

Evolution of the postseismic slip associated with the 2011 Tohoku Earthquake based on land and seafloor geodetic data

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On 11 March 2011, the 2011 off the Pacific coast of Tohoku earthquake (M 9.0) has occurred on the plate boundary between the subducting Pacific and continental plates. This huge earthquake has been associating postseismic deformations as well as past large earthquakes that occurred around the Japanese Islands. Especially, the postseismic slip events that were associated with recent interplate earthquakes in the northeastern Japan subduction zone, such as 1993 Sanriku-Haruka-Oki (Mw 7.6) and 2005 Miyagi-Oki (Mw 7.2) earthquakes, released moments as large as the seismic moments that were released by their mainshocks (e.g., Heki et al., 1997; Miura et al., 2006). Ozawa et al. (2011) have already reported the postseismic slip associated with the 2011 off the Pacific coast of Tohoku earthquake based on the terrestrial continuous GPS observation performed by means of a nationwide GPS array, "GEONET." The postseismic slip has been still continuing at present, but the released moment is still relatively small (< Mw 8.6 according to GSI, 2012, <http://www.gsi.go.jp/cais/topic110314-index.html>) comparing with the seismic moment of the mainshock, M 9.0. Therefore, we expect that the postseismic slip will continue for a while. However, we can not estimate postseismic slip at the very shallow portion on the plate interface precisely based only on the terrestrial GPS data, because such offshore areas are too far from the coast of the northeastern Japan.

Thus, We investigated the spatial and temporal evolution of the postseismic slip on the plate interface based not only on the terrestrial GPS data but also on the seafloor geodetic data such as crustal movements measured by means of GPS/Acoustic ranging and vertical displacements observed by using Ocean Bottom Pressure gauges. We estimated displacements due to large aftershocks based on their CMT solutions, and subtracted them from the original displacement time series data. A time-dependent inversion method devised by Yagi and Kikuchi (2003) is applied to estimate the postseismic slip distributions. Usages of the seafloor geodetic data significantly improve the spatial resolution of the slip distribution near the Japan Trench as well as the coseismic slip distribution.

Preliminary result shows following features; 1) Large postseismic slip has been occurring at the very shallow (< 20 km in depth) portion on the plate interface off Ibaraki, Fukushima and Iwate prefectures where huge (~50 m) coseismic slip did not occurred, 2) Significantly large slip is distributed at the deep (> 50 km in depth) plate interface beneath Miyagi prefecture where no seismic event occurs, and 3) No postseismic slip may occur at the asperities in Miyagi-Oki region that ruptured during the Miyagi-Oki earthquake in 1978 and the M 9.0 mainshock in 2011.

We will present the latest result in the meeting.

Keywords: 2011 off the Pacific Coast of Tohoku Earthquake, Crustal Deformation, Ocean Bottom Pressure, GPS/Acoustic ranging, GPS, Postseismic Slip