



Water Levels of the Great Lakes

February 2016

The Great Lakes, their connecting waterways, and their watersheds, comprise the largest surface freshwater system on the planet. The monthly, seasonal, and annual surface water elevations of the lakes fluctuate in response to a variety of factors. This brochure provides a brief overview of historical Great Lakes water level patterns and current water levels, as well as the research NOAA conducts through its Great Lakes Environmental Research Laboratory (GLERL) on seasonal water level forecasts.

El Niño and Great Lakes Water Levels



Whitecaps on an eastern Lake Superior bay in January 2016. Ice cover is expected to be below normal this year due to El Niño conditions in the Midwest. Photo credit: Joann Cavaletto, NOAA-GLERL

The El Niño that is impacting weather in the midwest and northeast this winter is also showing signs of impacting Great Lakes water levels. An El Niño develops when the sea surface temperatures in the equatorial Pacific Ocean are warmer than average. Typically, this means the polar jet stream stays farther north, producing warmer and drier conditions in the Great Lakes basin.

It is important to note that past El Niño periods have had very different impacts on Great Lakes water levels. The strong El Niño in 1997-98 resulted in a very warm winter across the basin (+5.0 degrees F above normal) while the El Niño in 1965-66 produced a winter period in much of the basin with temperatures below average. The Midwest is impacted by other large climate patterns as well, including the North Atlantic Oscillation and the Arctic Oscillation.

Previous research on past strong El Niño events in the Great Lakes indicates that water level impacts might be delayed. For example, this past fall, lake-wide levels for Superior and Michigan-Huron increased slightly from November to December, which is extremely unusual. In many past strong El Niño years, the fall following the event was characterized by a higher rate of over-lake evaporation than average. If that comes to pass, we may see seasonal lake levels decrease more quickly in November and December of 2016.

How are water levels predicted?

Forecasts of Great Lakes monthly-average water levels are typically based on computer simulation models. One example is the Great Lakes Advanced Hydrologic Prediction System (AHPS), developed by NOAA-GLERL, which combines historical meteorological data with a series of mathematical models and climate forecasts from NOAA's Climate Prediction Center to simulate multiple variables. The most important variables are overlake precipitation, overlake evaporation, and rainfall-induced runoff. The sum of these variables ("net" supply of water to the basin) is routed through the lakes and connecting channels using models that reflect flow patterns and regulation rules in order to produce a band of probability-based future water levels.

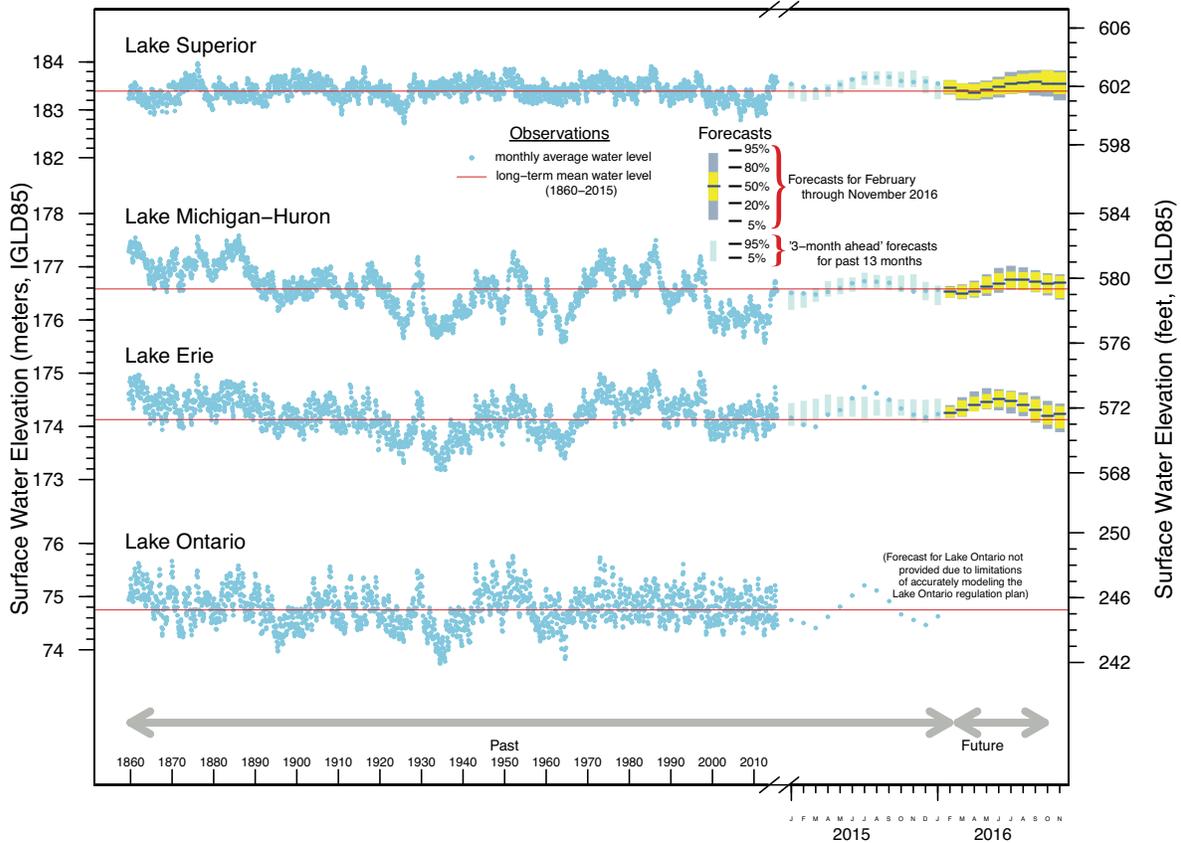
FOR MORE INFORMATION

www.glerl.noaa.gov/data/now/wlevels/levels.html

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The Current Outlook for Great Lakes levels

The research-oriented forecast generated by NOAA-GLERL's AHPS on February 5 indicates that the water levels of Lakes Superior, Michigan, Huron, and Erie are expected to follow their typical seasonal trends at above average levels; remaining above their monthly and long-term averages into fall of 2016. The uncertainty expressed in the forecast shown here is based on observed weather patterns and Great Lakes water levels from 1948 to present, along with NOAA Climate Prediction Center's regional forecasts. The 5 and 95% bands are expected to contain the observed water level 90% of the time. The NOAA-GLERL AHPS forecasts are used by the U.S. Army Corps of Engineers and Environment Canada as part of their internationally-coordinated operational water level forecasting systems (www.lre.usace.army.mil/Missions/GreatLakesInformation/GreatLakesWaterLevels/WaterLevelForecast/MonthlyBulletinofGreatLakesWaterLevels.aspx).

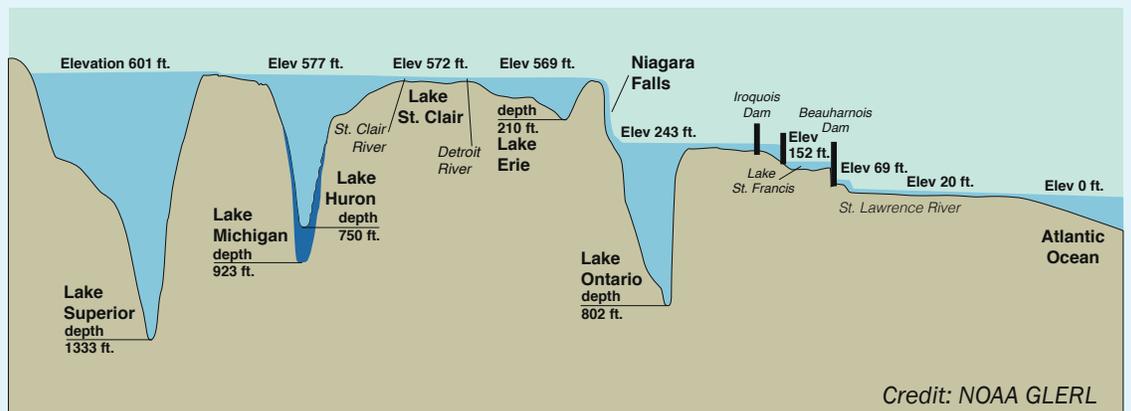


GREAT LAKES SYSTEM PROFILE

The Great Lakes and their respective watersheds and waterways all flow downhill to the ocean. Within the Great Lakes system, water flows from Lake Superior via the St. Marys River into Lake Huron. Lakes Michigan and Huron are joined at the Straits of Mackinac, which allows these two lakes to act as one hydrologic system. The upper lakes meet the lower lakes at the Huron-Erie corridor, which is comprised of the St. Clair River, Lake St. Clair, and the Detroit River. Lake Erie flows over Niagara Falls and into Lake Ontario before flowing through the St. Lawrence River into the Atlantic Ocean.

What is IGLD?

IGLD refers to the International Great Lakes Datum, an elevation benchmark (reference point) against which all water level gauging stations in the Great Lakes are compared. This reference point was last established around 1985. IGLD requires updating about every 30 years because the land surface around the Great Lakes is constantly changing in elevation due to the 'bounce back' of the earth's crust following the retreat of the glaciers during the last ice age (also referred to as isostatic rebound).



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Credit: NOAA GLERL