

INTERFEROMETRIC COHERENCE CHARACTERISTICS WITH HIGH RESOLUTION SATELLITE SYNTHETIC APERTURE RADAR

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Recently high-resolution space-borne synthetic aperture radar (SAR) systems with various polarizations have been launched and operated successfully. Data acquired by these systems have shown good results for various geodetic interferometric SAR (InSAR) applications [1-5]. In this study we evaluate the coherence characteristics of high-resolution data acquired by TerraSAR-X (X-band), ALOS (L-band), Radarsat-2 (C-band) and low-resolution data acquired by Radarsat-1, ERS, Envisat (C-band), Jers-1 (L-band) over southern Florida, U.S.A. Our coherence analysis reveals that the high-resolution X-band (3.1 cm wavelength) TerraSAR-X (TSX) data has a high coherence level, similar to that of the L-band (24 cm) ALOS data, even in wetland areas (> 0.35). Furthermore, the TSX coherence values in both urban and wetland areas are significantly higher than that of the C-band (5.6 cm) Radarsat data. The high TSX coherence is a surprising result, because according to common vegetation scattering theories, the shorter wavelength radar pulse interacts mostly with upper sections of the vegetation and, hence, does not provide good stable scatterers over time. We suggest that the higher coherence values of the TSX data reflect the data's high-resolution, in which stable and coherent scatterers are better maintained. The contribution of pixel resolution to the coherence is also detected in Radarsat-1 data showing that fine-beam data (7 m pixel resolution) is significantly higher than that of the standard beam (20 m pixels) coherence. We will continue this preliminary study by conducting

additional coherence analyses over various environments and developing appropriate theory that will account for data resolution in the coherence calculations.

Keywords: Interferometric SAR (InSAR), coherence, high resolution satellite SAR, wavelength, temporal decorrelation

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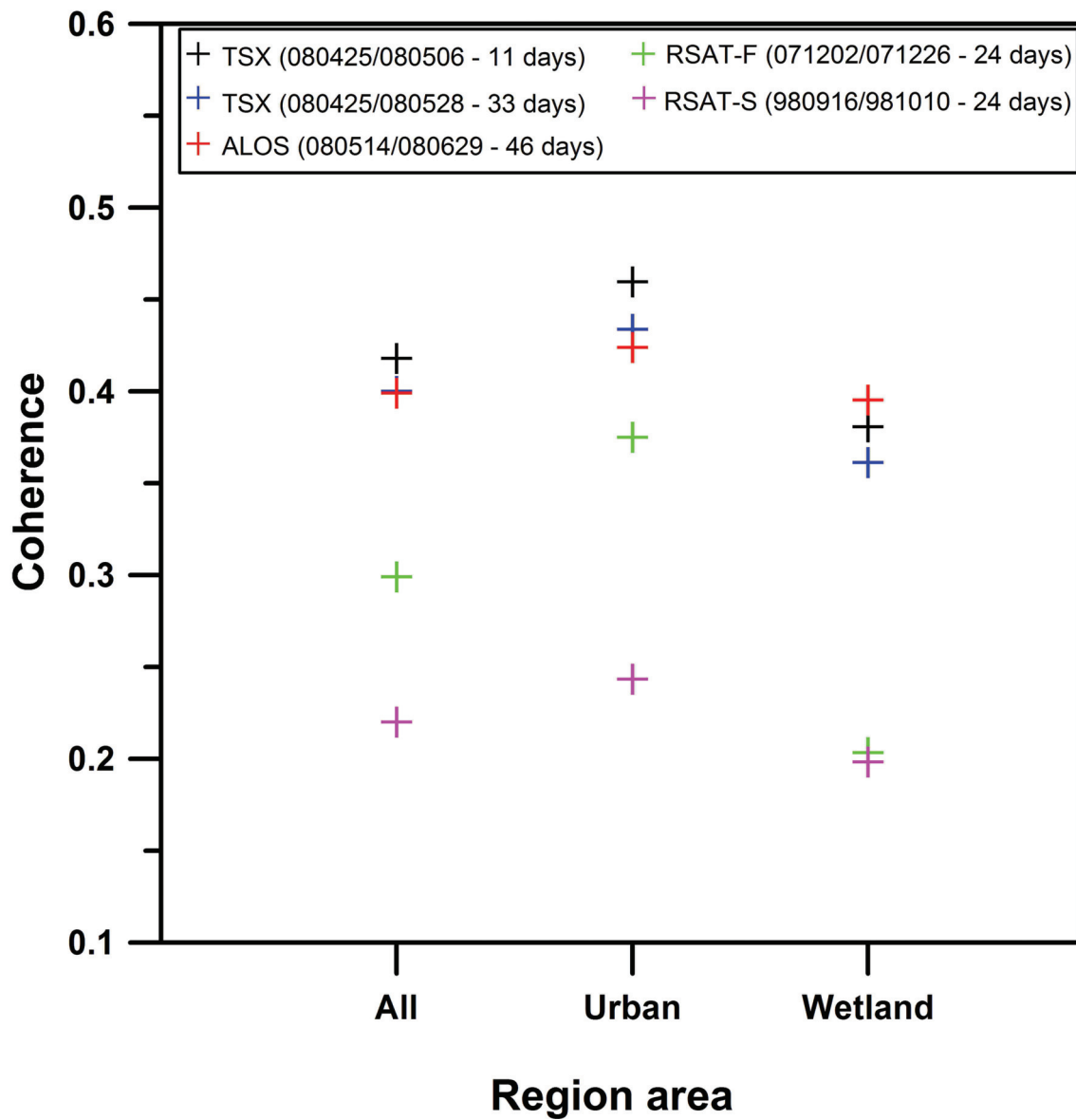


Fig. 1. Coherence analysis calculated from various SAR data types. The TSX data show similar coherence values to those of the L-band data and higher than the C-band data.

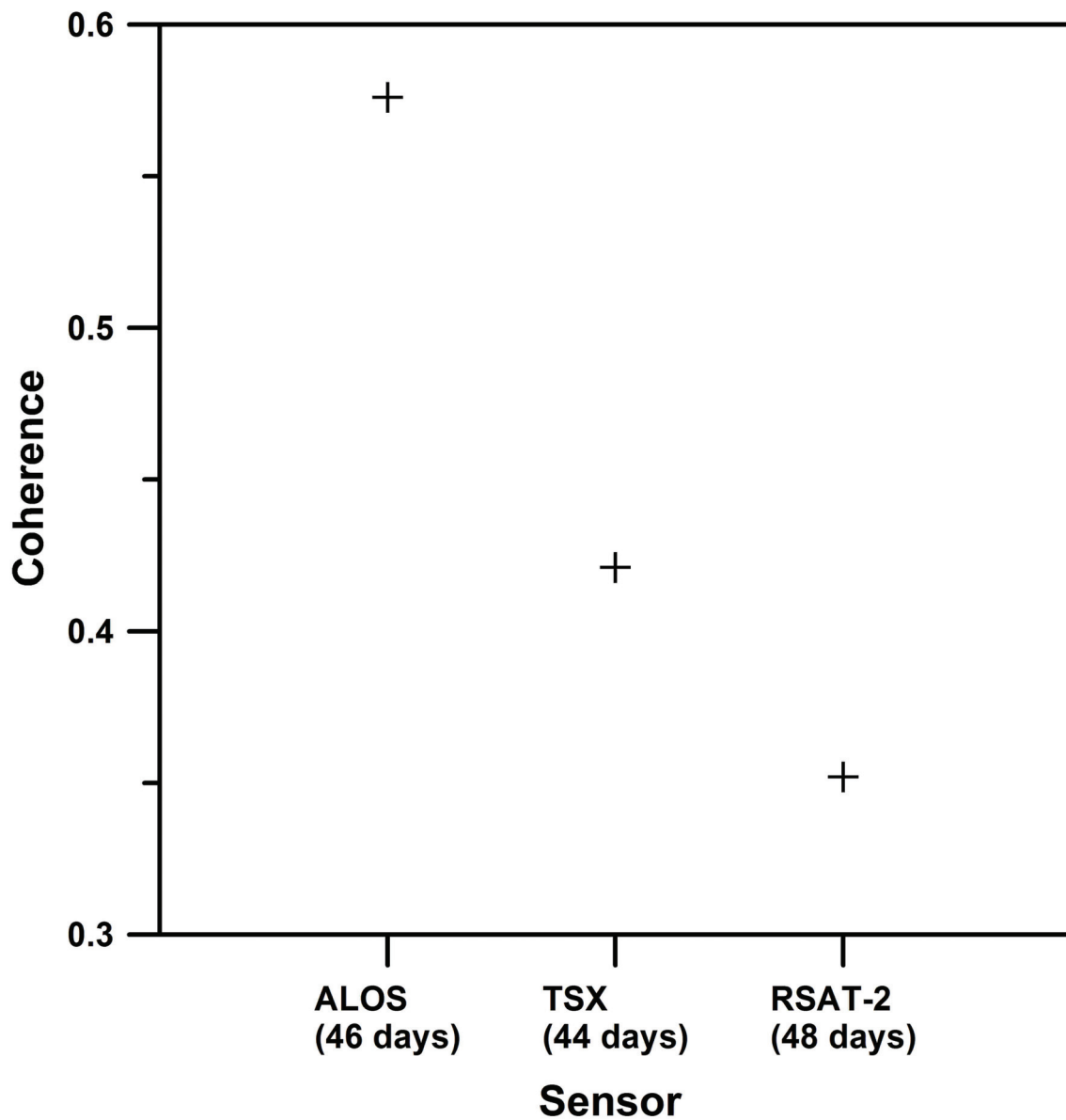


Fig. 2. Coherence analysis results of L-, X-, and C-band data, calculated from interferograms of similar temporal baselines. The L-band ALOS data shows better coherence than the other two sensor data. Surprisingly, the shorter wavelength X-band TSX data with 44-day temporal baseline maintains higher coherence than the Radarsat-2 C-band data.