Large-Scale Solid Earth Deformation Observed Using Space Geodetic Sensors

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ABSTRACT:

Innovative applications of space geodetic sensors have enabled observing and interpreting large-scale solid Earth geodynamics, such as volcanic deformation, coseismic deformation resulting from earthquakes, glacial isostatic adjustment process, tectonics, and natural or anthropogenic subsidence. The space geodetic measurements include GNSS measured horizontal and vertical crustal displacements, synthetic aperture radar interferometry (InSAR) measured line-of-signal surface deformations, satellite altimetry observed solid-Earth vertical displacements, and more recently, surface and subsurface deformation measurements using the spaceborne gravimetry data from the Gravity Recovery And Climate Experiment (GRACE) twin-satellites. Here we provide a review of these techniques and their contemporary contributions to geodynamics and geophysical studies, and present scientific results using these sensors, including the study of GIA process in the Hudson Bay region, permafrost deformation monitoring, and InSAR/GNSS/GRACE observed and inverted coseismic deformation resulting from large undersea earthquakes, including the 2010 Mw 8.8 Chilean Maule and the 2011 Mw 9.0 Sendai-Oki earthquake.