Alternative Methods for Evaluating Seasonal Rainfall Forecasts

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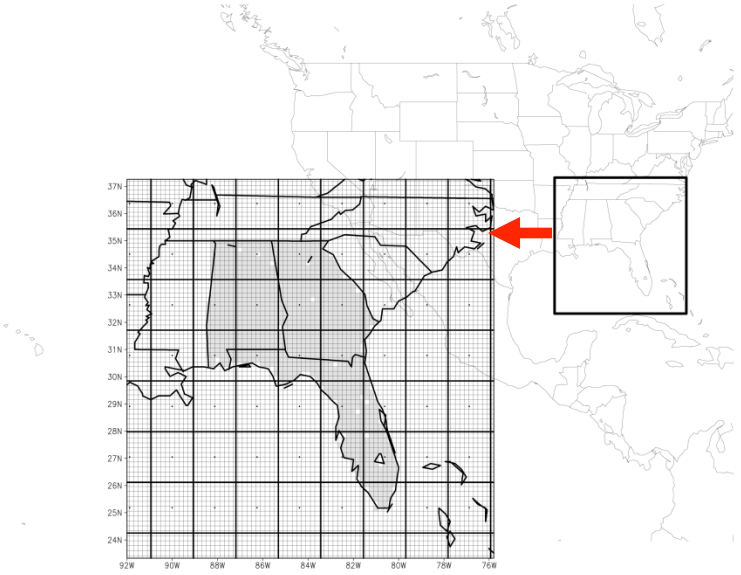
SOUTHEAST CLIMATE CONSORTIUM
AGRICULTURE CLIMATE WATER

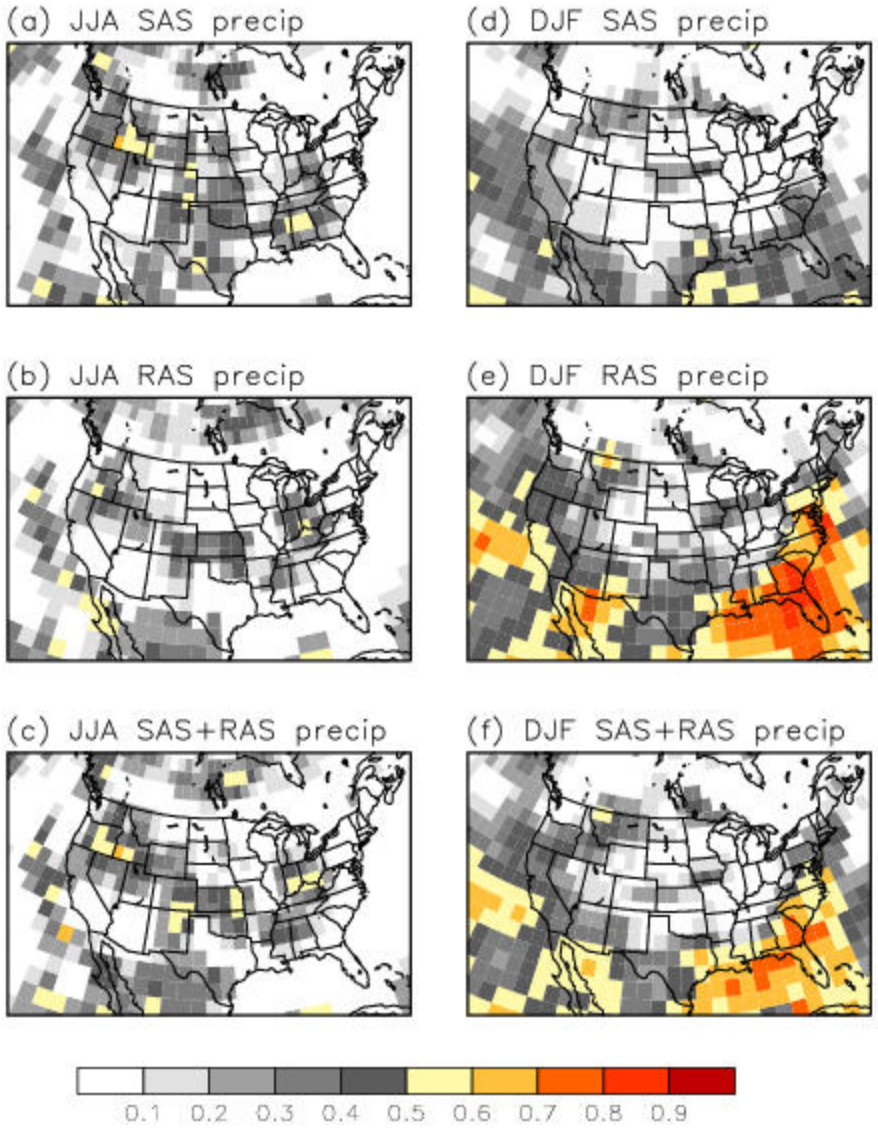
FSU/COAPS Climate Model

- **FSU/COAPS Global Spectral Model (FSU/COAPS GSM) has been downscaled to 20km grid resolution by the FSU/COAPS Nested Regional Spectral Model (FSU/COAPS NRSM) over the southeast U.S. →** ***Dynamical Downscaling***



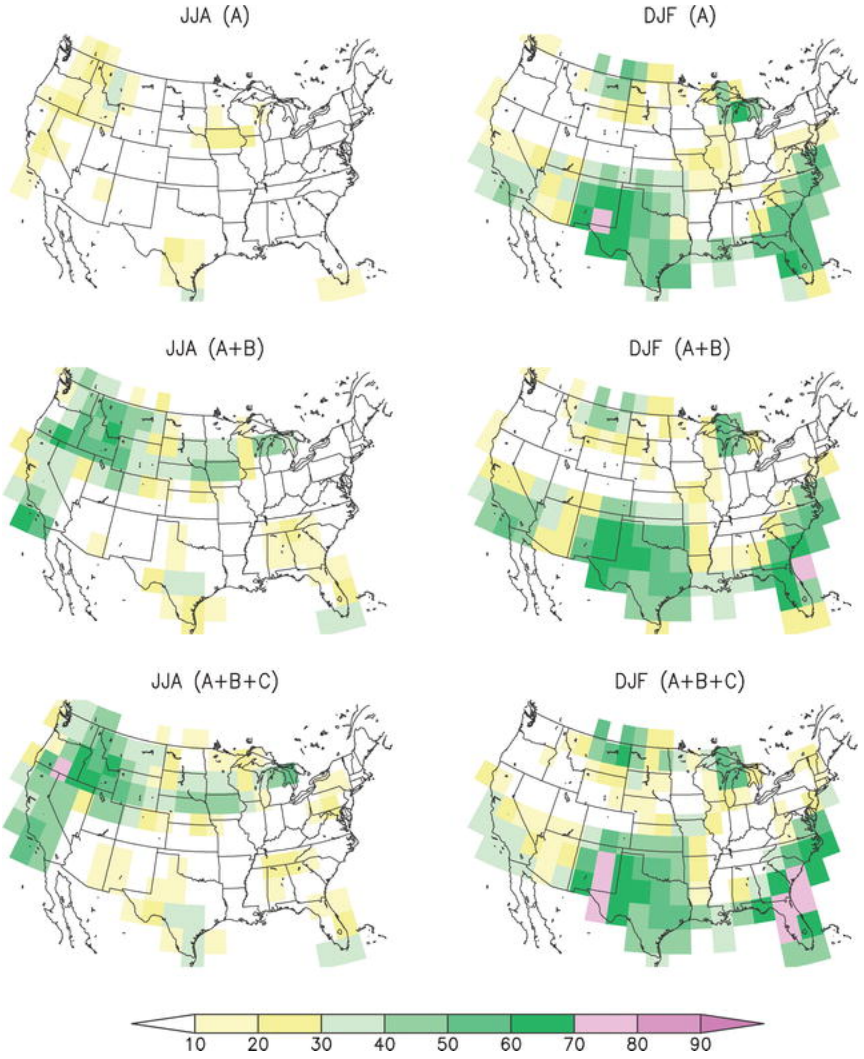
PRECIPITATION: Temporal correlation

FSU/COAPS (1987-2005)



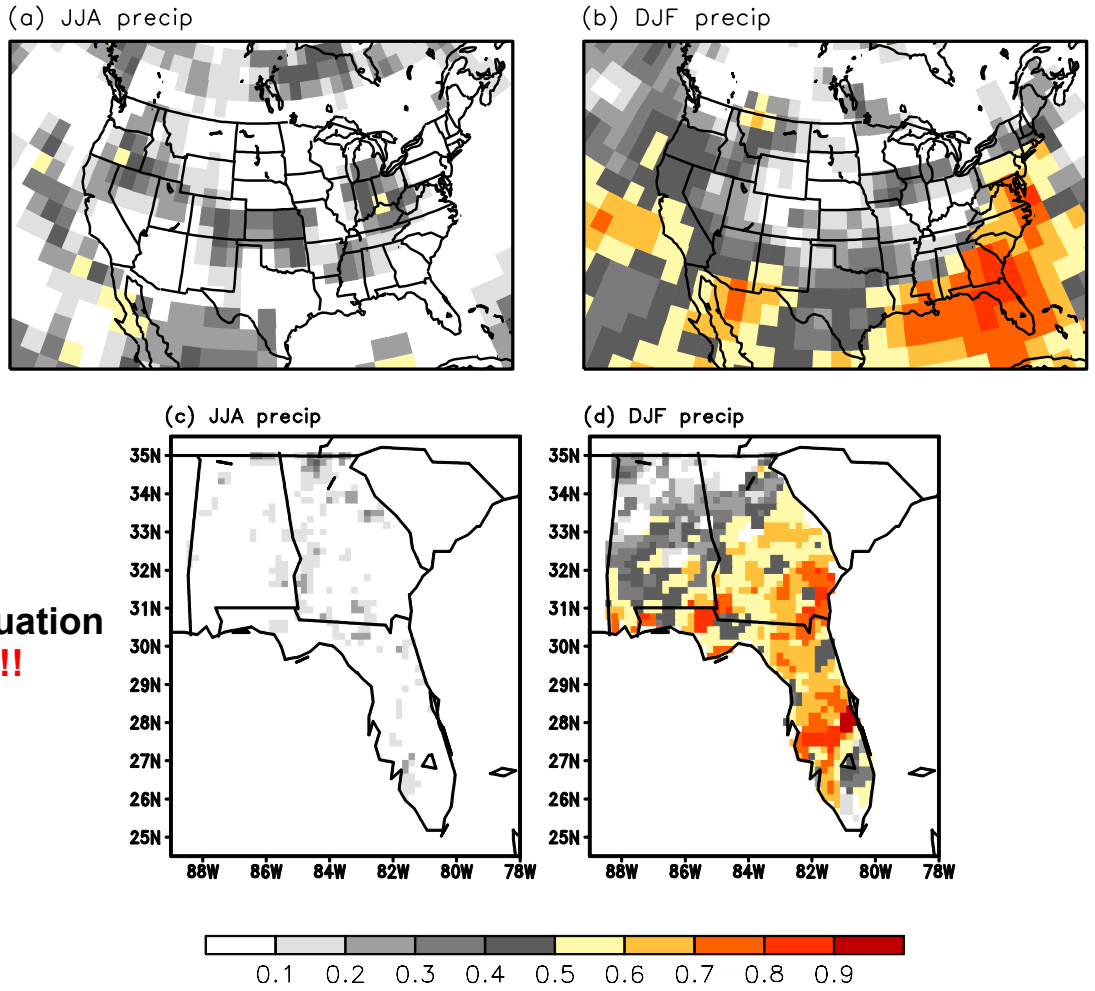
CFS (1981-2003)

Saha et al (2006)



Identification of problem

Seasonal Precipitation Anomaly: Temporal correlation (1987-2005)



FSU/COAPS GSM

FSU/COAPS RSM

Conventional model evaluation For JJA , NO SKILL!!!

Seasonal Forecast Evaluation

An alternative method **for evaluating seasonal forecast (mainly precipitation)?**

– ***a metric that characterizes other statistical aspects of precipitation (e.g., dry/wet spell)***

Although a *crop model* provides a single yield value per year, it uses **season-long daily** climate data, not seasonal average (or total) climate data. This means that the crop yield values implicitly include the high-frequency variability of seasonal climate information (e.g., dry/wet spell sequences).

Crop Model

DSSAT (Decision Support System for Agrotechnology Transfer)

Weather Data: max/min surface temperature, precipitation and shortwave radiation

Data period: 1987-2005 (19 yrs), 10 members
March 1-September 30

Location: Tifton, GA

Crop: Maize (corn)

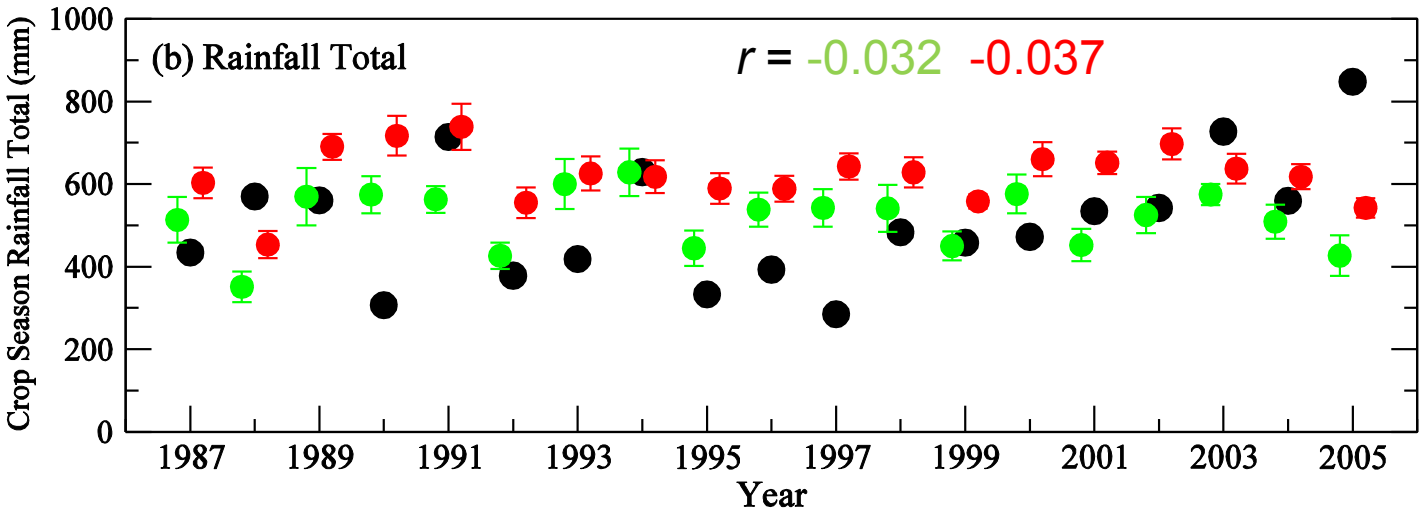
Planting date: April 1

Site specific soil profiles from USGS

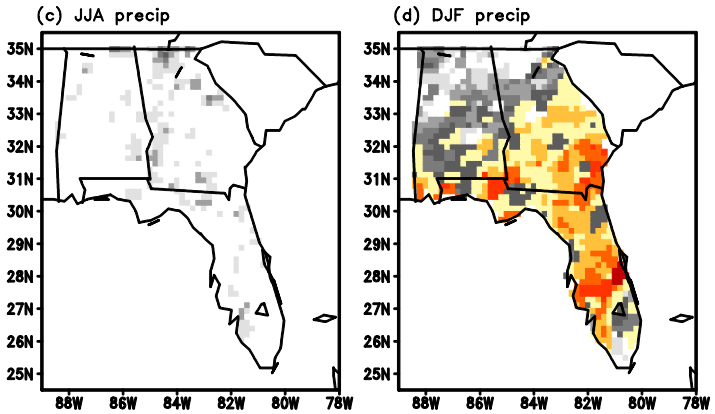
Rainfed conditions

Rainfall Total global vs. regional model

Tifton, GA

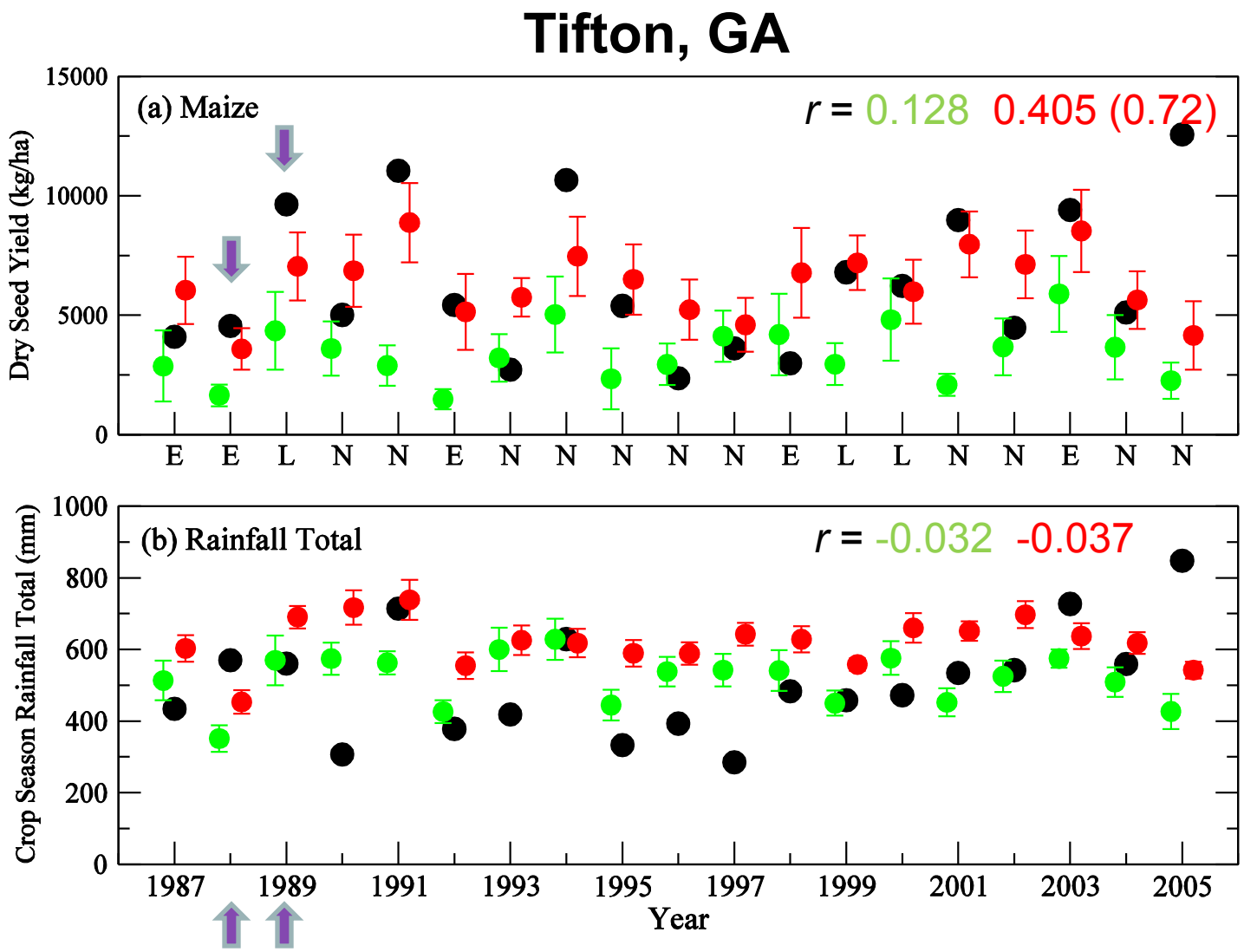


a kind of 1-D version of correlation maps

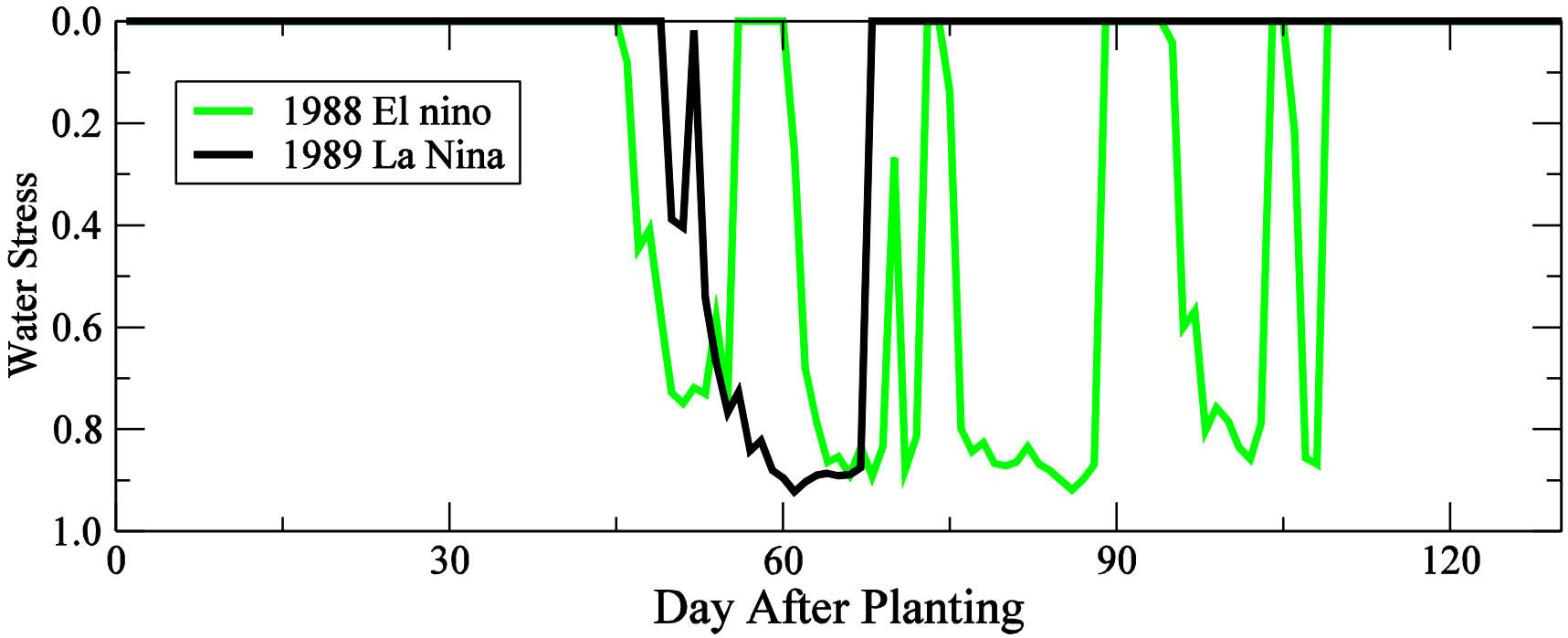


Maize Yield

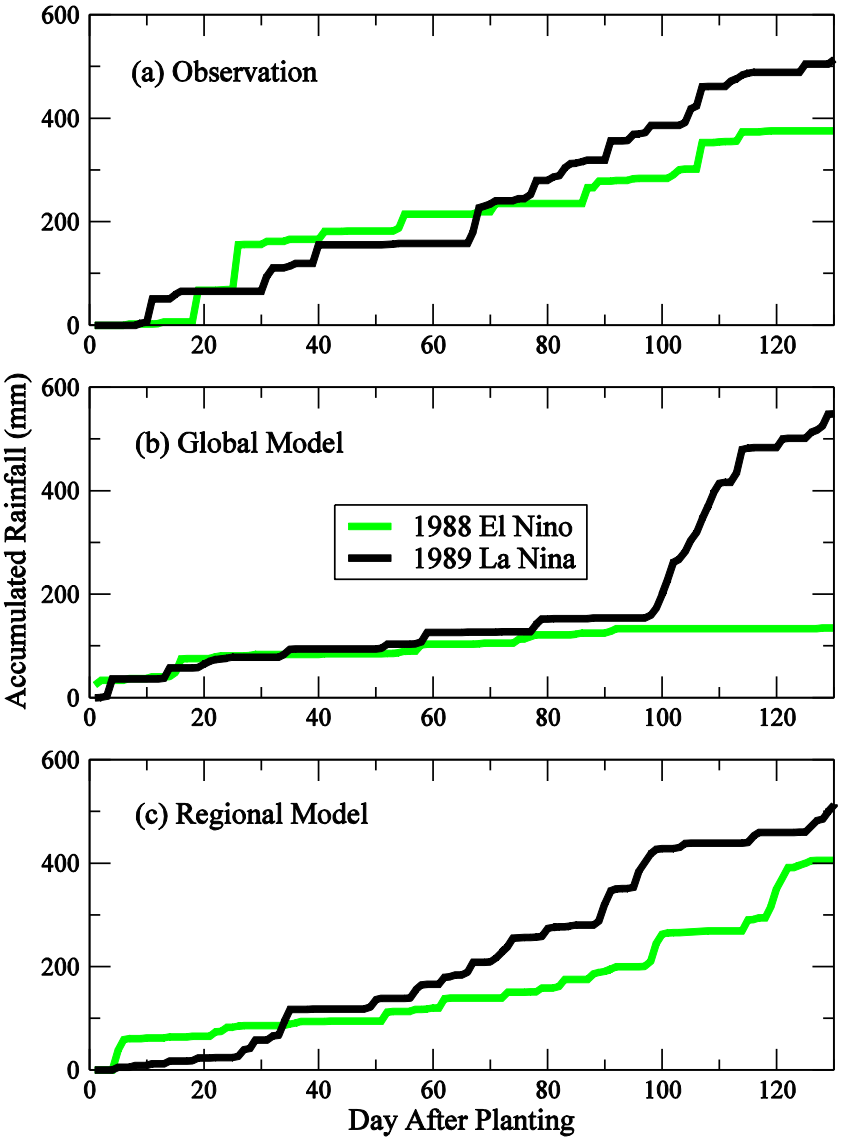
global vs. regional model



Water Stress (Maize)

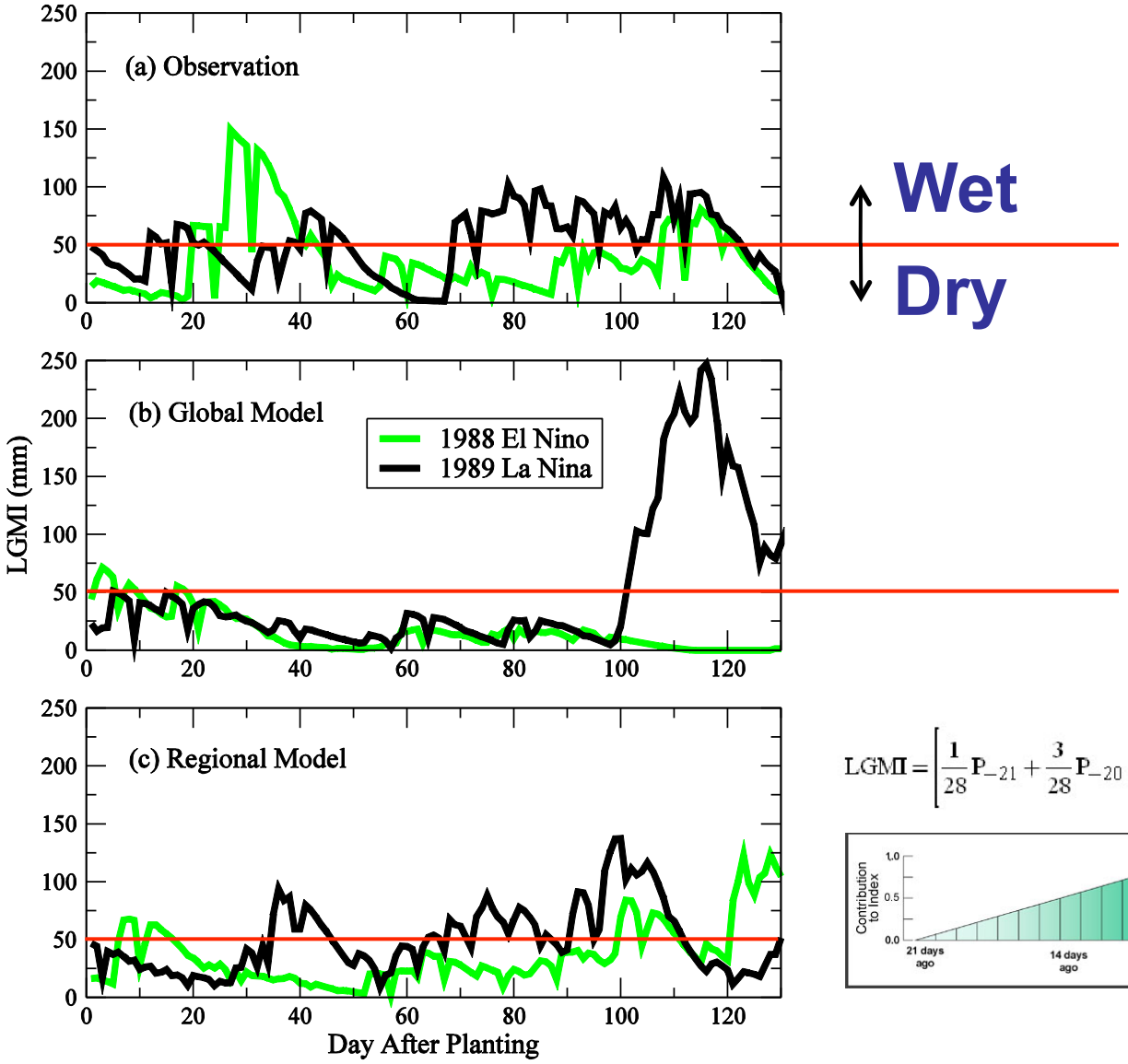


Accumulated Rain (1988 vs 1989)



Slope!!!

LGMI (1988 vs 1989) (drought index)



$$LGMI = \left[\frac{1}{28} P_{-21} + \frac{3}{28} P_{-20} + \ldots \frac{27}{28} P_{-8} + \sum_{i=-7}^{-1} P_i \right]$$

*LGMI: Lawn and Garden Moisture Index (Christy 2004, UAH)

Conclusions

- The conventional model evaluation methods, such as temporal anomaly correlation of seasonal average rainfall cannot demonstrate the value of (dynamically downscaled) seasonal forecasts
- Using a crop model as a performance metric provides an alternative to simply evaluating the prediction/simulation of seasonal mean, and has more practical relevance
- The value of regional model was better demonstrated by examining the time series of accumulated rainfall and LGMI (high frequency statistics), which are derived from rainfall data only
- This study clearly demonstrated why a dynamical downscaling could be useful for application models
- It might be interesting to compare statistical downscaling methods versus dynamical downscaling methods using the framework presented here

Precipitation vs. Yield Correlations