Ocean Technology Transition Project

OTT

Building Capacity to Measure and Assess Offshore, Full-Frequency Water Level Fluctuations to Support Coastal Hazard Observation and Prediction

The Team

The Great Lakes Observing System is leading the project with support from investigators:

- Shelby Brunner, Great Lakes Observing System
- Chin Wu, University of Wisconsin-Madison
- Eric Anderson, Colorado School of Mines
- Guy Meadows and Hayden Henderson, Michigan Technological University

and collaborators:

- Tosca Lichtenheld, Sofar Ocean Technologies
- Greg Dusek, Bob Heitsenrether, and Laura Fiorentino, NOAA CO-OPS.

great lakes observing system | IOOS Integrated Ocean Observing System | Michigan Tech | WISCONSIN UNIVERSITY OF WISCONSIN–MADISON | SCHOOL OF MINES 1874 COLORADO | NOAA CO-OPS | SOFAR

Primary Objectives:

1) Field deployment, testing and further development of various water level sensors with real-time communication capabilities
2) Development of toolkits for communities to detect and issue warning for high-frequency water level fluctuations-induced coastal hazards
3) Engage communities in developing a water level warning toolkit and transition the operations of the new water level monitors

Photo courtesy of Michigan Sea Grant

Background

Coastal communities can be severely impacted by water-borne coastal hazards. Currently the awareness of these hazards comes from a limited set of in-lake (or in-situ) observations, remote sensing capabilities, and forecast products. In most cases, the in-situ observations along the coast are limited to surface wind-wave buoys, on-shore or inland water gauges, and coastal webcams. By design, the sensors are only capturing a subset of the spectrum of water level fluctuations that exist along a coast, which means that a gap exists in the data related to the frequency of water level fluctuations. Water level fluctuations in this gap have been shown to pose dangerous coastal hazards to the public, including those associated with rip currents, inundation, and meteotsunamis. Furthermore, operational forecast products and models also fail to cover this frequency-gap related to coastal hazards.

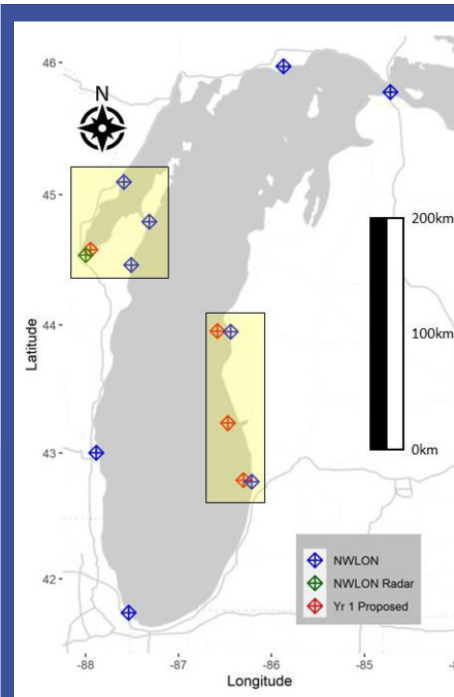
Project Timeframe

The project started on **September 1, 2024.**

Field components will begin **Spring 2025**, given the seasonal alignment with ice on the Great Lakes.

Technology Objectives:

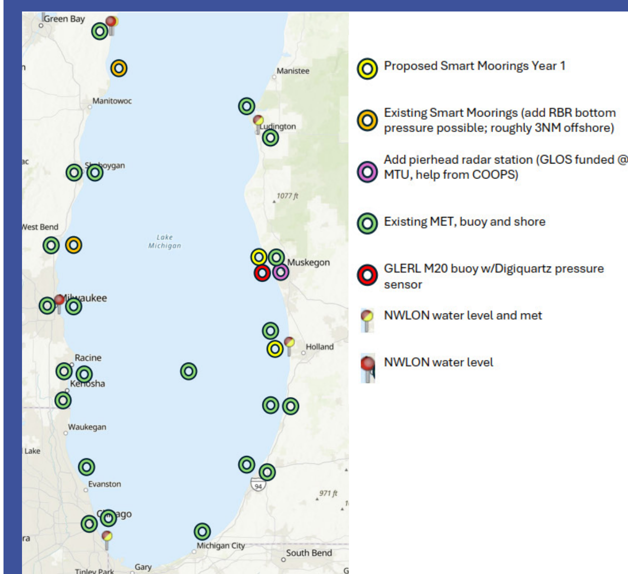
The project team plans to deploy in-situ observing platforms capable of capturing the full wave spectrum in real-time, to **1) address the high frequency water level fluctuations gap and the evaluation of their coastal impacts, 2) collect in-situ data that might better contribute timely information related to coastal hazards**, and **3) provide low-cost, easy-to-operate monitoring platforms to interested communities to help improve the spatial resolution of the observing network.**



Project Locations

The maps on the right indicate existing water level and/or meteorological sensors. The National Water Level Observation Network (NWLON) is a network of nearshore water level gauges operated by NOAA CO-OPS and is a crucial component to coastal hazard awareness. Meteorological sensors, particularly for wind speed and direction, are important for storm tracking. This project plans to deploy additional, buoy-based wave and water level sensors for capturing the full-frequency of water level fluctuations.

In Year 1, two zones in Lake Michigan will serve the testing phase. One buoy will be located nearest Green Bay, Wisconsin due to proximity with a NWLON Radar station and the other test zone will place buoys 3-5 nautical miles offshore of western Michigan in the vicinity of the Holland and Ludington, MI, NWLON sites. Further testing and expansion of the buoy network will be identified in Year 2 with help from the end user advisory group. Exact deployment site coordinates will be identified through working with the United States Coast Guard District 9 to ensure the surface buoy location meets their criteria and does not pose a safety risk.



Benefits

This project will have direct benefit to (1) NOAA CO-OPS, which operates and develops coastal observational platforms to protect life and property, (2) coastal communities, who rely on coastal observations to protect life and property, (3) commercial and recreational navigational users, who rely on marine observations for safe passage, (4) NOAA National Weather Service forecasters, who use coastal observations to issue beach hazard warnings, and (5) NOAA operational forecast model developers, who rely on coastal observations to develop, validate, and verify hydrodynamic forecast guidance.

Currently, all of these users are limited by the existing frequency gap in coastal observations that this project will address by providing a nearshore system that captures full-frequency information and finally fills an observational gap that has historically left communities vulnerable to many kinds of hazards.

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