LEVEL news

Great Lakes - St. Lawrence River Water Levels

Volume 11, Number 7 July 8, 2003

The Earth Moves—slowly, but surely—in the Great Lakes Region

During the last ice age, which ended some 12 000 years ago, the tremendous weight of the glacier that covered most of the Great Lakes region depressed the earth's crust underneath it and caused the crust to bulge upwards beyond the edge of the ice sheet. When the glacier melted, the crust, relieved of the excess weight began to recover. The earth's crust in the Great Lakes region continues to move today, affecting water depths along the shoreline around each lake.

The ice cover was thicker over the north and east portions of the Great Lakes basin. As a result, the land rises more rapidly there than it does in the south and west portions. In absolute terms, Rossport, on the north shore of Lake Superior, is rising about 47 centimetres per century (cm/century) relative to centre of the earth as the crust there rebounds. On the other hand, Calumet Harbor, near Chicago at the southern end of Lake Michigan, is subsiding about 11 cm/century as the peripheral bulge collapses. This differential crustal movement and its impact on Great Lakes water levels have been recognized and studied for well over a century.

On an individual lake, how water depths change over time along the shoreline due to differential crustal movement depends on the direction and rate that a particular shoreline location moves relative to the lake's outlet. Recent estimates, determined at water level gauging stations around each of the lakes, are shown in the figure on the back page. A positive vertical velocity value indicates that the location is rising relative to the outlet, and the lake's surface, over time. A negative value indicates that the site is either falling or not rising as fast as the outlet is. Rossport, for example, is rising about 28 cm/century relative to Lake Superior's outlet and the lake's water surface.

To help visualize the effects of differential crustal movement on the location of the water's edge and its depth along the shoreline, take a bowl and partially fill it with water.
(continued on next page)

Great Lakes Water Level Information

Lake	June 2003 Monthly Mean Level		Beginning of July 2003 Level	
	Compared to Monthly Average (1918-2002)	Compared to One Year Ago	Compared to Beginning-of-Month Average (1918-2002)	Compared to One Year Ago
Superior	23 cm below	8 cm below	27 cm below	12 cm below
Michigan-Huron	59 cm below	29 cm below	58 cm below	32 cm below
St. Clair	29 cm below	20 cm below	28 cm below	22 cm below
Erie	15 cm below	16 cm below	15 cm below	12 cm below
Ontario	8 cm above	21 cm below	6 cm above	22 cm below

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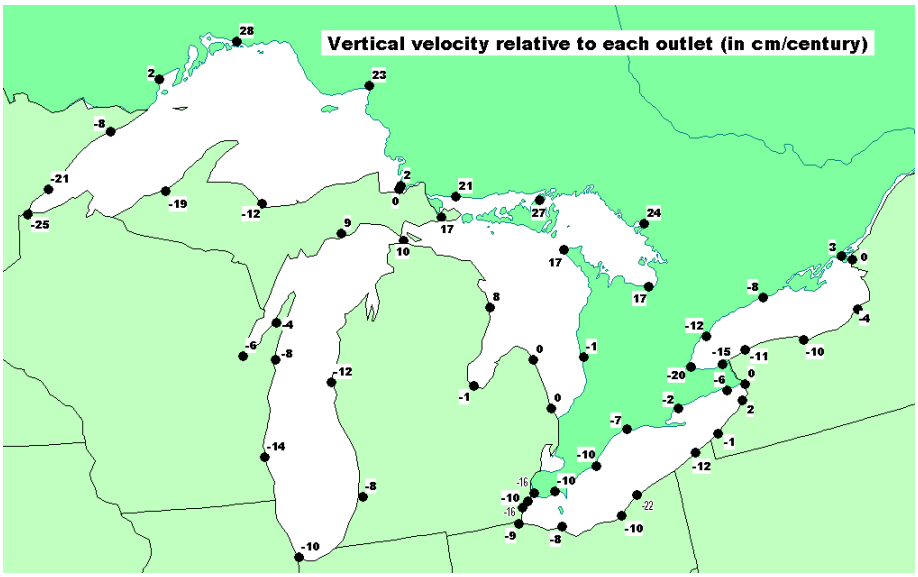
Next, tilt the bowl by slowly raising its upper right hand edge**.** As you do this, you should be able to notice that although the average level of the water in the bowl doesn't change, the water becomes shallower as it moves further away from the edge being lifted. At the same time, the water becomes deeper as it moves closer to the opposite side of the bowl.

What does this mean for property owners and boaters on Georgian Bay with Lakes Michigan-Huron levels currently the lowest they've been since 1964? Since February 2003 to the present, the monthly mean water levels recorded on Lakes Michigan-Huron have been 15 to 24 cm higher than the period-of-record lows of 1964. At the same time however, water depths recorded at Parry Sound for example, have averaged only 5 to 14 cm deeper than they were there in 1964. Why the difference? As indicated in the figure below, Parry Sound is rising about 24 cm/century relative to Lake Huron's outlet at Port Huron/Sarnia. As a result, during the 39 years that have passed since 1964, the Parry Sound area has risen about 10 cm more than the lake's outlet and water surface have. Since the entire Georgian Bay area continues to rise relative to the outlet, depths along its shoreline will continue to decrease for a given lake level as time goes by.

And what about Chicago? Well, as time passes the water there is getting deeper for a given lake level—a good thing during periods of low levels perhaps, but a problem during high water conditions.



Vertical velocity relative to each outlet (in cm/century)

Source: Figure 5 in *Apparent Vertical Movement Over the Great Lakes – Revisited*. A report prepared by the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data, November 2001.

Report URL: http://www.geod.nrcan.gc.ca/index_e/pgr_e/PGRgreatLakes_e.html

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LEVELn*ews/Info*-NIVEAU is a publication of Water Issues Division, Environment Canada-Ontario Region.

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June Precipitation Over the Great Lakes

As a percentage of the long-term June average:

Great Lakes Basin	**79%**	**Lake Erie**	**83%**
Lake Superior	**65%**	**(including Lake St. Clair)**	
Lakes Michigan-Huron	**82%**	**Lake Ontario**	**89%**

NOTE: These figures are preliminary