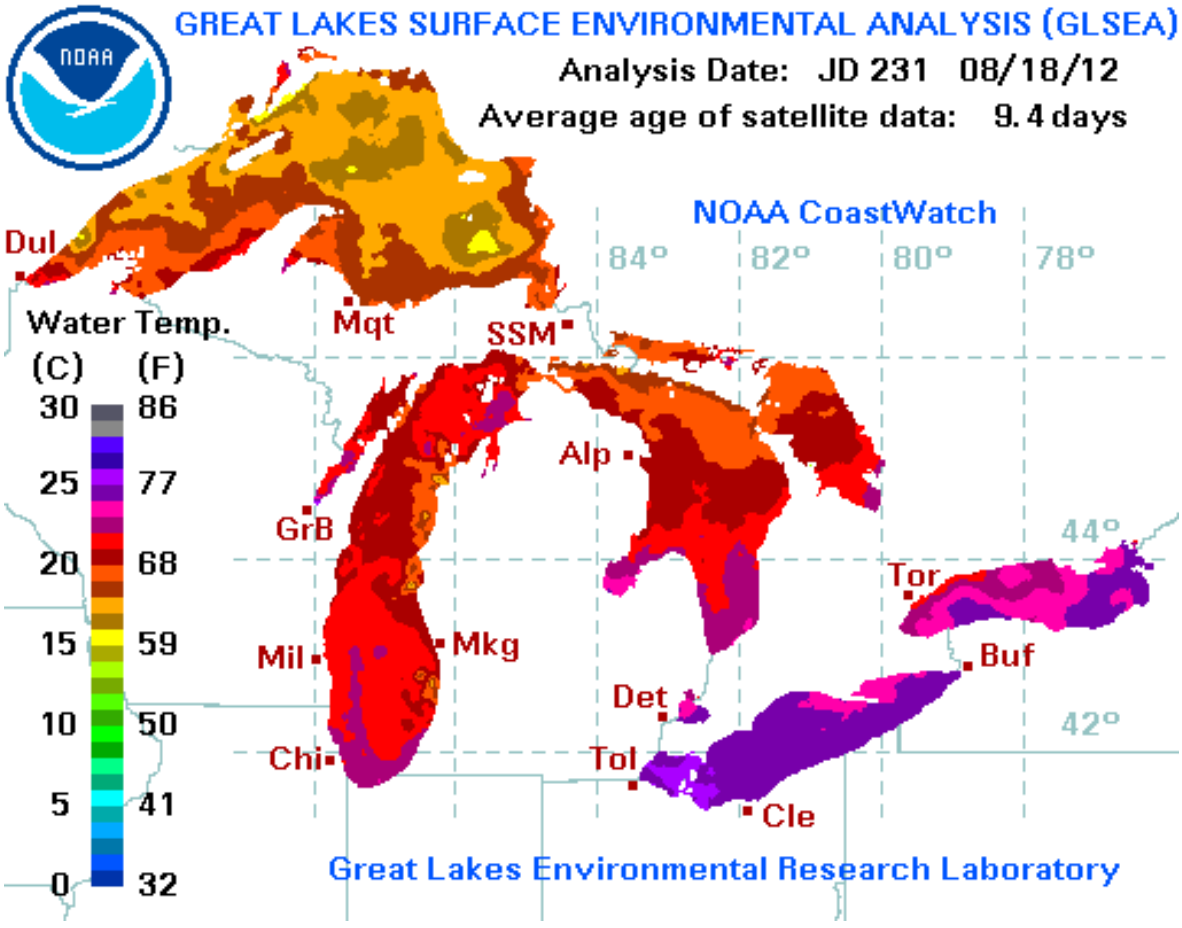
GREAT LAKES UPDATE - IMPLICATIONS FOR EARLY WINTER

August 20 07:38 AM

by Joe D'Aleo, Weatherbell.com co-chief Meteorologist

The warm July sent Lake Michigan water temperatures up to record levels briefly. But the cooler conditions and a Great Lakes storms helped tp bring them down. Lets look at the Lakes now.

A really cool currents map updated 4 times daily is available here.



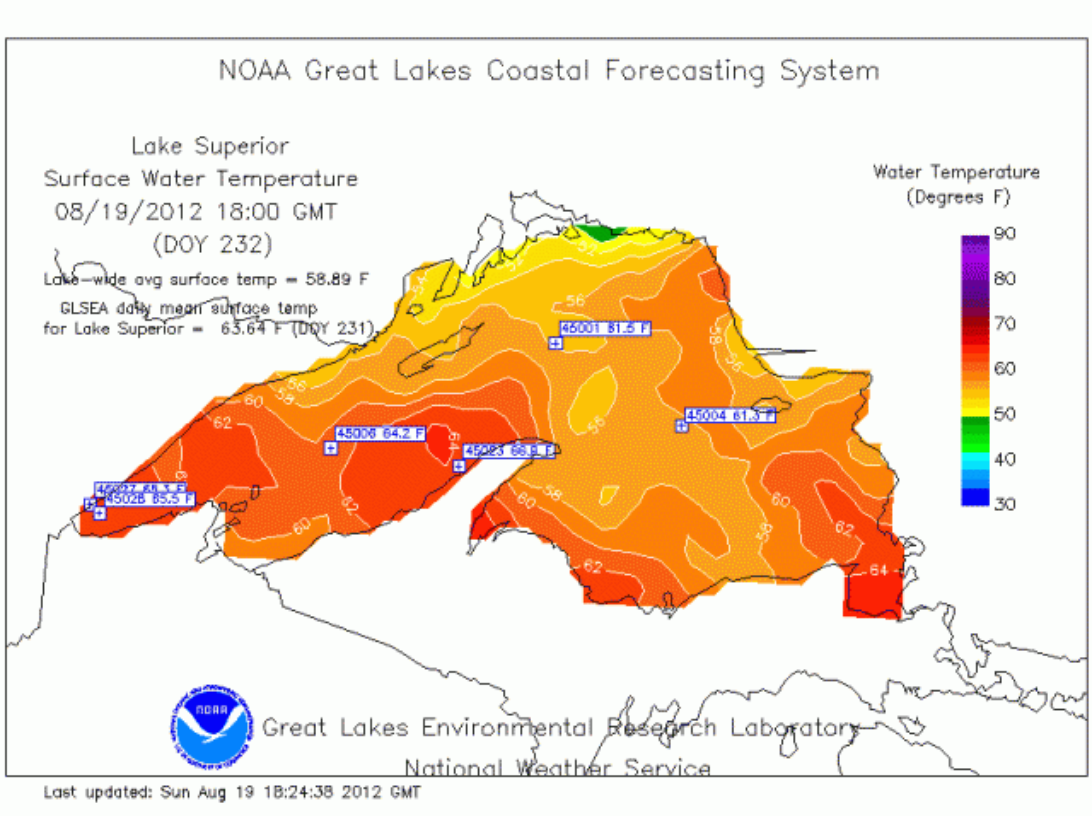
Lets start with Lake Superior.

LAKE SUPERIOR

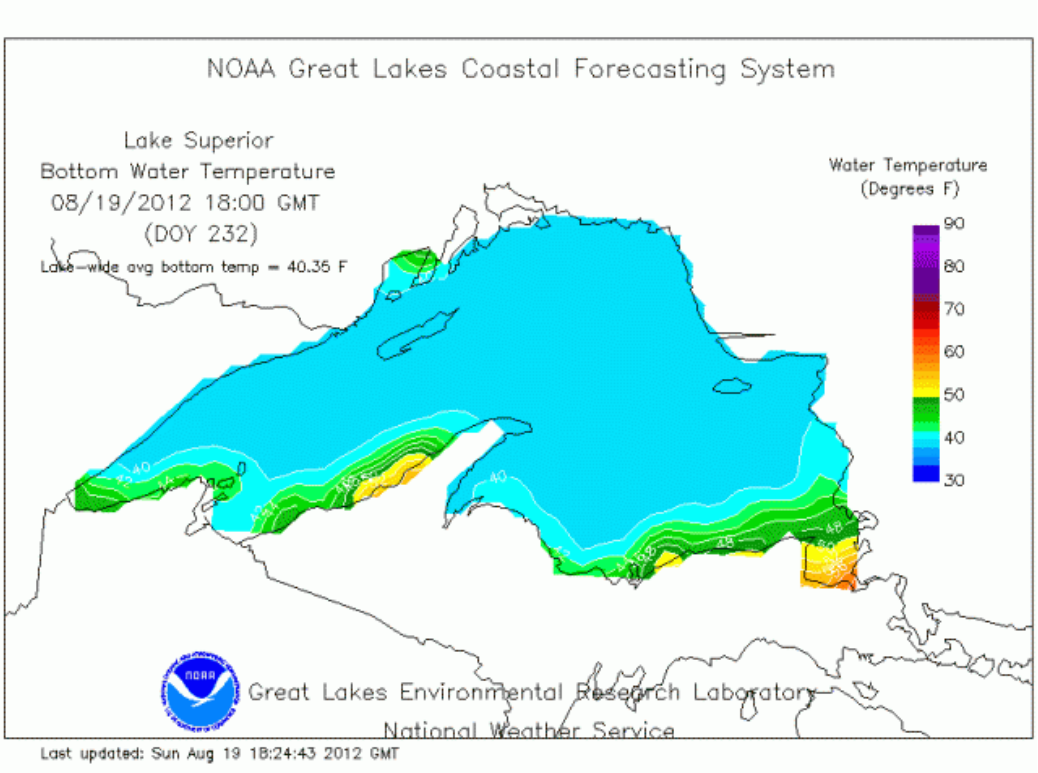
Superior shares shoreline with Canada and US. The river has an area of 31,820 square miles. It is the world's biggest freshwater lake. Lake Superior has a surface area which is approximately the size of South Carolina. It has a maximum length of 350 statute miles (560 km; 300 nmi) and maximum breadth of 160 statute miles (257 km; 139 nmi). Its average depth is 80.5 fathoms (483 ft; 147 m) with a maximum depth of 222 fathoms (1,332 ft; 406 m). Lake Superior contains 2,900 cubic miles of water.

Lake Superior contains 10% of the world's fresh water! There is enough water in Lake Superior to cover the entire land mass of North and South America with roughly 1 foot (30 cm) of water (roughly a depth of .93 feet) The shoreline of the lake stretches 2,726 miles (4,387 km) (including islands). The Ojibwe call the lake *Gichigami*, meaning "big water." Henry Wadsworth Longfellow wrote the name as "Gitche Gumee" in The Song of Hiawatha, as did Gordon Lightfoot in his song, "The Wreck of the Edmund Fitzgerald". The first French explorers approaching the great inland sea by way of the Ottawa River and Lake Huron during the 17th century referred to their discovery as*le lac superieur*. Properly translated, the expression means "Upper Lake," that is, the lake above Lake Huron.

Here is a map of current Lake Superior surface water temperatures.



Here is a plot of bottom water temperatures. Because of the depth, the bottom of the lake is nearly constant around 39F, the temperature at which water is at maximum density. If water did not behave this way and density continued to increases as temperatures fell, when ice formed it would sink to the bottom of the lakes or ocean and many shallower lakes would freeze sold preventing life. Considering the shallow areas are warmer, the average for the whole lake is still a chilly 40.36F.



With the warm winter, spring and early summer, the lake has been warmer than the 20 year average. It has dropped back to about where it was in 2010

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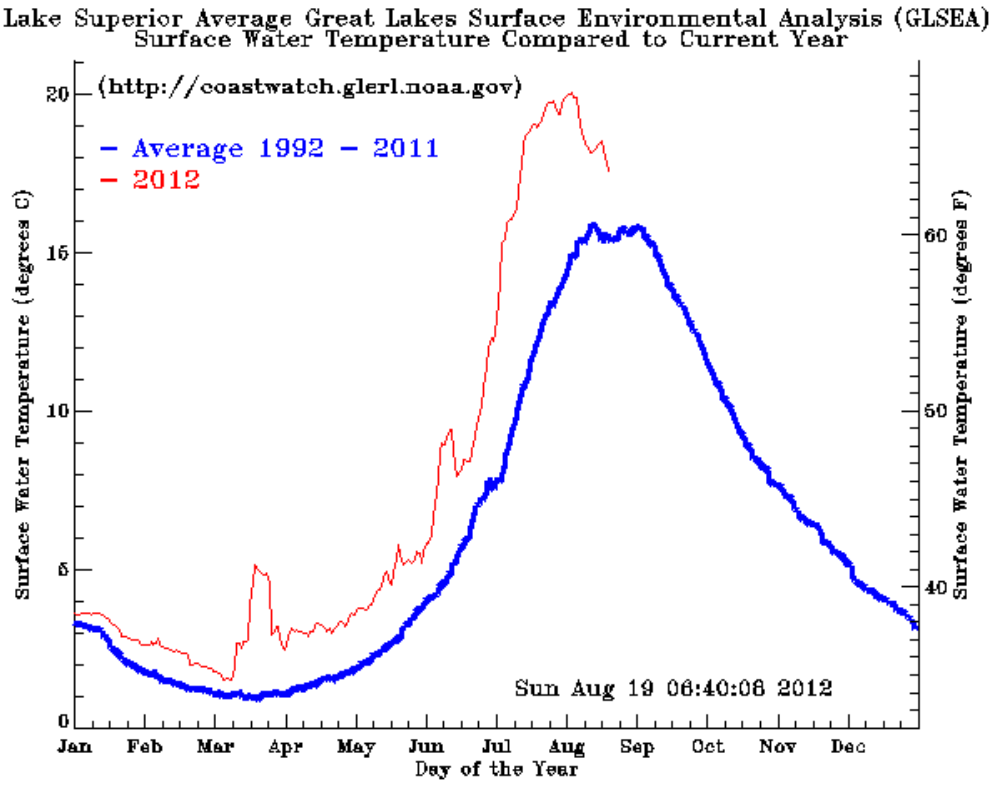
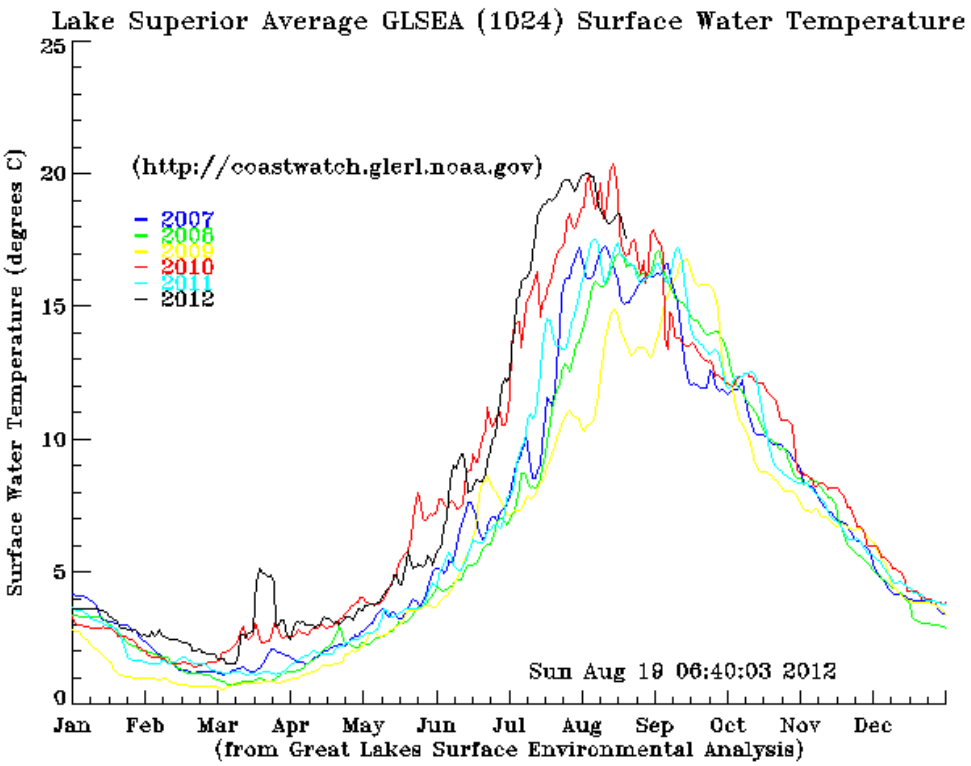
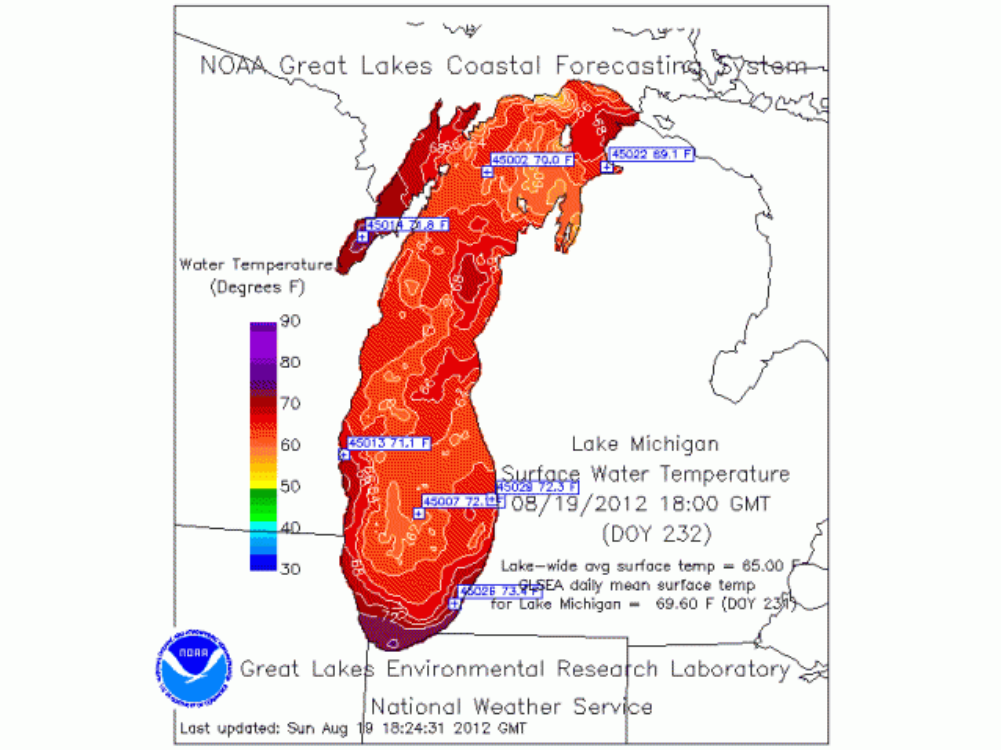


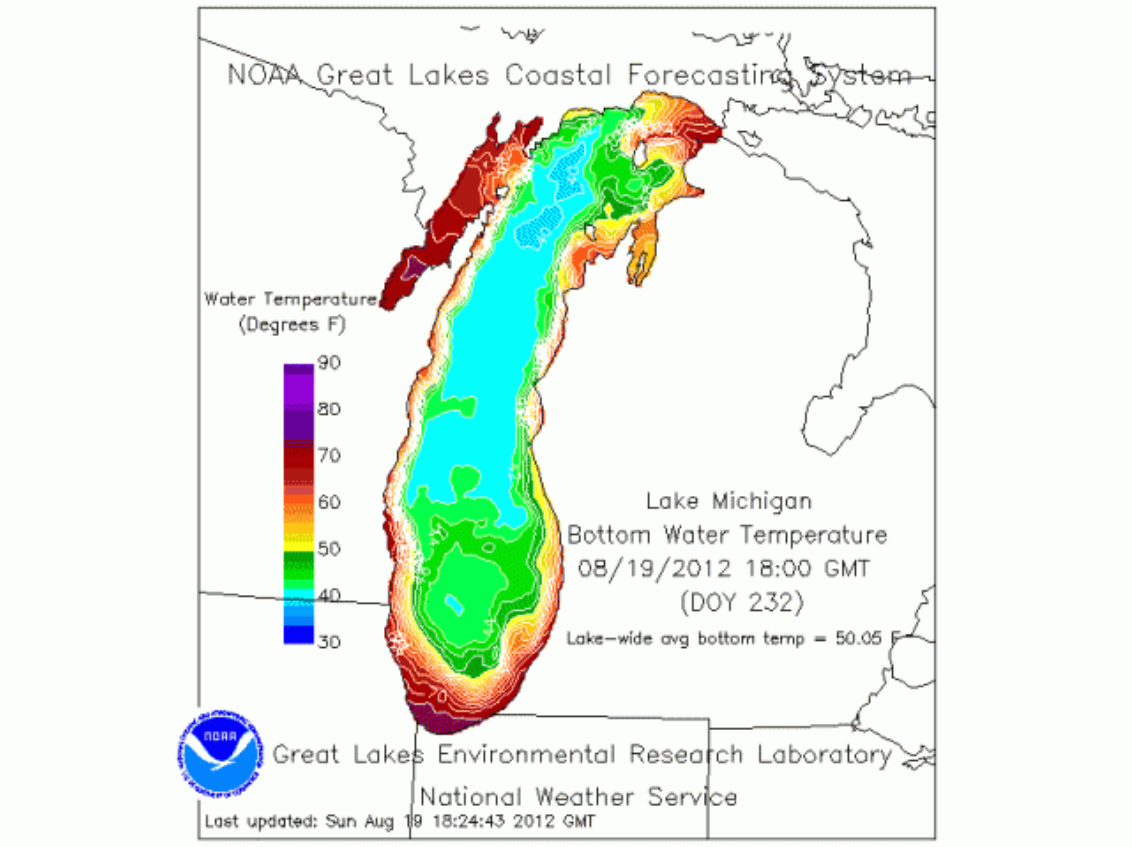


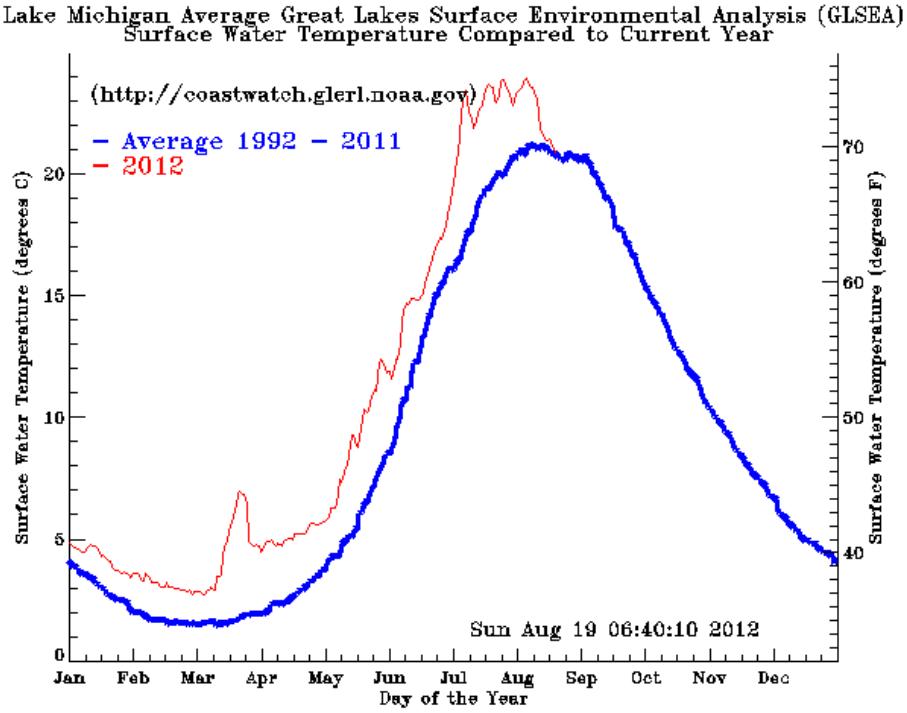
LAKE MICHIGAN

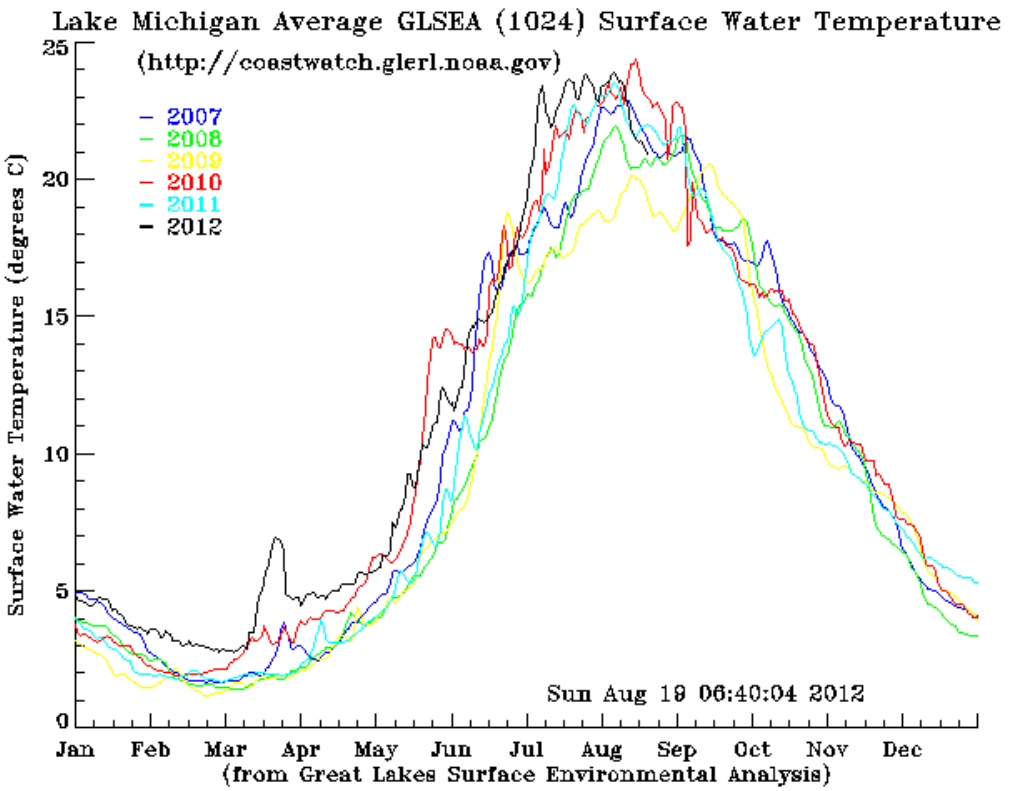
Lake Michigan is the only Great Lake located entirely within the United States. The other four Great Lakes are shared by the US and Canada. It is the second largest of the Great Lakes by volume and the third largest by surface area, after Lake Superior and Lake Huron (and is slightly smaller than the U.S. state of West Virginia).Hydrologically, the lake is a large bay of Lake Michigan–Huron, having the same surface elevation as Lake Huron (among other shared properties). Both are lower than Lake Superior. The word "Michigan" originally referred to the lake itself, and is believed to come from the Ojibwa word *mishigami* meaning "great water".

The lake was warm throughout the warm winter, spring and early summer, but a Great Lakes storm, many thunderstorm clusters and 10 days of cooler temperatures have cooled the surface to near normal. Deeper parts of the lake are in the 40s but the bottom water of the entire lake now has an average of 50F.




NOAA Great Lakes Coastal Forecasting System
Water Temperature
(Degrees F)
90
80
70
60
50
40
30
Lake Michigan
Bottom Water Temperature
08/19/2012 18:00 GMT
(DOY 232)
Lake-wide avg bottom temp = 50.05 F
Great Lakes Environmental Research Laboratory
National Weather Service
Last updated: Sun Aug 19 18:24:43 2012 GMT


Lake Michigan Average Great Lakes Surface Environmental Analysis (GLSEA)
Surface Water Temperature Compared to Current Year
(http://coastwatch.glerl.noaa.gov)
– Average 1992 – 2011
– 2012
Surface Water Temperature (degrees C)
Surface Water Temperature (degrees F)
0
5
10
15
20
40
50
60
70
Sun Aug 19 06:40:10 2012
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Day of the Year


Lake Michigan Average GLSEA (1024) Surface Water Temperature
(http://coastwatch.glerl.noaa.gov)
2007
2008
2009
2010
2011
2012
Surface Water Temperature (degrees C)
25
20
15
10
5
0
Sun Aug 19 06:40:04 2012
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
(from Great Lakes Surface Environmental Analysis)

LAKE HURON

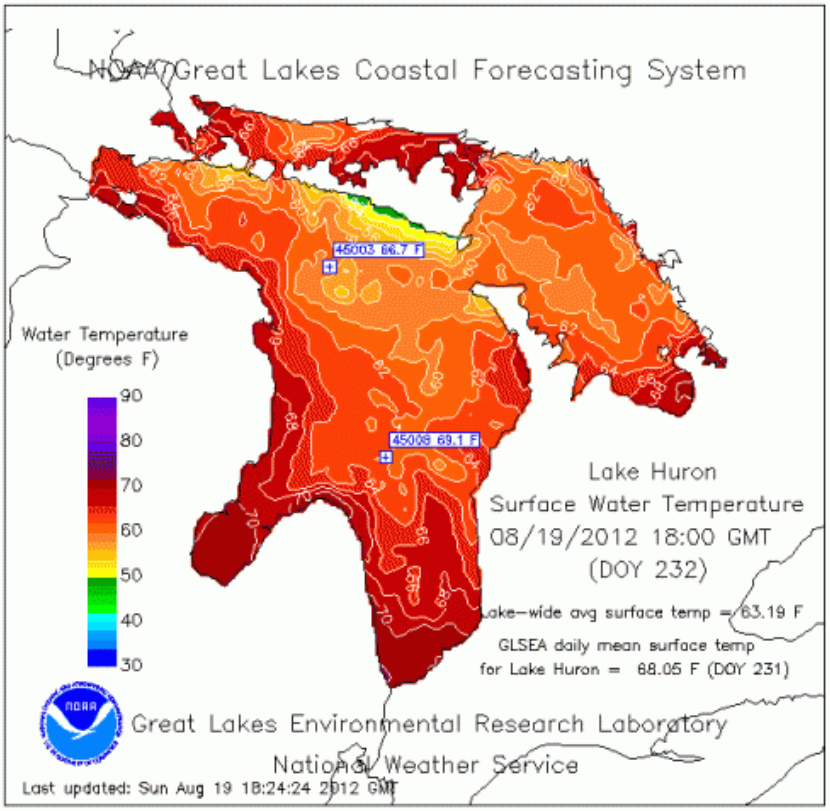
Lake Huron is the second-largest of the Great Lakes, with a surface area of 23,000 square miles (59,600 km^2) making it the third-largest fresh-water lake on Earth (and the fourth-largest lake, if the brackish Caspian Sea is counted as a lake). When measured at the Low Water Datum, the lake contains a volume of 850 cubic miles (3,540 km^3) and a shoreline length (including islands) of 3,827 miles (6,157 km).

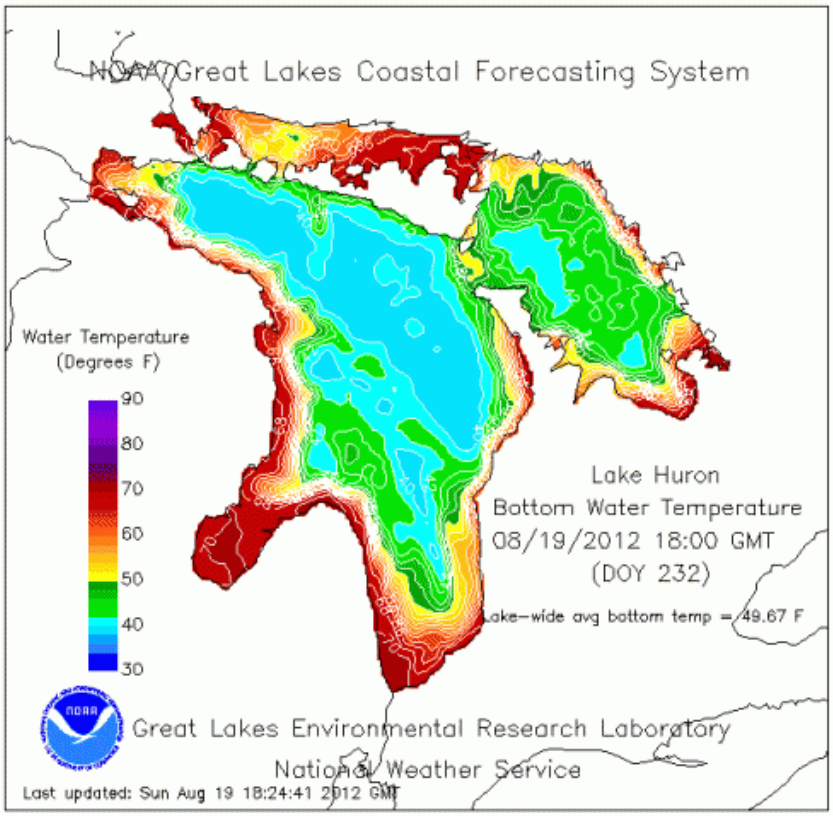
The surface of Lake Huron is 577 feet (176 m) above sea level. The lake's average depth is 195 feet (59 m), while the maximum depth is 750 feet (229 m). It has a length of 206 miles (332 km) and a greatest breadth of 183 miles (295 km).

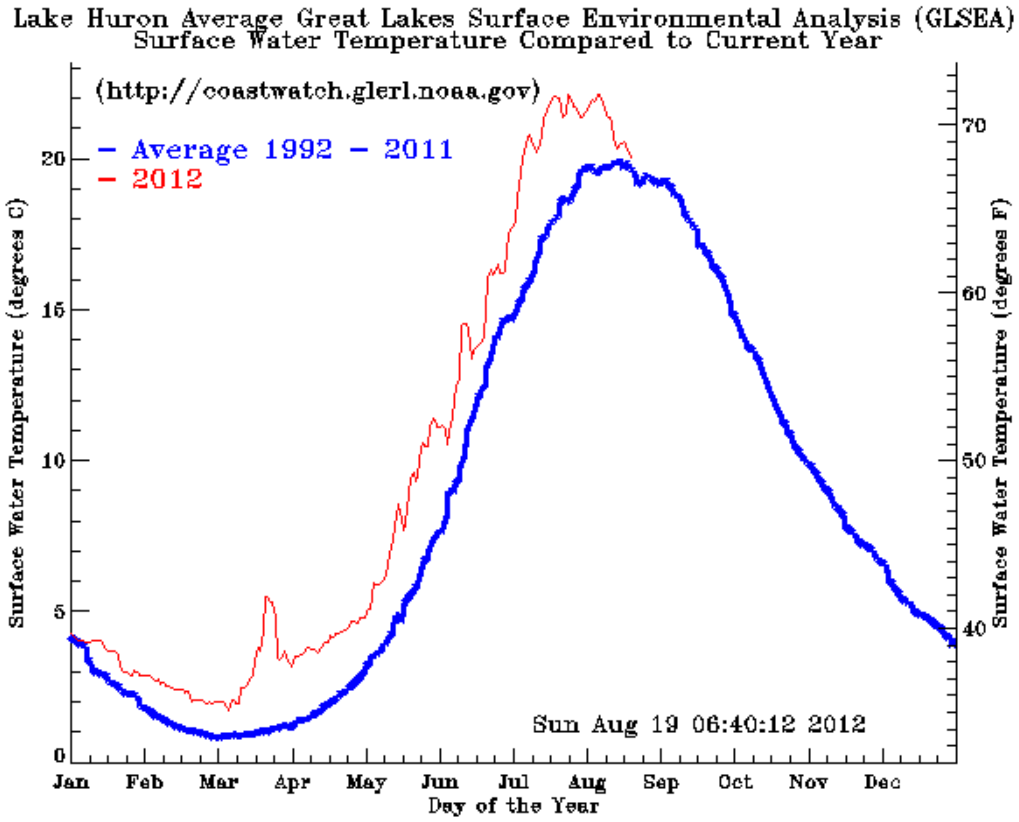
A large bay that protrudes northeast from Lake Huron into Ontario, Canada is called Georgian Bay. A notable feature of the lake is Manitoulin Island, which separates the North Channel and Georgian Bay from Lake Huron's main body of water. It is the world's largest freshwater island. A smaller bay that protrudes southwest from Lake Huron into the state of Michigan, U.S.A. is called Saginaw Bay.

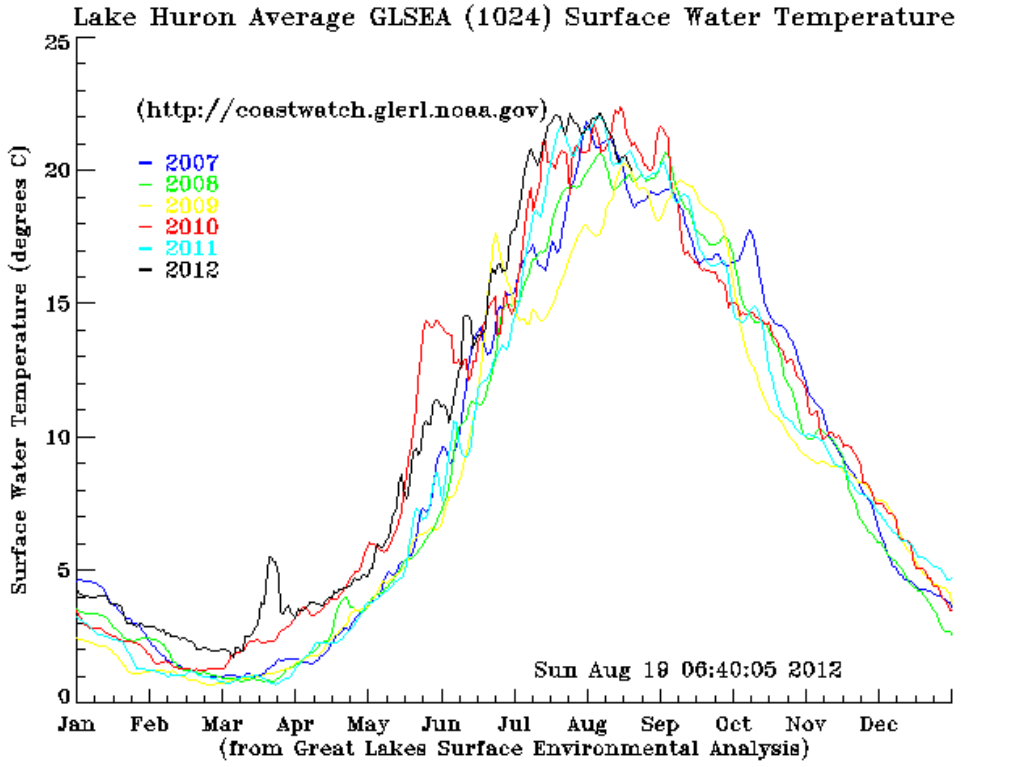
The French, the first European visitors to the region, often referred to Lake Huron as La Mer Douce, "the fresh-water sea". In 1656, a map by French cartographer Nicolas Sanson, refers to the lake as Karegnondi, a Wendat word which has been variously translated as "Freshwater Sea", "Lake of the Hurons", or simply "lake".The lake was generally labeled "Lac des Hurons" (Lake of the Huron) on most early European maps.

Huron has an average surface temperature of 68F and bottom of 49F. It was warmer than normal but has dropped near the 20 year mean.


NOAA/Great Lakes Coastal Forecasting System
45003 66.7 F
45008 69.1 F
Water Temperature
(Degrees F)
90
80
70
60
50
40
30
Lake Huron
Surface Water Temperature
08/19/2012 18:00 GMT
(DOY 232)
Lake-wide avg surface temp = 63.19 F
GLSEA daily mean surface temp
for Lake Huron = 68.05 F (DOY 231)
Great Lakes Environmental Research Laboratory
National Weather Service
Last updated: Sun Aug 19 18:24:24 2012 GMT


NOAA/Great Lakes Coastal Forecasting System
Water Temperature
(Degrees F)
90
80
70
60
50
40
30
Lake Huron
Bottom Water Temperature
08/19/2012 18:00 GMT
(DOY 232)
Lake-wide avg bottom temp = 49.67 F
Great Lakes Environmental Research Laboratory
National Weather Service
Last updated: Sun Aug 19 18:24:41 2012 GMT


Lake Huron Average Great Lakes Surface Environmental Analysis (GLSEA)
Surface Water Temperature Compared to Current Year
(http://coastwatch.glerl.noaa.gov)
Average 1992 - 2011
2012
Surface Water Temperature (degrees C)
Surface Water Temperature (degrees F)
Sun Aug 19 06:40:12 2012
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day of the Year

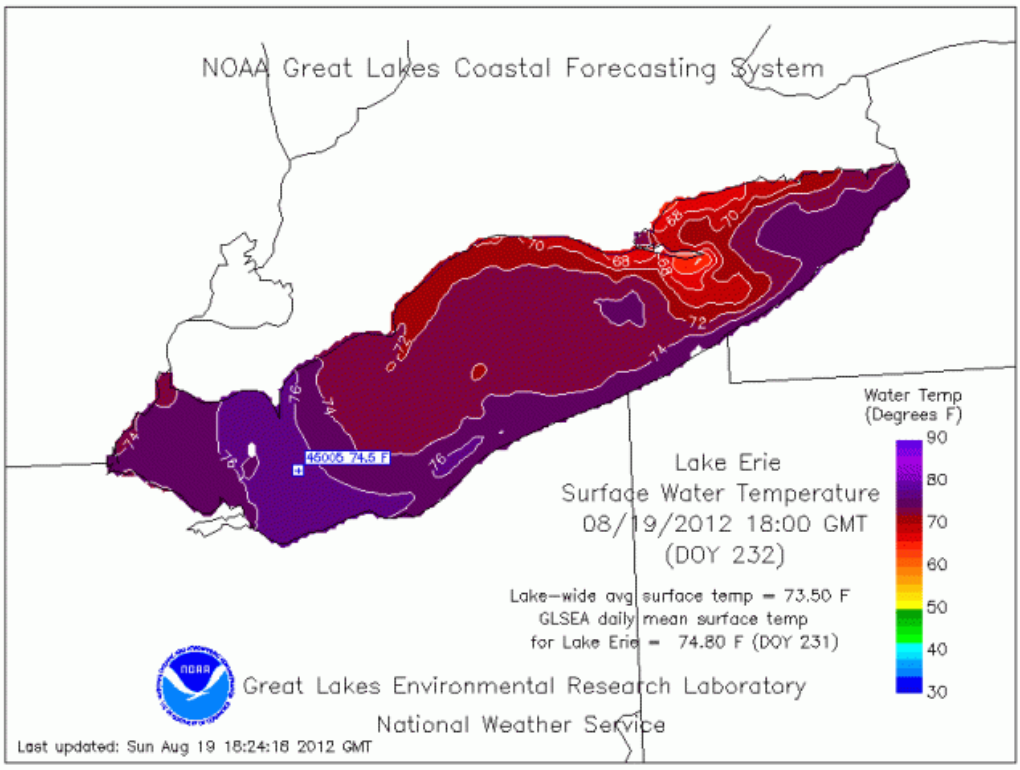

Lake Huron Average GLSEA (1024) Surface Water Temperature
(http://coastwatch.glerl.noaa.gov)
2007
2008
2009
2010
2011
2012
Surface Water Temperature (degrees C)
Sun Aug 19 06:40:05 2012
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(from Great Lakes Surface Environmental Analysis)

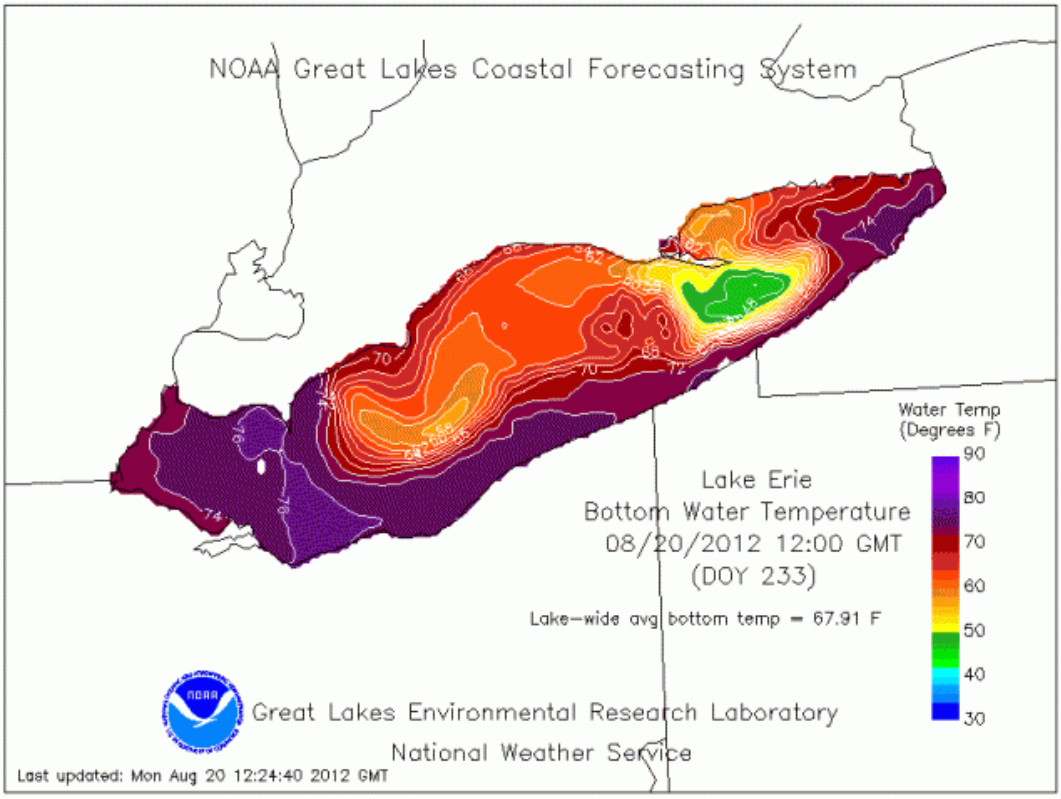
LAKE ERIE

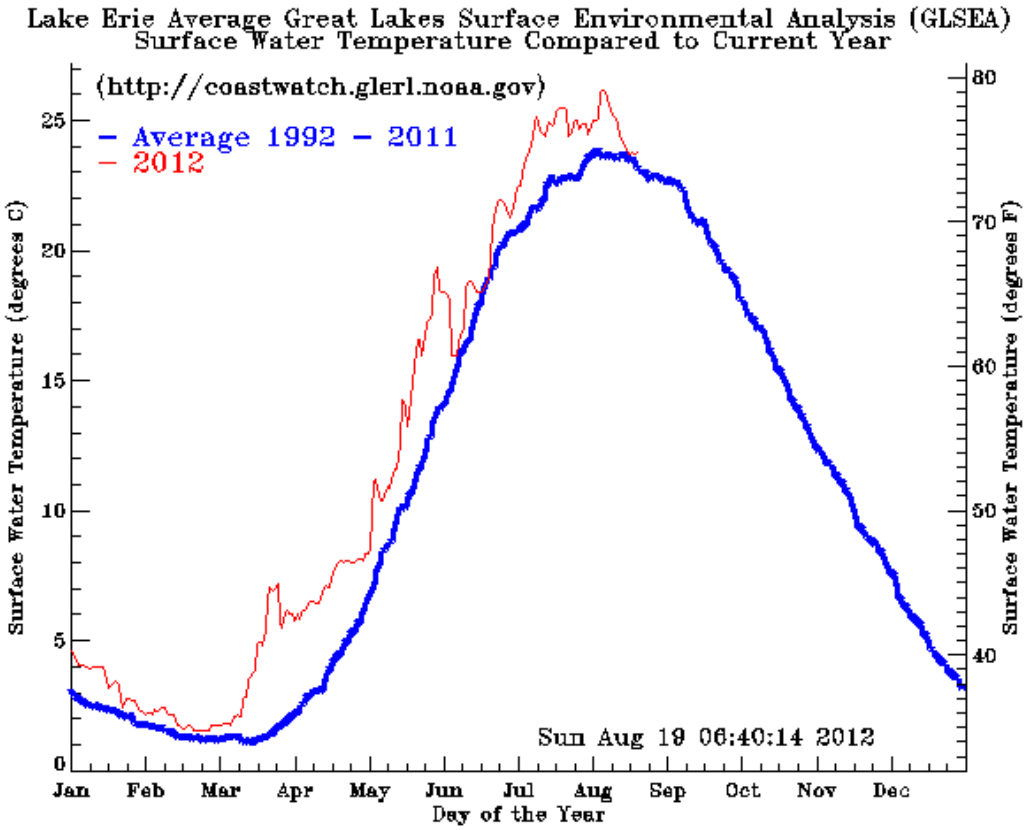
Lake Erie has a mean elevation of 571 feet (174 m) above sea level. It has a surface area of 9,940 square miles (25,745 km²) with a length of 241 miles (388 km) and breadth of 57 miles (92 km) at its widest points.

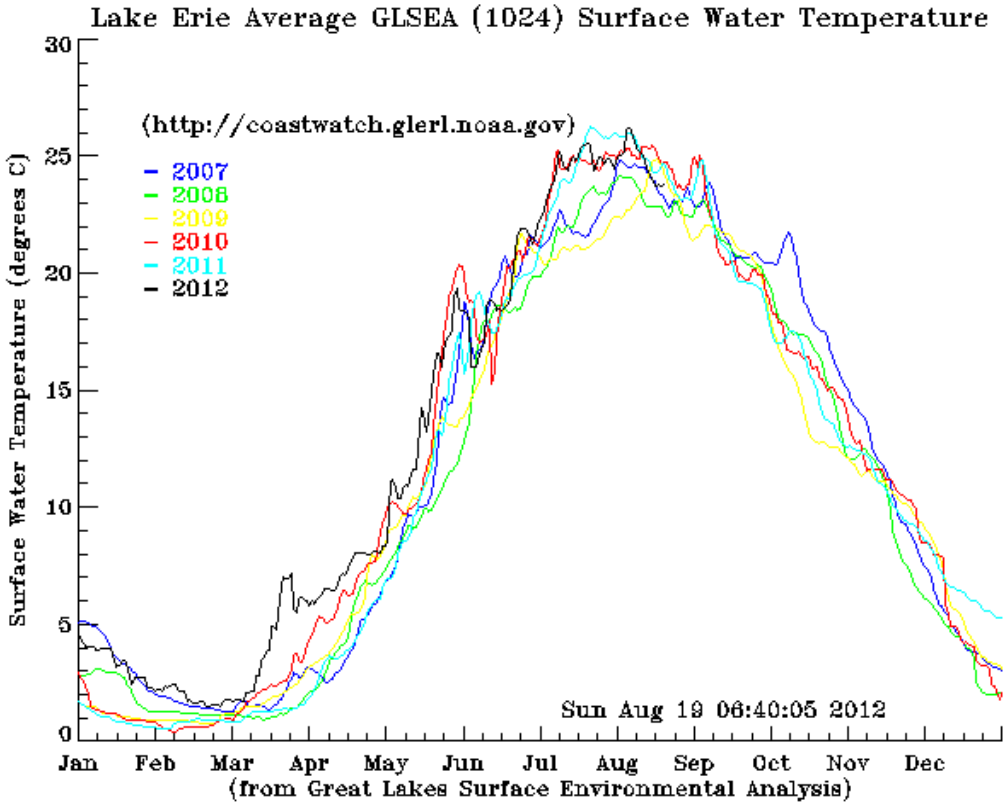
It is the shallowest of the Great Lakes with an average depth of 62 feet (19 m) and a maximum depth of 210 feet (64 m). For comparison, Lake Superior has an average depth of 483 feet (147 m), a volume of 2,900 cubic miles (12,100 km³) and shoreline of 2,726 miles (4,385 km). Because it is the shallowest, it is also the warmest of the Great Lakes. The shallowest section of Lake Erie is the western basin where depths average only 25 to 30 feet.

Erie being shallow and farthest south, it is warmest. It is 73.5F and the bottom waters a warm average of 68F. Temperatures here too have been warm until recent cooling brought it to near normal.






Lake Erie Average Great Lakes Surface Environmental Analysis (GLSEA)
Surface Water Temperature Compared to Current Year
(http://coastwatch.glerl.noaa.gov)
– Average 1992 – 2011
– 2012
Surface Water Temperature (degrees C)
Surface Water Temperature (degrees F)
Sun Aug 19 06:40:14 2012
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day of the Year


Lake Erie Average GLSEA (1024) Surface Water Temperature
(http://coastwatch.glerl.noaa.gov)
– 2007
– 2008
– 2009
– 2010
– 2011
– 2012
Surface Water Temperature (degrees C)
Sun Aug 19 06:40:05 2012
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(from Great Lakes Surface Environmental Analysis)

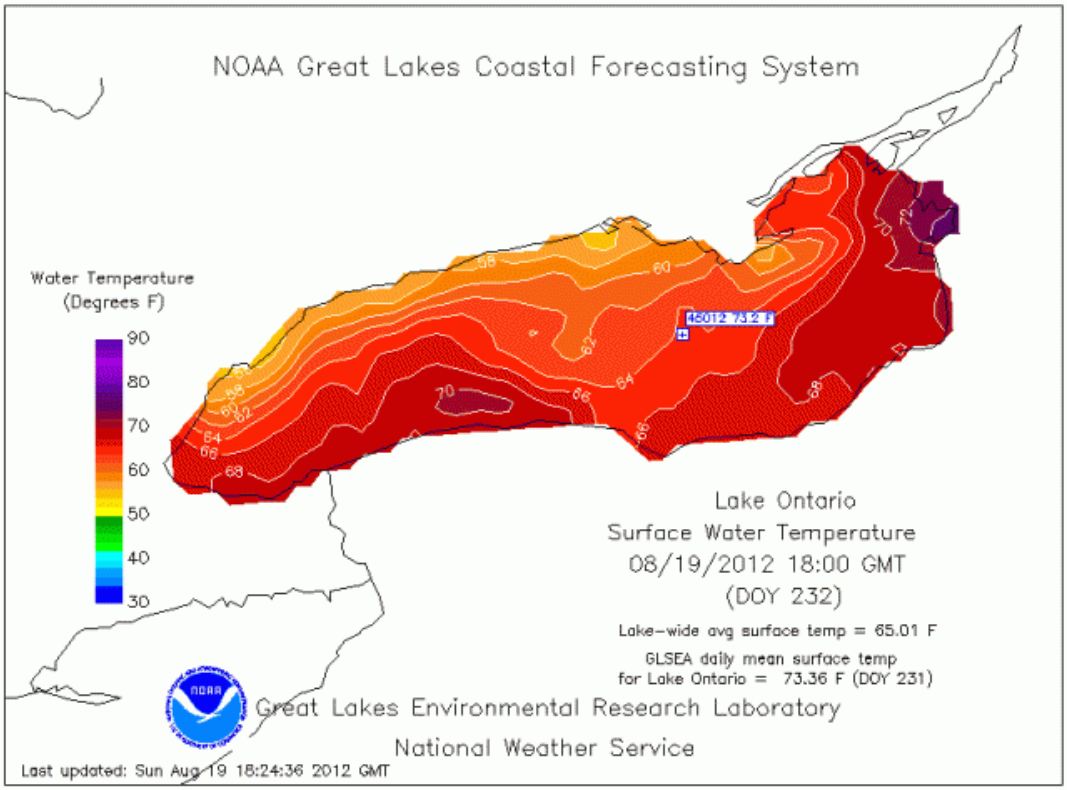
LAKE ONTARIO

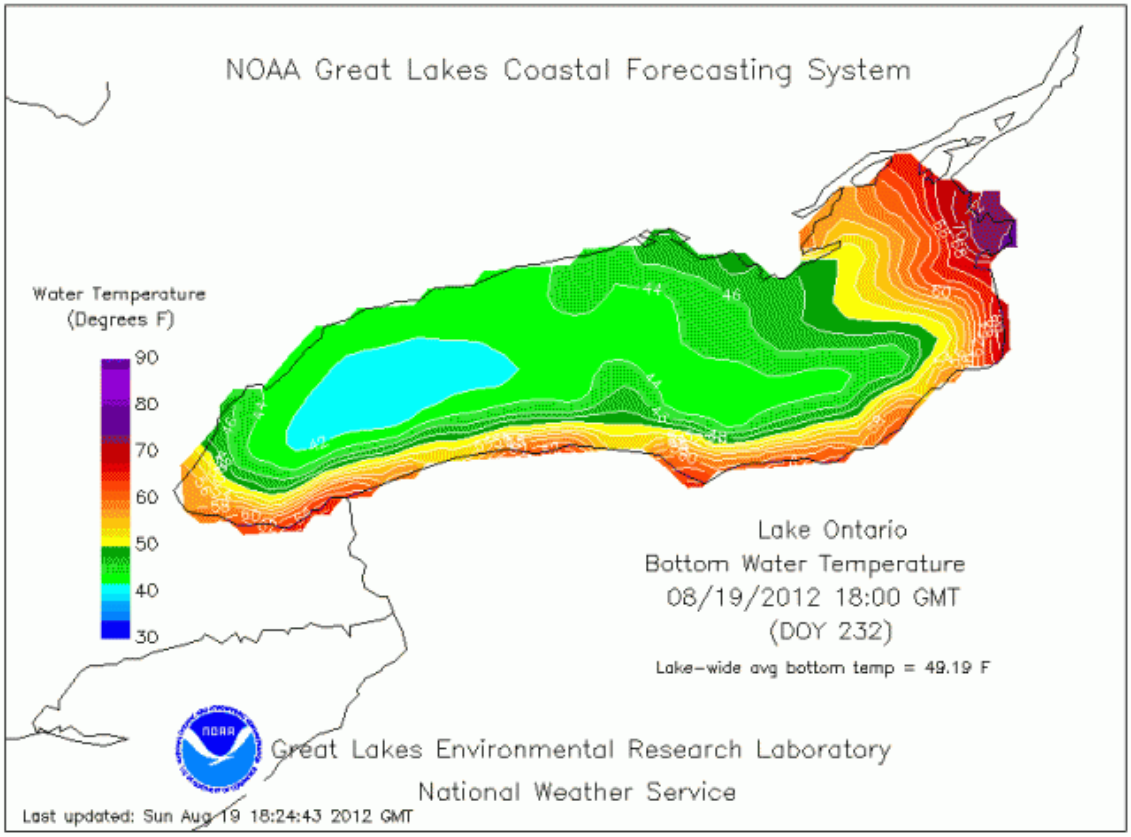
Lake Ontario is the easternmost of the Great Lakes and the smallest in surface area (7,340 sq mi, 18,960 km^2), although it exceeds Lake Erie in volume (393 cu mi, 1,639 km^3). It is the14th largest lake in the world. When its islands are included, the lake has a shoreline that is 712 miles (1,146 km) long. As the last lake in the Great Lakes' hydrologic chain, Lake Ontario has the lowest mean surface elevation of the lakes at 243 feet (74 m) above sea level; 326 feet (99 m) lower than its neighbor upstream. The lake's average depth is 47 fathoms 1 foot (283 ft; 86 m), with a maximum depth of 133 fathoms 4 feet (802 ft; 244 m).

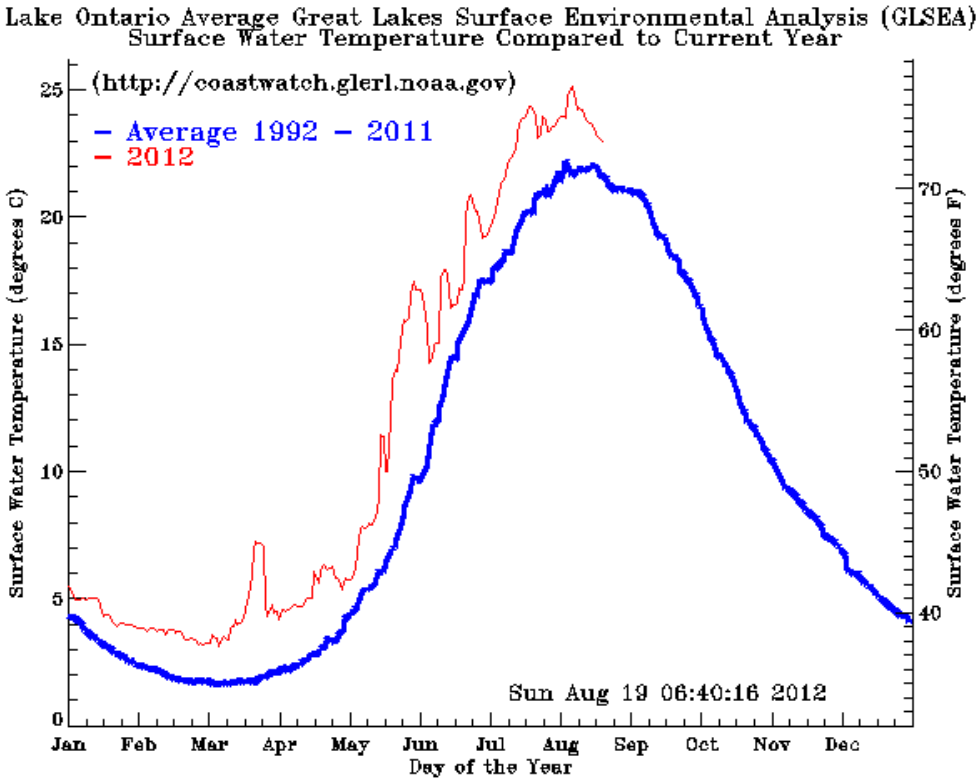
The lake's primary source is the Niagara River, draining Lake Erie, with the St. Lawrence River serving as the outlet.

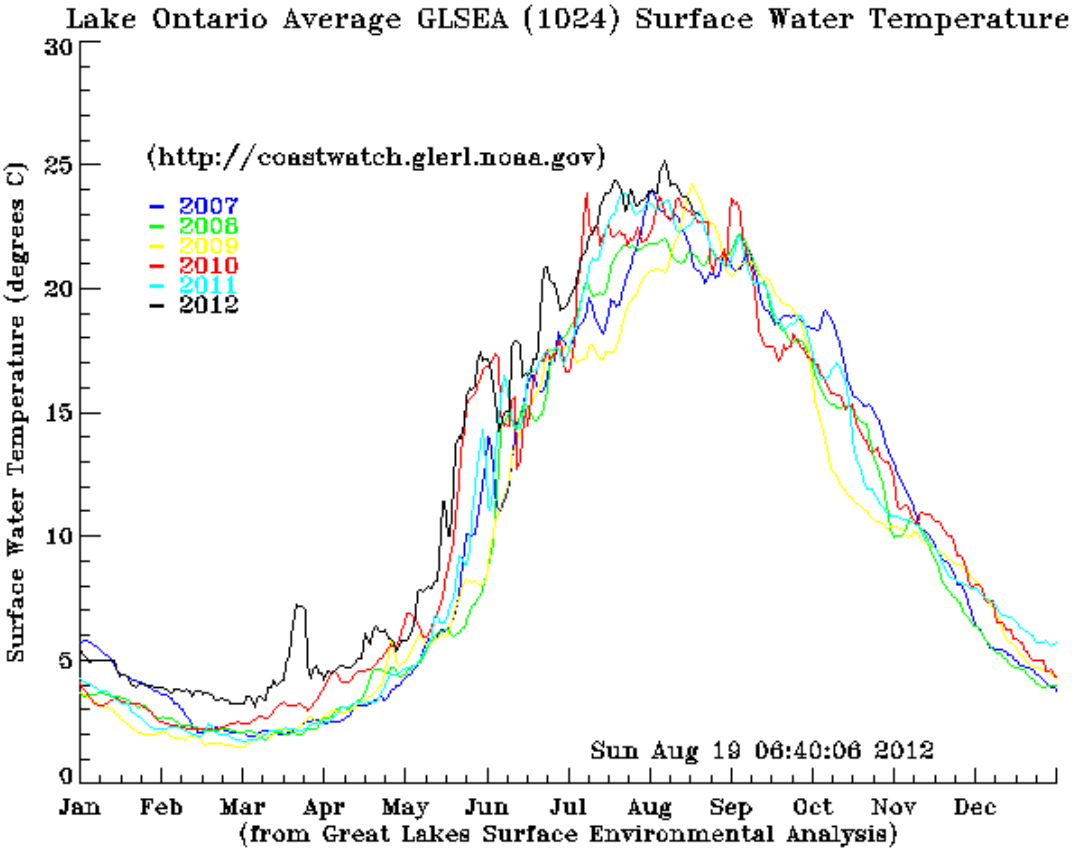
Ontario, Canada's most populous province, was named for the lake. In the Wyandot (Huron) language, *ontarío* means “Lake of Shining Waters”. It is the last in the Great Lakes chain and serves as the outlet to the Atlantic Ocean via the St. Lawrence River. Lake Ontario is also the only one of the five Great Lakes not to share a coast with the state of Michigan.

Lake Ontario like Erie is warm with an average surface of 73F though bottom water in 49F. With above normal temperatures this month, it is still running above the 20 year mean and comparable to 2010.

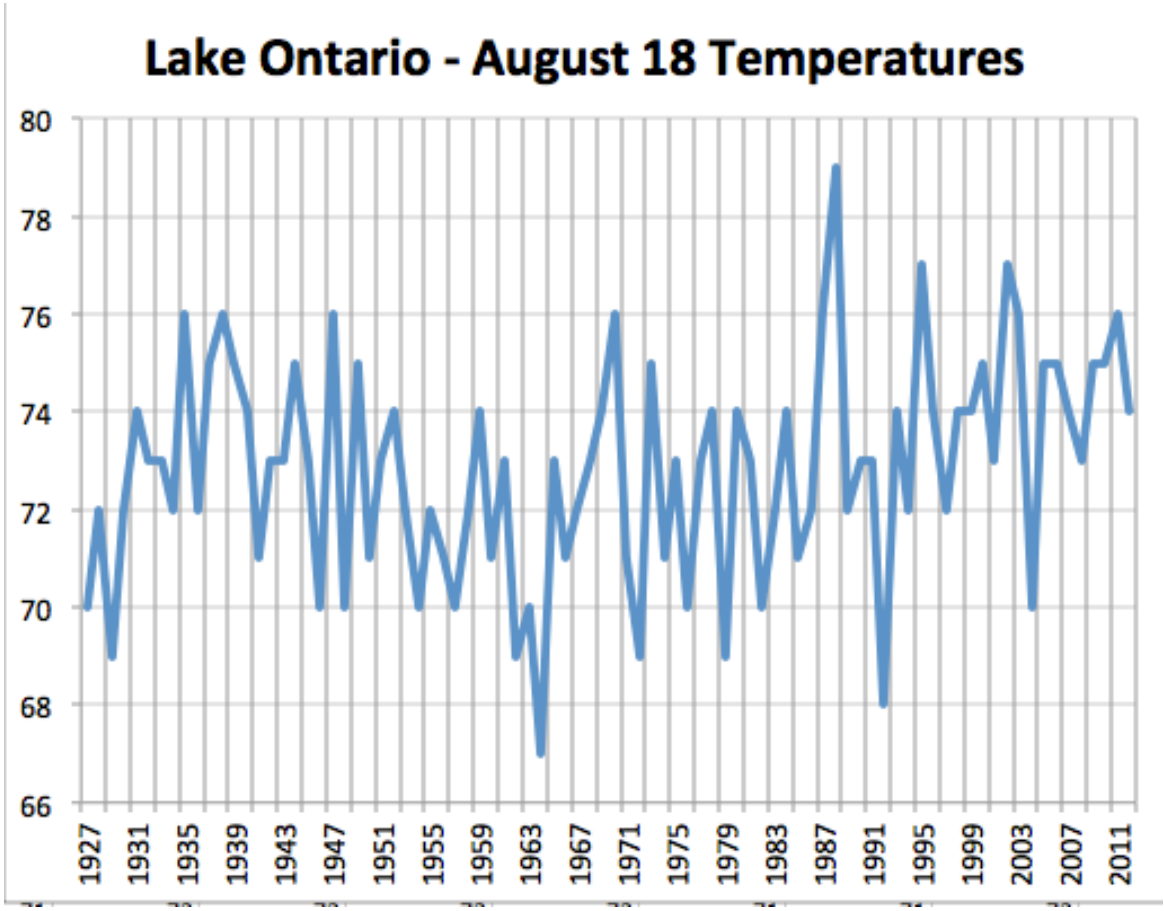

NOAA Great Lakes Coastal Forecasting System
Water Temperature
(Degrees F)
90
80
70
60
50
40
30
Lake Ontario
Surface Water Temperature
08/19/2012 18:00 GMT
(DOY 232)
Lake-wide avg surface temp = 65.01 F
GLSEA daily mean surface temp
for Lake Ontario = 73.36 F (DOY 231)
Great Lakes Environmental Research Laboratory
National Weather Service
Last updated: Sun Aug 19 18:24:36 2012 GMT


NOAA Great Lakes Coastal Forecasting System
Water Temperature
(Degrees F)
90
80
70
60
50
40
30
Lake Ontario
Bottom Water Temperature
08/19/2012 18:00 GMT
(DOY 232)
Lake-wide avg bottom temp = 49.19 F
Great Lakes Environmental Research Laboratory
National Weather Service
Last updated: Sun Aug 19 18:24:43 2012 GMT

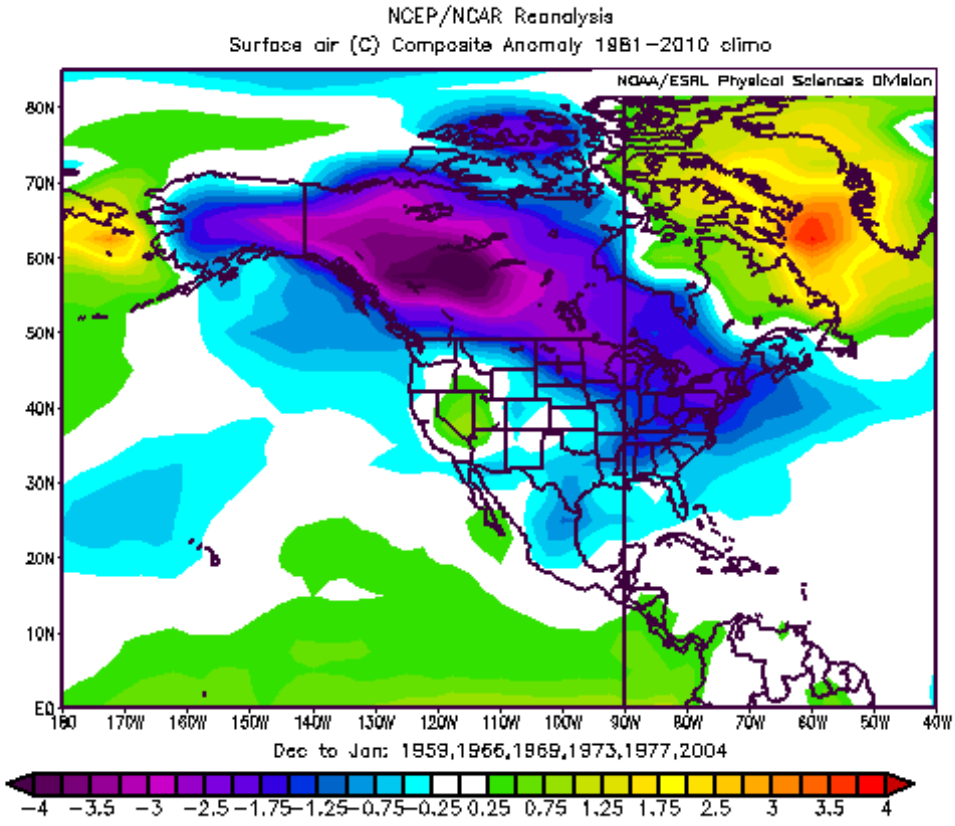

Lake Ontario Average Great Lakes Surface Environmental Analysis (GLSEA)
Surface Water Temperature Compared to Current Year
(http://coastwatch.glerl.noaa.gov)
Average 1992 - 2011
2012
Surface Water Temperature (degrees C)
Surface Water Temperature (degrees F)
Sun Aug 19 06:40:16 2012
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day of the Year

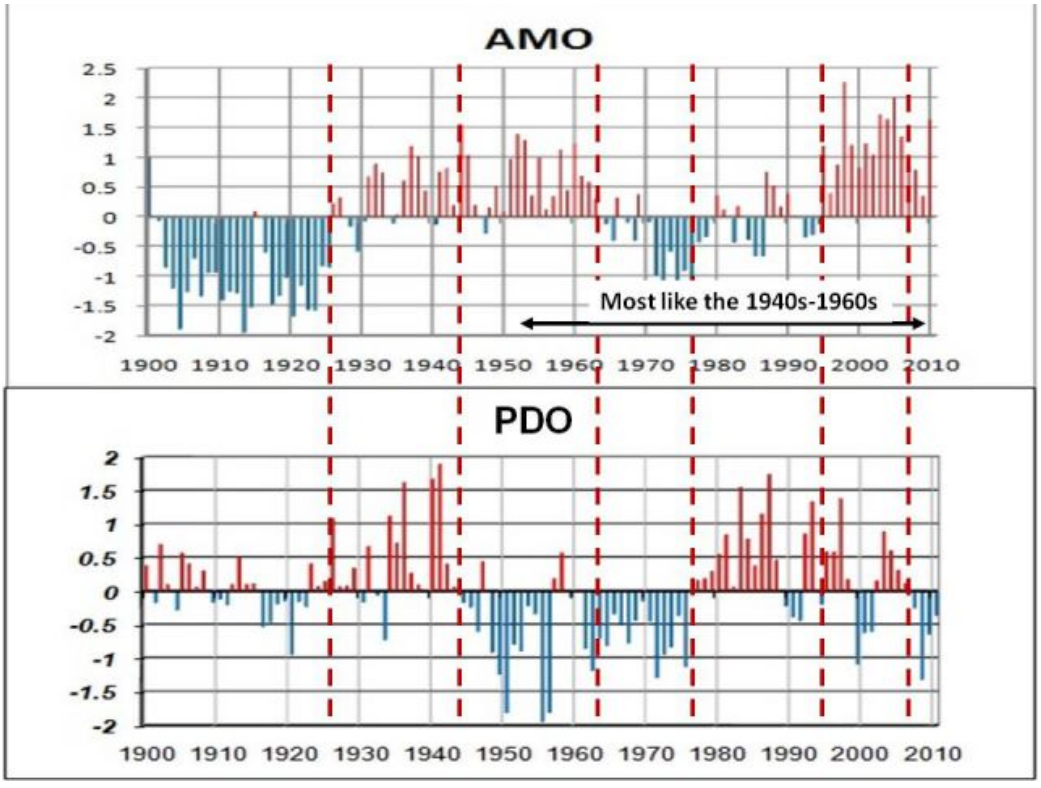

Lake Ontario Average GLSEA (1024) Surface Water Temperature
(http://coastwatch.glerl.noaa.gov)
2007
2008
2009
2010
2011
2012
Surface Water Temperature (degrees C)
Sun Aug 19 06:40:06 2012
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(from Great Lakes Surface Environmental Analysis)

I did a plot of Ontario daily temperatures for August 18th going back almost a century. We have been warmer (about 19 years), but warm enough that if we don't get a lot of fall big storms to mix and cool the water, we are in good shape should the cold be as cold as we think it might.



Should the El Nino East temperature pattern evolve this early winter (the December to January composite for El Nino east QBO winters), watch out. These winter saw either a relaxation of the PDO or a flip positive. In 1976/77, we were coming off a warm La Nina and string of La Ninas at the end of the cold PDO, The flip posiitve in `976 was the start of the longer term POD positive stage. In 2002/03, the El Nino was strong enough to flip the PDO from negative (where it had dropped after the 97/98 El Nino back positive. It was an El Nino west winter with a (+PNA)western rodge and eastern trough). 2003/04 was still El Nino but El Nino east and the PDO was still posiitve and would be until 2005. We can hope for the PDO to go 'temporarily positive as it did i the early 2000s and after the 1957/58 El Nino and the great winter of 1947/48.


NCEP/NCAR Reanalysis
Surface air (C) Composite Anomaly 1961-2010 climo
NOAA/ESRL Physical Sciences Division
80N
70N
60N
50N
40N
30N
20N
10N
EQ
180 170W 160W 150W 140W 130W 120W 110W 100W 90W 80W 70W 60W 50W 40W
Dec to Jan: 1959,1966,1969,1973,1977,2004
-4 -3.5 -3 -2.5 -1.75 -1.25 -0.75 -0.25 0.25 0.75 1.25 1.75 2.5 3 3.5 4


AMO
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
Most like the 1940s-1960s
1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010
PDO
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010

THE BLIZZARD OF 1977 IN BUFFALO

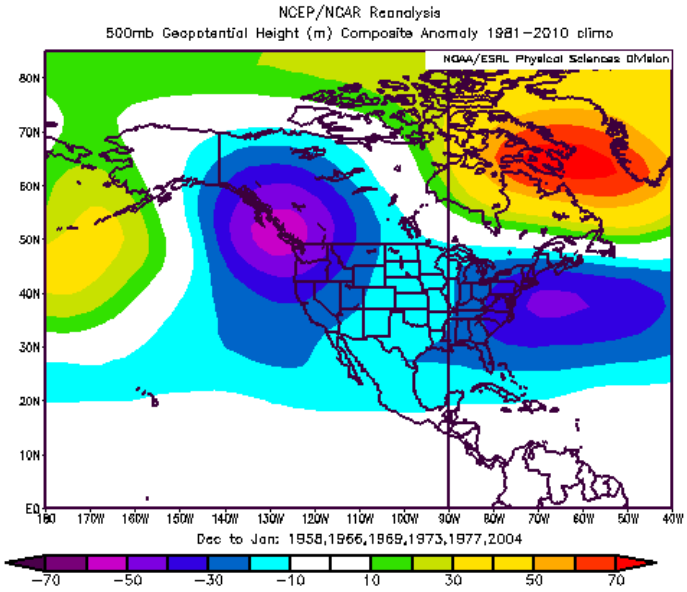
The **Blizzard of 1977** (video) was a deadly blizzard that hit upstate New York and Southern Ontario from January 28 to February 1, 1977. Daily peak wind gusts ranging from 46 to 69 mph (74 to 111 km/h) were recorded by the National Weather Service Buffalo Office (2006a).

Certain pre-existing weather conditions exacerbated the blizzard's effects. November, December and January average temperatures were much below normal. Lake Erie froze over by December 14; an ice-covered Lake Erie usually puts an end to lake-effect snow because the wind cannot pick up moisture from the lake's surface, convert the moisture to snow and then dump it when the winds reach shore.

Lake Erie was covered by a deep, powdery snow; January's unusually cold conditions limited the usual thawing and refreezing, so the snow on the frozen lake remained powdery. The drifted snow on roadways was difficult to clear because the strong wind packed the snow solidly. In addition to the roads becoming impassable, motorists had to deal with vehicles breaking down.

In the hardest-struck areas, snowmobiles became the only viable method of transportation. In western New York and southern Ontario, snow which was accumulated on frozen Lake Erie and snow on the ground at the start of the blizzard provided ample material for the high winds to blow into huge drifts –a ground blizzard.

The combination of bitter cold, high winds, and blowing snow paralyzed areas affected by the storm. Lake Ontario does not freeze over, which meant northern New York had to deal with considerable lake effect snow, which, when coupled with the existing snow cover and wind, created paralysis.



Though many east QBO winters have snows in the south and Mid Atlantic and less snow in the northern areas of the northeast, the lake effect regions would light up and if hurricanes don't cool the waters off the east coast the cold upper air would lead to explosive developments that could have greater reach. Though Boston only had 10 inches in the El Nino east winter of 1972/73, they did a lot better in 1965/66, 1968/69 (February) and 1976/77.