

Understand the drivers of cyanobacteria blooms in Missisquoi and St. Albans Bays in 2017, 2018, and 2019 using high-frequency buoy sensor data

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Research goal

Better understand the drivers of cyanobacteria blooms in Missisquoi and St. Albans Bays in 2017, 2018, and 2019 using high-frequency buoy sensor data.

Personal research goals

- Learn ecological forecasting model techniques
- Have help (and fun) intellectually interpreting the findings of the study and what data to include/how to prepare it for the model
- Use machine learning approaches to understand drivers of cyanobacteria blooms Potential research questions/sub-sections of the project (will depend on our interests and rate of progress):
- What environmental factors were driving the blooms in 2017, 2018, and 2019?
- Can we utilize the long-term monitoring data (since 1992 but less frequent time steps, no cyanobacteria levels) to forecast bloom dynamics in the bays?
- How many days out can we forecast blooms (the best I've seen is a few days)? Does it change from year to year and bay to bay?
- Comparison of PC and CHL signal from buoy sensors and what the satellites are picking up

Available Data:

- high frequency buoys monitoring: dissolved oxygen, temperature, stratification, nutrient concentrations, cyanobacteria, etc.
- long term monitoring: Similar data over longer time periods but lower frequency
- satellite imagery: Imagery of the bay is available and there are indices for mapping cyanobacteria & blooms. Data: intensity of different spectral bands: visible, IR, and indices combining bands for multiple time points.

Project ideas/questions:

- How does satellite spectral index for cyanobacteria correlate with buoy data for cyanobacteria concentrations?
- Combine high frequency buoy data (daily averages?) with available time points of satellite imagery data for buoy locations. See if we can use all this data to predict buoy cyanobacteria concentrations and/or satellite cyanobacteria index.
- See how well our model/forecast matches long term monitoring data! Like, if we have our model trained with the buoy data, and we put in the long term data on water temp & concentrations, will it predict blooms when there were blooms? Or would it only work for short term forecasting with high frequency data? In that case, Wilton could still try to forecast blooms next summer! Personal Goals:
- Learn more modeling! Maybe some machine learning stuff? Practice working with data in R (or python?) and working with satellite imagery/data.