



On the use of InSAR technology to assess land subsidence in Jakarta coastal flood plain

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Jakarta is the capital of Indonesia and is home to approximately 10 million people on the coast of the Java Sea. It is situated on the northern coastal alluvial plane of Java which shares boundaries with West Java Province in the south and in the east, and with Banten Province in the west. The Capital District of Jakarta (DKI) sits in the lowest lying areas of the basin. Its topography varies, with the northern part just meters above current sea level and lying on a flood plain. Subsequently, this portion of the city frequently floods. The southern part of the city is hilly. Thirteen major rivers flow through Jakarta to the Java Sea. The Ciliwung River is the most significant river and divides the city West to East.

In the last three decades, urban growing of Jakarta has been very fast in sectors as industry, trade, transportation, real estate, among others. This exponential development has caused several environmental issues; land subsidence is one of them. Subsidence in Jakarta has been known since the early part of the 20th century. It is mainly due to groundwater extraction, the fast development (construction load), soil natural consolidation and tectonics. Evidence of land subsidence exists through monitoring with GPS, level surveys and InSAR investigations.

InSAR stands for “Interferometric Synthetic Aperture Radar”. Its principle is based on comparing the distance between the satellite and the ground in consecutive satellite passes over the same area on the Earth’s surface. Radar satellites images record, with very high precision, the distance travelled by the radar signal that is emitted by the satellite is registered. When this distance is compared through time, InSAR technology can provide highly accurate ground deformation measurements.

ALTAMIRA INFORMATION, company specialized in ground motion monitoring, has developed GlobalSARTM, which combines several processing techniques and algorithms based on InSAR technology, to achieve ground motion measurements with millimetric precision and high accuracy.

World Bank studies conservatively estimate land subsidence in Jakarta occurring at an average rate of 5 cm per year, and in some areas, over 1 meters was already observed. Recent studies of land subsidence found that while typical subsidence rates were 7.5-10 cm a year, in localized areas of North Jakarta subsidence in the range 15-25 cm a year was occurring, which if sustained, would result in them sinking to 4 to 5 meters below sea level by 2025. Land subsidence will require major interventions, including increased pumping, dikes and most likely introducing major infrastructure investment for sea defense.

With the increasing prevalence of Earth Observation, the World Bank and the European Space Agency have set up a partnership that aims at highlighting the potential of EO information to support the monitoring and management of World Bank projects. In this framework ALTAMIRA INFORMATION has assessed land subsidence in Jakarta. Impressive results have been obtained by providing high resolution measurements which can help in improving the characterization of the subsidence mechanisms.