



CO₂ and Lake Superior

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Project Description

- Model CO₂ cycle within Lake Superior
 - Use measured gaseous and aqueous CO₂ concentrations
- Quantifying regional impact of Lake Superior on the carbon budget

Importance of CO₂ Flux over Lake Superior

- Effects on terrestrial CO₂ concentrations
- Source or Sink?
- Seasonal and spatial variability

Factors influencing CO₂ concentration over Lake Superior

- On-shore and in-lake diurnal photosynthesis and respiration patterns
- Seasonal variations in photosynthesis and respiration
- Atmospheric stability and fetch

Methods

- Micrometeorological instruments on boat mast 10 meters about the deck
- Other Instruments on deck
- Transect out into lake
 - Stations at 3km, 10km and 20km offshore
- Land Station
 - CO₂ gas analyzer
 - Humidity and temperature sensor

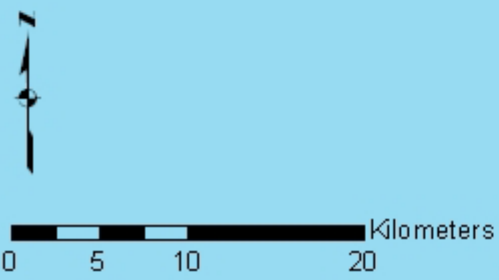


Lake Superior Sampling Stations

20 km offshore

10 km offshore

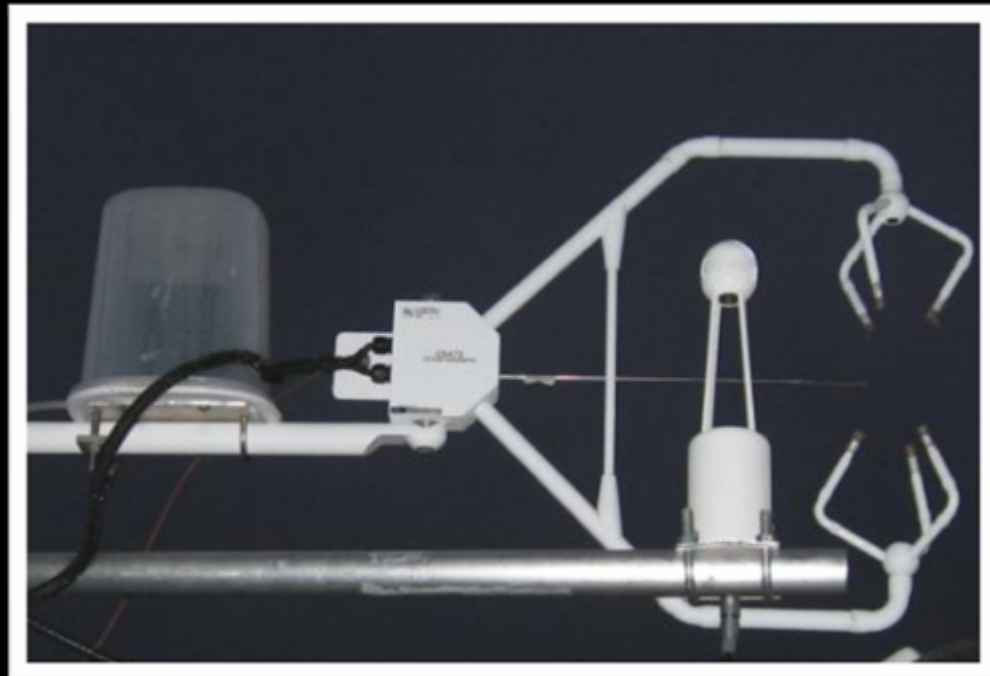
3 km offshore



USA contiguous Albers equal area conic
GCS North American 1983
Data Source: NOAA
Mark Rowe 8-31-07

Instruments on Ship

- From deck
 - GPS
 - Surface water temperature probe
- Mast 10m above ship deck
 - Sonic anemometer
 - CO₂ gas analyzer
 - Fine wire thermocouple
 - RM Young wind monitor
 - Humidity and temperature sensor
 - Gyroscope



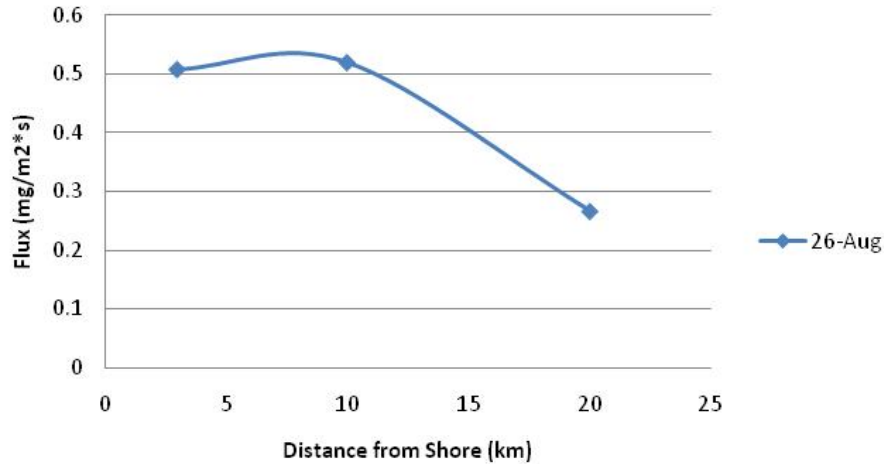
Flux Calculations

$$Flux(mg / m^2 - s) = ([CO_2] - [CO_2]_o)(mg / m^3) \times \left[\frac{\text{mixing height}(m)}{\text{time over lake}(s)} \right]$$

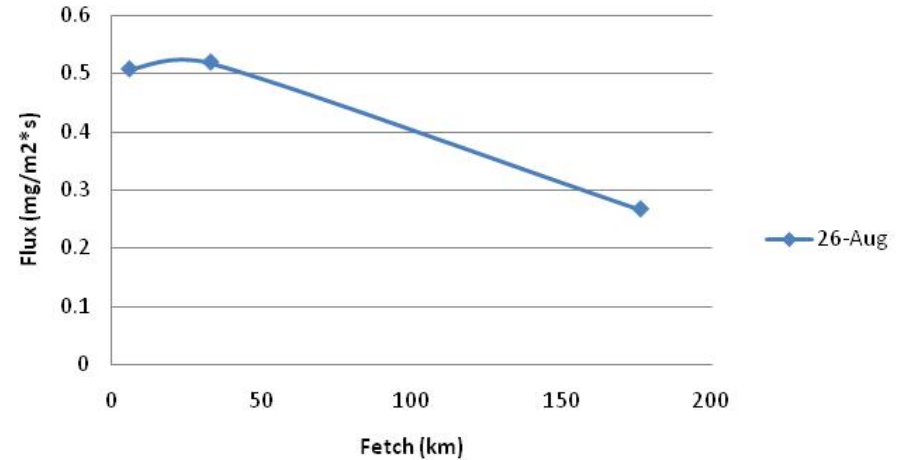
$$\text{Mixing Height} = \frac{\left[\frac{\text{Avg Flux (mg/m}^3\text{)}}{\text{time over lake}(s)} \right]}{([CO_2] - [CO_2]_o)(mg / m^3)}$$

Preliminary Results

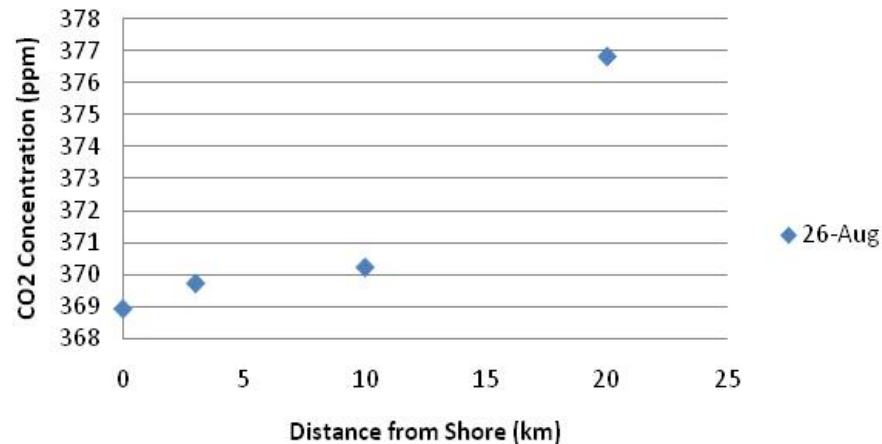
CO2 Over Lake Superior



CO2 Flux and Fetch



CO2 Concentration



What's Next?

- Motion Correct the wind speed data
 - Recalculate fluxes using vertical wind speed
 - Compare with other flux calculations
- Update Regional Model
- Paper

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