Study of Atmospheric Effects on Satellite Synthetic Aperture Radar (SAR) Measurements in Tropical Regions

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ABSTRACT

Repeat-pass interferometric synthetic aperture radar (InSAR) has been demonstrated to be very useful for topographic mapping and surface deformation measurement. However, satellite synthetic aperture radar (SAR) data are often seriously contaminated by atmospheric delays of the radar signals. Due to the highly variable nature of the atmosphere, especially the atmospheric water vapor, it is often difficult to accurately model and correct the atmospheric effects. Consequently, significant errors can potentially be resulted in InSAR measurements, especially in tropical regions like Hong Kong.

Atmospheric effects on InSAR measurements in the Hong Kong region are studied based on a tandem pair of InSAR data and a month-long continuous GPS (CGPS) tracking data obtained at six stations. Differential atmospheric signals extracted from the SAR data for two selected areas in Hong Kong show apparent power law nature of the signals. The RMS values of the signals are 2.12 and 3.40 rad respectively for the two areas. The GPS tropospheric zenith delays (ZNDs) estimated indicate that a peak-to-peak error of about 9.36 cm can potentially be resulted in a SAR interferogram at the 95% significance level even with only a one-day interval. The error increases to about 11.47 cm for a ten-day interval.

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