

Temporal evolution of afterslip following the 2011 Tohoku-oki earthquake

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We use GPS data recorded by the continuous GPS network, GEONET, to investigate afterslip following the March 11, 2011, Tohoku-oki earthquake (Mw 9.0). We analyzed GPS data after March 11 with the GIPSY-OASIS II software to estimate daily station coordinates. The daily GPS time series show large-scale postseismic deformation. The observed postseismic deformation is assumed to result from aseismic afterslip on the subducting Pacific plate interface and temporal evolution of afterslip distribution is estimated using a time-dependent inversion method. In the inversion, the curved plate interface is approximated with collection of many triangular dislocation elements. The Network Inversion Filter [Segall and Matthews, 1997] is applied to the GPS time series from March 11 to October 17, 2011, to estimate temporal variation of afterslip distribution. Our inversion analysis shows that afterslip is concentrated downdip of the coseismic rupture off Sanriku, off Miyagi, and off Fukushima. We find another afterslip patch that is adjacent to the rupture area of the largest aftershock off Choshi. Our analysis does not show significant temporal variation of spatial pattern of afterslip, indicating that afterslip propagated within a few days after the mainshock. As of October 17, 2011, the maximum cumulative afterslip is 2.79 m and the moment magnitude from the estimated afterslip distribution is Mw=8.52. Residuals between the observed and predicted displacements show a systematic pattern that is consistent with postseismic viscous relaxation.