Florida Agriculture

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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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 quantity 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. Moreover, 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.

RESULTS

Average Monthly Sea Breeze Rainfall by Watershed

El Nino Day Classification

Average Monthly Rainfall by Watershed

El Nino

La Nina

Neutral

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 -0.257 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.

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NATIONAL APPLICATION AREAS

Climate
Agriculture
Weather
Water Resources