

# GREAT LAKES WATER LEVELS

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Detroit District, Corps of Engineers

1 April 2020



US Army Corps  
of Engineers®



# HIGH WATER PHOTOS FROM ACROSS THE GL



Canal Park  
Near Duluth,  
MN (NWS)



South Haven, MI  
(NWS)



Stony Point, MI  
Lake Erie  
(Port of Monroe)



Oswego, NY  
(Bill Foley)

The high water levels are a Great Lakes wide event.



# NOTES ABOUT GREAT LAKES WATER LEVELS



- Not a depth, but an elevation above sea level, IGLD 1985
- Michigan and Huron = One lake
- Lake-wide daily means → Lake-wide monthly means
- Based on still water, not influenced by meteorological forcing
- Based on a network of water level gauges
- Detroit District Corps of Engineers = keeper of official monthly water level statistics from 1918-2019
- Coordination occurs with Environment and Climate Change Canada
- **Primary drivers of water level fluctuations are changing weather patterns and resulting fluctuations in water supply**

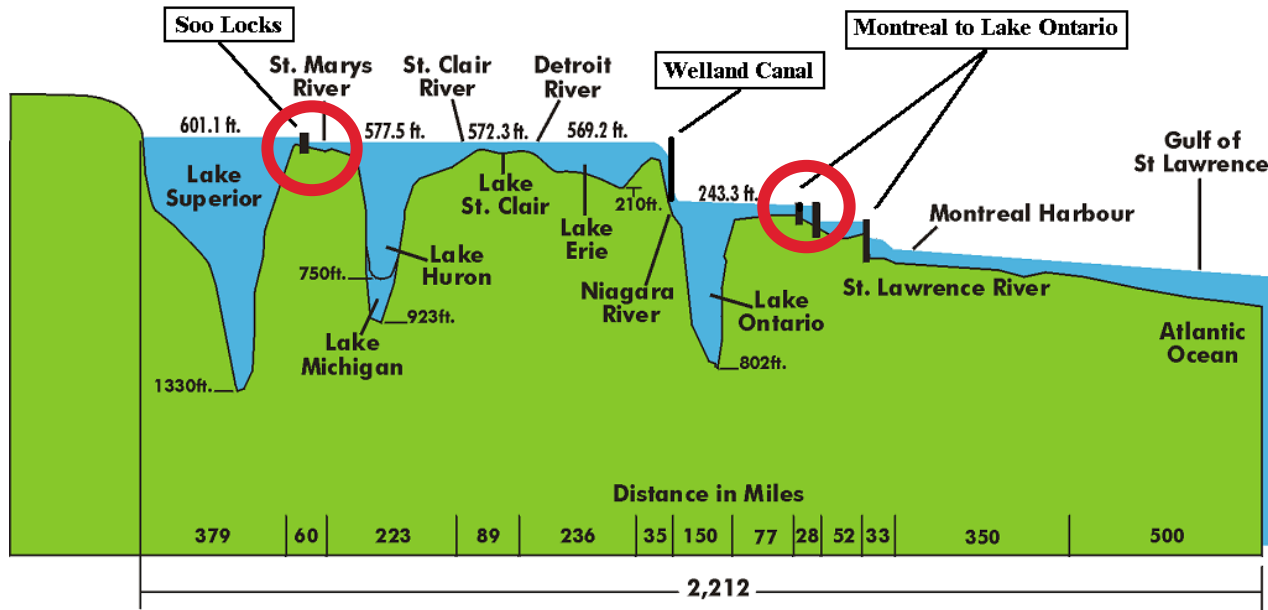


# MONITORING GREAT LAKES WATER LEVELS



## The Great Lakes Basin

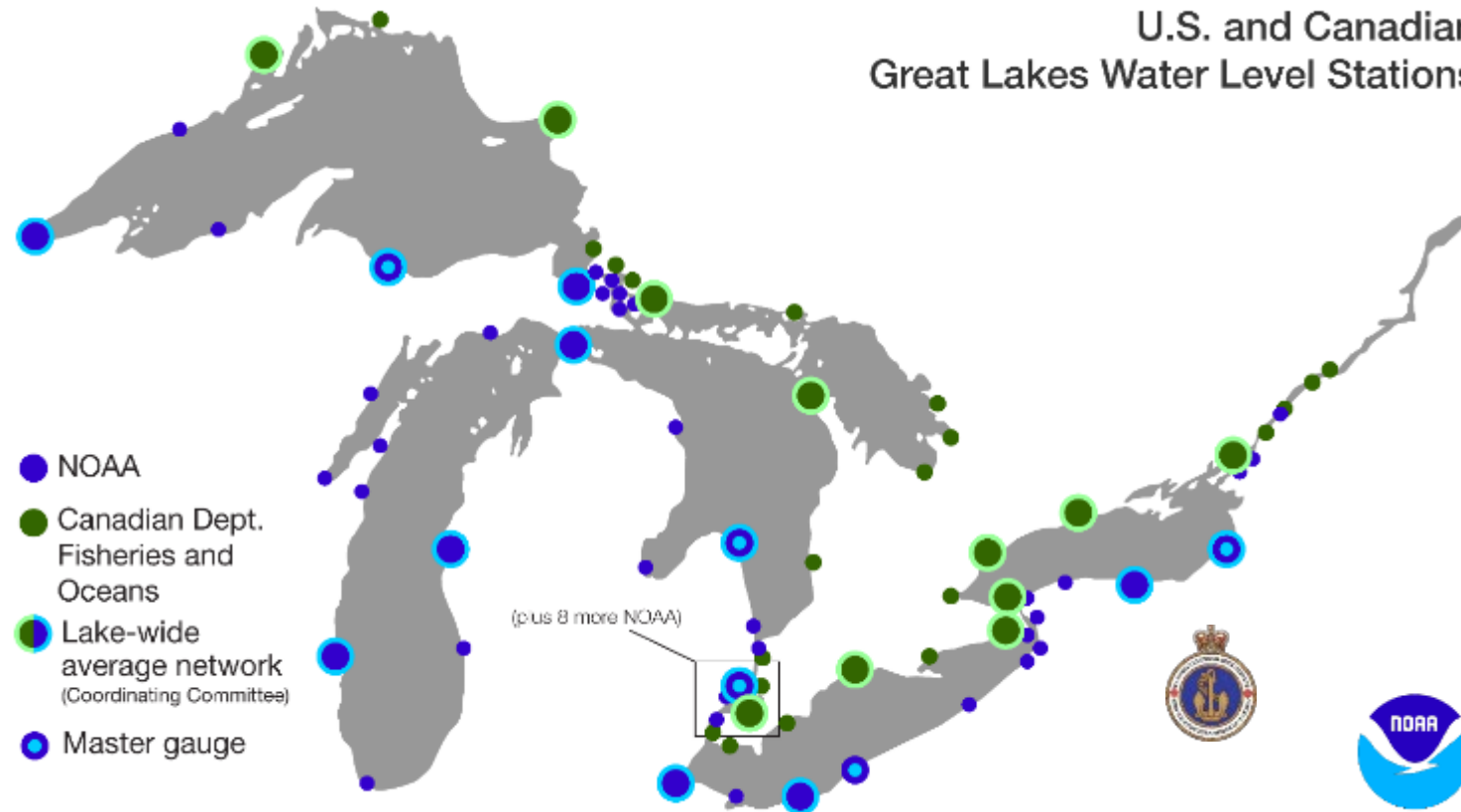
- 14,000 miles of shoreline
- 95,000 square miles of water
- 200,000 square miles of land
- 8 States & 2 Provinces



 Outflow regulation



# MONITORING GREAT LAKES WATER LEVELS



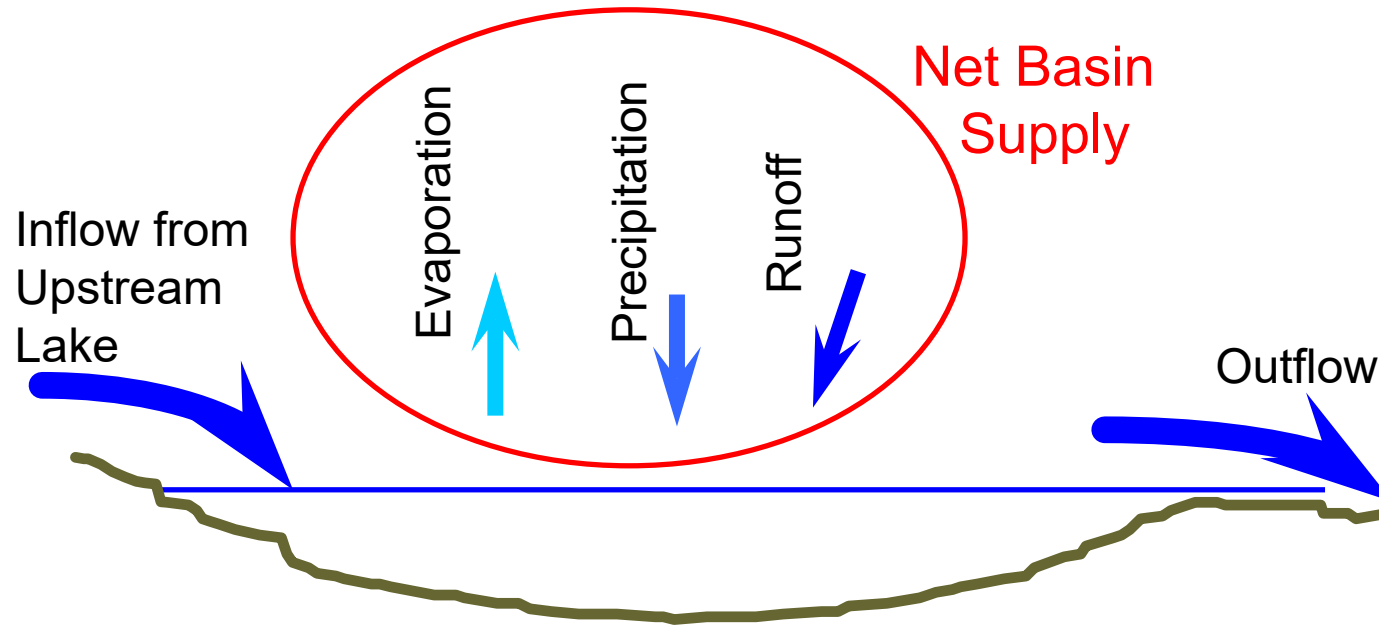
## Daily Average Water Levels Based on Lake-Wide Average Network

- **Lake Superior:** Duluth, Marquette, Pt. Iroquois, Thunder Bay, Michipicoten
- **Lakes Michigan-Huron:** Harbor Beach, Ludington, Mackinaw City, Milwaukee, Tobermory, Thessalon
- **Lake St. Clair:** St. Clair Shores, Belle River
- **Lake Erie:** Toledo, Cleveland, Port Stanley, Port Colborne
- **Lake Ontario:** Oswego, Rochester, Toronto, Kingston, Port Weller, Cobourg



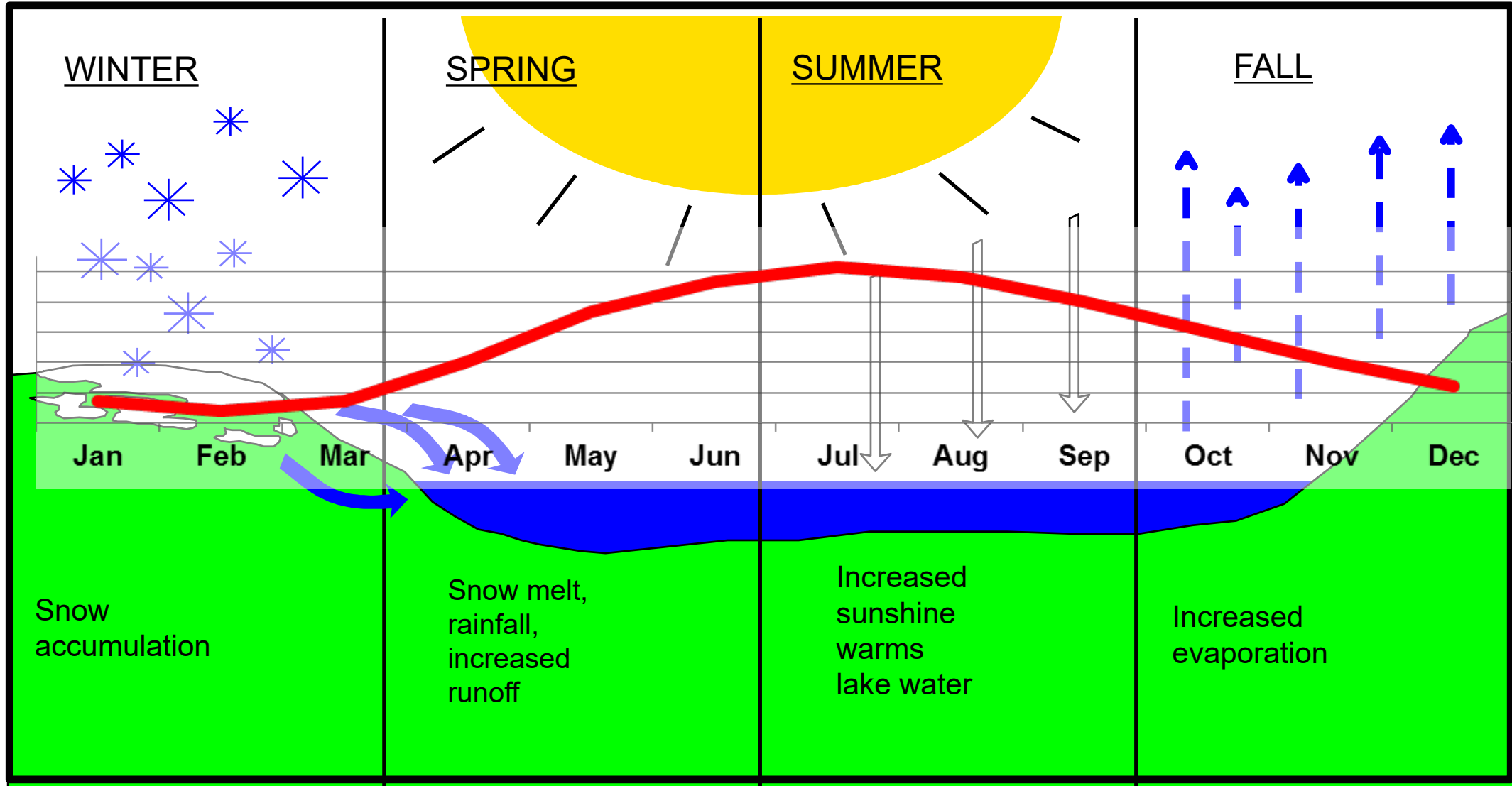


# FACTORS IMPACTING WATER LEVELS





# ANNUAL WATER LEVELS AND THE HYDROLOGIC CYCLE



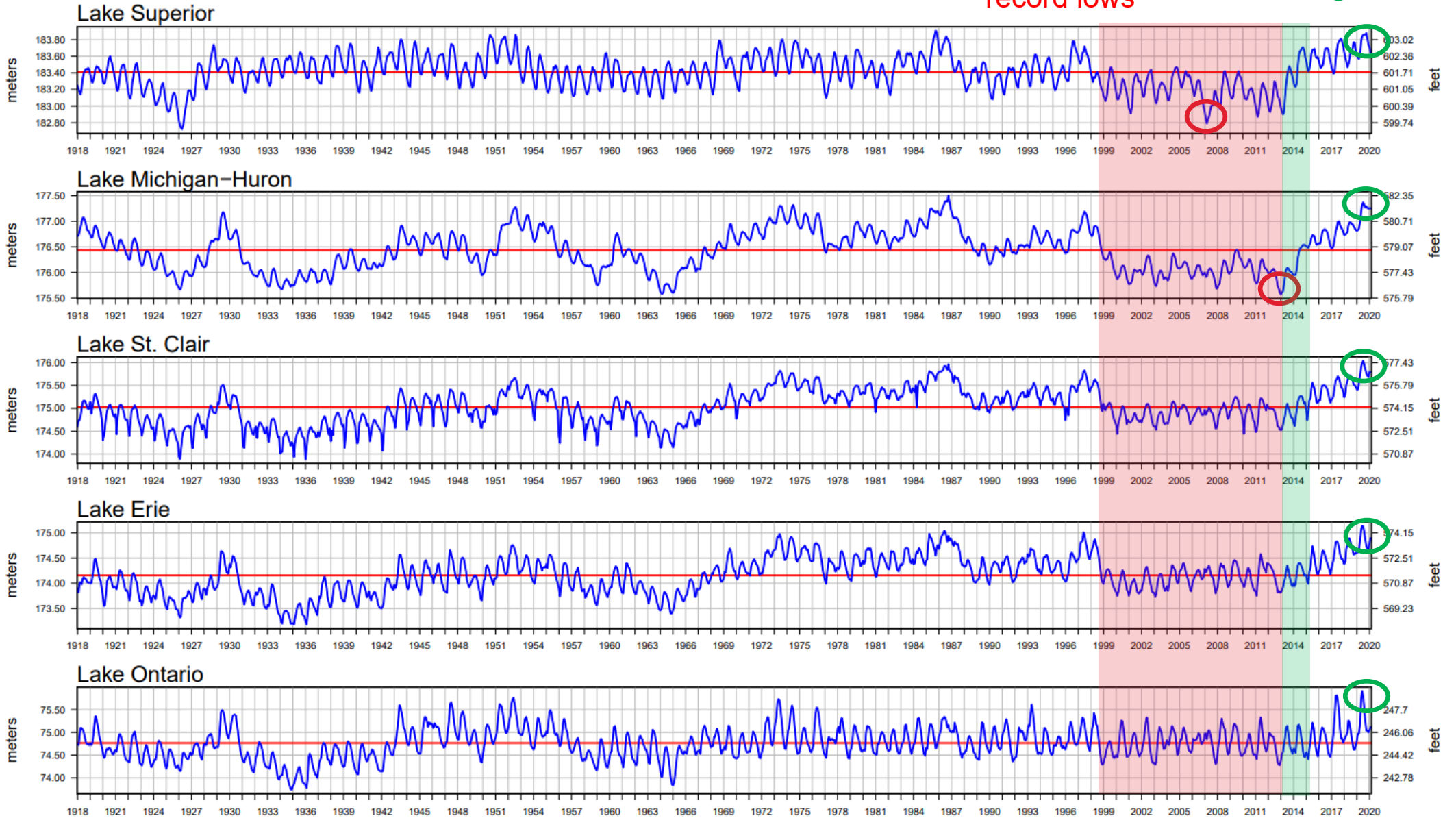


# Great Lakes Water Levels (1918–2020)

— Monthly Mean Level — Long Term Average Annual

Decade plus of low water with record lows

Record rise and record highs



The monthly average levels are based on a network of water level gages located around the lakes. Elevations are referenced to the International Great Lakes Datum (1985).

Water levels have been coordinated through 2019. Values highlighted in gray are provisional.





# GREAT LAKES WATER LEVELS

## New Record Highs in 2019

- May: Superior, St. Clair, Erie
- June: Superior, St. Clair, Erie\* and Ontario\*
- July: Superior, St. Clair\*, Erie and Ontario
- Aug: Superior (tied), St. Clair and Erie
- Sep: Superior (tied), St. Clair and Erie
- Oct: None (within 1 inch on Superior)
- Nov: None
- **Dec: None** (within 1 inch on Michigan-Huron)

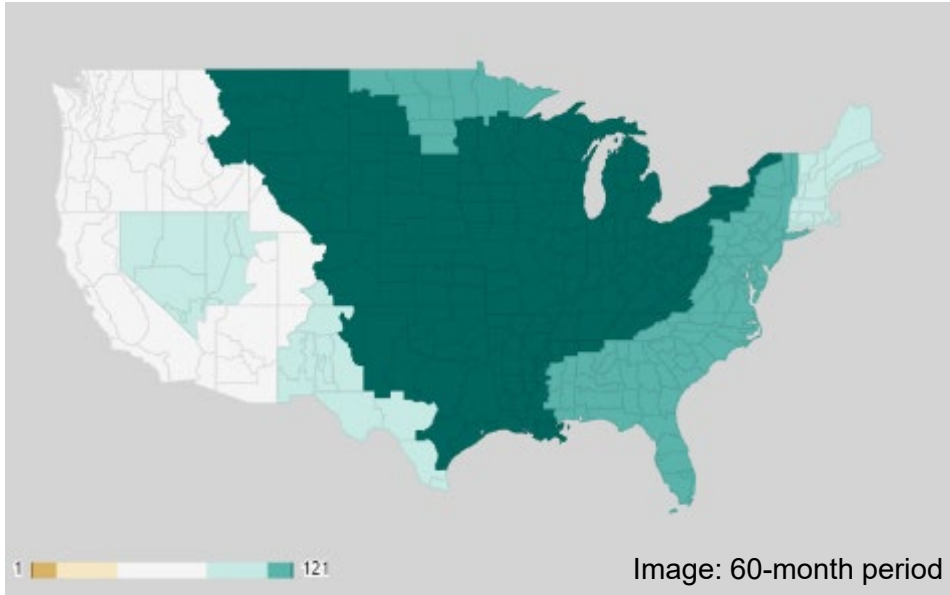
## New Record Highs in 2020

- Jan: Superior, Michigan-Huron, St. Clair (tied)
- Feb: Superior, Michigan-Huron, Erie

\*highest monthly mean on record for all months



# WHY ARE LEVELS SO HIGH? – WET PATTERN



Wettest 12 – 60 month periods in 120 plus years for the Great Lakes

NOAA National Centers for Environmental information, Climate at a Glance

PERIOD	VALUE	1901-2000 MEAN	ANOMALY	RANK (1895-2020)	WETTEST/DRIEST SINCE	RECORD
Mar 2019–Feb 2020 12-Month	41.50" (1,054.10mm)	32.76" (832.10mm)	8.74" (222.00mm)	125th Driest	Driest since: 2019	1931
				<b>1st Wettest</b>	<b>Wettest to Date</b>	<b>2020</b>
Sep 2018–Feb 2020 18-Month	60.55" (1,537.97mm)	47.33" (1,202.18mm)	13.22" (335.79mm)	124th Driest	Driest since: 2019	1964
				<b>1st Wettest</b>	<b>Wettest to Date</b>	<b>2020</b>
Mar 2018–Feb 2020 24-Month	80.50" (2,044.70mm)	65.52" (1,664.21mm)	14.98" (380.49mm)	124th Driest	Driest since: 2019	1964
				<b>1st Wettest</b>	<b>Wettest to Date</b>	<b>2020</b>
Mar 2017–Feb 2020 36-Month	121.33" (3,081.78mm)	98.29" (2,496.57mm)	23.04" (585.21mm)	123rd Driest	Driest since: 2019	1965
				<b>1st Wettest</b>	<b>Wettest to Date</b>	<b>2020</b>
Mar 2016–Feb 2020 48-Month	158.42" (4,023.87mm)	131.06" (3,328.92mm)	27.36" (694.95mm)	122nd Driest	Driest since: 2019	1964
				<b>1st Wettest</b>	<b>Wettest to Date</b>	<b>2020</b>
Mar 2015–Feb 2020 60-Month	194.26" (4,934.20mm)	163.81" (4,160.77mm)	30.45" (773.43mm)	121st Driest	Driest since: 2019	1935
				<b>1st Wettest</b>	<b>Wettest to Date</b>	<b>2020</b>



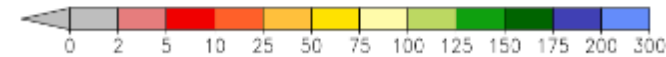
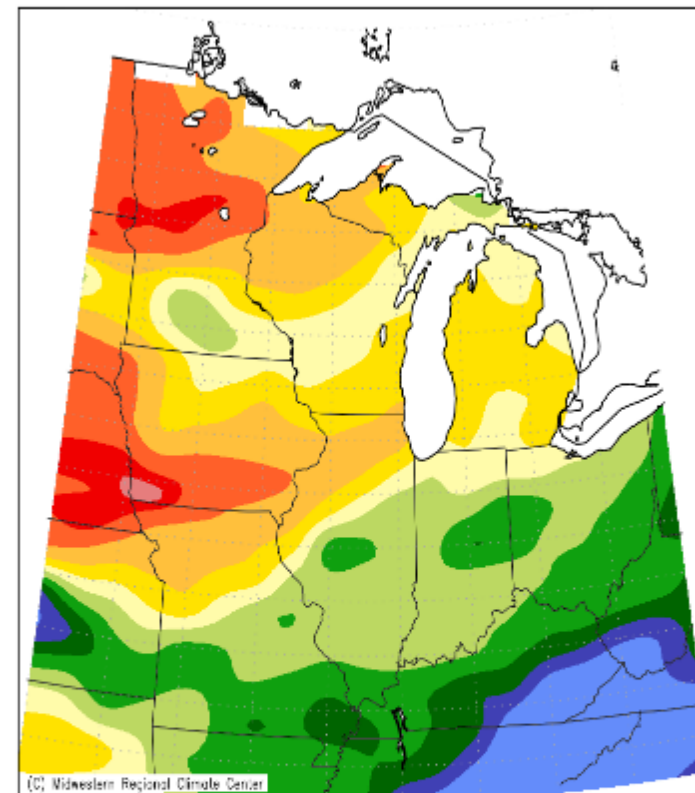
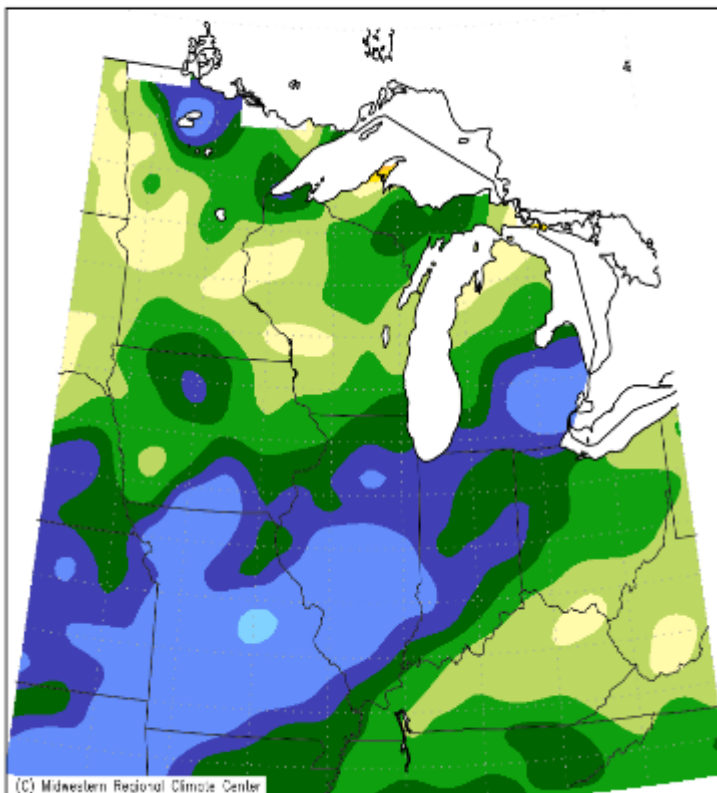
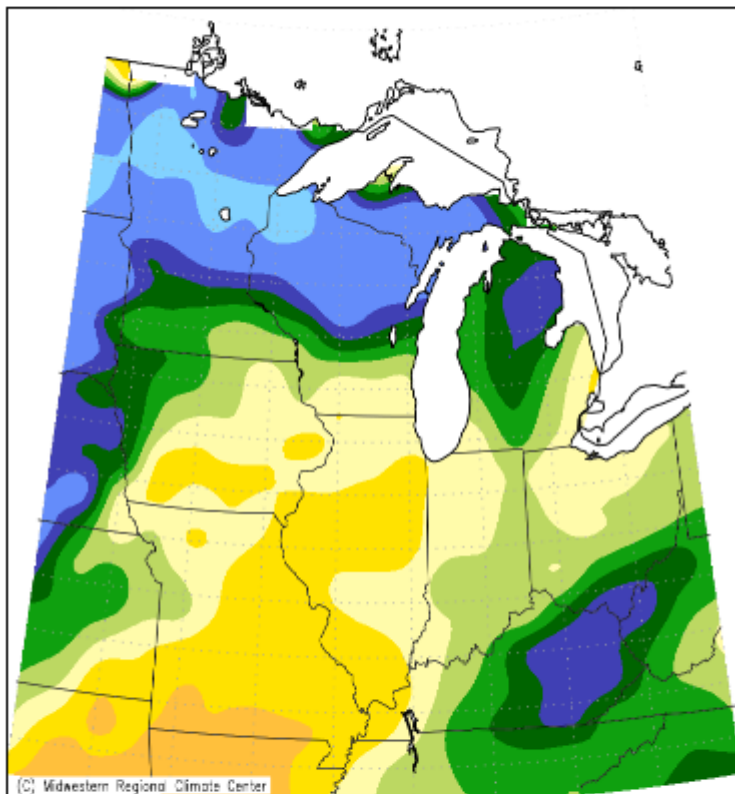
# WINTER PRECIPITATION CONDITIONS



Accumulated Precipitation: Percent of Mean  
December 1, 2019 to December 31, 2019

Accumulated Precipitation: Percent of Mean  
January 1, 2020 to January 31, 2020

Accumulated Precipitation: Percent of Mean  
February 1, 2020 to February 29, 2020



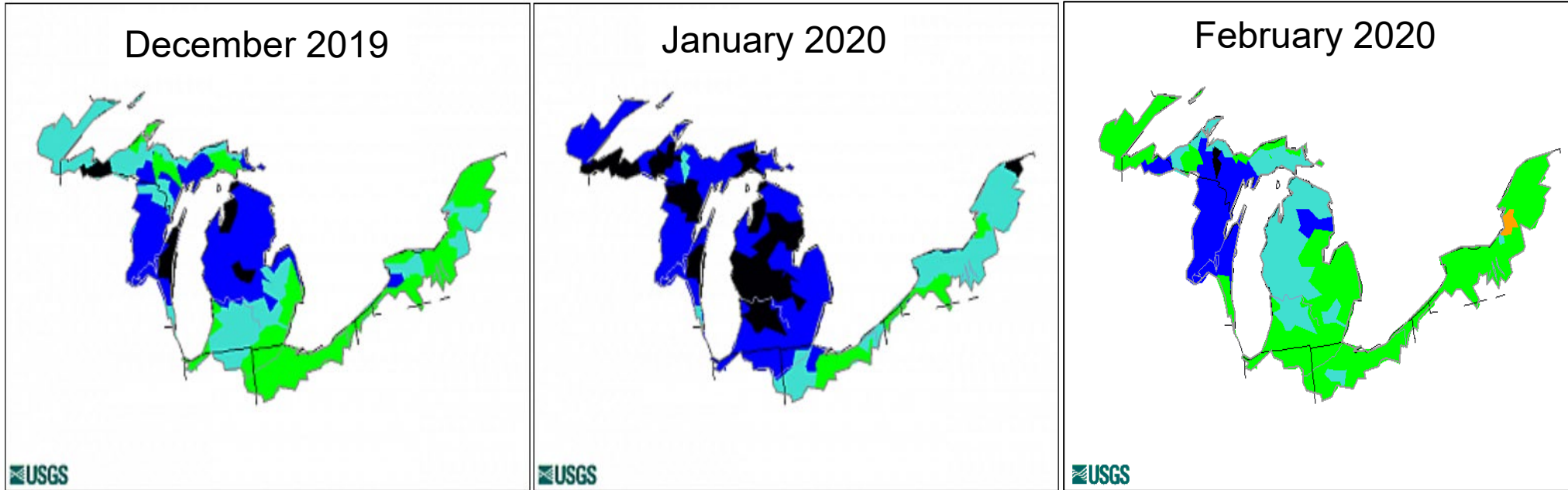
Midwestern Regional Climate Center  
Illinois State Water Survey, Prairie Research Institute  
University of Illinois at Urbana-Champaign

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# WINTER STREAMFLOW CONDITIONS



Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		

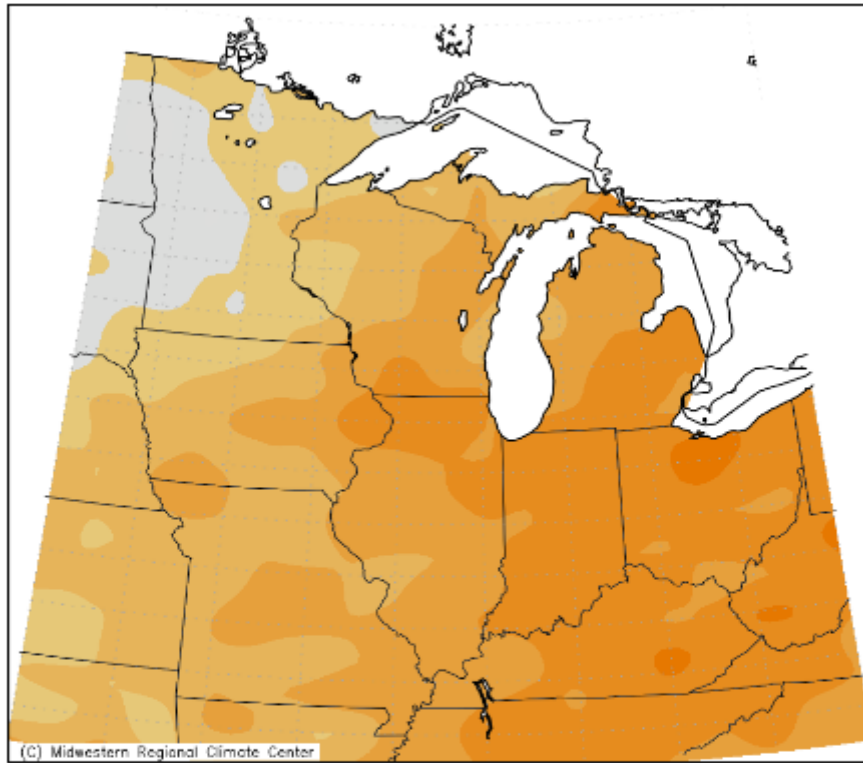


# WINTER TEMPERATURE CONDITIONS



## Winter Temperature Above Average

Average Temperature (°F): Departure from Mean  
December 1, 2019 to February 29, 2020



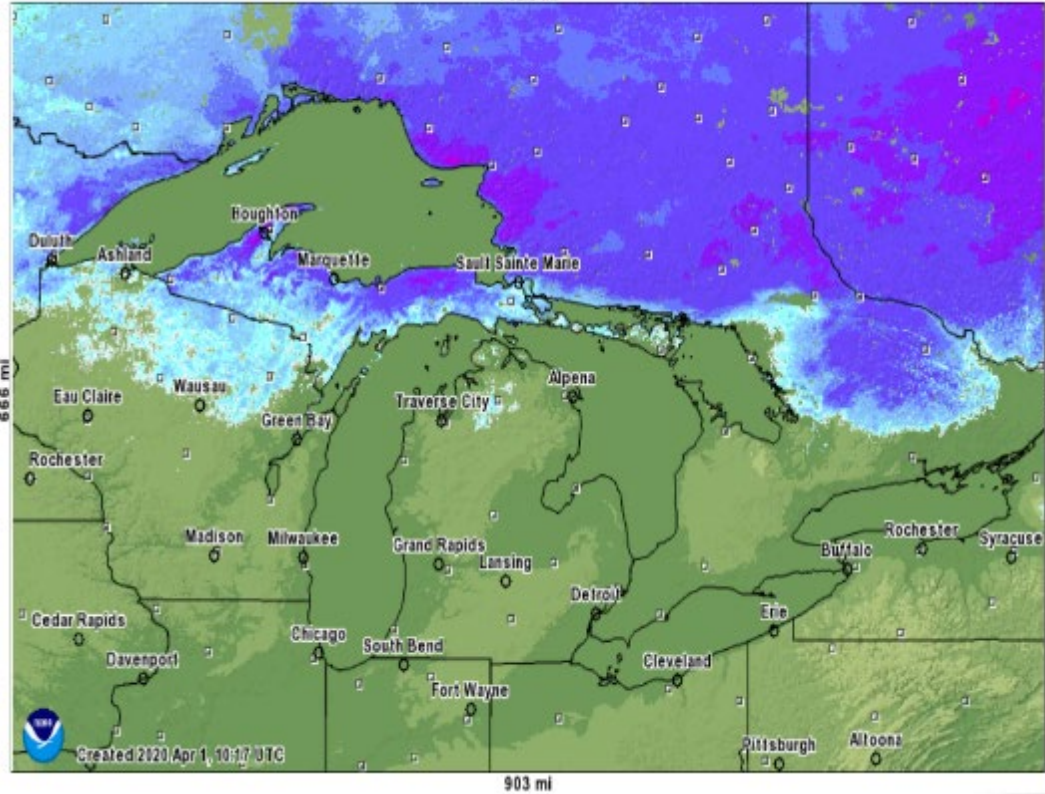
Midwestern Regional Climate Center  
Illinois State Water Survey, Prairie Research Institute  
University of Illinois at Urbana-Champaign

- Warmer than normal temperatures in December and January reduced the amount of evaporation off of the lakes.
- Although February was also warmer than normal over the entire month, a few cold air outbreaks during the month led to increased evaporation.

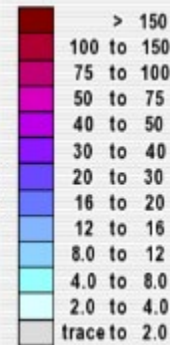
# SNOW DEPTH AND SNOW WATER EQUIVALENT



Modeled Snow Depth for 2020 April 1, 6:00 UTC  
762.3 mi



Inches of depth



## Snow Depth (Left)

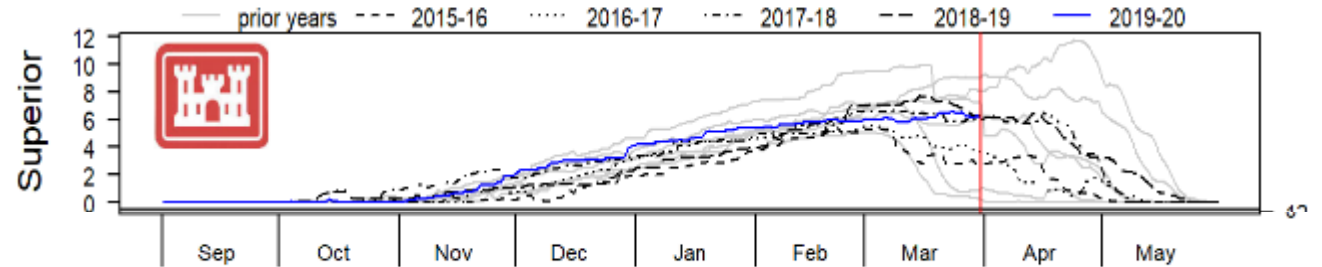
- Around Lake Superior still about 20-30 inches of snow on the ground.

## Snow Water Equivalent (SWE - bottom)

- About 6 inches of SWE left in the Lake Superior basin.

Lake Basin Snow Water Equivalent (inches)

Red line drawn at Mar 31



Created from data courtesy of NOAA/NWS Office of Water Prediction, Chanhassen, MN



# MONTHLY AND SEASONAL OUTLOOKS

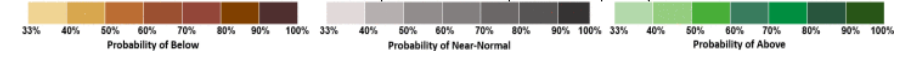
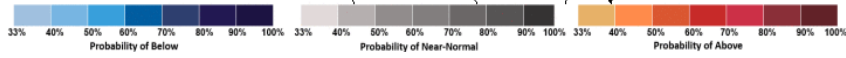
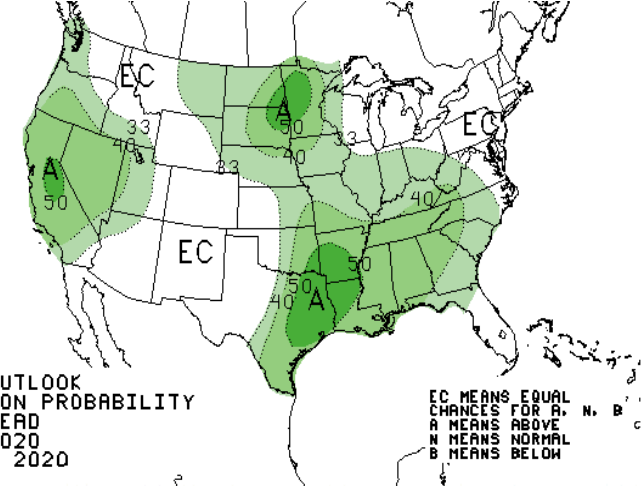
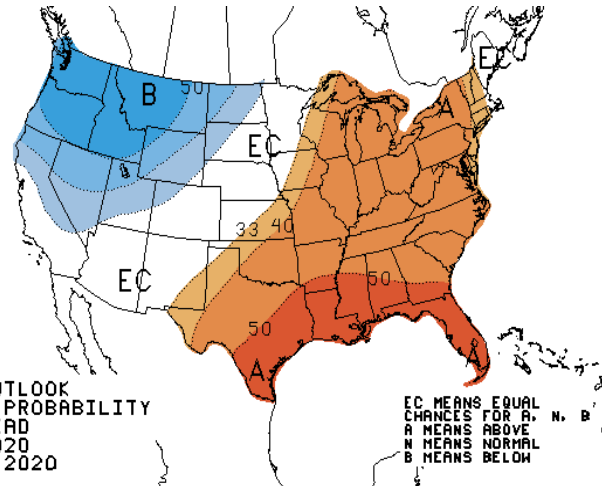


*April*

## TEMPERATURE

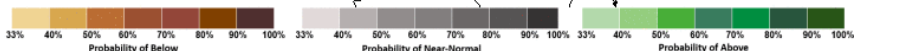
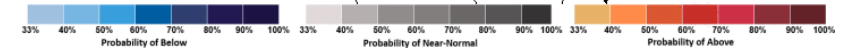
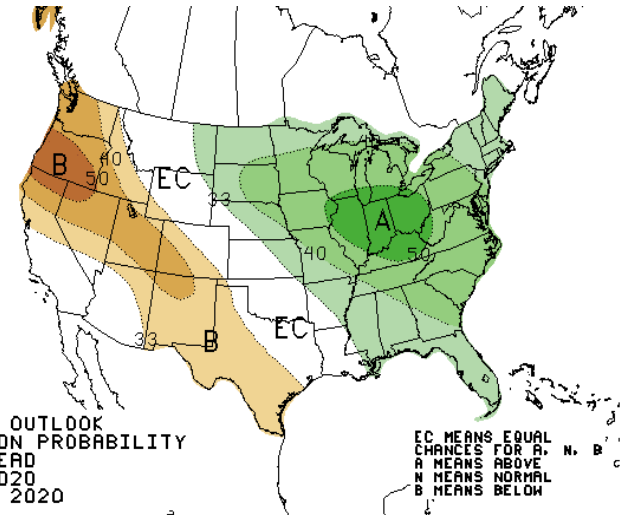
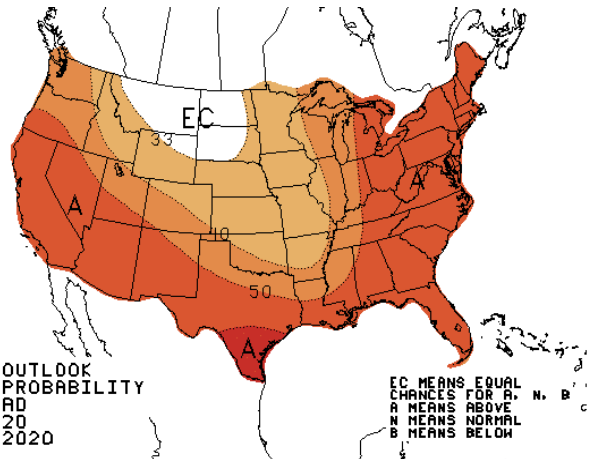
## PRECIPITATION

ONE MONTH  
OUTLOOK



THREE MONTH  
OUTLOOK

*Apr-May-Jun*





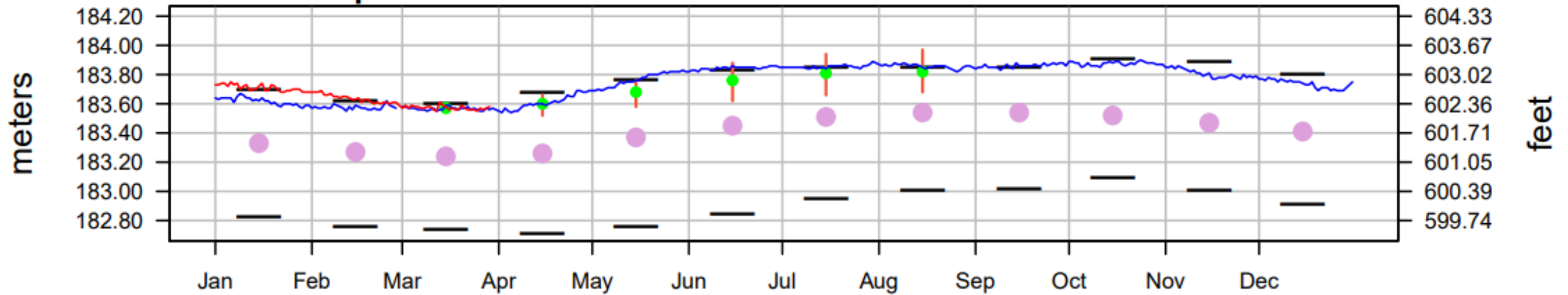
# 6 MONTH WATER LEVEL FORECAST

Mar 2020 forecast

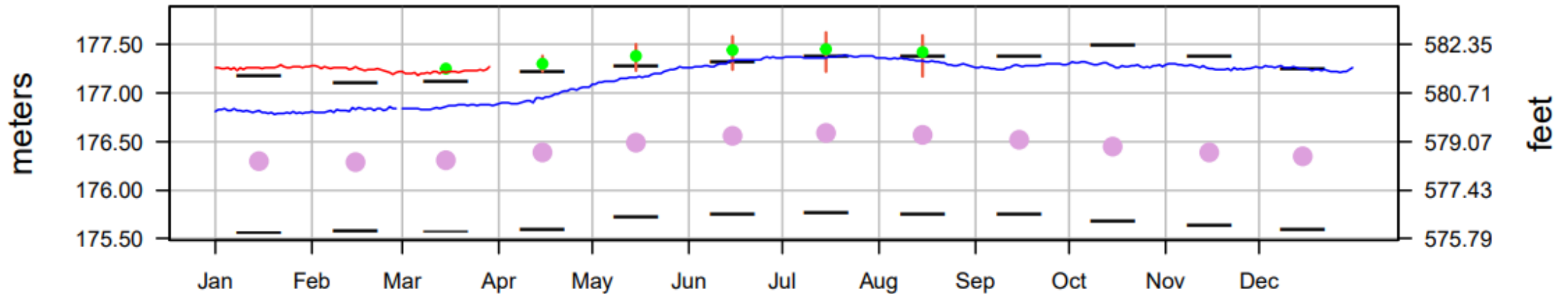


- 2020
- 2019
- Coordinated Forecast
- LTA Monthly Mean
- Record High/Low Monthly Mean

## Lake Superior



## Lake Mich-Huron



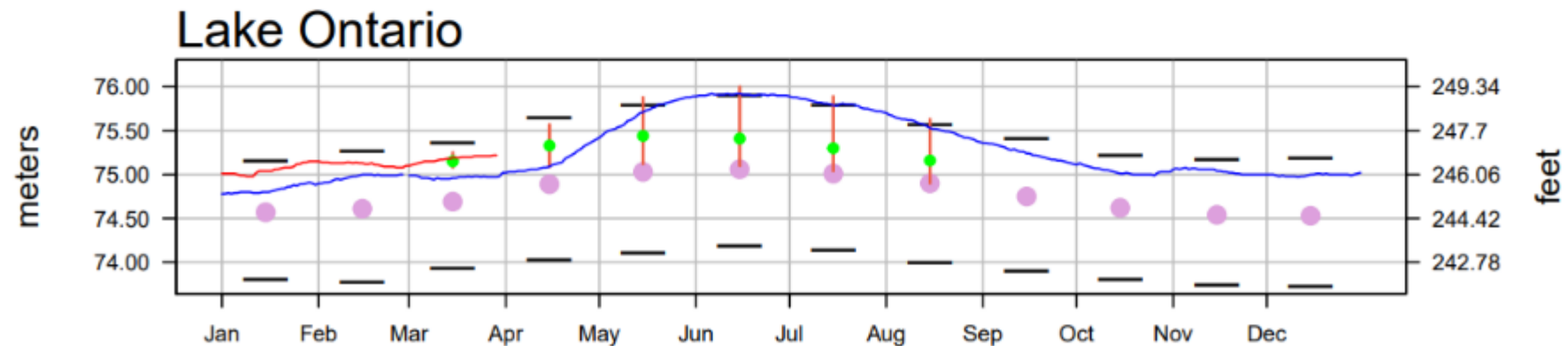
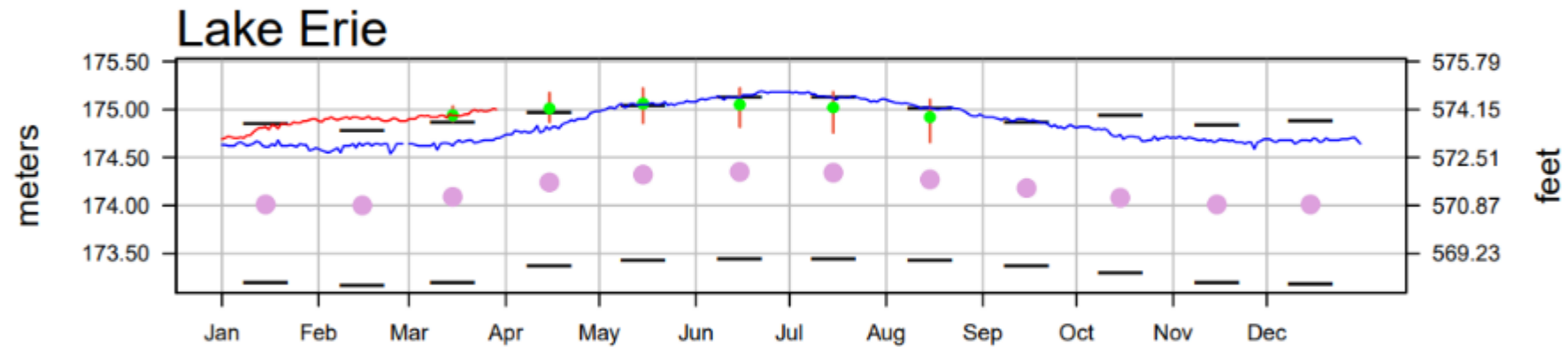
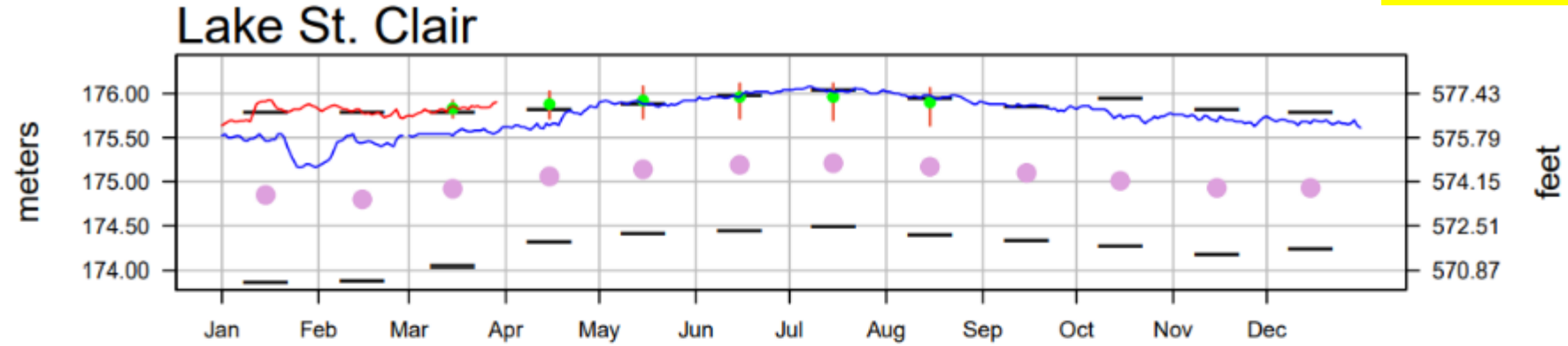




# 6 MONTH WATER LEVEL FORECAST



Mar 2020 forecast

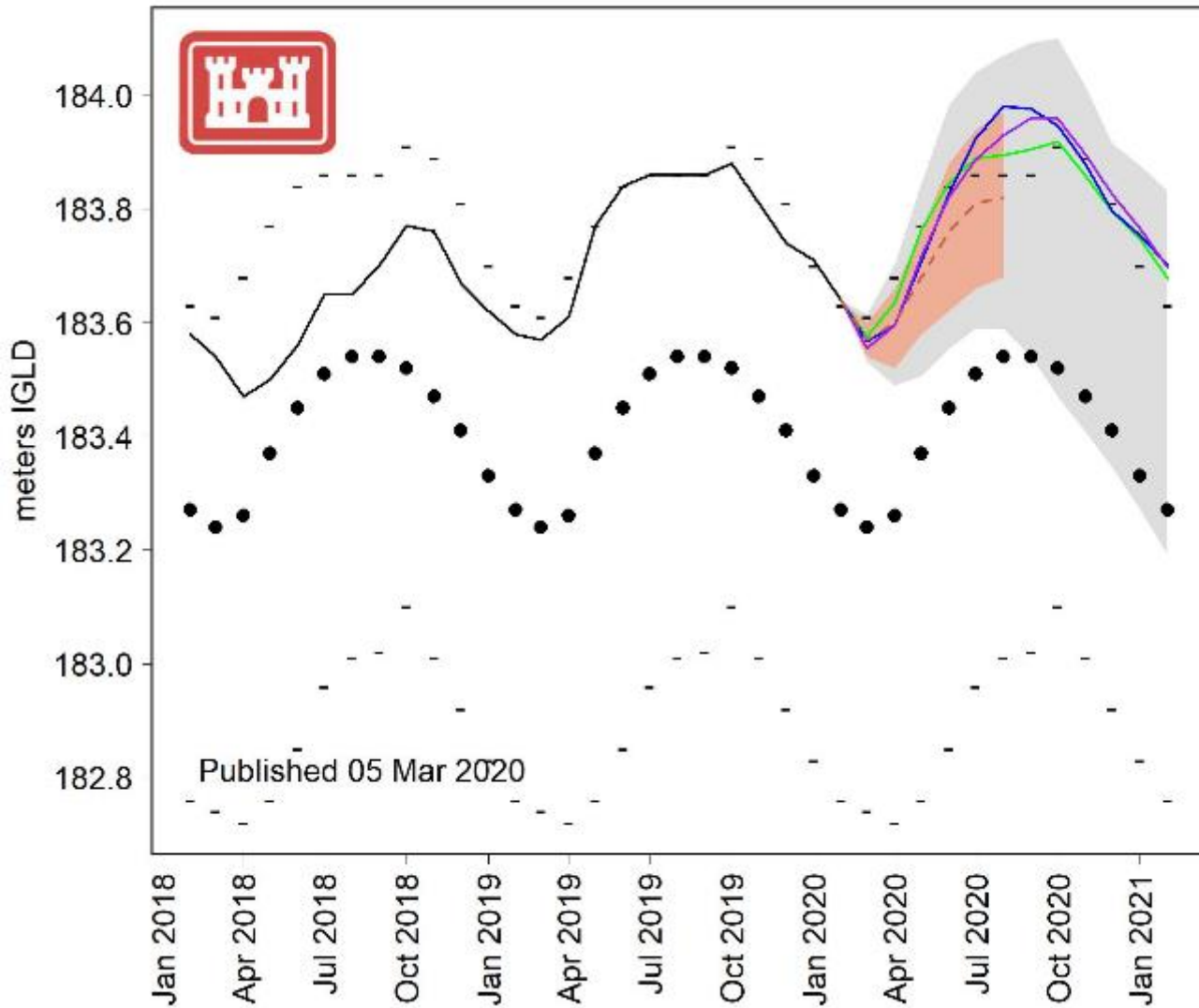




# Water Level Outlook



## Lake Superior Monthly Mean Water Levels



What if.....

Scenario driven based on historical supplies

- Observed Monthly Mean
- Long Term Average
- Long Term Max/Min
- Range of Possible Outcomes
- Mar Bulletin Forecast Range
- - Bulletin Forecast Most Probable
- 2019
- 1996
- 2017

Published 05 Mar 2020



# WATER LEVEL RESOURCES



## GREAT LAKES WATER LEVEL RESOURCES AND CONTACT INFORMATION

### Websites

<b>USACE Detroit District</b>	Link at the top of the page provides USACE resources related to high water levels	<a href="https://www.lre.usace.army.mil">https://www.lre.usace.army.mil</a>
<b>Water level forecasts</b>	Monthly Bulletin of Great Lakes Water Levels (6-month forecast)	<a href="https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/">https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/</a>
	Weekly Great Lakes Water Levels (update on current conditions and forecast for next month)	
	Great Lakes Water Level Outlook (Scenario-based 12-month outlook)	
	Connecting Channels Forecast (channel depths for next month)	
<b>Water level observations</b>	Current Conditions (preliminary daily lake-wide average levels and connecting channel water levels)	<a href="https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Water-Level-Data/">https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Water-Level-Data/</a>
	Historical Data (long term average, maximum, and minimum Great Lakes water levels)	
<b>Basin Conditions and Other Great Lakes Information</b>	Water Level Summaries (lake-by-lake summaries of recent conditions)	<a href="https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Basin-Conditions/">https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Basin-Conditions/</a>
	Great Lakes Update Articles (periodic publications on various Great Lakes topics)	
<b>Living on the Coast</b>	Brochure on coastal impacts	<a href="https://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/CoastalProgram/Living%20on%20the%20Coast%20Booklet.pdf?ver=2016-06-06-105107-683">https://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/CoastalProgram/Living%20on%20the%20Coast%20Booklet.pdf?ver=2016-06-06-105107-683</a>

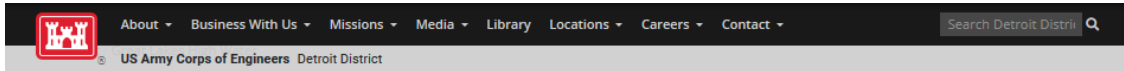
### Contact Information

- Water level forecasts
- John Allis, Chief Office of Great Lakes Hydraulics and Hydrology (313-226-2137)
  - Lauren Fry (313-226-3020)
  - Deanna Apps (313-226-2979)





HTTPS://WWW.LRE.USACE.ARMY.MIL/ABOUT/GREAT-LAKES-HIGH-WATER/



### Great Lakes High Water

Multiple record high levels were set on the Great Lakes in 2019 resulting in increased risks from erosion and coastal flooding. The U.S. Army Corps of Engineers, Detroit District, is committed to ensuring public safety while providing technical expertise and assistance during this time of high water around the Great Lakes.



During response operations, our Emergency Management Office conducts emergency operations to save lives and protect improved properties. In the event of natural disasters such as flooding, emergency permit procedures can be activated to expedite permits to reduce further damage, and protect life and property. The Corps of Engineers has authority to provide technical and planning assistance for flood plain management planning. The Great Lakes Hydraulics and Hydrology Office forecasts and monitors water levels of the Great Lakes and the conditions that lead to water level fluctuations.



### Helpful Links

- [Apply for a Permit](#)
- [Check Permit Application Status](#)
- [USACE, Detroit District, Role in Emergency Management](#)
- [International Lake Superior Board of Control](#)
- [Environment and Climate Change Canada](#)
- [Michigan Sea Grant](#)
- [NOAA - Great Lakes Environmental Research Laboratory](#)
- [Living on the Coast Booklet](#)
- [Sandbagging Instructional Video](#)

### Frequently Asked Questions

Click Question to expand Answer

- Why are water levels on the Great Lakes so high? How long is this expected to last?
- Does the U.S. Army Corps of Engineers have control over Great Lakes water levels?
- My shoreline is eroding, can the U.S. Army Corps of Engineers help?
- My property is flooding, can the U.S. Army Corps of Engineers help?
- What type of shoreline project requires a permit?



- [Emergency Management Office](#)
- [Hydraulics and Hydrology Office](#)
- [Outreach Office](#)
- [Regulatory Office](#)
- [Public Affairs Office](#)

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