キネマティックPPPデータ解析にもとづく2011年東北地方太平洋沖地震直後の余効変動にともなう内陸ひずみ異常の特徴

Characteristic of inland strain anomalies caused by the postseismic deformation immediately after the 2011 Tohoku-Oki earthquake based on kinematic PPP data analysis

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We have investigated spatial and temporal development of anomalous crustal strain in the northeastern Japan region associate with a postseismic deformation immediately after the 2011 Tohoku-Oki earthquake. Ohzono et al. (EPS, 2012) found the characteristic strain anomalies associate with the step-like stress change caused by the large coseismic displacement. Their results, however, should contaminate the crustal deformation by the early postseismic within one day.

Based on these backgrounds, we adopted the kinematic precise point positioning (PPP) analysis for understanding the crustal deformation caused by the early postseismic immediately after the mainshock. We used GIPSY-OASIS II Ver. 6.3 software for kinematic PPP processing of whole GEONET sites in 10 March 2011. We applied every 6 hours nominal wet and dry zenith tropospheric delay value as a priori information based on the ECMWF global numerical climate model. For the coordinate time series and tropospheric parameters, we assumed white noise and random walk stochastic process, respectively. These unknown parameters are very sensitive to assumed process noise for each stochastic process. Thus, we searched for the optimum two variable parameters; wet zenith tropospheric parameter and its gradient.

Furthermore, we applied the principal component analysis for eliminate the spatial correlated noise from the kinematic PPP time series. The strain calculation from the displacement data is based on the method developed by Shen et al. (JGR, 1996). Obtained dilatation strain clearly shows the inhomogeneous distribution. Compared with the seismic tomography results by Nakajima et al. (JGR, 2001), large expansion area by this study mostly just correspond to the low Vp region at the 10km depth. This results suggested that these localized expansion areas correspond to the lower elastic moduli in the upper crust and/or shallower portion. Furthermore, we assessed the amount of strain anomalies by the early postseismic deformation relative to strain anomalies by the coseismic deformation. Our early postseismic results suggest that the 20-30% of strain anomalies by Ohzono et al. (2012) may by caused by the postseismic deformation. This result suggested that the early large postseismic deformation behaved as “step-like” stress change to the crust as well as the coseismic deformation.