Assessment of Orbital Interpolation Methods for Accurate Baseline Estimation in InSAR Applications

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Interferometric synthetic aperture radar (InSAR) is a powerful technique to measure ground deformation and topographic changes with high precision. Accurate estimating of the baseline between two orbits, which refers to the satellite's relative position in space during radar image acquisition, is crucial for obtaining reliable InSAR measurements. However, the discrete orbital trajectory of the satellite requires interpolation to obtain the position and velocity at arbitrary times. This research investigates the impact of different orbital interpolation methods on the accuracy of baseline estimation in InSAR applications. Since some SAR satellites have centimeter-level accuracy through precise orbit determination, interpolation-induced errors play an important role in baseline estimation. In this study, the orbital interpolation methods include linear, cubic, and Lagrange. We analyze the results of various interpolation techniques and assess their influence on baseline estimation. The experiment utilized 9 TerraSAR-X images to calculate the perpendicular baseline between orbits. The calculated baselines were compared with ESA SNAP software, and the mean difference was less than 0.35m. The cubic and Lagrange interpolation methods show better results than the linear method. The findings provide valuable insights into selecting the most suitable interpolation method for accurate baseline estimation in different scenarios, contributing to improved InSAR data processing and interpretation.

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