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

SSS27-04 Room:103 Time:May 24 11:00-11:15

Predicting changing rates of swarm activity by volumetric strain

KUMAZAWA, Takao[1*] ; OGATA, Yosihiko[1] ; KIMURA, Kazuhiro[2] ; MAEDA, Kenji[2] ; KOBAYASHI, Akio[2]

[1]The Institute of Statistical Mathematicsa, [2]Meteorological Research Institute

Near the eastern coast of Izu peninsula is an active submarine volcanic region in Japan, where magma intrusions have been observed many times. The forecast of earthquake swarm activities and eruptions are serious concern particularly in nearby hot spring resort areas. It is well known that temporal durations of the swarm activities have been correlated with early volumetric strain changes at a certain observation station of about 20 km distance apart. Therefore the Earthquake Research Committee (2010) investigated some empirical statistical relations to predict sizes of the swarm activity. Here we looked at the background seismicity rate changes during these swarm periods using the non-stationary ETAS model (Kumazawa and Ogata, 2013, 2014), and have found the followings. The modified volumetric strain data, by removing the effect of earth tides, precipitation and coseismic jumps, have significantly higher cross-correlations to the estimated background rates of the ETAS model than to the swarm rate-changes. Specifically, the background seismicity rate synchronizes clearer to the strain change by the lags around a half day. These relations suggest an enhanced prediction of earthquakes in this region using volumetric strain measurements. Hence we propose an extended ETAS model where the background rate is modulated by the volumetric strain data. Here we have also found that the response function to the strain data can be exponential functions with the same decay rate, but that their intersects are inversely proportional to distances between the volumetric strain-meter and the onset location of the swarm. Our numerical results by the same proposed model show consistent outcomes for the various major swarms in this region.

Keywords: nonstationary ETAS model, background seismicity, swarm, volumetric strain, prediction