

International Great Lakes Datum: Coming Update & Access

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Overview of IGLD



- International Great Lakes Datum (IGLD) is a **common height reference** system to measure and relate water levels
- **Official vertical datum** used for water level measurements and navigation charts throughout the Great Lakes, their connecting channels and the St. Lawrence River
- Maintained by the **Coordinating Committee** on Great Lakes Basic Hydraulic and Hydrologic Data, a binational committee with representatives from the Governments of Canada and the United States
- IGLD is **updated every 25-30 years** due to Glacial Isostatic Adjustment (GIA)
- **Next update will be IGLD (2020), expected for release around 2027**

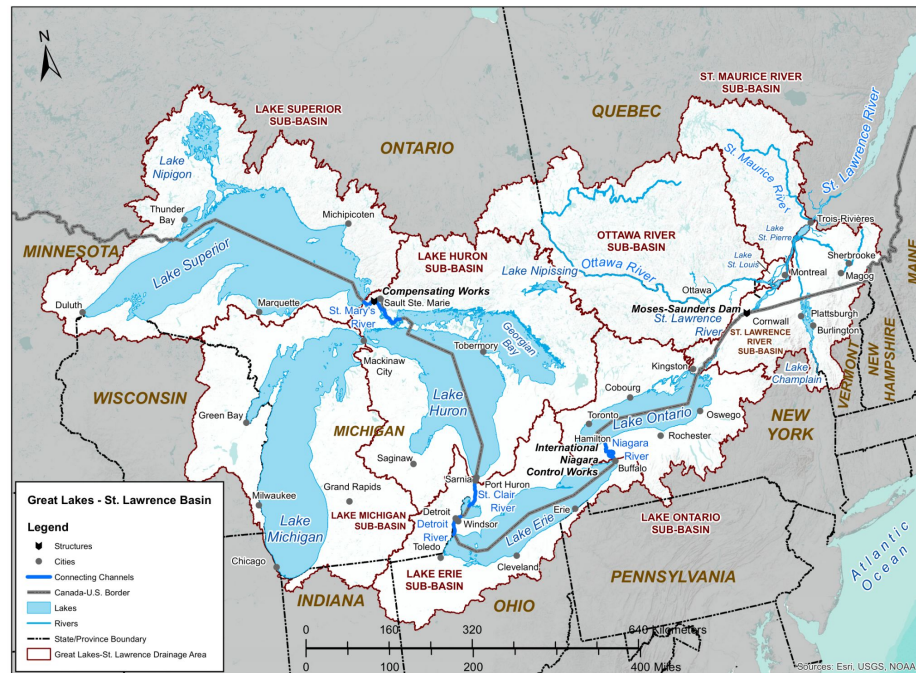
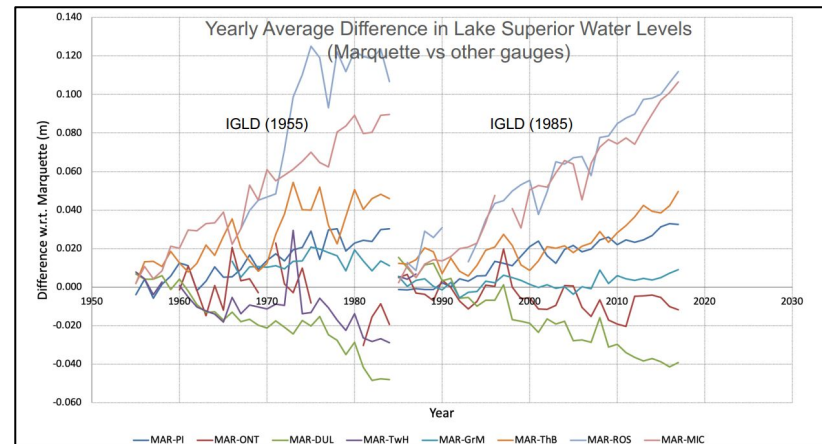
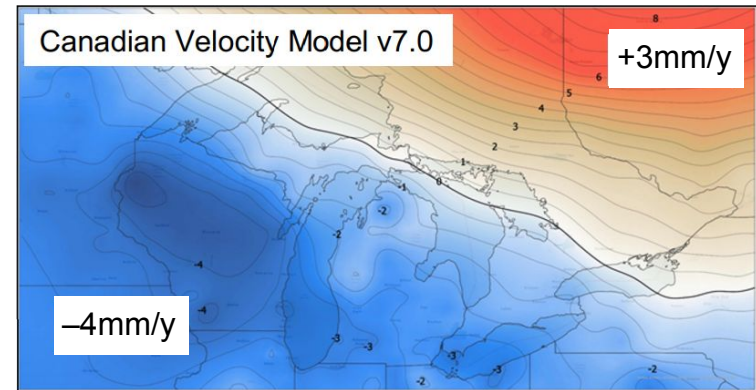
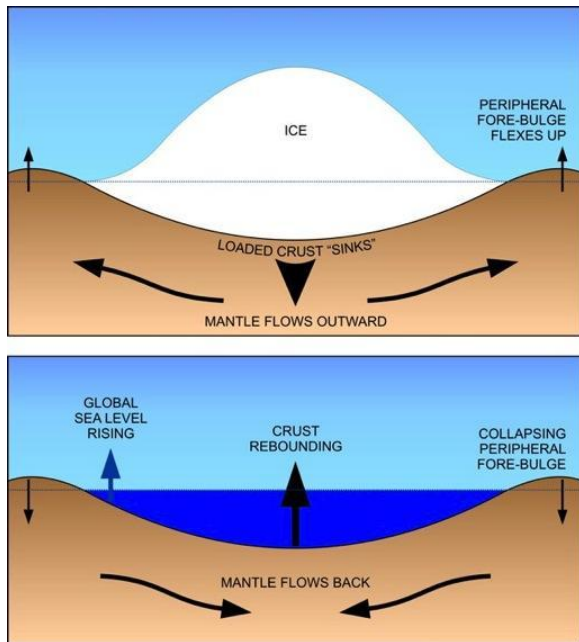


Image credit: IJC

Why a new IGLD?

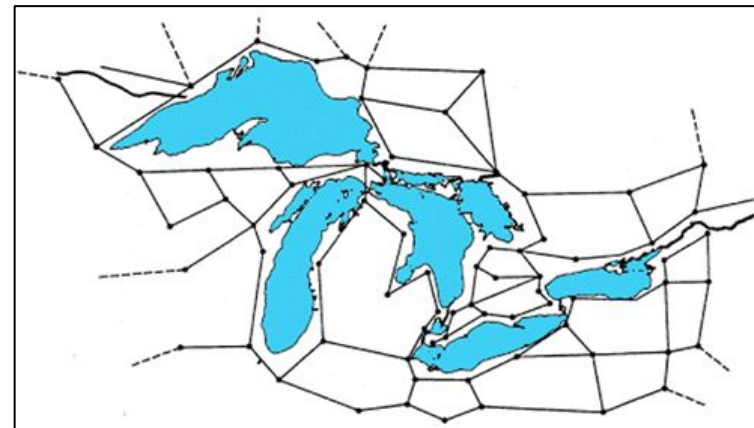
- Uplifting in north subsiding in south
- Overall tilting ~ 7 mm/year (21cm or 8" over 30 years)
- Need to update IGLD every 25-30 years => **overdue!**



Effect of GIA on Water Level Measurements

Current IGLD (1985)

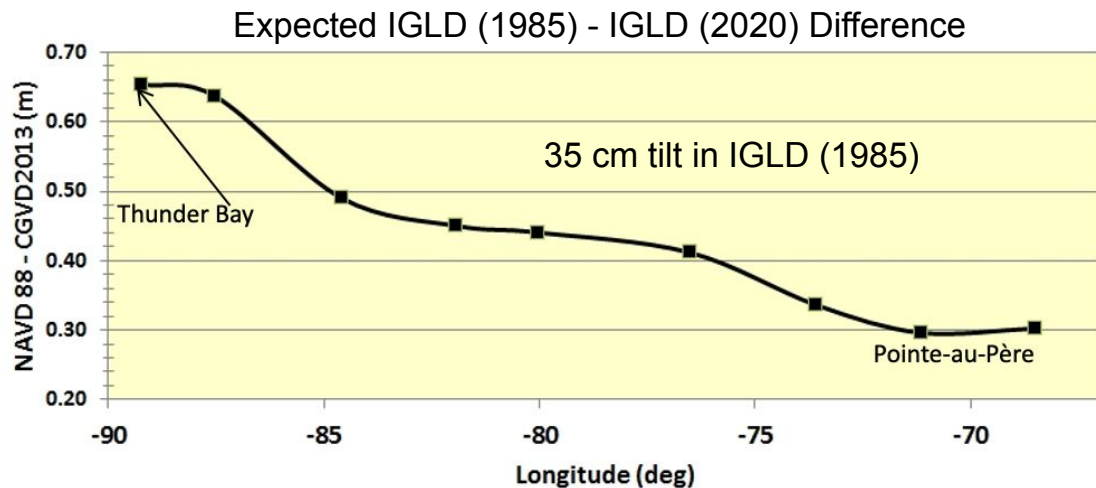
- Based on current vertical datum in U.S. (NAVD88)
- Reference zero is mean sea level at Pointe au Père & Rimouski, Québec
- Reference surface (datum) extended inland using leveling
 - Very time consuming & cost prohibitive
 - Datum accessible only where leveling bench marks exist
 - Affected by systematic errors in long leveling loops
- Uses dynamic heights for measuring hydraulic head – dynamic heights are constant along a level surface (e.g., undisturbed lake)



NAVD88 Network Level Loops

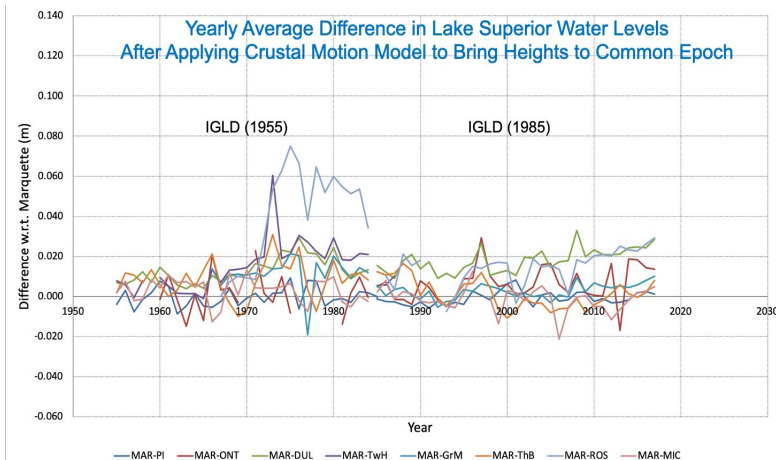
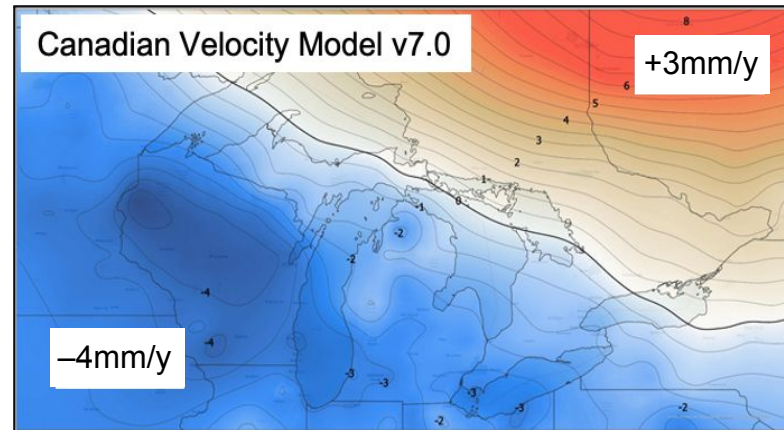
New IGLD (2020)

- Based on the new North American vertical datum (NAPGD2022)
- Reference zero is mean sea level around the coasts of North America
- Reference surface (datum) extended inland using a geoid model
 - Geoid model based on gravity data, not leveling
 - Defined everywhere, not only where leveling bench marks exist
- Using dynamic heights
- Heights referenced to epoch 2020.0 (mid-point of 7 year water level obs period)
- **Heights expected to change 30-65 cm (12"-26") from existing IGLD (1985)**



“Dynamic” Nature of IGLD (2020)

- IGLD (2020) will be a time-dependent “dynamic” datum
- Heights are changing in time due to regional & local crustal motions
- Can correct for crustal motion using a crustal velocity model estimated from GPS
- Velocity model will be provided by geodetic agencies & incorporated into commercial software (e.g., ArcGIS)
- Deciding how to implement for water levels
- Example of correcting water level data →



Determining Heights via GNSS

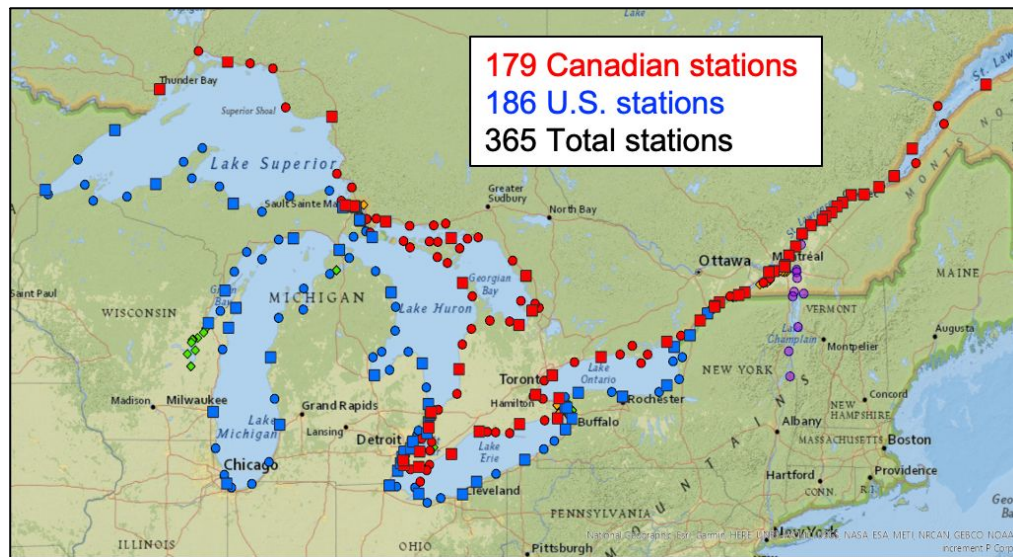
- **Primary access to the new datum will be by GNSS**
 - GNSS = Global Navigation Satellite Systems such as GPS (US) and systems from other countries
 - Provides very high accuracy positioning, especially over long distances
 - Provides more accurate & direct ties to the new datum
 - Local leveling around each gauge will still be required
- Online GNSS data processing tools will be provided by the geodetic agencies (CGS & NGS)



GNSS Setup at Blue Water Bridge, Upper St. Clair River

Moving Water Level Gauges to IGLD (2020)

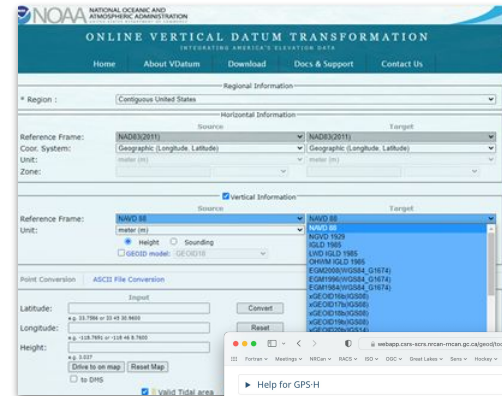
- Need to determine IGLD (2020) heights for all water level gauges/benchmarks
- Previous GPS surveys in 1997, 2005, 2010, 2015 to prepare for IGLD update
- 2022 GNSS survey completed and expanded to include:
 - Permanent gauges (CHS, ECCC, NOAA, USACE, USGS, Seaway, NYPA, OPG)
 - Seasonal gauges for determination of hydraulic correctors
- GNSS processing completed



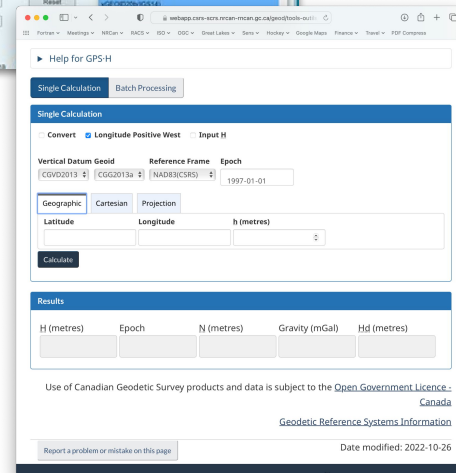
Transformations from Older Datums

- Transformation grids & tools will be needed for moving large data sets from older datums to IGLD (2020)
- Will use the OGC international GGXF standard for grid format
- Transformation grids & tools will be provided by CGS & NGS
 - GPS-H (Canada)
 - VDatum (US)
- Many commercial GIS developers also committed to incorporating transformations into their GIS software

VDatum



GPS-H



Impacts of Updating IGLD

Updated IGLD(2020) water level reference will need to be implemented for:

- Commercial and recreational navigation, including charts, ports/harbors
- Water level regulation and forecasting
- Coastal zone management and planning, including flood & erosion prediction and response, and coastal structure design, construction & maintenance
- Legislation may need to be updated to reflect IGLD (2020)

Remaining Tasks

- ☐ Create crustal motion model for the Great Lakes - St. Lawrence River system using GNSS campaigns and CORS/CACS data
- ☐ Perform another GNSS campaign survey to validate velocities at permanent gauges
- ☐ Determine and publish transformations between IGLD (2020) and other datums, including IGLD (1985)
- ☐ Update and publish gauge histories
- ☐ Reference LWD & step charts along interconnecting channels to IGLD (2020)
- ☐ Publish new IGLD (2020) and report

Resources



<https://www.greatlakescc.org/en/international-great-lakes-datum-update/>

[Email: info@GreatLakesCC.org](mailto:info@GreatLakesCC.org)

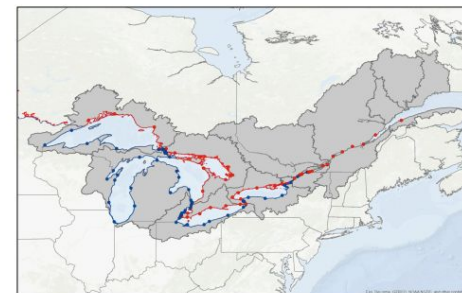
THANK YOU



Coordinating Committee on Great Lakes
Basic Hydraulic & Hydrologic Data



Updating the International Great Lakes Datum (IGLD)



Prepared by the
Vertical Control – Water Levels Subcommittee
on behalf of the
Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data

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