Detection of surface ruptures associated with the 2016 Kumamoto earthquake with ALOS-2/PALSAR-2

*Manabu Hashimoto[1]

1.Disaster Prevention Research Institute, Kyoto University

The Japan Aerospace Exploration Agency conducted urgent observations of ALOS-2/PALSAR-2 after the occurrence of the Mjma 6.5 earthquake of April 14, 2016, in Kumamoto. ALOS-2/PALSAR-2 gives us high resolution and quality images of the ground and its changes associated with this earthquake sequence.

There are several methods to detect changes of the ground surface. Interferometry and offset tracking are most often used to detect displacements, while changes in intensity and coherence is exploited for the detection of structural damages, landslides and surface ruptures. In this study, we look closer at interferograms and associated coherence images and discuss the distribution of surface ruptures.

In the interferogram spanning the Mjma 7.3 shock of April 16, we recognize many discontinuities in phase accompanied by low coherence (< 0.6), while coherence is almost perfect (~ 1.0) in other interferograms. They are distributed mainly along the strands of the Futagawa –Hinagu fault system and on the western frank of the Aso caldera. The former is related to the coseismic surface ruptures of the source fault. Several strands of low coherence zone (< 0.8) are recognized in the coherence image. One is along the Futagawa fault in the west and the other is consistent with the Mifune segment of the Hinagu fault. These two strands join near the central part of the Mashiki city. East of the junction, the low coherence zone extends toward ENE and finally reaches the Aso caldera. In the Aso caldera, low coherence zone is separated to ENE trend and E-W swarm. Low coherence zone is not a simple line but a belt of short and thin lines of low coherence. Since surface deformation due to other factors such as liquefaction also decreases coherence, all discontinuities cannot be regarded as coseismic fault. However, it is reasonable to consider that these low coherence zones include the surface ruptures of the coseismic source fault on the basis of their feature and location.

The discontinuities on the frank of the caldera are located off the trend of coseismic surface rupture and have a different strike of nearly E-W. Some discontinuities have phase jump of about 10 rad (~ 19 cm) and several hundred to thousand meters long. However the width of low coherence and associated deformation is small. Therefore the source of these discontinuities may be shallow. This area is covered with pyroclastic deposits. Unconsolidated material moved differentially due to the strong ground motion.

The ALOS-2/PALSAR-2 images were provided by JAXA through SAR earthquake WG (Secretariart: GSI).

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