Great Lakes and St. Lawrence River

Test Bed Leaders

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Test Bed Description

The Great Lakes basin, located at the Canada-US Border (Fig. 1), contains approximately 20% of the world fresh water supply. The watershed area is approximately 1 million km² and close to 40 million people live on this watershed, including roughly one third of the population of Canada. Water empties from the Great Lakes into the St. Lawrence River and passes through the Moses-Saunders dam at the outlet of Lake Ontario.

Decisions on Lake Ontario outflows are typically taken on a weekly basis and are based on lake levels, forecasted inflows to the lake and forecasted outflows from the Ottawa River basin for the following weeks, and thus may benefit from better ensemble streamflow forecasts both of Lake Ontario inflows and Ottawa River flow for the first 15 days.

At this time scale, ensemble streamflow forecasts should benefit from an accurate analysis of initial conditions (snow and soil moisture) as well as ensemble weather forecasts.

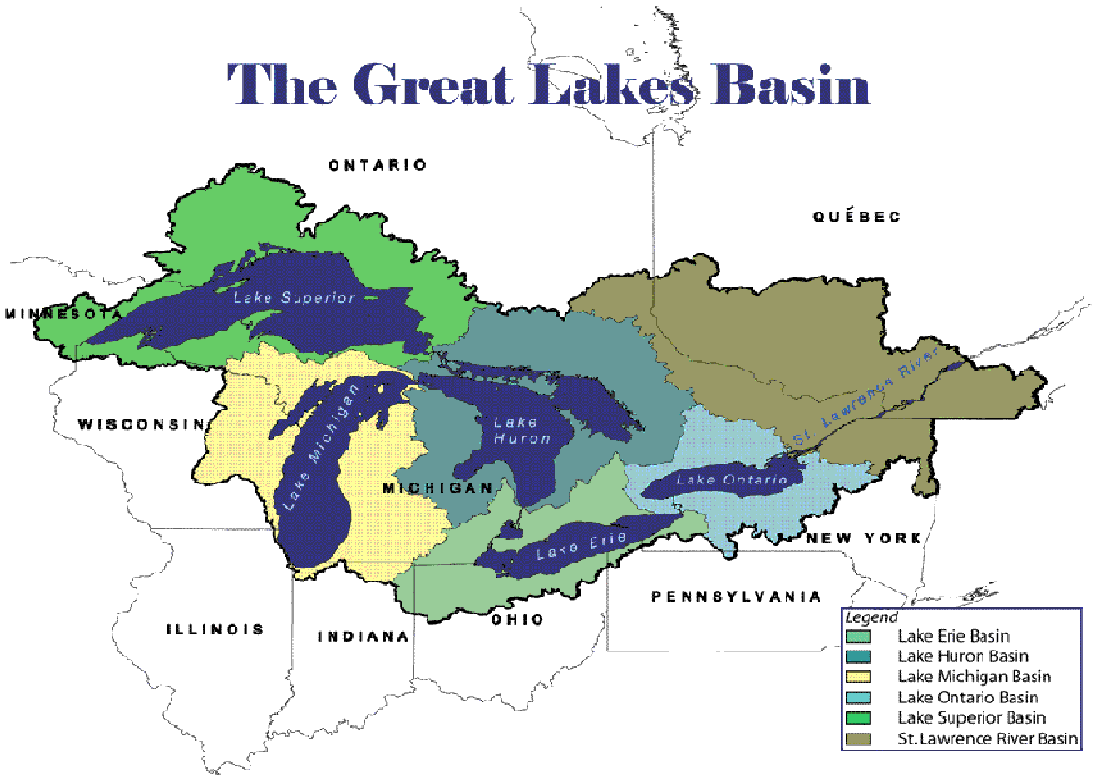

Fig.1 The Great Lakes basin (1)

Key Scientific Questions

While the Great Lakes basin is fairly large, individual lakes and in particular Lake Ontario, are fed by a number of much smaller watersheds. It is known that for some of these watersheds, for example the Raquette river which takes its source in the Adirondack mountains, basin average snow water equivalent is better estimated from a high resolution analysis. **(2)** It is also known that the Great Lakes influence both winter-time and summer-time weather at the regional scale. **(3)**, **(4)** Given the importance of resolving the terrain and the lakes for realistic hydrometeorological modelling of the Great Lakes, this test bed can be used to test the influence of increased resolution both for the land-surface scheme and for the atmospheric model on the accuracy and reliability of ensemble streamflow forecasts and ensemble weather forecasts.

Key Objectives of the Research Project

- To demonstrate the importance of relatively detailed atmospheric and hydrologic modeling for medium-range atmospheric and hydrologic forecasting on large basins.
- To evaluate the added value of using the new North American Ensemble Forecasting System (NAEFS), compared to only using ensemble forecasts from the individual centers (CMC and NCEP), but also compared to the GFS reforecasts.
- There is considerable hydroelectric power production on the basin, and as some of the hydropower companies such as Hydro-Québec can readily use better ensemble streamflow forecasts to improve their operations, the testbed can be used to evaluate the added economic value of using ensemble weather predictions instead of climatology for lead times of up to two weeks.

The HEPEX scientific community will be asked to propose and test different strategies for downscaling the atmospheric forecasts for specific events, and for hydrological modelling. The user community will be asked to help evaluate the economic value of the forecasts.

Data Resources

The Great Lakes Environmental Research Laboratory **(5)** maintains a comprehensive database of hydrologic, meteorologic, climatic, nivometric and physiographic data:

- Monthly hydroclimatic time series dating back more than a century
- More than 180 hydrometric stations on unregulated basins on the Canadian side of the border
- Daily hydrometric and meteorologic observations are available freely through the web, 6-hourly data is available for synoptic weather stations
- A 15-km analysis of precipitation combining the regional GEM model first guess with synoptic observations is available in realtime for the whole basin, as well as a 10-km radar mosaic

Land cover information is available for the US through the Great Lakes Assessment Project of the U.S. forest service **(6)** or through the NOAA Coastal Services Center **(7)**, and for Canada through the Ontario land cover database.
Soil information is available from the STATSGO **(8)** and CANSIS **(9)** databases.
The U.S. and Canada are presently putting in place a comprehensive GIS database for the Great Lakes **(10)**
Elevation and land cover at a 1 km resolution and information on soil type at a 10 km resolution is however readily available from the Canadian Meteorological Centre and could be provided in GRIB format. 90m elevation data is also available freely (30m elevation data is available over the United States), but needs to be processed to obtain a complete, higher-resolution digital elevation model over the whole basin. Using elevation from the SRTM mission (available freely at a 90m resolution) is also a possibility over Canada.

References

(1) Taken from the web site of the Council of Great Lakes Governors
(2) Lefaivre, D.; Pellerin, P.; Ritchie, H.; Turcotte, R.; Fortin, V.; Pietroniro, A.; and Lamontagne, M. 2004. Water level forecasting in the St. Lawrence River between Lake St. Louis and Quebec City: Ongoing operation and future outlook. 11th Annual International Conference on the St. Lawrence River Ecosystem, Cornwall, Ontario. May 18-19th, 2004.
(3) Bosart, L. and T.J. Galarneau Jr. 2005. The Influence of the Great Lakes on warm season weather systems during BAMEX, 6th AMS Coastal Meteorology Conference, San Diego CA, January 10-13th, 2005.
(4) http://www.islandnet.com/~see/weather/elements/lkefsnw3.htm
(5) http://www.glerl.noaa.gov
(6) http://www.umesc.usgs.gov/umesc_spatial/projects/gr_lakes_assessment/usfs_page.html
(7) http://www.csc.noaa.gov/crs/lca/greatlakes.html
(8) http://www.ncgc.nrcs.usda.gov/products/datasets/statsgo/
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(10) http://www.glfc.org/glgis/