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A10絶対重力計によるインドネシアでの地盤沈下・地殻変動モニタリング（第２報）
Application of A10 absolute gravimeter for monitoring land subsidence and crustal movement in Indonesia (the 2nd report)

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In many of the urbanized cities in Indonesia, one of the urgent problems is land subsidence mainly due to excess pumping of groundwater. In Jakarta, for instance, the recent GPS surveys conducted by ITB have revealed the significant subsidence along the northern costal area with the rate of more the 10 cm/yr. It has been also reported that more than 10 cm/yr land subsidence is in progress in some areas in Bandung. In West Java, there are some active faults (e.g. Lembang fault) whose tectonic activities may cause crustal movements. These land movements can be measured by present-day space geodetic techniques, such as GPS and InSAR. In addition, precise gravity measurements can provide useful information to understand the mechanism of the movements, because they reflect the underground density changes or mass movements.

In order to detect the gravity changes associated with the land movements in West Java, we have been conducting gravity measurements with a field type absolute gravimeter, Micro-G LaCoste Inc. (MGL) A10 since 2008. The outline of the absolute gravity measurements and the survey areas have already been reported at the 2010 JpGU meeting. In this paper, we reports the surveys conducted in 2010 and some results obtained so far.

The gravity measurements in 2010 have been conducted from July 15th to August 5th. Practically the measurements in Jakarta and Bandung have been carried out from July 22 to 25 and from July 31 to Aug 3, respectively. We employed both A10-07 and a Scintrex gravimeter for the measurements as same as before. In addition, we tried to occupy the same points as many times as possible to confirm the repeatability of the measurements. A note is that some of gravity points in Jakarta were lost mainly due to road construction. We therefore set up a couple of new points, in particular near the coastal area where large subsidence has been observed. The GPS measurements, on the other hand, have successfully been carried out by the ITB team from late June to the end of July.

During the survey before 2009, we experienced several technical problems on the absolute gravity measurements, particular on the field measurements in high temp and humid condition. We suspected these problems are mainly due to voltage drop of the DC batteries and thermal effects on the computer system for control and data acquisition. Therefore, this time, we directly used the car battery with the engine on during the measurements and tried to keep the computer cool with a PC cooling pad. All these efforts almost overcome the problems so far, and we could get the data as good as those obtained in normal condition. On the other hand, we found some offsets or drifts in the absolute gravity values obtained. This means that the absolute values need calibration, and we corrected the values afterwards by comparing the reference values measured in Japan.

The result of the GPS measurements in Jakarta show the same subsidence pattern as before, i.e., more than 10cm/yr subsidence along the northern coastal area. The gravity measurements show the same tendency, although the number of available gravity points are limited. The comparison between the height changes and the gravity changes shows more like the gradient of water density. However the uncertainty is still large and we need further data accumulation for more precise conclusions.

The gravity changes in Bandung also show the similar spatial pattern with the GPS data. However the quantitative comparison is still difficult. One of the reason is that many of the gravity points are not completely same points as the GPS points. This should be considered in the future surveys.
Keywords: absolute gravimeter, land subsidence, crustal movement, GPS, Indonesia