



Center for Ocean-Atmospheric Prediction Studies



Florida Climate Institute

The unique climate variations of Florida and the Challenges it poses

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The Monsoon-like Florida Rains

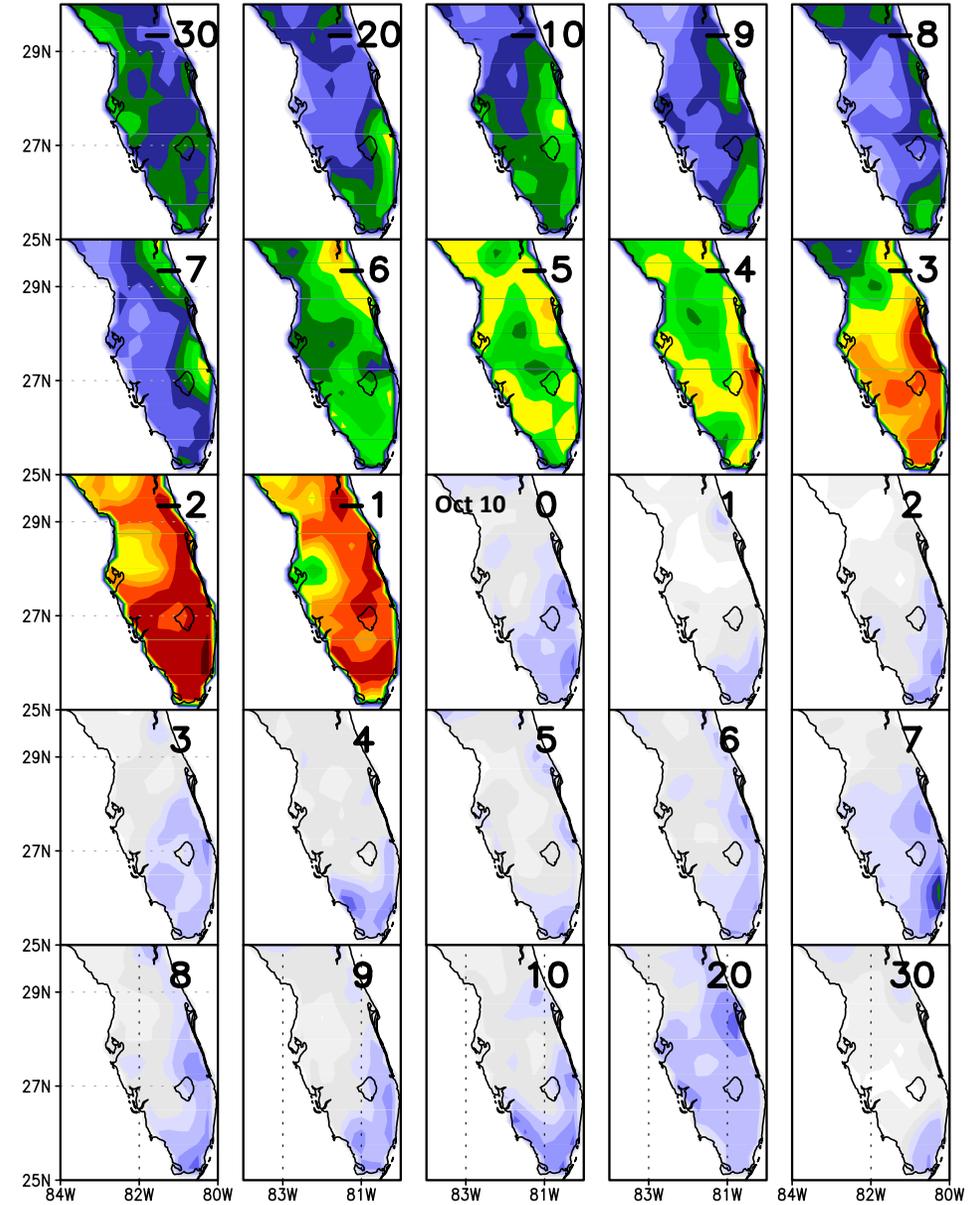
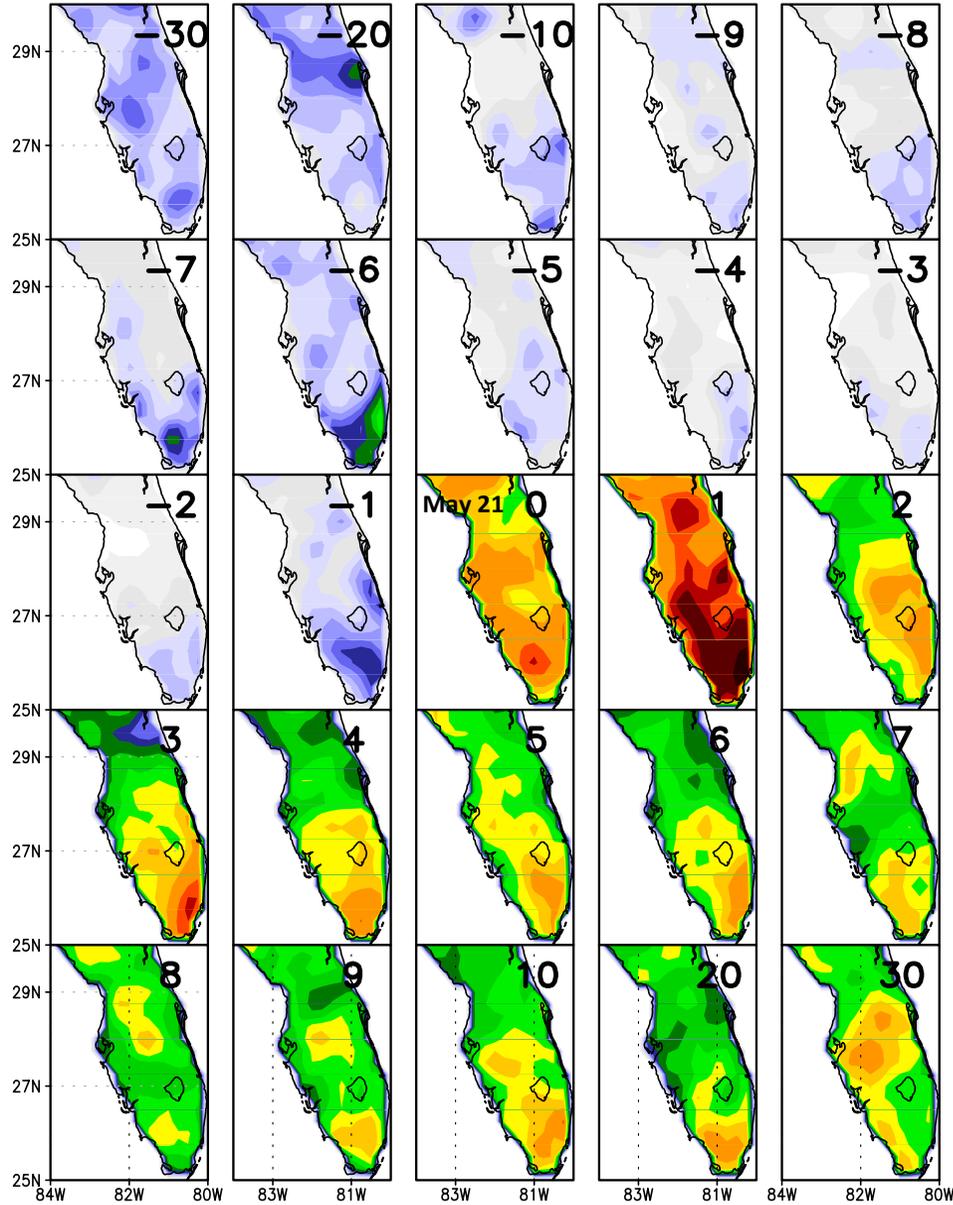
- Peninsular Florida displays a very strong seasonal cycle of rainfall with a distinct wet season that delineates the season from the rest of the year
- This robust seasonal cycle also manifests in other variables including oceanic variables

The dramatic onset of the rains in Peninsular Florida-

Onset

CLIMATOLOGY

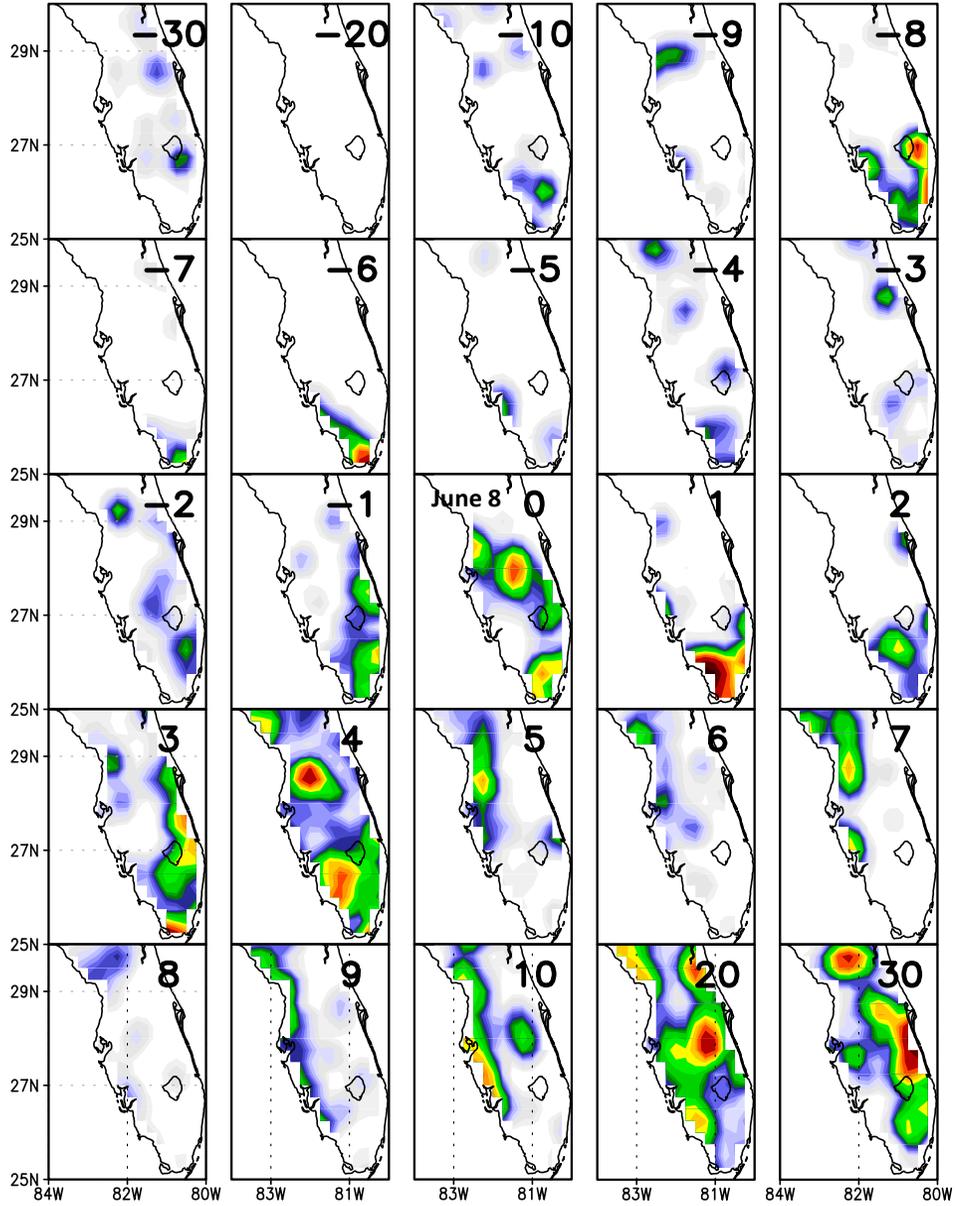
Demise



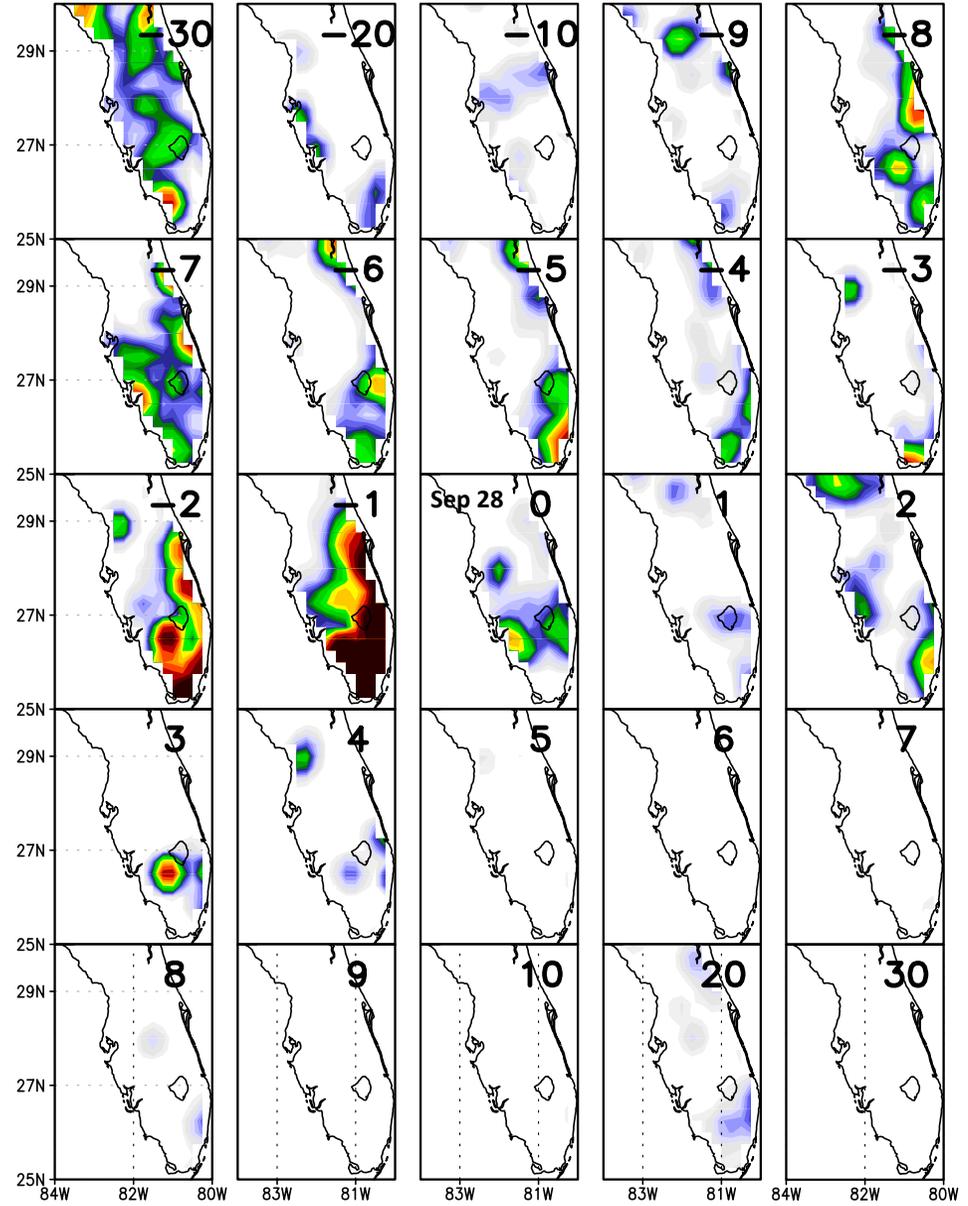
An example for the year
2000

The dramatic onset of the rains in Peninsular Florida

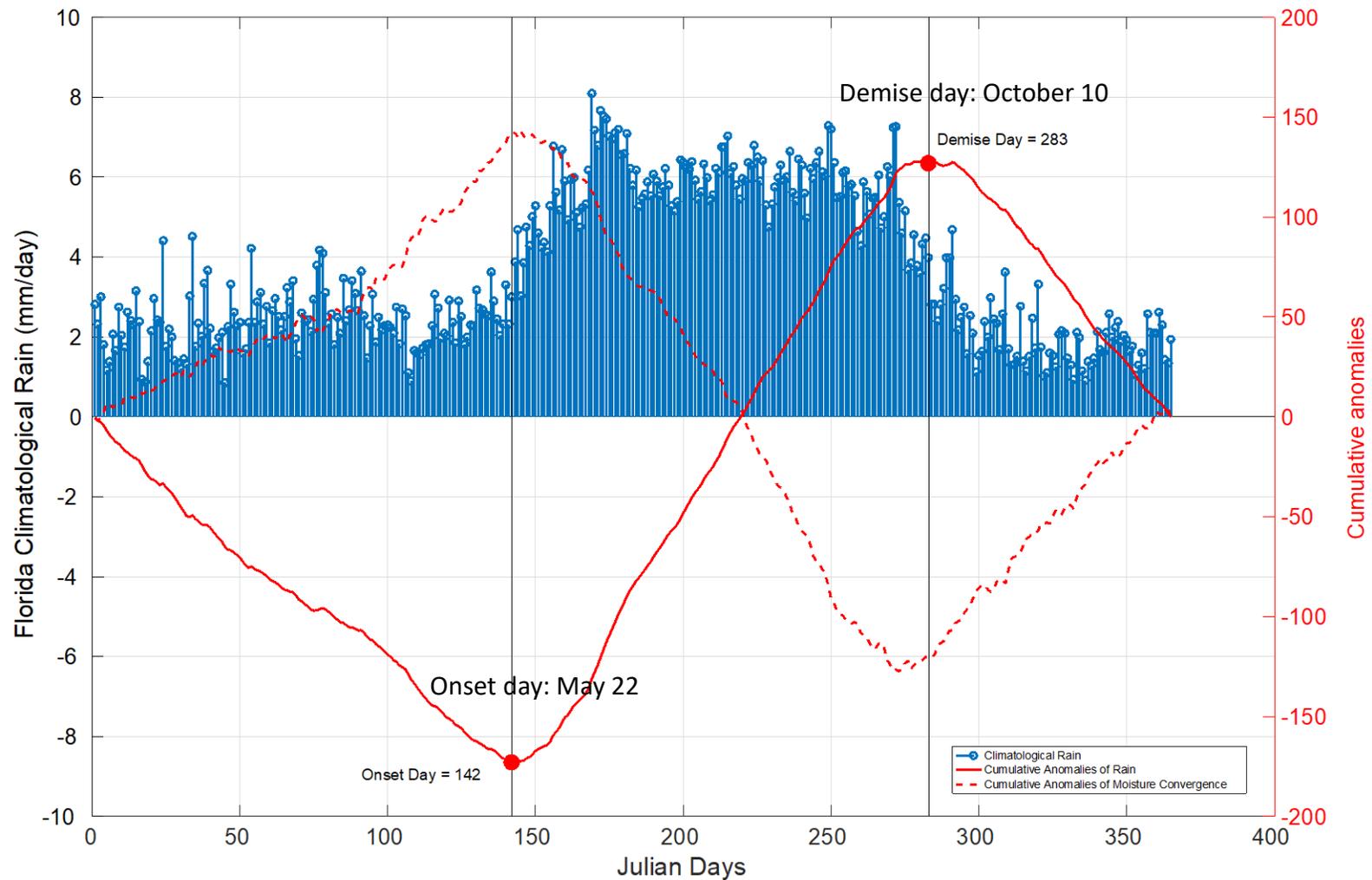
Onset in 2000



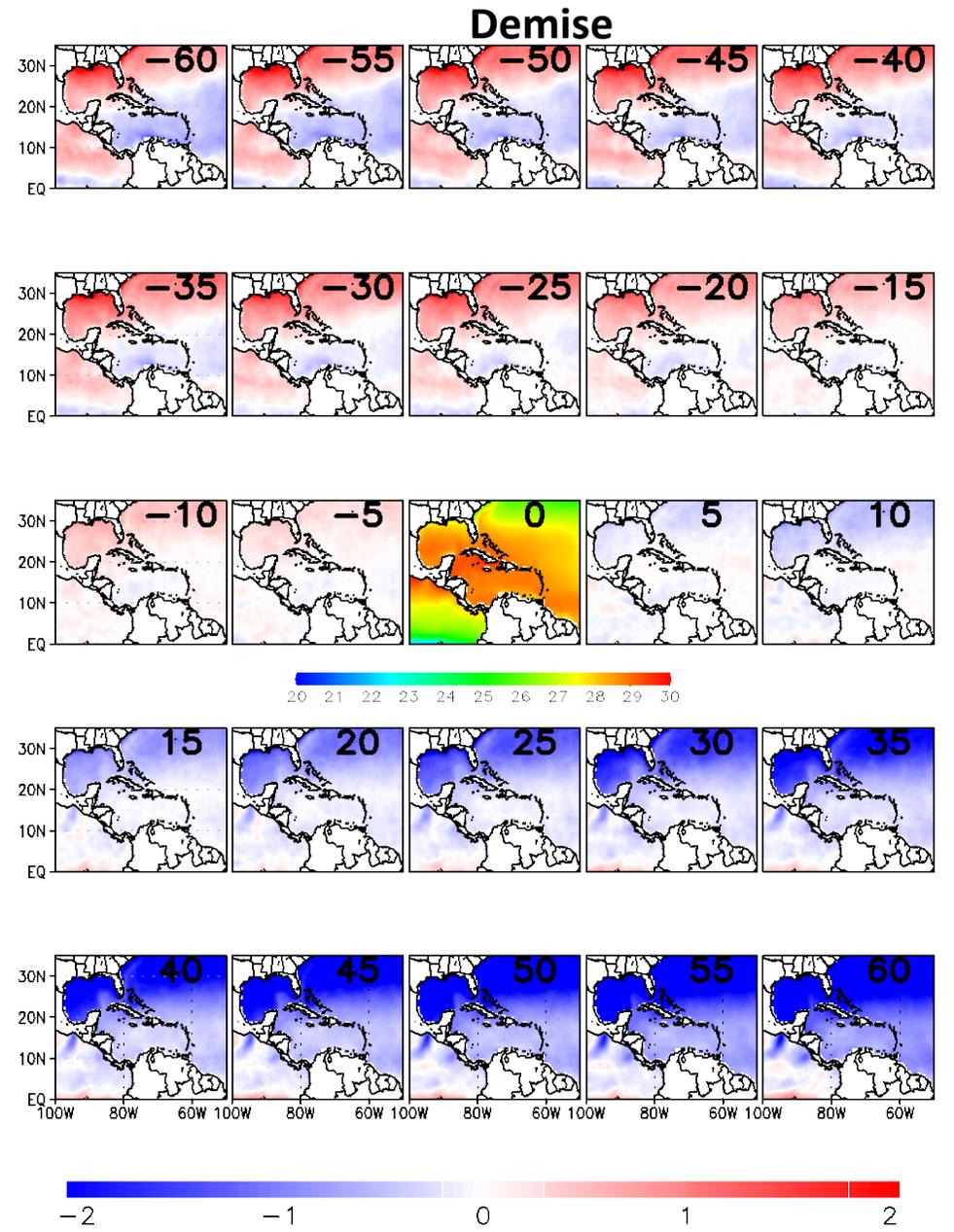
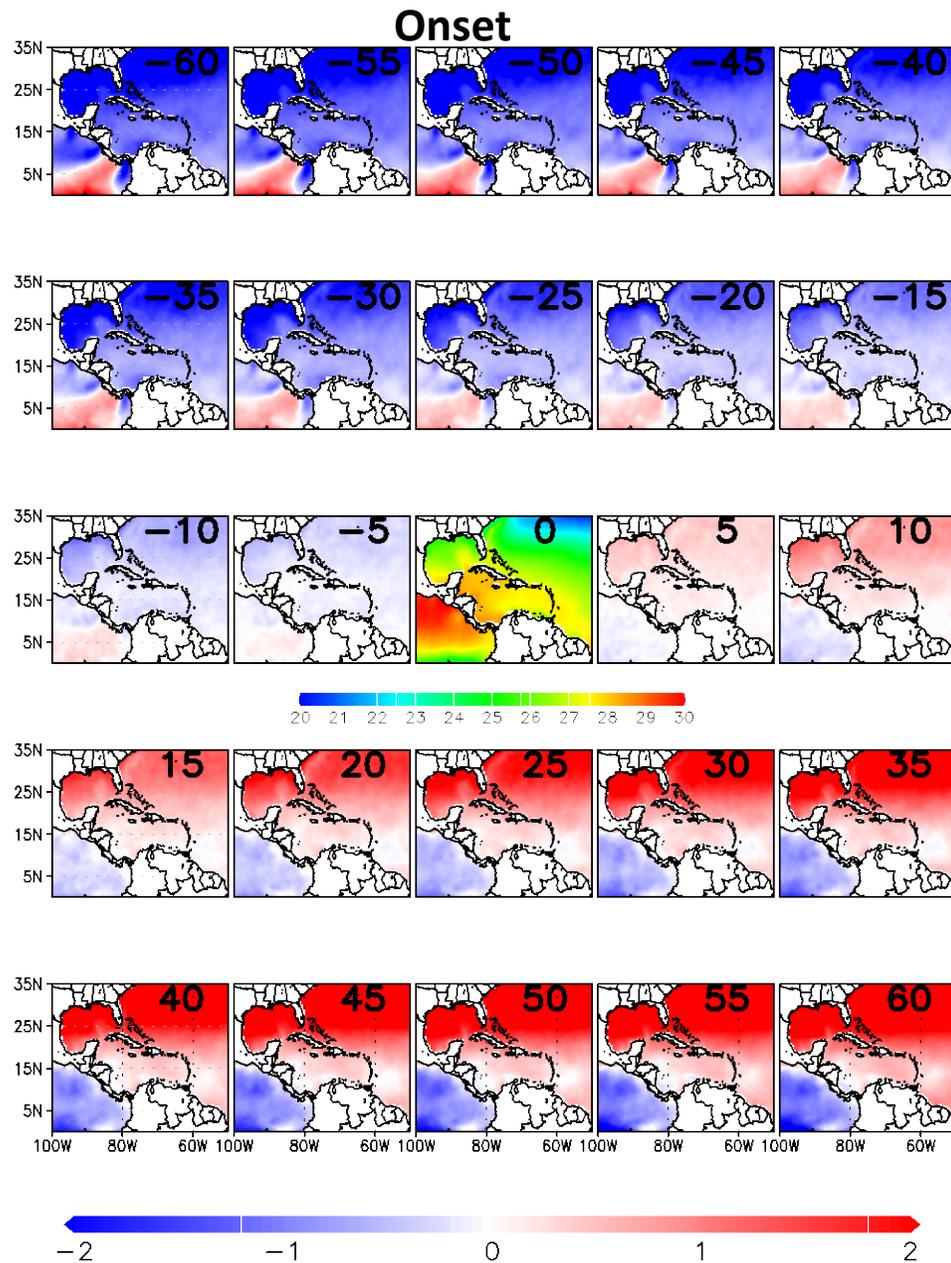
Demise in 2000



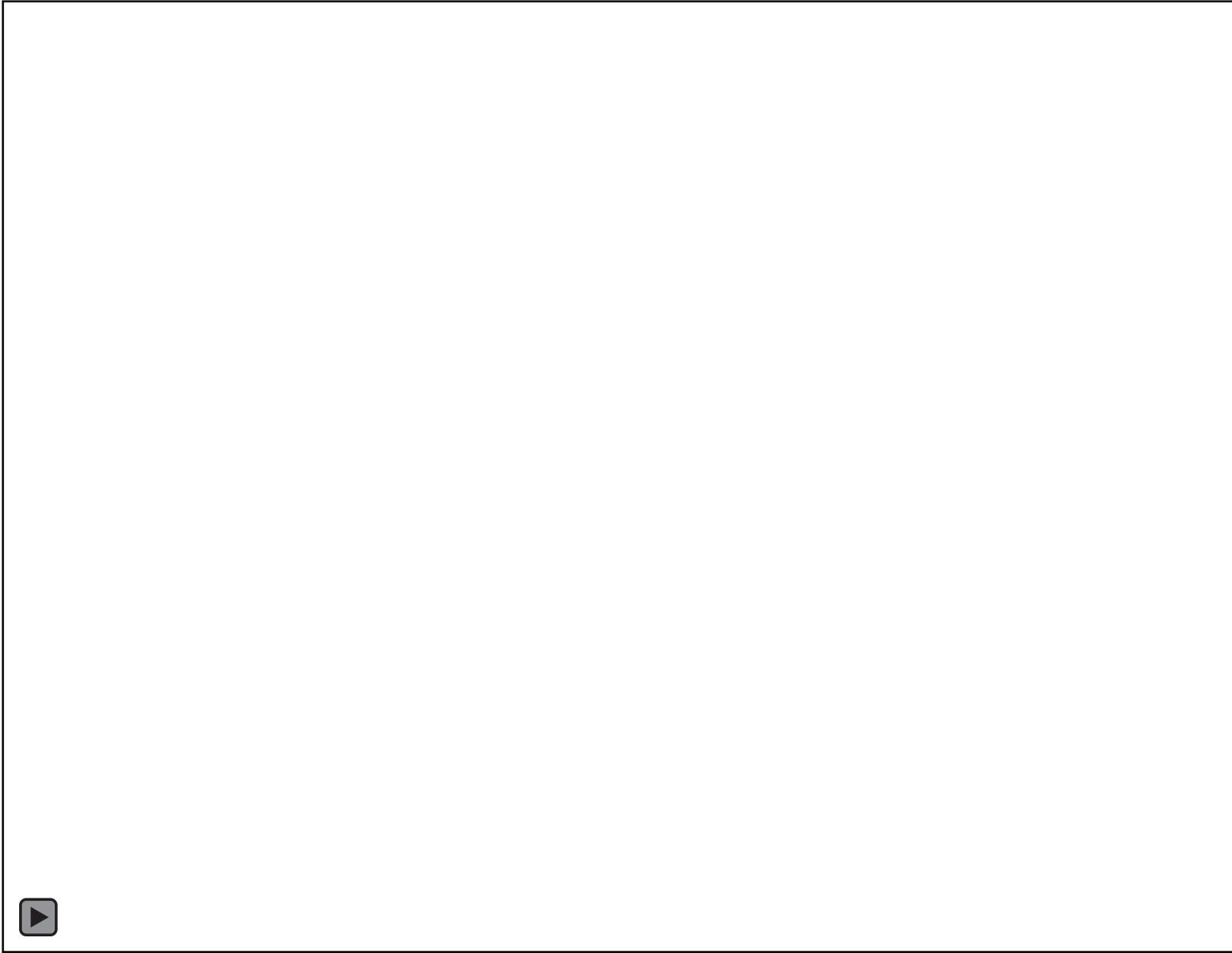
The dramatic onset of the rains in Peninsular Florida—CLIMATOLOGY (58 Years; 1948-2005)



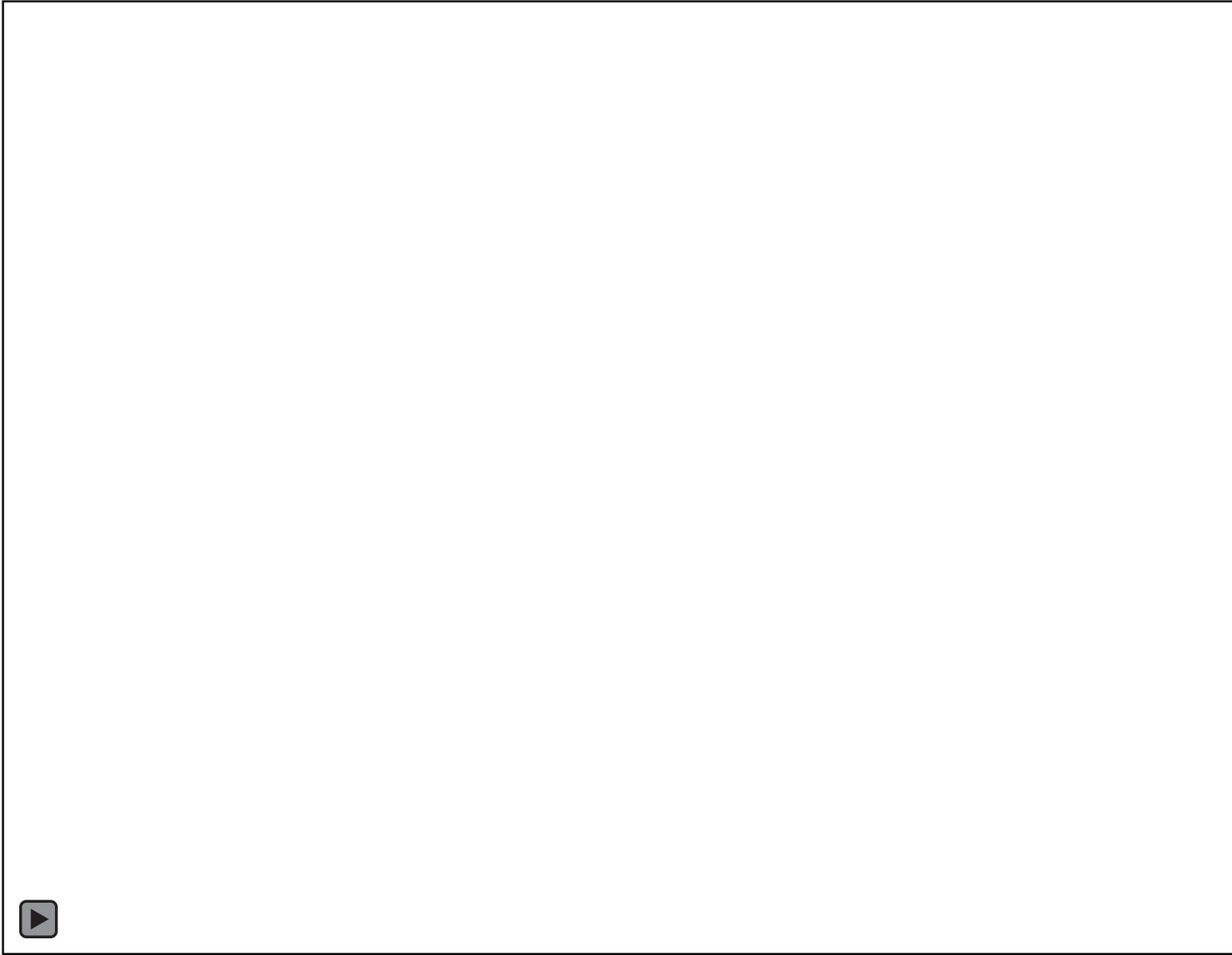
Evolution of Sea Surface Temperature



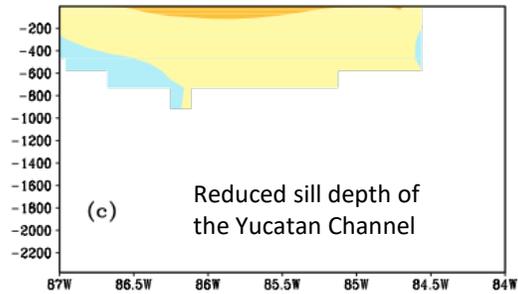
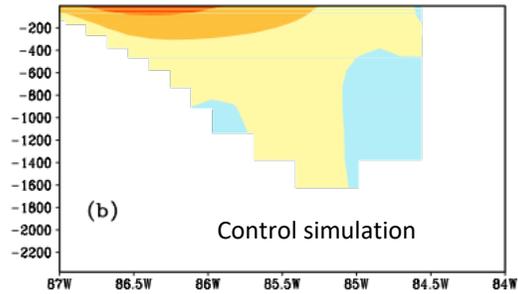
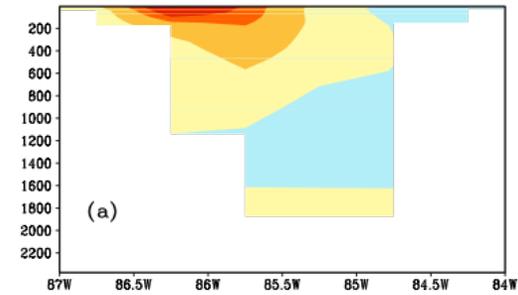
Movie loop of ocean heat content and ocean heat transport vector pre and post onset



Movie loop of ocean heat content and ocean heat transport vector pre and post demise

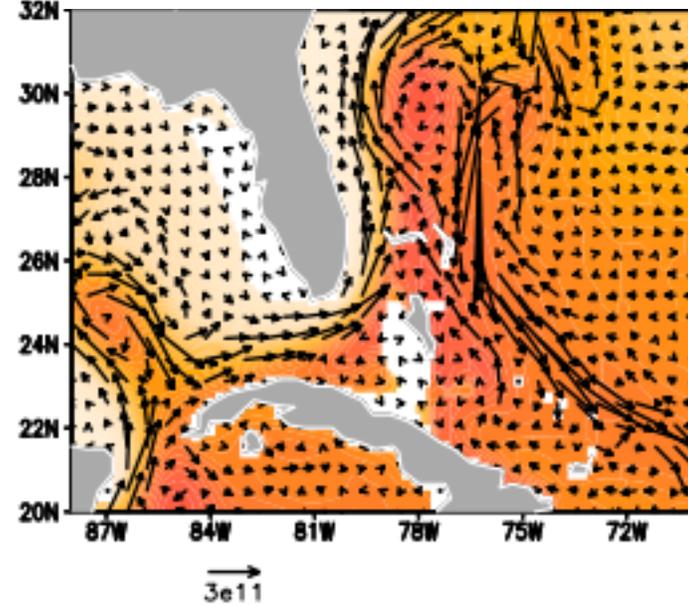


Model simulations

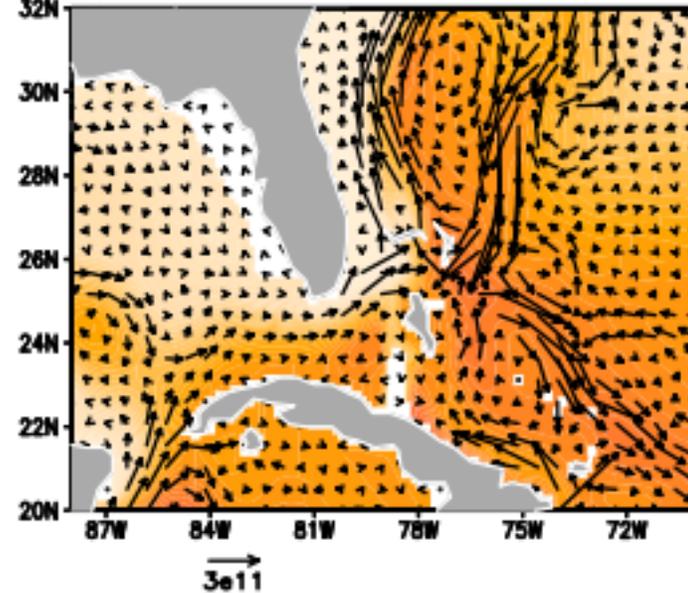


Vertical cross section of the meridional flow (ms⁻¹) through the Yucatan Channel from a) SODA ocean reanalysis, b) CTL and c) EXP integrations.

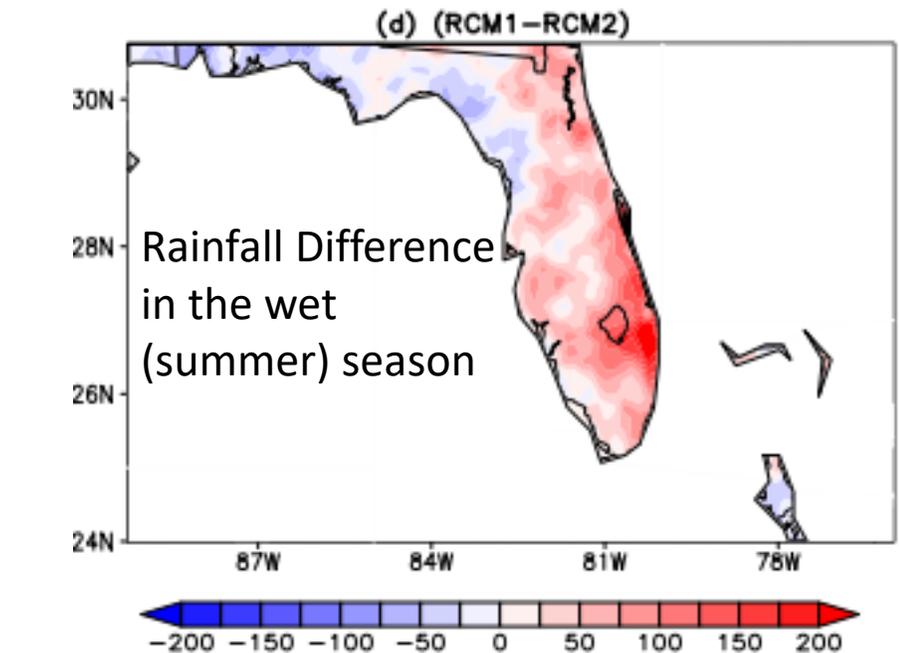
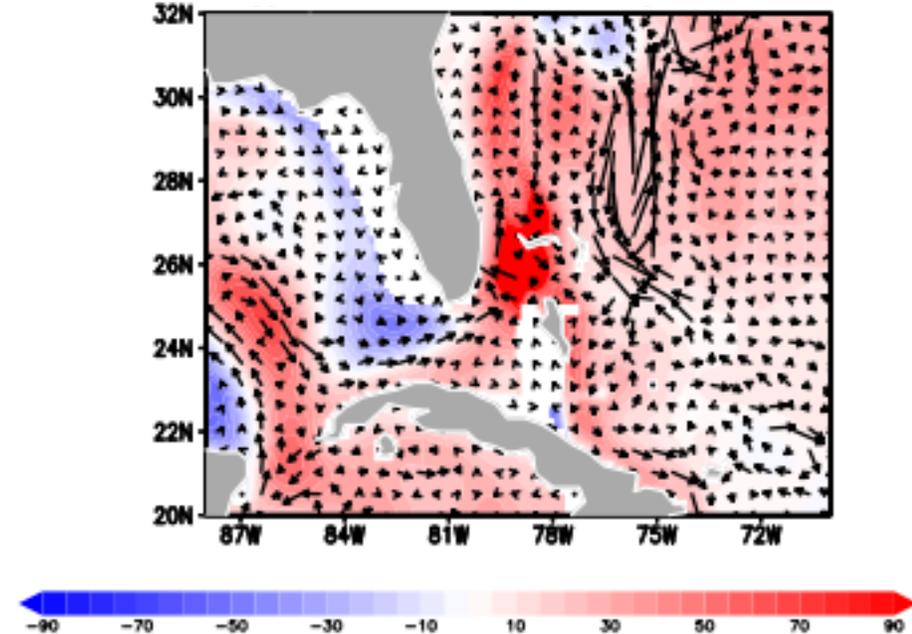
Model simulation with strong currents



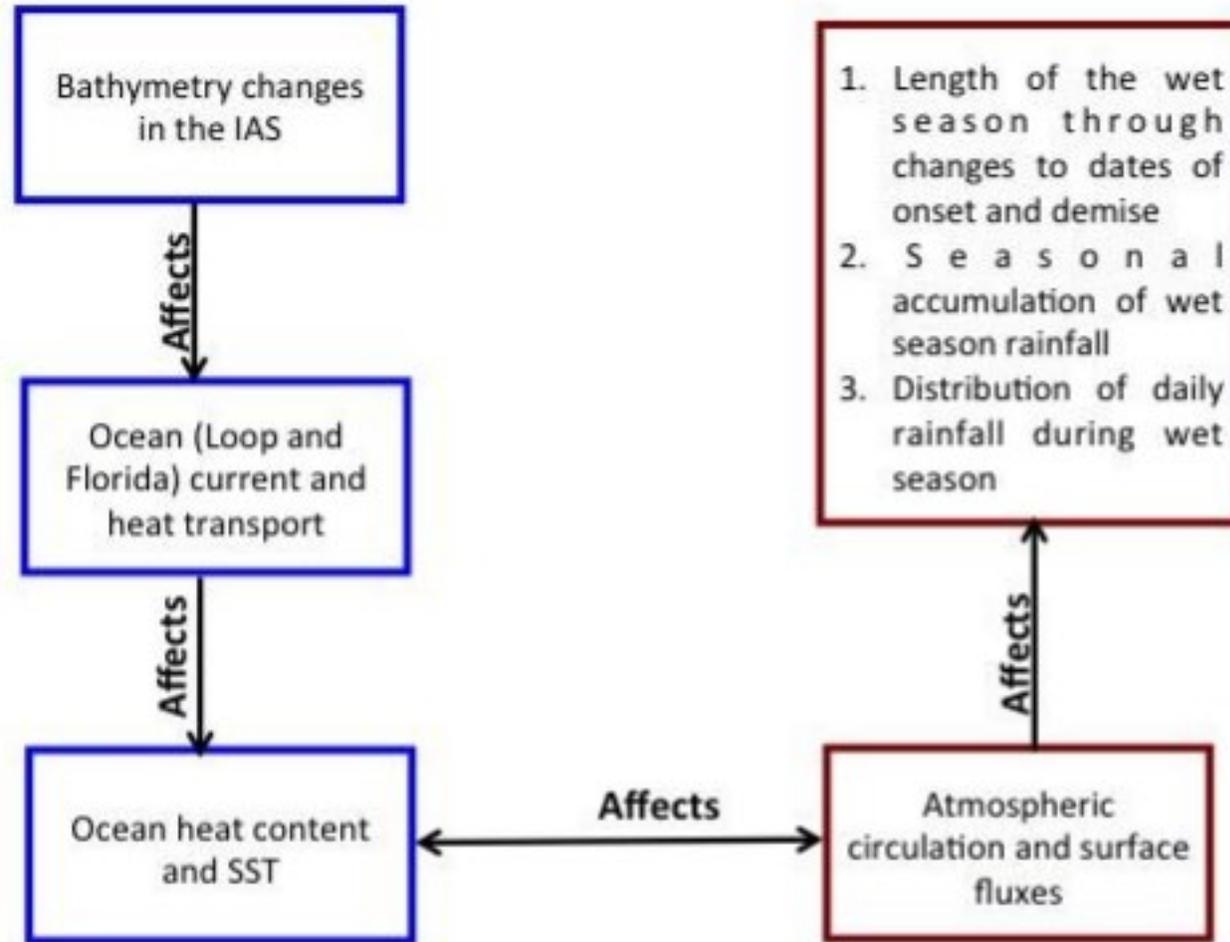
Model simulation with weak currents



Heat content and heat transport

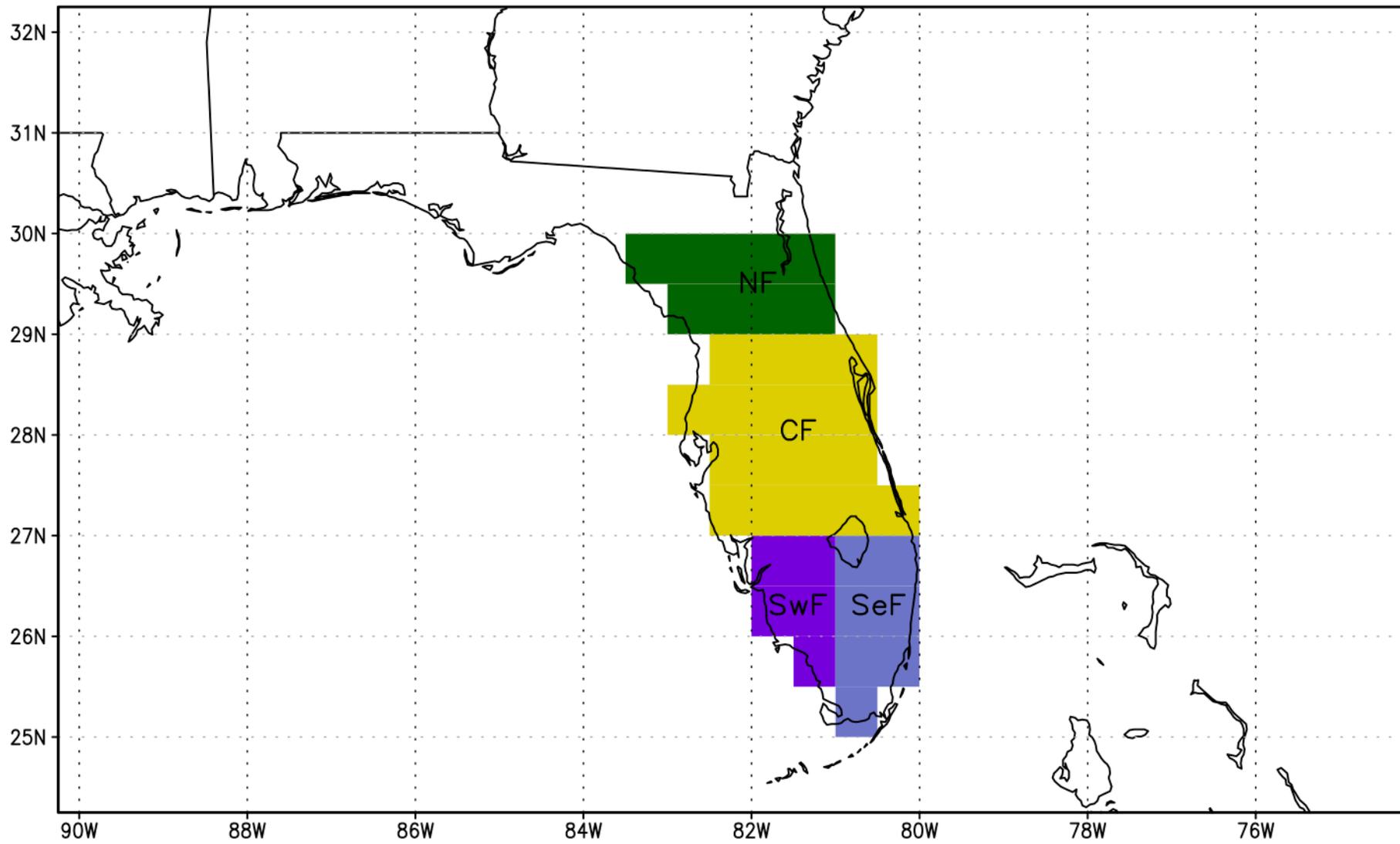


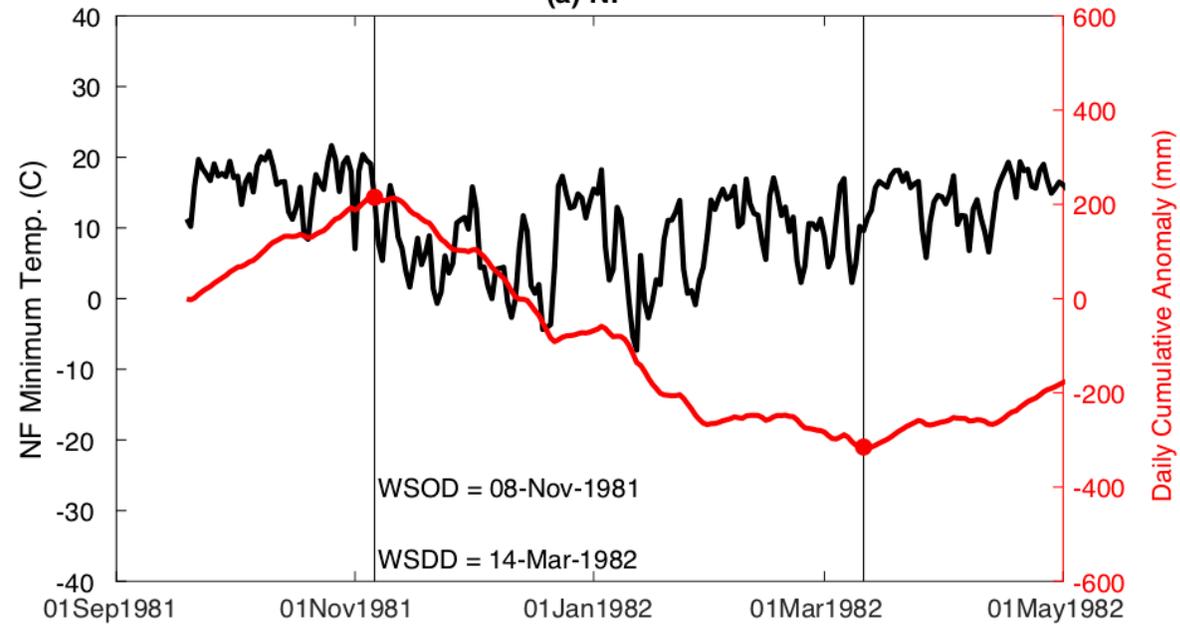
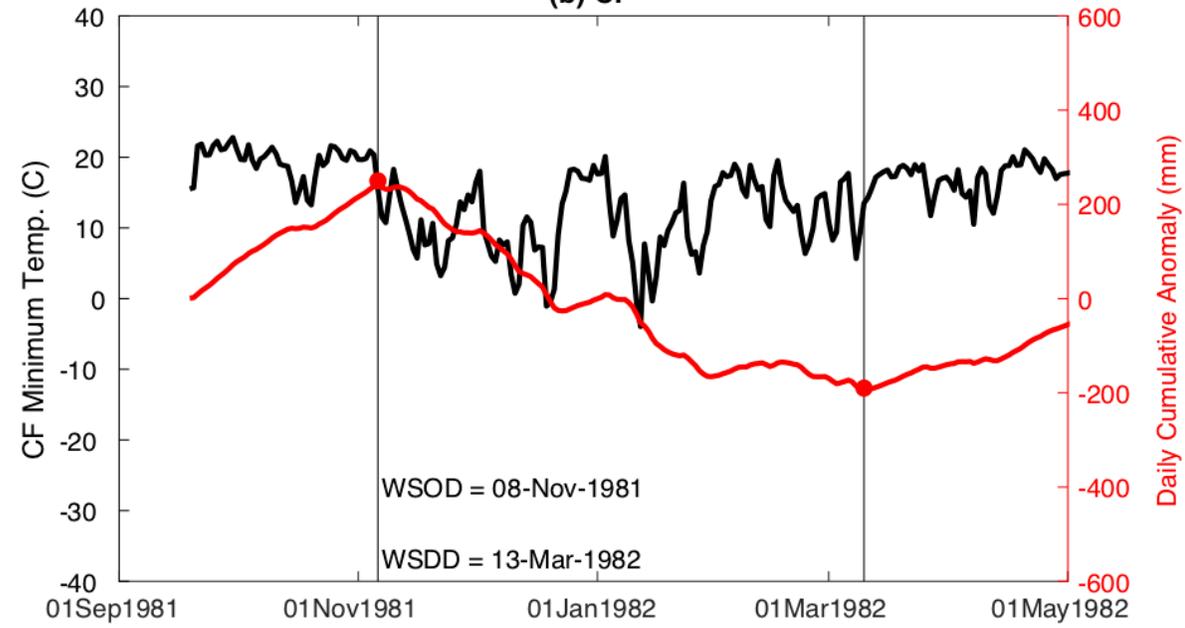
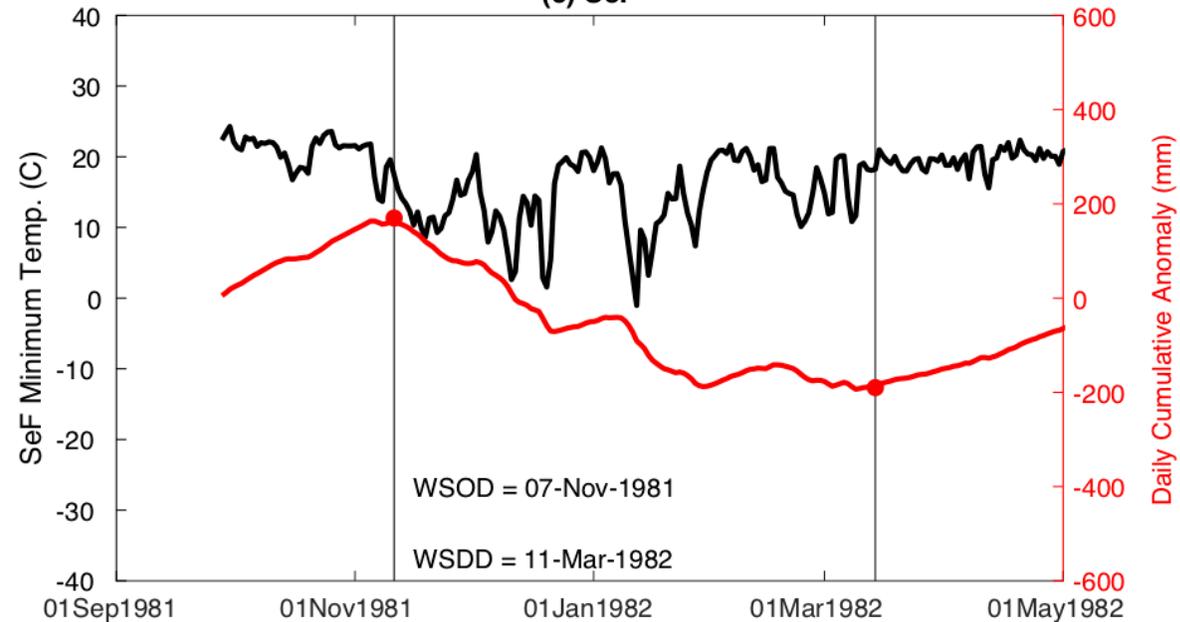
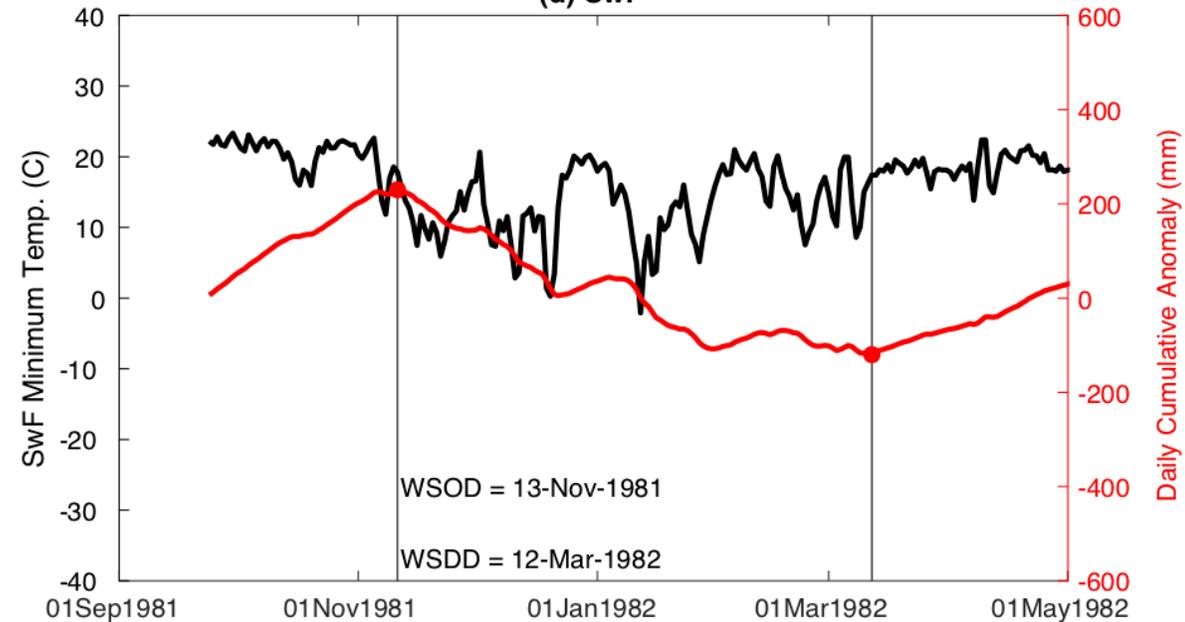
Feedback loop of the Florida Monsoon hydroclimate with the ocean

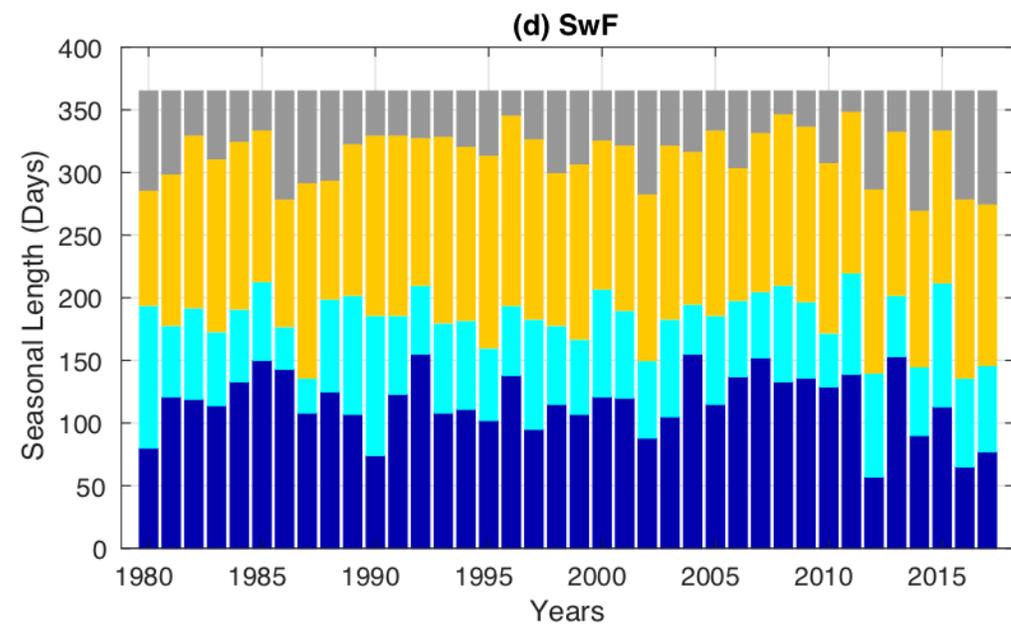
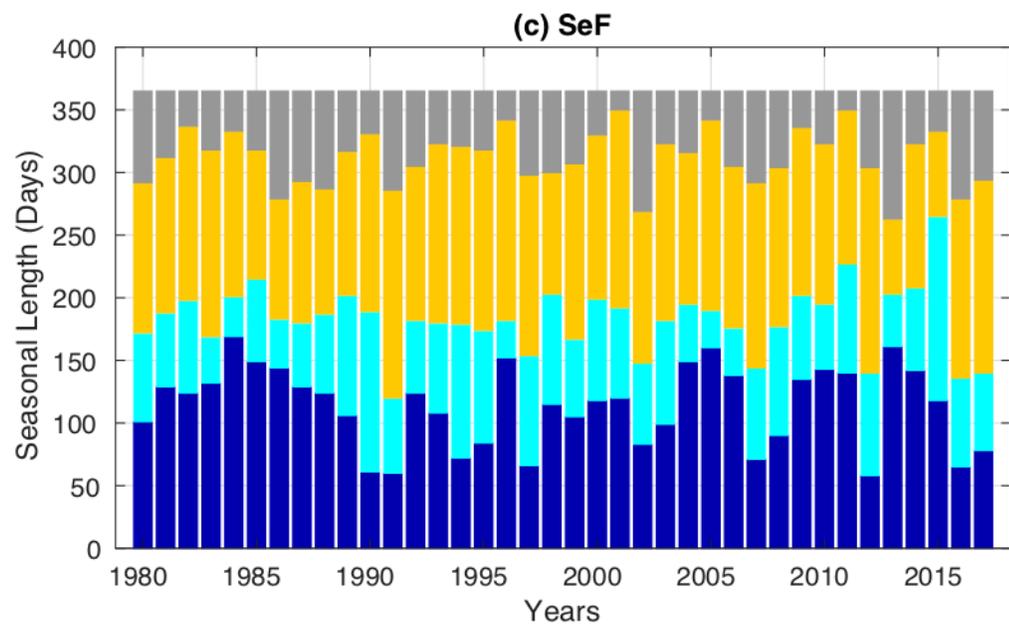
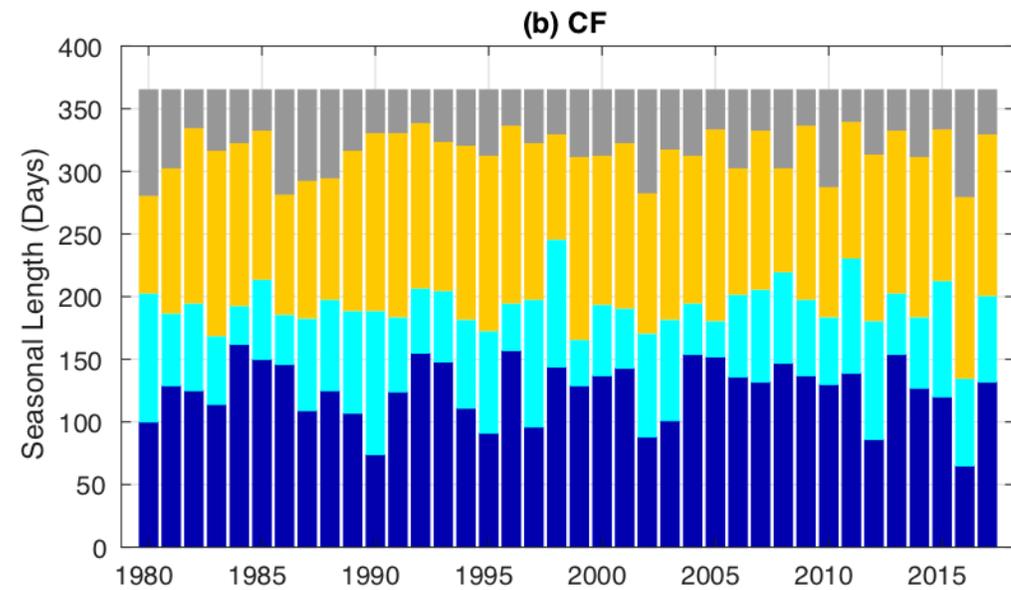
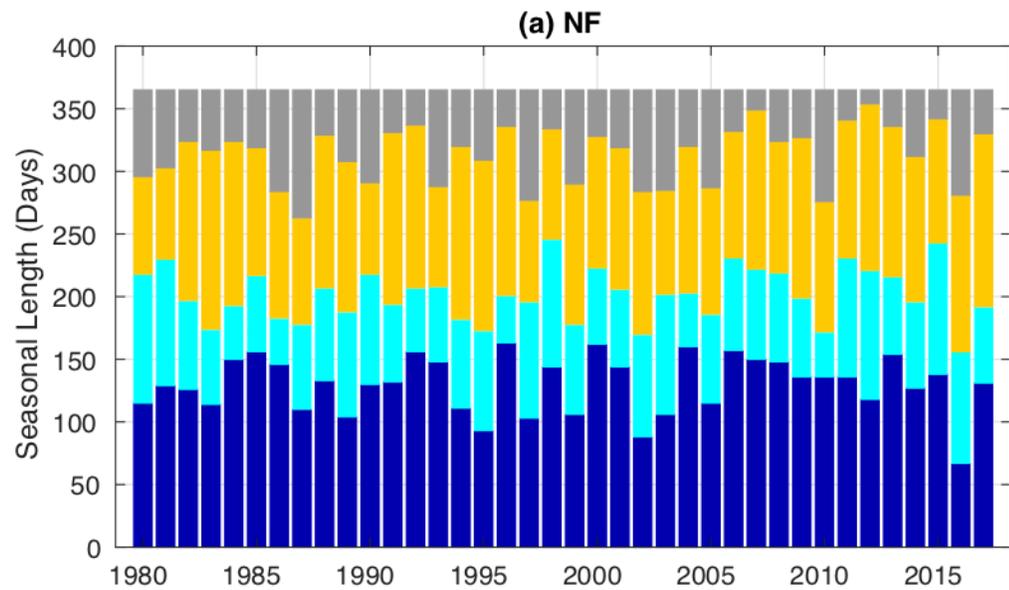


The varying seasonal lengths of Peninsular Florida

- The four seasons of the year in Peninsular Florida are not fixed by calendar months
- The four seasons of the year have varying seasonal lengths

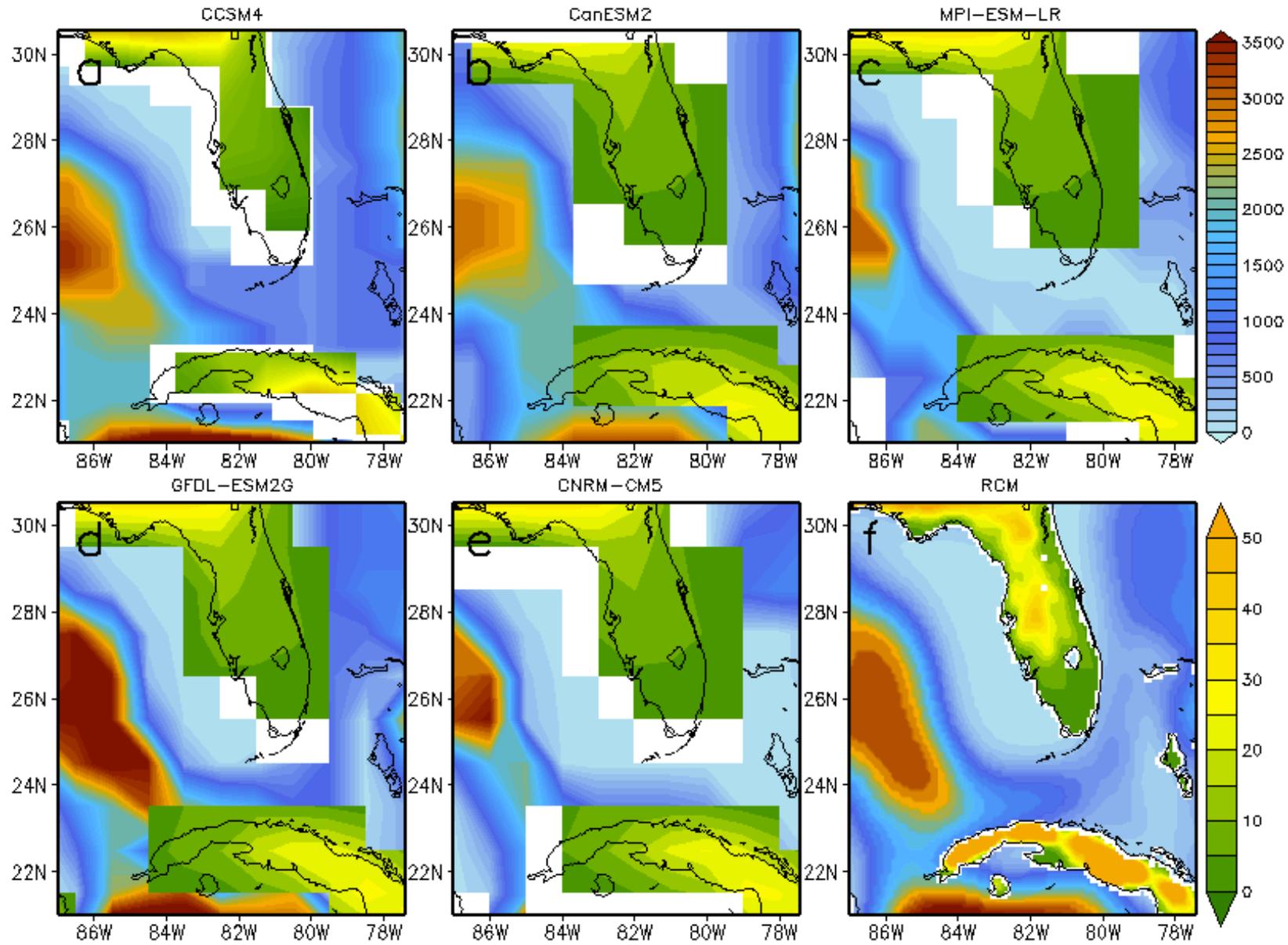


(a) NF**(b) CF****(c) SeF****(d) SwF**

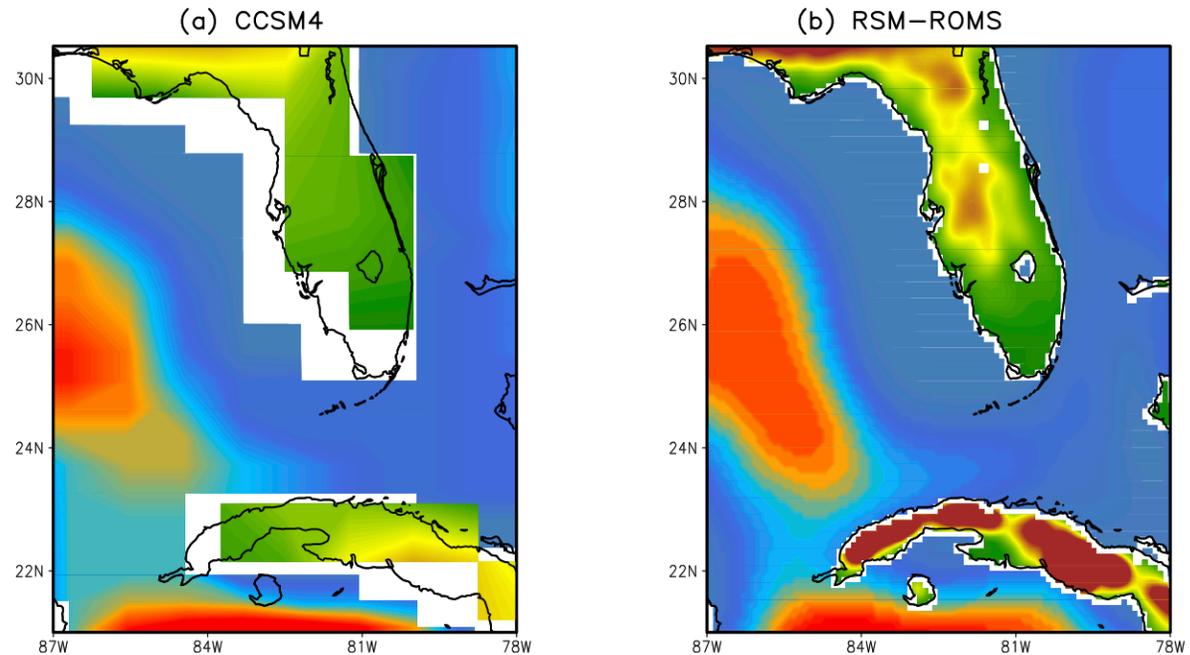


The challenge that Florida's climate poses

The challenges of the global model spatial resolution



How is the future climate changing?

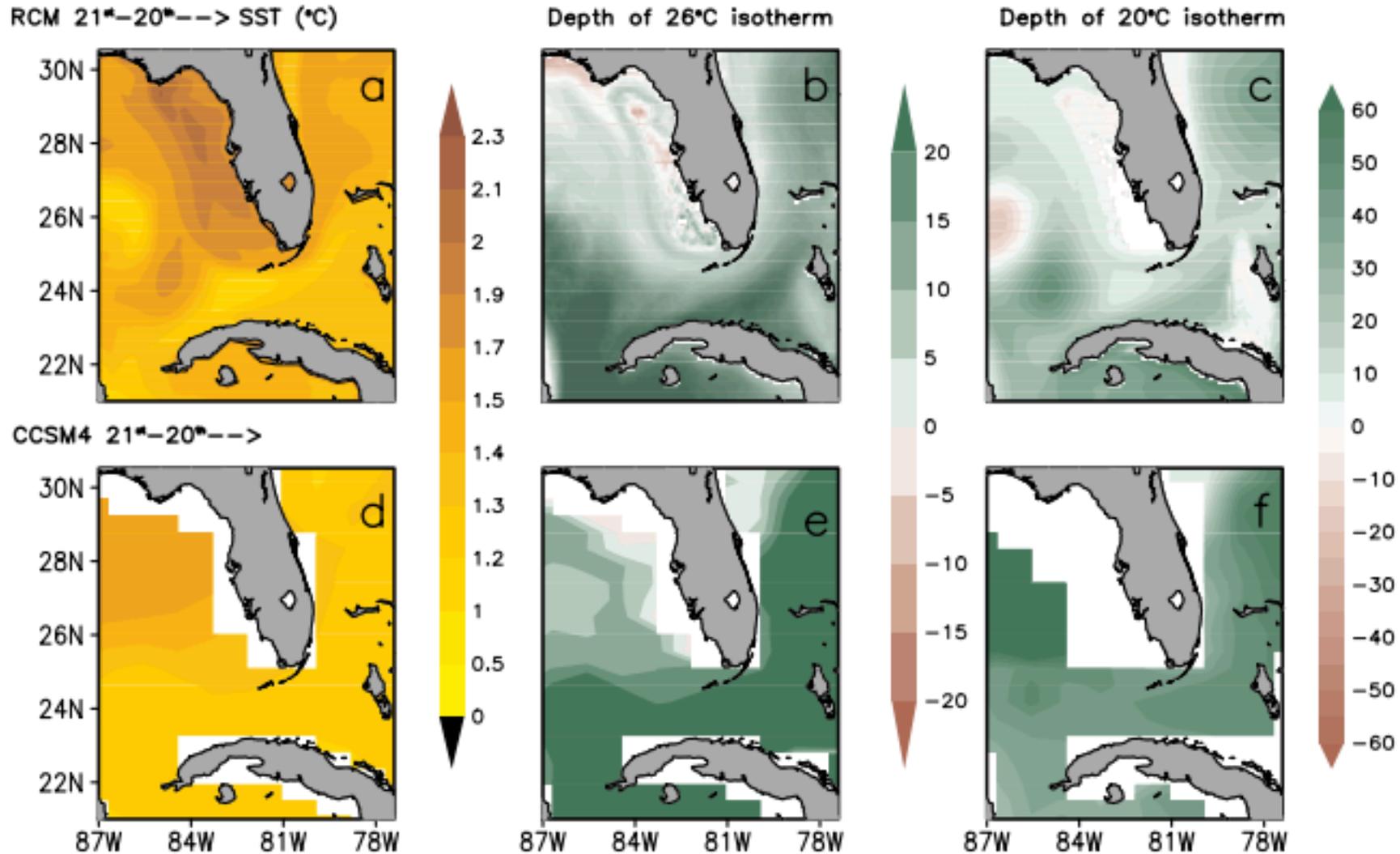


Grid spacing: 139km x 100km for land
123km x 45km for ocean

Grid spacing: 10km x 10km

How is the future climate changing?

RCM@10km: Significantly warm in the West Florida Shelf in the mid-21st century



CCSM4: Mild warming of the upper oceans in the mid-21st century

Fig. 6. The projected annual mean climatological (2041–2060) difference from the mean current climate (1986–2005) for (a, d) SST (°C), (b, e) depth of the 26 °C isotherm, and (c, f) depth of the 20 °C isotherm (in meters).

How is the future climate changing?

RCM@10km: Significantly dry over Peninsular Florida in the mid-21st century

CCSM4: Insignificant to moderate increase in in the mid-21st century

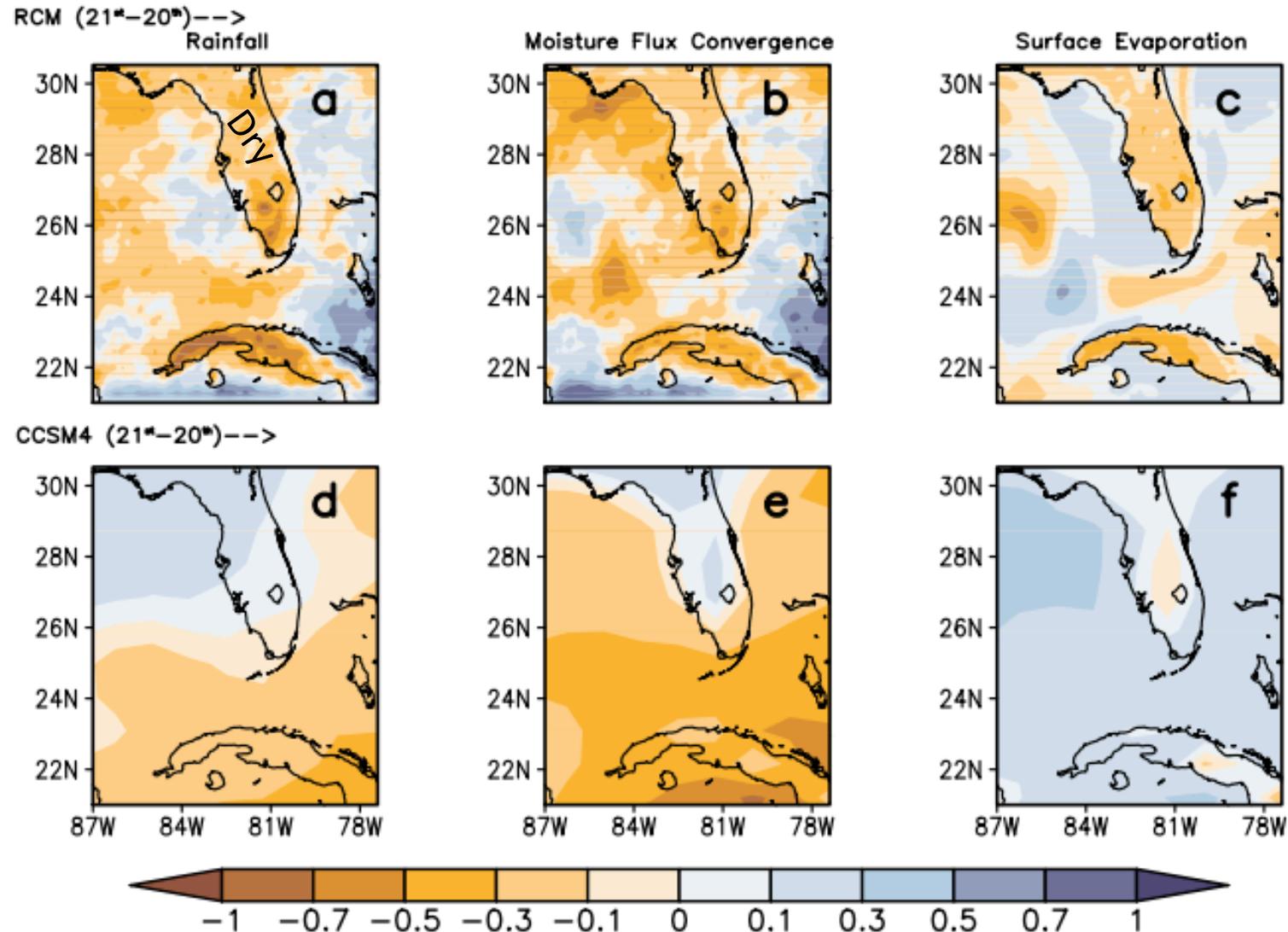
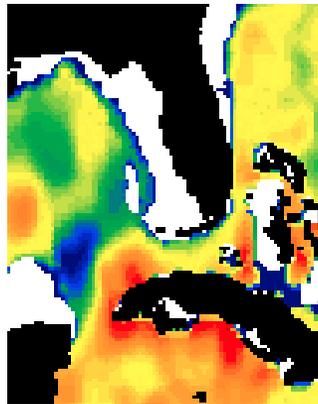
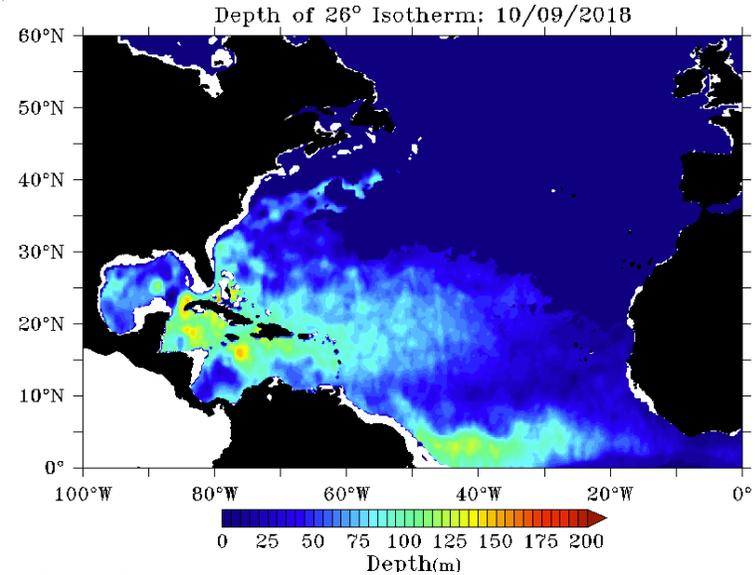
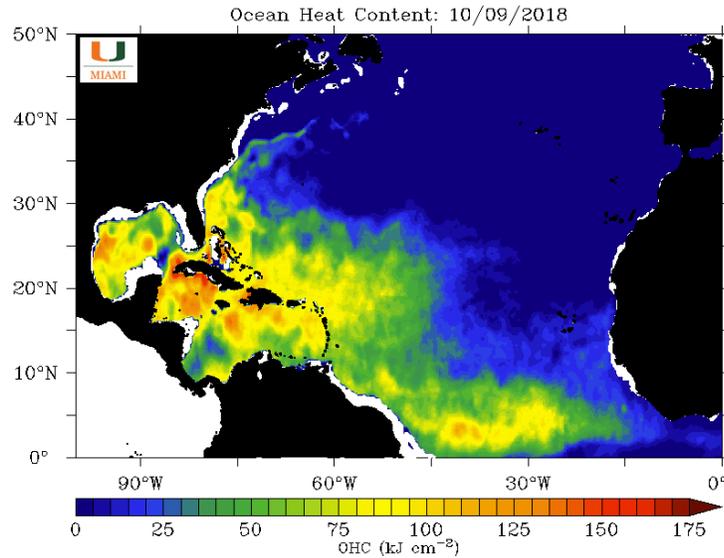
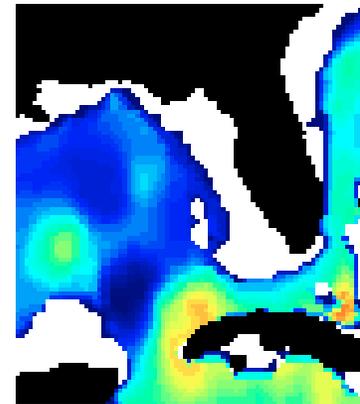


Fig. 5. The projected annual mean climatological (2041–2060) difference from the mean current climate (1986–2005) for (a, d) rainfall (mmday^{-1}), (b, e) moisture flux convergence (mmday^{-1}), and (c, f) surface evaporation (mmday^{-1}) from (a, b, c) RCM and (d, e, f) CCSM4 simulations.

Hurricane Michael, 10/10/2018



The warming in the West Florida Shelf is reminiscent of the warming expected from increased radiative forcing from increased greenhouse gas emissions by 2060.



How is the future climate changing in Florida?

- The surface temperature is projected to increase by approximately 4⁰F to 8⁰F by 2100
- Vulnerability to heat waves, days with maximum temperatures exceeding 95⁰F is projected to increase
- Disruptions to essential services on account of the projected increase in frequency of severe weather impacts are going to raise the vulnerability of the population

How is the current climate changing?

Impact of urbanization

1. Urban areas throughout Florida Peninsula are experiencing shorter, increasingly intense wet seasons relative to rural areas; We find that wet season length has decreased by about three and half hours per year in Florida's most urban areas compared to its most rural areas in the last 40-60 years.
2. We find that wet season length has decreased by about three and half hours per year in Florida's most urban areas compared to its most rural areas in the last 40-60 years.
3. The linear trends of T_{\min} in urban areas of the SE united States including Florida show warming of approximately 7°F/century compared to 5.5°F/century in rural areas

Conclusions

- Florida displays a robust seasonal cycle that manifests both in the oceanic and atmospheric variables
- The variations of the seasonal length in Florida is an important parameter to monitor in a changing climate
- Most climate models do a very poor job of simulating the ocean circulations around Florida; as a result summer climate is affected and the potential influence on weather extremes (e.g. hurricanes)
- Land cover has subtle but significant impact on surface temperature precipitation trends.