Appearance of ’accompanied’ crustal deformation detected by SAR interferograms

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1. The ’earthquake faults’ triggered by the Southern Sumatra Earthquake in 2007

On September 12th, 2007, an earthquake occurred off the coast of southern Sumatra, Indonesia with the magnitude of 8.4 (after USGS) as the result of thrust faulting on the boundary between the Australia and Sunda plates.

The Geographical Survey Institute (GSI) analyzed the crustal deformation associated with this earthquake using Daichi’s Synthetic Aperture Radar ’PALSAR’. Although it is difficult to figure the whole deformation for its vast extent of affected area, we succeeded to form interferograms showing the deformation of the area around Bengkulu in Sumatra and Pagai Islands.

Pagai Islands, composed of North and South Pagai Islands, stretch for nearly 100km long. Fourteen fringes of phase can be seen between the south end of the South Pagai Island and the north end of the North Pagai Island. This means that the former has moved 1.8m toward the satellite relative to the latter. Such movement can be illustrated as the elastic crustal deformation affected by the destruction of the source fault on the plate boundary with a large slip at the south of South Pagai Island. In addition, two discontinuity of the phase were found in the Islands (refer to attached figure). We consider that it implies the appearance of ’surface earthquake faults’ on the ground along the existing active faults because the place of discontinuity corresponds the clear topographical lineaments. However, judging from earthquake mechanisms, crustal deformation pattern in wider area and the estimated slip distribution, it seems that the ’earthquake faults’ in Pagai Islands are not source faults which caused the earthquake, but ’accompanied’ earthquake faults, whose slip along the existing active faults was induced by the seismic motion and/or crustal deformation caused by the destruction of source fault on the plate boundary. Fringe pattern shows that the area between two continuity lines has moved away from satellite, suggesting that the graben-like relative subsidence of the area between two faults has occurred.

2. Growth of an active fold triggered by the Niigataken Chuetsu-oki Earthquake in 2007

GSI found a narrow uplift belt triggered by the Niigataken Chuetsu-oki Earthquake in 2007 in the different area from the source fault by the analysis of crustal deformation using Daichi’s SAR interferograms. It suggests the occurrence of the growth of active folding lead by the slip of a shallow reverse fault. This deformation may also be considered as the ’accompanied’ crustal deformation.

3. Meaning of ’accompanied’ crustal deformation

As an example for the secondary slip of a fault which is different from the source fault of the main shock, it is known that the surface earthquake fault appeared along a part of the Takeyama Fault zone in Miura Peninsula accompanied by the Kanto Earthquake in 1923. If such ’accompanied’ crustal deformation occupies a certain extent among the total amount of the slip of a fault, it might be necessary to consider its effect for estimating paleo-seismicity from crustal deformation.