Water Levels of the Great Lakes

February 2015

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.

Above Average Water Levels on ALL of the Great Lakes

Since September 2014, all of the Great Lakes have been above their monthly average levels for the first time since the late 1990s. The unusually wet conditions of 2013 and 2014 effectively ended the 15-year period of persistent below-average water levels on Lakes Superior, Michigan, and Huron. The surprisingly swift rebound in water levels on the upper lakes broke records across the region. The net rise in water levels on Lake Superior from January 2013 through December 2014 was roughly 2 feet (about 0.6 meters), the highest net increase ever recorded for a 2-year period starting in January and ending the following December. Similarly, on Lake Michigan-Huron, the rise in water levels from the record-low in January 2013 through December 2014 was a remarkable 3.1 feet (nearly 1 meter), an increase that almost tied the record rise set in 1950-1951.

The combined effects of a storm and the recent rapid return of water levels to above-average can provide challenging conditions for shoreline residents (Credit: Lisa S. Gerstner).

The recent surge in water levels has largely provided relief to communities, businesses, and industries that depend on Great Lakes waters, including commercial shipping, hydropower, recreational boating, and tourism. However, higher water levels can have negative impacts as well, including coastal erosion, flooding, and property damage along the shoreline. The severe storm that lashed the shores of southern Lake Michigan on October 31, 2014 is just one example.

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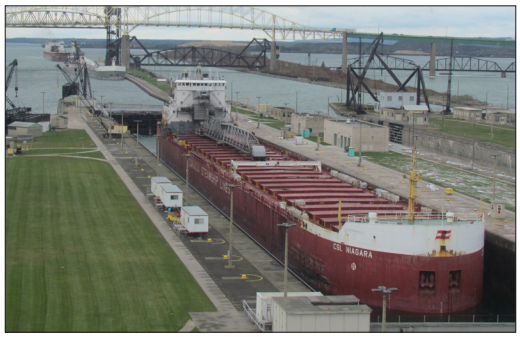

The CSL Niagara is in the Poe Lock at Sault Ste. Marie while the James L. Kuber/ Victory and Mesabi Miner line up behind it waiting to lock through, Nov. 9, 2014 (credit: M. Briggs, US Army Corps of Engineers).

What's next for Great Lakes water levels?

Will they continue to rise, or is this return to above average levels a 'blip' that will give way to another long period of low levels? These are very difficult questions to answer. Predicting Great Lakes water levels much beyond 6 months is a challenge because the drivers of climate variability that impact our regional water budget remain difficult to predict. NOAA scientists are analyzing these relationships to see whether our predictions of the major drivers of Great Lakes water levels (over-lake precipitation, evaporation, and runoff) can be improved. Monitoring Great Lakes water levels is an important part of NOAA's mission to understand and predict changes in climate, weather, oceans, and coasts.

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

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

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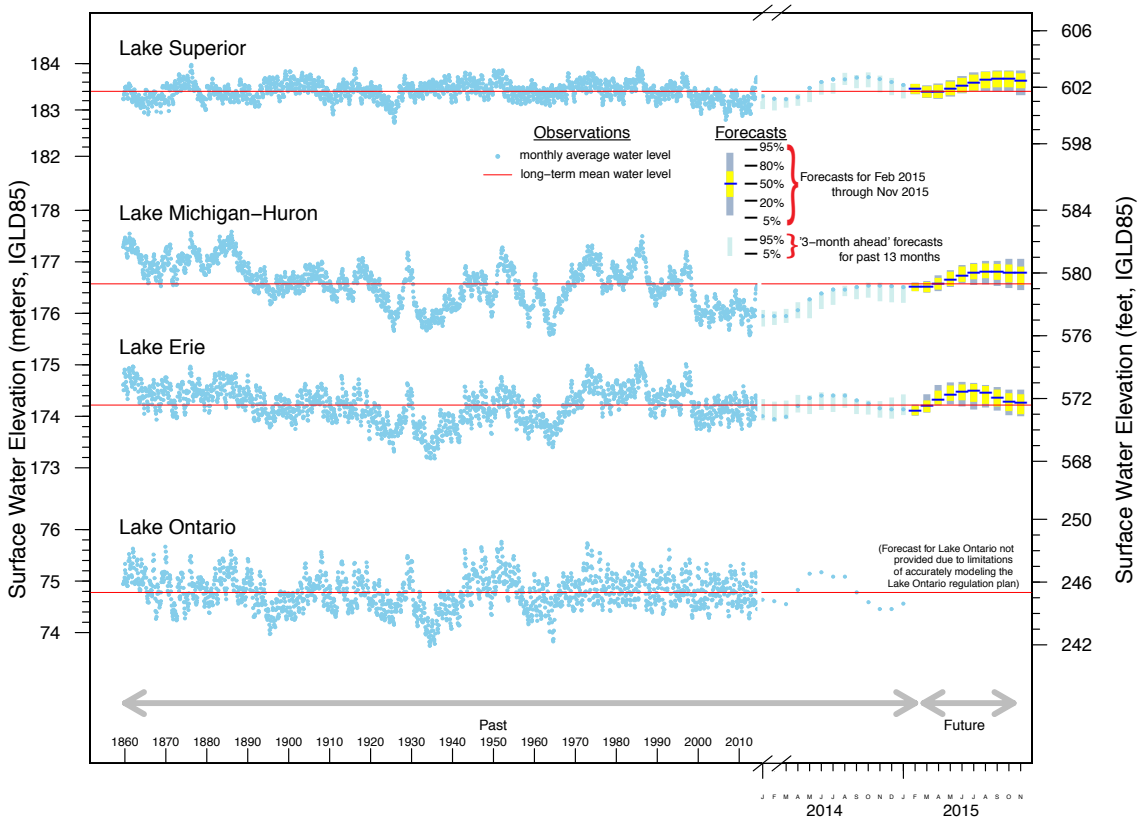
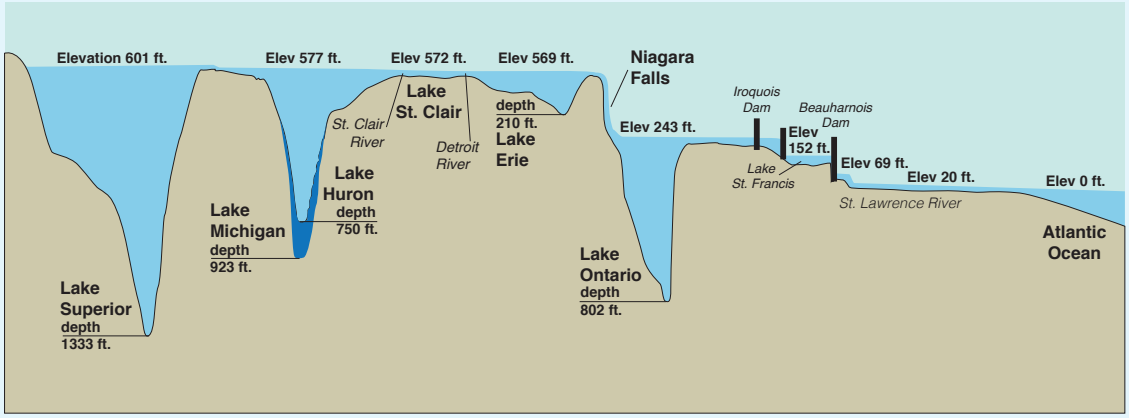
The Current Outlook for Great Lakes levels

The research-oriented forecast generated by NOAA-GLERL's AHPS on February 5 indicates that the water levels of Lakes Superior, Michigan, and Huron are expected to follow their typical seasonal trends at above average levels; remaining above their monthly and long-term averages for 2015. Lake Erie water levels may be slightly higher than 2014, and will stay at or slightly above their monthly average levels. 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 operational water level forecasting systems (http://www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/waterlevelforecasts/monthlybulletinofgreatlakeswaterlevels).



GREAT LAKES SYSTEM PROFILE

The Great Lakes, their respective watersheds and waterways, and the ocean are all connected. 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 IGLD85?

IGLD85 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 in 1992. 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).