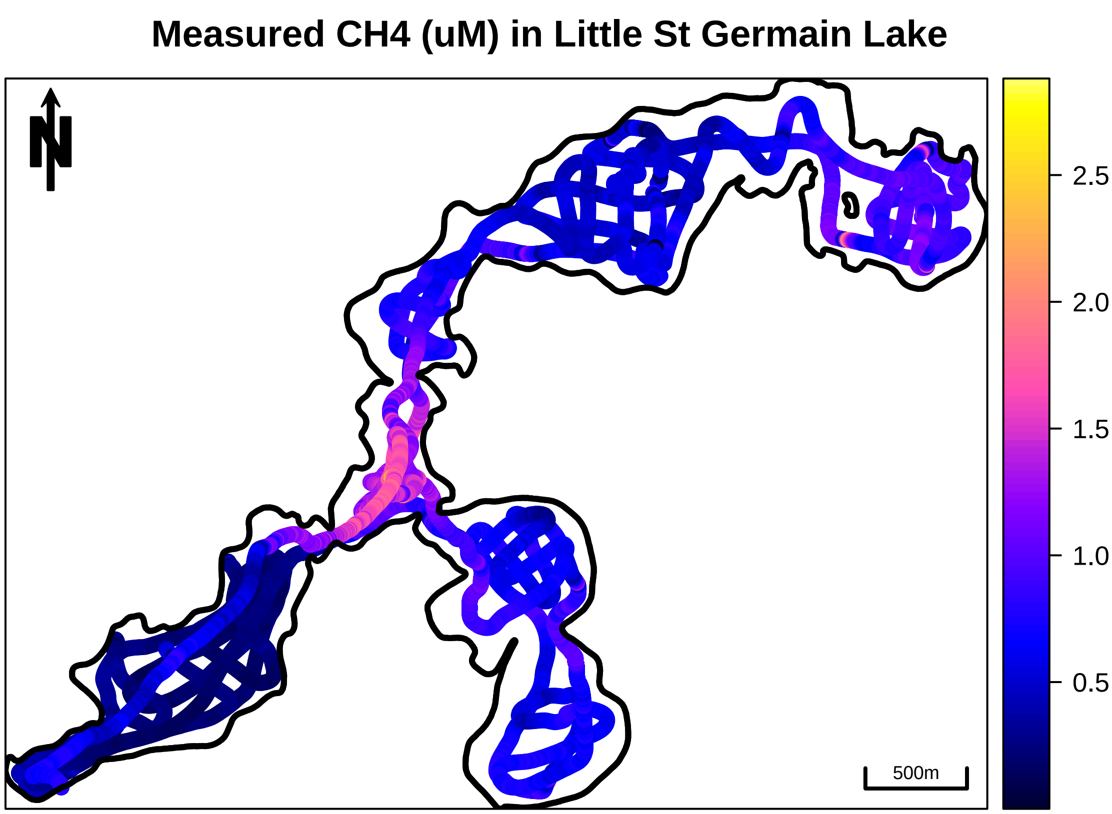


Figure 1: Crawford, Loken et al. 2015



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## [inverse distance weighted interpolation]
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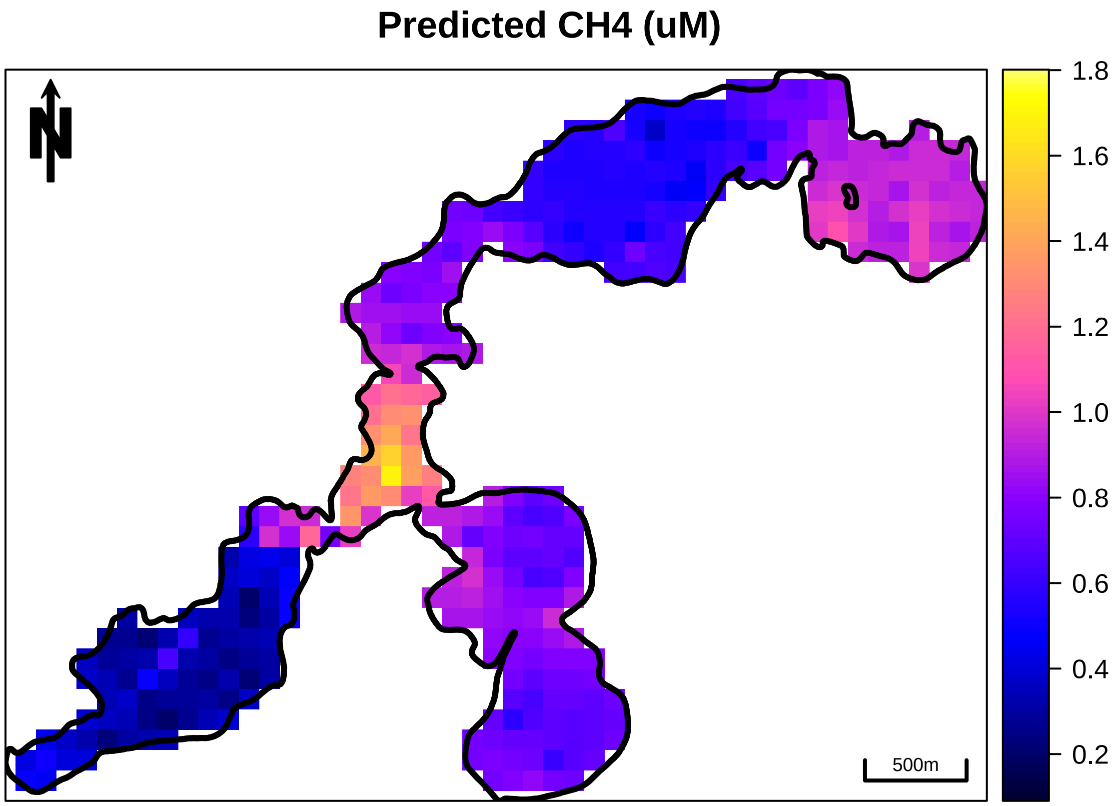
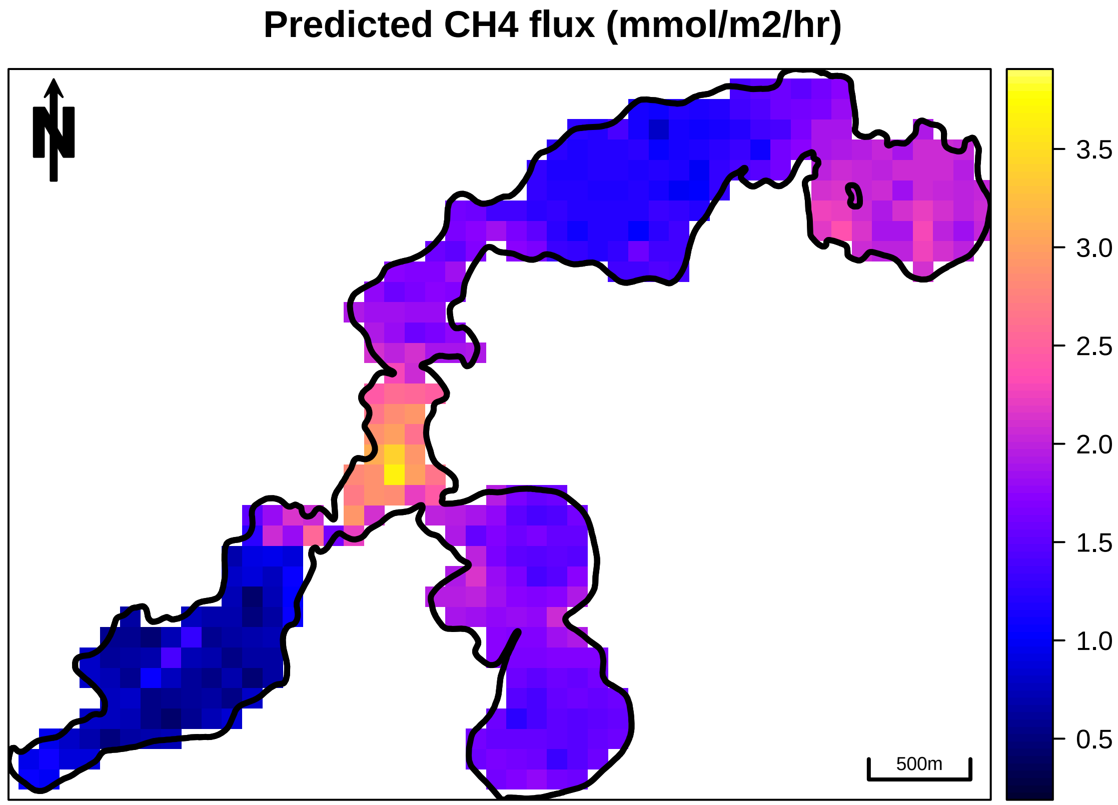
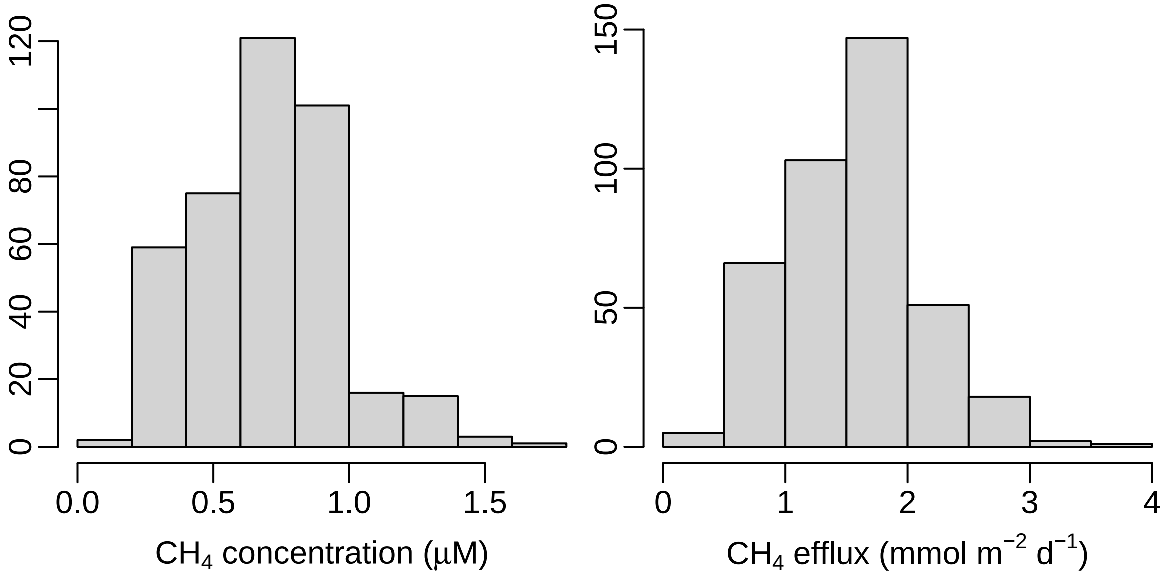






Clearly spatial patterns exist for methane and concentration/flux estimates from a single location do not represent the entire lake surface.

General questions

*How variable are individual lakes?

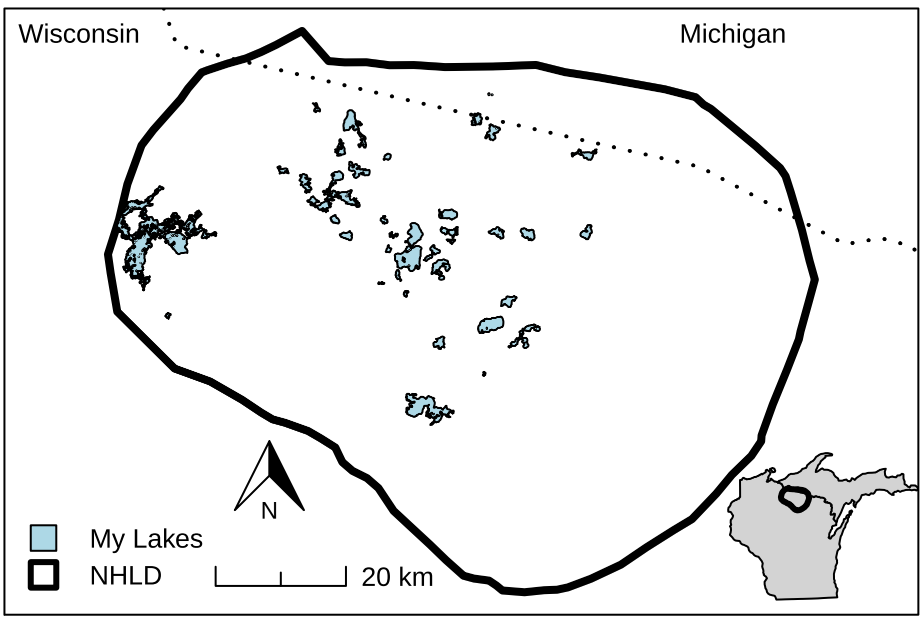
*How does variability vary among variables? (Temperature vs dissolved oxygen)

*How does variability vary among lakes? (Big lakes vs small lakes)

*What are the dominant scales of variation? (small patches vs large patches)

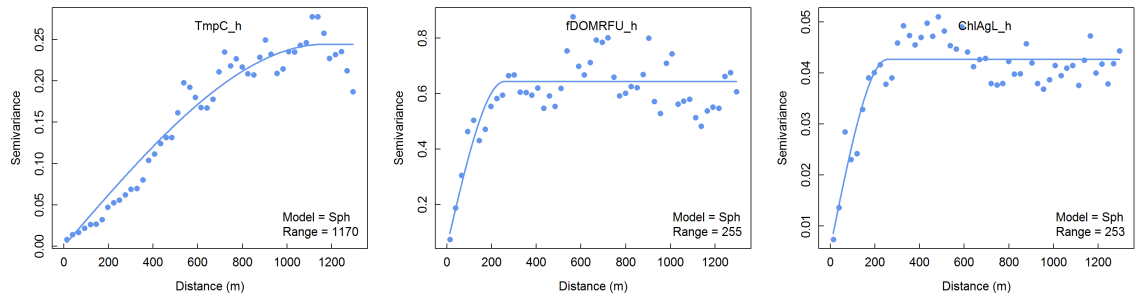
Example 2 - Within lake spatial variability among lakes

- Sampled 40 lakes in Northern Wisconsin across lake productivity, size, and morphometry gradients



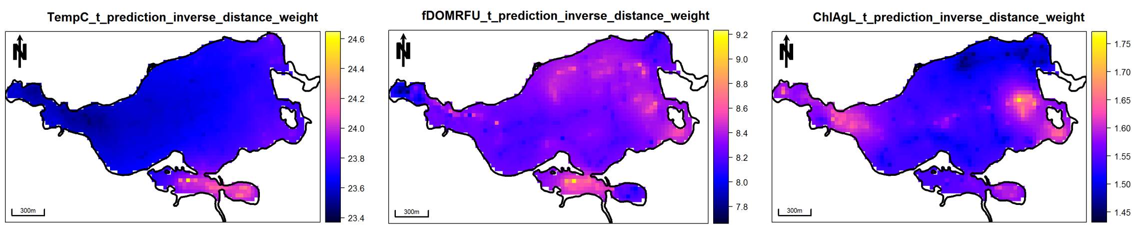
- For each lake, statistics describing spatial heterogeneity were calculated for all measurements (Temperature, oxygen, etc.)
  - standard deviation
  - quartile dispersion
  - coefficient of variation
  - skewness
- We also evaluated spatial structure using semivariance and correlogram models
  - semivariance range
  - correlation at distance intervals

Semivariance models for 3 variables



Semivariance range is the distance at which observations are no longer spatially autocorrelated.

In this example, temperature (left panel) has a greater semivariance range (~1000 m), while fDOM (middle) and Chlorophyll (right) have shorter ranges (~250 m). In this example, we can say that the dominant scale of variation for temperature occurs at a broader scale than the other variables.



Looking at the maps, we see finer patches for fDOM and chlorophyll than temperature