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Superconducting Gravity Effects of Earthquake at Cascadia Subduction Zone on Vancouver Island, Canada

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Superconducting gravimeter (SG) iGrav #01 was deployed at NRCan's Pacific Geoscience Centre (PGC) on Vancouver Island near Sidney in British Columbia, Canada, in July 2012. The PGC is situated in the forearc of the northern Cascadia Subduction Zone (CSZ) and is equipped with FG-5 and A-10 absolute gravimeters, a borehole strainmeter, and a GPS network. In this area, a transient surface deformation accompanied by tremor-like seismic signals has been documented with a recurrence interval of 13 to 16 months. This phenomenon, named Episodic Tremor and Slip (ETS), has been interpreted to be associated with slow slip events (silent earthquakes) in the deeper (25–45 km) part of the CSZ. These slip events have been detected by transient horizontal displacements. The SG is not sensitive to horizontal displacements but it has the largest sensitivity in vertical direction.

For detecting of ETS, the continuous SG recordings at the PGC site were reduced for the Earth and ocean tides, polar motion, atmospheric pressure and soil moisture, and, then were band-pass filtered and analyzed in the time and frequency domains and compared with the GPS-detected ETS. Furthermore, we present the gravity effect of the Haida Gwaii earthquake, which occurred near the plate boundary between the Pacific and North America plates (52.788N, 132.101W, 136 km south of Masset, Canada, on October 28th 2012 at 03:04:09 GMT with a magnitude 7.8 at a depth of 14 km). During the observation, a large co-seismic gravity change of -2.6 microGal was recorded at the onset of the Haida Gwaii earthquake. In addition, a significant decrease of gravity was observed from the 15 days prior to the earthquake, and the decrease lasted for 11 days after the earthquake. The analysis of other earthquakes, e.g. the southwestern Alaska earthquake (55.28N, 134.87W, January 5th 2013 with a magnitude 7.5) is also presented.