

Water flux model around TRIES/MIU to explain the gravity change - II

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Gravity measurement has been operated in three observation stations in and around the Tono Research Institute of Earthquake Science (TRIES) since 2003, and detected the gravity change in the 2011 off the Pacific coast of Tohoku Earthquake. The change was about 10 micro Gal ($1 \times 10^{-4} \text{ m/s}^2$) decrease in all three stations which exceeds the effect of ground deformation, moreover it is opposite sense of change for the 14 m of ground water level increase in nearby station. We have constructed the ground water flux model to explain the gravity decrease and the water level increase simultaneously. Based on gravity change simulations on hydraulic geological structure in the study area, we confirmed that the water flux which flows down to the deeper area can explain both the gravity and the ground water level. Niwa et al. (2012) reported the coseismic ground water level changes of the Tohoku Earthquake in several wells in and around the Mizunami Underground Research Laboratory (MIU, JAEA), which is near by the TRIES.

In this report, we first reviewed the effect of ground deformation including the afterslip to the gravity data obtained in and around the TRIES/MIU. Ground water level is almost recovering in this 5 years, nevertheless the gravity values are still same as of just after the earthquake. Coseismic vertical displacement is less than 1 cm in the study area, which gravitational effect is about 1 micro Gal. Postseismic vertical displacement shows about 4 cm uplift in the last 5 years. This is an amount of 9 micro Gal decrease for the gravity, which cancels the coseismic step. We conclude that the gravitational effect of the ground water level recovery is masked by the effect of postseismic displacement. We also studied the individual coseismic ground water level response for all the wells in the study area, including reported in Niwa et al. (2012). For each well, we compiled the amount of change, time to the peak of the change, duration for the recovery and so on. The correlation was found between the recovery speed and the water catchment area on the basement topography. We also questioned for the implication of downward water flow in the wells where the water pressure is monitored by multi packer system.

Keywords: Gravity, Ground Water, Coseismic Response