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Interferometry of PALSAR-2 images for crustal deformation study

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Since the first acquisition of image in June, 2014, PALSAR-2 has been operated satisfactorily. Since the beginning of operation, earthquake and volcanic activities occurred and crustal deformations associated with these events were detected. In this paper, we examine coherence, accuracy of PALSAR-2 interferograms and observed deformations for the Ontake eruption, Northern Nagano (Mjma6.7) and Southern Tokushima (Mjma5.1) earthquakes.

For the analysis we used the RINC (developed by Dr. Ozawa, NIED) and Gamma software, and the digital ellipsoidal models or ASTER-GDEM ver.2 for coregistraion and reduction of topography phase. UBS mode images with 3-m azimuthal resolution were analyzed.

We used two pairs of PALSAR-2 images acquired on August 22 and October 3, and August 18 and October 13. Both pairs were acquired on ascending orbits with right-looking configuration. Incidence angles and perpendicular baselines are 36 deg. and 5 m, and 53 deg. and 24 m, respectively. We recognized high coherence in both interferograms despite of mountainous region. However we also recognized systematic deviation from the synthetic LOS displacements at GEONET stations in the scene and its standard deviations were estimated 4˜5 cm. LOS decrease was observed near the summit of Ontake volcano, but no significant deformation was found in the surrounding region. Therefore we can conclude that the deformation was localized in the vicinity of the summit.

We analyzed two pairs of images acquired on October 2 and November 27, and September 19 and November 28. The former pair is observed from a descending orbit with left-looking configuration, while the latter is from an ascending orbit with right-looking. Incidence angle and perpendicular baseline are 36 deg. and 6 m, 40 deg. and 112 m, respectively. We recognized high coherence but lines of low coherence on the hanging wall side of source fault. These belts might coincide with surface ruptures of subsidiary faults such as backstop. We estimated slip distribution from interferograms and obtained up to 1.3 m thrust on an ESE dipping plane in a depth range shallower than 5 km.

We also analyzed two pairs of PALSAR-2 images acquired before and after the Southern Tokushima earthquake, but did not observed any significant surface displacements.

Keywords: PALSAR-2, crustal deformation, SAR interferometry