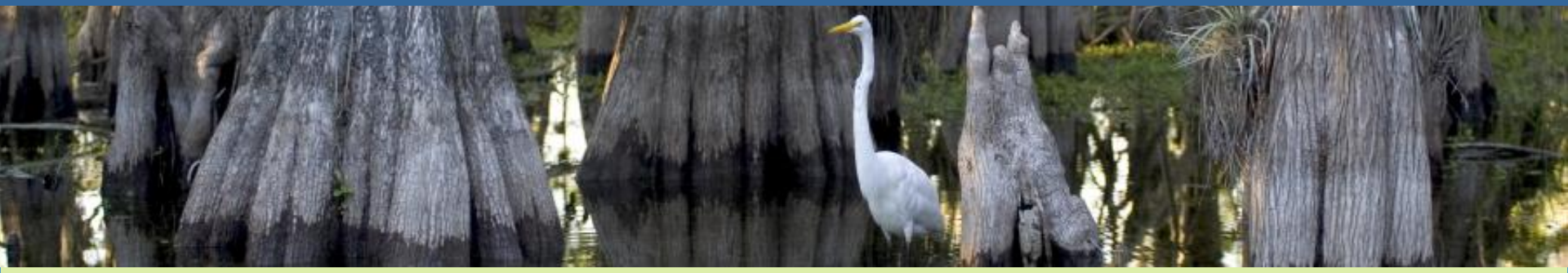
Florida Climate Institute

Southeast Climate Consortium

Assessment of Climate Change Impacts and Adaptation Potential: Cropping Systems in the SE USA

James W. Jones



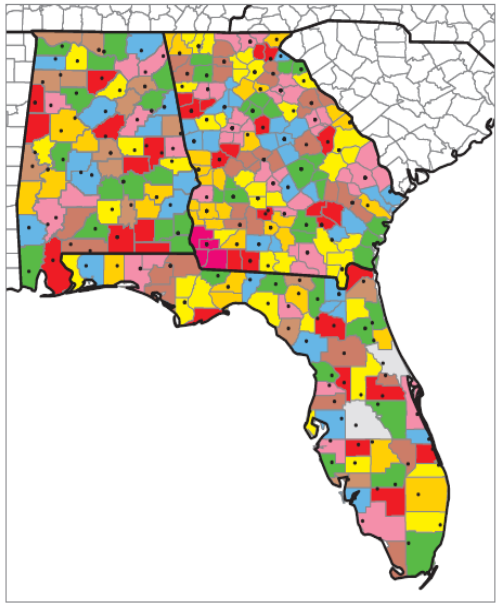
UF UNIVERSITY of FLORIDA

FLORIDA STATE UNIVERSITY 1851

Projects

I. Bipartisan Policy Center (BPC)*

Climate Change Impacts on Peanut, Cotton, and Corn in Georgia and Florida



II. NASA – ROSES – Gulf Coast States Project

Integration of NASA Models and Missions into Agricultural Decision Support (Florida, Georgia, Alabama)

* Advisory Board: Senators Howard Baker, Tom Daschle, Bob Dole, George Mitchell

Florida Climate Institute

NASA

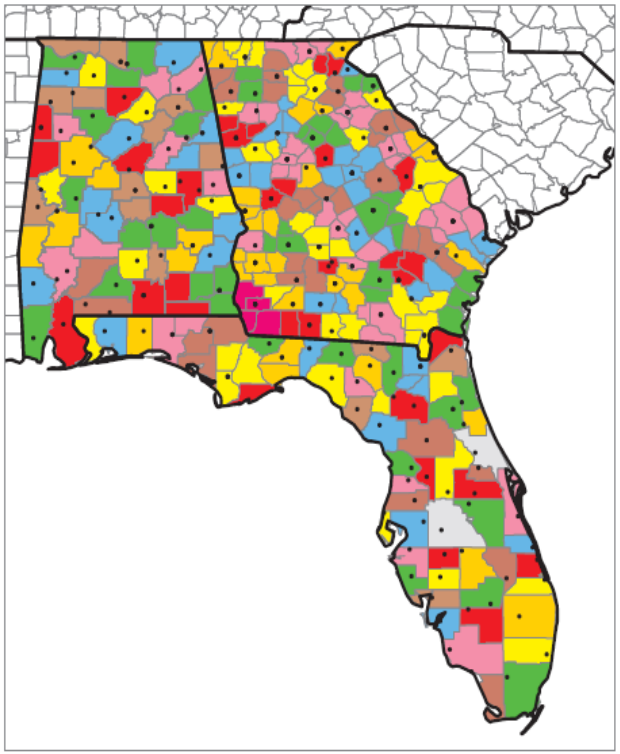
Southeast Climate Co

UF UNIVERSITY of FLORIDA

FLORIDA STATE UNIVERSITY 1851

BPC Project Goals

1. Downscale climate change projections for the SE USA (to weather stations) (K. Hayhoe)
2. Assess impacts of CC on climate indices important for agriculture
3. Simulate climate change impacts on crop production and irrigation requirements and assess potential adaptation options
4. Engage farmers and Extension to learn how they cope with climate variability and past climate change



Florida Climate Institute

NASA

Southeast Climate Cor

UF UNIVERSITY of FLORIDA

FLORIDA STATE UNIVERSITY 1851

BPC Project Partners

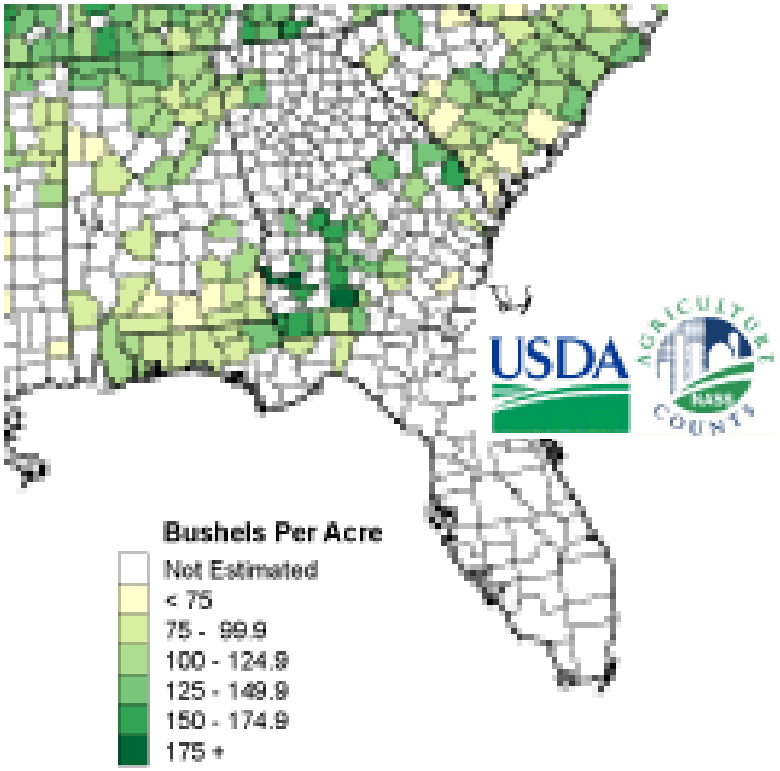
University of Florida:
James W. Jones, Guillermo Baigorria, Wendy-Lin Bartels, Kenneth J. Boote, Clyde Fraisse, Keith T. Ingram

University of Georgia:
Gerrit Hoogenboom, Carla Roncoli

Florida State University:
David Zierden and Vasu Misra

Texas Tech University:
Kathryn Hayhoe

Key Partners in Extension:
David Wright (UF), William Birdsong (Auburn), John Beasely & Bob Kemerait (UGA)



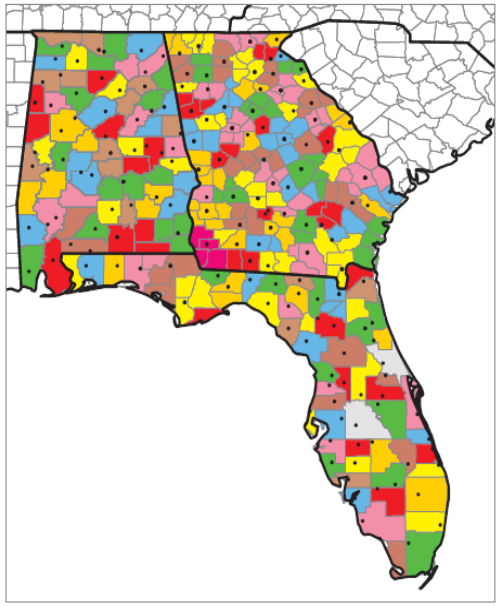
Florida Climate Institute

Southeast Climate Consortium

UF UNIVERSITY of FLORIDA

BPC Project Methods

1. **Downscaling**
   a. Two GHG scenarios, 4 climate models selected on basis of their ability to simulate current climate (Hayhoe)
   b. Statistical, downscale to points based on weather station network
   c. Daily realizations of climate variables for each station
2. **Agricultural Climate Working Group**
   a. Historical changes in climate
   b. Facilitated discussions of climate risks, responses to climate variability and barriers to adaptation
3. **Crop model analyses**. Simulate impacts of climate on yields, irrigation and on adaptation potential (~ 500 million runs)



Florida Climate Institute

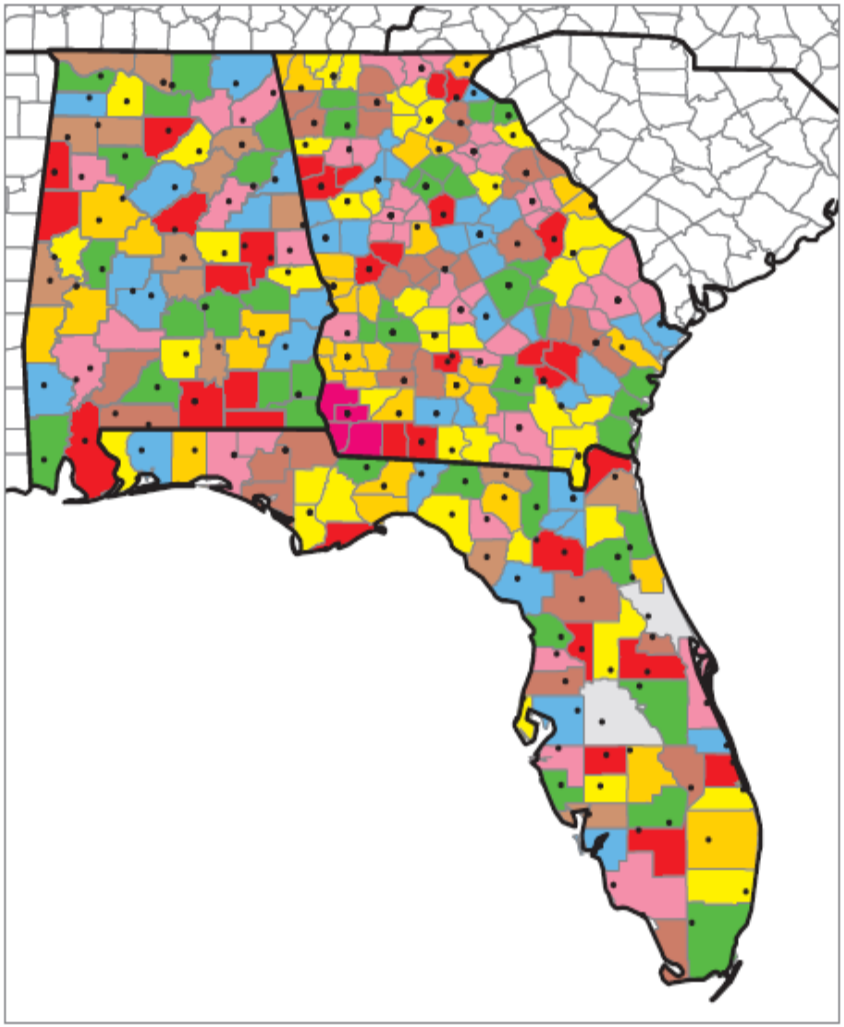
NASA

Southeast Climate Co

UF UNIVERSITY of FLORIDA

FLORIDA STATE UNIVERSITY 1851

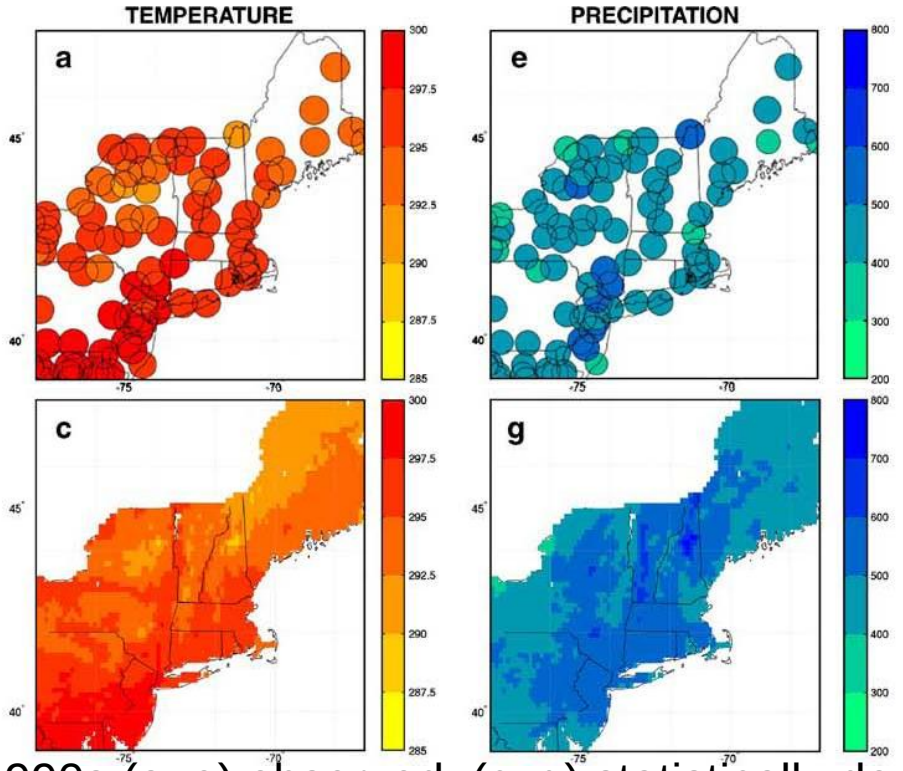
Meteorological Stations and Associated Counties



Location of meteorological stations and associated counties in Florida, Georgia, and Alabama.

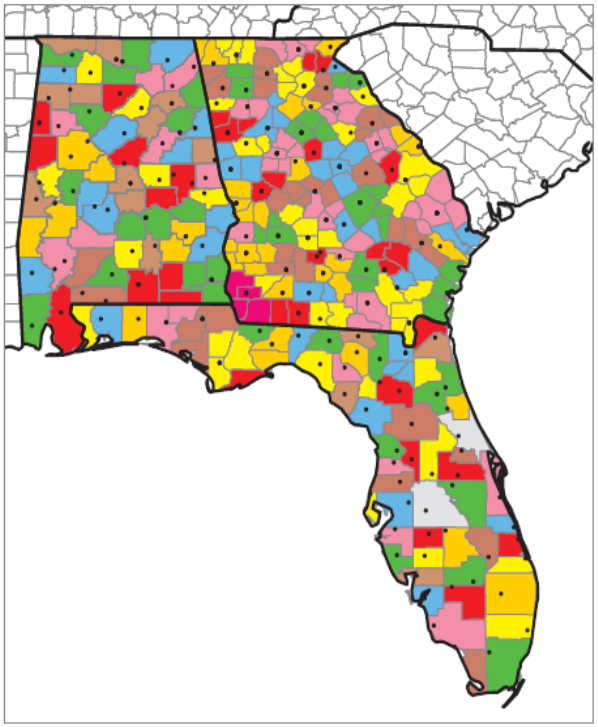
- Over 200 stations for Florida, Georgia, and Alabama, each county has been associated with a station for comprehensive coverage.
- SECC database available at COAPS, now used in www.AgroClimate.org, other SECC research

Example Results from NE Study by Hayhoe et al. (2008): Regional climate change projections for the Northeast USA. Mitig Adapt Strat Glob Change (2008) 13:425–436



Comparison of 1990s (a, e) observed, (c, g) statistically downscaled, and (d, h) seasonal-mean summertime maximum daily temperatures (K), and total precipitation (mm)

BPC Results to Date



1. **Downscaling**
   Completed, and data being used to compute climate indices, input to models
2. **Agricultural Climate Working Group**
   Three crop working group meetings
3. **Crop model analyses**. These are being run now (~ 500 million runs)

Florida Climate Institute

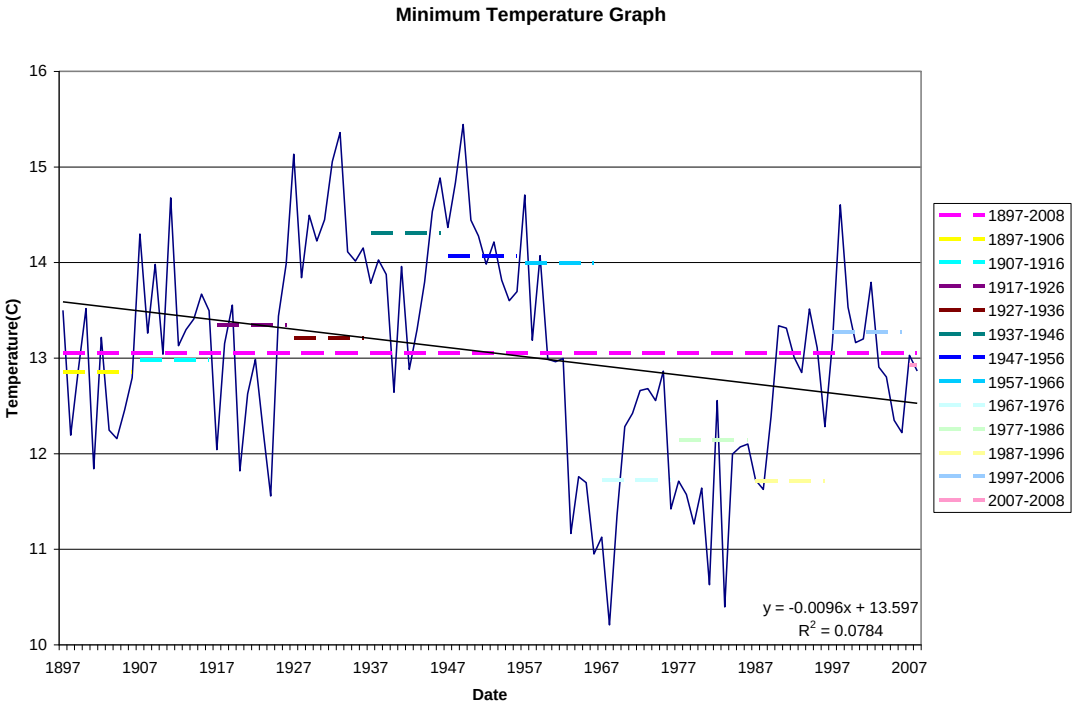
Southeast Climate Cor

UF UNIVERSITY of FLORIDA

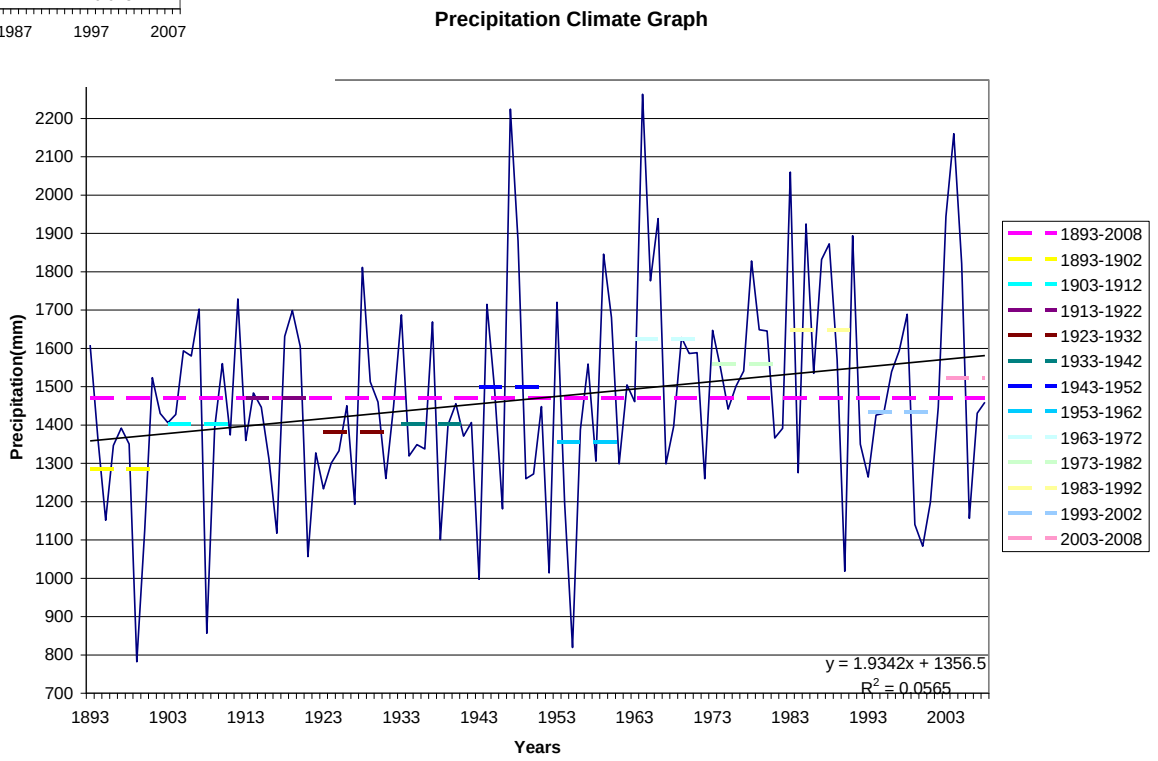
FLORIDA STATE UNIVERSITY 1851

Interest in Climate Scenarios based on Historical Changes

Minimum Temperature
DeFuniak Springs, FL



Precipitation
Lake City, FL



1st Meeting
April 12th
Camilla, GA.

2nd Meeting
Aug. 30th

3rd Meeting
Feb 18th 2011,
Alabama

Build a shared picture of the past: Stories of adapting to change

Production Successes and Challenges

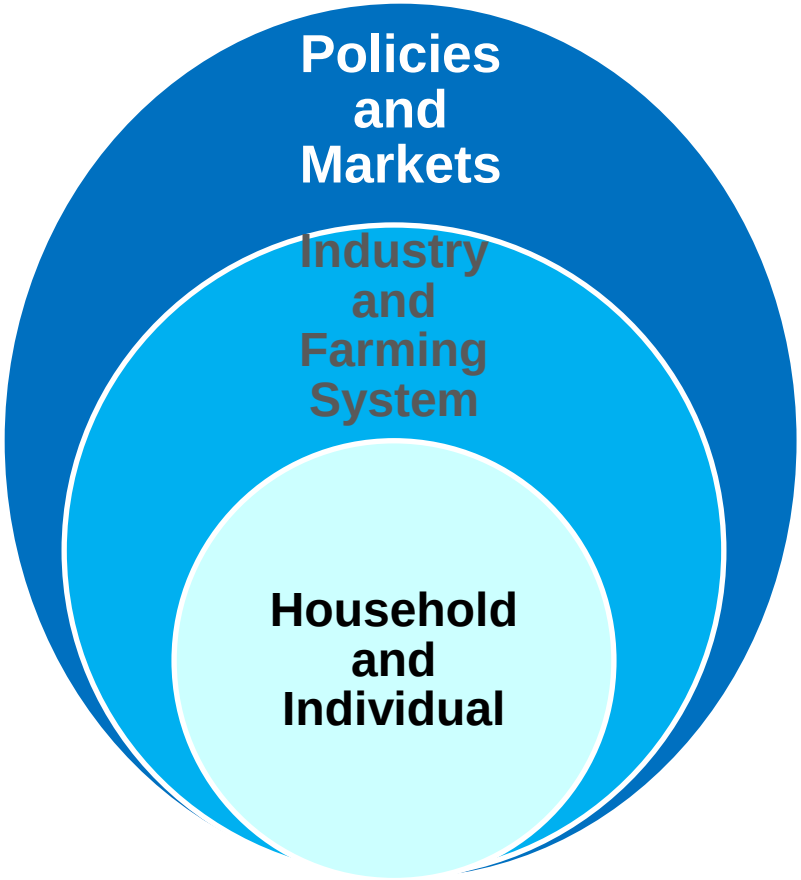
Hypothetical Futures

Seasonal Variability and ENSO effects on yields
The potential of models to inform decision making

Future scenarios and simulations
Roles & Group Assessment

From W. Bartels, 2011

Lessons Learned

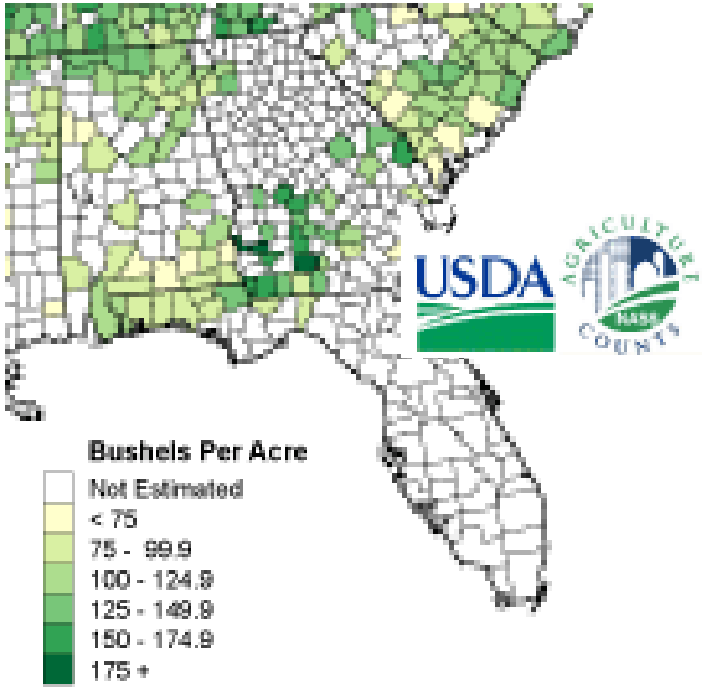


- Strong interest in historical changes in climate and events
- Interest in climate change is at a different time scale than the long term changes from IPCC (interest in weather to climate over next year, 5 years, or 20 years mostly
- infrastructural and industrial constraints may limit changes to their management practices.
- Markets and farm bill policies influence the possibility of modifying agricultural systems.

Adapted from W. Bartels, 2011

NASA Project Goals

1. Downscale climate change projections for the SE USA (to weather stations) C. Rosenzweig, A. Ruane, G. Baigorria, R. Horton (NASA and University of Florida)
2. Evaluate uncertainties associated with methods for producing future climate scenarios
3. Calibrate crop models for current crops, soils, climate, management
4. Simulate climate change impacts and potential adaptation on crop production and irrigation requirements



Florida Climate Institute

Southeast Climate Consortium

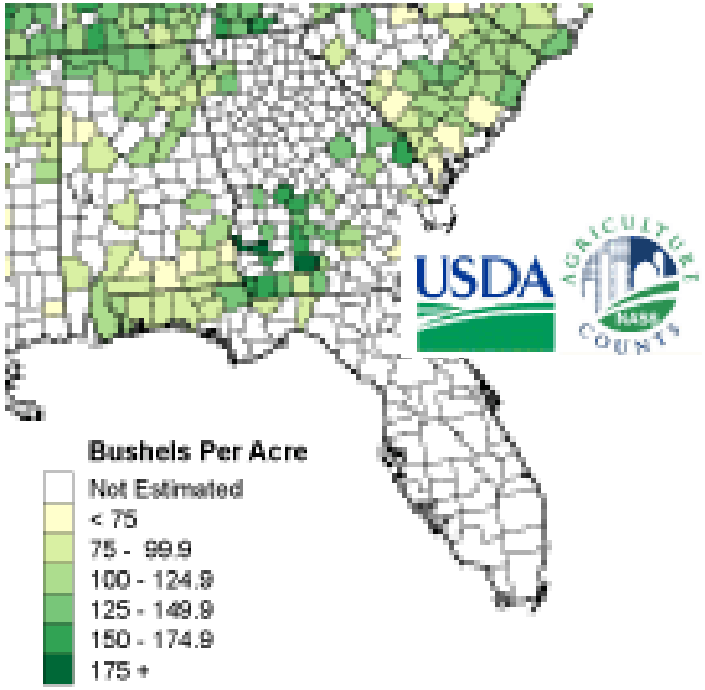
UF UNIVERSITY of FLORIDA

NASA Project Partners

University of Florida:
Guillermo Baigorria (PI), James W. Jones, Clyde Fraisse

NASA-GISS, Columbia University:
Alex Ruane, Cynthia Rosenzweig, Radley Horton, Adam Greeley, Jonathan Winter

Florida State University:
David Zierden, D. Shinn



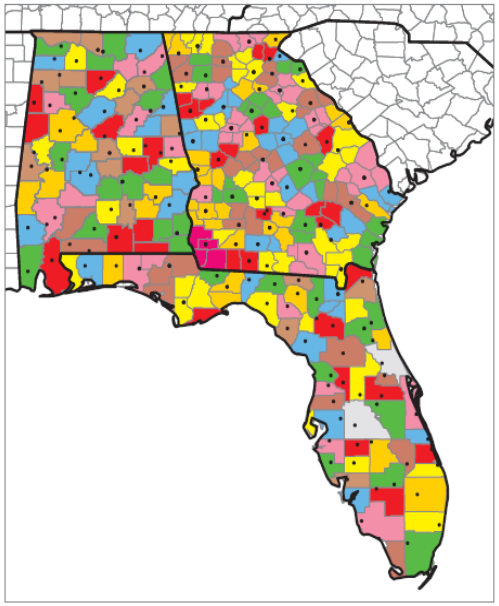
Florida Climate Institute

Southeast Climate Co

UF UNIVERSITY of FLORIDA

BPC Project Methods

1. **Downscaling**
   a. AR4 scenarios and climate models (16)
   b. Downscaling methods (to points)
      a. Delta method
      b. Geospatial Weather Generator (GiST, Baigorria et al., 2010).
      c. Distribution bias correction method
      d. Also use NARCCAP results
2. **Assemble SE USA database on soils, management, climate.** Calibrate the DSSAT crop models for key crops in the SE
3. **Crop model analyses**. Analysis of uncertainties in model simulations (associated with climate shifts in mean, distribution and extreme events)
4. **Provide Information for Decision Support.** Develop tools for presenting crop model results to users via AgroClimate.org



Florida Climate Institute

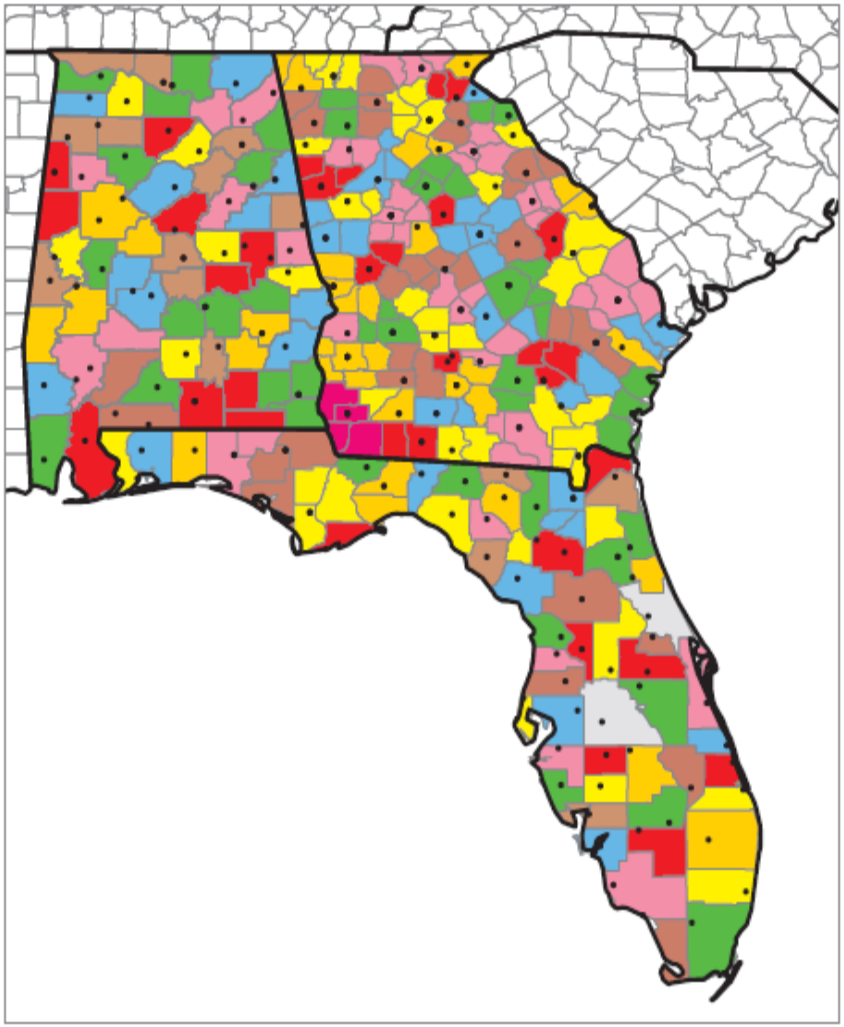
NASA

Southeast Climate Consortium

UF UNIVERSITY of FLORIDA

FLORIDA STATE UNIVERSITY 1851

NASA Project Results to Date



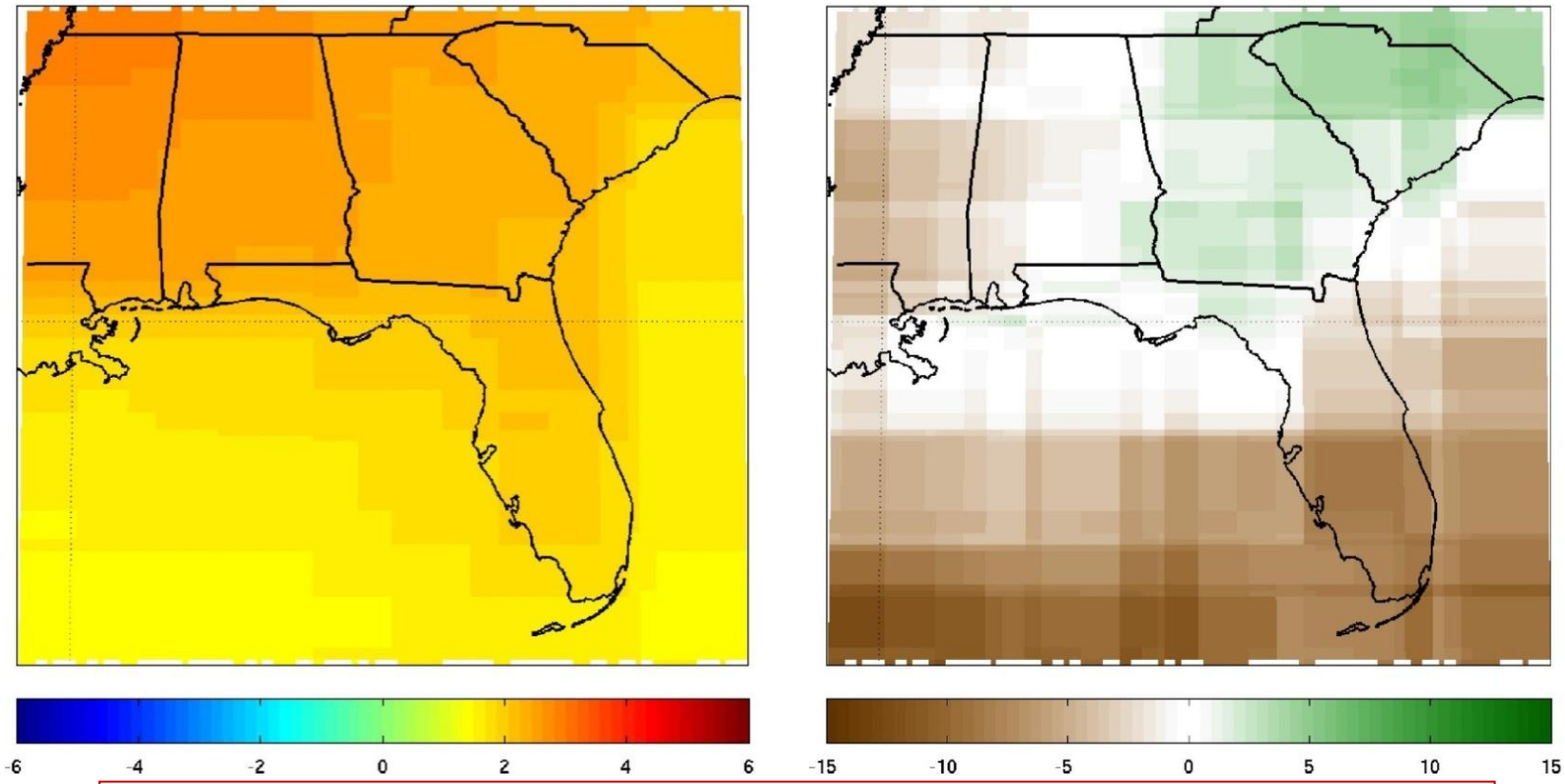
Location of meteorological stations and associated counties in Florida, Georgia, and Alabama.

- **Over 200 stations for Florida, Georgia, and Alabama, each county has been associated with a station for comprehensive coverage.**
- **Delta method has been used to create scenarios by imposing A2 and B1 temperature and precipitation changes from 16 GCMs for the 2020-2049, 2040-2069, and 2070-2099 period on each location's daily observations from 1970-1999**

GCM Ensemble Mean Changes for Growing Season

a) Change in temperature

b) % Change in rainfall



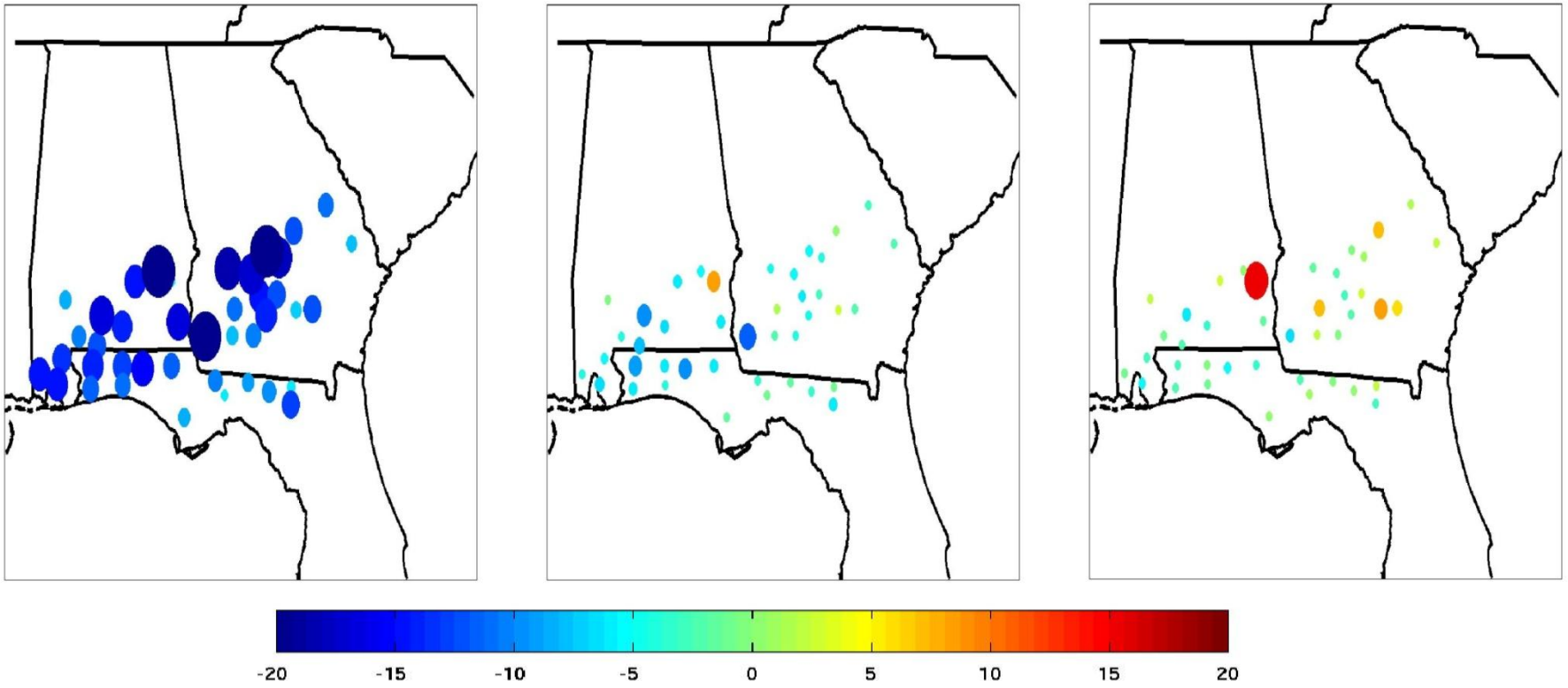
Mean changes in a) temperature (ºC) and b) precipitation (%) from 16 GCM ensemble for May-August growing season (A2 2050s compared to1980s baseline period).

GCM-based Projections (A2 2050s vs. 1970-99)

25th percentile of % change in corn yield

Median % change in corn yield (A2 2050s)

75th percentile of % change in corn yield



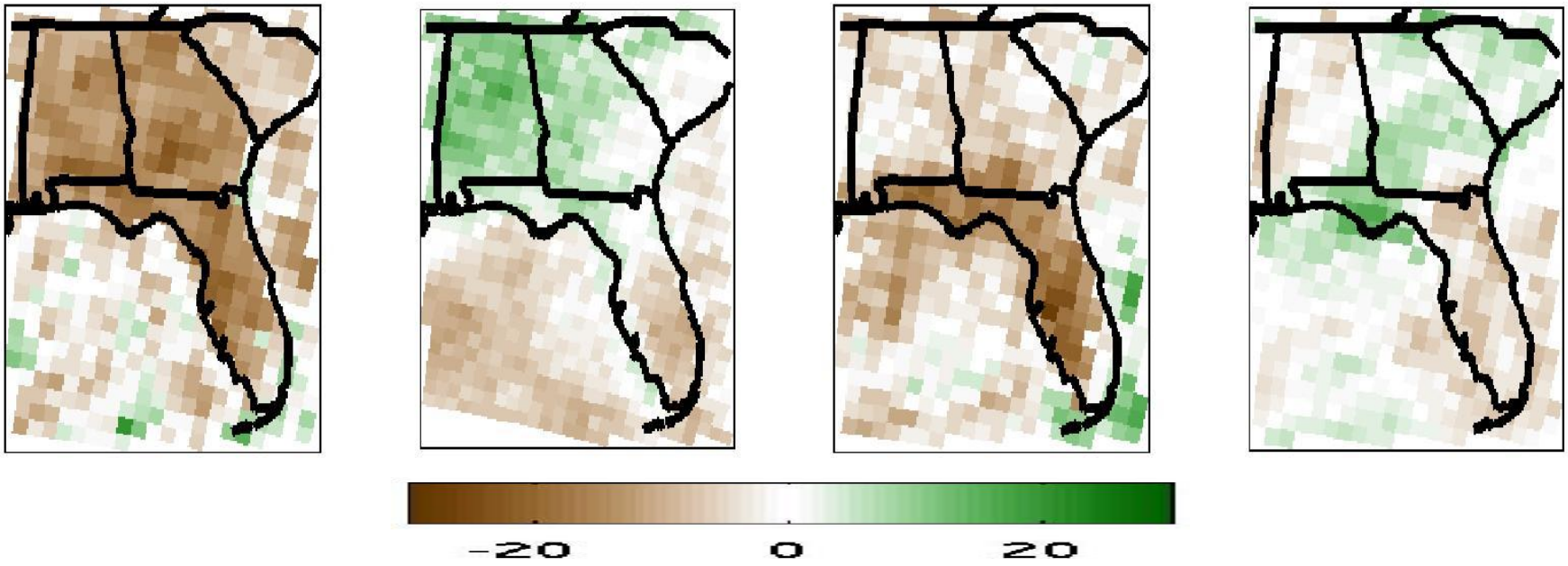
Using simple delta method from GCMs, corn projected to be negatively impacted by mean changes in T, P, and CO_2

- Substantial variability between 16 GCMs with output for the A2 2050s

- Spatial variability in soils, observed climate, and projected mean changes

NARCCAP % changes in growing season rainfall distribution's alpha parameter (lower = more extreme)

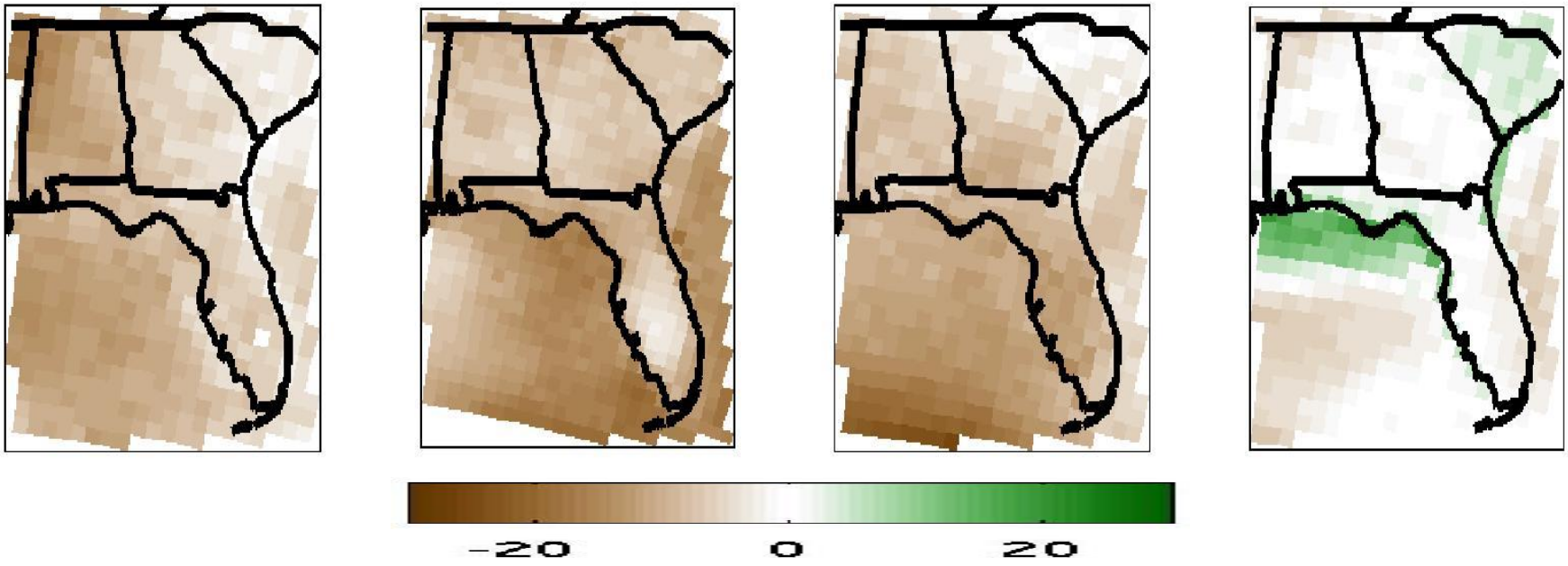
GFDL/rcm3 CGCM3/crcm CGCM3/rcm3 HadCM3/hrm3



RCM3 simulations producing more extreme distribution of rainfall

NARCCAP % changes in number of rainy days in growing season

GFDL/rcm3 CGCM3/crcm CGCM3/rcm3 HadCM3/hrm3



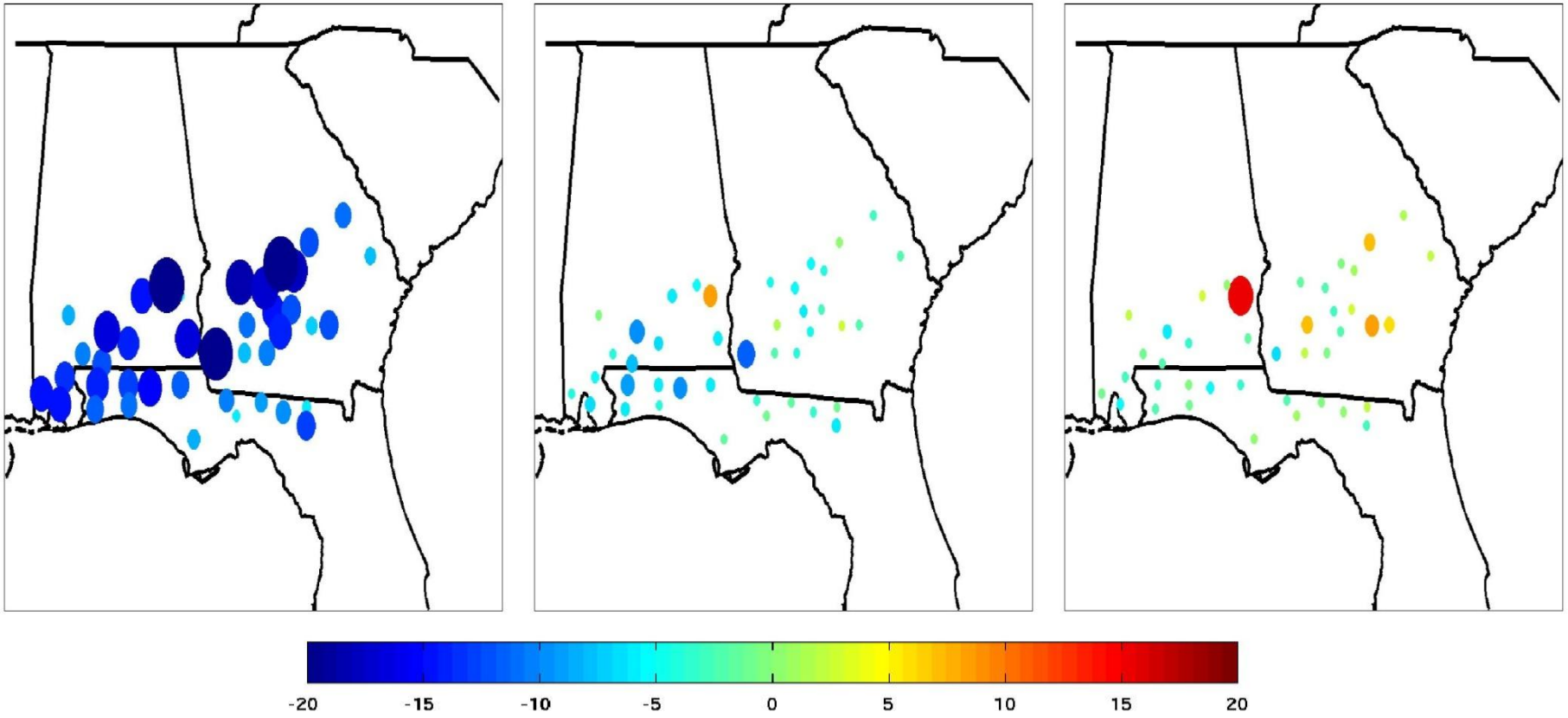
Decrease in number of wet days projected for almost all land areas in all models

GCM Ensemble Projections

25th percentile of % change in corn yield

Median % change in corn yield (A2 2050s)

75th percentile of % change in corn yield

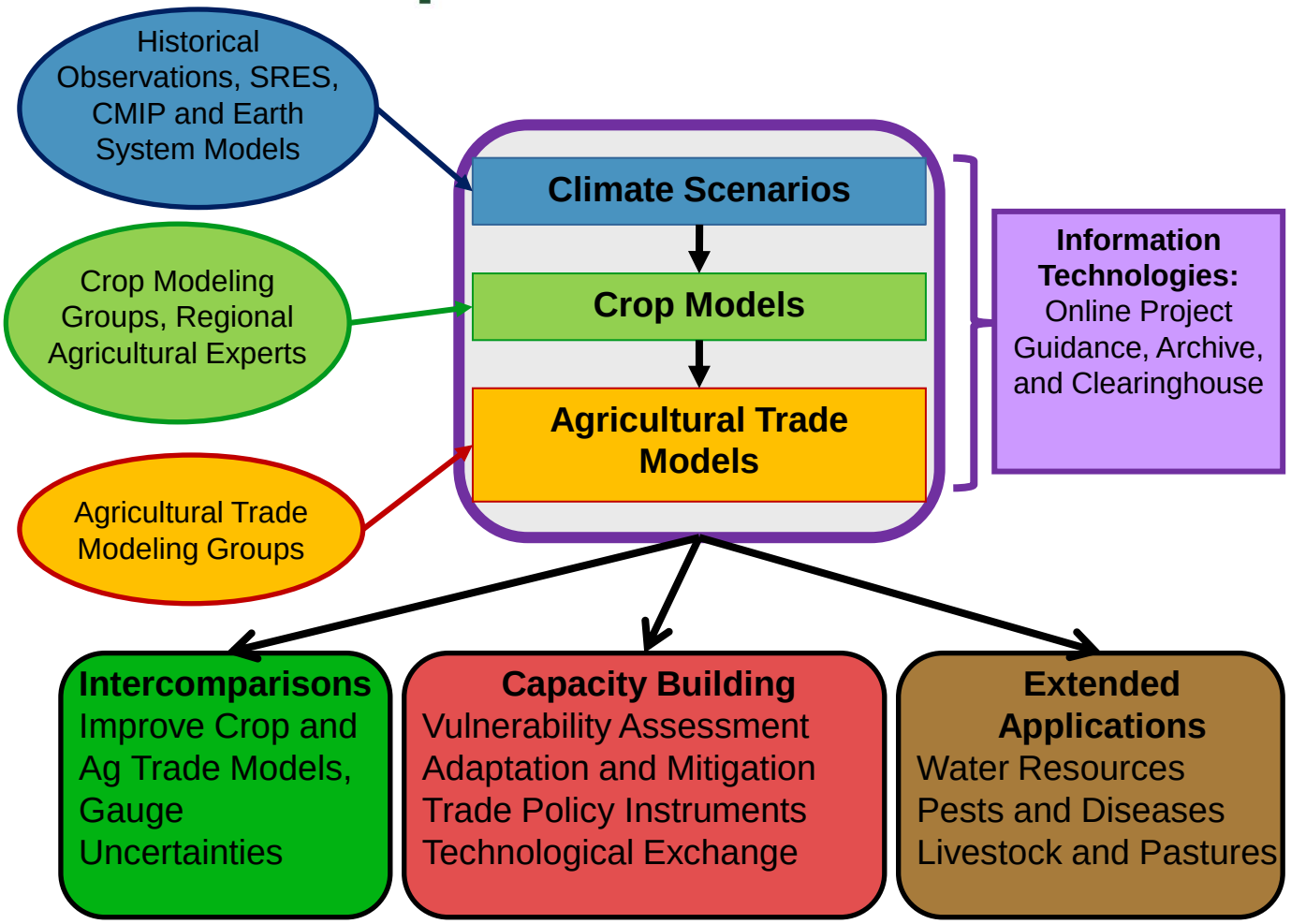


No variability changes

- **Imposes mean changes entirely on intensity of storms, not frequency**

AgMIP

The Agricultural Model Intercomparison and Improvement Project



Potential Relevance to the PWSU-CWIG Community

Climate Scenarios for Florida

- **AR4**
- **AR5**

Evaluation of methods

Potentially, changes in irrigation needs of crops

Access to additional partners (?)

Florida Climate Institute

Southeast Climate Co

UF UNIVERSITY of FLORIDA

FLORIDA STATE UNIVERSITY 1851