Absolute Gravity Operations & Priorities within Natural Resources Canada

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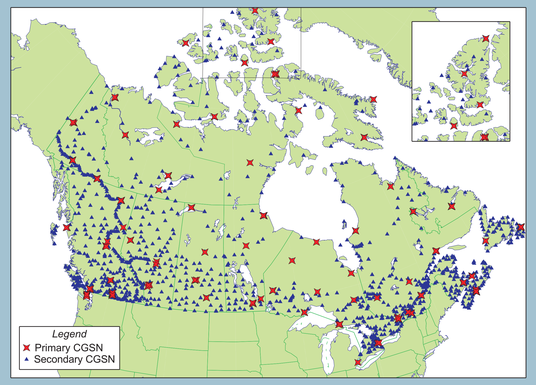
Geodetic Survey Division AG Operations

GSD's Canadian Spatial Reference System operates FG5-236 from its absolute gravity facility at the Canadian Absolute Gravity Site in Cantley, Québec (near Ottawa, Ontario).

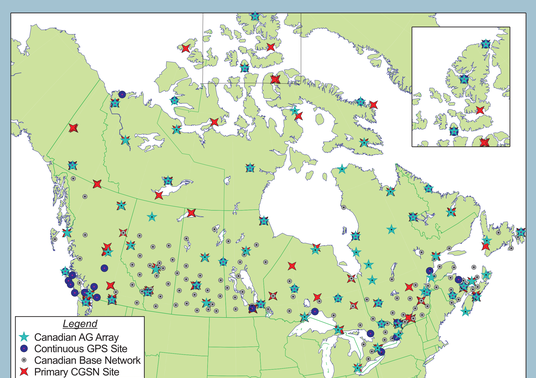
• The primary role of the Geodetic Survey Division (GSD) is to maintain, continuously improve, and facilitate efficient access to the Canadian Spatial Reference System (CSRS). This includes the responsibility to maintain the Canadian Gravity Standardization Net (CGSN) that provides datum control for gravity observations across Canada.

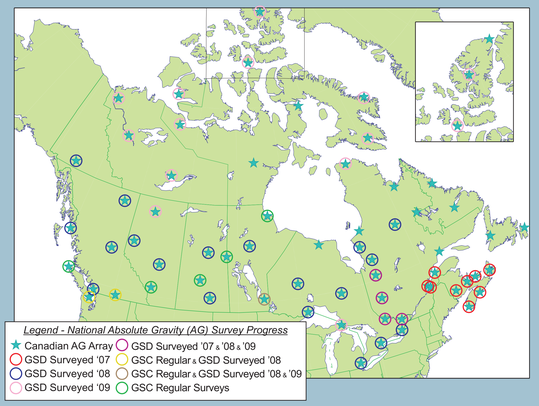
• The current primary control network and the complementary gravity stations of the CGSN have been mainly established and maintained using relative gravimetry linked to only a few absolute gravity stations.



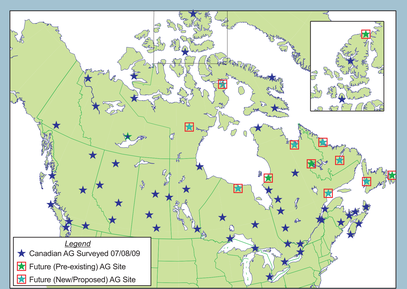
• Continued improvements in absolute gravimetry have made AG instruments more compact, robust, and efficient.
- ⇨ Modernization and subsequent maintenance of the CGSN utilize (primarily) AG techniques.
- ⇨ High precision of AG techniques facilitates monitoring the time evolution of gravity values across Canada.

• In order to better contribute to the definition of the vertical component of a highly accurate, multi-purpose, active and integrated Canadian Spatial Reference System (CSRS), GSD is in the process of consolidating the CGSN primary control sites with geometric reference stations (e.g. continuous and episodic GPS) of the CSRS.





- ⇨ Complete "1st epoch" survey (and ties) for National AG Array
  - ~11 remaining sites are predominately located in Newfoundland & Labrador and northern Québec
  - Subsequently update/re-adjust CGSN datum
- ⇨ Prioritize sites and their respective re-observation frequencies
  - Contribution to the understanding of the time-evolution of the height definitions within a accurate and integrated CSRS
  - Multi-purpose – contribute to scientific studies (*e.g.* coastal and earthquake hazards studies)
  - Possible expansion/densification where necessary

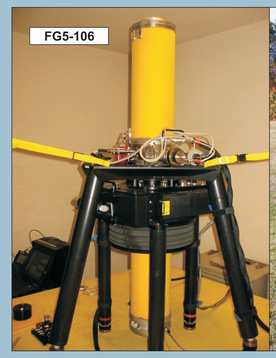


- ⇨ CSRS objectives, including:
  - Datum support for gravity surveys
  - Support time evolution of vertical component of geometric RF
  - Maintenance of a new gravity-based/geoid height reference system (e.g. direct measurement of g-dot/h-dot ratio provides simplified connection for corresponding reference standards)
- ⇨ Scientific applications/priorities (with NRCan partners):
  - Subduction/earthquake zone deformation studies
  - Sea-level rise studies
  - Hydrological/ground-water mass monitoring
  - Post-glacial rebound studies

Geological Survey of Canada AG Operations

The Geological Survey of Canada (Pacific Division) focuses absolute gravity efforts in two primary regions:
- ⇨ Vancouver Island
- ⇨ Mid-Continent

The GSC's Canadian Crustal Deformation Service operates FG5-106 from its absolute gravity facility at the Pacific Geoscience Centre.



Primary Rationale for Annual Mid-Continent Absolute Gravity Surveys:

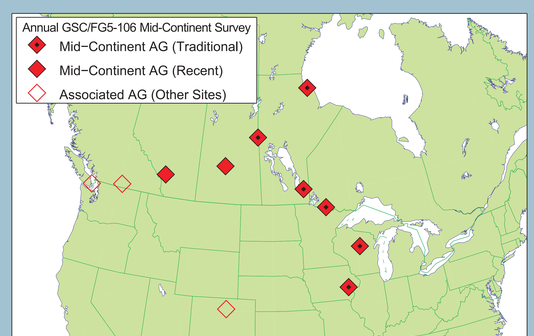
• Climate Change (*e.g.* drought studies on the Canadian Prairies)

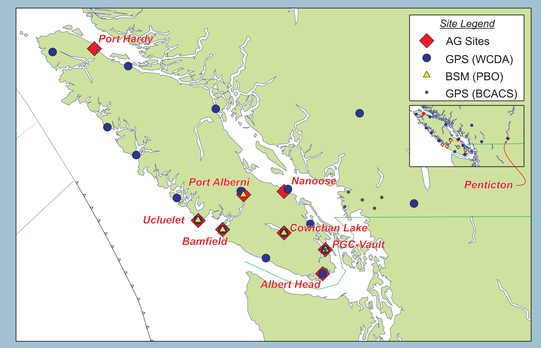
• Post-Glacial Rebound Studies

• Groundwater (*e.g.* water mass variability) Studies

• Satellite Gravity Mission (*e.g.* GRACE) Calibration and Validation Analyses

• Manitoba Hydro (water variability/availability studies - similar to Climate Change & Groundwater studies listed above)





Primary Rationale for Repeated Vancouver Island AG Surveys:

• Earthquake Hazards: dynamics/processes and vertical deformation
- ⇨ Co-located with key continuous GPS sites
- ⇨ Co-located with bore-hole observatory sites (continuous GPS + borehole strain-meter, pore pressure, & seismometer)

• Long-Term Regional Tectonic Studies

• Short-Term Events (*i.e.* ETS - episodic tremor and slip)

• Climate Change & Relative Sea-Level Studies (with tide gauges & GPS)

• Satellite Gravity (*e.g.* GRACE) Analyses and Comparisons

Absolute Gravity Observation Frequencies in Southwestern BC:

• Nanoose, Ucluelet, Albert Head, and PGC-Vault:
- ⇨ 4 times per year (last 10+ years)

• Port Hardy and Penticton:
- ⇨ 2 times per year; recently 4 times per year

• Bamfield, Port Alberni, Cowichan Lake (co-located with borehole strainmeters)
- ⇨ 1 time per year (planned)

• Extended "Continuous" Runs during ETS Events - Several Weeks Duration
- ⇨ Ucluelet (3x), PGC-Vault (1x), Port Alberni (1x)
- ⇨ Targeted for Port Renfrew or Jordan River (new AG sites near GPS)

Poster Presentation

2009 Workshop on Monitoring North American Geoid Change

Boulder, CO
Oct 21-23, 2009

Absolute Gravity Measurements in Canada
Mesures de gravimétrie absolue au Canada
Since 1902 - Depuis 1902

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