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Characteristic of the postseismic deformation following the 2011 Sanriku-Oki earthquake (Mw 7.2) by comparing the 1989 and 1992 Sanriku-Oki events

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The March 11, 2011, moment magnitude (Mw) 9.0 Tohoku earthquake (hereafter referred to as the mainshock) generated a large tsunami, which caused devastating damage and the loss of more than 15,800 lives. On March 9, 2011 at 2:45 (UTC), an M7.3 interplate earthquake (hereafter referred to as the foreshock) occurred ∼45 km northeast of the epicenter of the Mw9.0 mainshock. The focal mechanism estimated by the National Research Institute for Earth Science and Disaster Prevention (NIED) incorporates reverse fault motion with a west-northwest to east-southeast compression axis. This foreshock preceded the 2011 Tohoku earthquake by 51 h.
Kato et al. [Science, 2012] pointed out aftershock migration after the foreshock along the trench axis toward the epicenter of the Mw9.0 mainshock on the basis of an earthquake catalog, which was created using a waveform correlation technique. They also estimated aseismic slip amount by the repeating earthquake analysis. Ohta et al. [GRL, 2012] proposed a coseismic and postseismic afterslip model of the foreshock based on a GPS network and ocean bottom pressure gauge sites. The estimated coseismic slip and afterslip areas show complementary spatial distributions. The slip amount for the afterslip is roughly consistent with that determined by repeating earthquake analysis carried out by Kato et al. [2012]. Ohta et al. [2012] also pointed out a volumetric strainmeter time series suggests that this event advanced with a rapid decay time constant compared with other typical large earthquakes. For verification of this exception, we investigated the postseismic deformation characteristic following the 1989 and 1992 Sanriku-Oki earthquake, which occurred 100-150 km north of the epicenter of the 2011 Sanriku-Oki event. We used four components extensometer of the Tohoku University at Miyako (39.59N, 141.98E) on the Sanriku coast for these events. To extract the characteristics of the postseismic deformation, we fitted the logarithmic function. The estimated decay time constant was relatively small compared with the typical interplate earthquakes in a similar fashion to 2011 Sanriku-Oki event. Our result suggests that the short decay time of the postseismic deformation is characteristic of this region. The exact reason of short decay time for these afterslips is unclear at present, but it was possibly controlled by the frictional property on the plate interface, especially effective normal stress controlled by fluid.