



Coastal city subsidence in Shenzhen (China), monitored using multi-frequency radar interferometry time-series techniques

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In just 26 years, the coastal city of Shenzhen (Southern China) has been transformed from a small fishing village to a modern city with a population exceeding 8.5 million people. Following its designation as a Special Economic Zone in the 1980s, the city became a test bed for China's economic reforms and currently leads many new practices in urban planning. The rapid economic development was matched by a sharp increase in the demand for usable land and consequently, extensive coastal reclamation has been undertaken by piling rock fragments from nearby hills onto the seabed. However, it has recently been reported that new apartments, offices and transport networks built on the reclaimed land have become unusable due to ground subsidence. The additional threat of coastal inundation from sea-level rise also requires serious consideration.

InSAR time-series techniques (such as Persistent Scatterer and Small Baseline InSAR) are capable of detecting sub-centimetre elevation changes of the Earth's surface over large areas and at a density far exceeding the capabilities of a GPS network - particularly for such an urban environment as Shenzhen. This study uses numerous independent tracks of SAR data (two ENVISAT C-band tracks and two ALOS L-band tracks) to determine the surface movements between 2004 and 2013. Quantitative comparative analyses are carried out in the overlapping area between two adjacent tracks, and thus no ground data is required to validate InSAR results.

The results show greatest subsidence in coastal areas with the areas of reclaimed land also predominantly undergoing subsidence. The combination of different ascending and descending tracks allows 2D velocity fields to be estimated and it will be important to determine whether the subsidence from the recently reclaimed land is consolidation or part of a longer-term trend. This ability to provide accurate measurements of ground stability for the city of Shenzhen will help focus investigations into areas of land subsidence and should help mitigate future land use problems particularly given the city's vulnerability to sea-level rise.