Estimation of postseismic deformation of 2016 Kumamoto earthquake based on GNSS observation network

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Postseismic deformation is mainly caused by the afterslip and viscoelastic relaxation, which assumed by the temporal evolution in logarithmic and exponential functions, respectively. To investigate the postseismic deformation associated with the 2016 Kumamoto earthquake (M7.3), we fitted these decay function to postseismic Global Navigation Satellite System (GNSS) time series. We used approximately 7-months (until 11 November, 2016 after the mainshock) of the daily coordinates of F3 solutions at 134 GEONET stations in Kyushu Island and Amakusa Island, provided by the Geospatial Information Authority of Japan (GSI). For the time series, we fitted logarithmic decay function for first 50-day, 100-day and 211-day after the mainshock using a nonlinear least-squares method to find appropriate amplitude of the function and time decay constants. The estimated time constants in this study correspond reasonably well with the values 0.8-36 days obtained in Nakao et al. (2016). It seems that the afterslip has ended in 50-100 days. Averaged time decay constants for this afterslip is estimated approximately 1.84-2.50 days. These are slightly bigger than the result of Takahashi et al. (2005) studied about 2004 mid-Niigata prefecture earthquake. Using the averaged time decay constants as a common value for all stations, we re-fitted logarithmic decay function and estimated special distribution pattern of amplitude. The result indicated large value not only around the focal region, but also more northeastern region from the epicenter. The residual time series extracted afterslip deformation shows linear trend at some stations, and time-dependent trend at other stations. When we assumed that this residual time series is caused by the viscoelastic relaxation, fitted exponential decay functions for them shows more than 10000 days of time constant around the focal area. It may reflect that viscoelastic relaxation is ongoing as of 11 November, 2016, or the applied fitting function is not appropriate for the residual time series. In the future, we may be able to quantitatively evaluate by prolonging the time series.

Keywords: 2016 Kumamoto earthquake, afterslip, viscoelastic relaxation

