

Measuring Land Subsidence in Bangkok and its Vicinity Area using Sentinel-1 SAR Data for InSAR Time Series Analysis

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Abstract: InSAR time series analysis is a novel technique in remote sensing. Its potential had been demonstrated to be an effective measurement for land subsidence monitoring, by using the synthetic aperture radar (SAR) image. The success of the application based on data available and processing approach, which is costly, and time-consuming. Since 2014, ESA made Sentinel-1 SAR data available at no cost, which covers wide-area coverage connected to a relatively high spatial resolution, therefore allowing obtains a comprehensive outlook of the deformation phenomena. In this study, InSAR time series analysis was used to process Sentinel-1 data for the monitoring of land subsidence over Bangkok and its vicinity area, Thailand. The application of InSAR time series analysis in measuring land subsidence has higher uncertainty when spatial and temporal decorrelation is involved. This study demonstrated that the Sentinel-1 data pairs could be collected with smaller perpendicular baselines and lower temporary discrepancy, leading to better measuring results. We collected Sentinel-1 data from May to October in 2018 covering 6,938.89 Square kilometers with the perpendicular baseline within 50 m and 151 days of temporal baseline. Therefore, spatial and temporal decorrelation has a negligible contribution. From the development of algorithms for SAR data processing using 10 Sentinel-1 Single Look Complex (SLC) data, we can obtain 1,000,000 observation points after weeding pixels that are due to signal contribution from neighboring ground resolution elements and those deemed too noisy. InSAR time series measuring results reveal that the land deformation in Bangkok, Nonthaburi, Nakhon Pathom, Pathum Thani, Phra Nakhon Si Ayutthaya, Samut Prakan, and Samut Sakhon has been both uplifts and subsiding by the seasonal effect of the data collection with a short time period. The initial results of the land deformation rates are between 56.70 and -100.50 millimeters per year. This study maps the recent land subsidence rates over Bangkok and its vicinity area and illustrates the applicability of Sentinel-1 data in land subsidence monitoring for automated development, which can significantly contribute to the groundwater control in Thailand.

Keywords: InSAR, Time series analysis, Sentinel-1, Land subsidence, Bangkok