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Introduction:

Canada, bordering three oceans, has a strong tide and water level program in support of navigation, marine transportation, coastal zone management and climate research. The Canadian Hydrographic Service provide predicted times and heights of high and low waters, and water levels for over 700 stations in Canada, including over 200 locations along the St. Lawrence shoreline directly via the internet. As part of this program there are currently 88 tide/water level (TWL) gauges installed and operating providing data in real-time (Fig 1.). The responsibility of these gauges is a collaborative effort between the Canadian Hydrographic Service of the federal Department of Fisheries and Oceans and the Water Surveys Branch of the federal Department of the Environment. Five of these 88 stations have been designated as GLOSS stations (Table 1).

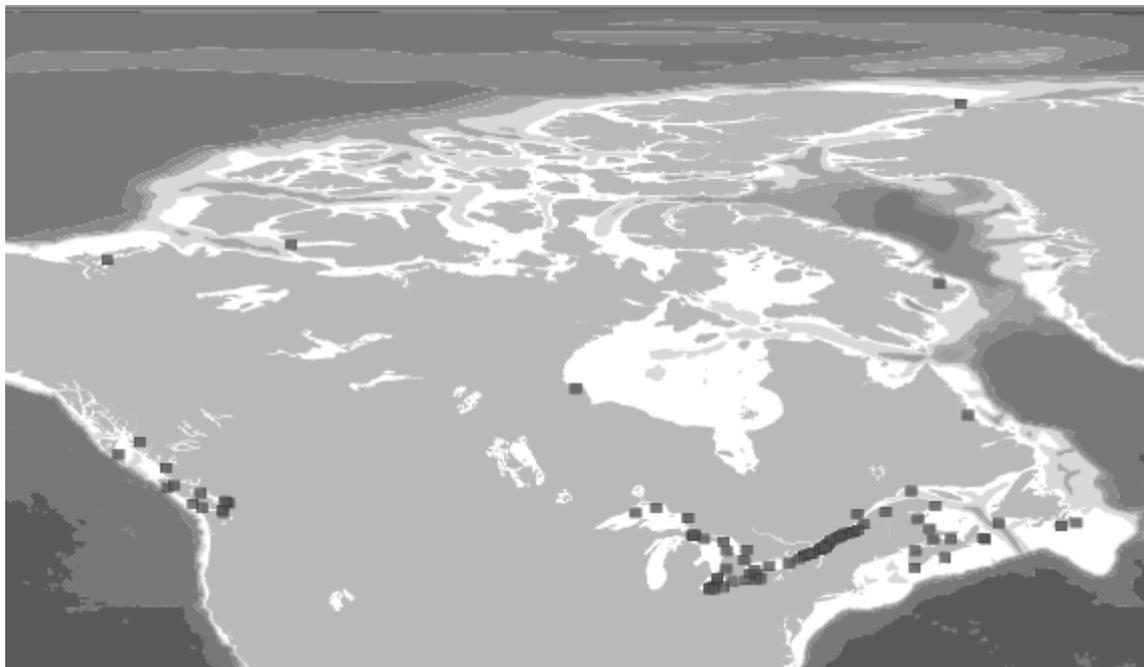


Figure 1. Permanent Operational Gauges

Table 1: Status of Active GLOSS Stations in Canada

GLOSS ID	Location	Gauge Information	Status
222	Halifax 44.6667 N 63.5833 W	Sutron	<ul style="list-style-type: none">• Ongoing, currently using a digital gauge• All the historical tabulated hourly heights have been recovered for this station.• The period of record spans from Oct 1895 to January 2005.• Data up to Dec 2003, has been sent to PSMSL.
224	Nain 56.55 N 61.6833 W	Sutron GPS co-located	<ul style="list-style-type: none">• Operational, currently using a digital gauge• The period of record spans from Jan 1963- Oct 1988 and starts again in April 2001- December 2004• Data for 2003 have been sent to PSMSL
155	Prince Rupert 54.317 N 130.324 W	Sutron	<ul style="list-style-type: none">• Ongoing, currently using a digital gauge.• MEDS recovered 276 station months of historical tabulated hourly heights from 1939 to 1962 (23 years), as part of a Data Archaeology Program.• The period of record spans from Jan 1906 to Jan 2005.• The complete data set, up to Dec 2003, has been transmitted to PSMSL.
223	St. John's 47.5667 N 52.7167 W	Sutron	<ul style="list-style-type: none">• Ongoing, currently using a digital gauge.• All the historical tabulated hourly heights have been recovered for this station.• The period of record spans from Aug 1935 to January 2005.• The complete data set, up to Dec 2003, has been transmitted to PSMSL.
156	Tofino 49.154 N 125.913 W	Sutron	<ul style="list-style-type: none">• Ongoing, currently using a digital gauge.• MEDS recovered 258 station months of historical tabulated hourly heights from 1909 to 1956 (21.5 years) as part of a Data Archaeology Program.• The period of record spans from Oct 1905 to January 2005.• The complete data set, up to Dec 2003, has been transmitted to PSMSL.

In response to increased demand for sea level and climatic information from the northern polar environment, Canada has 5 tide stations in the high latitudes. A list of these stations is presented in table 2.

Table 2. Arctic Tide Gauge Status			
Station Name	Geo Location	Gauge Type	Status
Alert	Ellesmere Island, Eastern Canadian Arctic 82.49 N, 62.31 W	Sutron GPS co-located	<ul style="list-style-type: none"> • Gauge re-established Dec 2002. • Previous period of record, 1961-1979 • Sampling at 3 minute intervals • Daily download of data to MEDS
Holman	Victoria Island, Western Canadian Arctic 70.73 N, 117.76 W	Sutron GPS co-located	<ul style="list-style-type: none"> • Gauge established Dec 2002 • Sampling at 3 minute intervals • Daily download of data to MEDS
Qikiqtarjuaq (Broughton Island)	Baffin Island. Eastern Canadian Arctic 67.53 N, 63.75 W	Sutron GPS co-located	<ul style="list-style-type: none"> • Gauge established July 2004 • Sampling at 3 minute intervals • Daily download of data to MEDS
Churchill	Hudson Bay, Central Canada 58.76 N, 94.18 W	Sutron	<ul style="list-style-type: none"> • Gauge established Jan 1940 • Sampling at 3 minute intervals • Daily download of data to MEDS
Tuktoyuktuk	Western Canadian Arctic 69.41 N, 132.96 W	Sutron GPS co-located	<ul style="list-style-type: none"> • Gauge re-established Aug 2003 • Previous period of record 1961-1982 • Sampling at 3 minute intervals • Daily download of data to MEDS

Gauge Technology

The majority of the gauges in the Canadian Permanent Water Level Network use Sutron float gauges with pressure transducer back-ups. Gauges located in the Arctic, use bubbler type gauges, with the exception of Nain which uses both types. Gauges located in the St. Lawrence River/Estuary system use pressure sensors.

Communications with most gauges are through modem, with the exception of the St. Lawrence system which uses a network of RF transmitters/receivers to transmit data to a central server. The data collected from the national networks are transmitted to the Marine Environmental Data Service (MEDS) within 30 days of measurement and in some cases within 24 hours.

GPS Technology

As highlighted in Table 2, the majority of the Arctic tide stations (including Nain) are co-located with continuously recording GPS sensors to allow interpretation of any tectonic motion. GPS sensors are also co-located with 4 water level stations in the Great Lakes basin. This is to measure isostatic rebound and water level changes in response. The GPS data are collected and managed by the federal department of Natural Resources.

GPS technology, integrated with real-time reference shore station observations, has been used for the past 2 years to measure in-situ tidal heights while conducting operational sounding and dredging operations in the St. Lawrence estuary.

Data Availability

All data collected by the Canadian Permanent Network are transmitted to MEDS within a maximum of 30 days and more often within 24 hours. Data are quality controlled, archived and available for free public access immediately. Exchanges with other government departments and international agencies occur on a daily basis. Monthly submissions of hourly and 15-minute tidal data are sent to the UHSLC. Monthly mean data are submitted to PSMSL on an annual basis.

Data are currently accessed through a request system in which clients fill out an online form and then receive the data after the request has been actioned by a data technician.

New Directions

Online Data Access:

There are current developments to provide online access to data. This is planned for production by the end of March 2005. This application will allow users to view/download hourly, daily or monthly data online, free of charge.

Benchmark, Gauge History and Tidal Height and Current Constituents are presently available in a password protected web application. In addition to the password protected application, Benchmark information is available in a public access application.

Tsunami Warning System:

In response to the tragic events in Southeast Asia December 26, 2004, the Canadian government is undertaking a study to establish a Tsunami Warning System on the Atlantic Coast. There is currently a Tsunami Warning System in operation on the Pacific Coast. The new system for the Atlantic Coast may result in new and updated TWL stations in the Atlantic region as well as updated communications systems.

Web Addresses

Online data inventory:

www.meds-sdmm.dfo-mpo.gc.ca/meds/Databases/TWL/TWL_inventory_e.htm

Public Benchmark access:

www.meds-sdmm.dfo-mpo.gc.ca/meds/Prog_Nat/benchmark/public/default_e.asp

Online Tidal Predictions:

<http://tides-marees.gc.ca/>