

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

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The absolute gravity measurement by FG-5 has been operated in and around the Tono Research Institute of Earthquake Science (TRIES) since 2003. During this period, two types of ground water level change was observed. One is the water level decrease more than 70 m in 12 years, which along the drilling of the 500 m deep shafts of the Mizunami Underground Research Laboratory (MIU). The other is the coseismic water level increase in many events. Generally, the gravity value increases if the water level just beneath increases, and vice versa. Nevertheless, the gravity values in 3 stations show the same trend; show no decrease along with water level decrease in 12 years and the gravity decrease along the coseismic water level increase. The distinct coseismic gravity change was observed only in two cases. One is in the 2004 off Kii Peninsula Earthquake (Tanaka et al., 2006, G3), and the other is in the 2011 off the Pacific coast of Tohoku Earthquake. We introduce the model of the groundwater flow, which is explicable for both gravity and ground water level.

The interspaces of these stations are 1 to 2 km. The coseismic gravity decrease in these stations were about 10 micro gals which suggest that the mass moved away from these three stations equivalently. Based on former researches of geology and hydraulic geology, which clarified the permeable and impermeable layers well, we reached the model as follows for the coseismic case. 1) The subsurface structure is constructed by three permeable and two impermeable layers 2) The seismic wave or stress propagation causes the high permeable path through the deeper impermeable layer. 2) The water reserved in the middle reservoir flows down to the bottom reservoir driven by gravity force. Geologic fault plays an impermeable role for a lateral flow, however, the high permeable region are generated by the seismic event, along fault plane.

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