

A FIELD STUDY OF EVAPORATION ACROSS LAKE ERIE

Fellow: Kevin Fries

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Overview and Objectives:

Our goal was to understand the complex processes that drive the Great Lakes water balance. To that end, the specific objective of this proposal was to carry out a field study of overlake evaporation across the 2014 GLERL field season, focusing specifically on Lake Erie. We have developed a prototype evaporation sensor platform, which was deployed by a graduate student to study the spatiotemporal variability of overlake evaporation in western Lake Erie. Data was successfully acquired during the 2014 seasons, and the sensors are again deployed on the Lakes this year.

Accomplishments:

Kevin Fries, the PhD student on this project, was awarded an NSF graduate fellowship due, in large part, to the preliminary work he completed during this CILER project. A radiation sensor and hygrometer were deployed on NOAA RECON's Cleveland buoy during the summer and fall of 2014. These measurements, in combination with other measurements from sensors already equipped on the buoy, were used to estimate hourly evaporation at the buoy's location. These estimates were made through a robust web infrastructure hosted on Amazon Web Services that is scalable to include future observation sites from both stationary and drifting buoys.

A drifting buoy prototype, equipped with a weather station and satellite modem, was developed and tested on Lake Erie. Further design iterations for the housing are necessary to ensure the buoy is robust enough to function for an entire season without swamping under aggressive wave action.



A large dataset of ship observations is currently collected by NOAA CoastWatch that includes measurements of many of variables we plan to measure on the above buoys. The ship data lacks quality control, though, and is sparse both spatially and temporally. Using a machine learning tool called Gaussian processes, we were able to assimilate these ship observations into current weather and lake models created by the National Weather Service and NOAA to get improved hourly estimates of air temperature, dew point, wind speed, and lake surface temperature for 2006-2014.

Publications:

Two papers are presently in preparation, to be published in 2015.

Presentations:

Fries, Kevin, Branko Kerkez. *Ship Data for Spatio-temporal Estimates of Hydrometeorological Conditions Across the Great Lakes*. Presented at the International Association for Great Lakes Research Annual Conference on Great Lakes Research, Burlington, VT, 2015.

Fries, Kevin, Branko Kerkez, Andrew Gronewold, John Lenters. *A sensor-based energy balance method for the distributed estimation of evaporation over the North American Great Lakes*. Presented at the American Geophysical Union Fall Meeting, San Francisco, 2014.

Outreach Activities:

None.

Relevant Web content:

See evaporation page on: <http://tinyurl.com/bkerkez>

Supplemental Material:

None.