Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SVC55-P10 Room:Poster Time:May 1 18:15-19:30

Gravity changes during magma accumulation period in Izu-Oshima volcano

ONIZAWA, Shin'ya[1*] ; TAKAGI, Akimichi[1] ; FUKUI, Keiichi[2] ; ANDO, Shinobu[1]

[1]Meteorological Research Institute, JMA, [2]Kakioka Magnetic Observatory, JMA

Since March, 2004, we have been conducting series of campaign gravity measurements, in order to understand magma accumulation process and to detect eruption precursor of Izu-Oshima volcano. Here, we show calibration results of relative scale factors between gravimeters, and characteristics of temporal gravity changes observed in the volcano.

We have been measuring relative gravity changes in the volcano using three instruments; LaCoste & Romberg Type-D #109, Scintrex CG3M #454, and Scintrex CG5 #033. Gravity differences in our campaign network are about 180 mgal in maximum from the coastal sites to the summit sites. Such large differences easily induce systematic deviations between data obtained by different instruments, when gravimeter scales are not calibrated. Further, temporal changes in the scale factor of Scintrex CG3M have been reported by some previous gravity researches.

Since scale calibrations using absolute gravity networks had not conducted until 2012, we cannot absolutely calibrate for past data. However, we can check relative scales between gravimeters and their temporal changes by comparing campaign data obtained simultaneously. The scale factor for CG3M#454 relative to one for D#109 shows clear temporal decrease. One for CG5#033 also shows change at breakdown occurred in 2010. This can be explained by a parameter change done by the maker during repairing processes. Furthermore, we found a non-linear relationship between D#109 and CG5#033, which implies a non-linear scale factor of either instrument. Probably, the non-linearity occurs in LaCoste & Romberg Type-D, and we should calibrate further.

Although calibrations of each instrument are still not sufficient to discuss smaller gravity changes down to c.a. 10 micro-gal, we can find systematic temporal changes in relative gravity by correcting relative scale factors. Gravity increases at higher altitude sites relative to coastal sites are observed during a two-year period from July, 2008 to June, 2010. Temporal changes in relative gravities reaches up to 100 micro-gal in maximum. A spatial pattern of the changes suggests its center is at the northern caldera, which implies some relationship with ground deformation sources inferred by GPS data. However, both the amplitudes and phases of the relative gravity changes can never be explained by the ground deformation observed during the period. The change seems to be related to temporal changes in precipitation. Increase in water content in vadose zone may be one of possible factor of the changes. Apart from these candidates, we tentatively inferred source location and mass increase by assuming single point mass source. The best fit location after grid searches was at depth of 3 km b.s.l. beneath the northern caldera, where approximately coincides with the ground deformation source. However, the estimated mass increase is as much as 1.8×10^8 ton, which is equivalent to erupted materials of one large scale eruption of the volcano. It is difficult to accept easily such large amount of mass increase without any another significant signs. To detect signs of magmatic activities and to evaluate volcanic activities appropriately by gravity measurments, it is important to calibrate instruments further and to evaluate effects of environmental factors such as precipitations.

Keywords: Izu-Oshima volcano, gravity change, ground deformation