Lake Huron Centre for Coastal Conservation

Climate Change

Lake Huron and Climate Change
What are the Possibilities?

Introduction

A changing climate has always been a part of life on our planet. Human-induced climate change has emerged as one of the most important global environmental issues. Due to human activity, carbon dioxide (CO_2) and other greenhouse gas levels have increased in our atmosphere. This has been from burning of fossil fuels and to smaller extent land use clearing (e.g. forest deforestation—see Figure 1).

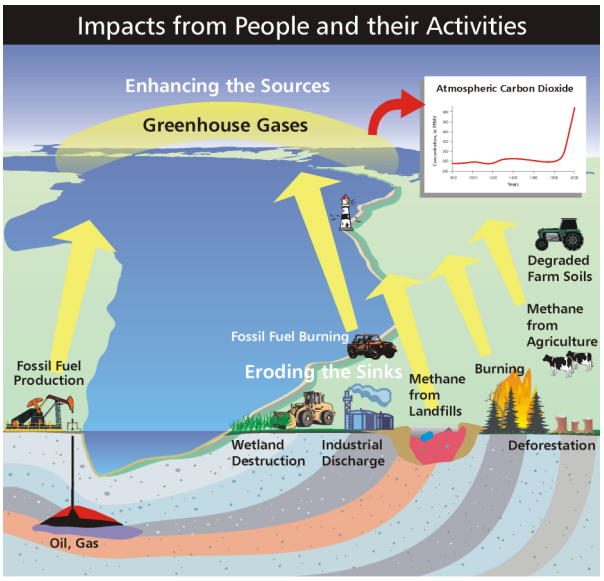

Figure 1

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Greenhouse gases create an atmospheric blanket that traps heat from the sun and warms the earth. Although a certain level of atmospheric heat is required, we are creating an environment in which unnaturally high and dangerous temperatures may be reached. Changes in temperature and precipitation resulting from climate change affect runoff, evaporation, and ultimately, lake levels. Decreasing water levels are of concern to all Great Lakes communities.

Climate impact assessments are carried out to study the potential effects of significant increases such as doubling or tripling of CO2 in the atmosphere. Assessments of "what if" scenarios, or plausible climate futures, demonstrate that climate change may affect our ability to enjoy the Great Lakes.

Points of Interest

- *At the peak of the last ice age, global temperatures were only 4 to 6^0C colder than today.*
- *Since the industrial revolution, the concentration of CO2 in the atmosphere has increased by 35%, and methane by 134%.*
- *By increasing the amount of these "heat-trapping" gases, we are adding to the warming effect of the natural atmospheric greenhouse.*
- *On the Great Lakes, warmer summers, warmer winters and greater period of ice free conditions would increase the amount of water evaporated from the lakes.*
- *Eleven of the last twelve years (1995–2006) rank among the 12 warmest years in the instrumental record of global surface temperature[9] (since 1850).(IPCC, 2007)*

Temperature and Precipitation Changes

Although we may see less snow overall in a warming climate, we may see more snow in any given storm as the intensity of storms increases. However, for lake effect snow, it's important to realize that the increased likelihood of greater snow squalls (or “streamers”) is in the earlier parts of this century. As temperatures warm and the snow changes to rain, by the 2080s, there would be a significant decrease in lake-effect snow and potentially more lake-effect rain.

These climate changes within the lake basin will alter the flow patterns of snowmelt dominated rivers, shifting the period of peak runoff from springtime toward a rainfall-dominated peak in the winter. Flow in rivers is likely to increase because of a higher percentage of precipitation falling as rain.

Increase in freeze/thaw cycles may bring about premature deterioration of roads, building materials and coastal infrastructure.

Lake Huron Water Levels

Figure 2 is a graph showing Lake Huron water levels between 1918 and 2006. Levels have fluctuated between record highs of 177.5 metres (582.2 feet) above sea level experienced in 1985-86, and record low levels of 175.5 m (575.6 ft) experienced in 1964.

Climate change models suggest a water level scenario for Lake Huron with a maximum lake level of 175.6 metres (576 ft) above sea level, and a minimum lake level of 173.6 m (569.5 ft). However, maximum and minimum lake levels preferred by riparian property owners are 177.1 metres (581 ft) and 175.6 m (576 ft), respectively. Thus, the maximum water level conditions projected by the model would only meet the minimum water level desired by lakefront property owners.

In spite of the increases in precipitation, increases in temperature and changes in meteorological factors such as cloud cover, wind and biological factors such as evapotranspiration (the water given off by soil and plants) are expected to lead to a substantial increase in overall evaporation. This increase in evaporation is very likely to lead to reductions in soil moisture, lake and river levels, and more drought-like conditions in many areas. This overall drying is projected even though there are also likely to be increases in the frequency and intensity of heavy precipitation events across the region. This will be occurring because a higher percentage of rain will be occurring on the 10% of days that already receive the most rain, so a higher percentage of the precipitation will runoff rather than infiltrate to be available as soil moisture for plants. (US CC Science Program, 2008).

What Can We Anticipate?

Warmer Air Temperatures- Longer summer & cottage recreational season, as well as extended demand for coastal parks, conservation areas & facilities.

Changed Precipitation Patterns - More rain and less snow in a shorter winter season (BUT lake-effect snow could INCREASE in the near future) with impacts on winter recreational activities & road safety & maintenance.

More Intense Storms- More dynamic shoreline zone, with more sand movement and erosion.

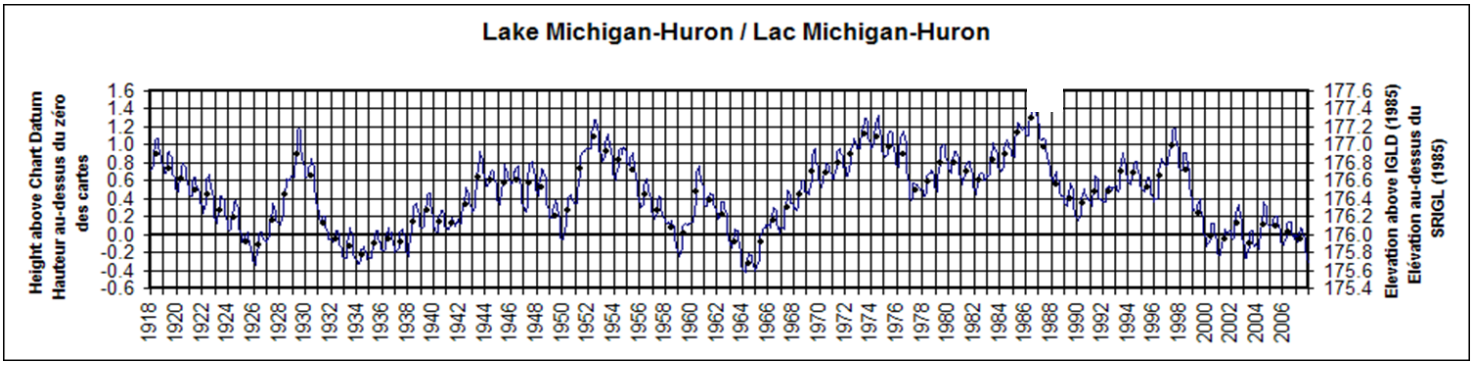
Warmer Water Temperature And Changes to Great Lakes Ice Cover

In the past, ice cover on Lake Huron typically reached 70 to 80%. In recent years, ice has only formed along the margins of the lake leaving most of the water body open. This has contributed to greater evaporation rates, as well as snow squalls in ‘snow-belt’ country.

Warmer average lake temperatures could also contribute to increased algal blooms, changes in the distribution of fish species and increase in warm water fisheries.

There may be an extended swimming season provided that water quality is acceptable.

Figure 2
Hydrograph showing lake levels on Lake Huron from 1918 to 2006



Declining Great Lakes Water Levels

Declining water levels will impact the shipping industry, with the reduction in depth of shipping channels. Local marinas may have to undergo extensive dredging to stay open, or abandon their current location in favour of locations with better lake access conditions.

Drying out of wetlands could contribute to local water quality problems, particularly in areas where wetlands cannot adjust to a new water level regime.

Municipal water intake pipes may require extensions into deeper water to safeguard water quality.

There will be an initial reduction in erosion damage to coastal bluffs in lower Lake Huron . Over the long term, as nearshore adjustments occur, bluff erosion could re-occur in some locations. Changes in precipitation patterns, including more flash storms, and winter snow melts, could contribute to more ravine erosion and surface and groundwater erosion of bluffs.

In dune areas, greater sand erosion will cause sand drifting and loss of sand where dune conservation measures have not been adopted.

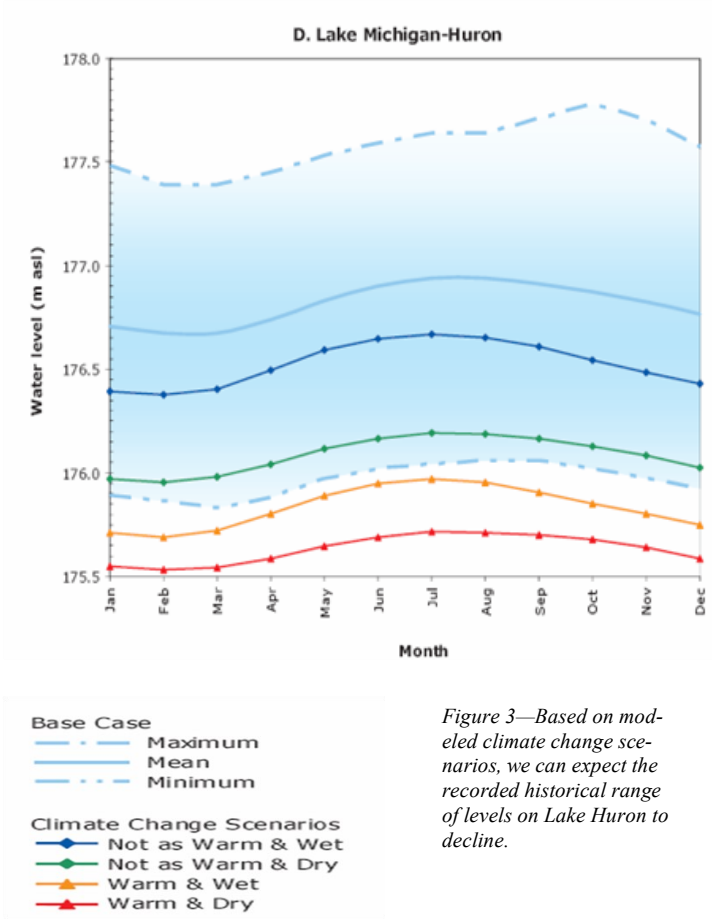


Figure 3—Based on modeled climate change scenarios, we can expect the recorded historical range of levels on Lake Huron to decline.

References

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US Climate Change Science Program, 2008. *Analyses of the effects of global change on human health and welfare and human systems*.

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P.O. Box 178
Blyth, Ontario, Canada
N0M 1H0

Phone: (226) 421-3029
Fax: (519) 523-4929
Email:
coastalcentre@lakehuron.on.ca

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Scenario Summary

Temperatures

- Annual warming of 2° to 4°C in the Goderich area by the 2050's.
- Seasonally, temperatures will be warmest during winter months.

Precipitation

- Total annual precipitation is expected to increase by approximately 2 to 12% by the middle of this century.
- Precipitation levels may increase in spring and fall, while summer and winter levels would decrease.
- Extreme precipitation is likely to become more frequent and intense while at the same time an increased risk of drought and more hot days.
- With Lake Huron and Georgian Bay potentially remaining ice-free for a longer period during the year, lake-effect snowfall ('squalls' or 'streamers') could increase over the short term.

Seasonal Changes

- Less wintertime precipitation may fall as snow and more as rain. Less snowpack accumulation. Less water storage. Therefore, less ice cover, leading to greater evaporation.
- Alterations to the flow patterns of rivers.
- Possible increase in wind speeds with changing wind patterns, shifting storm tracks, and increase in extreme weather events.
- Changing wind speeds and patterns will increase sand mobility and erosion of dunes where proper dune management strategies have not been implemented.

Water Levels

- The range of lake levels will shift downward. Average levels could drop by as much as one to two metres. The lake levels will still fluctuate between highs and lows, but relative to historical recorded levels, they are projected to be substantially lower than we are accustomed.