Developing a conceptual model of nutrient and bloom dynamics in two shallow, eutrophic bays in Lake Champlain

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Collaborators: Dr.'s Tom and Patricia Manley, Donna Rizzo, and Mindy Morales-Williams

Goal: Develop and test conceptual model of nutrient dynamics

WHY?

- Understand WHY and WHEN these systems will have severe cyanobacteria blooms
- System sensitivity to **environmental change**

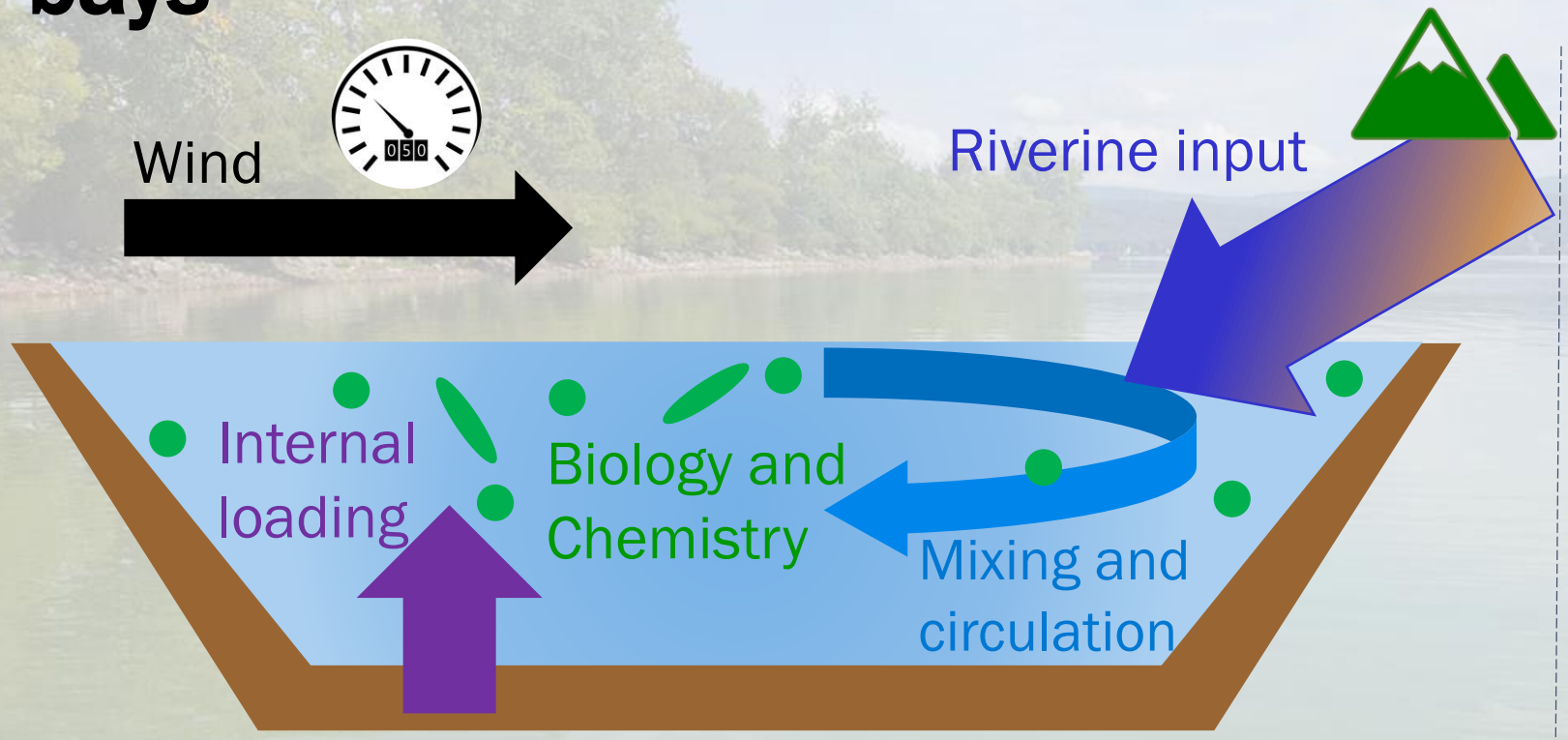
MB August 2015

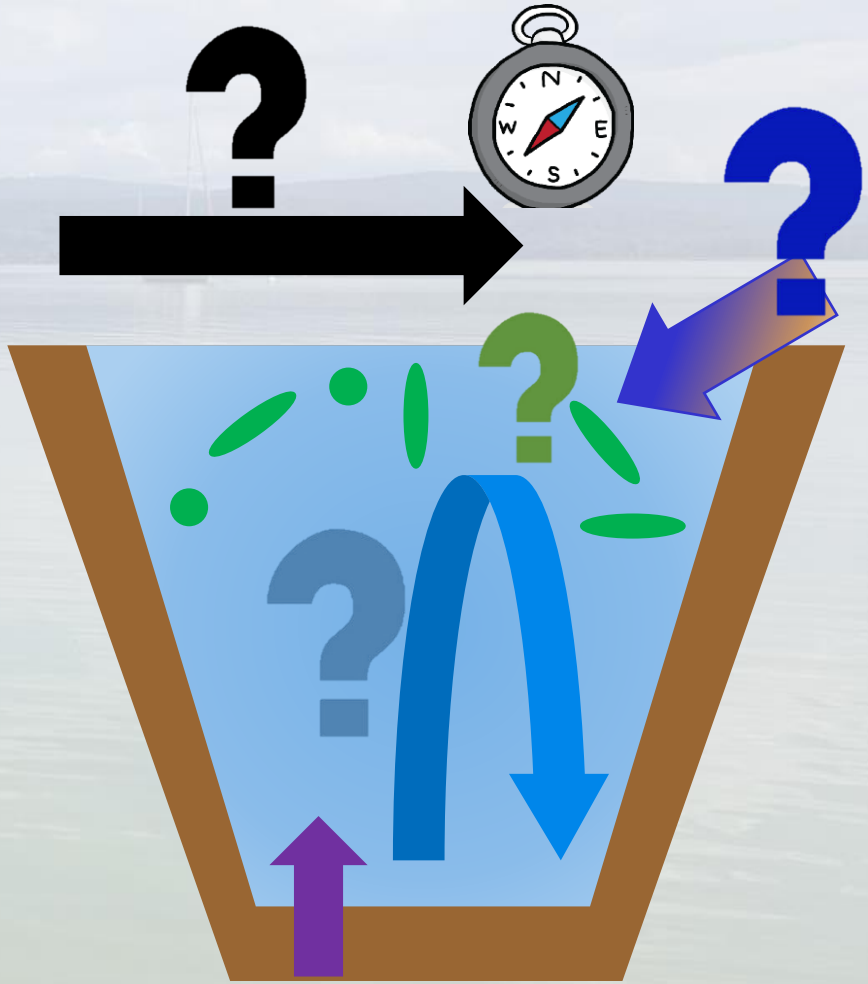
HYPOTHESIS

- Water quality resilience to weather/hydrologic events differs by bay due to differences in physical configuration (Connectivity to watershed, Connnectivity Inland Sea)

St. AB August 2017

Working towards a conceptual understanding of the two bays





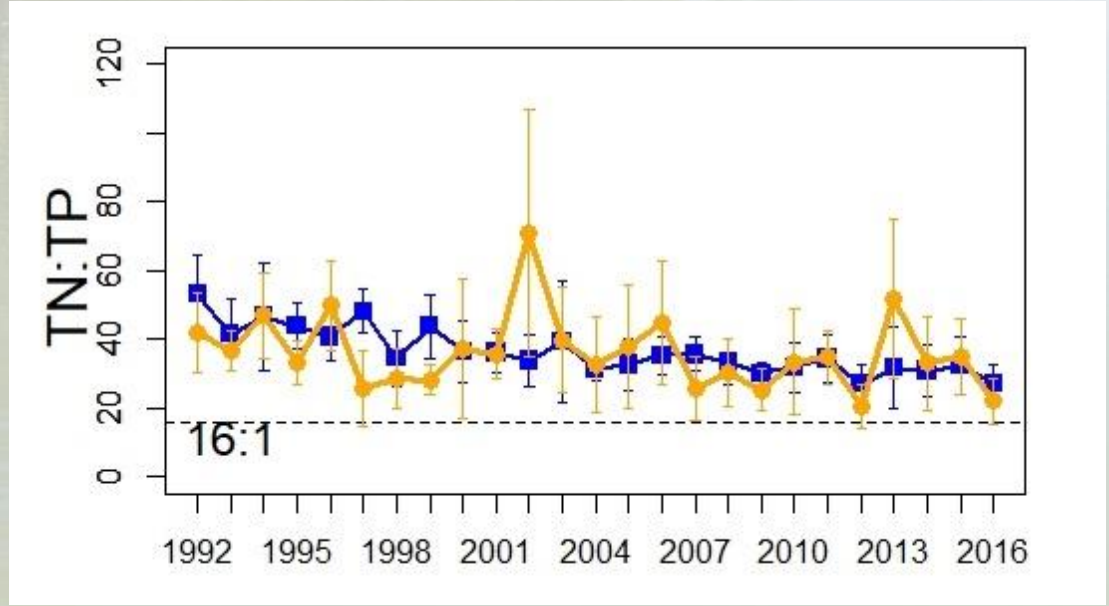
St. Albans Bay

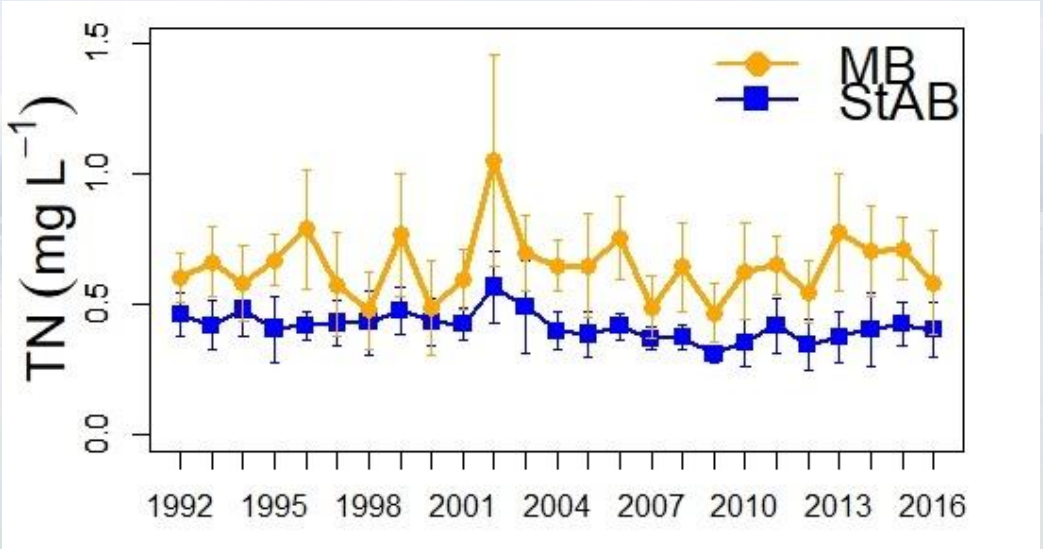
APPROACH (4-fold)

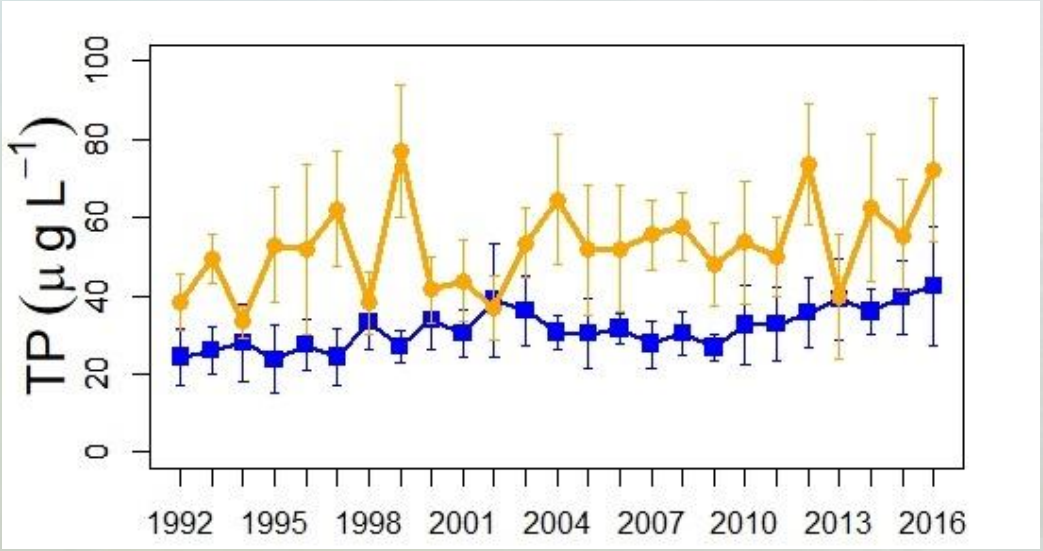
1) Long-term monitoring dataset from the VT DEC
2) High-frequency BREE monitoring
3) Hydrodynamic model
4) Remote sensing

1) Analysis of the VT DEC dataset shows similar ratio in both bays and higher total nutrients in MB

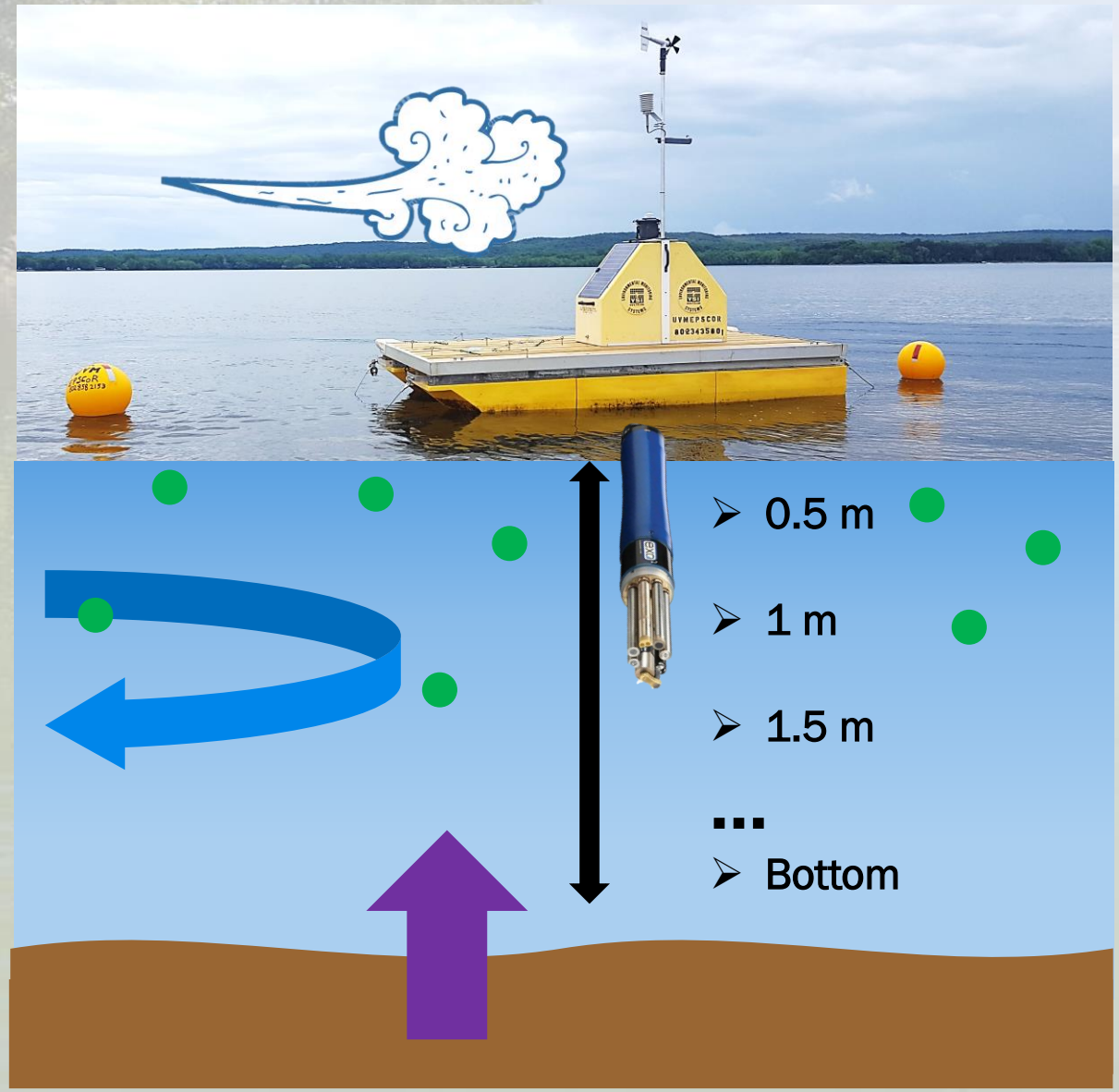
- Data: VT DEC 1992 – 2016, bi-weekly
- Average values for July - September







2) High-frequency monitoring of both bays and weekly grab samples May through November 2017

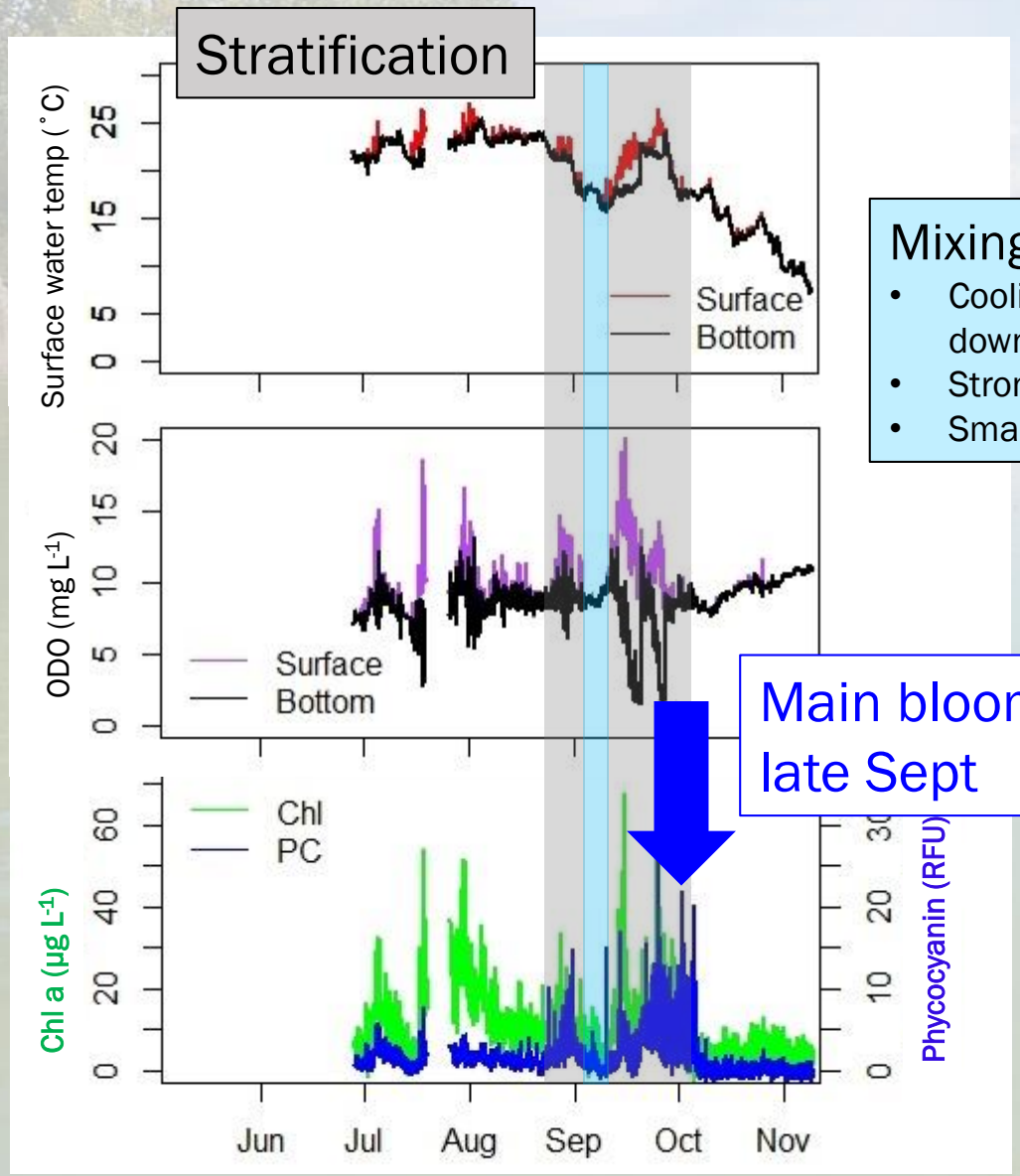


- High-frequency monitoring network (24 time points/day)
- Weekly grab samples

MB, June 2018

Bloom timing and duration different summer 2017

MB

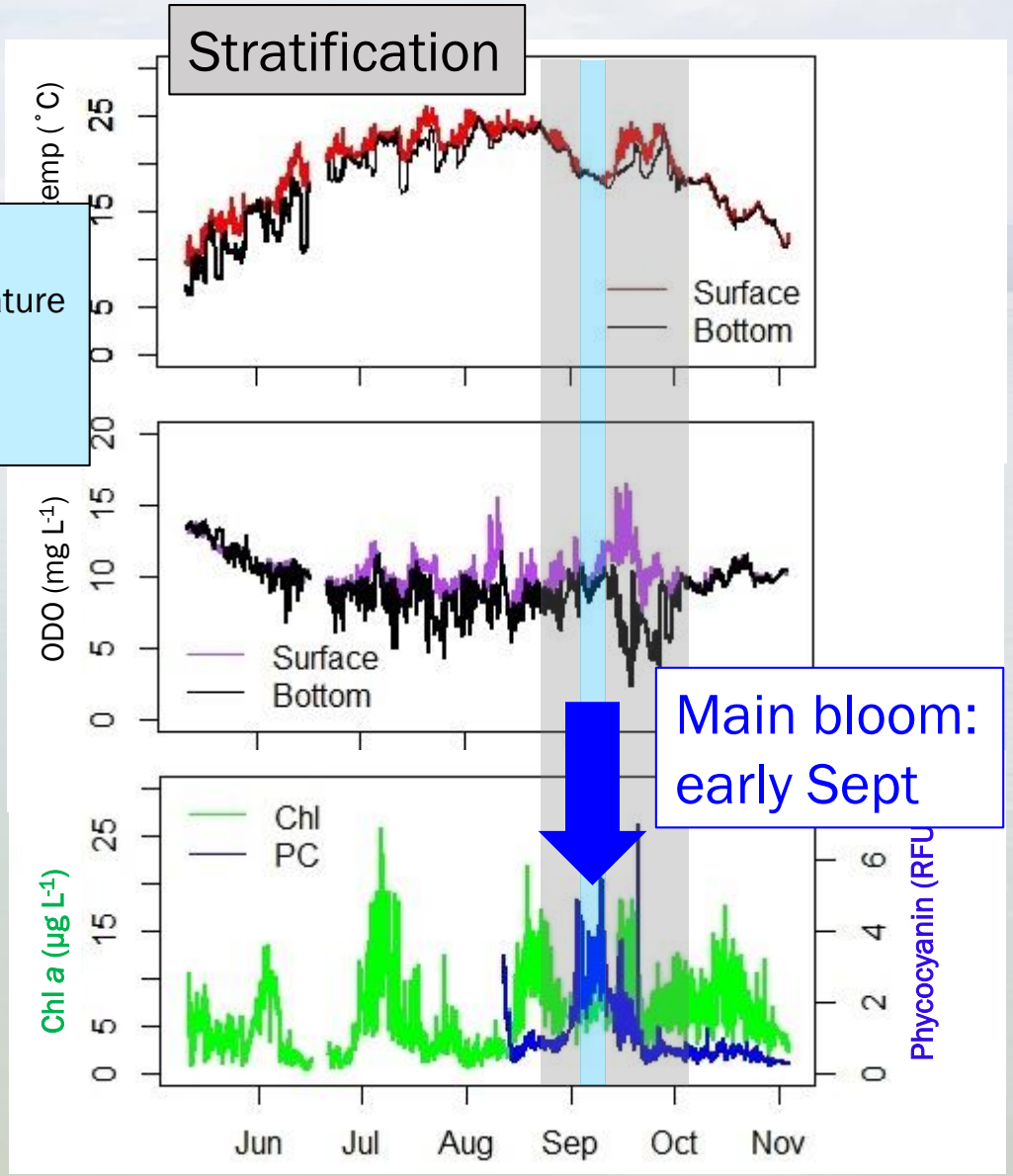


Mixing event

- Cooling (air temperature down to 10˚C)
- Strong W/NW wind
- Small rain event

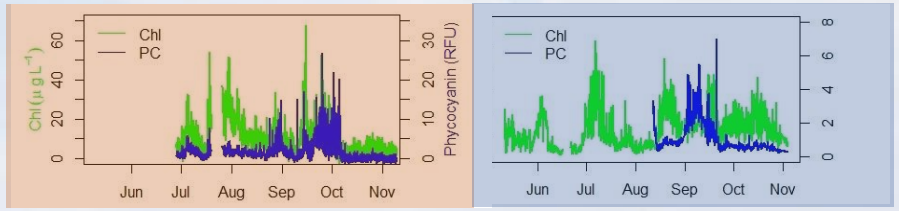
Main bloom: late Sept

St. AB



Main bloom: early Sept

3) Using remote sensing to better understand the 2017 bloom spatially



- Remote sensing of 2017 bloom (pictures from collaborator Tim Moore at UNH)

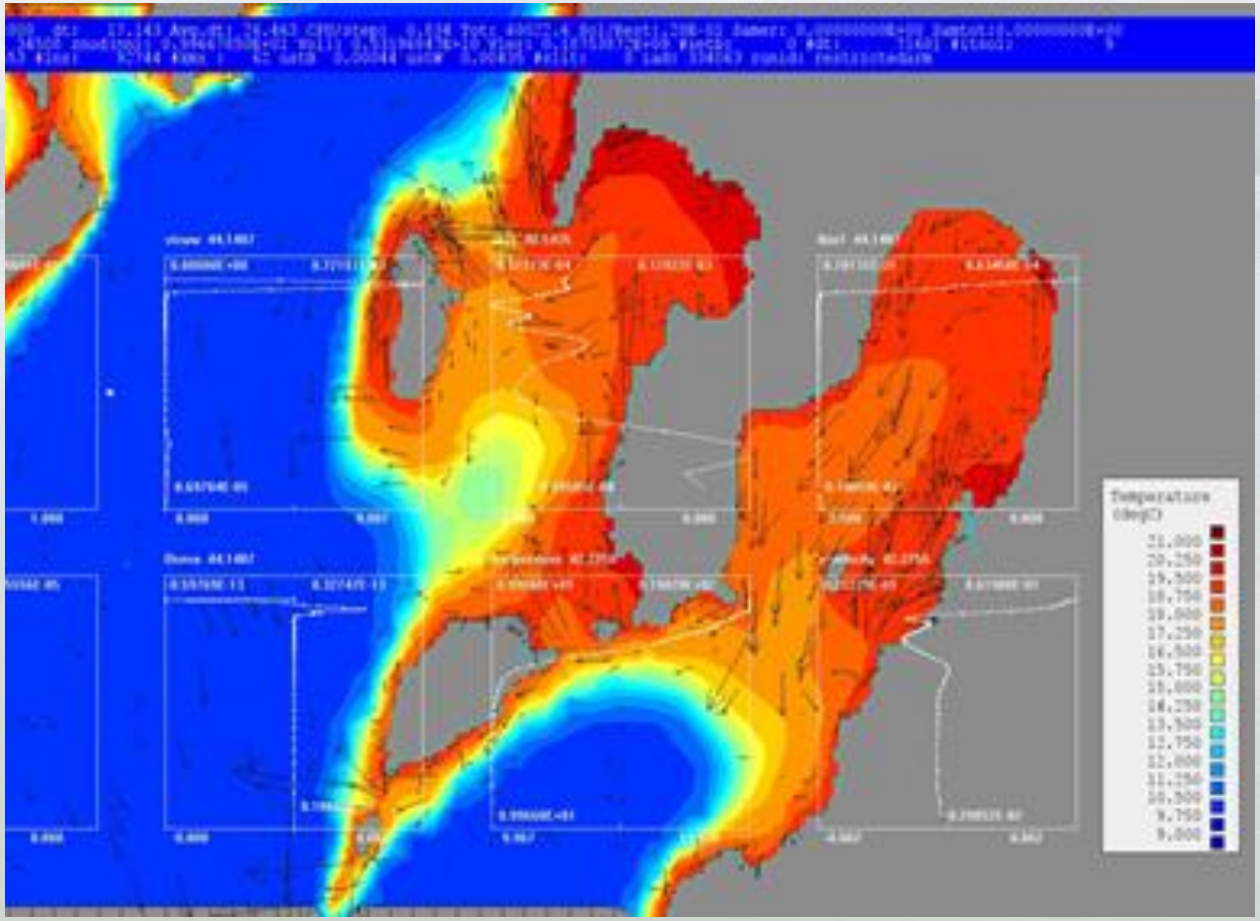
MB

St. AB

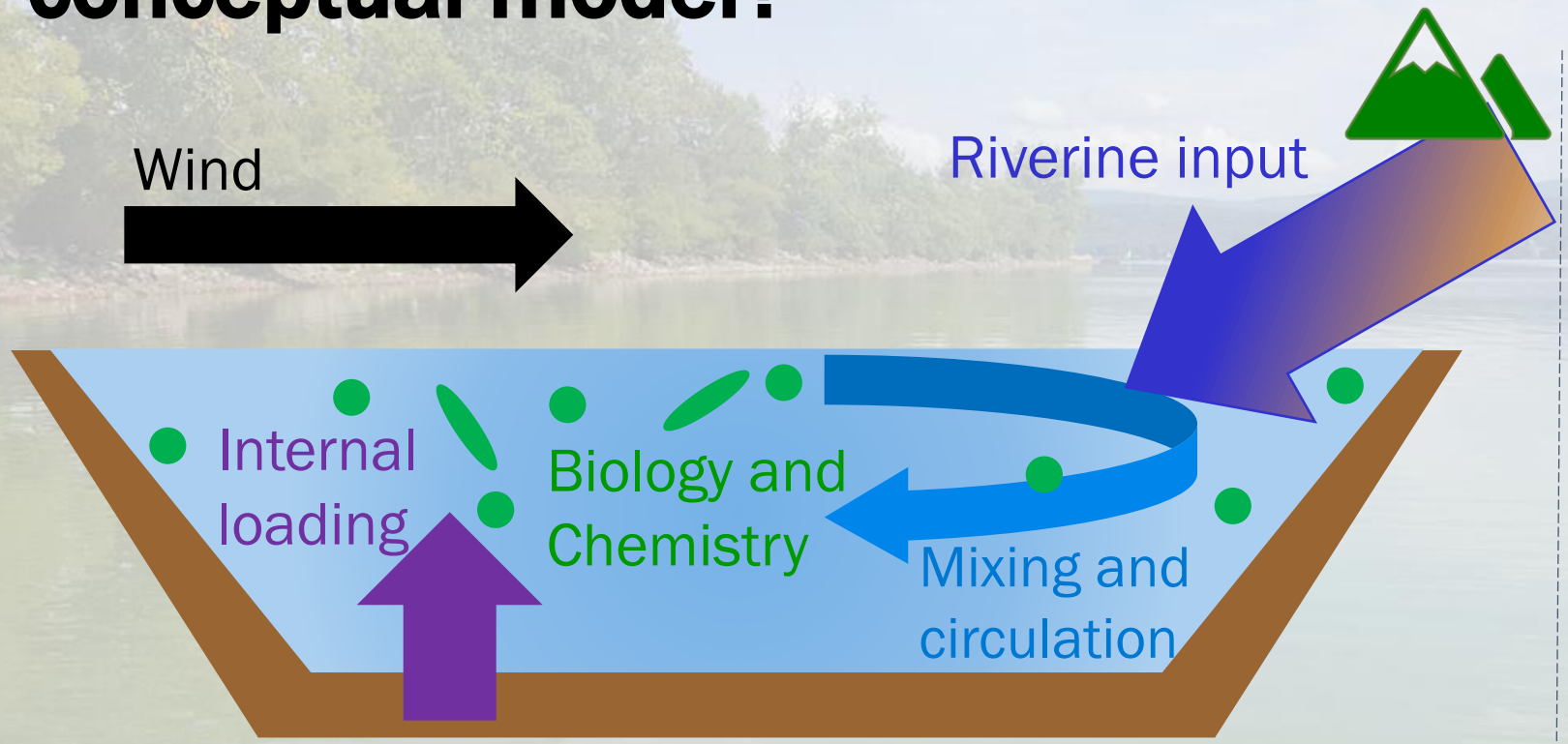
Aug 26, 2017 | Sept 13, 2017 | Sept 20, 2017 | Sept 23, 2017 | Oct 2, 2017 | Oct 10, 2017

4) Adding in the output from the hydrodynamic model

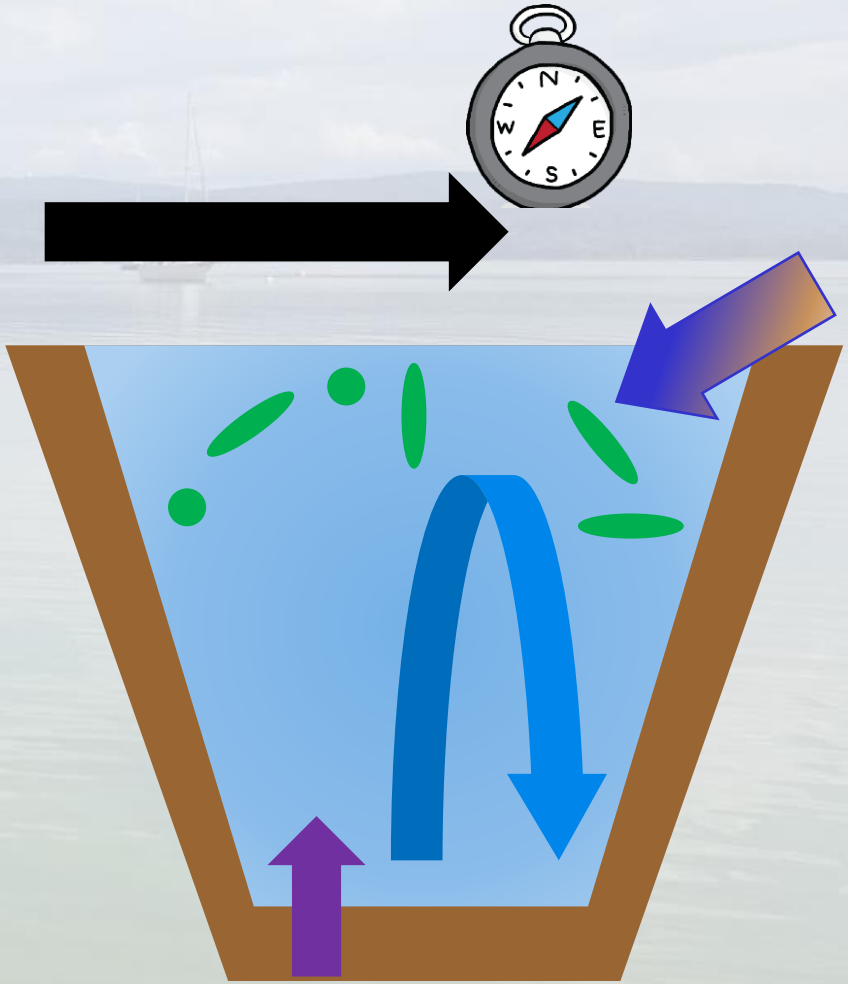
- **Bay physics:** moving water and sediment across bays (Liv Herdman and the Manley'a at Middlebury College)



How does summer 2017 stack up against our conceptual model?



Missisquoi Bay



St. Albans Bay

1) Stratification important in both
2) Wind **speed** may not be important in St. AB
3) Triggers to start and stop the 2017 bloom were different