

## InSAR Times-Series Phase Unwrapping for Urban Areas

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**Abstract :** The analysis of multi-temporal InSAR (MTInSAR) such as persistent scatterer (PS) and small baseline subset (SBAS) techniques usually relies on temporal/spatial phase unwrapping (PU). Unfortunately, it always fails to unwrap the phase for two reasons: 1) spatial phase jump between adjacent pixels larger than  $\pi$ , such as layover and high discontinuous terrain; 2) temporal phase discontinuities such as time varied atmospheric delay. To overcome these limitations, a least-square based PU method is introduced in this paper, which incorporates baseline-combination interferograms and adjacent phase gradient network. Firstly, permanent scatterers (PS) are selected for study. Starting with the linear baseline-combination method, we obtain equivalent 'small baseline inteferograms' to limit the spatial phase difference. Then, phase different has been conducted between connected PSs (connected by a specific networking rule) to suppress the spatial correlated phase errors such as atmospheric artifact. After that, interval phase difference along arcs can be computed by least square method and followed by an outlier detector to remove the arcs with phase ambiguities. Then, the unwrapped phase can be obtained by spatial integration. The proposed method is tested on real data of TerraSAR-X, and the results are also compared with the ones obtained by StaMPS(a software package with 3D PU capabilities). By comparison, it shows that the proposed method can successfully unwrap the interferograms in urban areas even when high discontinuities exist, while StaMPS fails. At last, precise DEM errors can be got according to the unwrapped interferograms.

**Keywords :** phase unwrapping, time series, InSAR, urban areas

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