Performance of the Geometric–Historic Method for Estimating Land Subsidence in Urban Areas of Indonesia

Hasanuddin Z. Abidin, Heri Andreas, Irwan Gumilar and Bambang D. Yuwono (Indonesia)

Key words: Deformation measurement; GNSS/GPS; Positioning; Risk management; land subsidence; geometric-historic; Jakarta; Bandung; Semarang

SUMMARY

Several large urban areas in Indonesia, i.e. Jakarta, Bandung and Semarang, have experienced land subsidence for at least more than a decade. Land subsidence in these cities have been estimated using several geodetic methods, such as leveling, GPS survey, InSAR, and/or microgravity. The results obtained from these technique over the period between 1982 and 2011 show that observed subsidence rates in Jakarta are about 1 to 15 cm/year, and can reach up to 20-28 cm/year at certain location and certain period. In Bandung basin, it was found that during the period between 2000 and 2011, several locations have experienced subsidence, with an average rate of about –8 cm/year and can reach up to about –23 cm/year. In Semarang, land subsidence with rates of up to about 19 cm/year were observed during the period of 1999 up to 2011. In this paper, the geometric-historic method for observing and estimating land subsidence is introduced. This method is based on observation of land subsidence impacts in the field. By measuring the vertical displacement caused by land subsidence effect on the impacted object or structure, combined with historical and interview data, then the subsidence rate can be calculated. This method has been implemented to estimate subsidence rates at several locations in Jakarta, Bandung and Semarang, and the obtained rates have been compared with GPS and InSAR derived subsidence rates. The strength and limitation of this geometric-historic method is laso presented and discussed.