

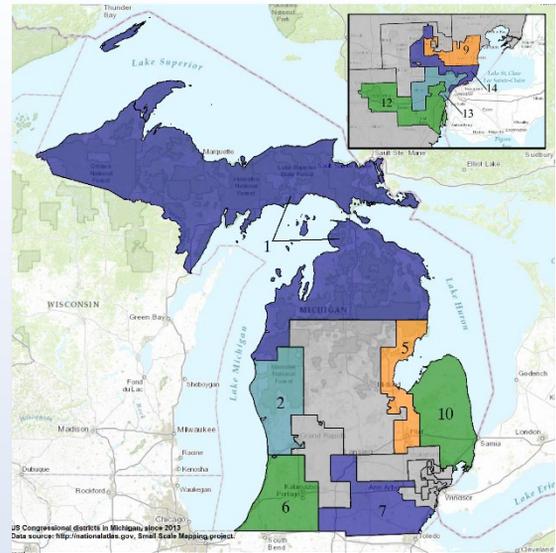
Water Levels & Coastal Flooding



Photo by Mark Breederland, Michigan Sea Grant

Coastal conditions on the Great Lakes affect the daily lives of tens of millions of people, impact the multi-trillion dollar regional economy, and influence resource management decisions. The consequences of water level change for shipping, commerce, and human safety have been magnified by a dramatic swing from persistently low lake levels to record-high levels and devastating coastal flooding over the past two decades.

With our partners at the NOAA Great Lakes Environmental Research Laboratory, CIGLR is engaged in research to understand changes in water levels and to develop water level forecasts that improve human safety and assist water-dependent commerce.



Map of Michigan Congressional districts impacted by water levels and coastal flooding



Hosted by the University of Michigan, CIGLR is a partnership between the National Oceanic and Atmospheric Administration (NOAA), universities, NGOs, and businesses.

With support from:



Quick Facts

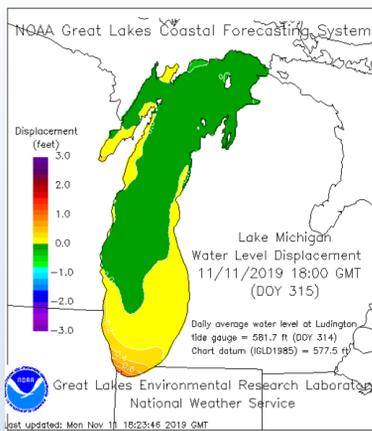
- Multiple periods of extreme high and low water levels have occurred in the Great Lakes over the past 100 years.
- Water levels have been above average since 2015, following a 15 year period of below average water levels.
- Extreme water levels can result in economic gains or losses for sectors including tourism, fishing, real estate, and shipping.
- Coastal flooding can be caused by extreme weather events that generate storm surges, seiches, or meteotsunamis.
- A seiche occurs when strong winds cause water to build up along one shoreline of a lake – a storm surge – then rebound back to the opposite shoreline, similar to water sloshing in a bathtub.
- A meteotsunami is a water wave created by a strong line of storms that causes rapid and often hazardous changes in water level.



Photo by Sean Marshall, Flickr

Water levels in Lake Ontario were at record highs during 2017 and 2019, causing devastating flooding in coastal communities. The Governor of New York estimated that these two events will cost the state over \$1 billion. Conflict arose between property owners who wanted maximum water release at regulatory structures and shipping interests who wanted lower flow downstream for safer shipping.

Current Research & Outcomes



The Great Lakes Coastal Forecasting System produces an experimental nowcast and 5-day forecast of water levels for each lake.



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- Research on the regional water budget is improving water level predictions in support of the International Joint Commission's management needs.
- An interdisciplinary summit on meteotsunami research and the installation of a new sensor network are advancing NOAA's efforts to develop a forecast model for meteotsunamis.
- Coastal flood forecasts are being developed by connecting existing watershed and lake models that previously operated separately, making coastal conditions difficult to predict.
- Water level gauges installed along the Detroit River are helping a local community anticipate and respond to flood emergencies.

Research & Management Needs

- Research to better understand the causes of water level variability in support of improved water resources management and policy.
- Improvements to long-term water level models in light of climate change scenarios.
- Development of a meteotsunami warning system to increase human safety and awareness of this previously overlooked hazard.
- Engagement with coastal communities to understand information needs and increase the capacity for coastal resilience.



Photo by Charles Dawley, Flickr

Meteotsunamis cause unusually fast changes in water level that often catch people off guard, damage waterfront property, and create strong currents. More than 100 meteotsunamis occur in the Great Lakes each year. They can seemingly come out of nowhere, and are associated with drownings and rescues of people swept from beaches and piers.

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