

Evaluation of ice models in large Lakes using Three Dimensional Coupled Hydrodynamic-Ice Models

Investigators:

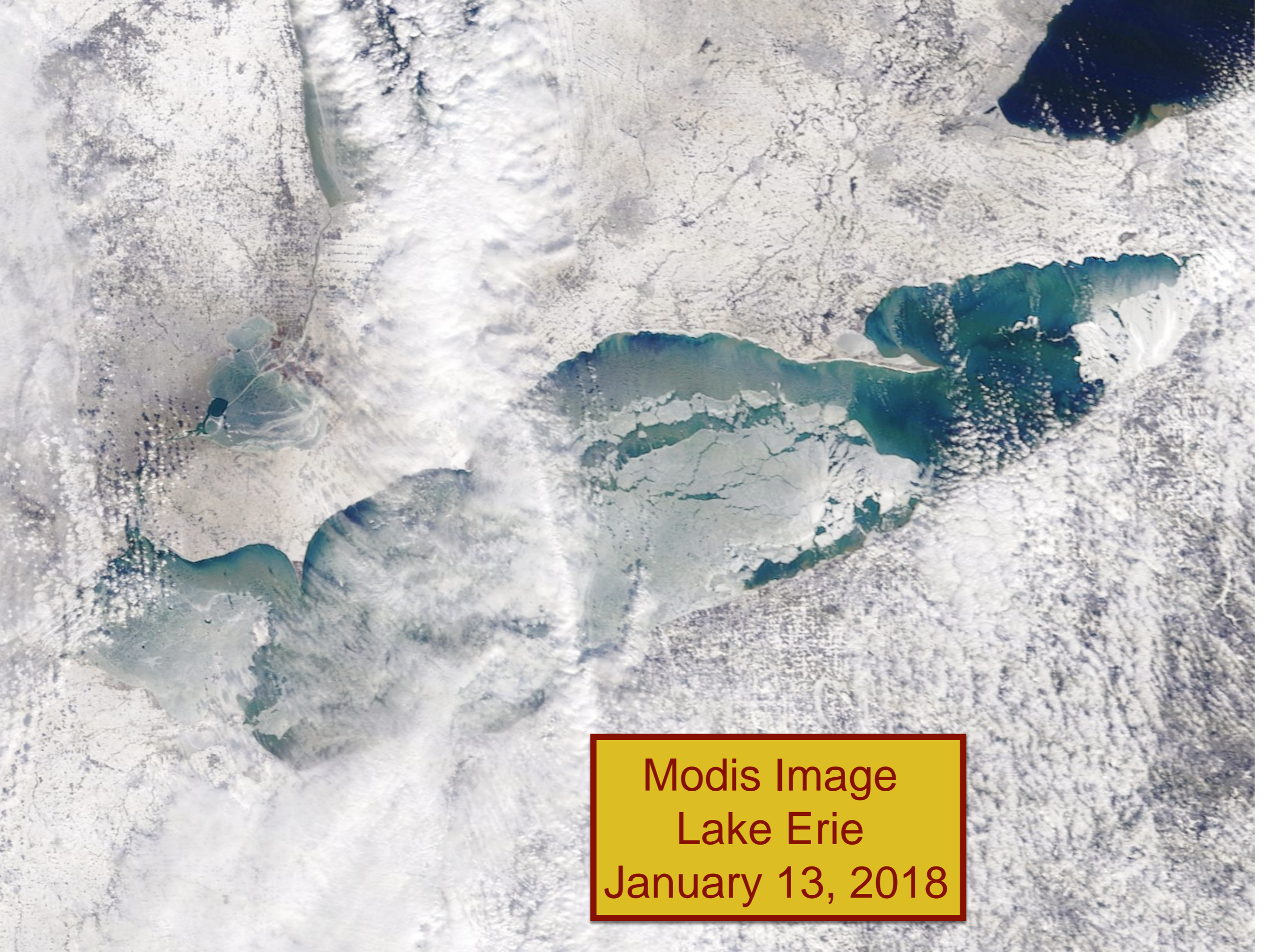
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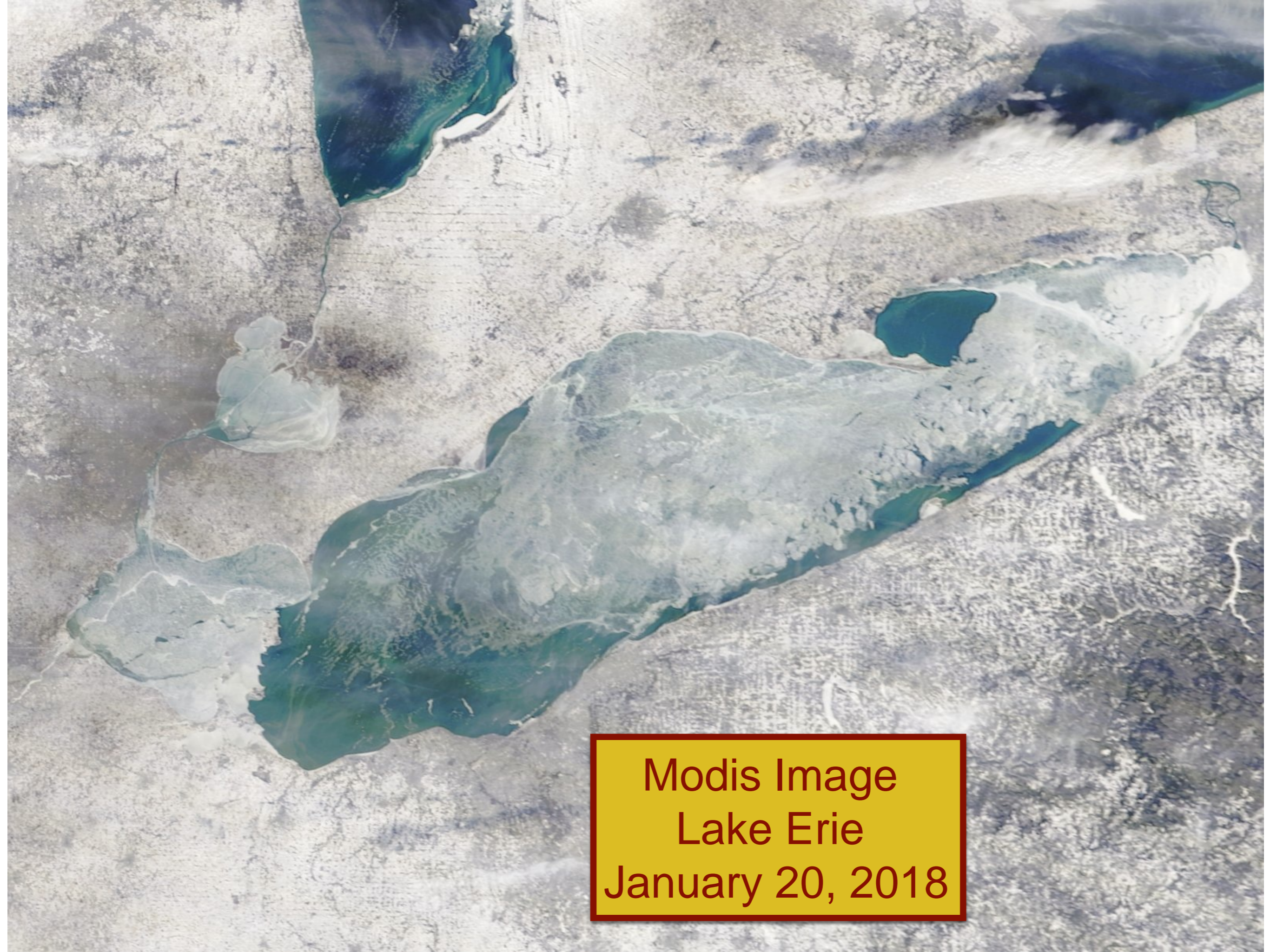
Modis Image
Lake Erie
January 9, 2018



Modis Image
Lake Erie
January 13, 2018



Modis Image
Lake Erie
January 19, 2018



Modis Image
Lake Erie
January 20, 2018

Ice on Large Lakes

- Partial coverage
- fragmented, moves around a lot under action of winds
- properties of fresh water ice and sea ice have important differences

Goals

- Conduct full winter high resolution (~200 m horizontal) numerical simulations to compare two lake-ice models using the same three-dimensional primitive equation model
- Large scale simulations of lakes Erie (primary, often >90% ice covered) and Ontario (secondary, typically < 25% ice covered)
- Small scale process studies on lake ice dynamics and convection near the ice edge and under ice (10 m resolutions, shorter time periods)
- Add Lagrangian model of frazil ice formation
- Compare with observations (e.g., satellite images)

Models

- hydrodynamic core: MITgcm
- ice model in MITgcm
- Los Alamos Sea Ice Model (CICE)
- both are dynamic/thermodynamic models with multiple thickness categories and simple parameterizations for snow thickness, frazil ice and snow-ice formation
- both use elastic-viscous-plastic rheology
- assess ability to model ice-floe break off, ice-eddy formation, ridges, opening in ice etc.
- compare with observations (satellite images)

Longer Term Goals

- Improve current ice models
- extend modelling to include silt, nutrients and phytoplankton: development/implementation/validation of biogeochemistry model. Extend team as necessary.
- incorporation of phytoplankton and silt into frazil ice model
- under-ice river plumes (Grand River, Niagara River)

GWF Core Teams

- data collection to drive model and for comparisons
- Homa Khreyollah Pour will help develop verification data (SAR, RCM, MODIS/VIIRS/GOES)

Progress to-date

- Have recruited one student so far. Two more to find.

Connections

- Lake Futures. Others?