Hydrological effect on gravity at Matsushiro and detection of coseismic gravity change caused by 2003 Tokachi-oki earthquake

Yuichi Imanishi[1]; Kazuya Kokubo[2]; Hidee Tatehata[3]

[1] ORI, Univ. of Tokyo; [2] Matsushiro Seis. Obs.,JMA; [3] Matsushiro Seismological Observatory, JMA

The short-term effect of underground water on superconducting gravimeter observation at Matsushiro, Japan is investigated. Analysis of rainfall data as well as gravity data reveals that observed gravity decreases immediately after rainfall by the amount which can be explained by a Bouguer model. This suggests that Newtonian attraction by the mass of water above the gravimeter supplied by rainfall is the dominant part of the effect of underground water. Gravity excursion due to rainfall decays linearly with time, suggesting the existence of a physical mechanism involving percolation, evaporation or drainage of water at a steady rate. A simple numerical model is introduced to calculate the gravity effect based on rainfall data. The model is shown to reproduce the observed gravity changes well. Finally, the model is applied to the data for the 2003 Tokachi-oki earthquake (Mw 8.0). As a result, a step in gravity smaller than 10 nms-2 (1 microGal) associated with earthquake faulting is found for the first time. This demonstrates the importance of hydrological corrections in precise gravimetry as well as opening of a new gravimetric window to the study of earthquake source processes.