The early postseismic phase of Tohoku-Oki earthquake (2011) from kinematics solutions: implication for subduction interface dynamics

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Earthquakes are usually followed by a postseismic phase where the stresses induced by the earthquakes are relaxed. Little work has been done at the transition from the co- to the postseismic phase, and the physical processes involved.

We study the 2011 Mw 9.0 Tohoku-Oki earthquake, using GEONET GPS data. We focus on the few minutes to the first month following the mainshock.

Following Twardzik et al. (2019), we process 30-s kinematic position time series and we use it to characterize the fast displacements rates that typically occur during the early stages of the postseismic phase. Without including early afterslip, we quantify precisely the co-seismic offset of the mainshock and the largest aftershocks. We analyze the spatial distribution of the co-seismic offsets for the earthquakes also the signal induced by the postseismic phase over different time windows to investigate the spatio-temporal evolution of the postseismic slip.

From the characterization of the first month of postseismic kinematic time series, we find that the best-fitting law is given by an Omori-like decay. The displacement rate is of the type $v_o/(t+c)^p$ with spatial variation for the initial velocity v_o and for the time constant c. We find a consistent estimate of the p-value close to 0.75 over most of the studied area, apart from a small region where higher p values (p~1) are observed. We discuss about the implications of these observations in terms of subduction interface dynamics and rheology.

Twardzik Cedric, Mathilde Vergnolle, Anthony Sladen and Antonio Avallone (2019), doi.org/10.1038/s41598-019-39038-z

Keywords: Early Postseismic, Afterslip, GPS, Kinematic, Omori

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