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Groundwater level monitoring using A10 absolute gravimeter

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It is important to monitor the aquifer mass balance of pumping up and recharge to use the ground water for a long term. The pumping up of ground water causes mass fluid movement and mass redistributions, which can cause measurable gravity changes and ground deformation at the ground surface. We carried out the repeat gravity measurement at some fields in order to detect the gravity changes caused by groundwater level changes. We combined the Absolute gravity measurement and the relative gravity measurement. We used the instruments for the relative gravity measurement (CG-3M and CG-5 gravimeter: Scintrex Ltd.) and the absolute gravity measurement (A-10 gravimeter: Micro-g LaCoste, Inc.). The A10 absolute gravimeter is a portable absolute gravimeter produced by Micro-g LaCoste Inc. It operates on a 12V DC power supply (i.e. vehicle battery). We can measure the absolute gravity using the vehicle battery at the field.
First, we started repeat gravity measurement at Ito campus, Kyushu university Fukuoka city, Japan, where the instrument is usually maintained, since 2008 in order to assess the A10 gravimeter's accuracy and repeatability.[U+3000]We measured 10 sets at each measurement, and 1 set consists of 100 drops. There are 3 groundwater level monitoring wells near the gravity station. It can be seen that there is a good correlation between gravity changes and groundwater level changes. We confirmed that the instrument is maintained good condition in general, although some bad data was included. It seems that the repeatability of A10 gravimeter is better than 10 microgals.
After checking the A10 gravimeter's condition, accuracy and repeatability, we have started repeat gravity measurement in Jakarta and Bandung, Indonesia since 2008. These 2 cities observed a large amount of subsidence caused by a large amount of pumping the groundwater. We cannot get the gravity data in 2008 survey because of the instrument troubles. Although we got only limited number of gravity data, we learned a lot of technical and logistic viewpoints. There are some problems (high temperature and humidity, ground noises caused by heavy traffics) to get the good gravity data. In particular the measurement in high temperature condition caused a problem in vacuum and laptop computer. We installed 2nd Ion pump for upgrading the vacuum capacity. We detected gravity increase from July 2009 to July 2010 at 7 stations in Jakarta. We can see the large gravity increase (30 – 50 microgals) in the coastal area where the large subsidence was observed by GPS.