Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC12-P05 Room:Convention Hall Time:May 26 18:15-19:30

Spatial and temporal analysis of stress fields inferred from crack distributions in the Mt. Fuji volcanic area

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Understanding stress fields is an important topic to interpret geologic processes in volcanoes. After 2011 Tohoku-Oki earthquake, a Mw5.9 event occurred in the area on 15th March 2011. Therefore, this area is assumed to be affected by static and dynamic stress changes recently. We attempted to interpret those stresses from viewpoints of microcrack distribution by measurement of shear wave splitting and seismic interferometry by using seismic data from 24 seismic stations maintained by ERI, JMA and NIED in the Mt. Fuji volcanic region.

We measure shear wave splitting by upper crustal seismic event data from 2009 to 2012. In our measurement, fast polarization directions near the summit show radial pattern from the summit while those at stations far from the summit direct to the NW-SE. The pattern of fast polarization directions far from the summit is consistent with the direction of regional stresses.

From previous studies(e.g. Nakamura, 1977; Acocella and Neri, 2009) about dike, fissure eruption patterns and stresses in volcanic regions, we assumed that interaction of gravitational effect of the volcanic edifice and the regional stress can results in the crack distribution near Mt. Fuji. We conducted forward modeling of stress fields around Mt. Fuji to test the hypothesis of the influence of stresses on the contrast of the two patterns of splitting. We could reproduce the pattern of fast polarization directions as directions of maximum horizontal compressions.

Owing to the limitation of the time resolution of shear wave splitting measurement, we could not obtain significant temporal changes before and after the 2011 Tohoku-Oki earthquake and the Mw5.9 event. In order to interpret possible subtle changes of microcracks during the period, we attempted seismic interferometry in our data. Our preliminary results by vertical channels show consistent velocity drop with the results of Brenguier et al. (2014). In Brenguier et al. (2014), they used stations 15 km away from the summit of Mt. Fuji. In this research, we will increase the temporal and spatial resolution of change of seismic velocity by using 3 components of seismic data within the 15km of the volcanic edifice in addition to Hi-net stations.

Keywords: Mt. Fuji, Shear wave splitting, Seismic interferometry, microcrack, Tohoku-Oki Earthquake, seismic anisotropy