



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2004FL76G

Title: Space-based monitoring of wetland surface flow

Project Type: Research

Focus Categories: Wetlands, Surface Water, Hydrology

Keywords: Wetlands, remote-sensing, Everglades, surface flow

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Abstract

Space-based interferometric SAR (InSAR) observations of South Florida reveal spatially detailed, quantitative images of water levels in the Everglades. The new data capture dynamic water level topography, providing the first detailed picture of wetland sheet flow. We observe localized radial sheet flow in addition to well-known southward unidirectional sheet flow. In a preliminary study, we use a 1-D linear diffusive flow to simulate the unidirectional flow. Our initial results provide quantitative estimates of flow diffusivity/transmissivity (40-180 m²/s) and Manning's friction coefficient (0.3-1.0), the first space-based estimates of such hydrologic parameters.

The proposed work expands upon our initial study of the Everglades wetland and have the following components:

(1) InSAR analysis of wetlands -- obtaining more high spatial resolution space-based observations of the Everglades (both C-band and L-band) and other wetlands (Louisiana, Chesapeake Bay). We will use both archive data (ERS1/2, RADARSAT-1, and JERS-1) and current data (ENVISAT and ALOS) in order to further develop of the InSAR technique for wetlands hydrological applications.

(2) Hydrological analysis — InSAR observations provides relative measure of water level changes both in space and time. In order to understand and utilized the high spatial resolution InSAR observation, we need to evaluate the observation with respect to terrestrial-based (e.g., stage data) and field observations. In the proposed research we will investigate other regions, where we obtained InSAR observations (Everglades National Park, WCA-3, etc.), but still not obtained hydrological understanding. Based on the new InSAR analysis, we will expand our investigations to other wetlands such as the Louisiana Coast and Chesapeake Bay.

(3) Numerical Modeling — after obtaining Hydrological understanding of surface flow in the Everglades and other wetlands, we will use the high spatial resolution observations to constrain surface flow models. This part of the project will be conducted by the USGS, which developed a 500 x 500 m² resolution grid for studying surface flow in the southern section of the Everglades. The space-based observations will allow us to evaluate key parameters that govern wetlands surface flow and their changes in space and time.

Our proposed research will provide new space-based observations, which will be used to understand in details the complexity of wetland surface flow and, hence, better manage wetlands water resources. Furthermore using the new observations as constraints in 3-D flow models, we will be able to evaluate the tempo-spatial distribution of key hydrologic parameters that govern shallow surface flow in the Everglades and other wetlands.