[EJ] Evening Poster | S (Solid Earth Sciences) | S-GD Geodesy

## [S-GD01]Gravity and Geoid

convener:Takayuki Miyazaki(Geospatial Information Authority of Japan), Keiko Yamamoto(National Astronomical Observatory of Japan)

Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Recent precise gravity measurements lead to advances in many kinds of applications, e.g., investigation of internal structure of the Earth and Moon, studies of earthquake, volcano, subsidence, landslide and tsunami, monitoring ice mass balance, and so on. In this session, we call wide range of papers related to topics of gravity and geoid, including theory of gravity field, absolute/relative gravity measurements/observations, data analysis of satellite gravity missions, and development of gravity sensors.

# [SGD01-P05]Continuous relative gravity data collected in Minami-Aso Village during the foreshock of the 2016 Kumamoto Earthquake

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Keywords:gravity change, tilt change, Kumamoto Earthquake, crustal deformation, seismic ground motion, Aso Volcano

Relative gravity measurements have been repeated at geodetic sites in Aso Volcano (Kumamoto Prefecture) once every several years since 1981, to monitor volcanic activities in terms of mass movement (e.g., Yoshikawa et al., 2009). Sofyan et al. (2016) frequently measured relative gravity 3-4 times every year since 2011 using a CG5 gravimeter belonging to Kyushu University (KU), and revealed spatiotemporal density variations under the ground of Aso Volcano. Aso Volcanological Laboratory (AVL), Kyoto University also started relative gravity measurements using another CG5 gravimeter in 7-10 March 2016, and compared the measured gravity values with those simultaneously measured by the KU’s CG5 gravimeter (Miyauchi et al., presented in this meeting). After the field gravity measurements, the AVL’s CG5 continuously collected relative gravity every minute at the AVL faculty in Minami-Aso Village, and experienced a strong ground motion due to a big foreshock of Kumamoto Earthquake (Mw 6.2) at 21:26 JST on 14 April 2016. The continuous gravity measurement was manually stopped about an hour after the foreshock for fear of coming aftershocks.
In general, gravity values are rarely measured near epicenters of big earthquakes, so it is very important to evaluate a coseismic gravity step due to the foreshock of Kumamoto Earthquake in clarifying its source mechanism from the aspect of mass movements. Furthermore, since CG5 gravimeters record two-axes tilt values as well as relative gravity, the AVL’s CG5 may have detected coseismic tilt changes due to the foreshock (e.g., Kazama et al., 2016). We were therefore motivated to quantitatively discuss coseismic gravity/tilt variations by processing the CG5’s continuous data recorded during the foreshock of Kumamoto Earthquake.

We first corrected tidal gravity changes from the original continuous gravity data, using the software packages of BAYTAP-G and TIDE4N (Tamura et al., 1991). We then extracted gravity/tilt data having small observation errors from the CG5’s time series, and calculated the gravity/tilt steps during the foreshock. The obtained step values for gravity and tilt were +2.8 +/- 2.3 microGal and 66.4 micro-rad for the azimuth angle of N11E, respectively.

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We also estimated coseismic gravity/tilt variations expected at the AVL faculty according to dislocation theories (Okubo, 1993; Okada, 1993), using a fault slip model determined from crustal deformation data (Geospatial Information Authority of Japan, 2016). The theoretical gravity/tilt steps were estimated to be +0.65 microGal and 0.13 micro-rad for the azimuth angle of N120E, respectively.
The observed gravity step, which has a large deviation value, agrees with the theoretical one in terms that both values are not significantly greater than the resolution of the CG5’s gravity value (= 1 microGal). However, the observed tilt amplitude is different with the theoretical one by more than double digits, and those azimuth angles are also inconsistent with each other by about 90 degrees. These inconsistencies may be related to the strong seismic ground motion caused by the foreshock event, so we’ll compare the observed gravity/tilt variations with the time series of ground motion recorded by seismometers and GNSS receivers.

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