Combined use of a superconducting gravimeter and Scintrex gravimeters for hydrological correction of precise gravity measurements - A superhybrid gravimetry

*Yuichi Imanishi[1], Kazunari Nawa[2], Yoshiaki Tamura[3], Hiroshi Ikeda[4], Ryo Honda[5], Takashi OKUDA[6], Makoto OKUBO[7]

1. Earthquake Research Institute, The University of Tokyo, 2. AIST, 3. NAOJ, 4. University of Tsukuba, 5. MFRI, 6. Nagoya University, 7. Kochi University

Precise gravity observations are often subject to influence of temporally variable distribution of underground water near the observation sites. It is in general difficult to model and correct such effects from the observed gravity series, because it requires knowledge of the hydrological nature of the underground which varies from place to place. The superconducting gravimeter CT36 at Ishigakijima, Okinawa, Japan also experiences very complicated effects of underground water, apparently combined with the atmosphere and the ocean. Effects of the fluids near the surface on gravity must be precisely corrected so that the possible gravity signals associated with the long-term slow slip events occurring near the Ryukyu trench can be detected.
To overcome this difficulty, we employ combined use of the superconducting gravimeter (SG) and Scintrex CG-5 gravimeters. The latter are used as mobile instruments, measuring relative gravity values with respect to the SG pier as in a local gravity survey. One of the advantages of the CG-5 gravimeter is that it enables continuous measurements and therefore comparison with the SG, thus greatly mitigating the problems of instrumental drift inherent to mobile gravimeters. Under the assumption that temporal gravity changes are common within the survey area, using the SG data as reference helps improving estimates of the local gravity field significantly.
We made an experiment of this kind of measurements (which we term superhybrid gravity measurements) using two CG-5's at Ishigakijima in January 2017. Preliminary analysis of the data has shown that relative gravity values at a particular point measured on different days were in agreement at 1 microgal precision. We will present further results and discuss temporal changes of gravity in relation to the dynamics of underground water.

Keywords: superconducting gravimeter, Ishigakijima, underground water, superhybrid gravimetry

