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Space borne InSAR and urban subsidence: From theory to practice

The traffic congestion in a major city is a nuisance. One approach to ease the congestion is to develop a subway system. In the subway construction, the beneath surface excavation for the tunnel and station is routine. Although the reinforcement piles are created, subsidence of surrounding land surface can occur. If the subsidence is beyond the predetermined safety threshold, disastrous events can happen. Thus, there is an urgent need to assess the subsidence along the subway. InSAR (Interferometric Synthetic Aperture Radar) technique is one widely-used approach to quantify the land surface deformation. With appropriate multi-temporal SAR datasets and InSAR analysis algorithms, one can assess surface variation at millimeter-scale through time. In this study, we quantified surface change and linked the change to Metro Line 1 of Chengdu, China using multi-temporal SAR datasets and the small baseline subset (SBaS) algorithm. Metro Line 1 constructed between 2005 and 2010 has been in operation since 2010. Eleven PALSAR FBS (fine bean single) L-HH and 10 FBD (fine beam dual) L-HH SAR data were acquired from 2007 to 2011. The study area was 9 km×4 km along the metro line. Surface subsidence was revealed. The rate ranged from 0 to 33 mm /year with the dominant rate of 0–11 mm/year. The subsidence was attributed to the construction and operation of the metro. The time-series analyses consisting of 21 datasets at four locations were conducted. At two locations above two underground stations, large subsidence rates were observed. Patterns of rate changes from both stations were very similar. Small subsidence rates were quantified at two locations above subway tunnels. Patterns of rate changes were almost identical. In comparison with the low surface subsidence rate above the tunnel, the large open space and high traffic volume of passengers at the stations were attributed to the causes for the high subsidence rate.

Biography

Yong Wang received his PhD degree from the University of California, Santa Barbara, California, USA, in 1992 focusing on synthetic aperture radar (SAR) and its application. His current research interests include the application of remotely sensed and geospatial datasets to the study of environments and natural hazards, and the algorithm development in SAR imaging and information extraction and in InSAR (Interferometric SAR) data analysis and application.

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