



# Water Levels of the Great Lakes

September 2013

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.

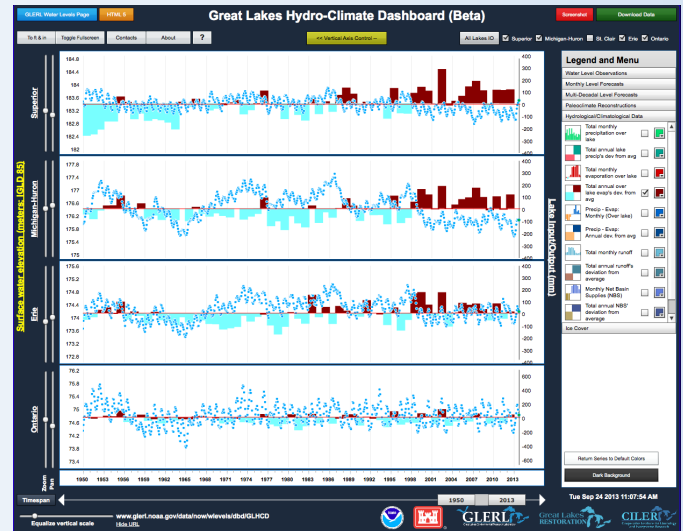
## Introducing the Great Lakes Hydro-Climate Dashboard

<http://www.glerl.noaa.gov/data/now/wlevels/dbd/GLHCD/>

The Great Lakes Hydro-Climate Dashboard (GLHCD) contributes to improved understanding of Great Lakes water level dynamics and climate change impacts through visualization of critical time series data sets including:

- Historical monthly and annual average water levels
- Projected seasonal and decadal water levels
- Historical climatological data including precipitation, evaporation, runoff and ice cover
- Paleoclimate water level reconstructions

The screen shot at right from the new Great Lakes Hydro-Climate Dashboard shows the relationship between monthly average water levels (blue dots) and estimated over-lake evaporation across the Great Lakes from 1950 to present. Brown bars represent years when the over-lake evaporation is above average, while teal bars indicate over-lake evaporation below the long-term average. The image underscores how changes in the water budget (precipitation, evaporation), particularly those that took place in the late 1980's and 1990's, can lead to dramatic changes in Great Lakes water levels. This is just one example of how the Great Lakes Hydroclimate Dashboard helps address questions about not just how, but *why* water levels have changed. The GLHCD was developed with funding from the Great Lakes Restoration Initiative.



Low water levels in Grand Traverse Bay, Lake Michigan, January 2013. Credit: Michigan Sea Grant

## How are water levels predicted?

Forecasts of Great Lakes water levels are typically based on computer simulation models. One example is the Great Lakes Advanced Hydrologic Prediction System (AHPS), run 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 (also referred to as the "net" supply of water to the basin) is routed through the lakes and their interconnecting channels using models that reflect flow patterns in those channels and the regulation rules that guide operation of water level control infrastructure.

### FOR MORE INFORMATION

**GLERL Water Levels** <http://www.glerl.noaa.gov/data/now/wlevels/levels.html>

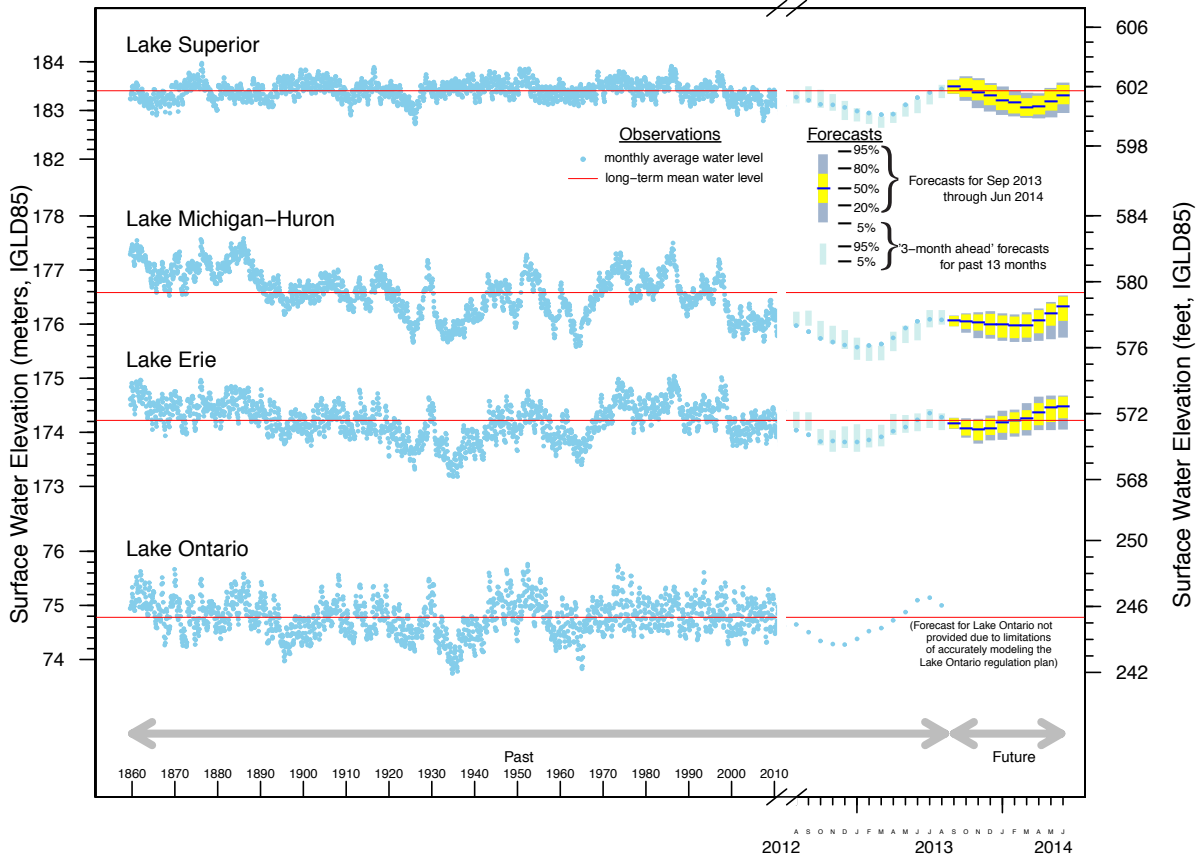
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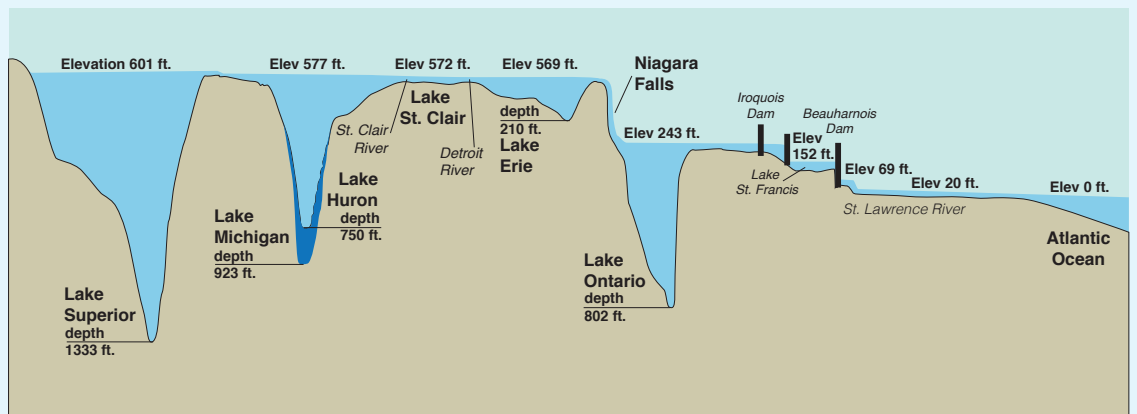
# The Current Outlook for Great Lakes levels

The research-oriented forecast generated by NOAA-GLERL's AHPS on September 18, 2013 indicates that the water levels of the Great Lakes in winter 2014 may be significantly higher than they were in December 2012 and January 2013, when new low level records were set. The uncertainty expressed in the forecasts 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).