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Post-seismic deformation of the 2011 Tohoku earthquake, Japan

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The Mw 9.0 Tohoku earthquake on March 11, 2011 occurred near the northeast coast of Honshu, Japan. The earthquake resulted from a thrust faulting on the subduction zone boundary between the Pacific and North America plates. Surface displacements due to the Tohoku-Oki earthquake were observed by more than 1200 continuously recording Global Positioning System (GPS) sites, installed and operated by the Geodetic Survey of Japan (GSI). For the first time, in a megathrust event, the displacement above the hypocenter is detected from 5 GPS installed in the seafloor (Sato et., al 2011), giving new insights into the megathrust mechanism. The link, i.e. Green's Functions, between the surface displacement and the model parameters is obtained from a 3D Finite Element (FE) model for the 11 March earthquake. Several geophysical features of the Japan trench are implemented into the FE model. The Subducting slab geometry is implemented from USGS and Gavin Hayes Slab 1.0 project. Bathymetry and topography from the ETOPO Global Relief Project (NOAA) are implemented as well. Moreover, the model is designed to simulate coseismic and postseismic (poroelastic) deformation while simultaneously account for the known geologic structure and geophysical context (Zhao et al., 1992) of the Japanese subduction zone. The postseismic deformation is explored using the postseismic GPS vectors available in the literature. Furthermore, we applied DInSAR (Differential SAR interferometry) to infer the post-seismic deformation field by exploiting the available SAR images acquired by the ENVISAT satellite.