Co- and post-seismic crustal deformations associated with the 2016 Kumamoto earthquake sequence using ALOS-2/PALSAR-2 data

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The 2016 Kumamoto earthquake sequence started to occur at 21:26 on 14 April 2016 (JST: Japan Standard Time) with Mw 6.2 earthquake at the southwestern part of the Beppu-Shimabara graben, one of the tectonic lines across the central Kyushu island. It was followed by moment magnitude (Mw) 7.0 mainshock on 16 April at 01:25. Japan Meteorological Agency catalog reported that the mainshock focal mechanism was dominated by strike-slip components with north-south extensional axis. Geodetic measurements by Global Navigation Satellite System (GNSS) and satellite synthetic aperture radar revealed not only right-lateral displacement as the focal mechanism showed, but also greater than 1 m of subsidence at the northwest side of the Futagawa fault. In particular, PALSAR-2 pixel tracking data depicted phase discontinuities across the northeast-southwest direction. Some urgent field surveys were also conducted, and reported the locations and dislocation amounts of surface ruptures due to the earthquakes (e.g., Shirahama et al., 2016). We compare displacements along the surface rupture that were derived from the PALSAR-2 pixel tracking data and the previous field surveys. Measuring displacements along the surface ruptures in detail is important for evaluating rupture processes and propagation features along the faults during the earthquake event.

We also report the post-seismic deformations following the 2016 Kumamoto earthquake using PALSAR-2 data, and discuss the difference of spatial characteristic in the co- and post-seismic deformations. Although some papers have also reported post-seismic deformations observed by GNSS measurements and Sentinel-1 InSAR data for estimating viscoelastic structures beneath the central Kyushu island, near-fault post-seismic deformations are still poorly understood. We employed the conventional InSAR stacking for extracting long-lasting small deformations and mitigating artificial noise. We also performed the 2.5-dimensional analysis for depicting quasi-eastwest and quasi-vertical displacements using the stacked interferograms. To identify the small deformation signals, two independent quasi-displacement fields are generated. Although multiple aperture interferometry (MAI) allow us to detect along-track horizontal movements, we could not identify actual post-seismic deformation signals due to strong ionospheric artifact noises in most of MAI data.

Keywords: Synthetic Aperture Radar, 2016 Kumamoto Earthquake Sequence, Crustal Deformation, Surface Ruptures, SAR Interferometry, ALOS-2/PALSAR-2

