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Summertime seasonal rainfall predictability over Florida

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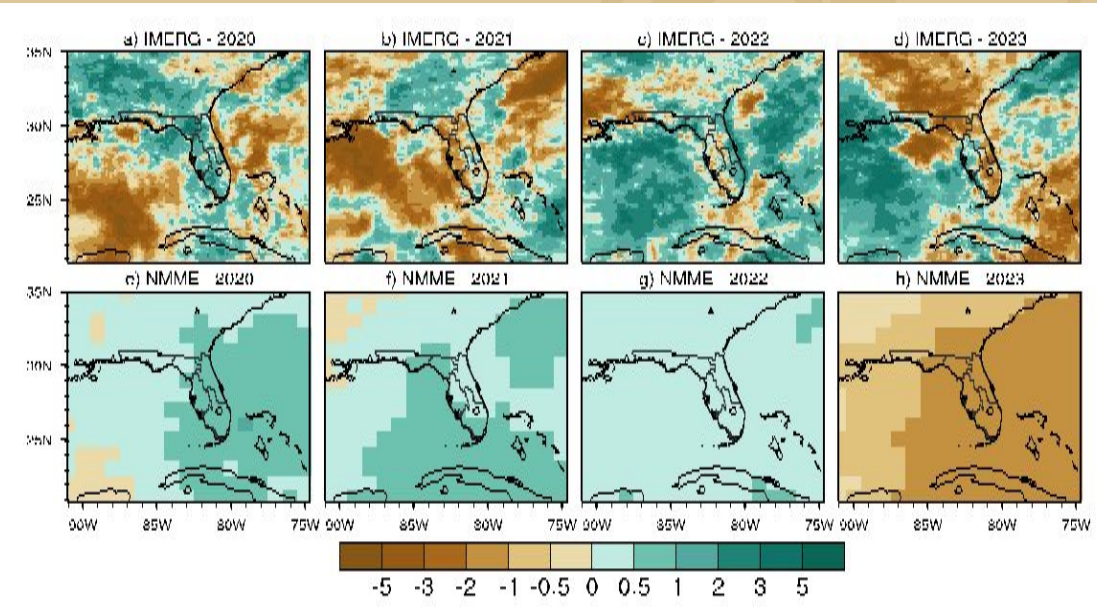
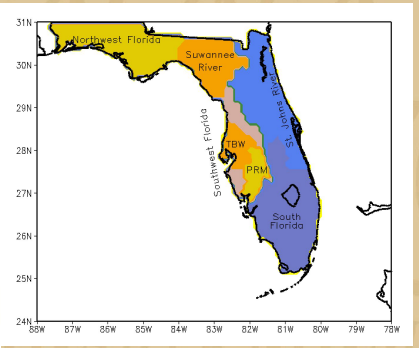
The Issue



JJA seasonal mean precipitation anomalies



The observed JJA seasonal precipitation anomalies over Florida are heterogeneous, which our global models are unable to resolve.

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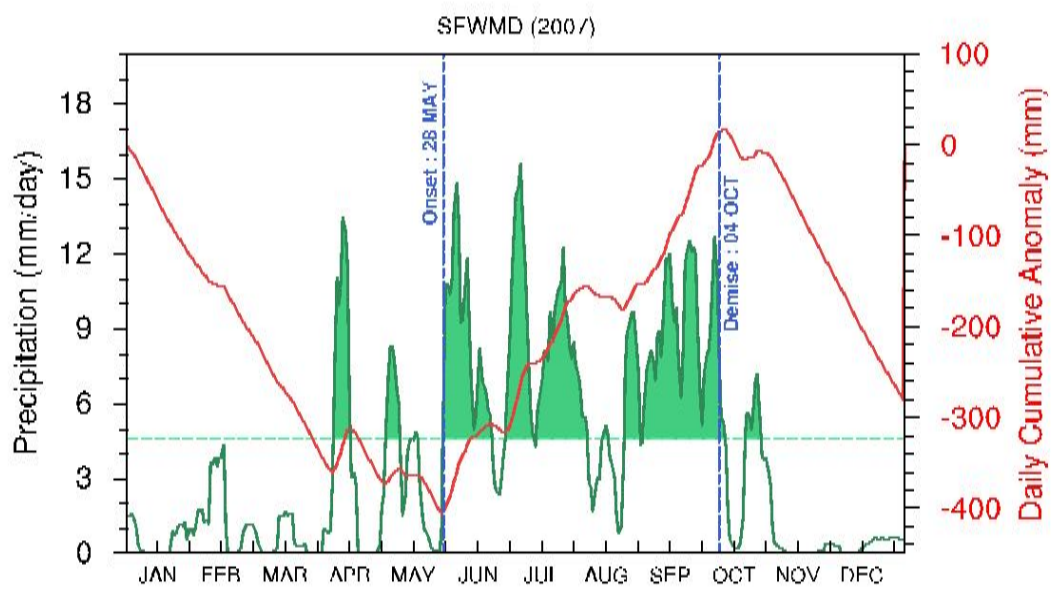
Diagnosis of onset/demise date



The timeseries of daily rainfall (black) for 2007 over SFWMD in Florida.

Onset date: The first day of the year when the daily rain rate (in mm/day) exceeds the annual mean climatological rain rate (in mm/day).

Demise date: The last day of the year when the daily rain rate (in mm/day) exceeds the annual mean climatological rain rate (in mm/day).

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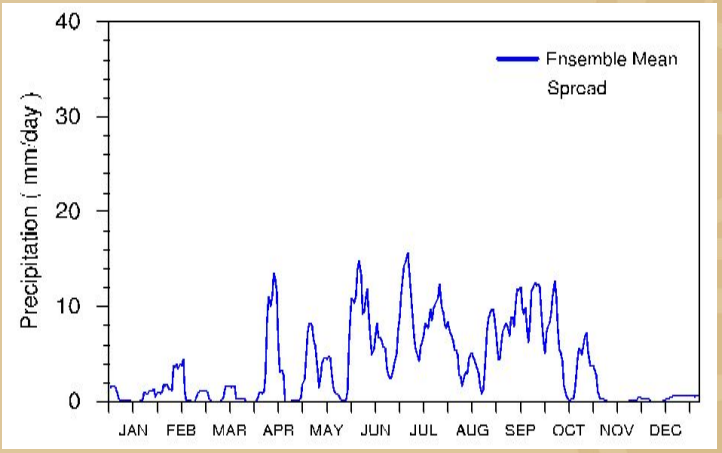
Perturbing the timeseries



The ensemble mean of the daily timeseries of rainfall over SFWMD in Florida and the spread (shaded) represented by the range of 1001 ensemble

Perturbations of the observed daily precipitation timeseries are generated to:

- Reduce the likelihood of diagnosis of bogus onset/demise dates
- Account for the uncertainty of observations

The perturbations to the timeseries are generated by shuffling the original daily timeseries of rainfall on the timescale of 7 days (representing synoptic scales) with rain rates of every day being replaced by rain rates occurring within the sequence of ± 3 days of the chosen date. We generate 1000 such perturbed timeseries per year per grid point.

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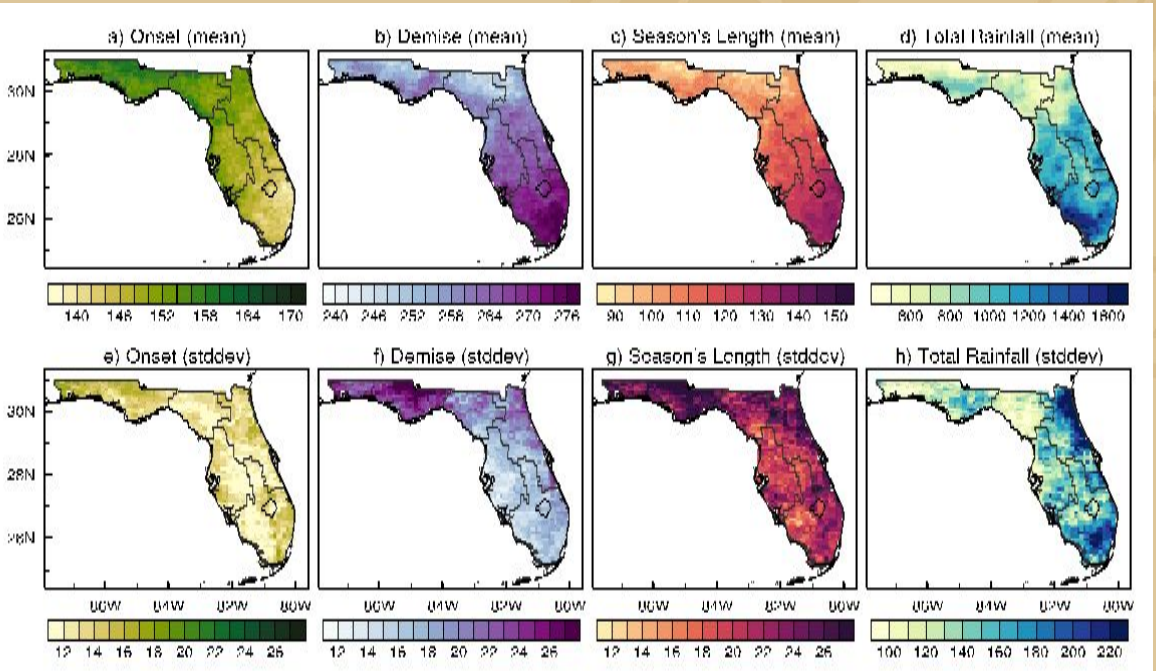
GPM Rainfall Dataset



The climatology and standard deviation from GPM rainfall (IMERG-12h latency product) available at 0.1°×0.1°.

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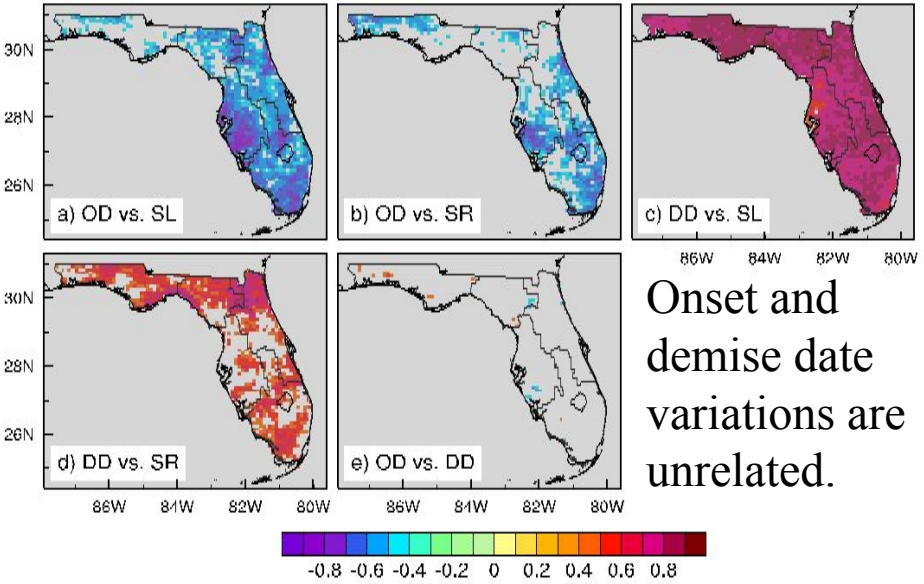
Interannual variability

Early onset wet seasons have longer and wetter seasons.



Onset and demise date variations are unrelated.

Later demise wet seasons have longer and wetter seasons.

Correlations of anomalies of Onset Date (OD) with anomalies of Seasonal Length (SL), Seasonal Rain (SR), and Demise Date (DD).

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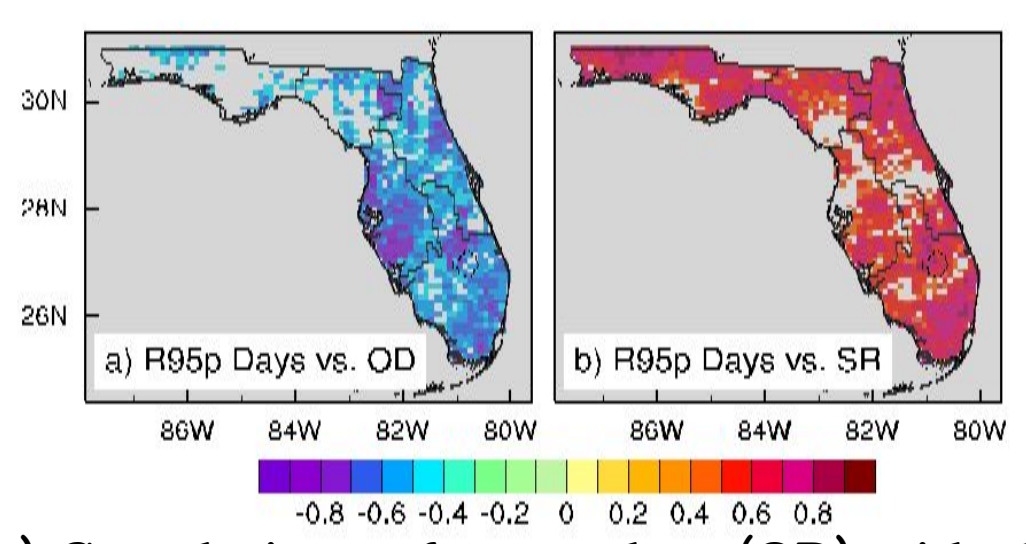
Extremes and onset date variations



a) Correlations of onset date (OD) with the frequency of daily precipitation rate exceeding 95th percentile (R95p) in the season. b) Correlation of R95p with seasonal rainfall anomaly

Early onset seasons have more extreme rain rates that also are associated with anomalously wet seasons.

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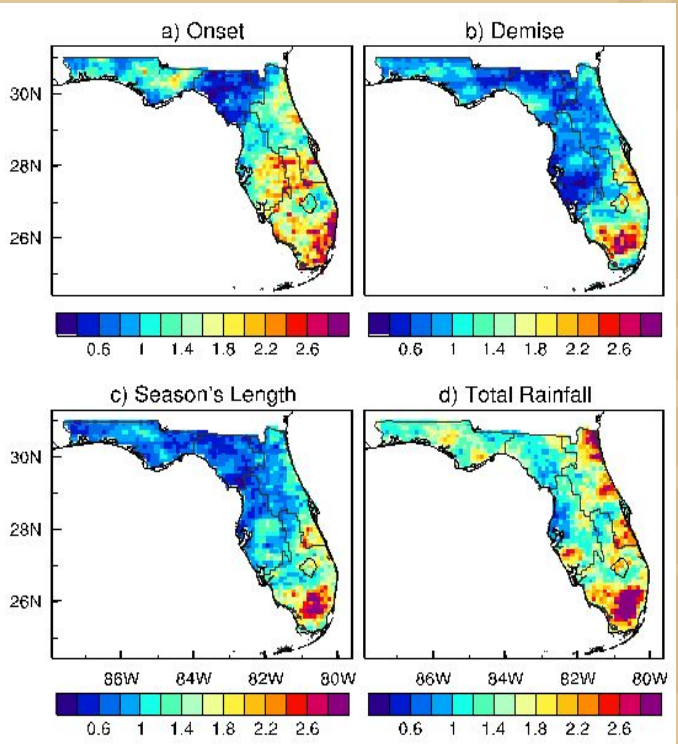
Signal to Noise Ratio



$$\sigma^2_{\text{noise}} = \frac{1}{N(n-1)} \sum_{i=1}^{N} \sum_{j=1}^{n} (x_{ij} - \bar{x}_i)^2, \quad (3)$$

$$\sigma^2_{\text{signal}} = \sigma^2_{\text{EM}} - \frac{1}{n}\sigma^2_{\text{noise}}, \quad (4)$$

where,

$$\sigma^2_{\text{EM}} = \frac{1}{(N-1)} \sum_{i=1}^{N} \left(\bar{x}_i - \bar{\bar{x}}\right)^2, \quad (5)$$

- There is more signal in onset date variations than in demise date variations
- Seasonal rainfall has more signal than noise across Florida

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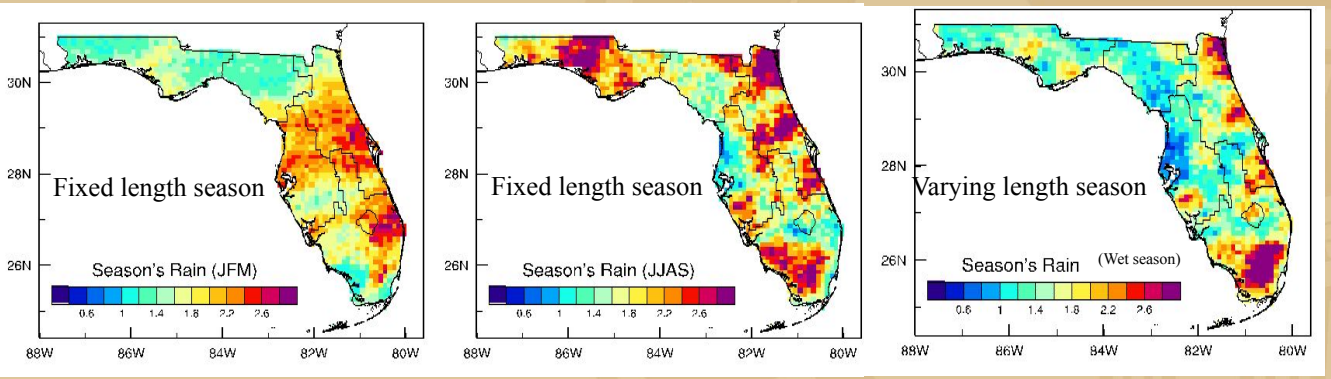
Signal to Noise Ratio of Seasonal Rainfall Anomaly



- In JFM the Signal is least in Panhandle Florida
- In JJAS, the signal-to-noise ratio is far more heterogeneous (spotty) than in JFM
- The varying length of wet season reduces the signal compared to the fixed JJAS season.

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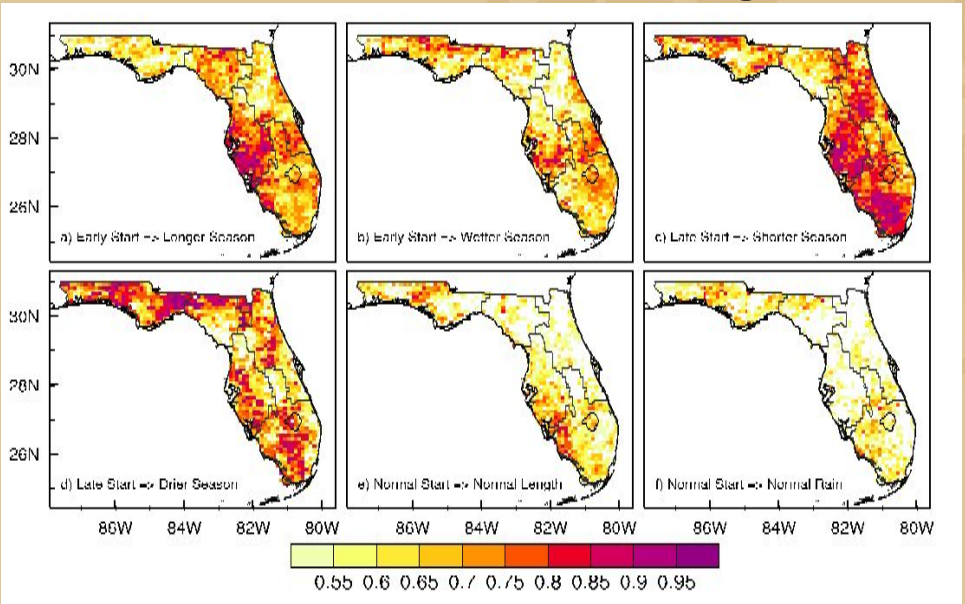
Probabilistic skill score for tercile anomalies



Area under the Relative Operating Characteristic Curve with values > 0.5 shaded.

- Anomalous seasons have more skill
- The Gulf coast displays more skill than the Atlantic Coast
- Late-start seasons show more skill than early-start seasons

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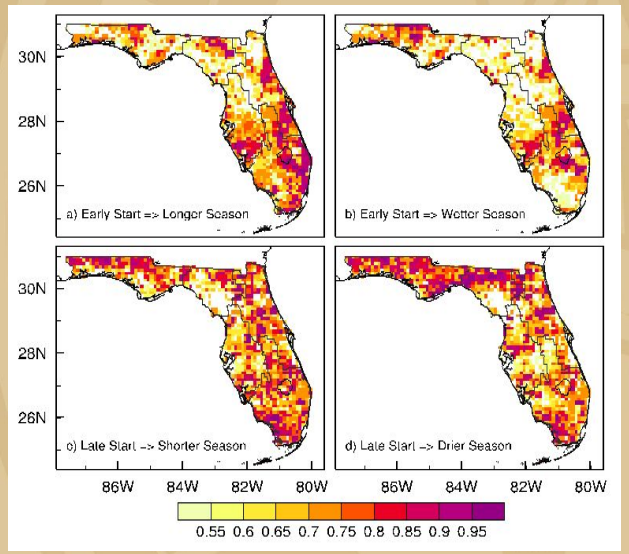
Probabilistic skill score for extreme pentile anomalies



- The skills are encouraging for extreme pentiles too!

Area under the Relative Operating Characteristic Curve with values > 0.5 shaded.

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Conclusions

- Monitoring of the onset date of wet season could be extremely beneficial for providing reliable seasonal outlook
- When climate models lack predictability for lack of strong external forcing for Florida's wet seasons, internal variations such as those illustrated here could be usefully exploited
- Onset date variations are very strongly linked to seasonal rainfall anomalies of the wet season and the length of the season
- A simple seasonal prediction based on terciles and pentiles of the onset date variations seems to provide very skillful seasonal outlooks
- The availability of GPM rainfall in near real time makes the proposed technique viable for real time applications.