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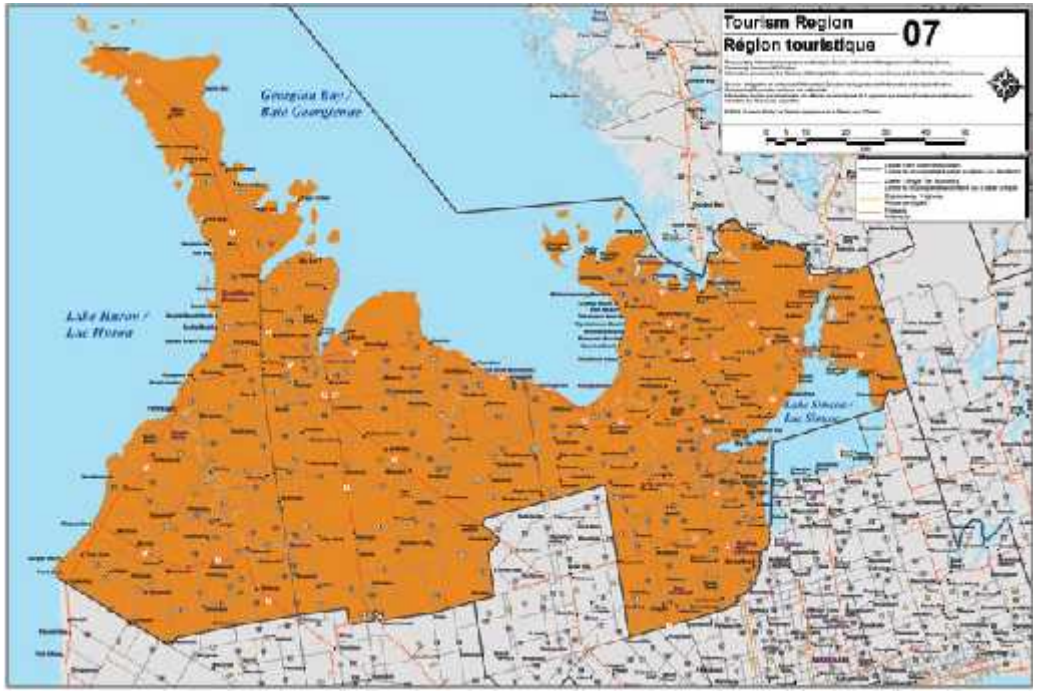
Lake Huron Water Levels – Past, Present and Near Future

Chuck Southam
Boundary Water Issues Unit
MSC Operations Ontario

RTO7 Symposium
Collingwood, Ontario
September 25, 2013

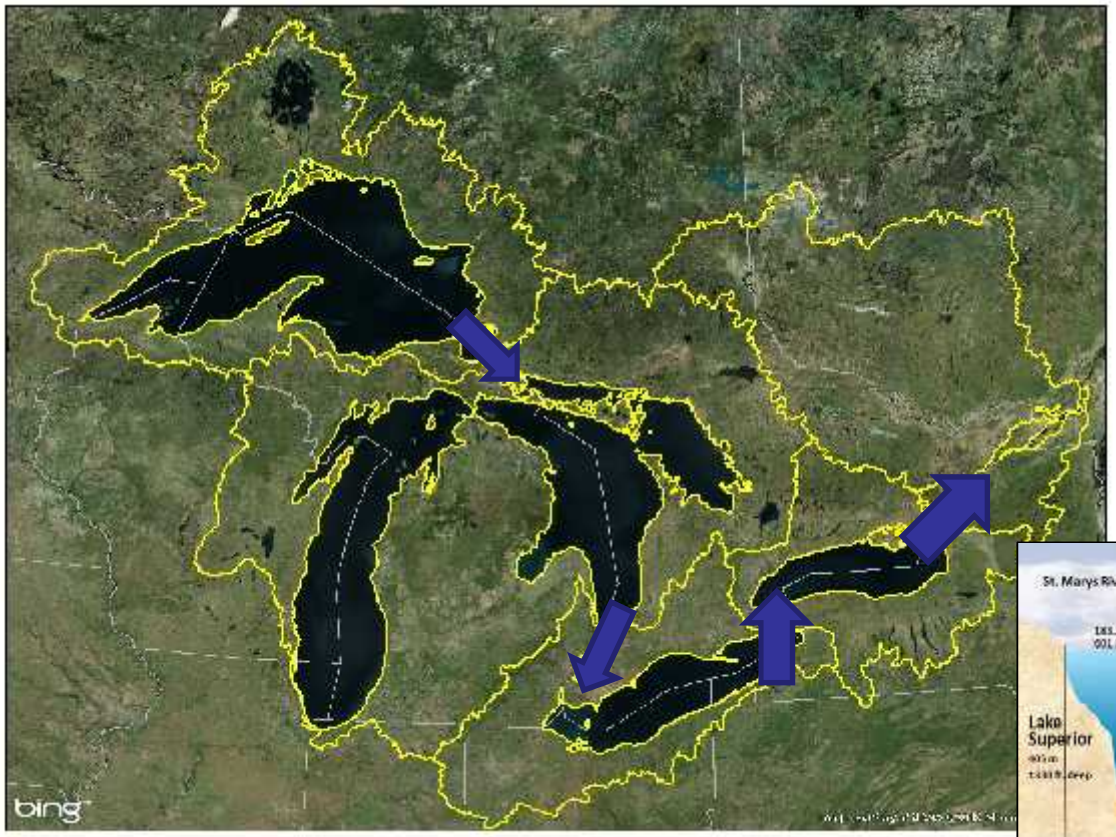


Contents

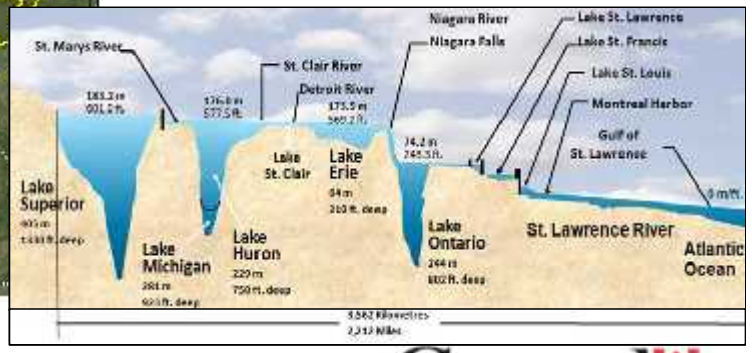
- Description of Great Lakes – St. Lawrence River System
- Formation
- Types of water level fluctuations
- Factors affecting water
  - Natural
  - Human
- Water Levels – Past, Present and Near Future (?)

The Great Lakes – St. Lawrence River System

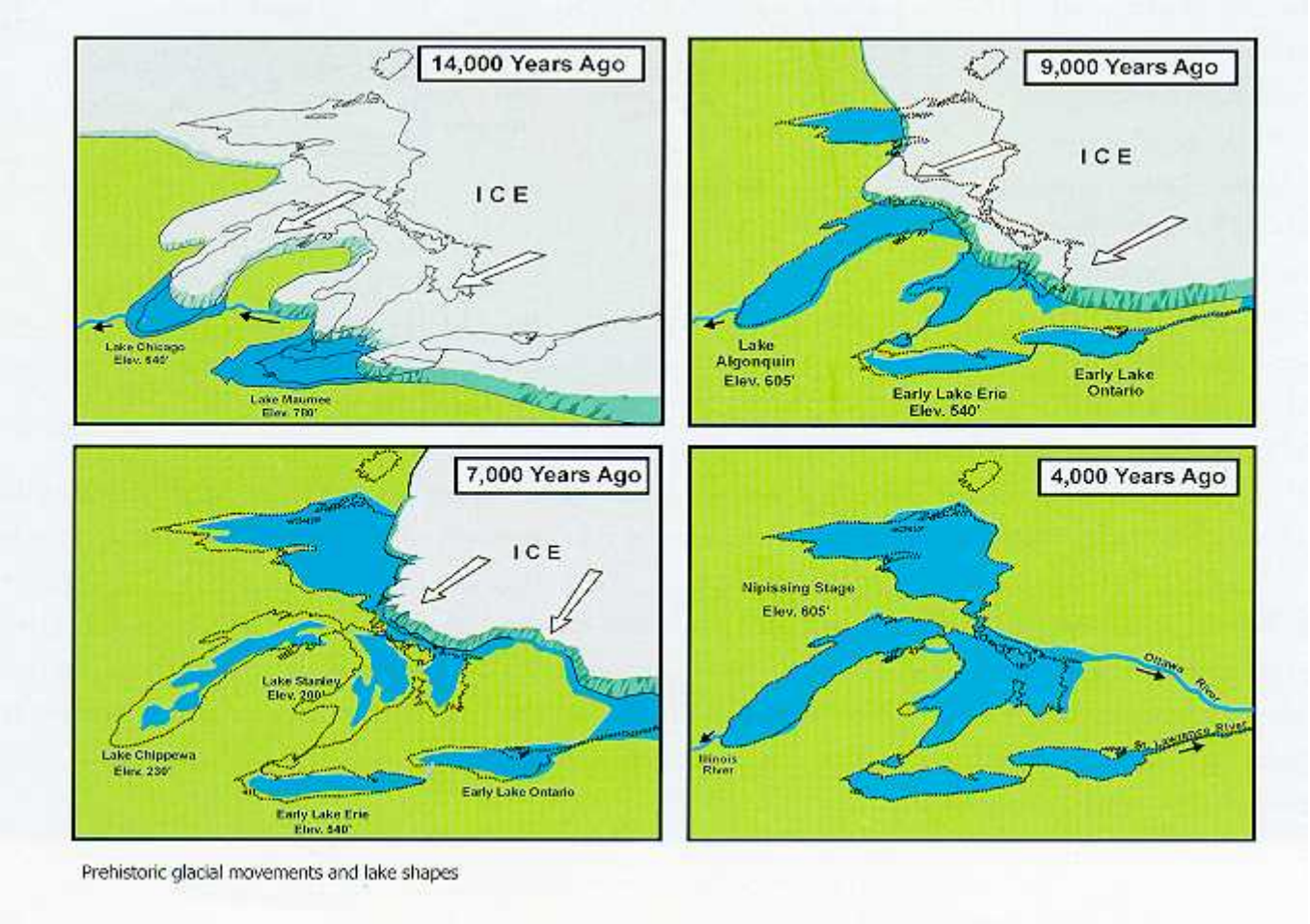
- The Great Lakes Basin covers approximately 774,000 km^2
- The lakes cover ~32% of the basin and contain ~23,000 km^3 of water



	Surface Area
Superior	82,100 km^2
Michigan-Huron	117,000 km^2
Erie	25,700 km^2
Ontario	19,000 km^2
	Volume
Superior	12,100 km^3
Michigan-Huron	8,460 km^3
Erie	484 km^3
Ontario	1,640 km^3

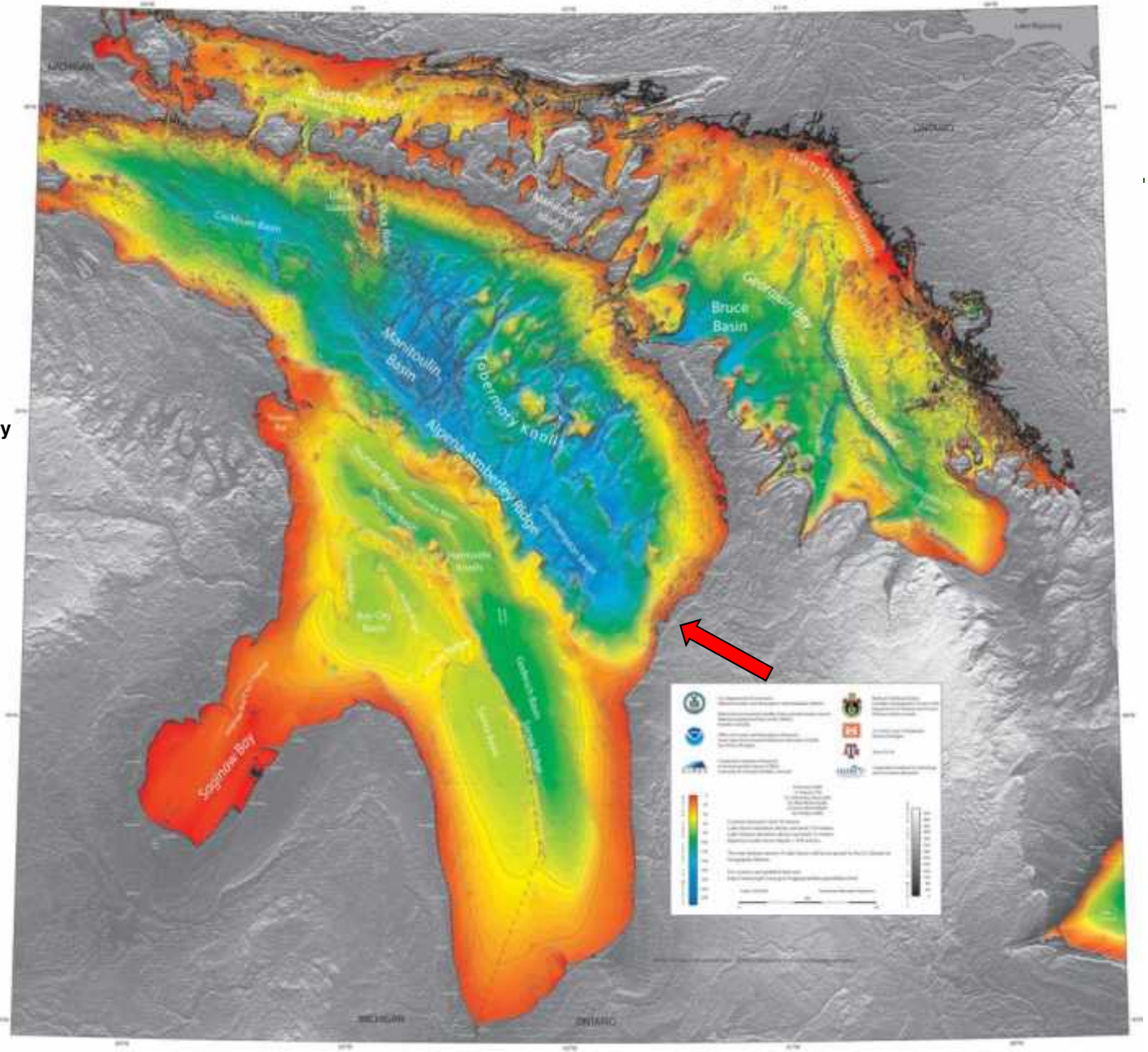


System Formation



Prehistoric glacial movements and lake shapes

Bathymetry of Lake Huron with Topography



NOAA Great Lakes Bathymetry

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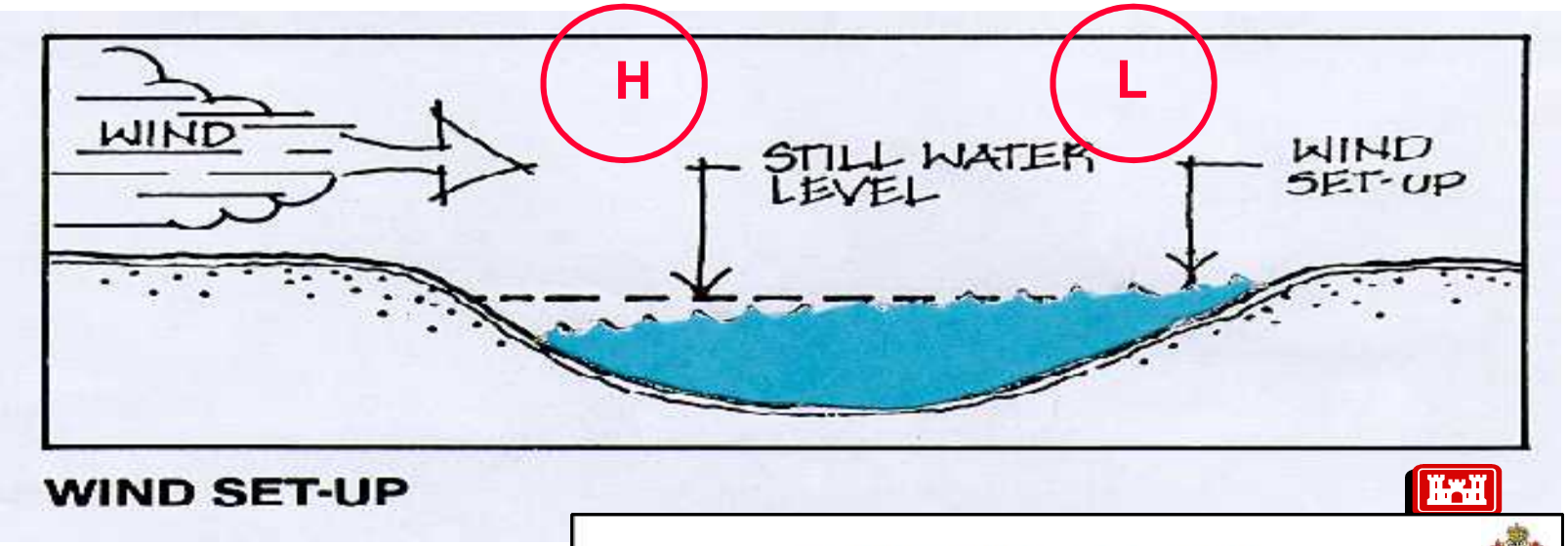
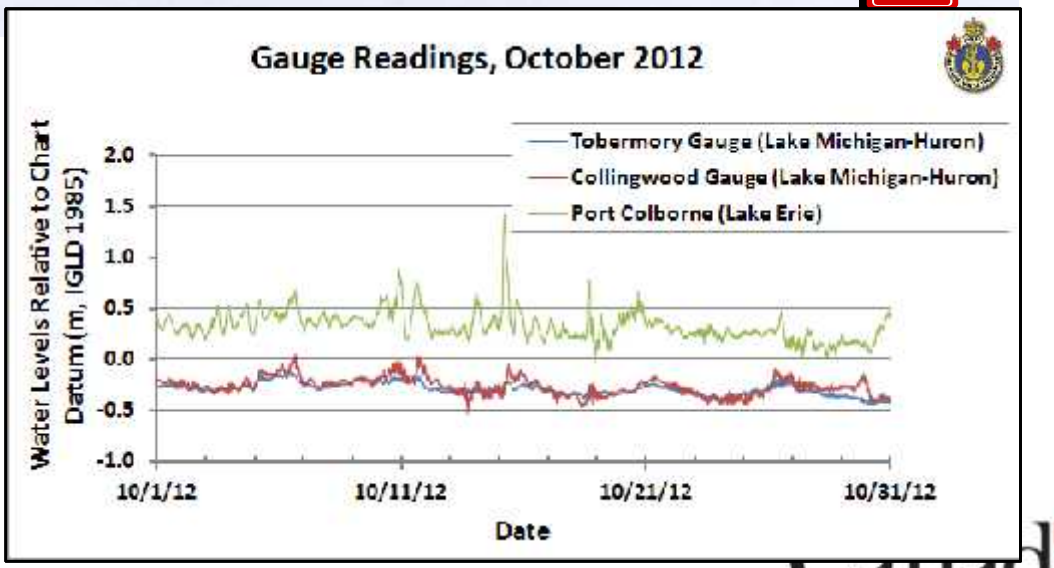
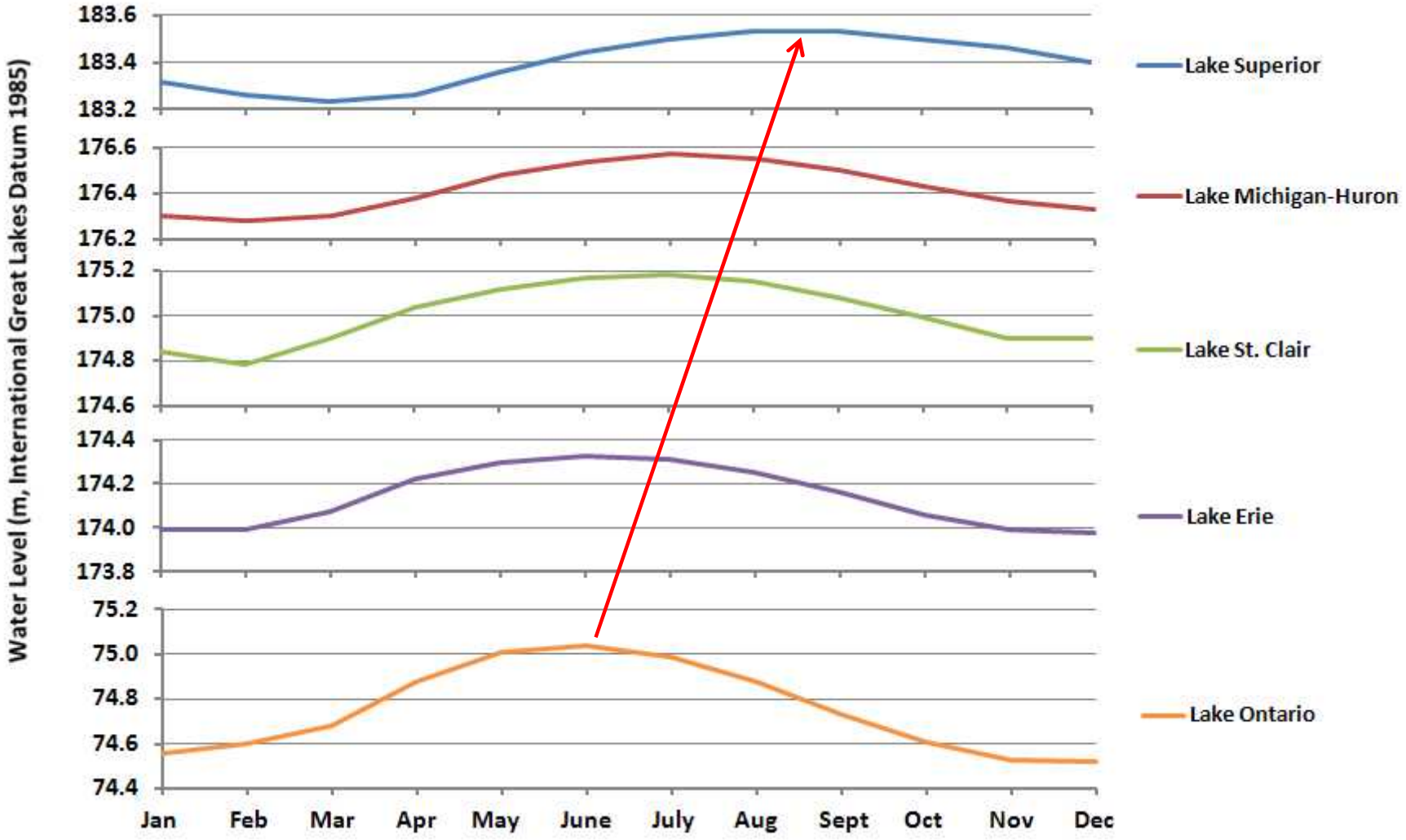
Short-Period Fluctuations





Seasonal Fluctuations



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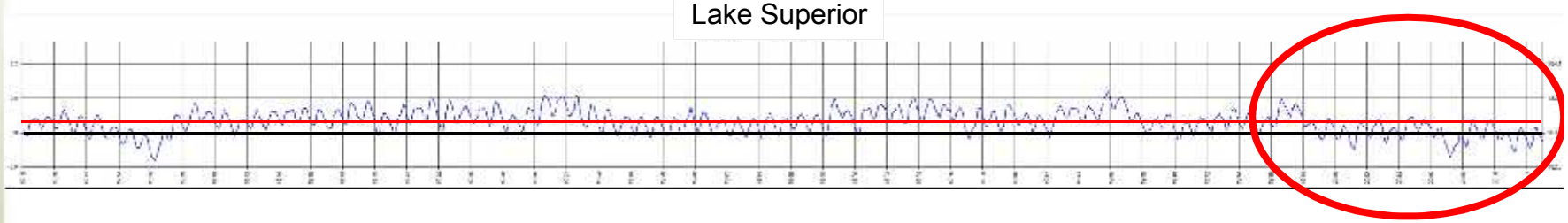
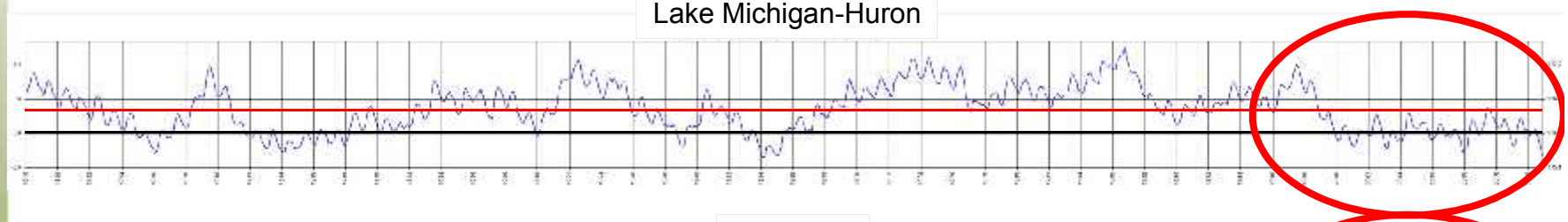
Long-Term Fluctuations

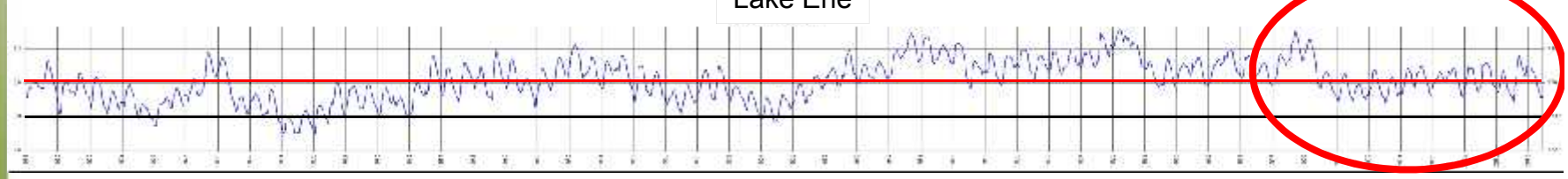
Lake Superior



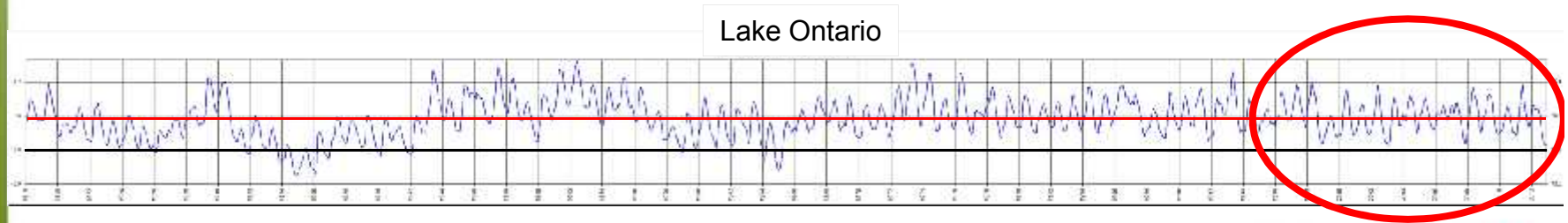
Lake Michigan-Huron



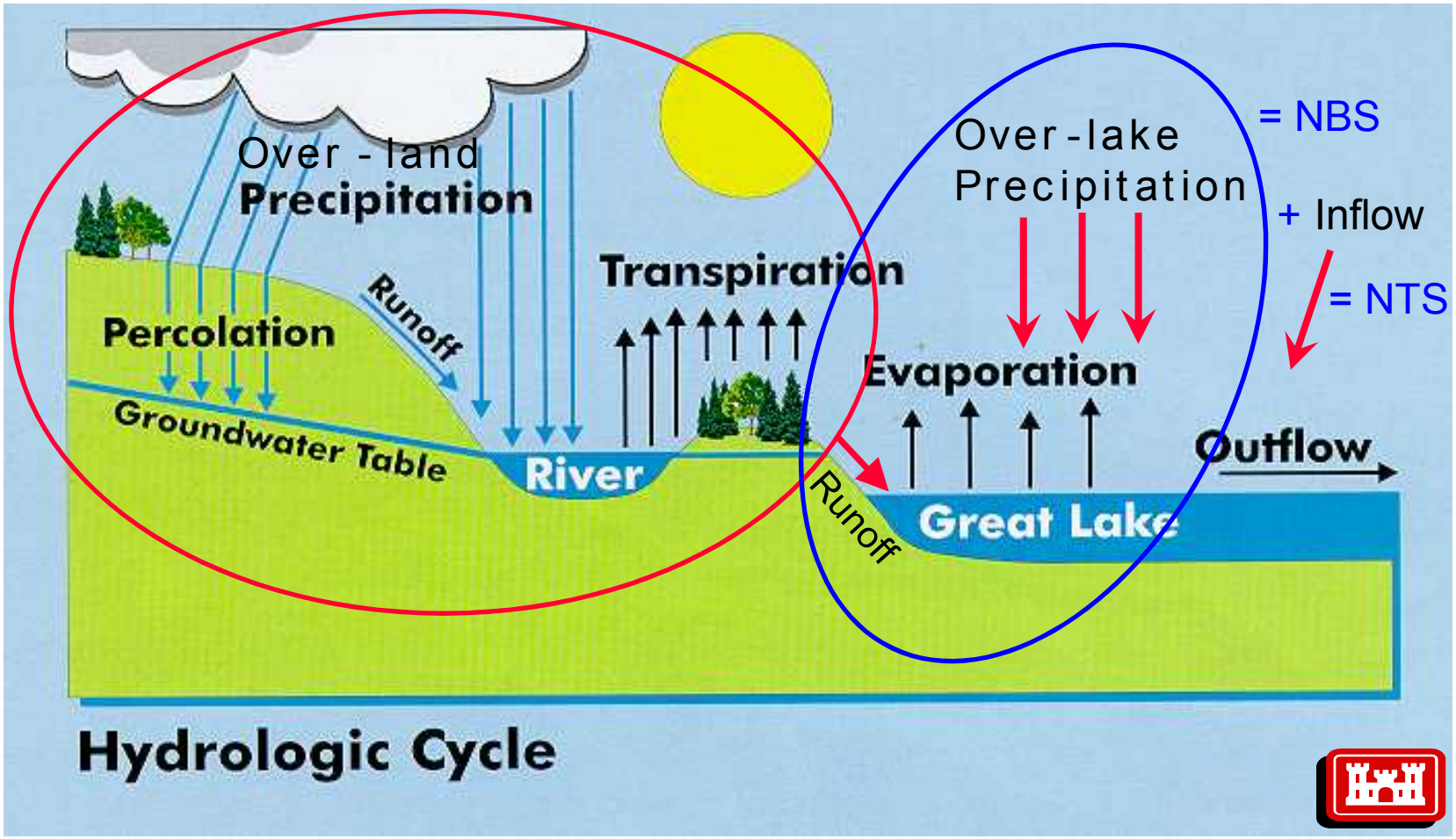
Lake Erie



Lake Ontario

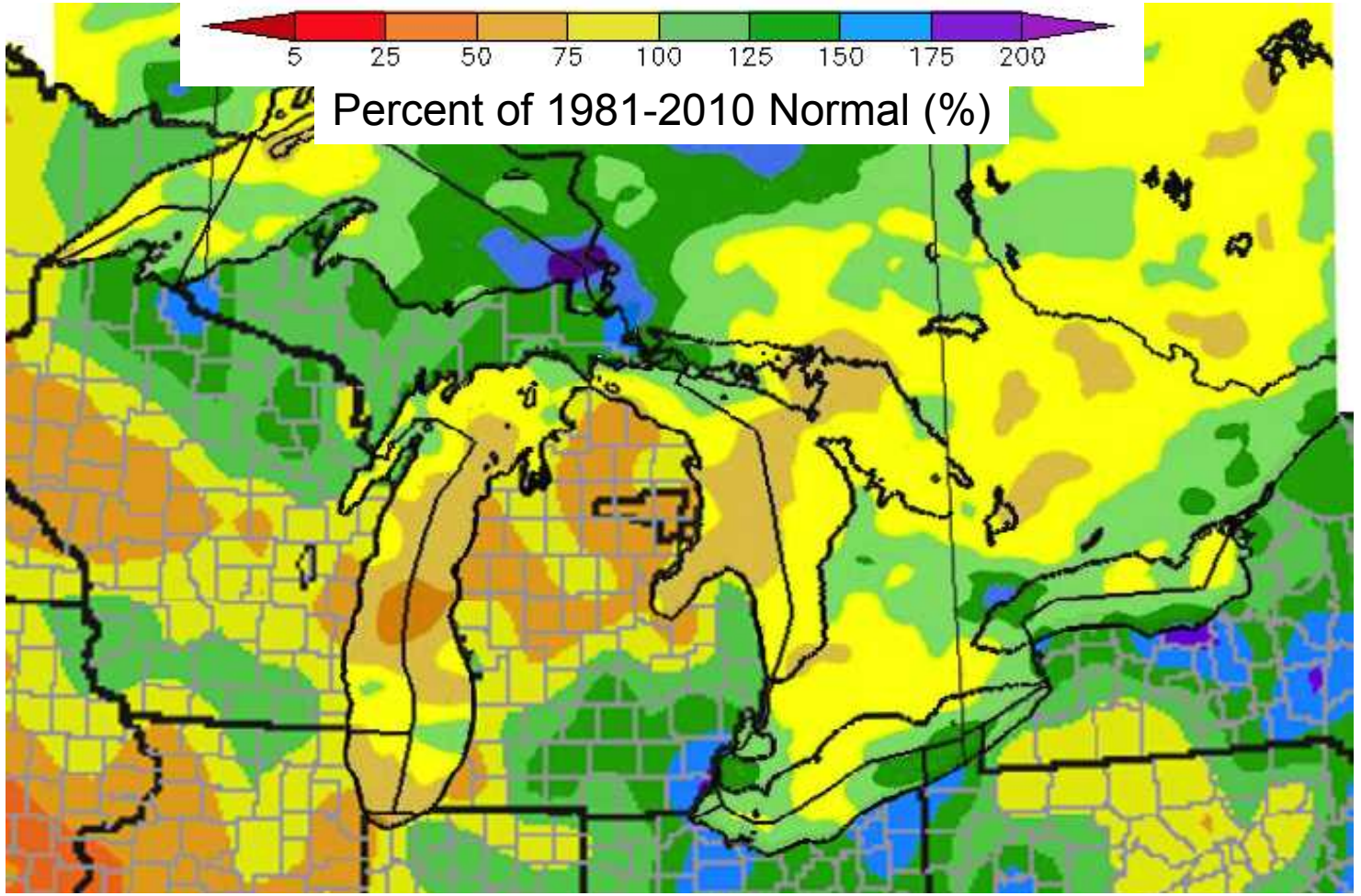


Natural Factors - Hydrologic Cycle



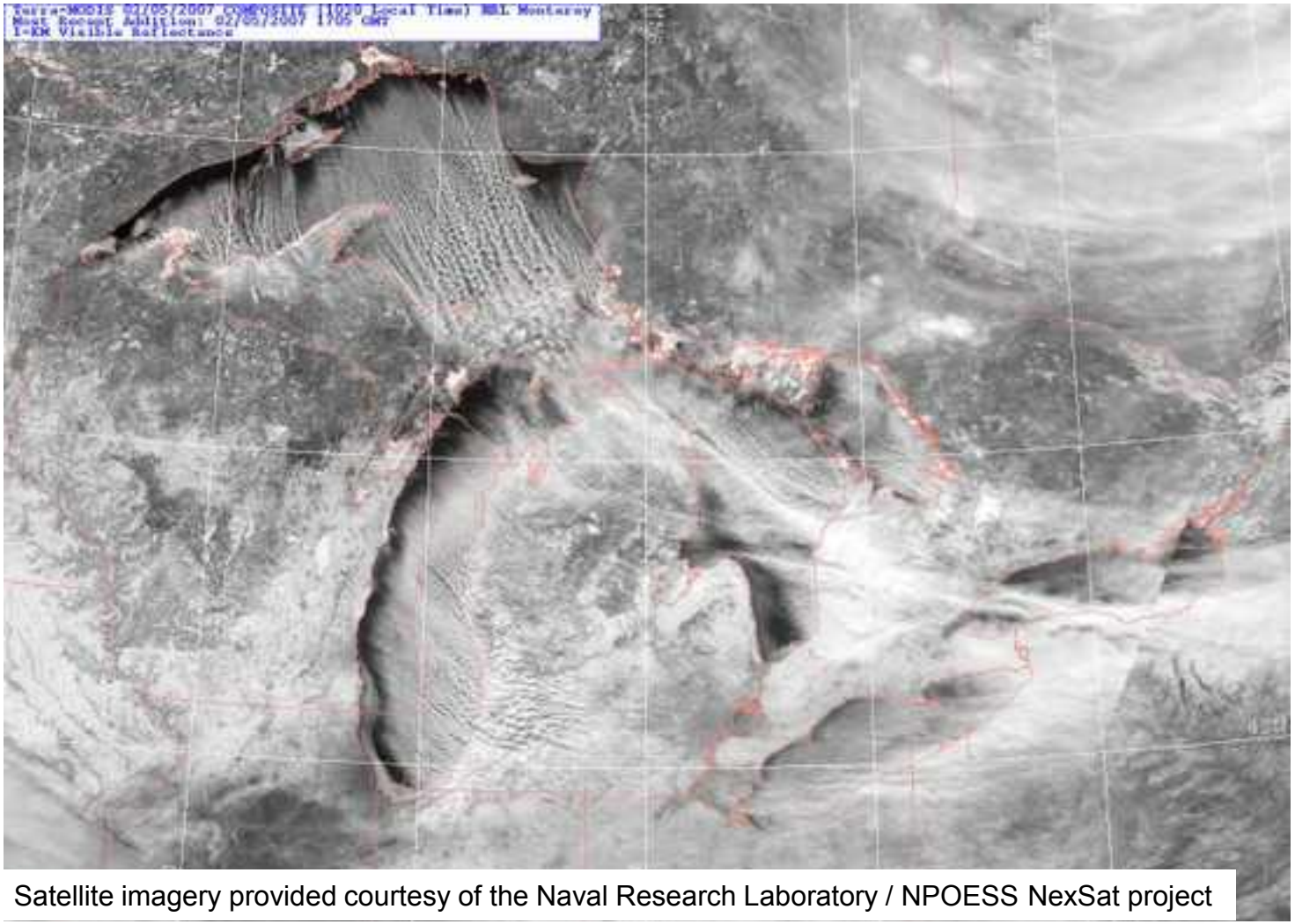
Precipitation Departures: June 1 to August 31, 2013

From: Draft of the *Great Lakes Region Quarterly Climate Impacts and Outlook / Sept. 2013 (Experimental).* In production.



Precipitation: Canada/Great Lakes data based on CaPA U.S. dafa is interpolated station data

Evaporation



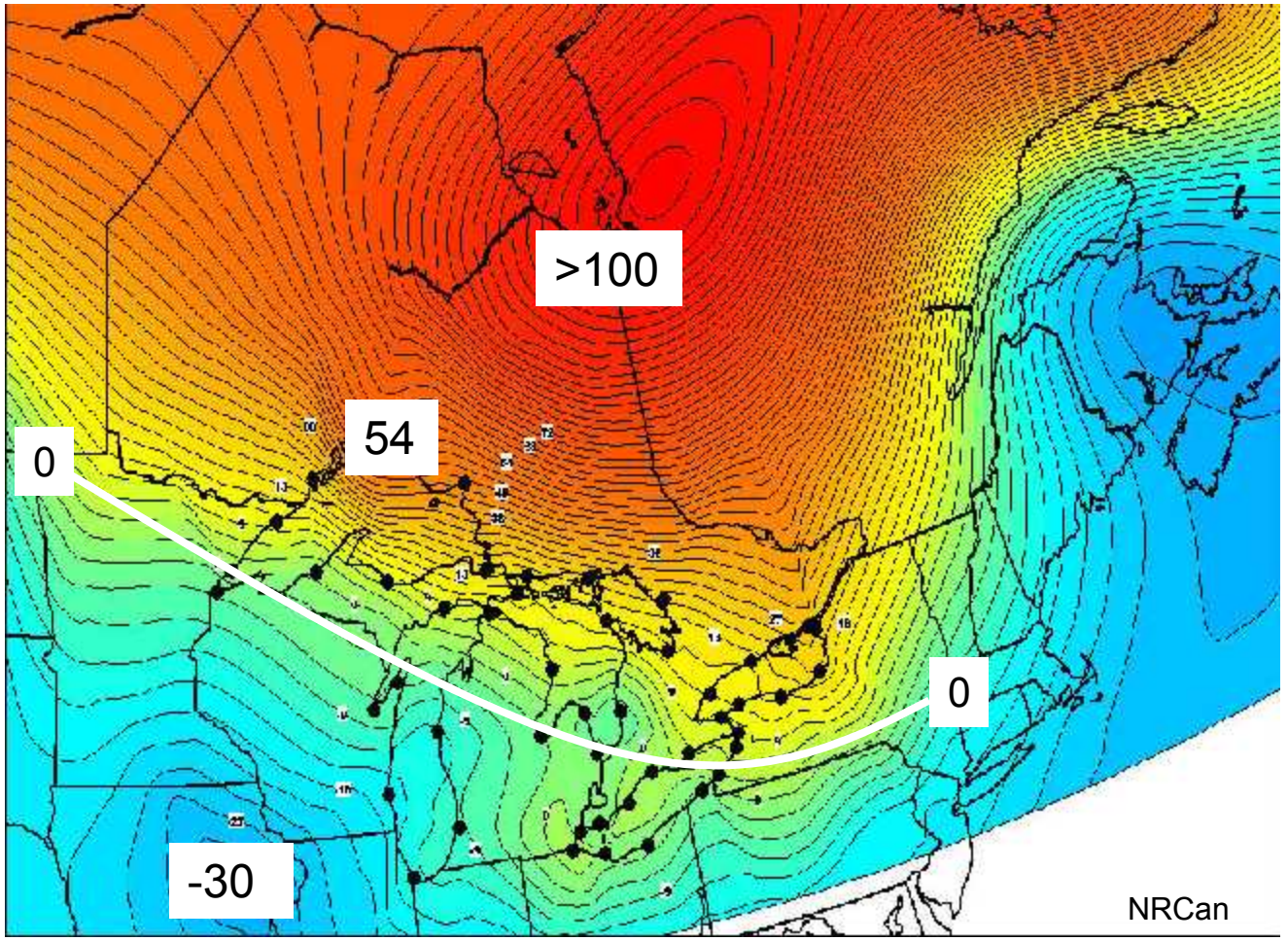
Satellite imagery provided courtesy of the Naval Research Laboratory / NPOESS NexSat project

Inflow

Lake Superior – Summer 2006 (Fay)

Storage & Stage-Discharge Relationships

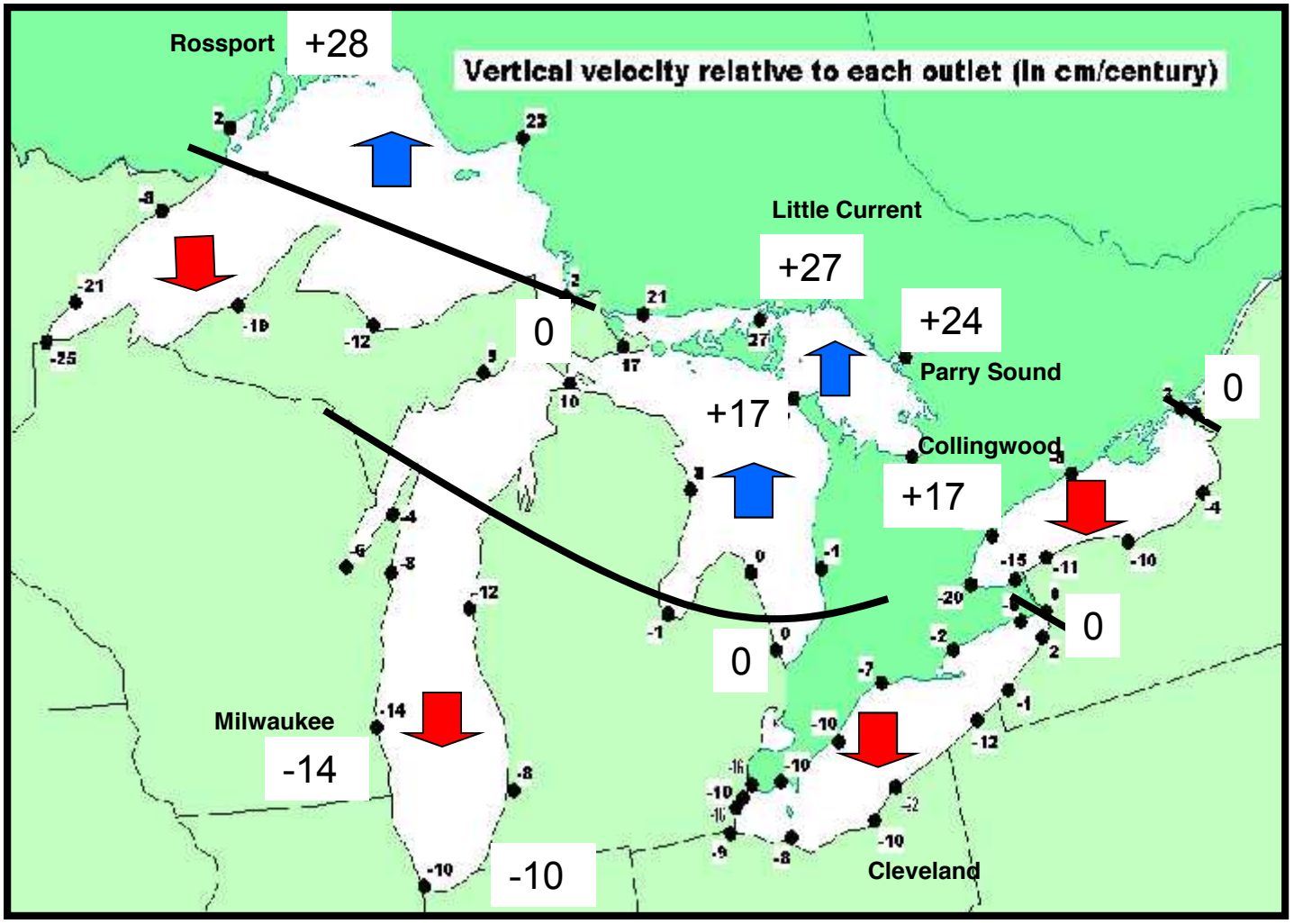
Glacial Isostatic Adjustment (GIA)



Suggested Vertical Velocity of the Earth's crust relative to the centre of the Earth (in cm/century)

Relative Movement

What the land is doing relative to the lake's outlet and the water surface



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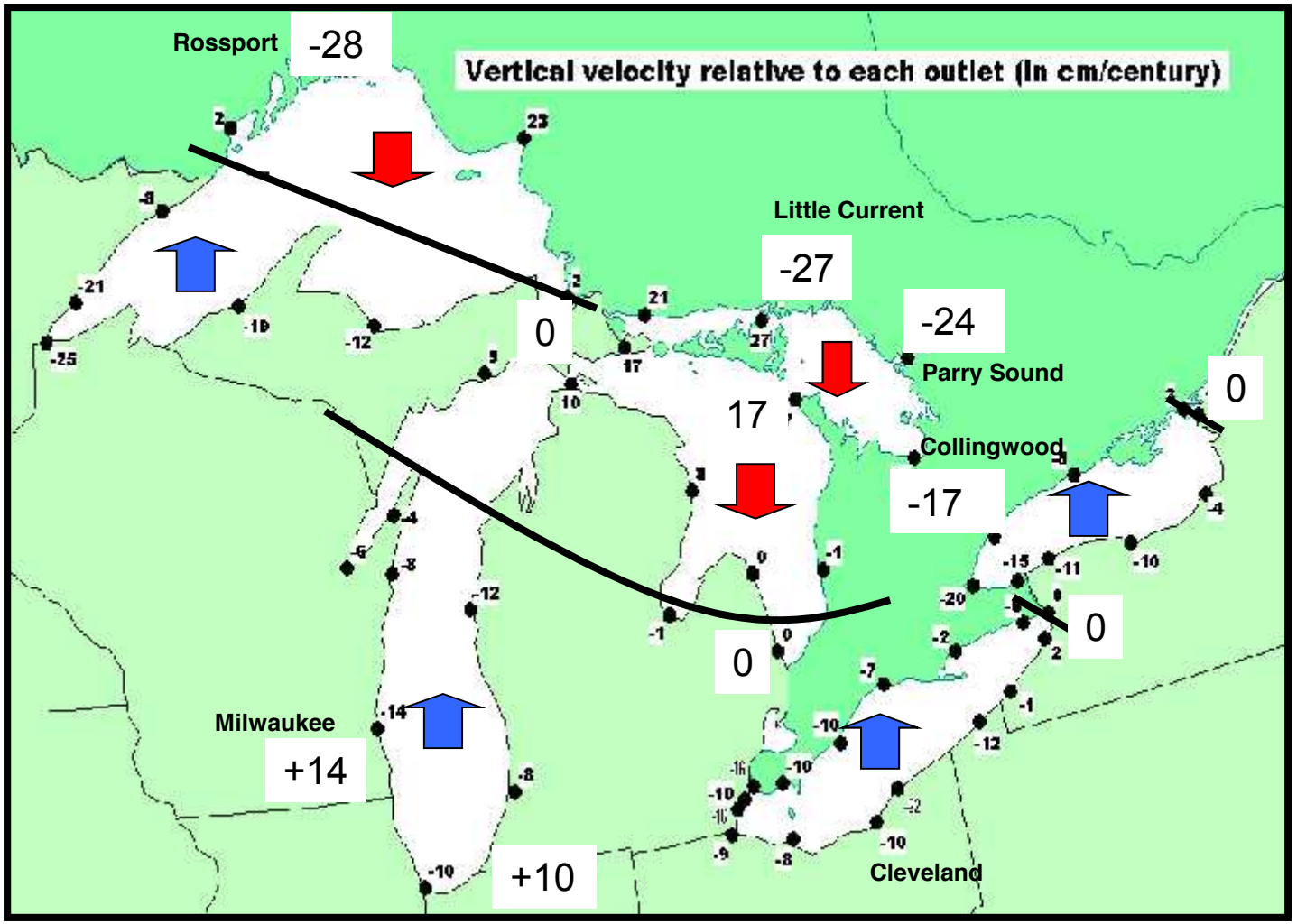
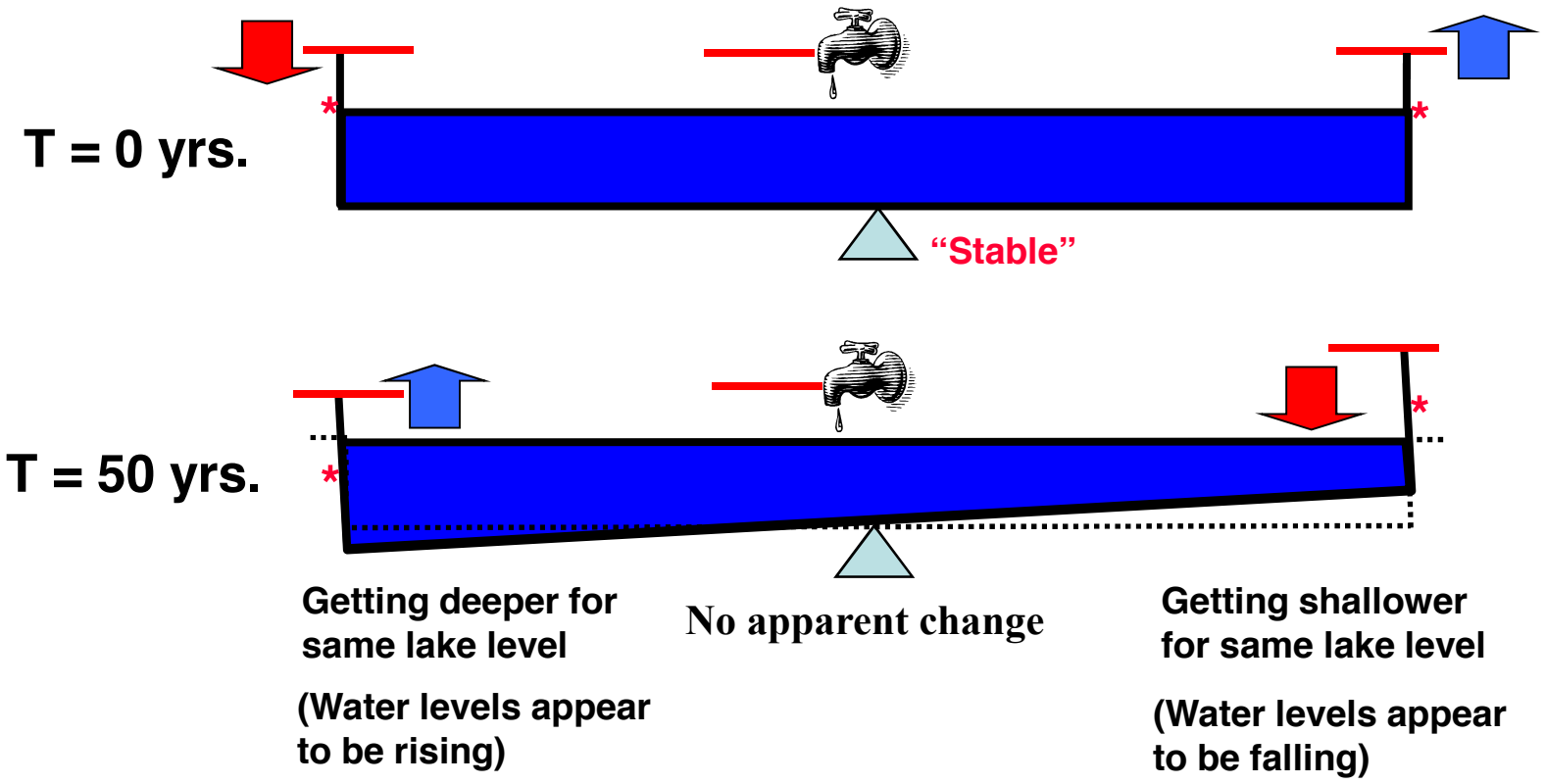
Apparent Impact

What people think the water is doing



Effect of GIA on Land-to-Water Relationship



Human Factors - Regulation

Regulation of Lake Superior Outflows at Sault Ste. Marie on St. Marys River

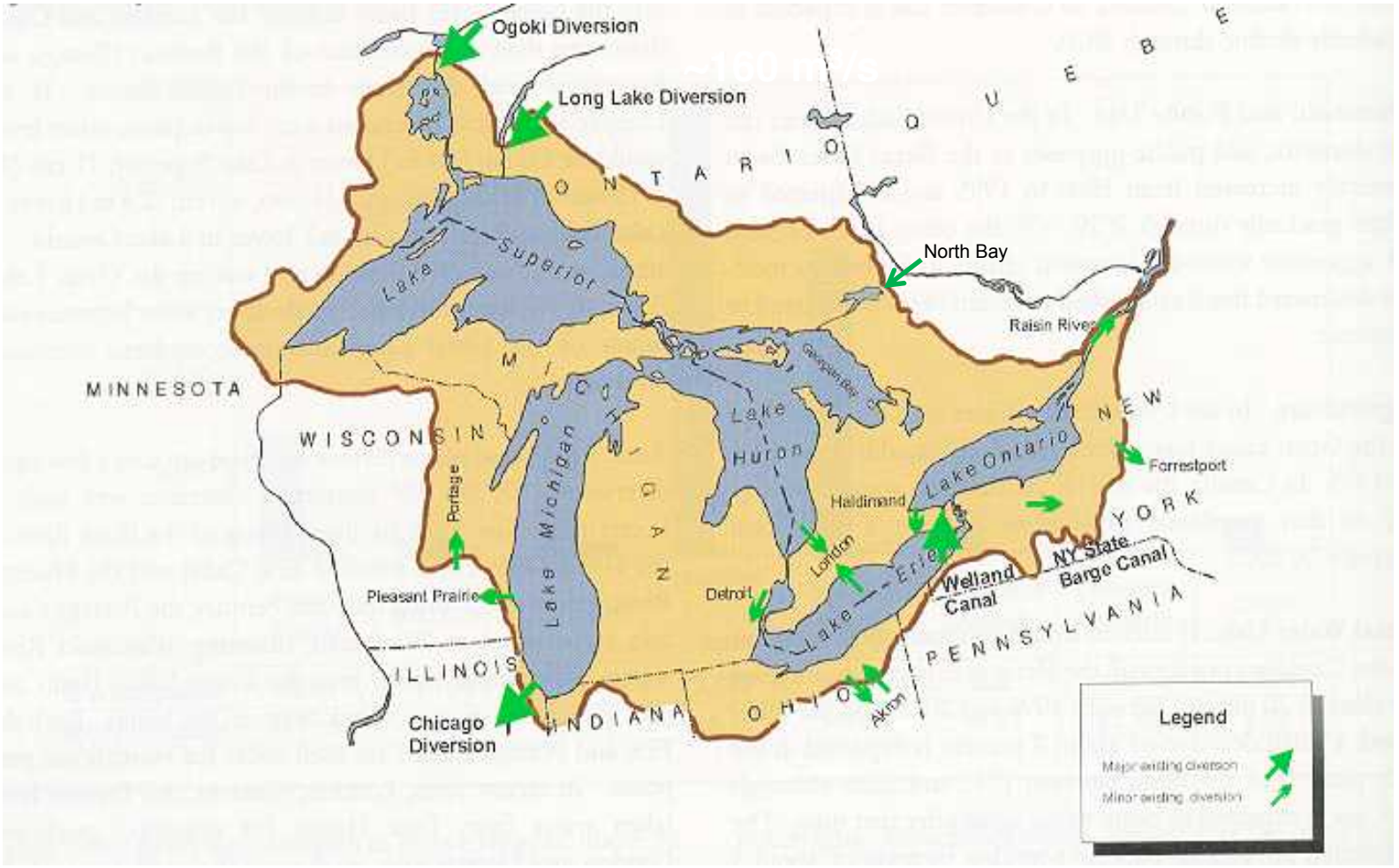
Regulation of Lake Ontario outflows at the Moses-Saunders Dam on the St. Lawrence River at Cornwall/Massena

Upper St. Lawrence R.
(existing control point)

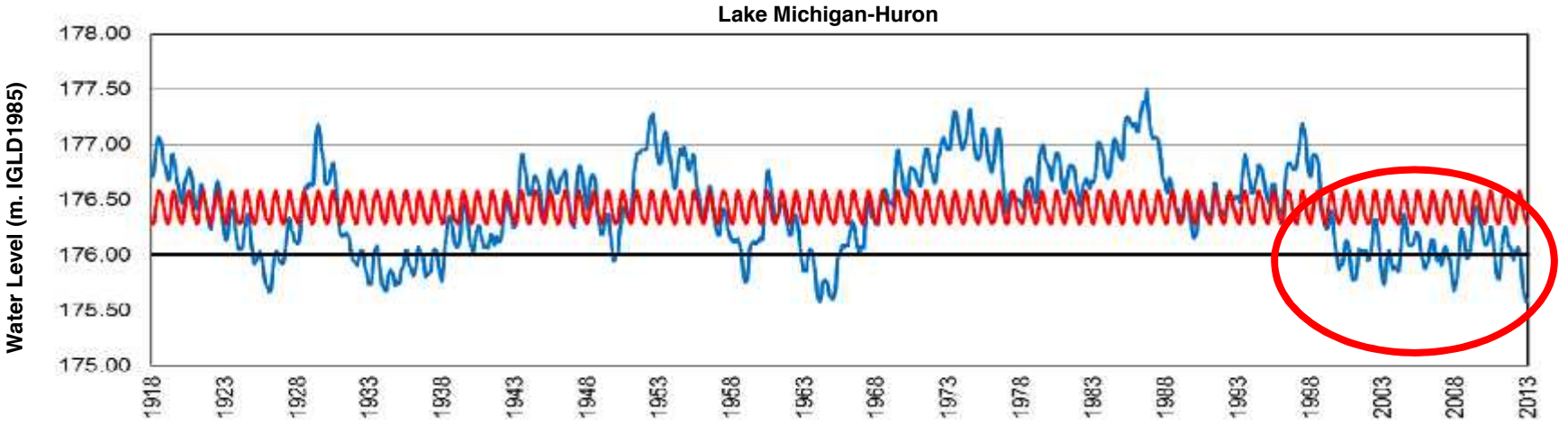
Channel Modifications

- Dredging
- Obstructions (e.g. bridge piers)
- Infilling, armouring
- Ship wrecks
- Ice/weed management

Diversions and Consumptive Uses



Current Low



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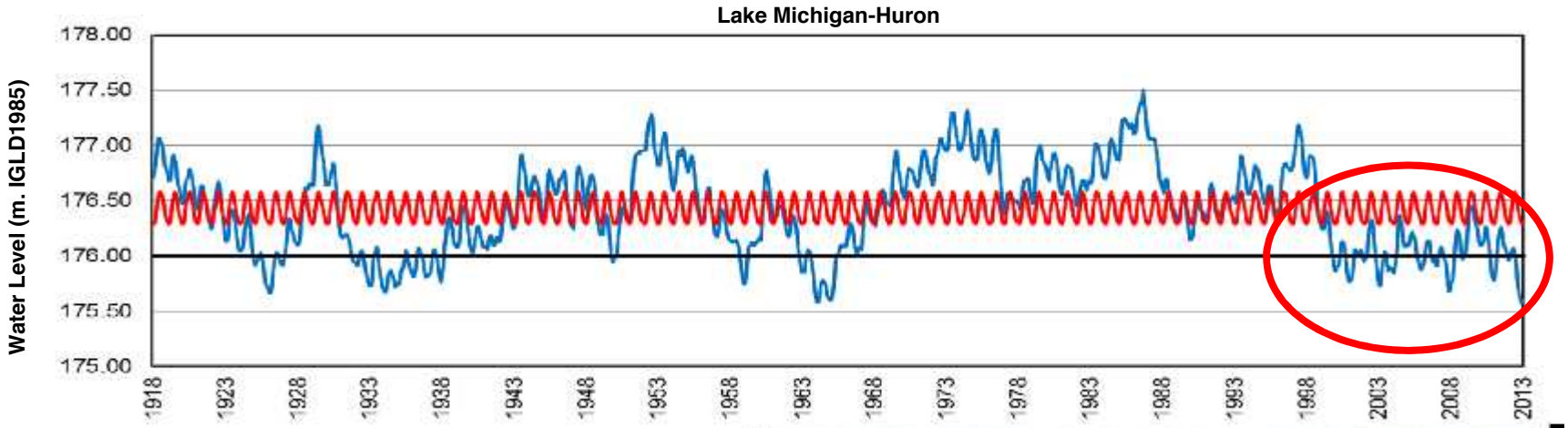

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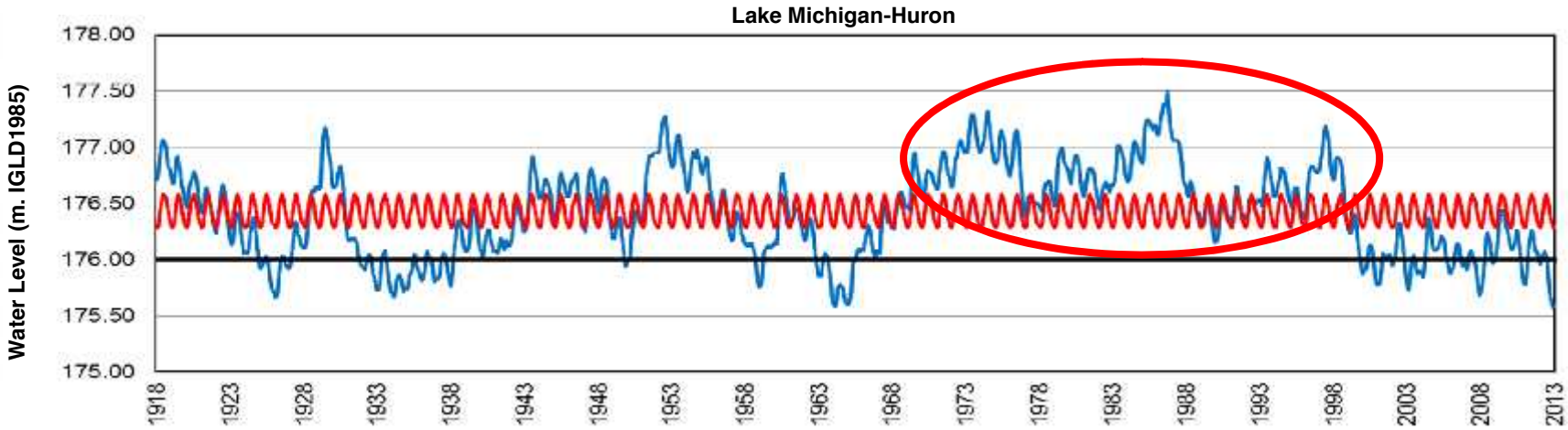
Past Highs



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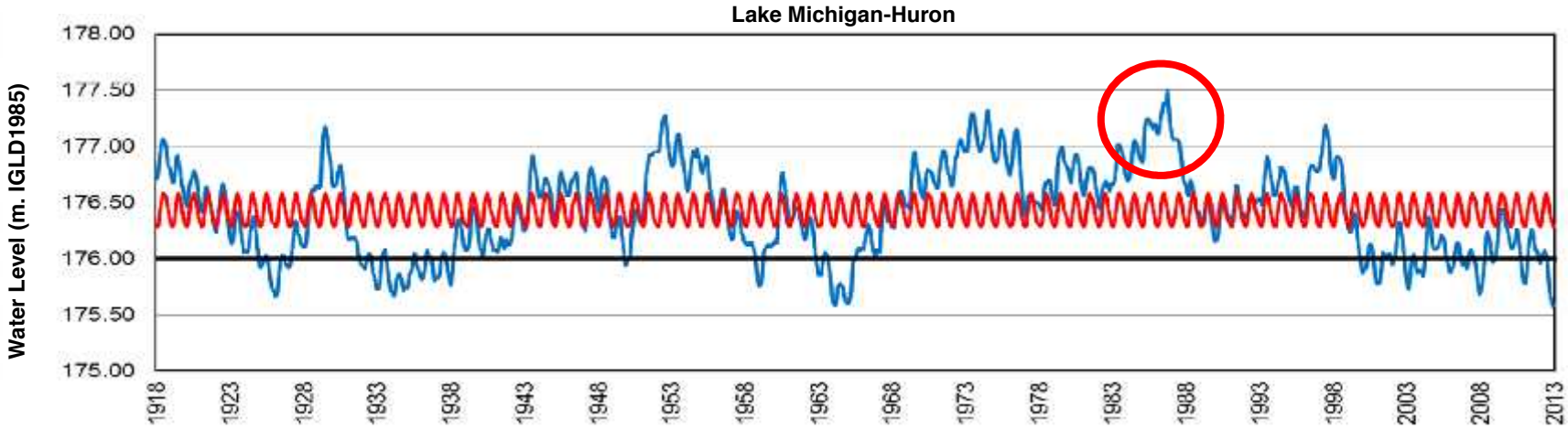

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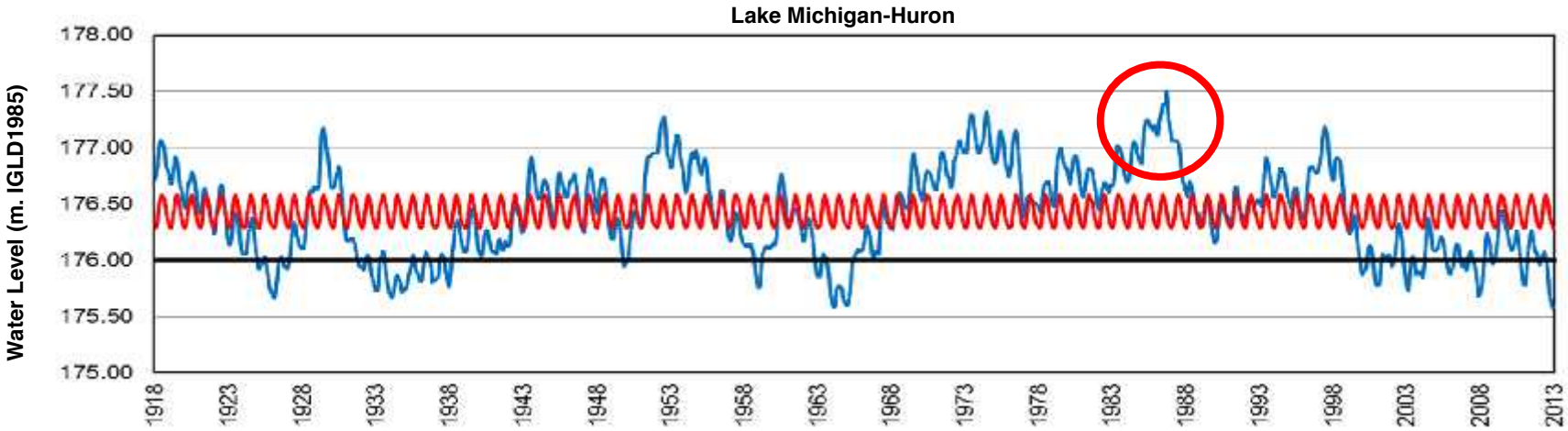

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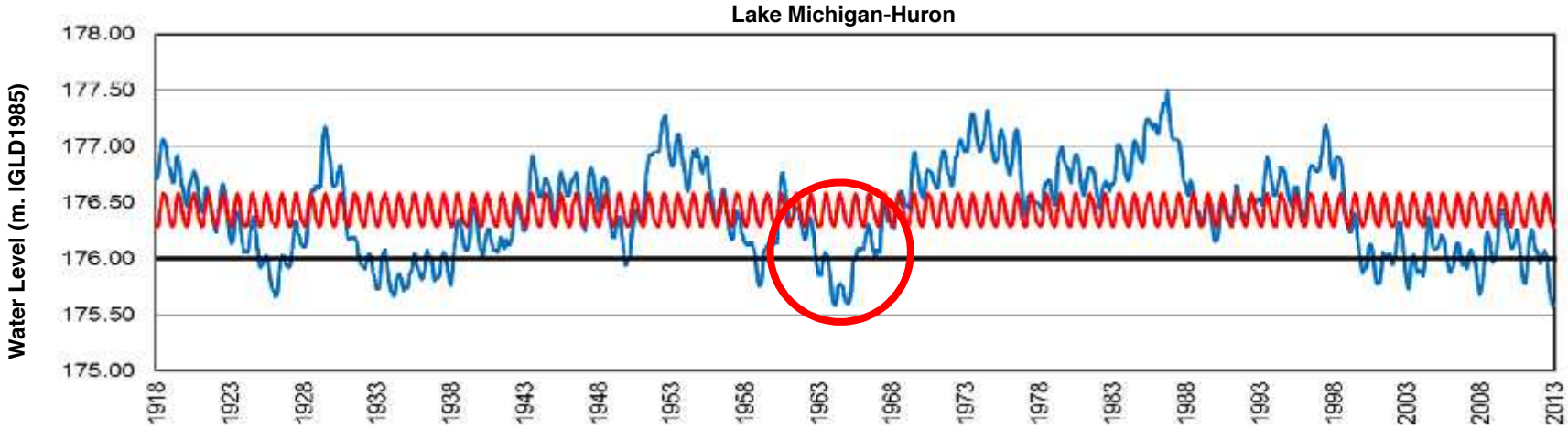
60s Low



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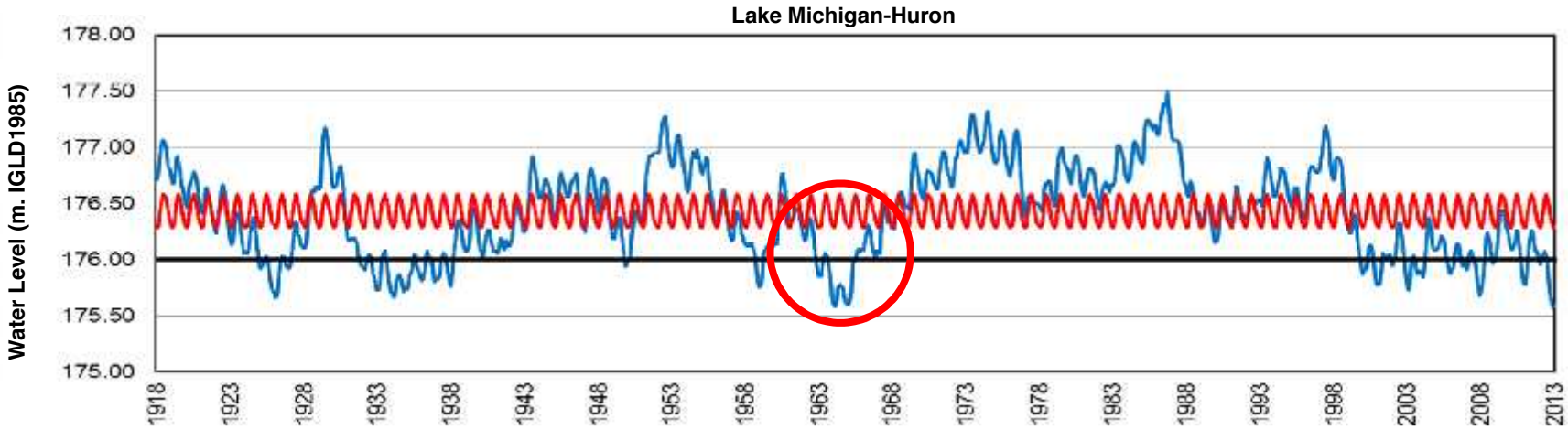

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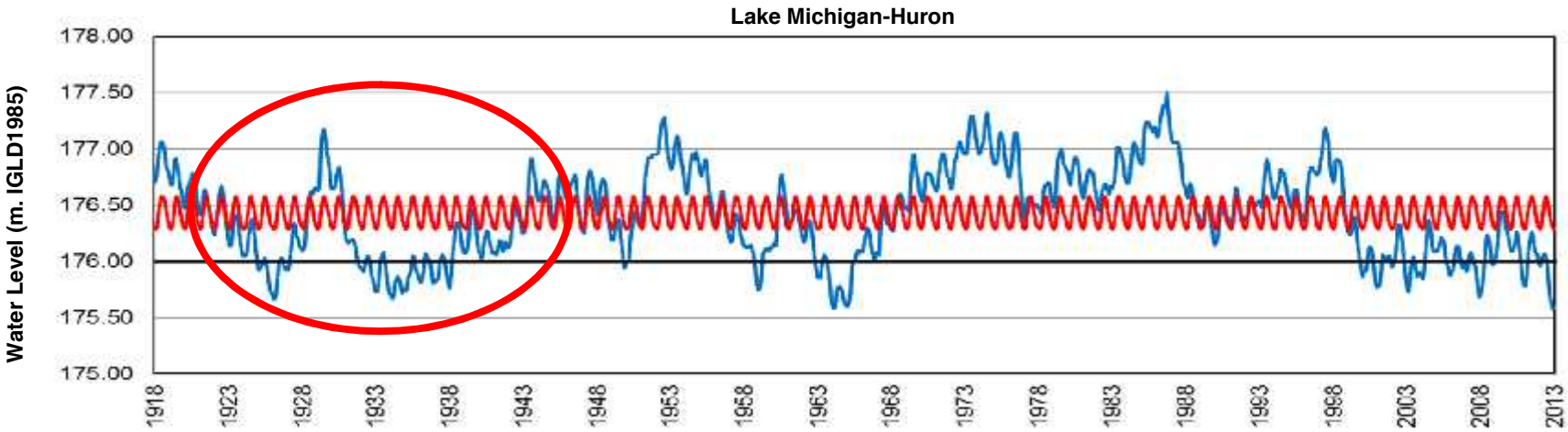
20s & 30s Low-High-Low



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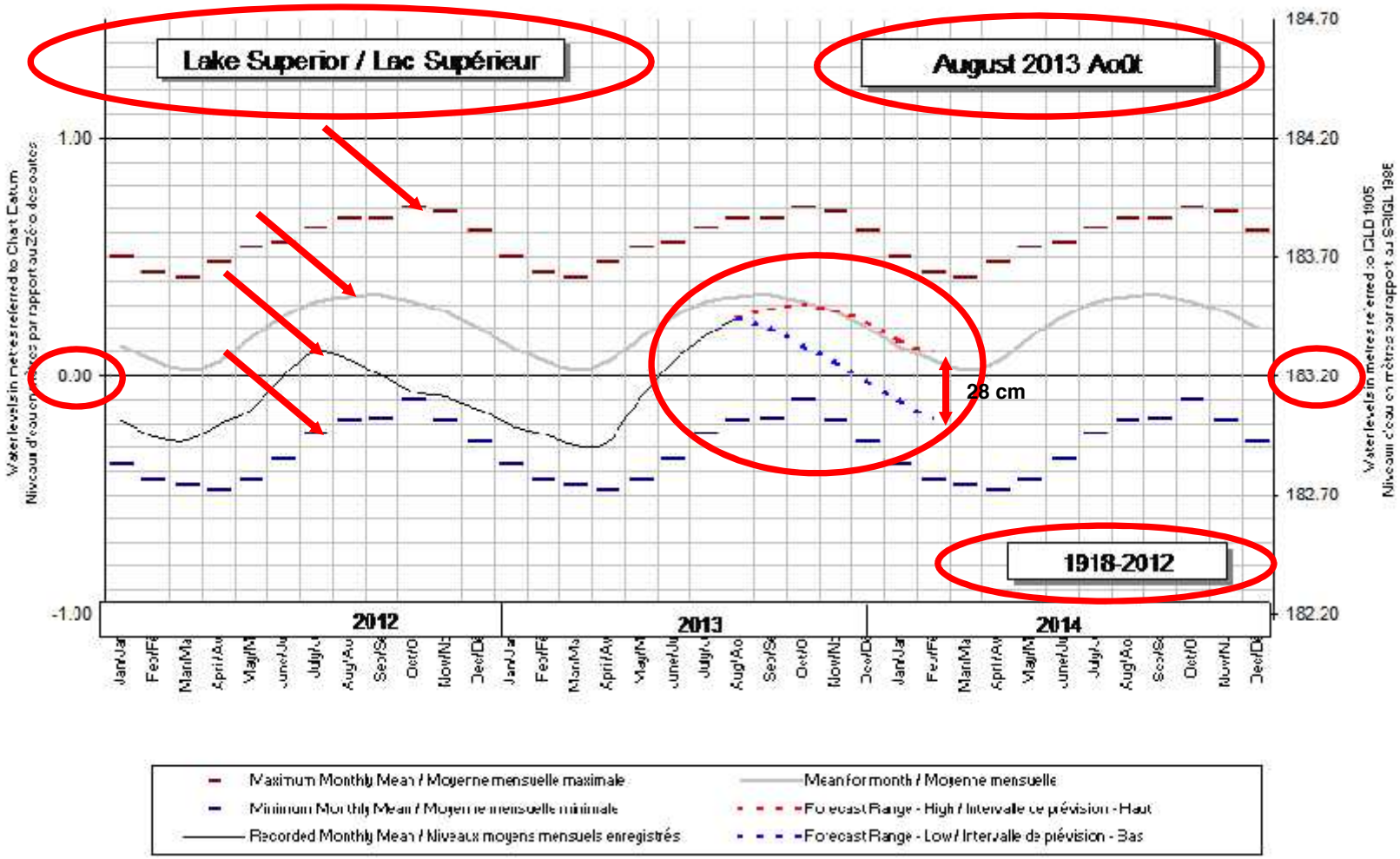
Past, Present & Near Future



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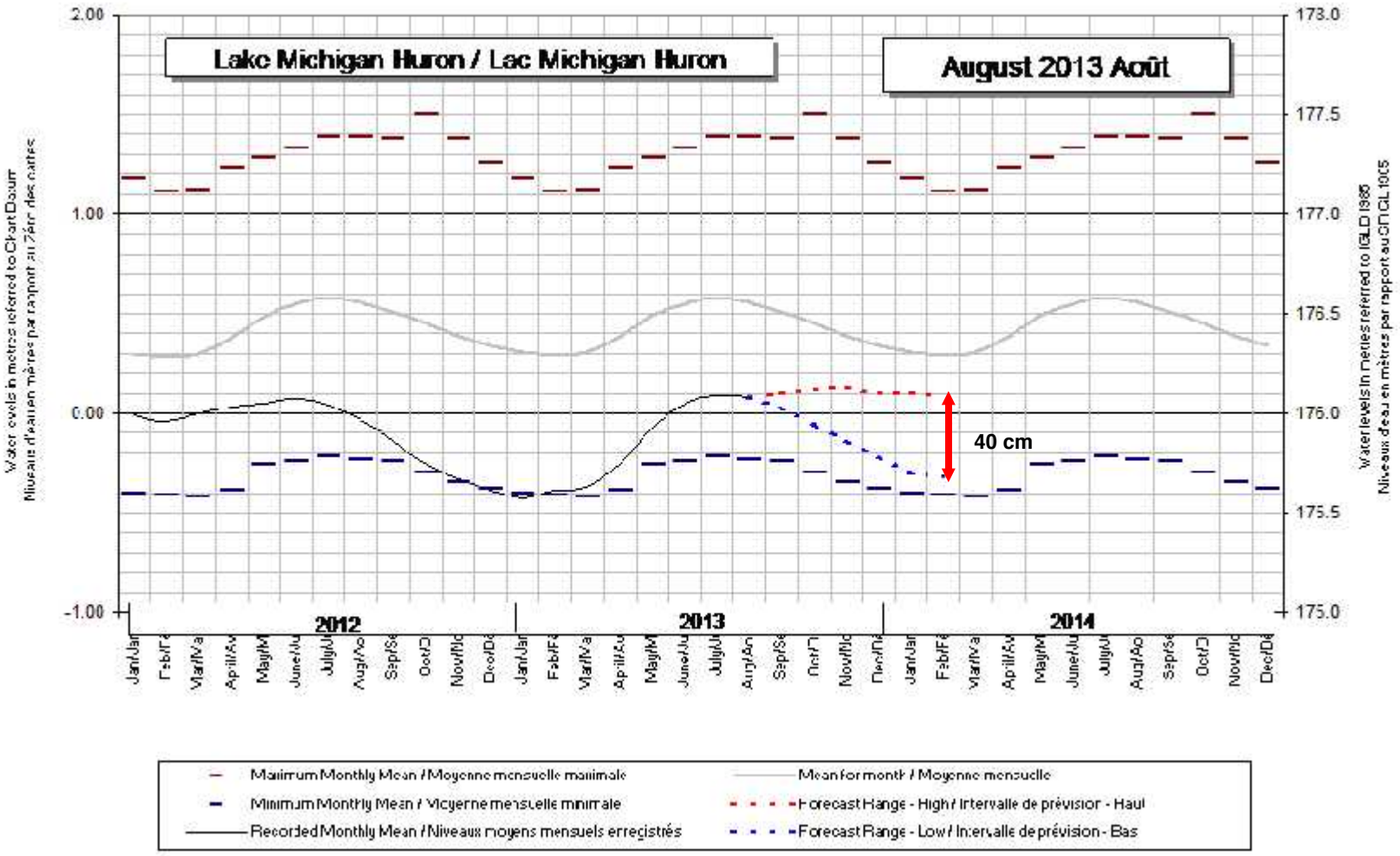
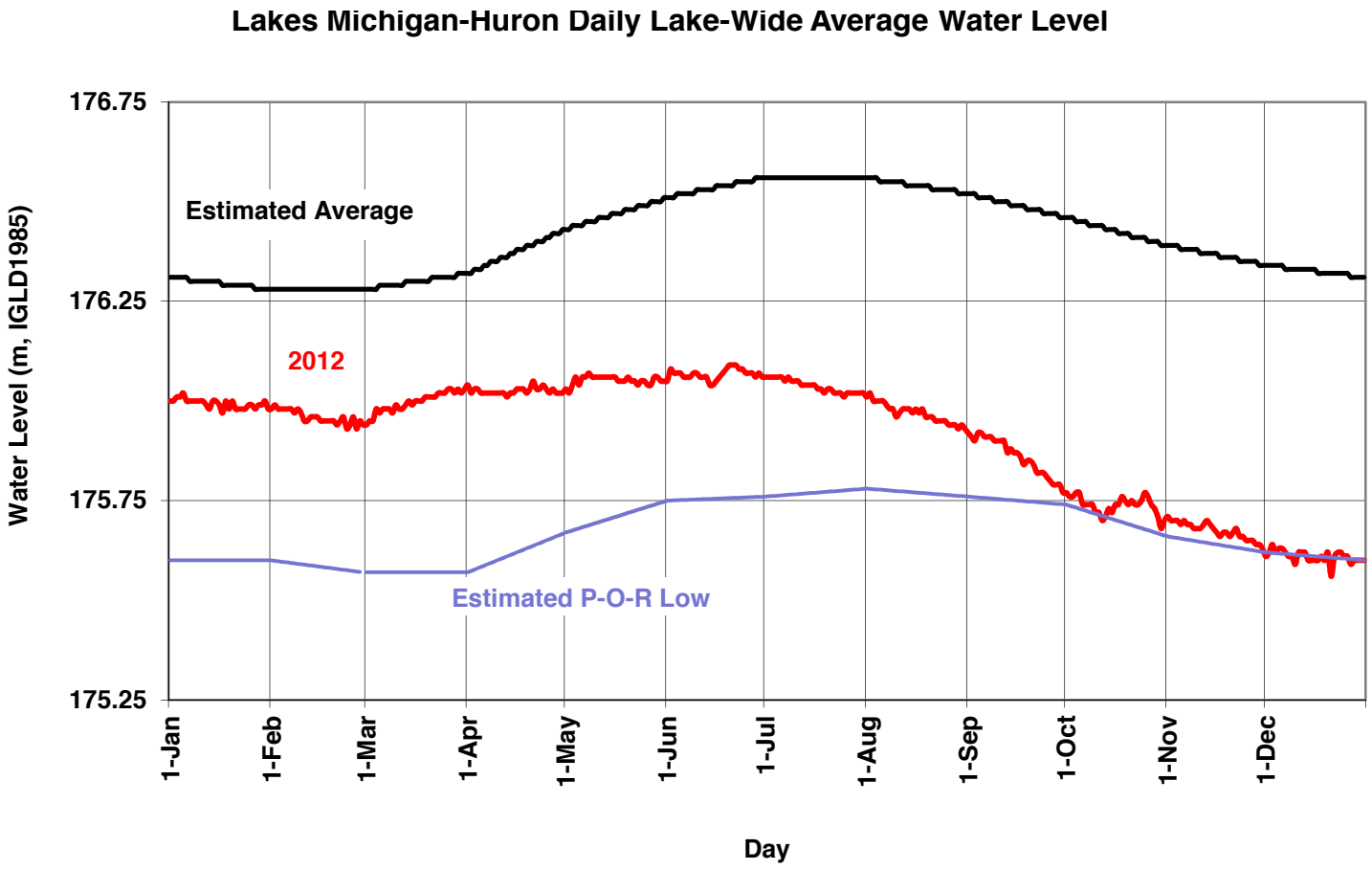


A bit more about M-H



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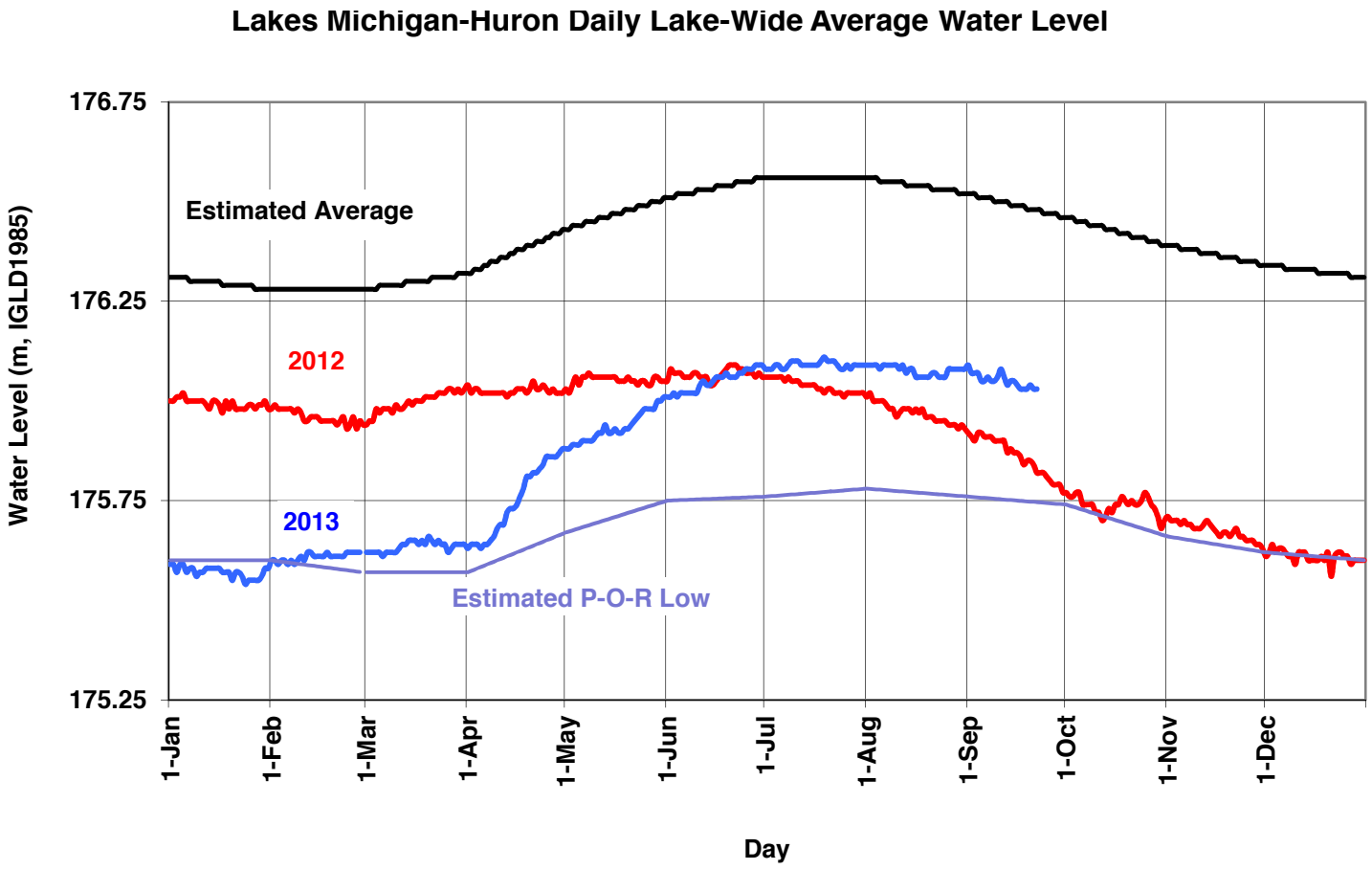
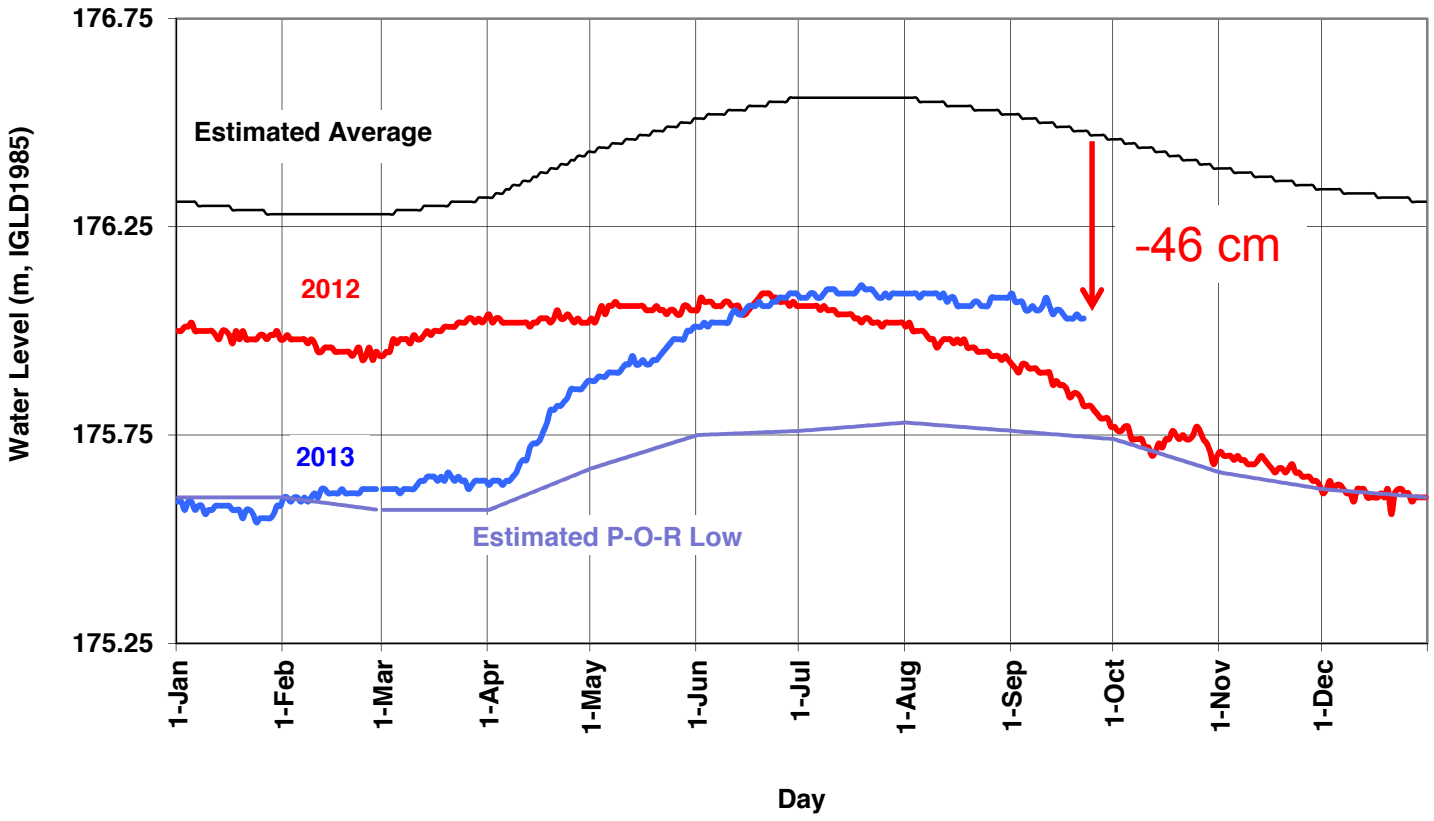


Lakes Michigan-Huron Daily Lake-Wide Average Water Level



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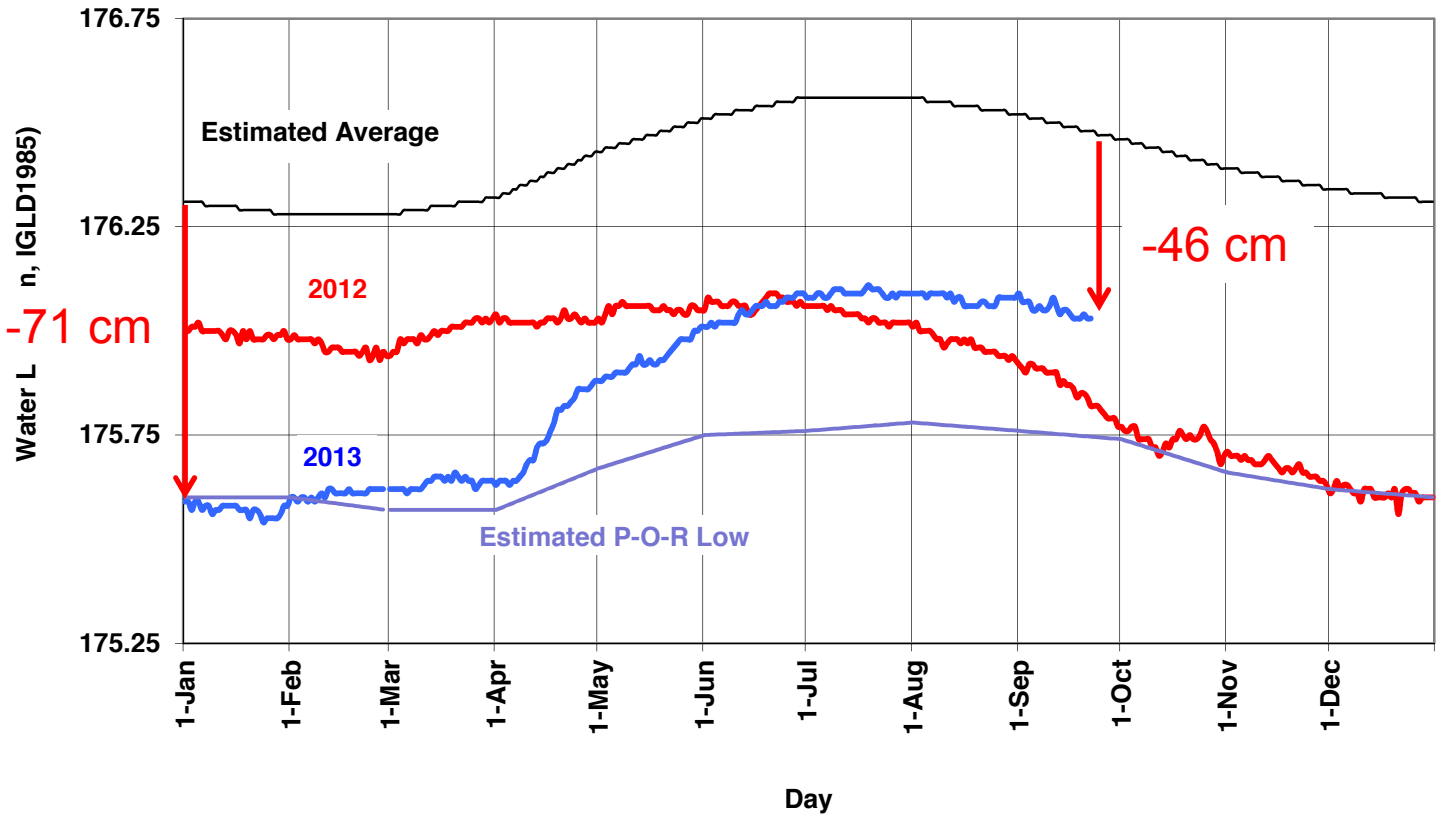

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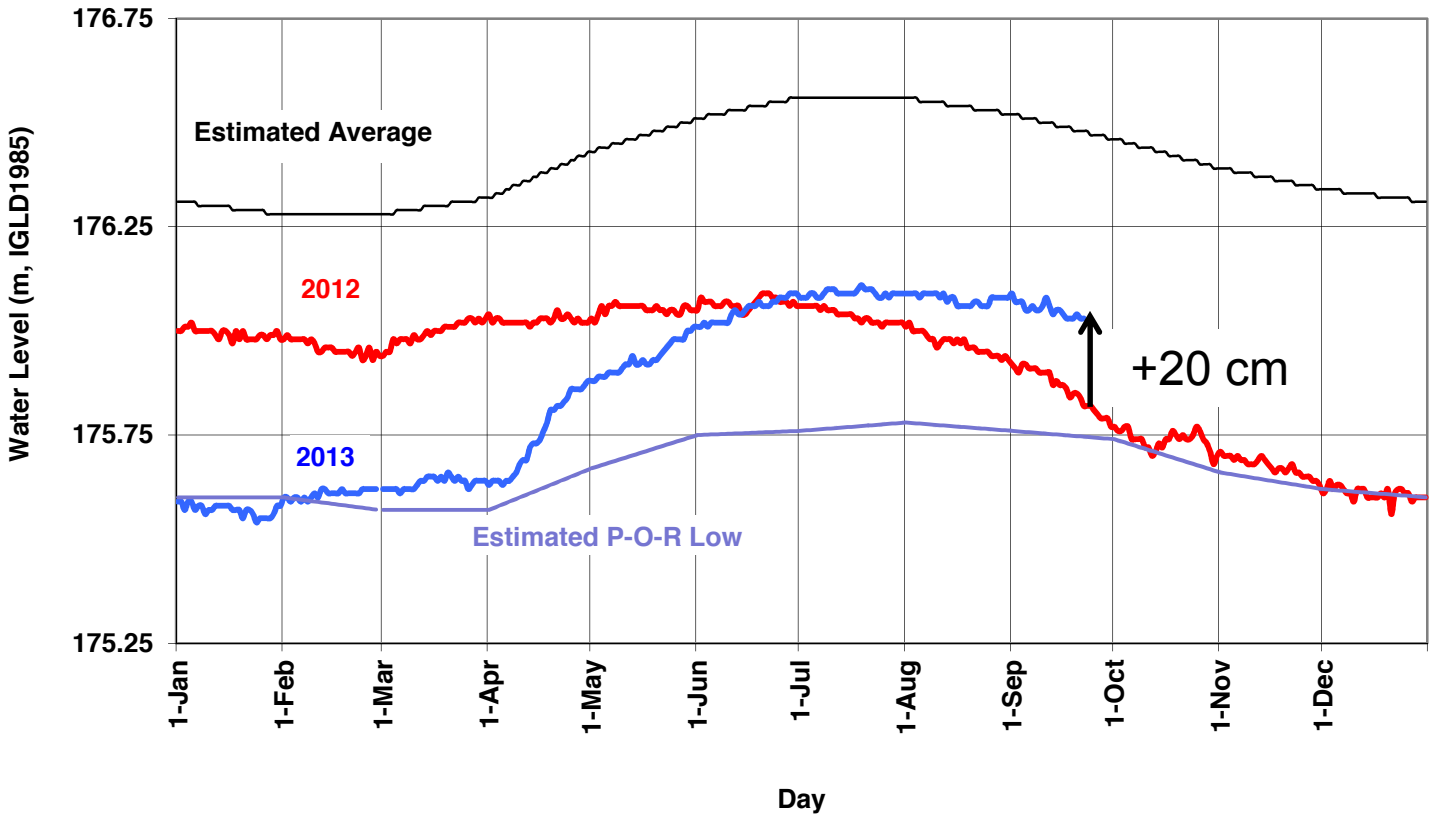

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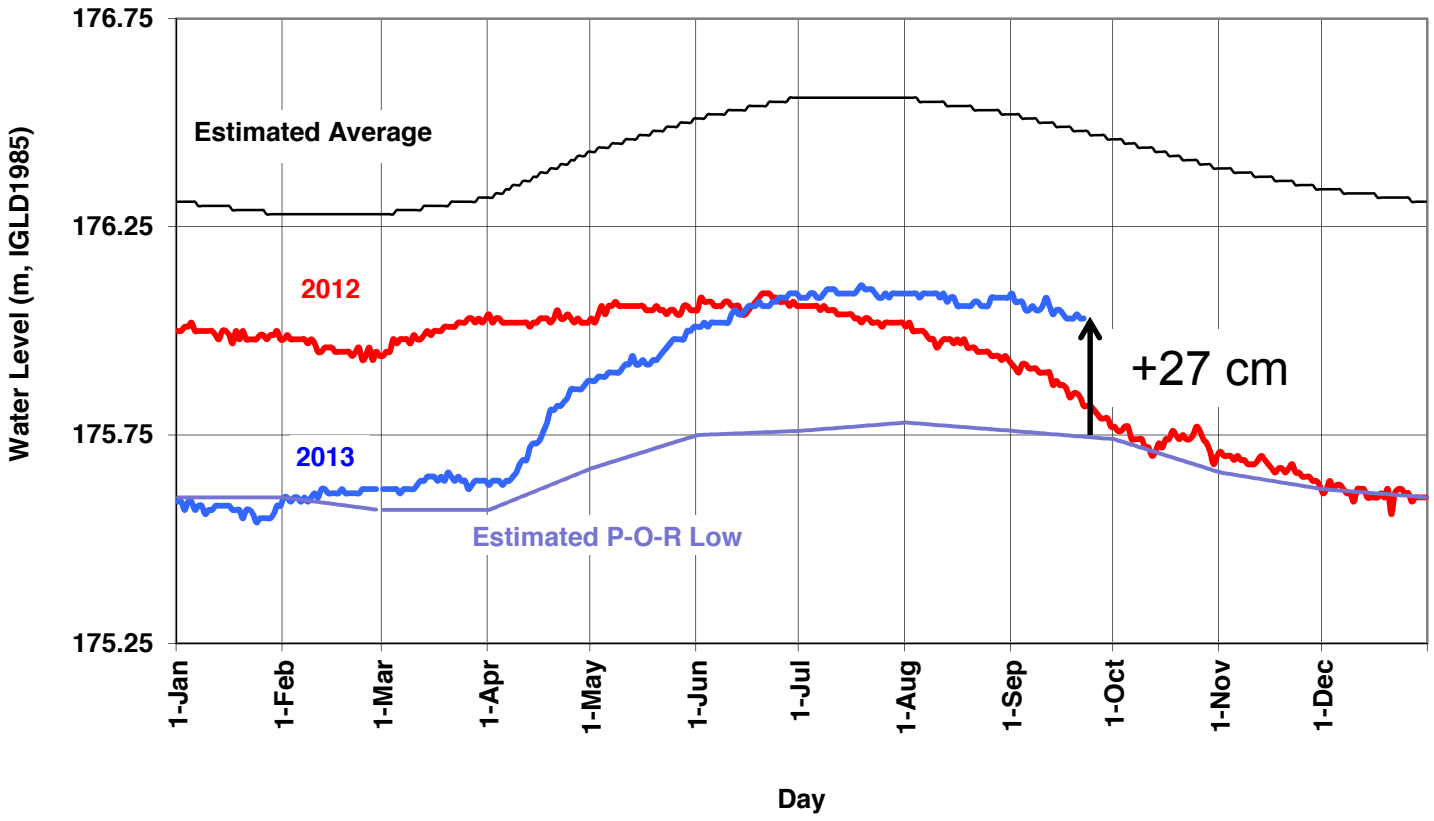
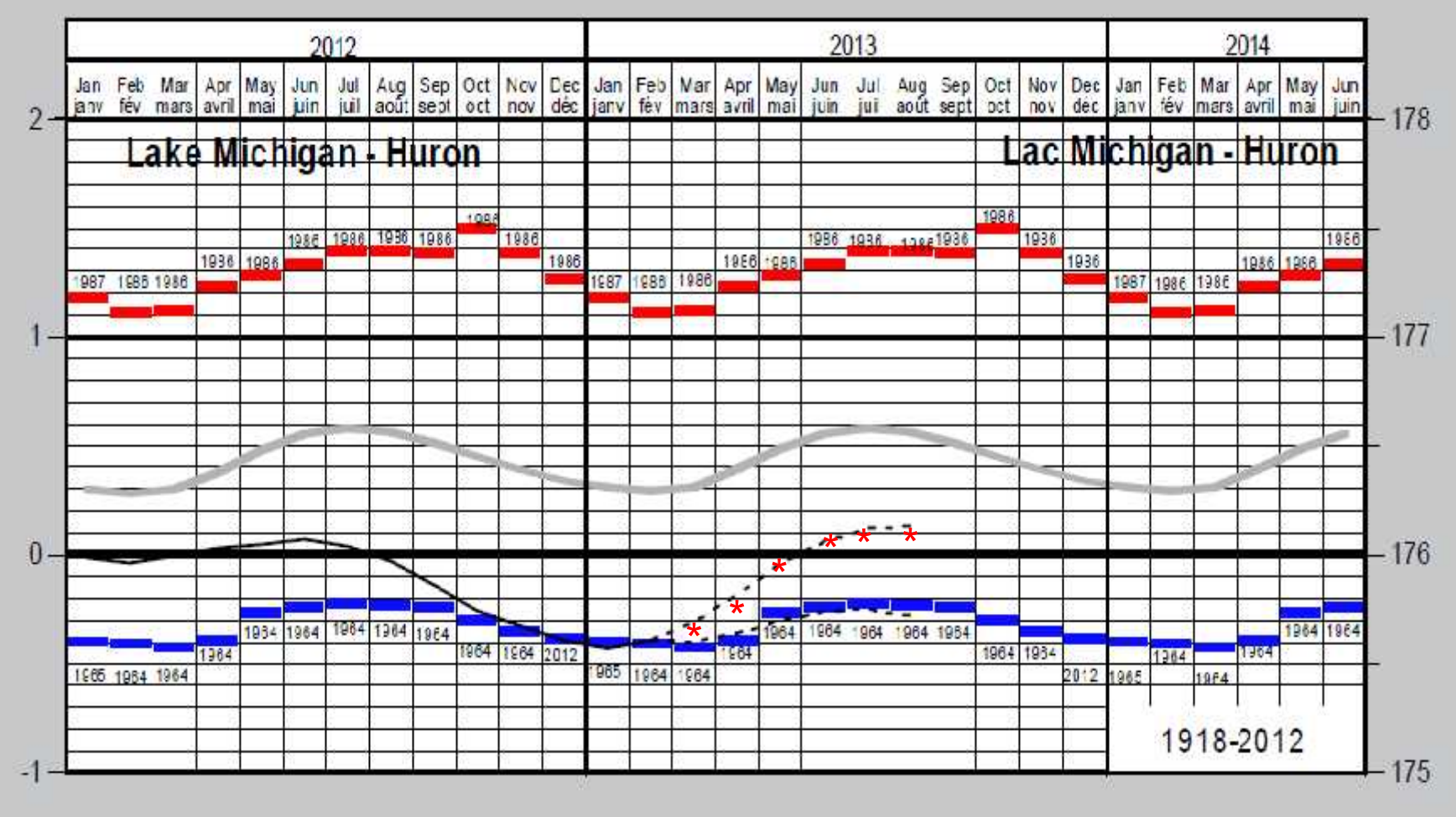


February's Six-Month Forecast



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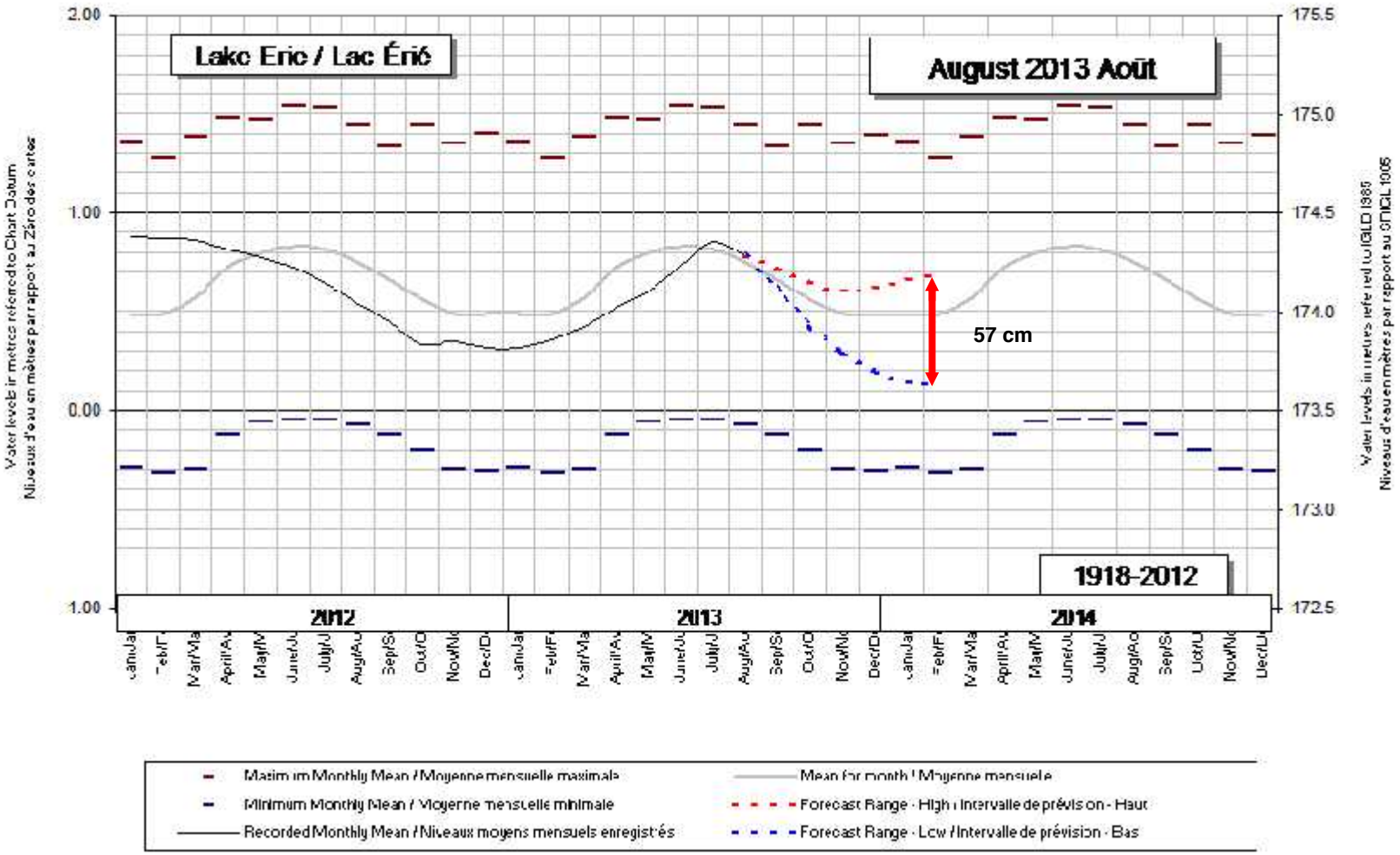

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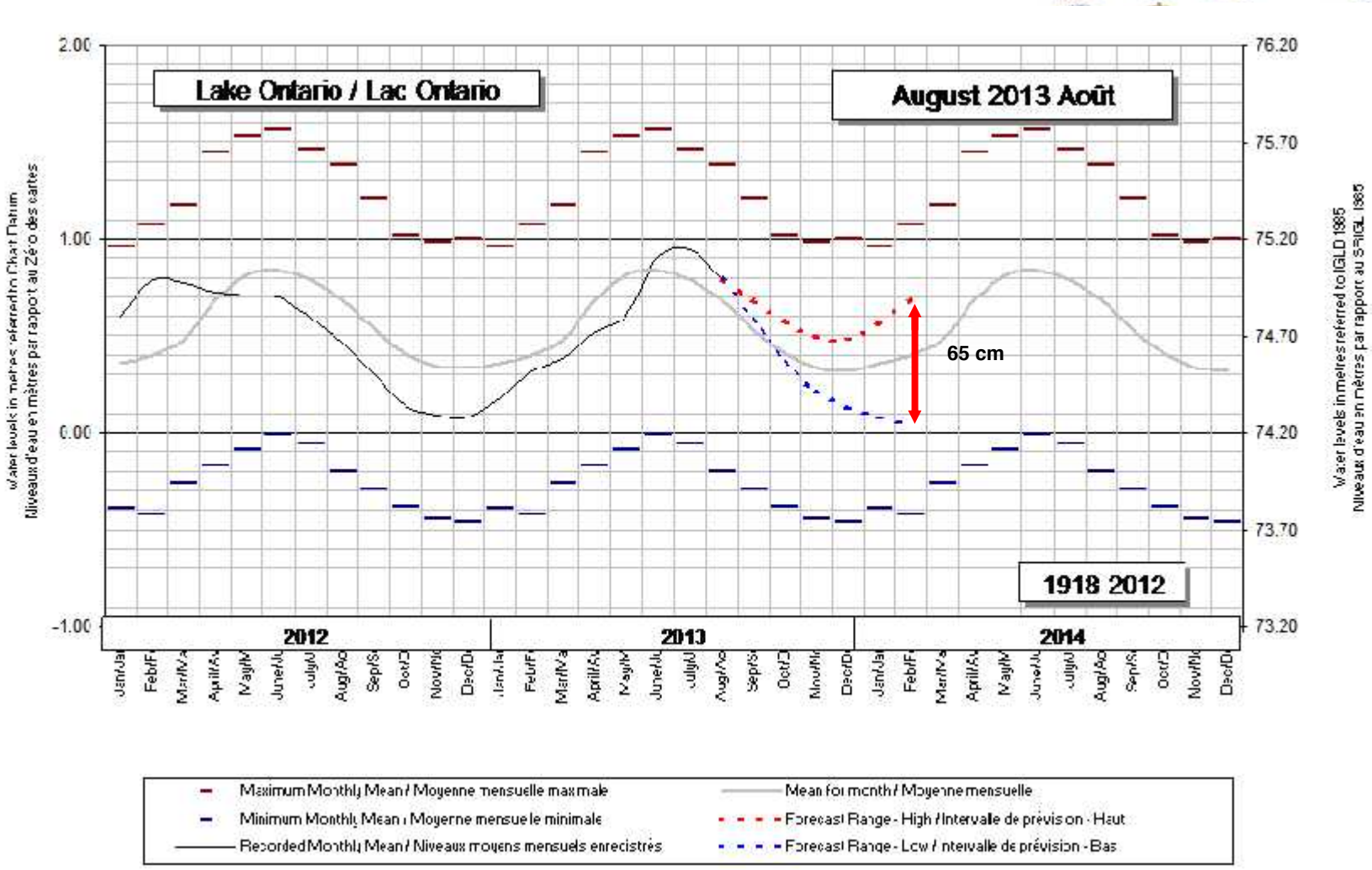

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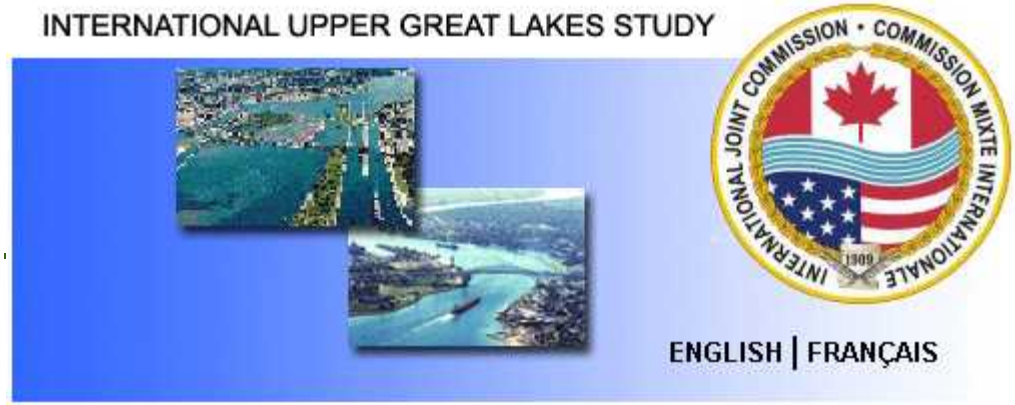

www.igc.org

- This was a 5-year, $17.6 million study
- Major topics investigated include:
  - Determining the factors that affect water levels and flows;
  - Developing and testing potential new regulation plans; and
  - Feasibility and Implications of Restoring Upper Great Lakes Water Levels
- Study Board submitted final report to IJC in March 2012
- IJC reviewed study findings and undertook public hearings - recommendations made to both Canadian and US federal governments in April 2013

Summary

- Both natural and human factors contribute to the range of water level conditions observed over the past century
- Water levels are always changing and future water levels are uncertain
- Need to plan and manage our activities accounting for a range of possible future water level conditions