

Great Lakes Hydrologic Data Base Development

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Co-Investigators: Midwestern Regional Climate Center, US Army Corps of Engineers (Detroit District), Environment Canada, Hydrologic Engineering Center of the COE (Davis)

Overview

The goal of this project is to develop and provide new or improved historical hydrometeorological databases for Great Lakes climatological, water resource and water supply forecasting studies. This task also includes GLERL support to the International Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data and the US-Canada Great Lakes St. Lawrence River Ice Information Working Group. This project produces the basic hydrologic data used in all of the water resources and climate change projects at GLERL. The data are also used in the international water quantity studies supporting the International Joint Commission. User agencies include the Corps of Engineers, EPA, Environment Canada, Fisheries and Oceans, various states and provinces, consulting engineers and scientists, and interested private and commercial interests.

2001 Accomplishments

St. Clair and Detroit Rivers Flow Coordination: GLERL has completed their portion of the international coordination of the flows; a report documenting the entire coordination process, along with all data used is forthcoming but awaits completion by Canadian agencies.

Data Acquisition: GLERL updated their hydrometeorological databases through 1999 (2000 for some data types). This required writing FORTRAN code to accommodate changes in supplying agency data formats; see GLERL Tech. Report 83

Great Lakes Internationally Coordinated Routing Model: GLERL, along with the US Army Corps of Engineers (Detroit District) and Environment Canada, and with cooperation from the Hydrologic Engineering Center of the COE (Davis), is developing a coordinated routing model encompassing the entire Great Lakes basin for use in Great Lakes water resource studies and lake level forecasting.

Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data: Thomas E. Croley II is now serving as one of the two US members of the board for the Coordinating Committee as well as the GLERL member of the Hydrology Subcommittee. S. Keith Martin is serving as the GLERL member of the Hydraulics Subcommittee.

US-Canada Ice Information Working Groups: Ray Assel continues to co-chair the US-Canada Great Lakes Ice Information Working Group and participate in the US-Canada Ice Information Working Group.

2000 Accomplishments

St. Clair and Detroit Rivers Flow Coordination: GLERL is participating, along with the COE and Environment Canada, in the international flow coordination of the Detroit and St. Clair river monthly flows for the period 1990-1999. The flows will be published for use in Great Lakes water quantity and water quality studies.

Data Acquisition: GLERL continued adding to their hydrometeorological data bases through interagency data transfers, including data purchase and annual subscription to the Midwest Climate Center services.

Great Lakes Internationally Coordinated Routing Model: A modular, object-oriented, middle Great Lakes hydrologic routing model, developed and coordinated between the US and Canada, has been linked with the Lake Superior regulation plan and is now operational for the basin above Niagara Falls. Work is in process for refining the model and incorporating the Lake Ontario regulation plan. The model is currently being run operationally for a number of Great Lake studies.

ESDIM Project to Digitize Great Lakes Water Level Data: Completed Digitizing water level data (August 18th 2000)-- which we recovered hourly water level data for the Master Gages around the Great Lakes. This involved developing computer programs that were used in the digitizing and quality controlling of over 6 million lines of data. This hourly data, which goes back to the period of record (in some cases to 1860), was digitized from deteriorating handwritten records. As of September 1, 2000 this data was given to NOS who will put it on the correct datum and make it available to the public. Additionally, NOS is using the procedures developed at GLERL to digitize the remaining 36 Great Lakes gages. Once the data is on the correct datum, we can use it for looking at long-term storm activity in the Great Lakes.

1999 Accomplishments

GLERL has been participating, along with the COE and Environment Canada, in the international flow coordination of the Detroit and St. Clair River monthly flows for the period 1990-1996. We are finishing up our work to finalize our proposed flows for coordination. The international Coordination will likely occur late this year or early next year. In addition Frank Quinn is serving as one of two U.S. members of the Coordinating Committee and Tom Croley and Cynthia Sellinger are participating as members of the Hydrology Subcommittee and Hydraulics Subcommittee respectively. The ESDIM data rescue project is proceeding on schedule. The objective of this two year project is to develop a computer database of historic hourly, tri-daily, and daily water level data from the 6 master water level gages, one for each Great Lake and Lake St. Clair, and from the long term water level gage at Buffalo on Lake Erie. The original water level data, consisting of the original data reductions (hourly, tri-daily, and daily observations), are contained in a large set of hand written notebooks for the individual gauges going back to the early to mid 19th century. Data for the master and recent gauges have been digitized from 1970 to the present time. We have designed and developed the necessary database and QA/QC system for processing and archiving the data. This includes error checking from the hourly daily and monthly values. The digitizing and quality control have been

completed for the master gage at Harbor Beach with the data sent to the NOS for datum corrections and inputting into the national water levels data base. The process for the master gages at Marquette and Cleveland are about 2/3 completed. The GLERL Great Lakes Monthly Hydrologic Database has been updated through 1997. The data can be accessed from the GLERL web site. Work is continuing on the assessment of secular changes in Great Lakes Precipitation. The extremely high precipitation regime over the last 30 years has found to result from major increases in summer and fall precipitation. An additional pilot study, done under contract by Peter Sousounis and Emily Grover at University of Michigan, documented the increasing fall precipitation trend at both local and statewide levels in Michigan. A 31% and 14% increase in precipitation totals was exhibited respectively. There was an increase in the frequency of precipitation days as well as in the length of precipitation events. An increase in the frequency of extreme precipitation days was also observed.

1998 Accomplishments

A method to provide better estimates of area-weighted precipitation for the late 19th and early 20th centuries was developed for Lake Superior. Analysis methods and results are summarized in a Technical Memorandum (Assel et al, 1998). The ratio method provides better estimates of area average precipitation for the late 19th and early 20th century which are useful in climate and lake water balance studies. Coordinated Great Lakes Regulation and Routing Model. A modular, object-oriented, middle Great Lakes hydrologic routing model, MIDLAKES, was developed and coordinated between the US and Canada, for use in bi-national Great Lakes studies and operational regulation and forecasting. This model is part of a larger project to develop a common American and Canadian Great Lakes regulation and routing model for both operational and research purposes. The new model is independent of datum, units, and form of stage-fall-discharge relationships. Its versatility will be useful for operational regulation and forecasting, evaluation of alternative lake regulation plans, simulation of historical conditions, and assessment of impacts due to channel changes, diversions, and climate change.

Products

Croley, T.E. and T.S. 1994. *Great Lakes Monthly Hydrologic Data. NOAA Technical Memorandum ERL GLERL-083.* Great Lakes Environmental Research Laboratory, Ann Arbor, MI. 15 pp.

Kryza, J., and F.H. Quinn. 1999. *Large Lakes Groundwater Budget. Final Report on the Bi-National Polish/U.S. Project on Comparative Groundwater Mass Water Balance Study between a U.S. Great Lake (Michigan) and a Large Lake in Poland.* University of Wroclaw, Laboratory of Environmental Geology, Wroclaw, Poland, 41 pp.

Assel, R. A., Norton, D.C. and Quinn, F. H. September 1998. *Early 20th Century Lake Superior Basin Precipitation Estimates. NOAA Technical Memorandum ERL GLERL-107.* Great Lakes Environmental Research Laboratory, Ann Arbor, MI. 22 pp.

Clites, A.H., and D.E. Lee. 1998. *MIDLAKES: A Coordinated Hydrologic Response Model for the Middle Great Lakes*. NOAA Technical Memorandum ERL GLERL-109. Great Lakes Environmental Research Laboratory, Ann Arbor, MI. 48 pp.