The Use of GNSS at Water Level and Tide Gauge Stations in Canada

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Abstract—Monitoring vertical crustal motions is uniquely important in Canada where much of the landmass is affected by glacial isostatic adjustment (GIA). These motions can have a significant impact on water level and tide gauging stations that determine lake levels and sea levels around the country. In order to build on current and past efforts to measure and model both vertical and horizontal motions at their gauges, the Canadian Hydrographic Service (CHS) in partnership with the Canadian Geodetic Survey (CGS) have worked together to use GNSS to monitor these crustal motions at both water level stations on the Great Lakes and tide gauge stations in the Arctic. At some CHS gauges, permanent GNSS stations have been installed that are also part of the national Canadian Active Control System providing positioning infrastructure to the wider public. These so called Regional Active Control Stations (RACS) have been installed at 12 permanent water level stations around the Great Lakes and at 5 permanent tide gauge stations in the Arctic. These stations are being used to densify the national CACS network and improve regional crustal velocity models which enables more accurate regional GNSS positioning. These RACS also enable the determination of accurate water levels even for gauges affected by local motions such as subsidence induced by large salt mining operations. Further RACS at water level stations are planned for the near future. In addition to permanent GNSS stations, high accuracy campaign surveys have also been conducted around the Great Lakes regional since 1997 to determine accurate heights for the International Great Lakes Datum (IGLD) and to further densify the monitoring of crustal motions in the region. A new GNSS campaign is planned for 2020 in support of updating the IGLD to a new geoid-based vertical datum where GNSS will be the primary method of determining heights.

Keywords—GNSS, water level networks, tide gauges, water level gauges, crustal motion, glacial isostatic adjustment, vertical datum, IGLD