

Gravity change simulations of various environmental changes around TRIES gravity stations

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The Tono Research Institute of Earthquake Science (TRIES) has been operating absolute gravity measurement since 2004, with Micro-g LaCoste FG-5 absolute gravimeter. From the beginning of the observation, gravity values do not show variation larger than 10 micro Gals. The excavating of two vertical shafts and horizontal caves for research in Mizunami Underground Research Laboratory (MIU) is the largest action. It has been carried out by Japan Atomic Energy Agency (JAEA) since 2004. The shaft excavation site is vicinity of two gravity measurement stations, MGA and TGR. The drawdown of water depth level accompanying the excavation is observed around the site. Besides, the leveling which has been carried out since 2004 detected at most 17 mm subsidence near the TGR gravity station. The artificial topographic change might be also effective. We examined the gravitational effect of such environmental changes around our stations.

The effect of the tunnel excavation is estimated based on a detailed drift way model, which was provided by JAEA. The original model is prepared as a wire frame data. We arranged the wire frame model to the grid data. Then we adopted the method of Banerjee and Gupta (1977), which calculates the vertical component of the theoretical attraction force of rectangular prism.

The artificial topographic change took place near the TGR station. It was the elimination of crest and the infill of a channel. The effect of the topographic change is estimated by Digital Elevation Map (DEM). The latest DEM is provided by Geographical Survey Institute of Japan (GSI) as a 5 m grid model. We made an old DEM by digitizing altitude contours of the 1:1000 map of Mizunami city, which was published in 1986. The difference of the two DEM is employed to the attraction force calculation.

The detected subsidence was simply applied to a free-air gravitational effect. As a result, the total gravity change estimated for these various environmental changes was less than 5 micro Gals. The remaining problem is the change of the ground water level. We must explain the mechanisms of large ground water level change, which does not affect gravity values.

Banerjee, B. and S. P. D. Gupta (1977): Gravitational Attraction of a Rectangular Parallelepiped, *Geophysics*, 42, 1053-1055.

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