Characterization of Tropical Wetlands Ecosystems with Radar Remote Sensing

Graduate Student Mentor: Jessika Alvarez
Supervising Professor: Prof. Kyle McDonald PhD

HIRES Summer 2016 Research Project Description

Background:

Wetlands exert major impacts on global biogeochemistry, hydrology, and biological diversity. The extent and seasonal, interannual, and decadal variation of inundated wetland area play key roles in ecosystem dynamics. Wetlands contribute approximately one fourth of the total methane annually emitted to the atmosphere and are identified as the primary contributor to interannual variations in the growth rate of atmospheric methane concentrations. Tropical palm swamp wetland ecosystems form in tropical rainforests with moderate seasonal flooding and a consistently inundated the land surface. The combination of permanently saturated soils, year-round warm temperatures, and low oxygen levels in the palm swamp soils can lead to a large release of carbon into the atmosphere, particularly as methane gas. Methane has a warming potential as a greenhouse gas that is 23 times higher than that of CO2.

During early 2013, NASA's UAVSAR, an aircraft-mounted, multipurpose imaging radar system, collected extensive remote sensing observations of the Pacaya-Samiria in Peru, one of the most extensively protected flooded forest-wetlands areas in the Amazon. More recently, the availability of the European Space Agency's Sentinel SAR, an imaging radar system in Earth orbit, offers consistent time series observations of Pacaya-Samiria over multiple seasons. Containing large expanses of flooded palm swamps, the Pacaya-Samiria wetlands complex offers a unique opportunity to investigate the use of radar imaging data to characterize tropical wetlands and associated linkages to land-atmosphere carbon exchange.

Description of Project:

Students will apply computer-based analysis tools to assemble imaging radar classifications for the Pacaya-Samiria region. Students will analyze the radar data to develop maps and work with supplemental dataset to characterize the quality of the products developed from the remote sensing data. Student will examine the seasonality elucidated by the time series data, assessing timings of maximum and minimum inundation conditions and the maximum extent of the wet season inundation. Students will examine data from different rainfall stations in order to analyze rain periods that enable identification of wet and dry seasons of the area and how this information is characterized by the radar images. UAVSAR and Sentinel SAR data will be compared and contrasted.

Outcomes:

Students will develop and understanding of how to analyses imaging radar data, the physical information contained in radar images of wetlands, and an understanding of the importance of wetlands systems in Earth's carbon cycle and climate.