

Satellite SAR differential interferometry analysis on surface deformation associated with 2011 and 2016 earthquakes in northern part of Ibaraki prefecture

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Surface deformation pattern associated with earthquakes occurred in northern part of Ibaraki prefecture on March 19, 2011, and on December 28, 2016, was investigated by using co-seismic pairs of Satellite SAR data. Two co-seismic pairs of ALOS PALSAR data observed from the ascending and the descending orbits were used for the analysis of the earthquake in 2011. The earthquake occurred in 2016 can be covered by two co-seismic pairs of Sentinel-1 CSAR data acquired in ascending and descending orbits. The distribution patterns of vertical and horizontal (E-W) surface displacement associated with these two earthquakes were derived from the 2.5 dimensional analyses using these SAR data pairs. As the co-seismic pairs of ALOS PALSAR data contain non-uniform regional displacement pattern associated with M9.0 the 2011 off the Pacific coast of Tohoku Earthquake, occurred on March 11, 2011, the displacement amount along the line of sight of interferometric pairs were simulated from GNSS data and were removed from the differential interferograms, in order to extract local displacement associated with the earthquake on March 19, 2011. Fault traces inferred from the satellite SAR differential interferometry analyses of earthquakes in 2011 and 2016 perfectly coincide, indicating that these earthquakes, from macroscopic viewpoint, may be associated with the activity of the same fault. Geographic location of the peak of vertical displacement was found not to coincide with that of horizontal displacement by 2.5 dimensional analyses, for both earthquakes. The distribution patterns of vertical and horizontal displacement indicate the normal fault activity along the listric fault. Amount of the surface displacement associated with the earthquake in 2011 is as twice as of that in 2016, in both vertical and horizontal directions, which may reflect the difference in the distance from the hypocenters to the fault trace.

Keywords: Northern part of Ibaraki Prefecture, Earthquake, Surface displacement, Satellite SAR
Differential Interferometry, 2.5 dimensional analysis