# NASA Applied Sciences'
# DEVELOP National Program

## Summer 2010
## Florida Agriculture

Stennis Space Center

11/8/2010

# 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

## Goals

- Assess the influence of ENSO on sea breeze thunderstorm patterns and general rainfall patterns during the summer season in South Florida.
- Illustrate the spatial and temporal variations in rainfall accumulation for each oscillation in relation to major agricultural areas.
- Analyze the impact this research has on agricultural land use.

## Community Concerns

- 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.
- There is an interest by the agricultural community about the effect weather has on usable surface water; however, research into viable weather patterns during La Nina and El Nino has yet to be researched.
- The EPA is proposing higher water and sewerage taxes in Florida; therefore using alternative water sources will aid in the decrease in water taxes faced by Florida farmers.

**Advisor**

Joe Spruce
CSC, Stennis Space Center

# Florida Agriculture

## Partners

- Southeast Climate Consortium (SECC)
- Florida Department of Agriculture and Consumer Services (FDACS) Office of Agricultural Water Policy (OAWP)


## Decision Making Process & Partner Needs

- A better understanding of sea breeze thunderstorm patterns in Southern Florida during the Southern Oscillations can enhance the SECC outreach program to farmers.
- This project will also align with the ROSES A28 awarded project at Stennis Space Center, “Enhancing NASA’s COAST Online Application for Agricultural Best Management Practices Decision Support.”

## National Applications

Agriculture | Water Resources | Climate | Weather

OAWP

UF UNIVERSITY of FLORIDA

Southeast Climate Consortium

# Study Area

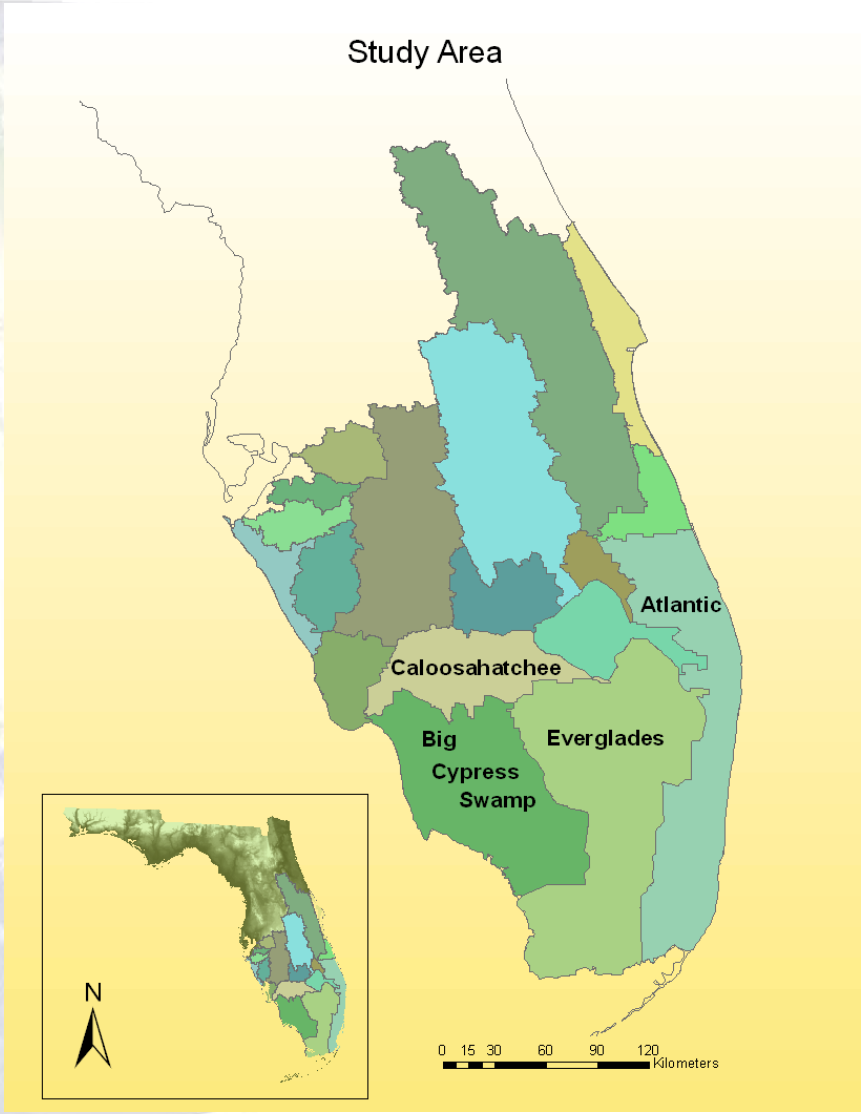
## Study Period

- 1998-2009
- Wet Season (May-October)

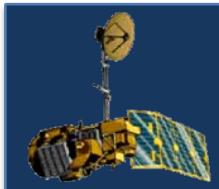
## Study Area

- South Florida
- 18 Southernmost 8-digit Hydrologic Unit Code  Watersheds (HUC 8)
- 4 HUC 8 watersheds with the most agricultural area

| Watershed Name | Total Hectares of Agriculture |
|---|---|
| Everglades | 130,768.7 |
| Big Cypress Swamp | 43,463.88 |
| Caloosahatchee River | 43,435.71 |
| Atlantic | 41,263.56 |



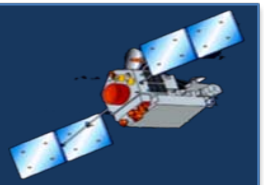
# Project Methodology



Landsat 5 TM

## Earth Observations

PR & TMI on TRMM



### Data Acquisition

- **TRMM Level 3B data was acquired from Giovanni for 1998-2009**

## Analysis

### Data Processing

- **ArcGIS**
- **ERDAS *Imagine***

- **Analysis of the influence of ENSO on sea breeze thunderstorms patterns and general rainfall patterns in S. Florida**

## Results

- **Maps of the main agricultural areas displaying rainfall distributions during El Nino, La Nina, and Neutral periods**

- **Aid the SECC in providing precipitation information to farmers**

## Value & Benefits

- **Increased scientific knowledge of the teleconnection between ENSO and precipitation**

### Established Partnerships

Southeast Climate Consortium

OAWP

## End-Users

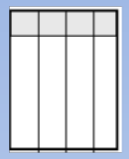
### Potential Partnerships

Sustainable Water Resources
Complex Challenges, Integrated Solutions

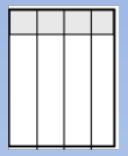
UF UNIVERSITY of FLORIDA

# Project Methodology

## Rainfall Rasters Flow Diagram

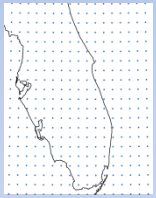


Downloaded Tabular Daily Rainfall Data for Sea Breeze Days from Giovanni with Lat, Long and Accumulation Values



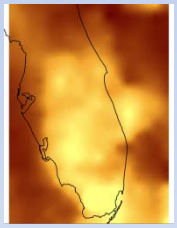
Downloaded Tabular Monthly Rainfall Data from Giovanni With Lat, Long and Accumulation Values

Added XY Data

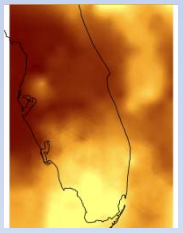


Point Locations With the Rain Accumulation Values

Used Krigging to Interpolate a Raster



Raster with Daily Rainfall Accumulation for Sea Breeze Days



Raster with Monthly Rainfall Accumulation

Summed Rainfall Accumulation Values for Each Month

Raster with Monthly Sea Breeze Rainfall Accumulation

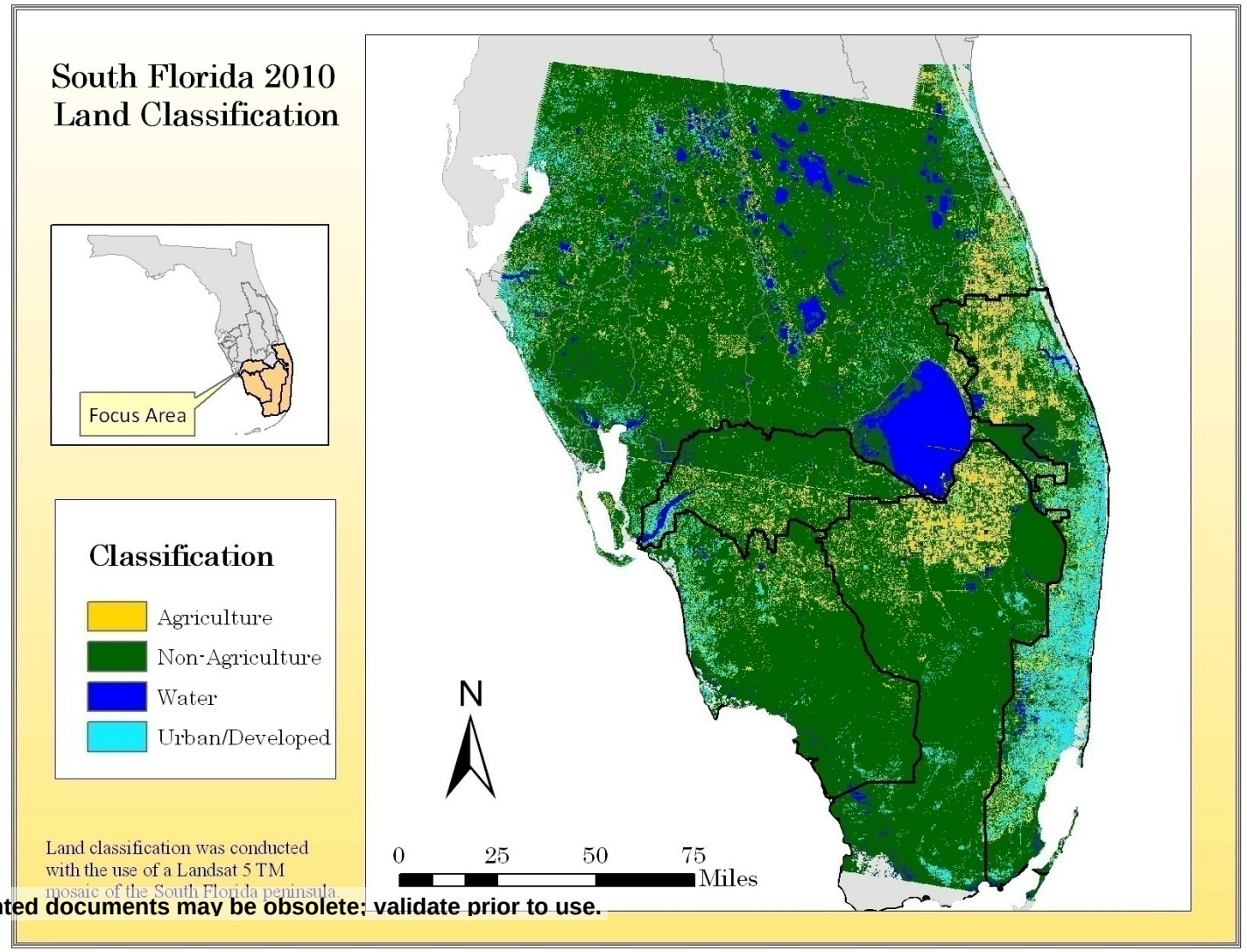
# Project Methodology

**Data Analysis**

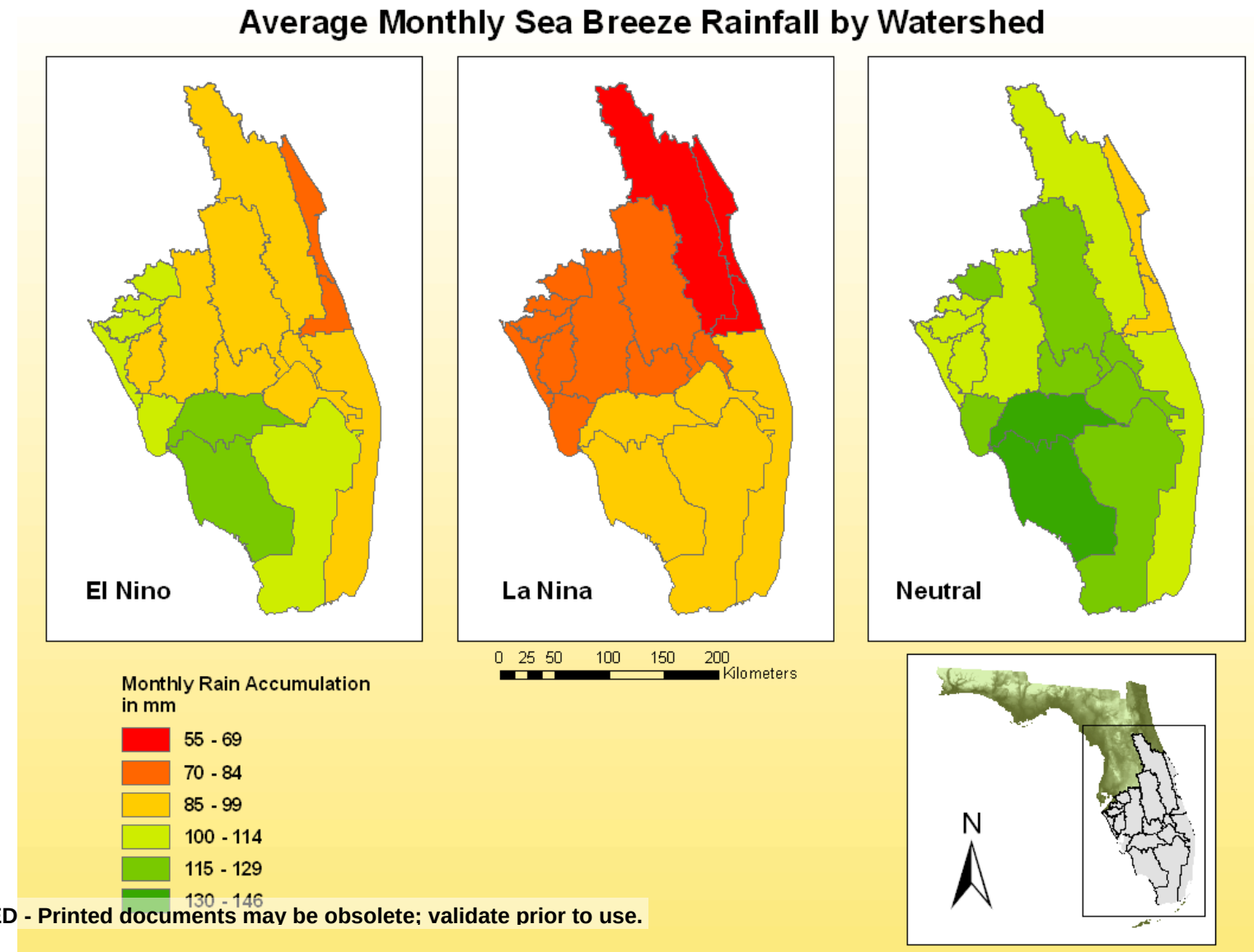
- Updated land cover map was created.
- Zonal statistics were computed from the TRMM rainfall rasters to determine monthly rainfall and monthly sea breeze rainfall for each HUC 8 watershed.
- Monthly rainfall, monthly sea breeze rainfall, and monthly rainfall anomalies were correlated with the Oceanic Nino Index and the Southern Oscillation Index.
- Maps were created in ArcGIS to display rainfall accumulations and distribution during El Nino, La Nina, and neutral periods.
- Accuracy assessments were preformed for the TRMM rainfall data and the land cover map.

# Results

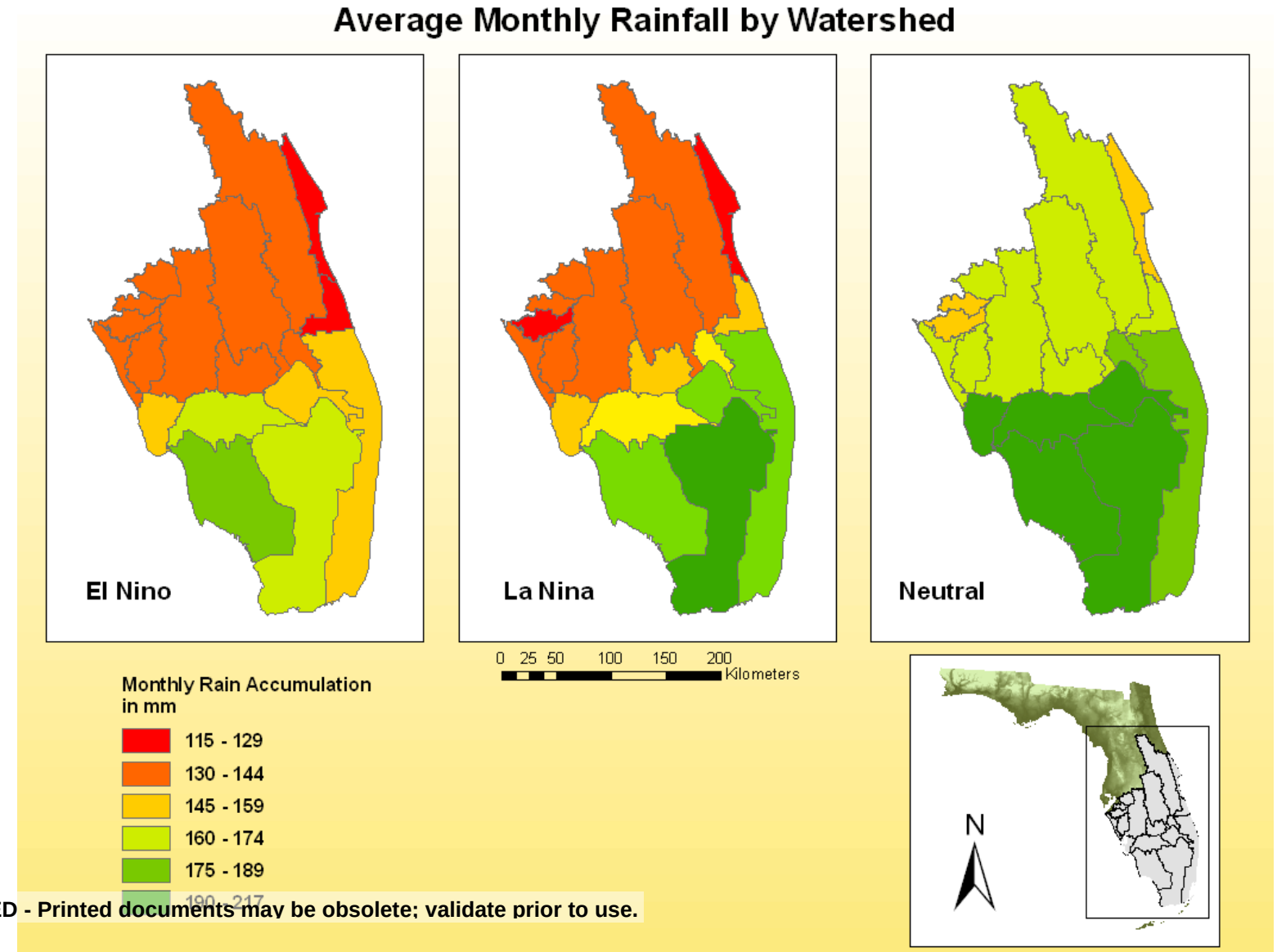
## Updated Land Cover Map



# Results

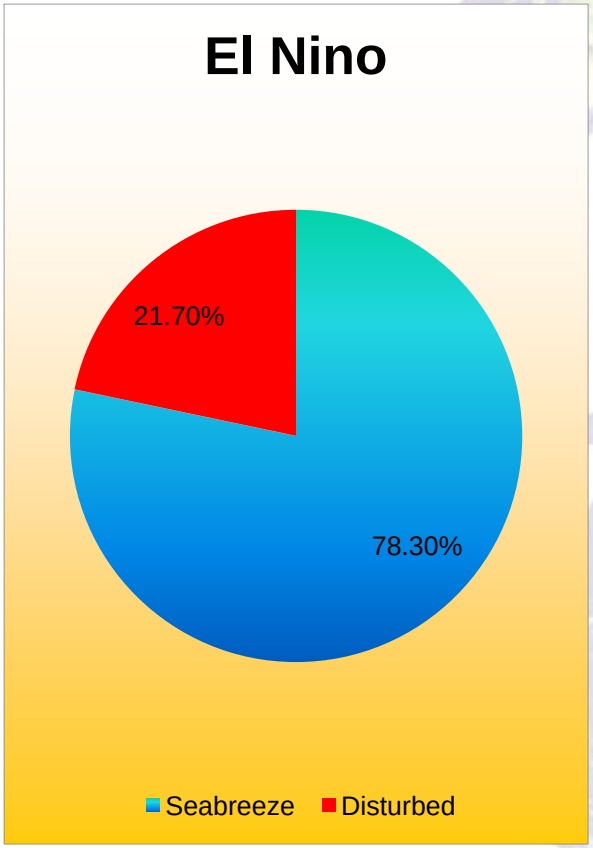


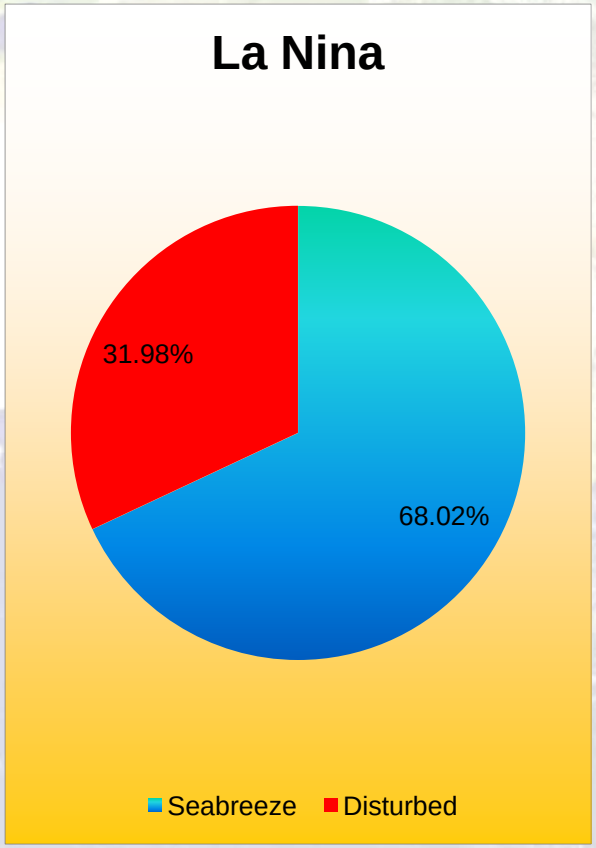
# Results

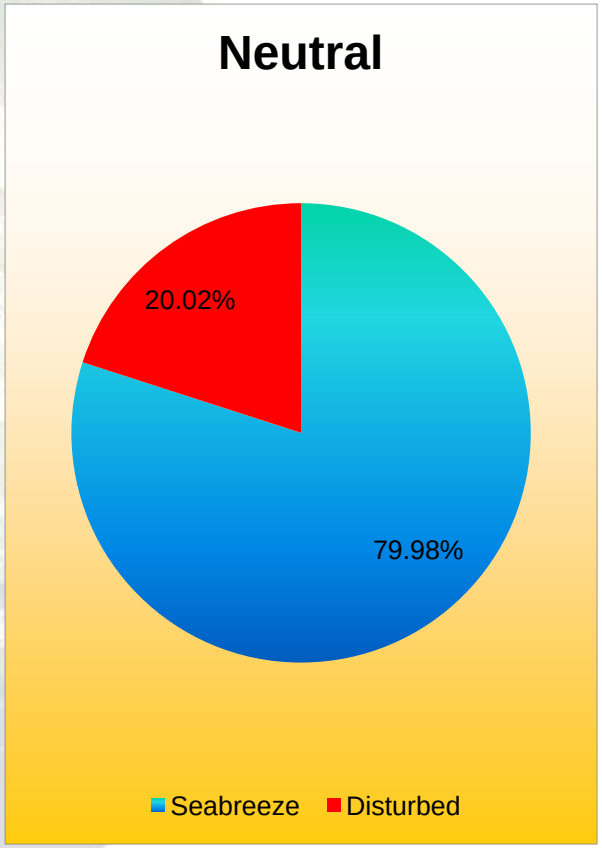


# Results

## Sea Breeze vs. Disturbed Days for the Study Period*

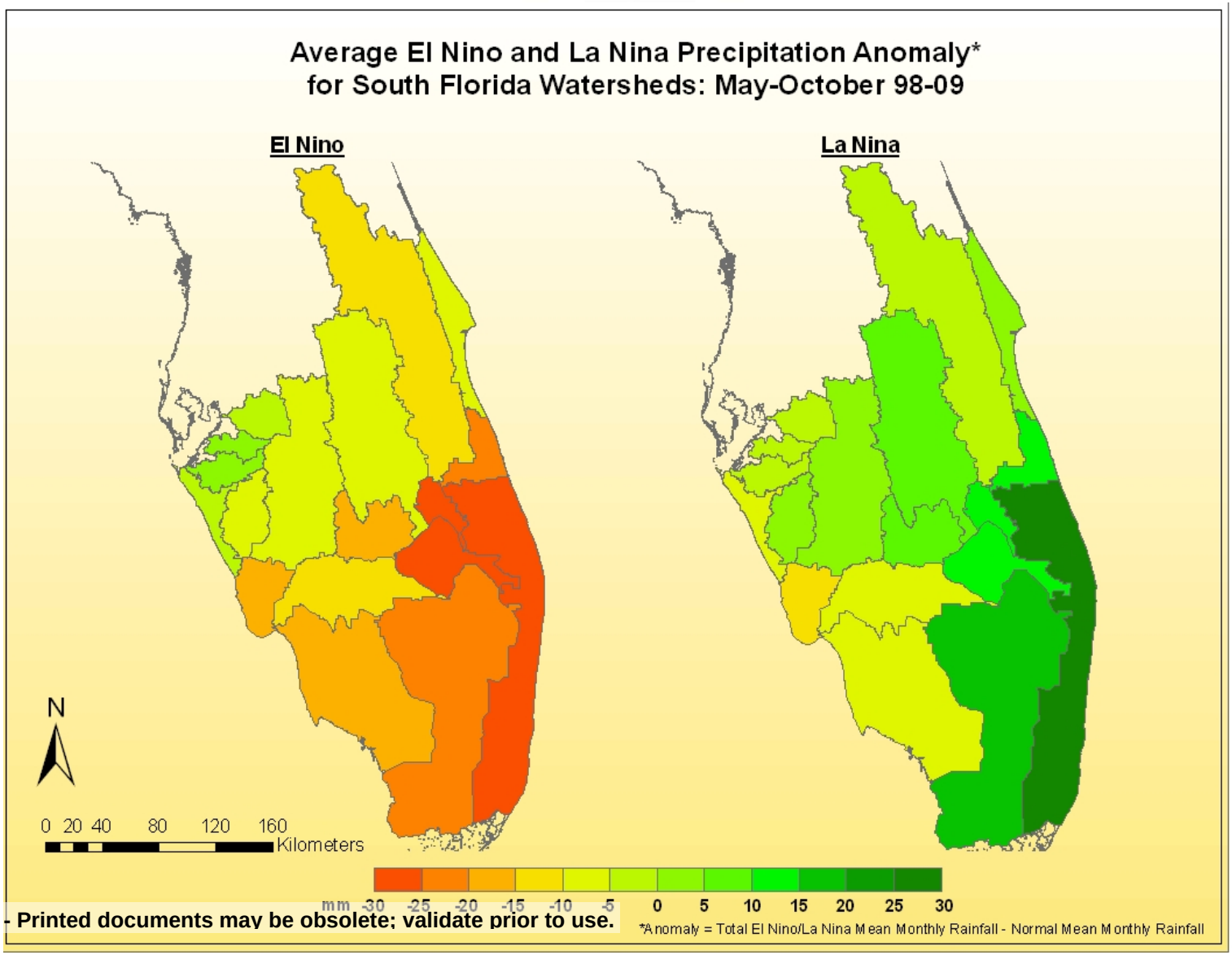



*May-October, 1998-2009

# Results



# Conclusions

- The main agricultural areas in South Florida are located within the fertile land surrounding Lake Okeechobee.
- The Atlantic Watershed monthly rainfall anomalies showed a weak but statistically significant correlation to the Oceanic Nino Index (ONI). No other watershed's anomalies showed significant correlations with ONI or the Southern Oscillation Index (SOI).
- During La Nina months, less sea breeze days and more disturbed days were found to occur compared to El Nino and neutral months. The increase in disturbed days can likely by attributed to the synoptic pattern during La Nina, which is known to be favorable for tropical systems to follow paths that affect South Florida.
- 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 during our study time.

# Transition to Partner

**Partner(s):**

Southeast Climate Consortium (SECC)
FDACS Office of Agricultural Water Policy (OAWP)

## Benefits to Partner

- Increased scientific knowledge of the teleconnection between ENSO and rainfall patterns in South Florida has the potential to enhance SECC outreach programs to farmers.

## Project Transition Plan

- We have provided the SECC and the OAWP with an electronic version of the technical paper.
- A presentation was given to Dr. Keith Ingram of the SECC by teleconference.

# Questions / Comments

Questions?

Comments?

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http://develop.larc.nasa.gov