

Monitoring reclamation settlement of Chek Lap Kok Airport with TerraSAR-X interferometry

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KEY WORDS: Monitoring Concepts for Static and Dynamic Deformations of Engineering and Geotechnical Structures

ABSTRACT:

Hong Kong International Airport at Chek Lap Kok (popularly known as Chek Lap Kok Airport) is one of the largest reclamation sites in Hong Kong and worldwide. Due to soil consolidation of the underlying unconsolidated-marine sediments, the Airport's platform has been experiencing ground subsidence since the beginning of reclamation in late 1992. Our previous studies have demonstrated the potential of satellite InSAR techniques to measure the ground deformation in this area by using middle resolution SAR data, e.g. approximately 25 m ENVISAT ASAR imagery [1].

This paper presents our latest results of reclamation settlement of the Airport measured with very high resolution TerraSAR-X (TSX) data. A total of 31 TSX Spotlight SAR images (VV polarization) acquired between Oct. 2008 and Dec. 2009 were used in this study, which have one meter of spatial resolution and 11 days of temporal interval. An elaborated Persistent Scatterers Interferometric (PSI) processing chains, including DEM-assisted coregistration, spectral shift filtering, phase ramp correction and multi-master stacking analysis, was performed to determine spatial pattern and temporal process of reclamation settlement. The PSI-derived deformation results showed ground instability and differential displacements (-3 mm/yr \sim -15 mm/yr) occurring along runways, terminal buildings and infrastructure in the reclamation areas of the airport. Particularly, the results highlighted a remarkably high density of PS points ($>2,500$ PS /km²), which is approximately ten times density of those from ASAR results, and more PS points to be identified in the runways that failed in our previous results. This benefits from the advanced capacity of the TSX satellite mission, characterized by the higher spatial resolution, the shorter repeat cycle of eleven days and the higher sensitivity regarding displacement as the result of the shorter radar wavelength. The more accurate and detailed displacement maps generated with TSX satellite data can assist in assessing reclamation performance at present and in planning, designing and maintaining sustainable development in the future.