

Crustal Deformation Associated with the Central Sumatran Earthquakes of March 6, 2007, Derived from ALOS/PALSAR and GPS

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A doublet of M6.3 and M6.4 earthquakes hit in the vicinity of Padang, central Sumatra, Indonesia, on March 6, 2007. These events are closely located to the Sumatra Fault which is the largest strike-slip fault in Sumatra Island and runs parallel to the Sunda trench. This fault is considered to accommodate a part of oblique convergence between the subducting Indo-Australia plate and the continental Sunda block. These events occurred around a pull-apart basin and their focal mechanisms are of strike-slip type (USGS, 2007). Therefore these events are related to the formation of a pull-apart basin. It was reported surface breaks are associated with these events with right lateral motion and uplift on the west side of about 20cm (Natawidjaja et al., 2007). Several events repeatedly occurred along the Sumatra fault. Especially there is a tendency of doublet in the source area of the 2007 events. Thus it is important to reveal the nature of faulting of these events from the viewpoint of not only earthquake science but disaster mitigation. However there are no dense networks of seismograph or GPS. Continuous observations have been conducted only at Padang by STEL, Nagoya University and Kototabang by JAMSTEC. Therefore InSAR, especially of L-band feature, is the only tools to approach to the present problem.

We analyzed ALOS/PALSAR images acquired on Oct. 15, 2006, and June 6, 2007. Figure 1 shows an unwrapped interferogram deduced from these images with the Gamma software. Discontinuities of fringes are clearly recognized along the surface ruptures. Furthermore, maximum LOS changes larger than 11cm are observed in their close vicinity. The pattern of observed fringe is consistent with right-lateral motion on a NNW-SSE trending fault. Using Okada's(1985) formula, we calculated theoretical LOS displacements to derive a fault model. By trial and error, we obtained a model with two segments dipping westward by 78 degree. Coseismic slips on each segment are estimated to be 0.3 - 0.4 m. Total length of these faults is 65km and width is 20km. Moment magnitudes of both earthquakes are estimated to be 6.5.

We also analyzed GPS data at Padang and detected about 3cm NNE-ward horizontal shift on March 6. The direction of theoretical displacement at Padang calculated for the above model is concordant with the observed, but its magnitude is a bit larger.

If we apply Matsuda's formula (1978) to these events, length should be much shorter than the estimated and slip much larger. Therefore there is a possibility that aseismic slip occurred.

PALSAR level 1.0 data are shared among PIXEL, and provided from JAXA under cooperative research contract with ERI, Univ. Tokyo. The ownership of PALSAR data belongs to METI (Ministry of Economy, Trade and Industry) and JAXA. GPS data at Padang are provided on the courtesy of Dr. Yuichi Otsuka from STEL, Nagoya Univ.

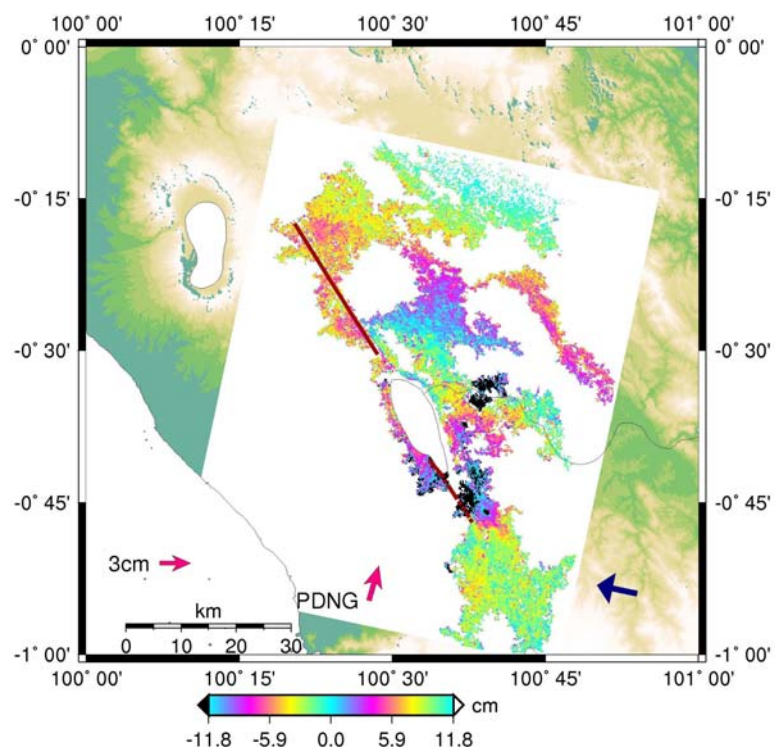


Figure 1. Unwrapped interferometric image derived from the pair of ALOS/PALSAR images acquired on Oct. 15, 2006 and Jun. 6, 2007 ($B_{\text{perp}} = 1510\text{m}$). Blue arrow shows the direction of line of sight from the satellite. Pink arrow indicates coseismic horizontal displacement at the Padang GPS station in ITRF2005.