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Hydrological gravity response detection using a gPhone -aboveground, and 100- & 300-m belowground-

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Inland water fluctuations are one of the most important source of disturbance for gravity monitoring which monitors density change of the underground. We have proposed the gravimeter array method as the technique of removing the disturbance due to inland water fluctuations. Namely, the effect of rain-/snow-fall should be cancelled using two continuous gravimeters with a free water plane between them. We have performed three gravity observations; aboveground (Ontake volcano), 100-m deep belowground (Mizunami Underground Laboratory (MIU)), and 300-m deep belowground (MIU). Although the data of 300-m deep are still under analysis, we have succeeded in approximately 1 ~ 4 microGal of gravity responses due to inland water variations in the data of both aboveground and 100-m deep belowground. However, the data of 100-m deep belowground also contained unknown gravity variations (real signal from the deep part of crust or non-linear spring sensor behavior). Our absolute gravity measurements have doubled as a calibration tool for the gPhone and a detector of rainfall response itself (Tanaka et al., 2011, JPGU abstract). However, even the rainfall over 20 mm/hour could not be detected with the usual operation policy (100 drops/hour, 10-second drop interval). Based upon the foregoing, the following strategy is realistic as gravity monitoring: (1) two relative continuous gravimeters both above- and belowground are in charge of detections of the response of inland water fluctuations. (2) absolute gravity measurements are repeatedly carried out to calibrate the sensor-drifting of relative gravimeters when atmosphere and ocean are under calm conditions.

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