Project Title: Enhanced monitoring and data management to support meteotsunami research and detection

Project Budget: $11,900 ($9,900 for data management and observation system, $2,000 for outreach)

Project Start/Stop: April 26, 2018 to July 31, 2018

Key Project Personnel:

NOAA-GLERL: Dr. Phillip Chu, NOAA GLERL Contact

LimnoTech: Ed Verhamme, Principal Investigator

The recent occurrences of a meteotsunami event on Lake Michigan, including a 14 inch water level rise in only 40 minutes near Ludington MI on April 13, 2018 (*MLive*), demonstrated that the existing observing network is not adequate to observe or attempt to predict this phenomenon. Meteotsunamis have the potential to cause significant damage to shoreline structures and can endanger lives (Bechle et al. 2016, *Nature*). A more robust monitoring and alert system is needed on Lake Michigan and Lake Erie to monitor, detect and mitigate the impact of future events. The rapid funding provided by CIGLR will be used to immediately supplement ongoing projects at NOAA GLERL and LimnoTech to develop a monitoring and notification system for atmospherically significant events that could lead to meteotsunami events. The rapid response funds will be used to support three major tasks: (1) develop a data management system to log, archive, and display relevant meteorological (wind speed, direction and air pressure) and water level data from existing and new stations; (2) Upgrade the existing observing system reporting frequency and add up to four new stations; (3) educate the public about the risks of meteotsunamis and new sensor monitoring network. Both tasks will focus on Lake Michigan and Lake Erie as those two lakes have higher occurrence and resulting impacts to life and property.

Task 1 – Data Management System to Support Meteotsunami

This task will support the rapid development of a web database and toolset to support viewing of high frequency data from select new and existing stations on Lake Michigan and Lake Erie. The tool will be able to receive data from up to 20 stations at a one-minute frequency. Parameters of interest will likely include air pressure and wind speed and direction. Selection of stations and parameters will be made by NOAA GLERL and LimnoTech. LimnoTech will draw on its experience and tools that are utilized by the Great Lakes Observing System to develop a rapid pilot monitoring and notification system. The data system will display recent observations (no more than the previous 24 hours) and have the ability to download historical data. A notification system will be developed in coordination with NOAA GLERL to notify key personnel of a potential meteotsunami event. The notification system will be based on the rate of change of wind speed and pressure measurements.

Task 2 – Fortify existing observing system and add new stations

This task will support the deployment of low-cost, high frequency monitoring stations at up to four new locations on Lake Michigan or Lake Erie. This task includes working with existing partners that maintain shoreline weather stations (e.g. NOAA GLERL, NOAA NWS, NOAA NOS, and WeatherFlow) and shoreline property owners (at parks, boat ramps, piers) where new stations could be deployed. Funds could be

used to add a high frequency sensor to existing stations, modify software on existing stations to transmit data at higher frequency, or deploy a new station. Our target is for a total of 16 stations, consisting of up to four new stations and cooperation from 12 existing stations. LimnoTech will utilize software and hardware from the EnviroDIY (https://www.envirodiy.org/) project when possible to reduce equipment costs and maintain open-source flexibility. Many stations will already have power and data collection infrastructure on site, but may need augmentation to measure pressure and to send high frequency data to the data management system. The initial focus will be to enhance observations of atmospheric pressure as it is easy to monitor and correlates well with meteotsunami potential.

Task 3 – Public outreach and education tool development

This task will support the development of key education and outreach materials related to the outputs of task 1 and 2. It will include information and technical knowledge about the new high frequency network, detection system, and how to contribute to the network. LimnoTech will host a meeting that consists of PI and network partners at suitable location at the completion of this project. Materials that will be generated for the meeting will include project summaries suitable for a project website as well as a PowerPoint presentation.

Project Timeline

April 26 – Notice to proceed received from UM-CIGLR

April 27 – Meet with Dr. Phillip Chu, NOAA GLERL, to discuss goals and potential sites

May 1 – Start reaching out to existing station owners via email and phone

May 4 – Begin logging high frequency data from existing stations on Lake Michigan (Port Sheldon, South Haven, and St. Joseph). Expand number of stations as buoys get deployed for 2018

May 18 – Finalize list of existing and new stations that can be included in this rapid response effort.

June 1 – Complete development of online data storage system for high frequency observations and prototype monitoring system

July 1 – Begin deploying new stations and sensors

July 31 – All stations deployed and online storage/notification system running

Budget:

A total of $9,900 is allocated towards tasks 1 and 2 and a total of $2,000 is allocated towards task 3 for a total cost of $11,900. Costs for task 1 include $4,550 in labor (35 hours) and $500 in supplies (web hosting services). Costs for task 2 include $2,600 in labor (20 hours), and $2,250 in equipment and supplies. Task 3 includes $2,000 in labor (16 hours).

References:

MLive - http://www.mlive.com/news/index.ssf/2018/04/lake_michigan_pier_completely.html
CIGLR Ocean Science Meeting: https://ciglr.seas.umich.edu/wp-content/uploads/2018/02/FAQs_and_Additional_Resources_on_Meteotsunamis.pdf
Nature Article: https://www.nature.com/articles/srep37832.pdf