Florida Agriculture

DEVELOP

Utilizing TRMM to Analyze Sea Breeze Thunderstorm Patterns During El Nino Southern Oscillations and their Effects Upon Available Fresh Water for South Florida Agricultural Planning and Management

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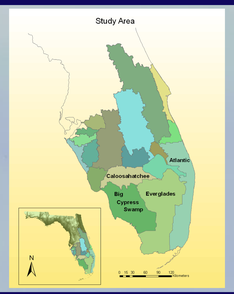
OBJECTIVES

- Use TRMM to analyze the influence of ENSO on sea breeze and general rainfall patterns during the summer season in South Florida.
- Assess the impact of sea breeze precipitation upon areas of agricultural land use in southern Florida.
- Create maps of main agricultural areas in Southern Florida displaying precipitation levels during El Nino and La Nina.

STUDY AREA



The Study Area includes the 18 southernmost 8-digit Hydrologic Unit Code (HUC 8) watersheds of Florida. Land cover consists of mostly Pine Barrens and Wetlands, including a large portion of Florida's most fertile agricultural land that surrounds Lake Okeechobee. Primary crops produced in this area include sugarcane, oranges, and other citrus.

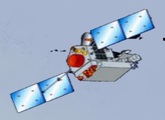
PROJECT PARTNERS

OAWP

Southeast Climate Consortium

EARTH OBSERVATION SOURCES

Landsat 5 TM



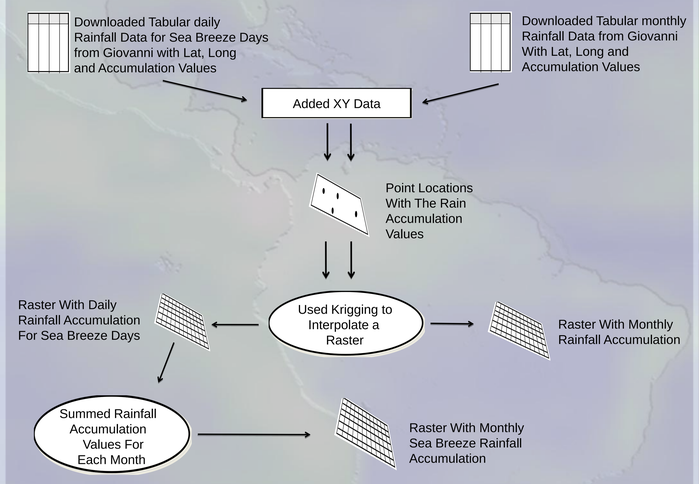
TRMM

ABSTRACT

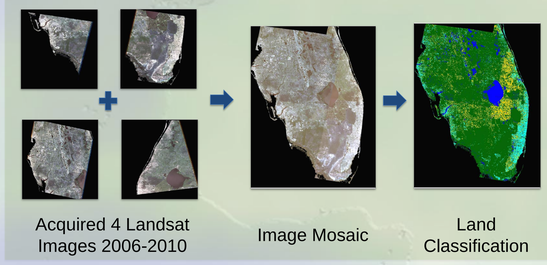
This project utilizes Tropical Rainfall Measuring Mission (TRMM) and Landsat satellite data to assess the impact of sea breeze precipitation upon areas of agricultural land use in southern Florida. Water is a critical resource to agriculture, and the availability of water for agricultural use in Florida continues to remain a key issue. Recent projections of statewide water use by 2020 estimate that 9.3 billion gallons of water per day will be demanded, and agriculture represents 47% of this demand (Bronson 2003). Farmers have fewer options for water supplies than public users and are often limited to using available supplies from surface and ground water sources which depend in part upon variable weather patterns. Sea breeze thunderstorms are responsible for much of the rainfall delivered to Florida during the wet season (May-October) and have been recognized as an important overall contributor of rainfall in southern Florida (Almeida 2003). TRMM satellite data was used to analyze how sea breeze-induced thunderstorms during El Nino and La Nina affected interannual patterns of precipitation in southern Florida from 1998-2009. TRMM's Precipitation Radar and Microwave Imager provide data to quantify water vapor in the atmosphere, precipitation rates and intensity, and the distribution of precipitation. Rainfall accumulation data derived from TRMM and other microwave sensors were used to analyze the temporal and spatial variations of rainfall during each phase of the El Nino Southern Oscillation (ENSO). Through the use of TRMM and Landsat, slight variations were observed, but it was determined that neither sea breeze nor total rainfall patterns in South Florida were strongly affected by ENSO during the study period. However, more research is needed to characterize the influence of ENSO on summer weather patterns in South Florida. This research will provide the basis for continued observations and study with the Global Precipitation Measurement Mission.

METHODOLOGY

Rainfall Raster Flow Diagram



Land Cover/Land Use



Acquired 4 Landsat Images 2006-2010 | Image Mosaic | Land Classification

Data Analysis

- Zonal Statistics were computed from the rainfall rasters for each HUC 8 watershed in the Study Area.
- Total Monthly Rainfall and Monthly Sea Breeze Rainfall were correlated with the Oceanic Nino Index (ONI) and the Southern Oscillation Index (SOI).
- Maps of TRMM rainfall accumulation data were created in ArcGIS to illustrate spatial and temporal variations in accumulation for each oscillation.

CONCLUSIONS

- Landsat results indicate most agricultural areas in South Florida occurred on the fertile land near Lake Okeechobee.
- TRMM-based Atlantic watershed monthly rainfall anomalies showed a weak, but statistically significant correlation of -.257 to the Oceanic Nino Index (ONI). No other watershed's anomalies showed a significant correlation with ONI or the Southern Oscillation Index (SOI).
- During La Nina months, fewer sea breeze days and more disturbed days were found to occur compared to El Nino and neutral months.
- Overall, neither sea breeze rainfall patterns nor total rainfall patterns in South Florida's main agricultural areas were found to be strongly influenced by the El Nino Southern Oscillation.

TEAM MEMBERS

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Clayton Cooley– University of Southern Mississippi

ACKNOWLEDGMENTS

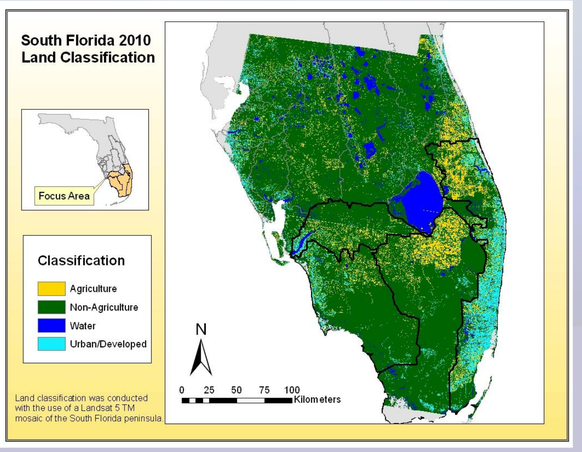
Mr. Joe Spruce, Science Advisor
CSC, Stennis Space Center

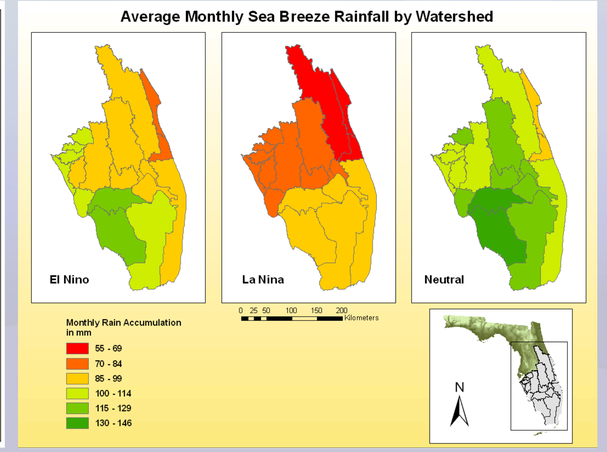
Mrs. Cheri Miller, Mentor
DEVELOP Southeast Regional Manager, Stennis Space Center

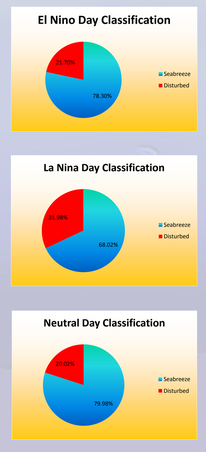
NATIONAL APPLICATION AREAS

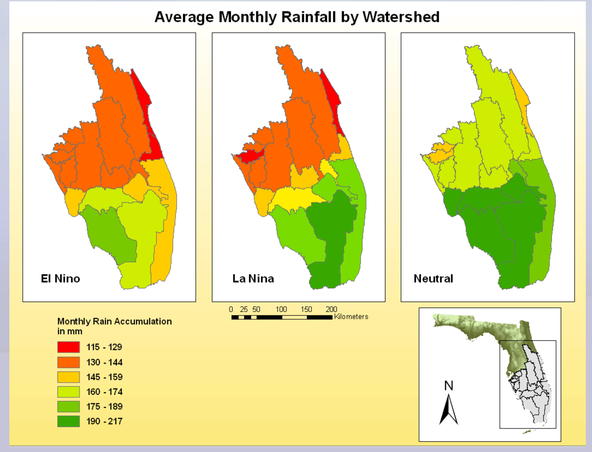
Climate | Agriculture | Weather | Water Resources

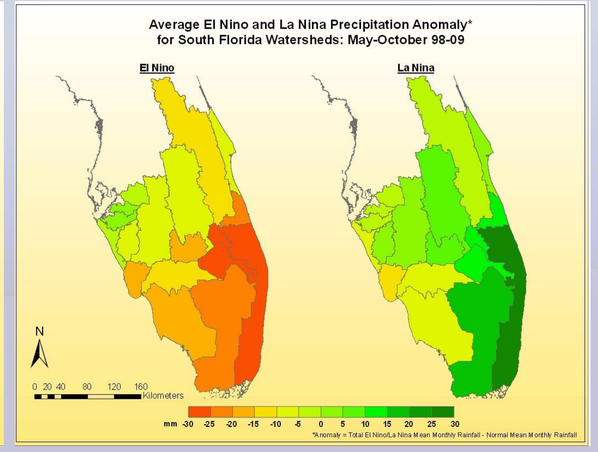
RESULTS











* All rainfall totals were calculated from the TRMM products 3B42 and 3B43, which also incorporate data from the microwave sensors AMSR-E, SSM/I, and ASMU-B.