Great Lakes Coastal Flood Study

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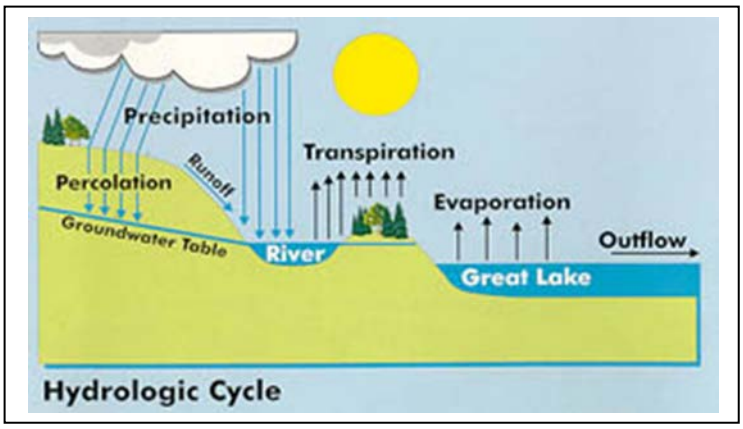
Great Lakes Water Levels

Water levels have fluctuated throughout the history of the Great Lakes. This fact sheet provides information on the causes and significance of these fluctuations.

Water Level Fluctuation

The Great Lakes coasts differ from ocean coasts in that water levels in the Great Lakes fluctuate in response to changes in available water supply, as well as in response to winds and storms. Changes in water supply (i.e. volume) are driven by climatic factors like precipitation and temperature. Due to the size and extent of the Great Lakes, these changes in supply produce gradual changes in water levels, most noticeable over periods of months and years. Winds and storms, however, can create dramatic, localized changes in levels in a very short period of time with no change in lake volume.



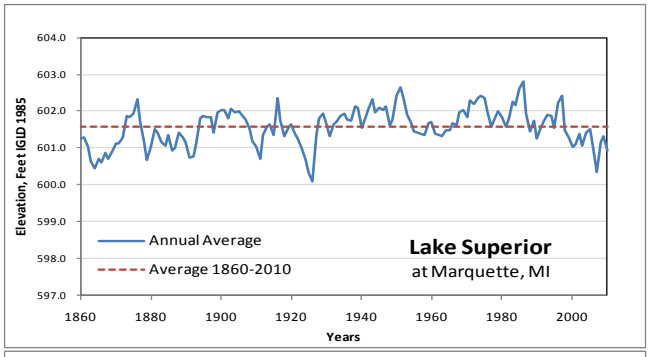
Source: Living with the Lakes, U.S. Army Corps of Engineers; Great Lakes Commission, 1999.

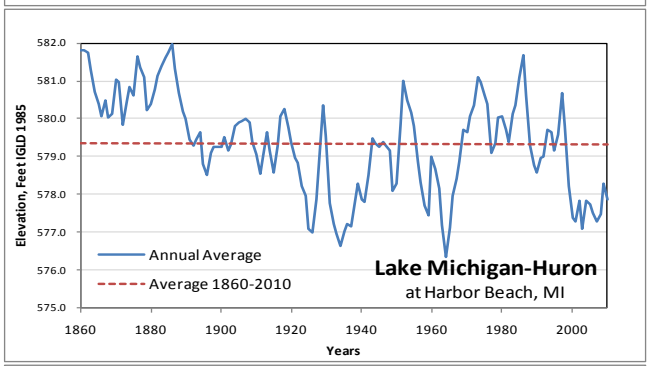
Water Level Records

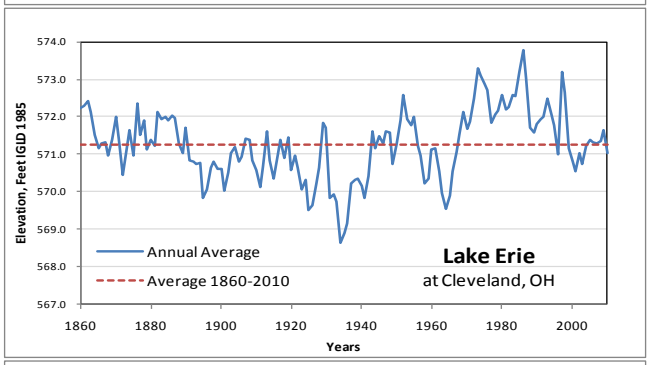
Water levels at some sites on the Great Lakes have been regularly recorded since 1860. These records show the extent of long-term fluctuation on the lakes.

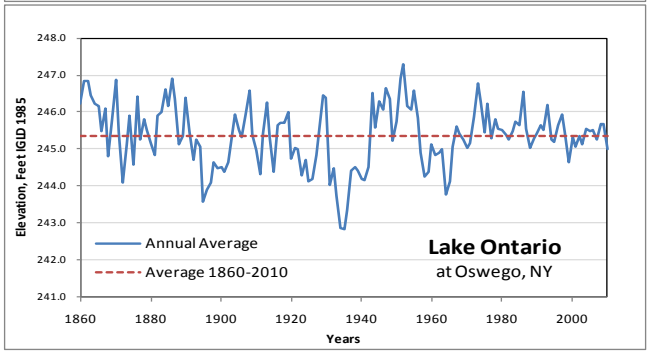
In recent history, a period of nearly three decades of above average water levels on the Great Lakes, during which time record highs were approached or exceeded each decade, was followed by a decade of low levels. Lake Michigan-Huron rose from record lows in the 1960s to extreme high levels in less than a decade.

Great Lakes Annual Average Water Levels, 1860-2010









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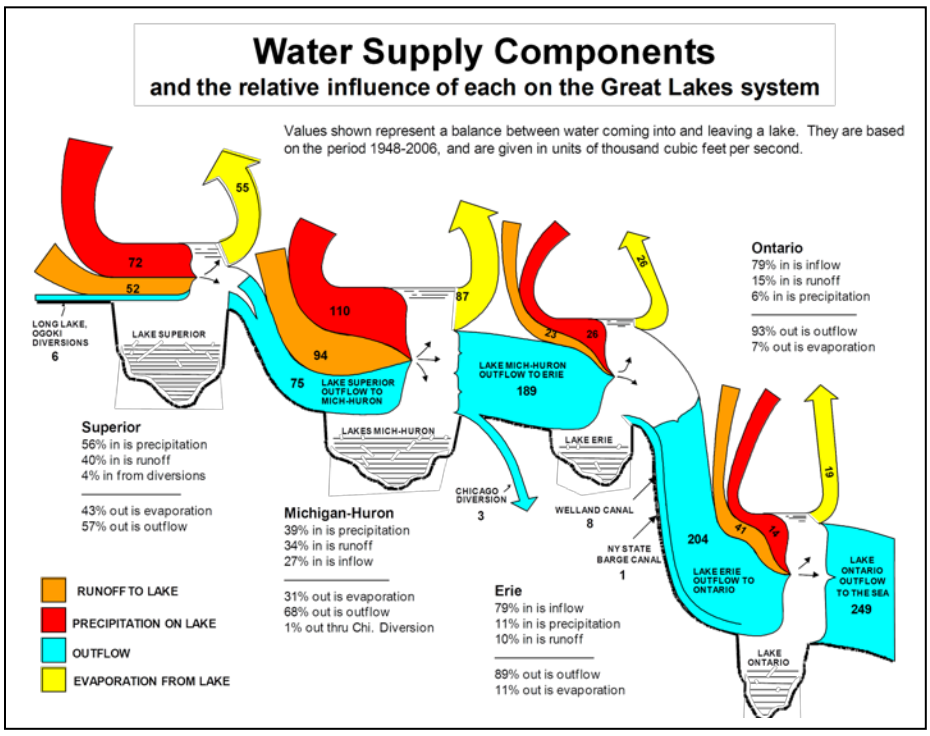
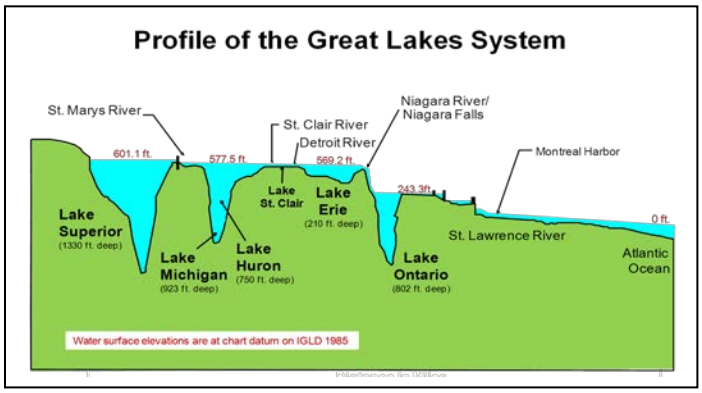
Water Supply

Seasonal and long-term lake level fluctuations depend upon the balance between the amount of water going into the lake and the amount of water exiting it. If more water goes in than exits, the water level rises, and vice versa. Water enters a lake through runoff from the land, precipitation on the lake, condensation, ground water, and sometimes through inflow from an upstream lake and/or a man-made diversion from outside the lake drainage basin. Water leaves a lake through evaporation from the lake's surface, consumptive use, outflow to a downstream lake or the ocean, and sometimes through man-made diversions.



Source: U.S. Army Corps of Engineers.

Human activity has influenced water level fluctuations in a longer term, more permanent way. Regulation of the outflows from Lakes Superior and Ontario has modified the levels on these lakes, decreasing the range of fluctuation. Increases in the outflow capacity of the St. Clair River have in the past decade lowered the level of Lake Michigan-Huron from what would have occurred under natural conditions, though the extreme high levels of the 1970s to 1990s would have been higher without this increased capacity.



Source: U.S. Army Corps of Engineers.

Natural Outlet Channels

Each of the Great Lakes has a natural outlet channel which drains water to the next downstream lake, or in the case of Lake Ontario, to the ocean.

St. Mary's River - Lake Superior flows 65 miles by way of the St. Mary's River into Lake Michigan-Huron. A hydropower dam controls Lake Superior outflows and the Soo Locks facility assists ships navigating the 21-foot drop from Lake Superior to the St. Mary's River.

Straits of Mackinac - Lakes Michigan and Huron are considered as one lake hydraulically (hence the use of the hyphenated name Lake Michigan-Huron) due to their connection at the broad and deep Straits of Mackinac.

St. Clair River – Lake St. Clair – Detroit River - Lake Michigan-Huron is connected to Lake Erie by the St. Clair River-Lake St. Clair-Detroit River system (often called the St. Clair River system). These water bodies together are about 100 miles in length. In 1860, there was a water level drop of about 9.5 ft (2.9 m) as it flowed from Lake Michigan-Huron to Lake Erie. Today, the elevation difference is 6.2 ft (1.9 m).

Niagara River - The Niagara River flows north from Lake Erie to Lake Ontario. The river is about 35 miles (56 km) long and includes Niagara Falls in its course. The total drop in elevation along the river is 325 feet (99 m).

In addition to the natural channels, water is diverted into Lake Superior through the Long Lac and Ogoki projects; out of Lake Michigan at Chicago; and between Lakes Erie and Ontario through the Welland Canal and the New York State Barge Canal.