A study on measurement error of topography using cross-track interference SAR

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Synthetic aperture radar (SAR) has been developed to obtain radar images with high spatial resolution. Applying digitally signal processing, SAR obtains higher processing abilities, like the cross-track interferometric SAR (XTI SAR) technique to measure the topography of wide area. In these days, the improvement of accuracy is strongly required for quick topography measurement at the disaster scenes.

The XTI SAR technique uses more than two antennas with spatial separation perpendicular to the moving direction of platform. All antennas receive the scattered signal from the same target. The differences of target ranges between each antenna pairs are measured from the difference of signal phases received by each antenna with sensitivity of sub-wavelength order. The target position is determined by combining the antenna positions and the differences of target ranges.

On the processing of XTI SAR, the antenna positions measured on ground are dealt as known value, because the position measurement in flight is quite difficult. However, the real antenna positions in flight may differ from the measured positions on ground due to the different conditions of circumstances. Moreover, the platform altitude, which is needed to solve the ambiguity in difference of target ranges, may include error. In addition, the target ranges measured each antenna also include pseud lengths due to the time delays in electronic circuits. These errors of measurement parameters on XTI SAR may lead the measurement error of topography.

In this paper, considering the simple XTI SAR technique using two antennas, the relations between the errors of measurement parameters and the measurement error of topography is studied. Based on these relations, the features of measurement errors due to each error of measurement parameters are simulated and the influences are discussed.

Keywords: Synethtic Aperture Radar (SAR), Cross-track interfelometric SAR, topography

