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Coseismic Deformation Detected by SAR and Fault Source Modeling of the 2009 Cinchona Earthquake (Mw6.1), Costa Rica

UMEMURA, Shutaro[1*] ; FURUYA, Masato[1]

[1]Department of Natural History Sciences, Hokkaido University

A shallow earthquake with magnitude 6.1 (Mw) occurred in Costa Rica, Central America, on 8 January 2009. This earthquake, called Cinchona earthquake, accompanied with many landslides and caused around 20 fatalities. In the proximity of epicenter, there is the Angel-Vara Blanca fault that has a strike NNW-SSE. Montero et al. (2009) inferred the fault as the earthquake source fault. After 4 days of the earthquake occurrence, Poas volcano located 6 km to the west of the epicenter erupted (Volcanic Explosivity Index 1) after a quiescence of one year. This volcano had remained dormant for a decade after 1996 and became active since 2006. As the 1st step to study the possible relationship between earthquake and volcanic eruption, we detected the coseismic deformation by using the ALOS/PALSAR data and created fault models to explain the data.

In this study, we used ascending (path 162, frame 190) and descending (path 465, frame 3410) data of ALOS/PALSAR. To correct for the topography effect, we used the digital elevation model of ASTER GDEM. We analyzed the SAR data with GAMMA software. In the interferogram processing, we removed the atmospheric noise. We calculated the Green's function by triangular dislocation elements using Meade (2007) scripts.

The detected interferogram indicated that the maximum coseismic LOS (Line of Sight) changes were 20cm for ascending and 22cm for descending track, respectively. We derived the fault source model that could explain the LOS changes by trial-and-error approach. The estimated strike/dip angle of the fault were 133/65, and the rake angle at the center of fault was -163 degree. The difference of fault parameter from Angel-Vara Blanca fault suggested that the previously unknown fault worked. We calculated the pressure change caused by fault movement. This indicated positive change (compression) under the Poas volcano.

Keywords: InSAR, Coseismic Deformation, Fault Source Model, Costa Rica