Great Lakes Water Levels

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National Oceanic and Atmospheric Administration

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Silver Spring, MD
April 23, 2013

Outline

1 Introduction

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2. Great Lakes water levels

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3. Impacts on economy and ecosystems

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4. Regional collaborative modeling and forecasting

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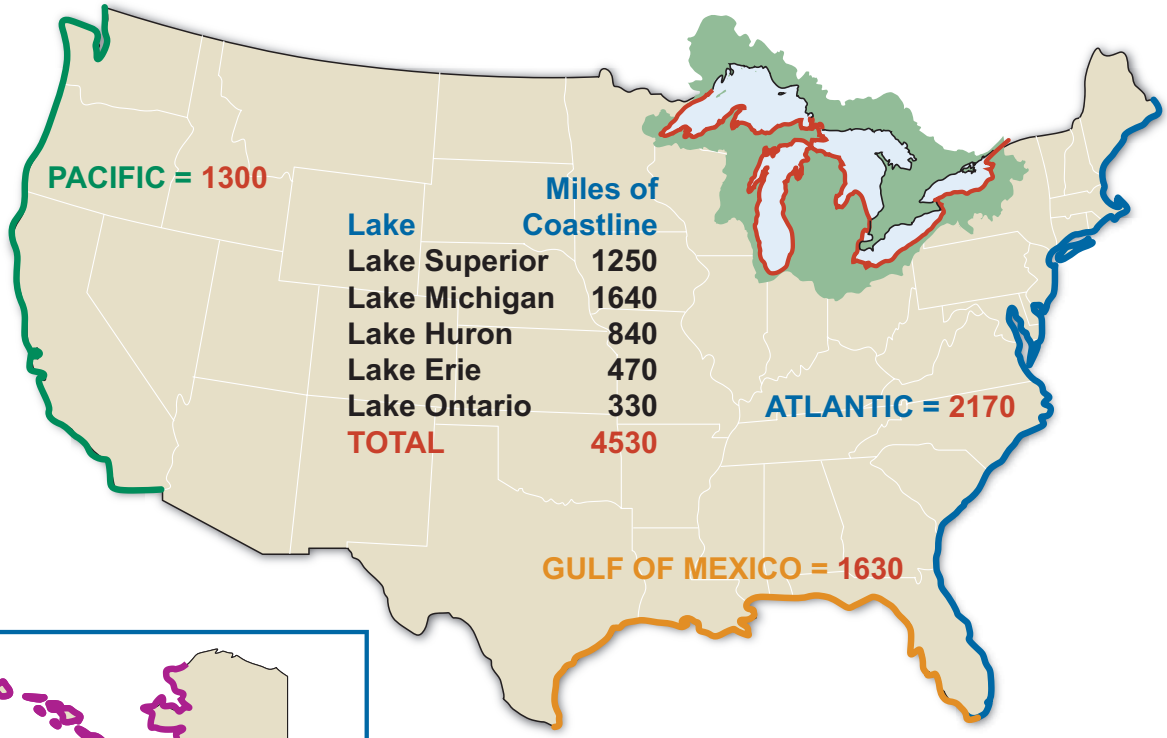
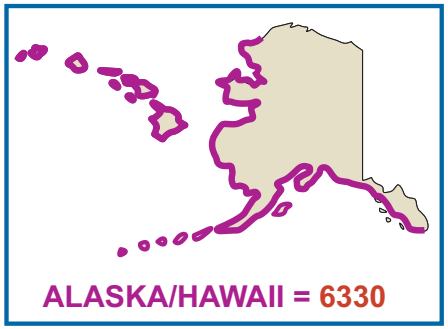
U.S. Great Lakes Coastline Comparison



Lake	Miles of Coastline
Lake Superior	1250
Lake Michigan	1640
Lake Huron	840
Lake Erie	470
Lake Ontario	330
TOTAL	4530



*All numbers rounded to the nearest 10 miles.

Source: The Coastline of the United States. U.S. Dept. of Commerce, NOAA, NOAA/PA 71046 (Rev. 1975).

Name	Country	Surface area		Volume	
		(km^2)	(mi^2)	(km^3)	(mi^3)
Michigan–Huron	U.S. and Canada	117,702	45,445	8,458	2,029
Superior	U.S. and Canada	82,414	31,820	12,100	2,900
Victoria	Multiple	69,485	26,828	2,750	660
Tanganyika	Multiple	32,893	12,700	18,900	4,500
Baikal	Russia	31,500	12,200	23,600	5,700
Great Bear Lake	Canada	31,080	12,000	2,236	536
Malawi	Multiple	30,044	11,600	8,400	2,000
Great Slave Lake	Canada	28,930	11,170	2,090	500
Erie	U.S. and Canada	25,719	9,930	489	117
Winnipeg	Canada	23,553	9,094	283	68
Ontario	U.S. and Canada	19,477	7,520	1,639	393

Table: Water volume and surface area of the earth's highest surface area unfrozen fresh water bodies.

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PRIMARY WIND
BACKUP WIND
RELATIVE HUMIDITY
AIR TEMPERATURE
CORS (GPS)
GOES ANTENNA
NOT VISIBLE:
BAROMETRIC PRESSURE (in building)
WATER TEMPERATURE (in water)
WATER LEVEL (in sump)
MACKINAW CITY, TYPICAL WATER, METEOROLOGICAL & GPS
SENSOR CONFIGURATION

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☑ Superior ☑ Michigan-Huron ☐ St. Clair ☑ Erie ☑ Ontario

Surface water elevation (meters; IGLD 85)

Superior

184.4
184
183.6
183.2
182.8
182.4
182

Michigan-Huron

177.4
177
176.6
176.2
175.8
175.4
175

Erie

175.2
174.8
174.4
174
173.6
173.2
172.8

Ontario

75.8
75.4
75
74.6
74.2
73.8
73.4

Zoom
Pan

1918 1921 1924 1927 1930 1933 1936 1939 1942 1945 1948 1951 1954 1957 1960 1963 1966 1969 1972 1975 1978 1981 1984 1987 1990 1993 1996 1999 2002 2005 2008 2011

Legend and Menu

Water Level Observations

- Lakewide monthly average (1918-Present)
- Master gauge monthly average (1860-Present)
- Lakewide annual average (1918-Present)
- Lakewide annual average (1860-1917)
- Master gauge annual average (1860-Present)
- Average for period of record (1918-Present)
- Month's average (1918-2011)
- Month's record high (1918-2011)
- Month's record low (1918-2011)

Monthly Level Forecasts

Multi-Decadal Level Forecasts

Paleological Reconstructions

Hydrological/Climatological Data

Ice Cover

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Timespan 1918 2013

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Equalize vertical scale

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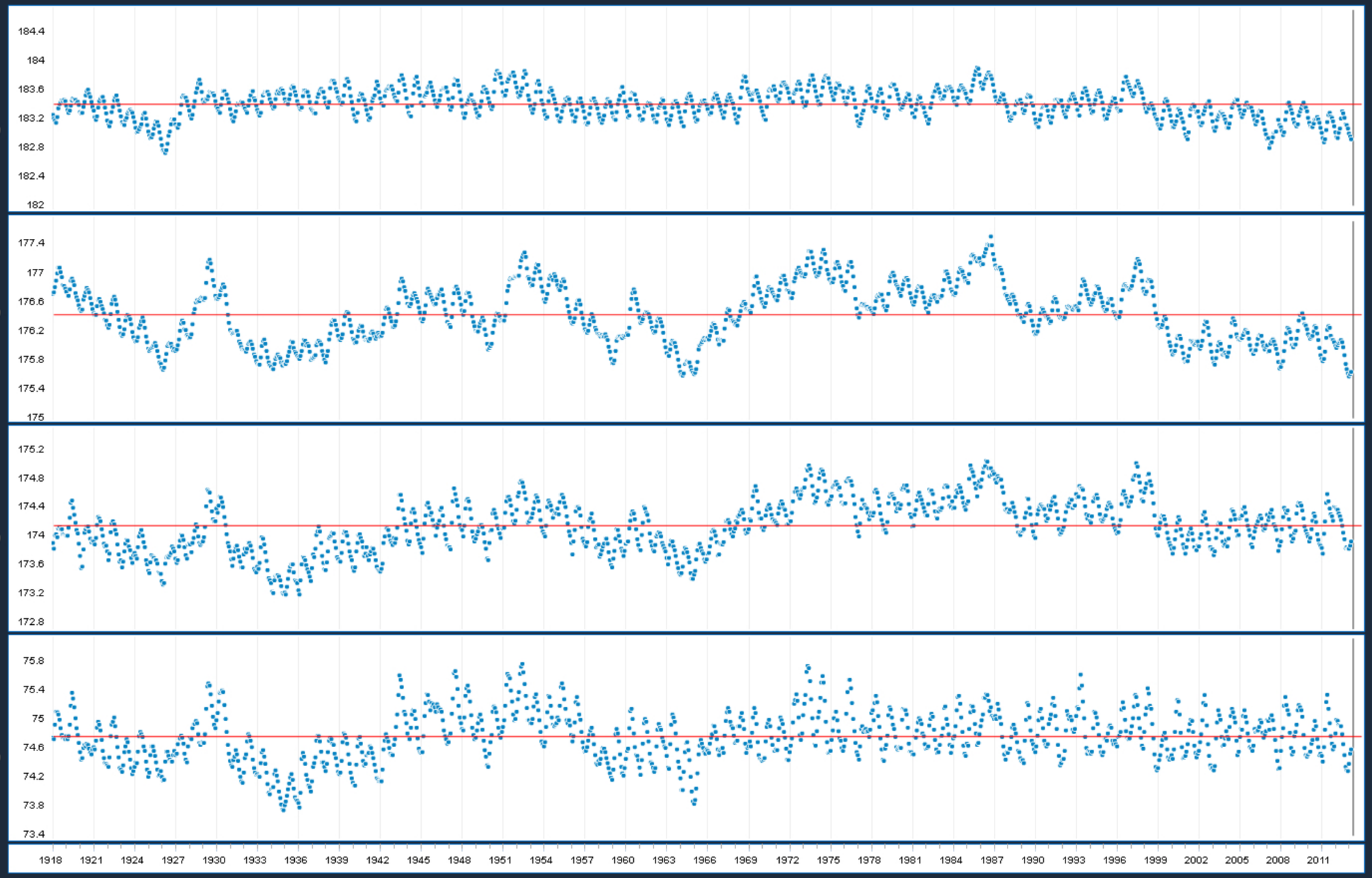

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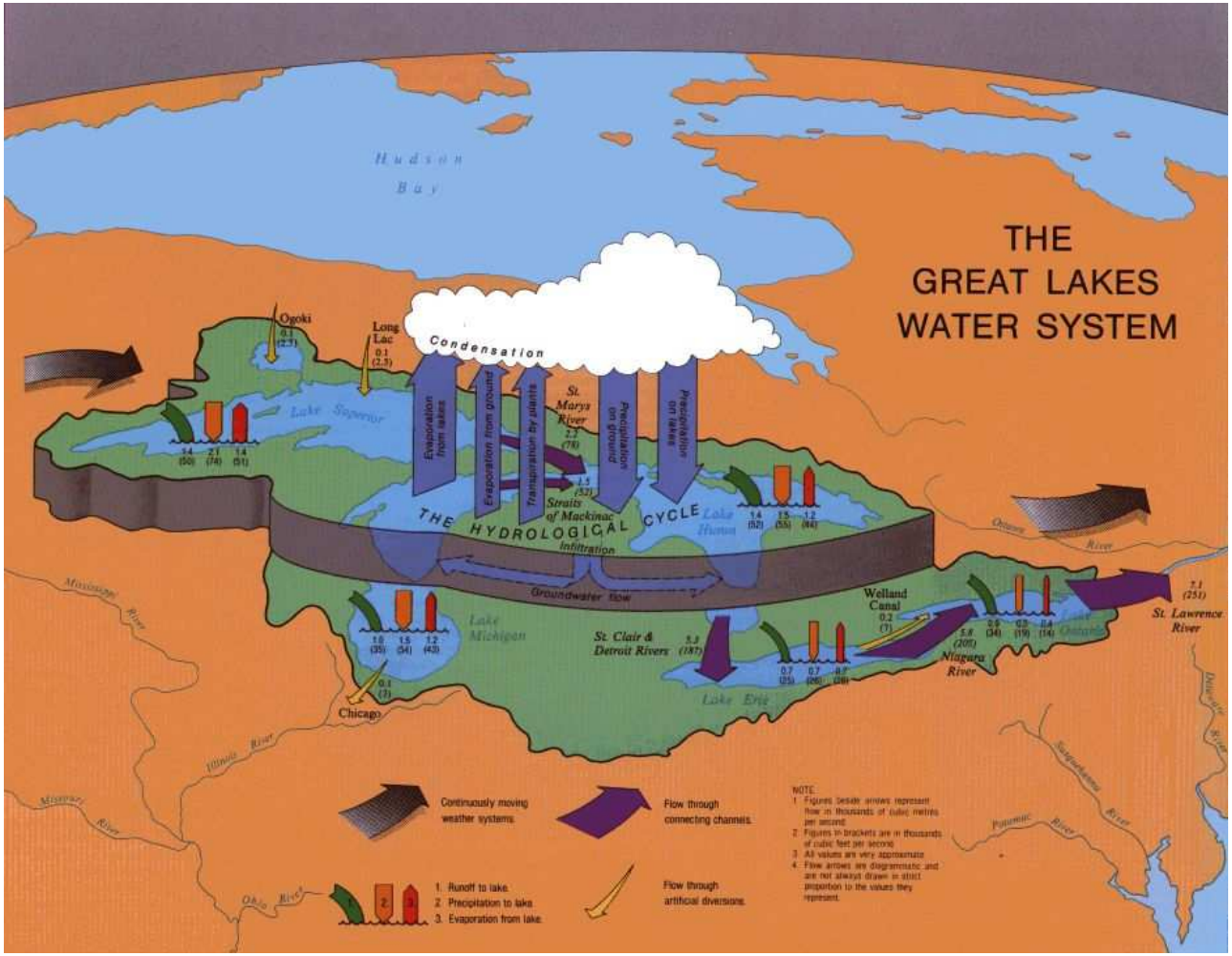
Water levels: drivers and dynamics (mid-term)



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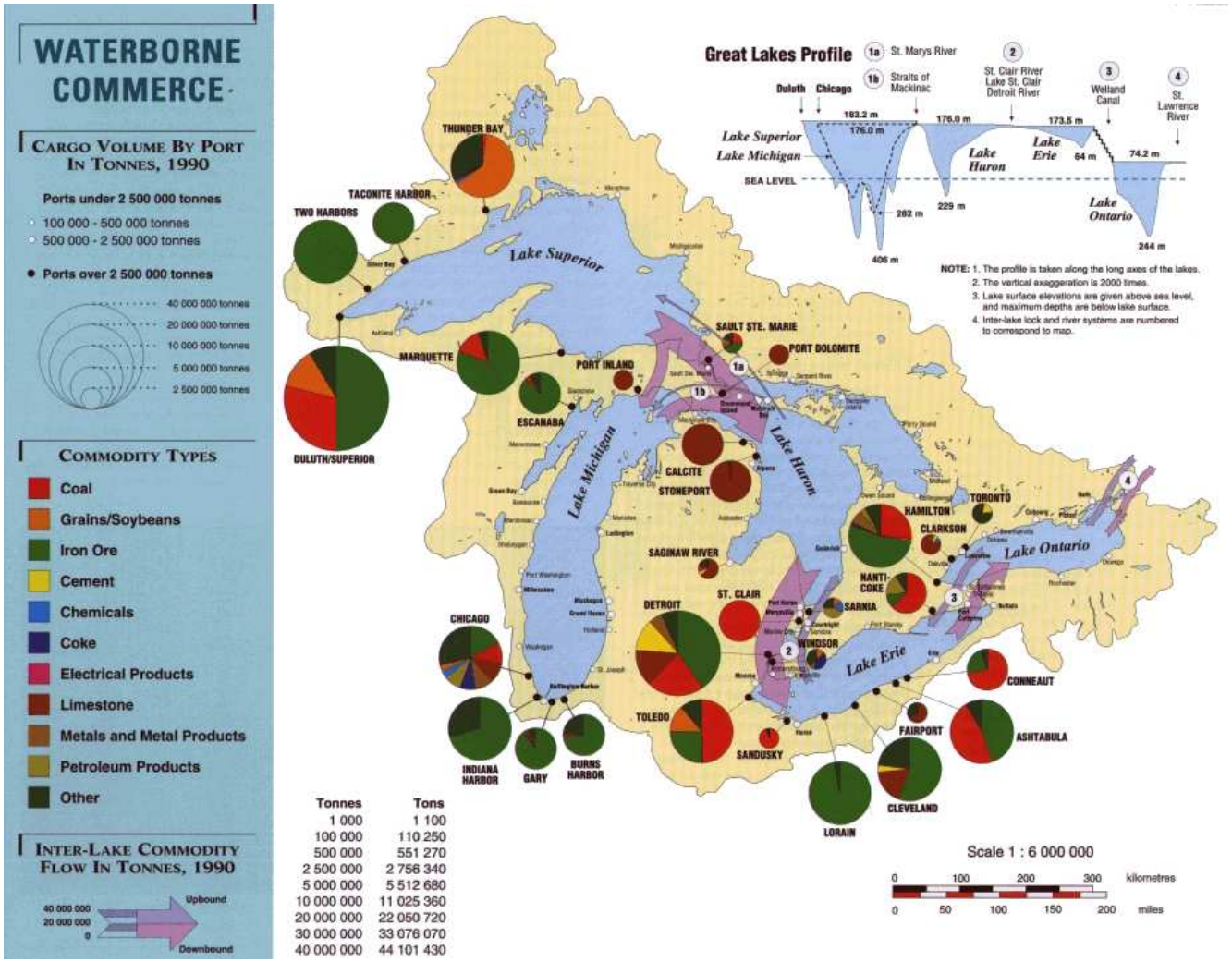
Great Lakes economy and ecosystems: shipping



Tonnes	Tons
1 000	1 100
100 000	110 250
500 000	551 270
2 500 000	2 756 340
5 000 000	5 512 680
10 000 000	11 025 360
20 000 000	22 050 720
30 000 000	33 076 070
40 000 000	44 101 430

Great Lakes economy and ecosystems: nearshore habitat

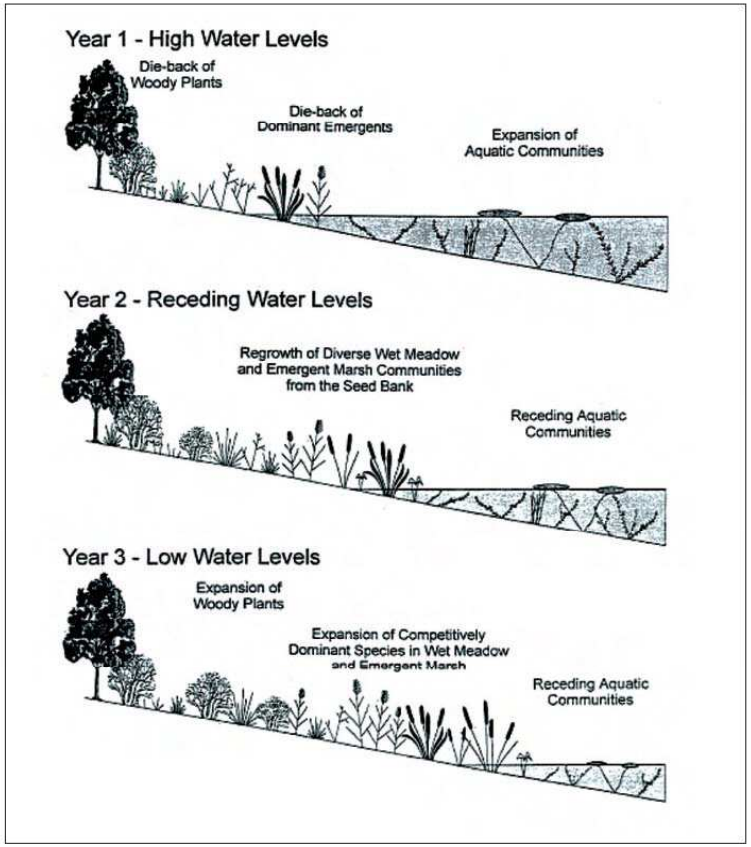


Figure 11. Simplified diagram of the effects of water-level fluctuations on coastal wetland plant communities (from Maynard and Wilcox, 1997).

Great Lakes economy and ecosystems: property and recreation

Source: IJC adaptive management task team

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184.6 184.2 183.8 183.4 183 182.6 182.2 181.8 181.4

Michigan-Huron

178 177.6 177.2 176.8 176.4 176 175.6 175.2 174.8

Erie

175.6 175.2 174.8 174.4 174 173.6 173.2 172.8 172.4

1905 1916 1927 1938 1949 1960 1971 1982 1993 2004 2015 2026 2037 2048 2059 2070 2081 2092 2103

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  - Lofgren et al. (2011): Base Case
  - Lofgren et al. (2011): A2 - CGCM3 - TA
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Lofgren series are from same paper. Click info button below for details.

Info on multi-decadal forecasts

- Paleological Reconstructions
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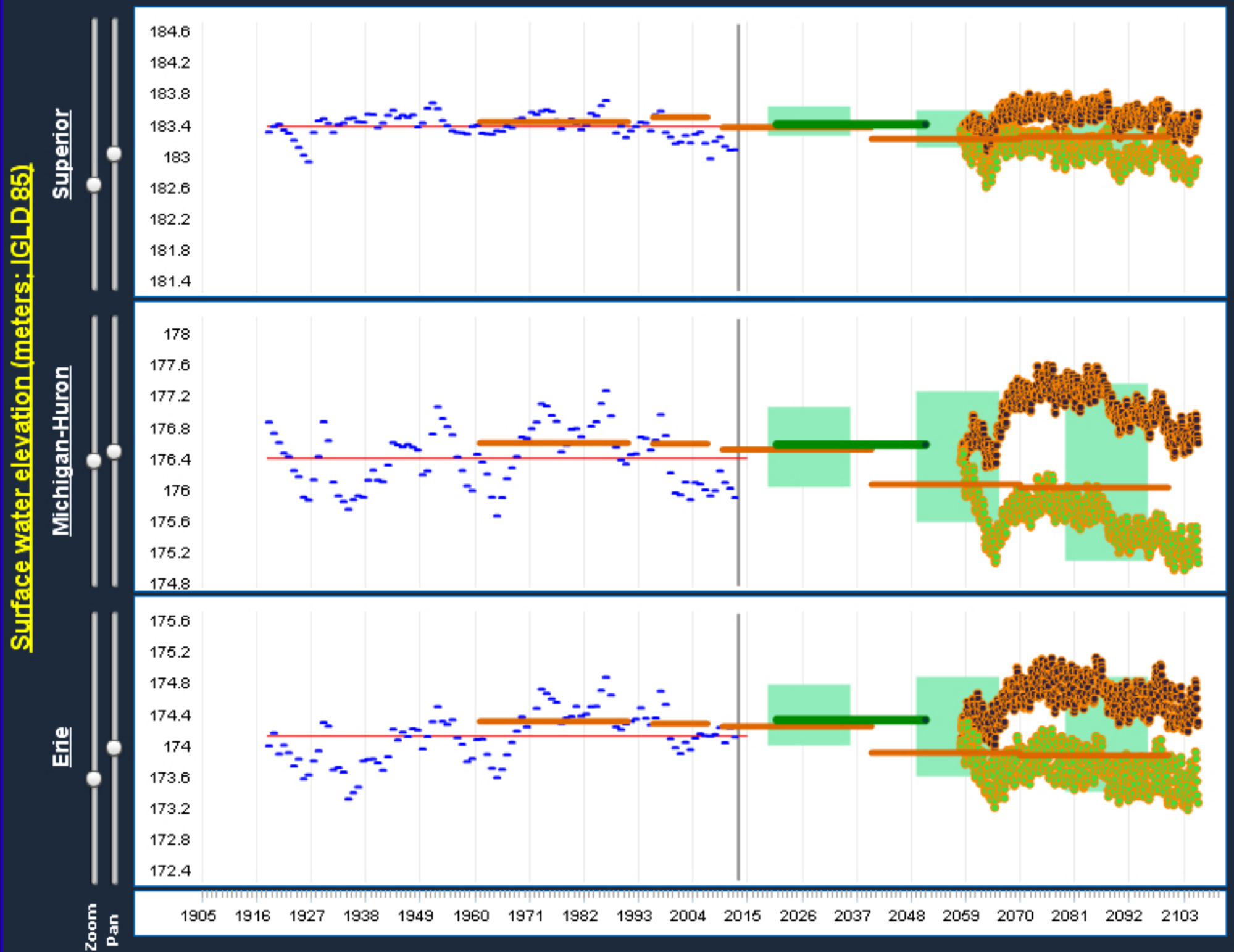

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