

Superconducting gravimeter observation in NAOJ Mizusawa, and geodetic collocation observations

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We started gravity change observation with a superconducting gravimeter (SG) in the National Astronomical Observatory of Japan (NAOJ), Mizusawa VERA Observatory since late December, 2008. This gravimeter was used for tidal gravity observation in the Esashi Earth Tides Station since 1988. In this time, this SG was moved from Esashi to Mizusawa campus. It is installed in the old gravity measurement building (at present, RISE laboratory) and is stayed on a pillar which was used ILOM stationary absolute gravimeter (Sakuma type gravimeter). The data acquisition system is almost same one which was used in Esashi station. The clock was kept by a GPS time receiver. GGPI, TIDE and MODE filter outputs from SG, barometer data, tilts data and related data are recorded with one second interval. We replaced thermal leveler control (SG tilts control) cards in this time. Old card had a time constant of about 20 minute, while new one have a time constant of about 5 minute. This shorter time constant makes tilt minimum adjustment easier, and moreover, tilts bias for the observation of earth's free oscillation bands will be reduced.

The main purpose of SG observation in Mizusawa campus is collocation with VLBI and GPS observations. Geodetic observations by VLBI and GPS in NAOJ VERA system prove horizontal movements with 1mm order accuracy, but the positioning accuracy of vertical component is a few times worse than that of horizontal ones. We often discover cm order fluctuation in the vertical component within a few years and rather short period change with in a month. In many cases, those vertical motions are not so reliable and it is required other evidences to confirm those motions. The collocated observations of precise positioning by VLBI and GPS, and gravity change measurement will ensure the detection of vertical motion of the observation site and will help the understanding of the physical phenomena. The drift rate of the SG is a few micro gal per year and is capable to detect gravity change caused by vertical displacement. We also observe gravity tide in Mizusawa by the SG. The tidal analysis result will be used to verify the tidal displacement model used in VLBI analysis system.

There are many sources to change the gravity. One of large source is underground water level change. In some cases, understanding of ground water level change becomes essential to interpret the cause of gravity change. There are four wells surrounding the SG observation site in Mizusawa. Water level meter of float type and pressure gage are installed in each well. Thus we have good environment to monitor the ground water level change. We are measuring rain and snow fall, and solar radiation regularly. Moreover, we start ground moisture measurement since October, 2008. Those observation data are very useful to construct a model of ground water behavior. We believe that Mizusawa campus is one of the best field to model the change of ground water level and we can predict gravity change caused by ground water with adequate accuracy for the SG observation.