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Postseismic deformation following the 2008 Iwate-Miyagi Nairiku earthquake deduced from PS-InSAR time series analysis

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We detected the anomalous long-term crustal deformation after the 2008 Iwate-Miyagi Nairiku earthquake (hereafter IMEQ) deduced from PS-InSAR time series analysis based on the ALOS/PALSAR data. The anomalous crustal deformation caused by superposition of the long and short wavelength deformation.

The 2008 Iwate-Miyagi Nairiku earthquake occurred beneath the border between the Iwate and Miyagi prefectures at north-eastern Japan in 13 June 2008. Based on the long-term GPS time series (~1.5 years), Ohzono et al. (EPS, 2012) detected clear postseismic signal, which indicates wider-area crustal shortening between the focal area and the subsidence signal in the focal area. They conclude that this postseimsic signal is caused by viscoelastic relaxation process in the lower crust and/or upper mantle, and constructed a simple spherical 2-layerd (elastic and Maxwell viscoelatic layer) model. The viscoelastic model, however, could not explain the large GPS displacement near the focal area. In this study, we discuss the long-term crustal deformation after the IMEQ deduced from PS-InSAR time series analysis based on the ALOS/PALSAR InSAR data.

We applied StaMPS (Hooper et al., JGR, 2007) approach to the ALOS/PALSAR data obtained by the JAXA. In order to produce our interferograms, we processed a set of 14 descending orbit SAR images (Track 57, Frame 2830), acquired by the ALOS/PALSAR sensors from July 2008 to October 2010. In particular, SRTM4 Digital Elevation Model of the study area and precise orbital information were used for the interferograms generation. The master data image is acquired in June 3rd, 2009. The result based on our analysis clearly shows LOS (Line of Sight) change in and around the focal area. We found the clear LOS change in the footwall and hanging wall side of the focal area. In the footwall side, the LOS is extended which may be subsidence or displaced to the westward. It is clear evidence of the viscoelastic relaxation after the mainshock pointed by (Ohzono et al., EPS, 2011). The hanging wall side LOS change is characteristic. In the hanging wall side, we found the two large amount LOS shortening regions (around Ameta-mori and Mt. Takamatsu-dake). It is difficult to explain by the simple viscoelastic relaxation. We tried to explain the origin of these anomalous LOS changes. In the Ameta-mori region, it is possible to explain by the aseismic fault slip. In contrast, in Mt. Takamatsu-dake area, it may be caused by the volcanic process because of the shallow part (~3km) of this region clearly show the low seismic velocity compared with surrounding region (Okada et al., EPS, 2012).

Keywords: Inland earthquake, postseismic deformation, InSAR