

Great Lakes Hydrology

Net Basin Supply

- (+) Precipitation
- (+) Runoff
- (-) Evaporation

Evaporation Driving Factors

1. Difference in cool air & warm water
2. Low Relative Humidity
3. High wind speeds

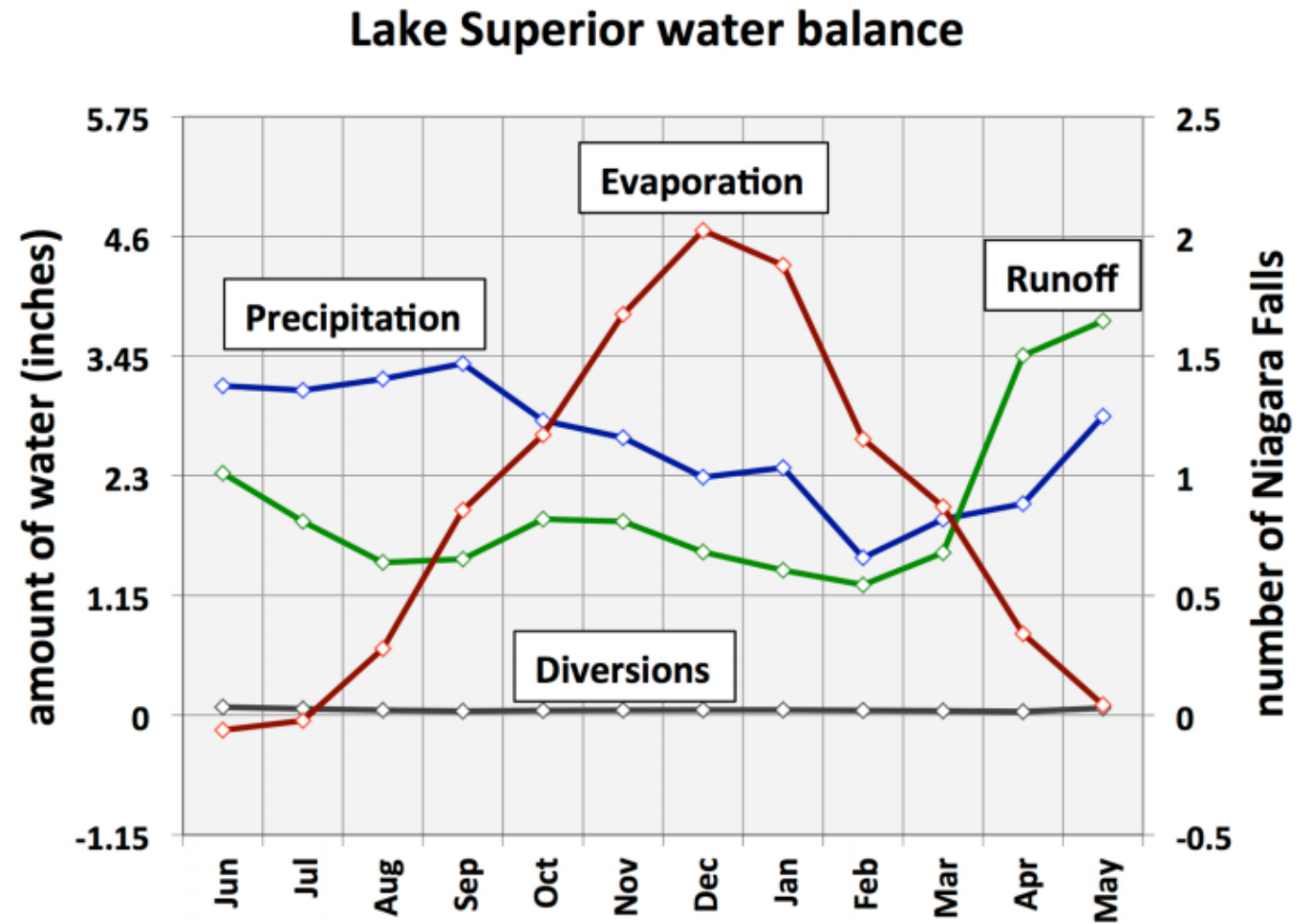
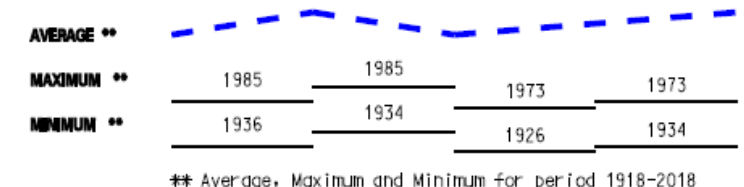
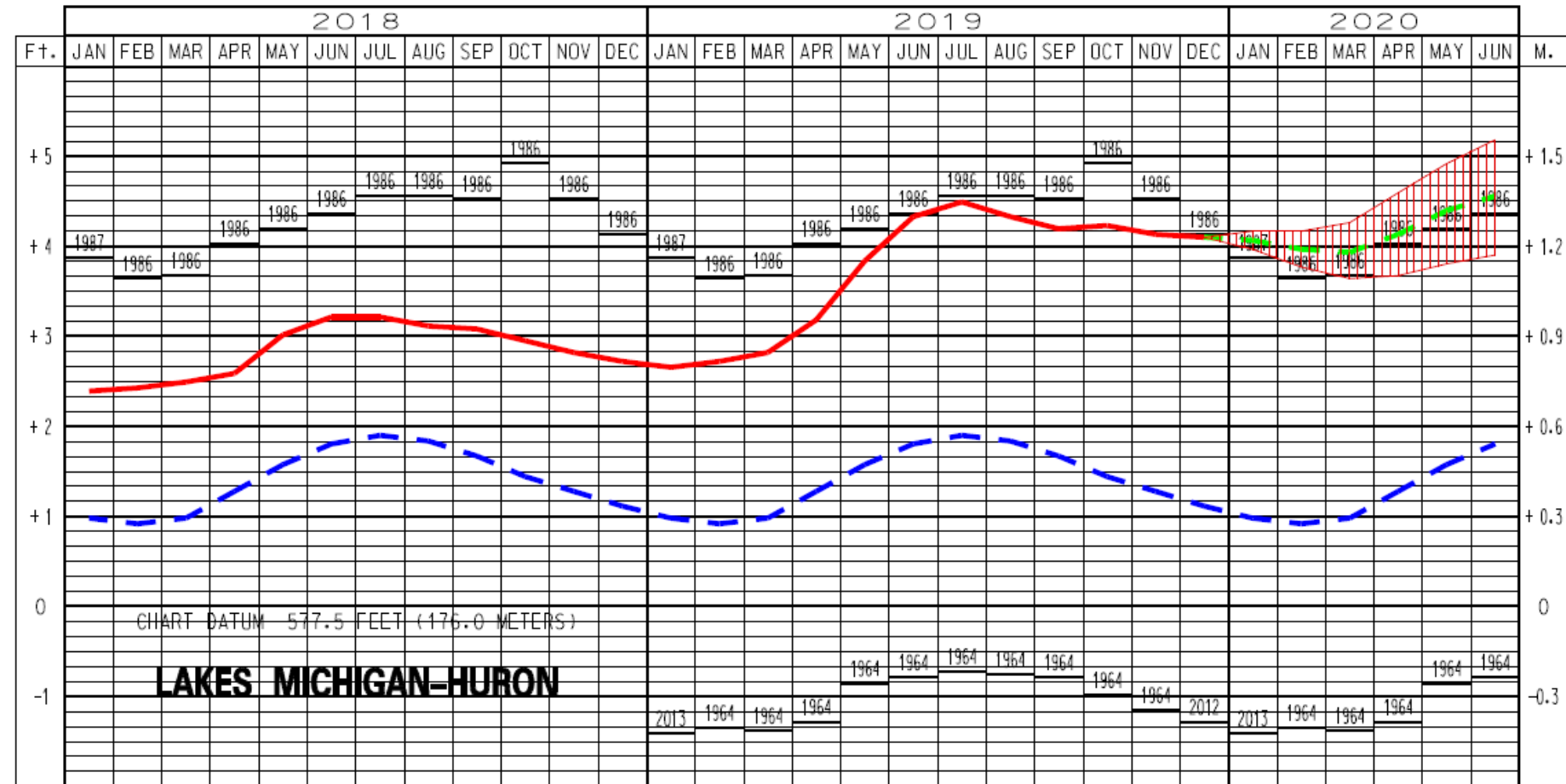


Figure 1. Four components of the monthly Lake Superior water balance, beginning with the month of June, which is the typical start of the “evaporation season.” Each component is shown as a flux of water in units of inches per month (left; spread out over the surface area of Lake Superior), as well as in equivalent “number of Niagara Falls” (right). Note, in particular, the strong seasonal variation in evaporation.

Great Lakes Water Levels

- Peak in the late summer and early fall and lowest in the winter months
- Average annual rise and fall varies from 12-18 inches on average
- USACE – Great Lakes Water Levels over 150 years of monitoring
- Modeling/prediction of water levels is from a group effort between NOAA, USACE and Environment Canada
- The forecasts fall within the projected range 90% of the time. However, a significant weather pattern shift can alter the lake levels enough to fall outside of the forecasted range.



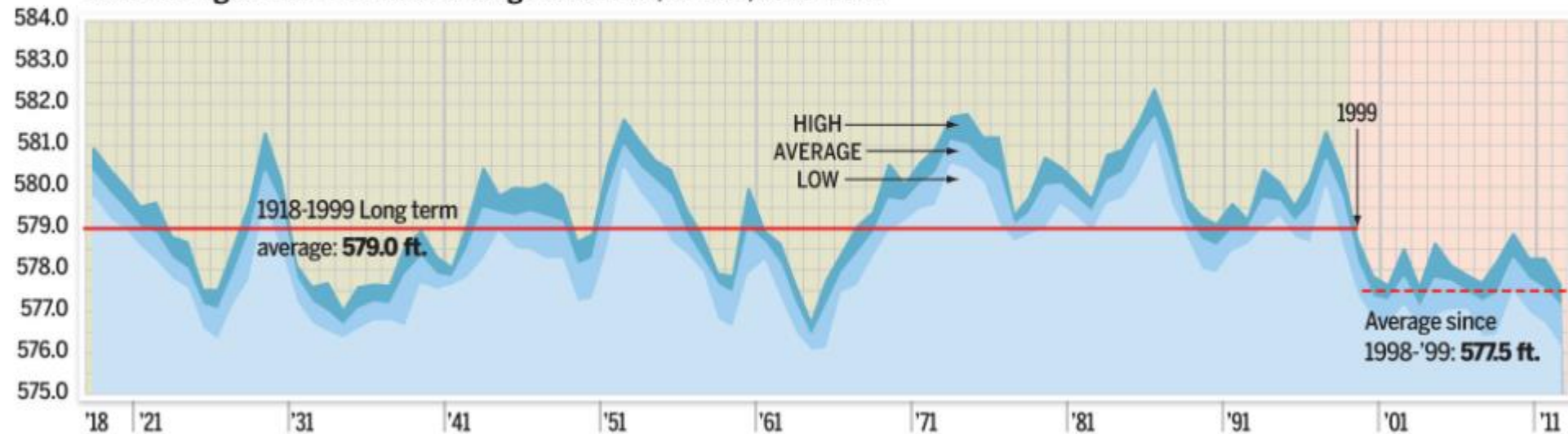
Why Record Low water in 2013

- 2013 Capped more than a decade of below average precipitation & above average temperatures resulting in high evaporation rates

Lake levels face sudden decline

Over the years, the volume of water flowing into and out of the Great Lakes has been so closely matched that water levels have been remarkably stable. But there are signs that exquisite balance is out of whack. Between 1998 and 1999, levels for Lakes Michigan and Huron fell more than three feet and have not recovered.

Lake Michigan-Huron annual average lake level, in feet, 1918-2012

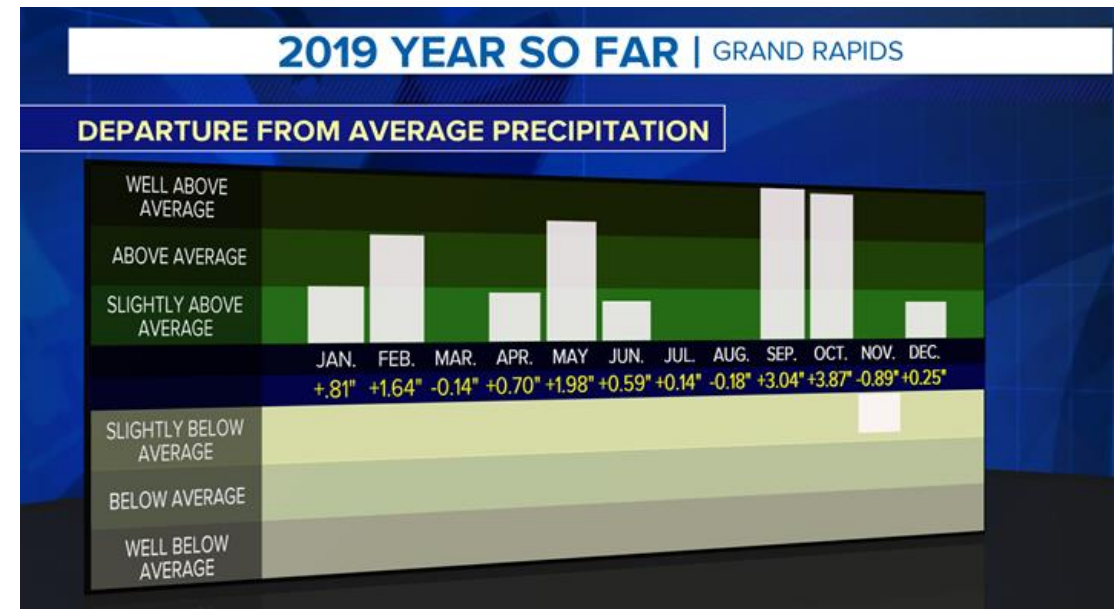
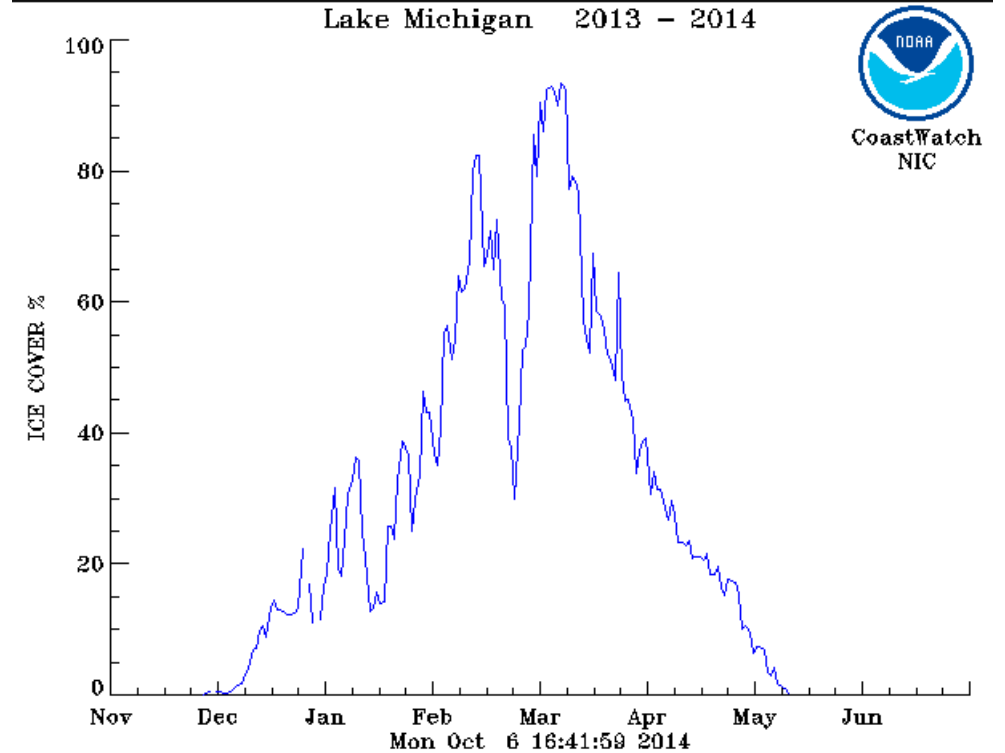


Sources: U.S. Army Corps of Engineers; National Oceanic and Atmospheric Administration

Journal Sentinel

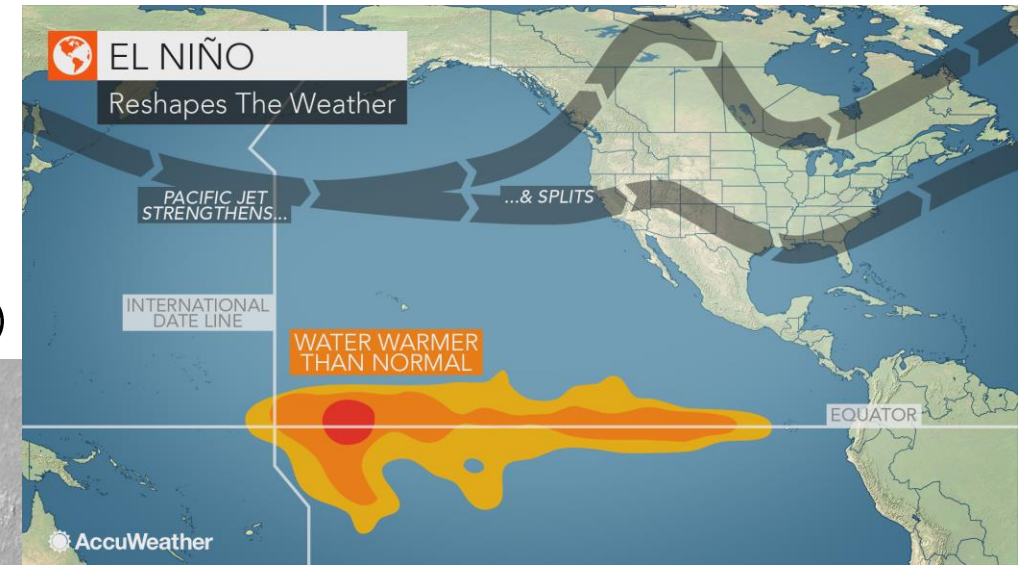
Why High Water Now

- Between Jan 2013- Dec 2014 Mich-Huron rose at the highest rate recorded within a 2 year period
- Polar vortex in 2014, below average evaporation with Lake Michigan freeze over 88%. Following a large ice cover, the water temperatures are cooler which minimizes evaporation rates.
- Since then, very wet weather
 - High spring runoff
 - High precipitation

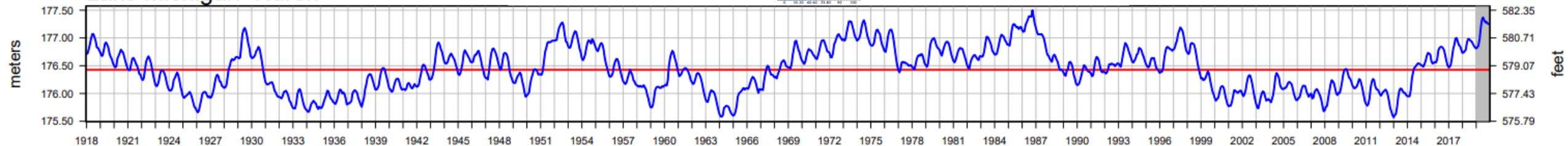


Predictability

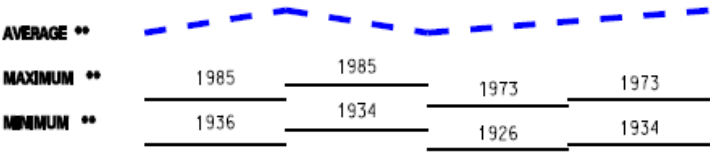
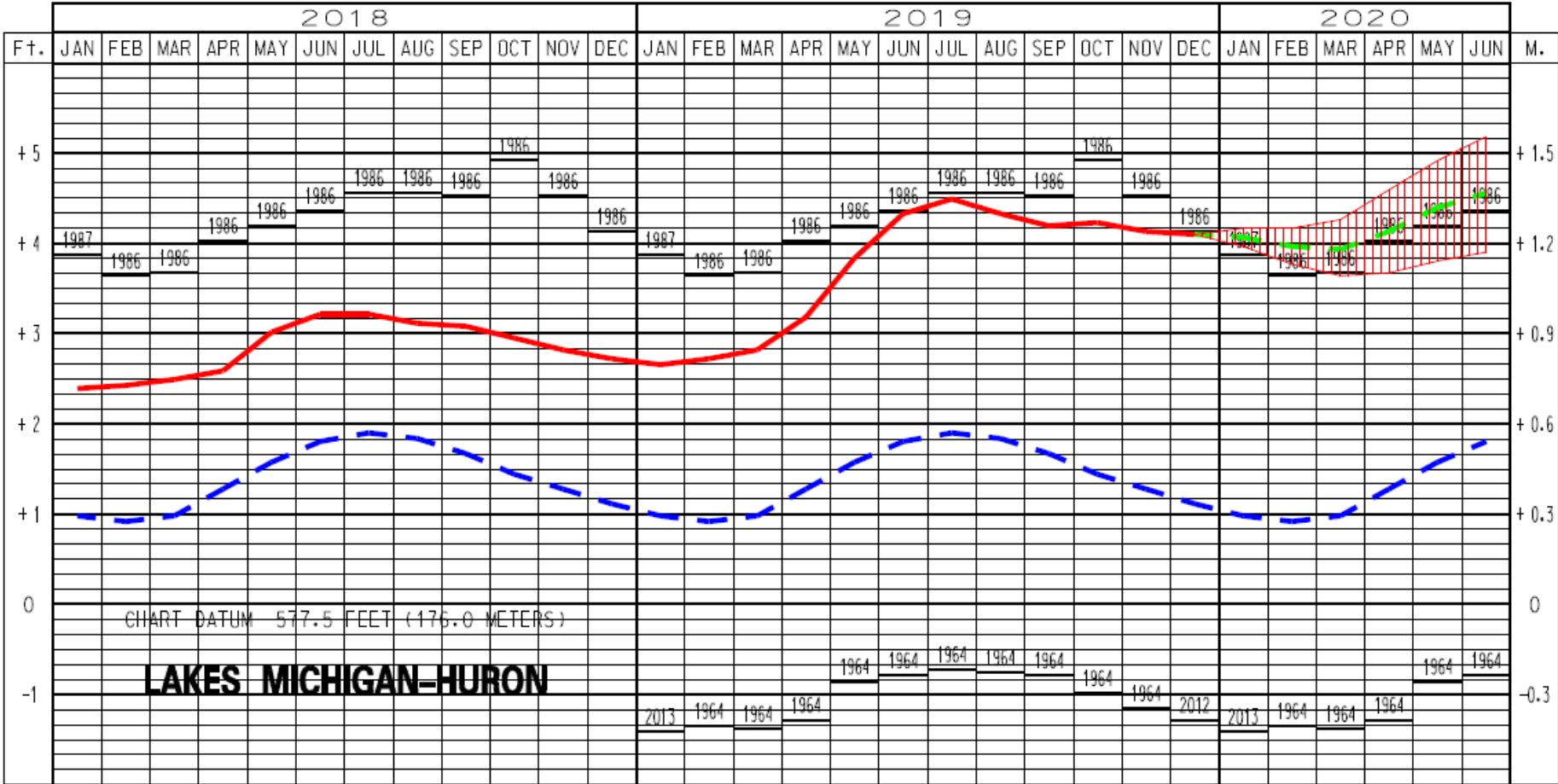
- Multi-year periods of high/low water levels are difficult to predict
- Long time scales show water levels reaching equilibrium (see below)
- Factors
 - Water Temperature
 - Air Temperature
 - Humidity
 - Wind
 - Ice Cover
 - Frost Season
 - Arctic Oscillation
 - Weather extremes



Lake Michigan-Huron



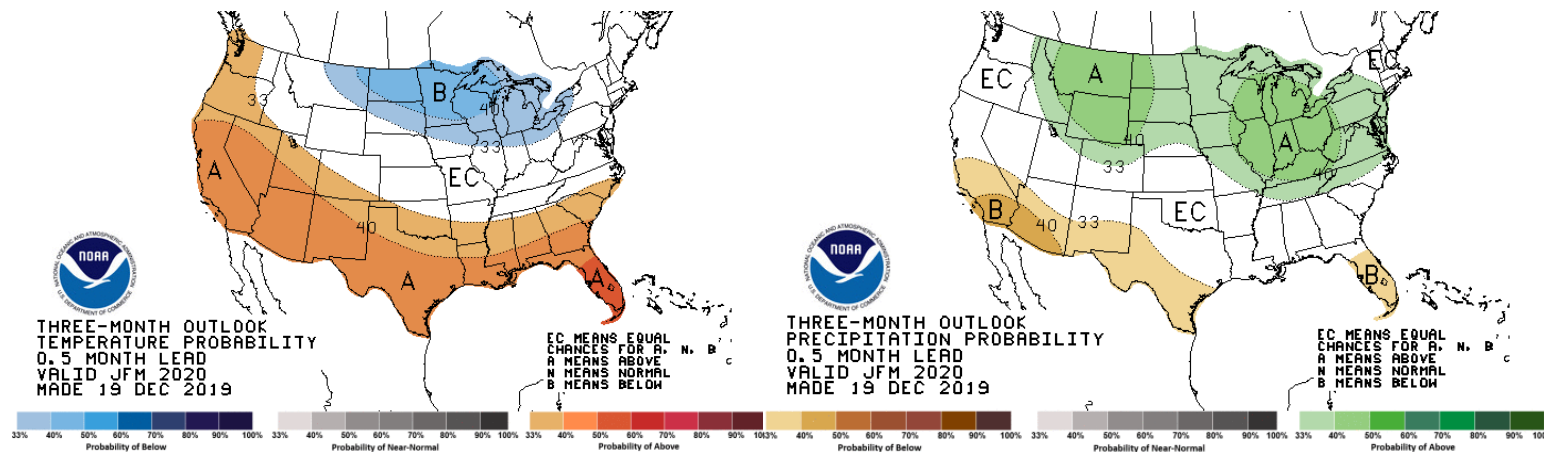
LAKES MICHIGAN-HURON WATER LEVELS - JANUARY 2020



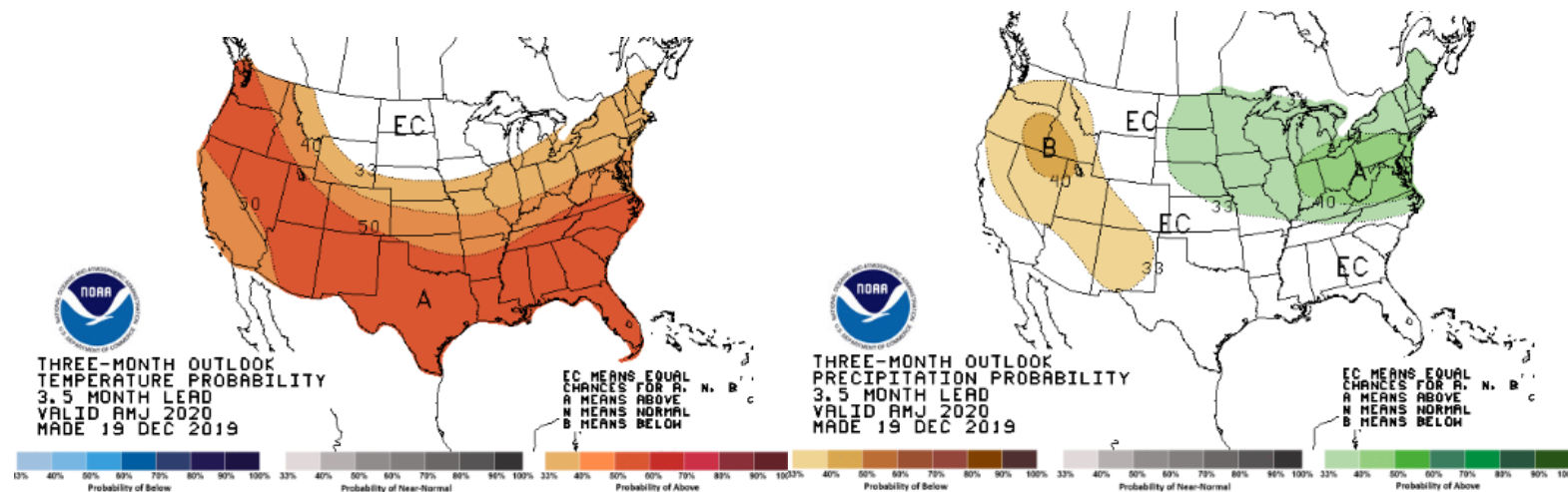
** Average, Maximum and Minimum for period 1918-2018

- Currently Lake Michigan is 16.5" higher than in December of 2018
- Current Lake Level is 581.5' IGLD (+4 LWD)
- FEMA updated base flood elevation is +6 LWD for Berrien County
- National Weather Service Climate Prediction Center
 - Below avg. temps for Jan-March, above avg. precipitation
 - Average temps for April-June, above avg. precipitation

January February March 2020



April May June 2020



Long-term Water Level Outlook for Lake Mich-Huron (updated 2020-01-10)

