

Aseismic strike slip associated with the 2005-2010 Afar rifting event

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Himematsu and Furuya (2015) have reported that the 2007 dike intrusion episode in Tanzania accompanied with significant aseismic strike slip along the subsidence of the graben. To our knowledge, no previous studies have considered such strike slip components associated with dike intrusion events. Although seismic swarms during rifting events are often attributed to the magma intrusion, there is a hypothesis that aseismic slip may be responsible for the generation of seismic swarm (e.g., Lohman & McGuire, 2007). It is thus possible that similar aseismic strike slip could have been universally occurring during any rifting events.

We re-examine the crustal deformation signals during the 2005-2010 Afar rifting episode using ALOS/PALSAR (L-band) images. The seismic swarm and the dike intrusion intermittently occurred from September 2005 to May 2010. Some previous studies have already reported the 3D displacements for the September 2005 rifting event (e.g., Wright et al., 2006). While two ~Mw5.5 right-lateral slip earthquakes were reported around the focal region, their results showed no remarkable horizontal displacements around the subsiding zone of the graben. However, we argue that the insignificant horizontal displacements along the intruded dike would be due to the lack of coherent signals near the subsiding zone.

We applied an offset tracking technique to the ascending-track data sets (12 June 2007 -5 Aug. 2010) to acquire the robust crustal deformation signals. Both the azimuth offset and the multiple aperture interferometry (MAI) data are sensitive to the displacement along the satellite track (~N350°E). The results showed clearly the NNW horizontal displacements at the subsiding zone. At the subsiding zone, the range offset and azimuth offset data depict the maximum changes of about 225 cm and 110cm, respectively. Because focal mechanisms of the earthquakes reported by previous studies and Global CMT catalogue during the rifting indicate almost no strike components, we propose that the horizontal displacements may be caused by aseismic strike-slip. We will discuss the mechanism of the aseismic strike slip relating with the seismic swarm.

Keywords: Dike intrusion episode, Synthetic Aperture Radar, Aseismic slip, Divergent plate boundary, Earthquake swarm, ALOS/PALSAR