Interferometric coherence variation of different wetland classes greatly influences the applicability of the Interferometric Synthetic Aperture Radar (InSAR) technique for wetland monitoring. Interferometric coherence is a quality indicator of InSAR observations and represents the degree of similarity of the same pixel in the time interval between two SAR acquisitions. Herbaceous vegetation, a component of most wetland ecosystem, may easily lose coherence within a day or week, which hampers the applicability of the InSAR technique for wetland monitoring.

This study used multi-temporal L-band ALOS PALSAR-1, C-band RADARSAT-2, and X-band TerraSAR-X data for statistical analysis of coherence variation in different wetland types, including bog, fen, marsh, and swamp in a study area located in the Avalon Peninsula, Newfoundland and Labrador, Canada. The mean and standard deviation of each coherence image were calculated for different wetland classes in all interferometric pairs in the multi-temporal, multi-frequency, and multi-polarization framework. Overall, the swamp and marsh wetland classes had the highest and lowest coherence among all wetland classes, respectively. The study illustrated that the temporal baseline was the most influential factor for coherence maintenance, particularly at shorter wavelengths such as C- and X-band. However, the coherence was less affected by the perpendicular baseline.

In general, coherence was the highest in L-band and intermediate-low degree for both X- and C-band, depending on the wetland classes. We also evaluated the relationship between SAR backscatter and coherence variation for images with the smallest temporal baseline. A linear correlation between coherence and SAR backscatter was observed during the ice-off season at both L- and X-band images. However, due to the limited number of RADARSAT-2 images, no deterministic conclusion was found between coherence and SAR backscatter variation at C-band data.

Our results demonstrated that the three wavelengths are suitable for wetland InSAR application for interferometric pairs with small temporal baseline. Furthermore, an adequate degree of coherence was observed for different polarizations, though the highest coherence was found for HH polarization.

**Keywords:** Wetland, Interferometric Synthetic Aperture Radar (InSAR), Coherence Analysis, Backscatter Analysis.