Geophysical Research Abstracts
Vol. 20, EGU2018-2789, 2018
EGU General Assembly 2018

Localized Deformation Following the April 2016 Kumamoto, Japan, Earthquake detected by InSAR

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The April 2016 Kumamoto, Japan, earthquake sequence caused significant coseismic deformations with numerous surface ruptures on and off the source faults. Modeling studies of coseismic deformations, teleseismic waves and strong ground motions reveal that the rupture occurred on two nearly vertical right-lateral strike slip faults. The main coseismic fault is the EEN-WWS trending Futagawa fault, with which the NEN-SWS trending Hinagu faults is connected at its western end. From the viewpoint of studies of earthquake cycle and tectonics, it is vitally important to what is going on in following years. To reveal the postseismic deformation, we collected ALOS-2 and Sentinel-1 SAR images acquired from April 2016 and processed them.

We detect at least 5 spots of increase of LOS in and around the active fault traces in ALOS-2 descending interferograms. Three of them are in adjacent to surface traces of the Futagawa fault. The maximum LOS change exceeds 10 cm till August 2017. We also notice a zone of LOS increase of 6 cm or more that extends NW-ward from the junction of Futagawa and Hinagu faults. We observed coseismic subsidence in coseismic interferograms and there are several reports of small surface ruptures there. Considering the location and timing, this off-fault LOC increase may be related to stress release by this event. The last one is in northern part of the Aso caldera, which also exceeds 6 cm. Although ionospheric disturbances are large in some ALOS-2 ascending interferograms, we can notice LOS increase in the above regions. Therefore, the observed signals are subsidence.

Changes in LOS increase across the surface fault traces are so sharp and non-symmetrical. We cannot apply a simple afterslip model. This area is covered with thick pyroclastic flow and marine or non-marine deposits. Subsurface heterogeneous structure may affect spatial distribution of postseismic deformation.