

Great Lakes Islands Alliance
 Webinar: “Great Lakes Water Levels 101”
 August 22, 2018

Featured Speaker: Dr. Andrew Gronewold, PhD, P.E., Physical Scientist, National Oceanic and Atmospheric Administration (NOAA) & Adjunct Professor, University of Michigan

Question and Answer Summary

For a variety of information on Great Lakes water levels, please visit the following sites:

- NOAA Great Lakes Environmental Research Laboratory: www.glerl.noaa.gov/data/wlevels/
- US Army Corps of Engineers (Detroit District): <https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/>

Question	Response
<i>Regional/Global Influences</i>	
I recall reading that Lakes Huron and Erie are on a large geodesic plate that is gradually tilting on a north-south axis, but I don't remember in which direction. Do you know?	Dr. Gronewold discusses this phenomenon, called “glacial isostatic rebound,” during his presentation at approximately 25:26. One of the more frequently referenced papers on Great Lakes regional isostatic rebound can be found through the following DOI: http://dx.doi.org/10.1130/B25392.1
How does global warming affect level?	It is difficult to establish direct linkages between global warming and changes in hydrologic response at regional (e.g. Great Lakes water level) scales. However, in general, global warming is expected to lead to higher average air and water temperatures, and higher average precipitation, across much of the Great Lakes region. Increasing water temperatures alone would lead to increased evaporation and lower levels, while increasing precipitation along would lead to high levels. Over a period of several years, lake levels could go up or down due to variability in temperature and precipitation. Over very long time periods (multiple decades), research on the Great Lakes indicates that future long-term average water levels may not be much different than historical long-term averages.
Please explain why how the drastic increase for Lake Huron (2012-13) is related to Hurricane Sandy	Dr. Gronewold's presentation provided two examples of water level rise on Lake Huron. One example, which occurred during Hurricane Sandy, was a short-term change at individual water level gages (Dr. Gronewold discusses the effects of Hurricane Sandy during his presentation at approximately 21:30). A second example

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	<p>was the multi-year rise in lake-wide average water levels (that also occurred across Lakes Superior and Michigan) from 2013 to 2016, however there is no clear linkage between Hurricane Sandy and the 2013 to 2016 rise.</p>
<p>Recent research published in Nature Communications says that summer weather patterns are beginning to stall as a result of a warming arctic—turning sunny days into heat waves, tinder-dry conditions into wildfires, and rains into floods. This pattern has been noticeable this summer on Manitoulin—two months of sunny, hot, dry, and still. Fire ban in effect all summer.</p> <p>What can we expect this pattern to do to the water level of Michigan/Huron? Is it figured into the models you have shown?</p>	<p>Translating global climate projections (from models) into regional information is a challenge. There is much research being done to ensure that this process (sometimes referred to as “downscaling”) correctly reflects current observations. There is considerable uncertainty about how well global models can be used to represent regional phenomena such as rains, floods, and wildfires.</p> <p>To the extent that “downscaled” models are accurate, it is expected that long-term average water levels are unlikely to change (though periodic highs and lows are still likely). It is also expected that there may be a shift in the seasonal water level cycle, with a less pronounced and earlier mid-year peak due to less precipitation falling as snow, and earlier snowmelt.</p>
<p><i>Water Level Management</i></p>	
<p>I don’t think anyone would argue that the Great Lakes are, today, a natural system. Does it not make sense for us to use the best science and engineering to help Mother Nature moderate extremes. For example controls, as recommended by the IJC, in the St. Clair River.</p>	<p>Dr. Gronewold’s agency, NOAA, does not comment on the benefits or impacts of potential water level control infrastructure. Summary reports from the IJC evaluating these alternatives can be found at: http://www.ijc.org/en_/Great_Lakes_Water_Quantity</p>
<p>With the various Dams in place how much control if any can man increase or decrease the water flow out of the lakes into the St. Lawrence River?</p>	<p>Water levels are primarily influenced by natural uncontrolled factors such as precipitation, runoff, and evaporation. The dams and regulation efforts can influence levels on a smaller scale. For instance, let’s take the 2017 natural conditions and look at the Lake Superior Regulation impacts on Lake Superior and Michigan-Huron. If we flowed at the monthly maximum flows on record for each month (i.e. the highest flow we have the ability to pass out of Lake Superior) instead of what was flowed in 2017, there would be approximately 8 inches less on Lake Superior and 5 in more on Lake Michigan-Huron. If we flowed at the lowest monthly flows on record for each month (i.e. the lowest flow we could pass out of Lake Superior) instead of what was flowed in 2017, there would be approximately 6 inches more water on Lake Superior and 4 inches less on Lake Michigan-Huron. By contrast, mother nature (through precipitation, runoff,</p>

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	and evaporation) has about 8 times the impact on lake levels.
Was there a lapse of control by the IJC causing the 1985/86 high water levels and are they staying ahead of the conditions now	The record high levels in the mid-80s were a result of natural, uncontrolled conditions basin wide. Lake Superior and Lake Ontario outflow regulation does not solely control water levels. The recently established Great Lakes Adaptive Management Committee (GLAM) provides information to the Boards of Control and the International Joint Commission (IJC) while advising them on the effects that the control structures approved in the IJC's Orders of Approval and directives have on levels and flows in boundary waters. More information on the GLAM efforts can be found here: http://ijc.org/en_/GLAM
<i>Specific Geographies</i>	
How do we explain the historic lows of Lake Huron from 1999 - 2012	Scientists primarily attribute the low water levels across the upper Great Lakes from 1999 to 2012 to persistent above-average water temperatures and subsequent above-average evaporation rates. Additional information can be found in the following paper in <i>Science</i> : DOI: 10.1126/science.1249978
Are there more changes expected locally from the Lake Michigan islands, especially the most remote inhabited island?	For more local conditions, the NOAA Lake Level Viewer is a screening-level tool which illustrates the approximate scale of flooding or land exposure at a given lake level. Visit https://coast.noaa.gov/llv/
Can you show forecast levels for Superior (multi-decadal)?	A suite of multi-decadal forecasts for each of the Great Lakes can be accessed directly through the Great Lakes water levels dashboard at: https://www.glerl.noaa.gov/data/dashboard/GLWLD.html
What water level model would you use for the St. Marys River, especially with the water flow monitoring at the Soo Locks?	Seasonal water level projections for the Great Lakes are generated using estimated water supplies to each of the lakes (i.e. the sum of lake evaporation, precipitation, and runoff) and the subsequent management decisions that would be made under those water supply conditions. A paper describing one of the modeling systems used to forecast water supplies, including the approach to simulating management actions, can be found here: https://doi.org/10.1016/j.jglr.2011.06.010
<i>Programs, Tools, Other Assistance for Communities</i>	
Is there a website for best practices for property owners to dealing with GL water levels fluctuations? We are	While the next seminar in the GLIA series will address this topic, one of the contributors to that seminar (Maggie Allan) has offered the following

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<p>currently witnessing large boulders being placed on shorelines only to have the wave action impacting the bluff behind the boulders.</p>	<p>The report listed below is a great place to start, particularly with regard to the specific question about the boulders and effects on adjacent bluffs:</p> <ul style="list-style-type: none"><li data-bbox="776 422 1393 695">• Living on the Coast: Protecting Investments in Shore Property on the Great Lakes - This report developed by the U.S. Army Corps of Engineers and University of Wisconsin Sea Grant Institute provides coastal property owners and managers useful information on coastal processes and options for protecting shoreline property investments. <p>Other key resources include:</p> <ul style="list-style-type: none"><li data-bbox="776 814 1393 1199">• The Great Lakes Coastal Resilience Planning Guide - This on-line resource shows how coastal communities are addressing a wide range of issues such as lake-level fluctuations, shore erosion, and flooding. It features case studies, maps, data, tools, and other information. The Planning Guide is a collaborative effort of the NOAA Digital Coast partnership and additional community-based partners from the Great Lakes. In the Library, you can filter by keyword tags such as "Water Level" or "Bluff Erosion."<li data-bbox="776 1241 1393 1556">• The Great Lakes Water Levels Integrated Assessment provides information on work conducted with four coastal communities along Lakes Michigan and Huron, and the final report discusses a number of options for living with water level variability that are applicable more broadly. The report and project resource page include links to the resources listed above and many others.