

Great Lakes Water Level Statistics

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Overview

Extreme Great Lakes water levels (both high and low) periodically cause major social, economic, and ecosystem disruption throughout the Great Lakes system. Reliable lake level frequency distributions are a critical component of any comprehensive strategy for coping with lake level fluctuations. Historical records of monthly lake levels reflect secular changes in connecting channel hydraulics, watershed hydrologic response, and climate. The objective of this research is to develop improved water level statistics that reflect (1) existing hydrologic and hydraulic conditions, (2) the long lag-response of the lakes to meteorologic variability, (3) secular changes due to changing climatic regimes, and (4) the needs (e.g., varied planning horizons, understanding the limits of lake level statistics) of diverse Great Lakes decision makers.

2000 Plans

A study of secular changes in the seasonal cycle of the Great Lakes from 1860 through the present will be completed to assess possible changes in seasonal water levels due to changing climatic regimes. The seasonal lake levels are obtained by filtering the monthly water levels with a centered 12 month moving average. Seasonal statistics include maximums, minimums, ranges, and timing. The majority of the work has been completed using monthly data and has shown major changes in the seasonal range of Lakes St. Clair and Erie. The causes of these changes, believed to be a result of changing ice conditions in the connecting channels, will be investigated using our mid-lakes routing model with varying ice retardation. Lake Ontario analysis will be completed this year to examine changes in the seasonal cycle due to lake regulation. A journal article describing the study and results will be submitted this fiscal year.

1999 Plans

A study of secular changes in the seasonal cycle of the Great Lakes from 1860 through the present will be completed to assess possible changes in seasonal water levels due to changing climatic regimes. The seasonal lake levels are obtained by filtering the monthly water levels with a centered 12 month moving average. Seasonal statistics include maximums, minimums, ranges, and timing. The majority of the work has been completed using monthly data and has shown major changes in the seasonal range of Lakes St. Clair and Erie. The causes of these changes, believed to be a result of changing ice conditions in the connecting channels, will be investigated using our mid-lakes routing model with varying ice retardation. Lake Ontario will be added to the assessment this year to examine changes in the seasonal cycle due to lake regulation. In addition, hourly data will be digitized from 1900-present for the Harbor Beach master water level gage representing Lake Michigan-Huron. This data will be aggregated into daily averages as a pilot project to assess more subtle seasonal changes in the order of days to weeks for all lakes. The first draft of a journal article describing the study and preliminary results will be initiated this fiscal year.

1999 Accomplishments

A study of secular changes in the seasonal cycle of the Great Lakes from 1860 through the present was continued to assess possible changes in seasonal water levels due to changing climatic regimes. The seasonal lake levels are obtained by filtering the monthly water levels with a centered 12 month moving average. Seasonal statistics include maximums, minimums, ranges, and timing. The majority of the work has been completed using monthly data and has shown major changes in the seasonal range of Lakes St. Clair and Erie. The causes of these changes, believed to be a result of changing ice conditions in the connecting channels, will be investigated using our mid-lakes routing model with varying ice retardation. Lake Ontario was added to the assessment this year to examine changes in the seasonal cycle due to lake regulation. We found a significant change in the Lake Ontario seasonal cycle which appears to coincide with the construction of the St. Lawrence Seaway and the regulation of Lake Ontario. We did not begin the work in looking at Lake Michigan-Huron with daily data. We plan on aggregating the hourly data into daily averages as a pilot project to assess more subtle seasonal changes in the order of days to weeks for all lakes. The hourly data have been digitized as part of the ESDIM program but the final levels corrected to a common datum have not been completed by NOS. The first draft of a journal article describing the study and preliminary results has not been initiated this fiscal year pending completion of the analytical portion of the study.

In addition to the above planned studies, GLERL participated in the IJC Reference on the Export of Great lakes Waters. We did the climate change scenarios that were used in the study and their report to the Governments of the U.S. and Canada.

Products

Quinn, F.H. 1999. Anthropogenic Changes to Great Lakes Water Levels. In *Great Lakes Update, Monthly Bulletin of Lake Levels for the Great Lakes*. U.S. Army Corps of Engineers, Detroit District. Vol. No. 136, July 2, 1999. 4 pages.