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Evaluation of Space-based Wetland InSAR Observations over the Cienaga Grande de Satnta Marta (CGSM), Colombia

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Hide abstract

The Cienaga Grande de Santa Marta (CGSM) is vast wetland and upland area located along the Caribbean coast of Colombia. It is sadly remembered as one of the ecological catastrophes of the Americas. A road construction along the wetland's perimeter blocked the natural hydrologic flow between sea and fresh water required for the natural functioning of the wetland's ecosystems [1-2]. This caused hyper saline conditions resulting in massive mortality of mangroves at the end of the 20^{th} century. Recent restoration efforts at CGSM have shown some recovery of the mangrove forest. Due to the large extent and the remoteness of the CGSM wetlands, ecological and hydrological assessments of the area require the use of remote sensing observations.

In this study we use wetland Interferometric Synthetic Aperture Radar (InSAR) observations, which have the capability to detect water level changes in aquatic environments with emergent vegetation over wide areas [3-5]. Our study is based on both L-band ALOS PALSAR and C-band RADARSAT-2 data. The ALOS PALSAR data consists of 44 images acquired over two tracks between 2007/01/01 and 2011/03/16. The RADARSAT-2 data consists of 20 Fine Quad polarization mode scenes acquired over three tracks between 2014/09/14 and 2015/01/05. These data were provided by RADARSAT-2 Science and Operational Applications Research Education International (SOAR-EI) initiative. The data were processed using the Repeat Orbit Interferometry PACkage (ROI_PAC) software, which generates differential interferograms eliminating topographic effects with a digital elevation model (DEM). We used 3 arc-seconds Shuttle Radar Topography Mission (SRTM) DEM for topographic phase removal in this study. Multi-looking was applied to reduce undesirable phase noise. The interferograms processing contains phase filtering to enhance the signal to noise ratio of the phase, and phase unwrapping.

We can evaluate the interferometric results in terms of interferometric coherence and fringe pattern. Our results yielded a different success level between the two datasets in extracting coherent phase over the CGSM wetlands. The L-band ALOS interferogram show mostly coherent phase changes across the entire wetland area, whereas the C-band RADARSAT-2 interferograms show only patchy areas with coherent phase. The low coherence of the RADARSAT-2 interferograms suggest that the mangrove forest at CGSM is tall and massive, because small and intermediate height mangrove forests yield coherent phase, as we observed in the Everglades wetlands [6].