

Frequent Questions

Lake Level Viewer

United States Great Lakes



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Geographic Coverage

Why doesn't my area have elevation data in the viewer?

We were only able to map areas with existing topographic and bathymetric lidar data. We are filling in key data gaps and updating the information in the viewer in 2015. Areas with no data are denoted with a hash marking. Please note that some data gaps have topography but no bathymetry data, and a smaller number of areas have bathymetry but no topography.

Data

Where do the data come from?

Many data layers are displayed in the viewer. Each functional tab displays different data, and source information for each data type can be found in the functional tabs.

Water Level Change

The maps in this tab show extent and relative depth of water from -6 below to +6 feet above average lake level. The water level maps are created by adding or subtracting 1 to 6 feet from the average water level.

The data in the maps do not consider natural processes such as erosion, subsidence, or future construction. Water extent is as it would appear on a calm day with no wind-driven waves or seiche effect. The data, maps, and information provided should be used only as a screening-level tool.

Visualization Locations

Clickable camera icons display water level impacts of -6 to +6 feet at various public locations. The water surface was superimposed on existing photographs based on site elevations taken from digital elevation models using a free software program called CanVIS, available as a free download on Digital Coast: www.csc.noaa.gov/digitalcoast/tools/canvis

"Areas not mapped"

These hash-marked areas indicate places where adequate accuracy elevation data (see question on data accuracy) were not available for mapping.

Mapping Confidence

Levels of confidence are depicted on this tab. Blue areas denote a high confidence of inundation, orange areas denote a low confidence of inundation or exposure, and unshaded areas denote a high confidence that these areas will be dry given the chosen water level. In this application, 80% is considered a high degree of confidence such that, for example, the blue areas denote locations that may be correctly mapped as "inundated" more than 8 out of 10 times. Areas with a low degree of confidence represent locations that may be mapped correctly (either as inundated or dry) less than 8 out of 10 times.

Confidence mapping is a fairly complicated procedure that is explained in detail in “Mapping and Portraying Inundation Uncertainty of Bathtub-Type Models,” available at www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-13-00118.1. This method was developed for the Sea Level Rise Viewer but applies to the Lake Level Viewer when tidal uncertainty is subtracted from the equation. In short, the uncertainty at a given point is determined by the lidar-derived elevation data set or sets (root mean square error, or RMSE) which make it up. This uncertainty is mapped to show that the inundation depicted in the viewer is not really a hard line, but rather a zone with greater and lesser chances of being wet.

Note that data in this tab do not depict uncertainties associated with climate change models and lake level change in any way.

Socioeconomic Vulnerability

By overlaying social and economic data on a map that depicts lake level change, a community can see the potential impact that changing lake levels can have on vulnerable people and businesses.

Social

The Social Vulnerability Index (SOVI), which shows areas of high human vulnerability to hazards, is based on population attributes (e.g., age and poverty) and the built environment. By looking at the intersection of potential lake level change impacts and vulnerable block groups, one can get an idea of how vulnerable populations might be affected by varying lake levels.

Dark red indicates block groups having a high vulnerability, and the lighter reds indicate decreasing vulnerability. This information is based on 2010 census tract data. The method for creating the SOVI data is available from the University of South Carolina Hazards and Vulnerability Research Institute, the creators of the data set:

<http://webra.cas.sc.edu/hvri/products/sovi.aspx>

Economic

The number of employees exposed to a hazard is a strong indicator of a community’s overall economic vulnerability. By looking at the intersection of potential lake level changes and the distribution of the employees within a community, one can get an idea of how a local economy might be affected by variable lake levels.

Darker greens represent block groups with higher concentrations of employment, wages, and establishments. Grey represents block groups where data cannot be displayed because of confidentiality issues.

These data represent total number of employees aggregated to census block groups and are from the Bureau of Labor Statistics’ Quarterly Census of Employment and Wages.

What is the accuracy of the mapping used in this tool?

The maps in the viewer are derived from source elevation data that meet or exceed the Federal Emergency Management Agency (FEMA) mapping specifications for the National Flood Insurance Program.

- 0.6 feet (18.5 centimeters) root mean square error (RMSE) for low relief terrain
- 1.2 feet (37.0 centimeters) RMSE for high relief terrain

Areas with missing topography and bathymetry data are shown as hash-marked no-data areas.

How often is the mapping updated with new elevation data?

New elevation data are being collected at various time intervals by federal, state, and local entities, so it is possible that newer data have been collected since the initial release of this viewer (fall 2014). Some elevation models will be updated in 2015 if data are available to fill key data gaps. The overall update strategy is to examine new elevation data sets as they become available to determine if a mapping update is warranted. Gaps in bathymetry data will be assessed and filled, where necessary, when new data are discovered or become available.

How do I access the data layers in the viewer?

To access the data layers that are shown in the viewer, click on the Download tab in the viewer interface or visit the tool page on Digital Coast, www.coast.noaa.gov/arcgis/rest/services/LakeLevels.

Can I get the digital elevation models (DEMs) that were used to create the layers in the viewer, and how are they different from most other DEMs?

DEMs used to create the layers in the viewer are available through NOAA at the links below:

Erie – www.ngdc.noaa.gov/dem/squareCellGrid/download/5195

Huron – www.ngdc.noaa.gov/dem/squareCellGrid/download/5190

Michigan – www.ngdc.noaa.gov/dem/squareCellGrid/download/5198

Ontario – www.ngdc.noaa.gov/dem/squareCellGrid/download/5197

Superior – www.ngdc.noaa.gov/dem/squareCellGrid/download/5196

Building the DEMs for the viewer is by far the most time-consuming process step. DEMs are created by first gathering the best available lidar-based topographic and bathymetric elevation data (see data accuracy question). Unlike DEMs delivered through the Sea Level Rise Viewer, these DEMs contain coverage for topography and bathymetry, and they are not hydro-enforced. There are data gaps throughout the coverage area, primarily on the bathymetric side.

Modeling Approach

How is this tool different from other lake level change mapping efforts?

The purpose of this data viewer is to provide a preliminary look at changing lake levels and their impacts (across the Great Lakes). The viewer is a screening tool that uses the highest accuracy

elevation data sets available at the time maps were produced. We are not aware of any other Great Lakes-wide lake level change mapping efforts at this time.

Why does the tool use the starting point of long-term average lake level?

Long-term average lake level is the average of all lake levels from 1918 to the present. It is different for every lake and represents a reasonable starting point for lake level change analyses because it is consistent with the data provided via the Great Lakes Environmental Research Laboratory Water Level Dashboard. For more information on average lake level, please visit the following publications:

[Coasts, Water Levels, and Climate Change: A Great Lakes Perspective](#)

[A Dynamic Graphical Interface for Visualizing Projected, Measured, and Reconstructed Surface Water Elevations on the Earth's Largest Lakes](#)

Is this viewer based on a “bathtub” modeling approach?

Yes, the process used to map lake level change in this viewer can be described as the bathtub approach or linear superposition method.

Does this viewer show timing of lake level change (e.g., 3 feet lower by 2100)?

This viewer does not show specific timing of lake level change. This is by design. One-foot increments are mapped above and below long-term average lake level (to plus and minus 6 feet). This range covers all the historical lake level variation and allows users to consider future scenarios of their choosing.

Do the maps shown in this viewer take into account levees or hydraulic features (culverts, pipes, dikes, bridges)?

The digital elevation models used to map changing lake levels in this tool do not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis (for example, culverts and ditches may not be incorporated, resulting in incorrectly mapped areas).

Do the maps take into account future changes in geomorphology, shoreline change, etc.?

The mapped lake levels in this tool do not incorporate future changes in coastal geomorphology and assume present conditions will persist. Geomorphologic changes associated with natural processes and human actions will, of course, be vital in determining water extents. Failing to consider these processes is a significant limitation of the mapping process. As the scientific community continues to increase its understanding of and skill in predicting these critical processes, the functionality of the tool can be updated. Until then, the above-mentioned effects are still sufficiently unknown that they may compound or offset each other in unpredictable ways, such that including only some processes may cause greater error than ignoring them.

Using the Tool

How do I get my regional or local GIS data to overlay with the layers in this viewer?

Because the main focus of this tool is to provide a region-wide preliminary look at impacts of changing lake levels, ingesting regional or local GIS data into the viewer is impractical. Because of scale, data quality, and consistency issues, we currently do not incorporate these data. For regional and local implementation, regional and local users must either obtain our data layers or ingest them as web map services. See the above question on data access. This strategy enables regional and local users to visualize the data layers on their own desktop or Web mapping GIS applications for visualization and analysis.

How far can I zoom in?

The layers included in the viewer are cached for display down to the 1:18,000 scale. This dictates how close users can zoom in. If zooming closer is necessary, users can download the layers and examine the data more closely.

Can I get the viewer source code?

The viewer was built using HTML 5 and OpenLayers 3, and the code is available upon request.

User Feedback

How do I provide feedback on this tool?

If you have questions or comments about the Sea Level Rise and Coastal Flooding Impacts Viewer, or want to request data or information, you may send an email to coastal.info@noaa.gov.