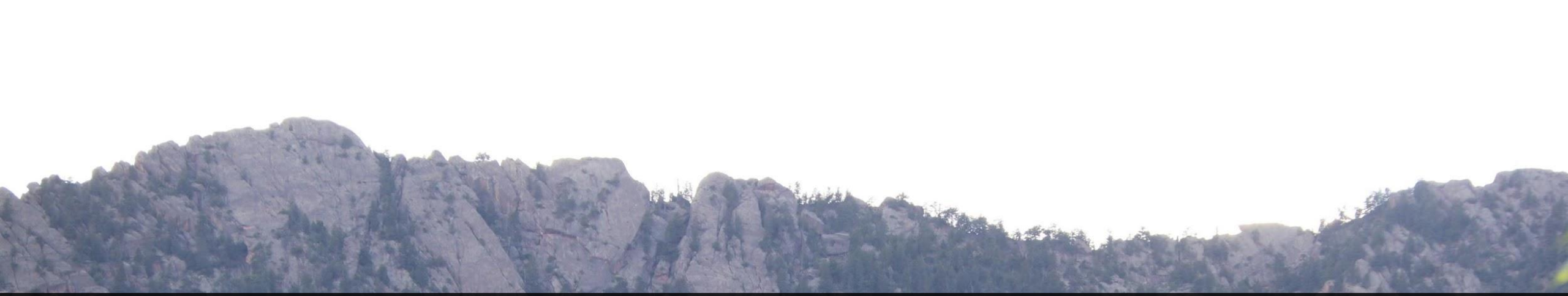

MESACLIP: Understanding the Role of MESoscale Atmosphere – Ocean Interactions in Seasonal-to-Decadal CLImate Prediction

THE 29th ANNUAL CESM WORKSHOP

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TAMU: Xue Liu, Greta Olson, Xiaoqi Wang, Gaopeng Xu, Qiuying Zhang

11 JUNE 2024

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CESM High-Resolution Simulations (CESM1.3; 0.1° ocn; 0.25° atm)

500-year PI control;

80-year 1%CO_2; 150-year 4xCO_2;

10-member (1850) 1920-2100 transient w/ RCP 8.5;

10-member 2005-2100 transient w/ RCP6.0;

1-member 2005-2100 transient w/ RCP4.5;

1-member 2005-2100 transient w/ RCP2.6;

3-member 1970-2020 Ozone withholding;

3-member 1950-2014 AMIP;

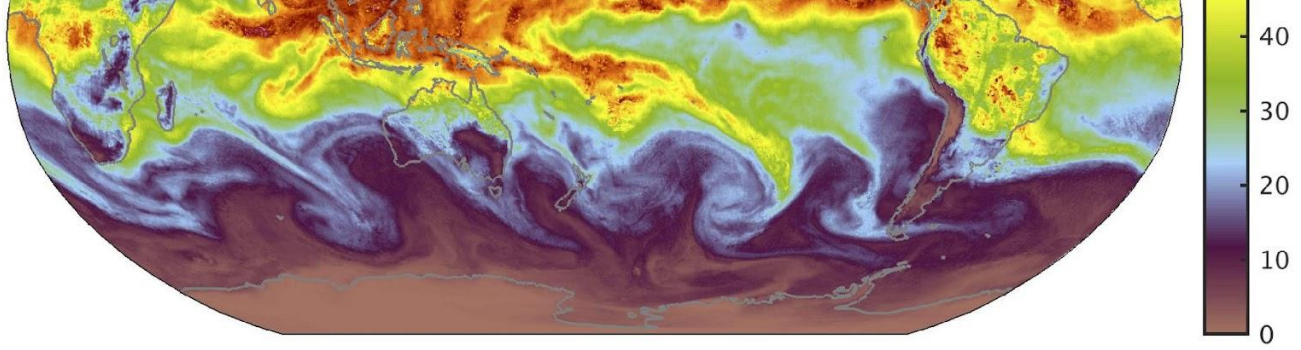
All HighResMIP coupled and AMIP;

5 cycles of 1958-2018 OMIP (w/ BGC);

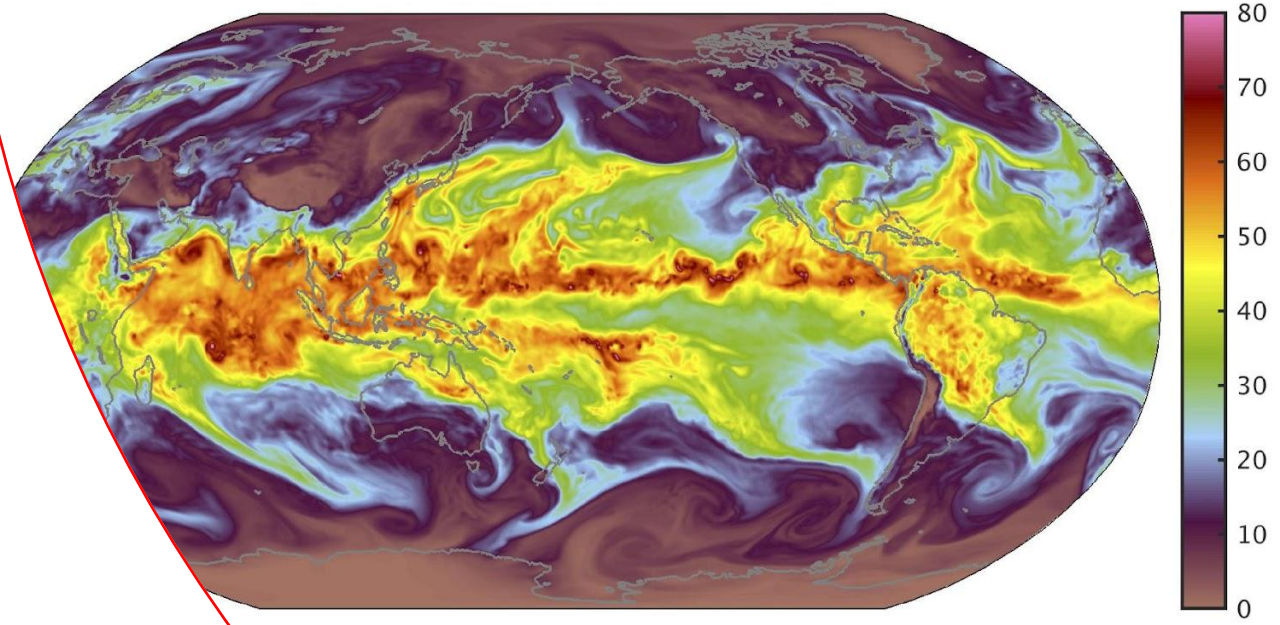
Decadal Predictions (1980-2023; HRDP); and

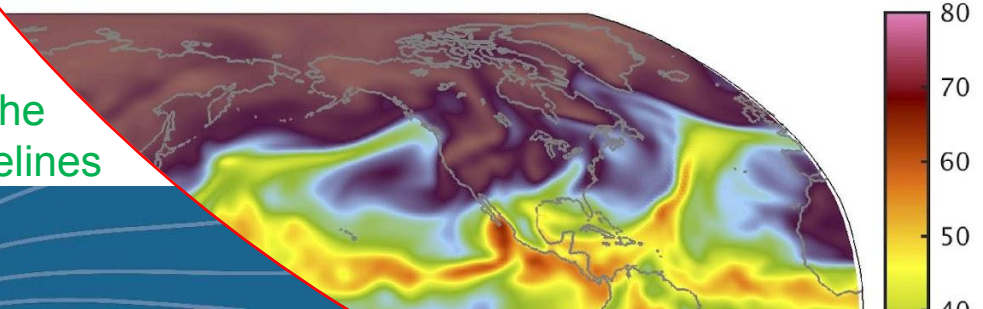
(PaleoCWG: 60-year high- and low-CO_2 past periods)

https://project.cgd.ucar.edu/projects/MESACLIP/



Vertically Integrated Water Vapor (IWV, in mm)





Chang et al. (2020, JAMES)

Datasets are becoming available to the community following the CESM guidelines

★★★

REPORT TO THE PRESIDENT

Extreme Weather Risk in a Changing Climate: Enhancing prediction and protecting communities

Executive Office of the President

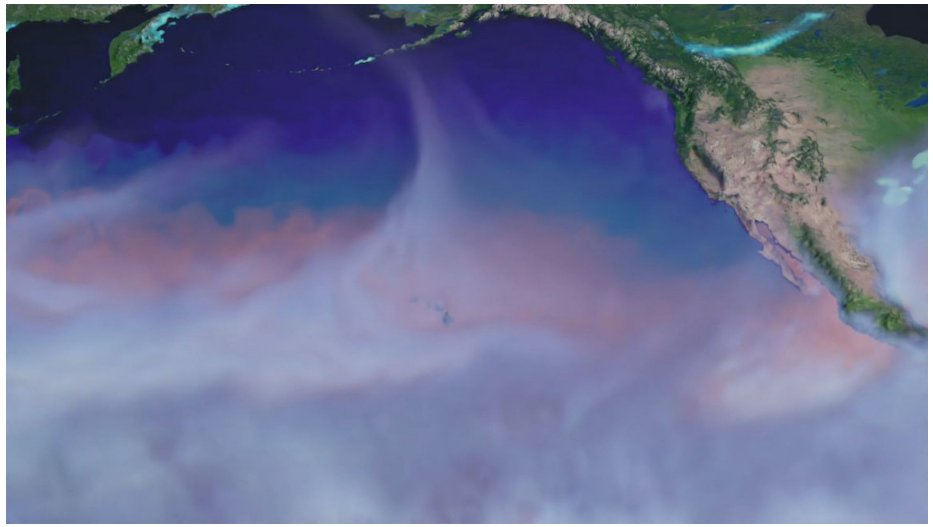
President's Council of Advisors on Science and Technology

April 2023

Report recommends:

- "*A focused federal effort to provide estimates of the risk that a weather event of a given severity will occur in any location and year between now and midcentury.*"
- Large multi-model ensembles (> 100 members) of climate simulations at **10 - 25 km resolution spanning the 20th century and extending through 2050**, consisting of simulations from various modeling centers.

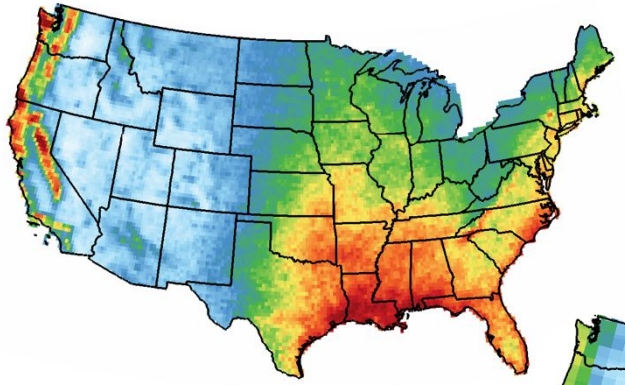
In response to the Report, NSF-NCAR (CGD & MMM) in collaboration with TAMU is providing global 6-hourly output of key variables used to identify and track extreme weather events.



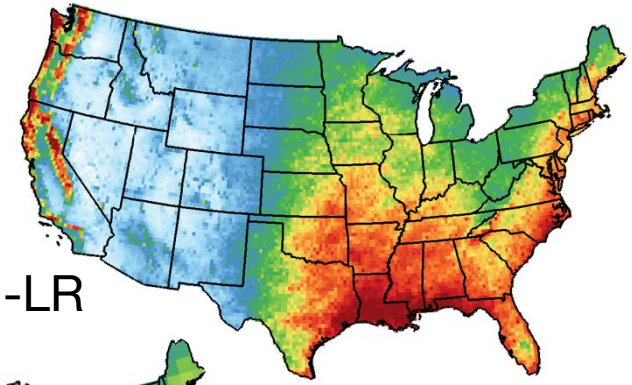
Atmospheric rivers and induced precipitation in CESM-HR (credit: Matt Rehme, CISL Vis Lab)

1981-2020 Winter-Time Extreme Daily Precipitation over US

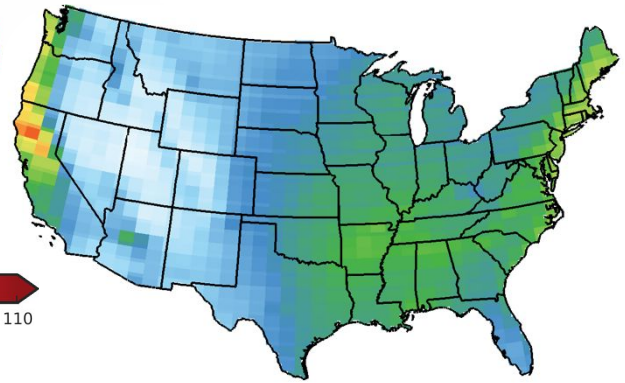
NOAA CPC observation

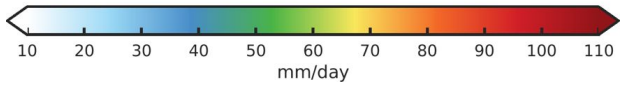


PRISM 4-km observation

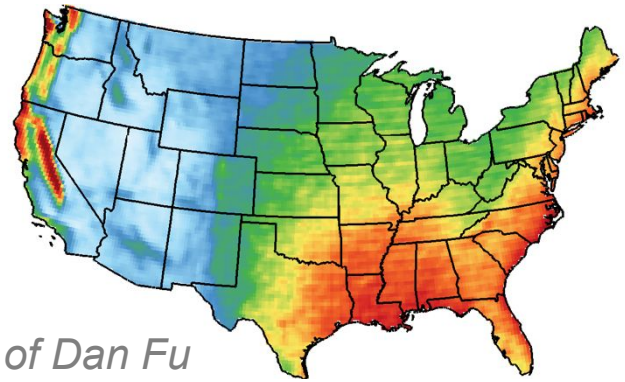


100-km CESM-LR

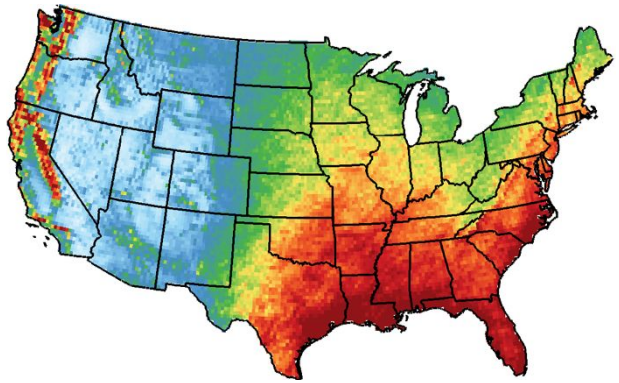


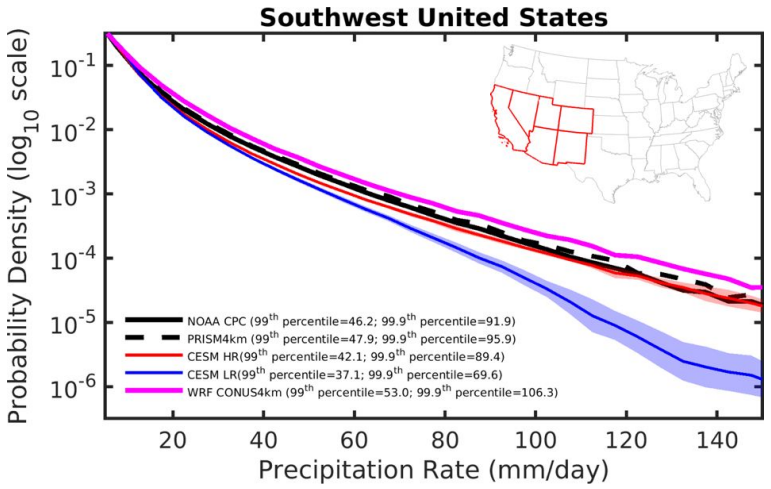


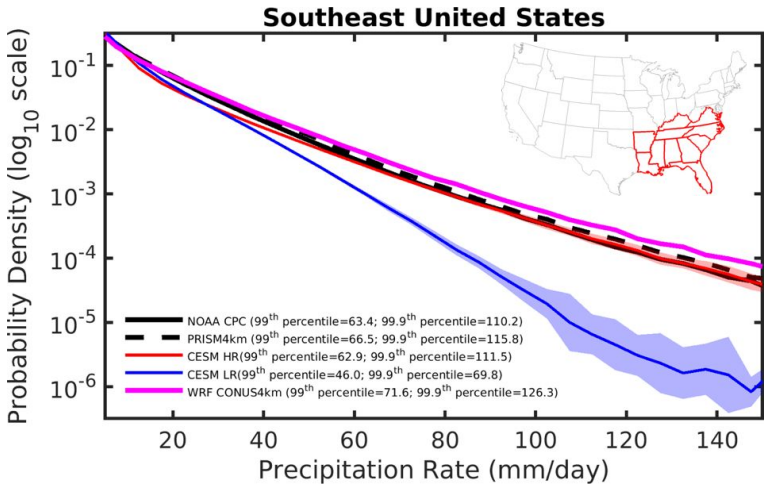
25-km CESM-HR



WRF 4-km Rasmussen et al. (2023)



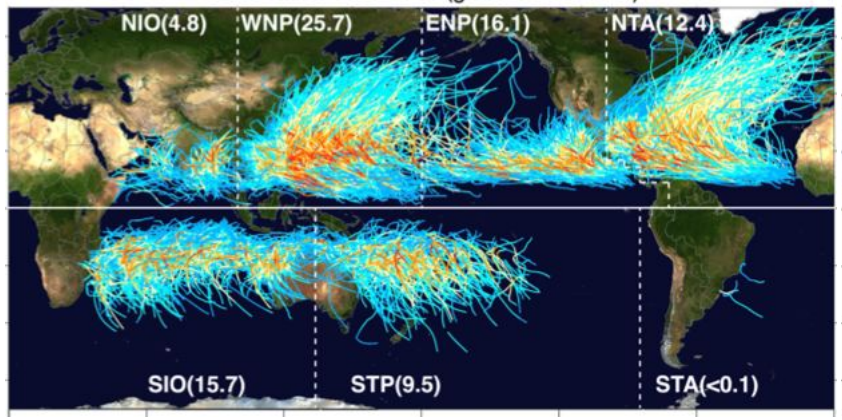




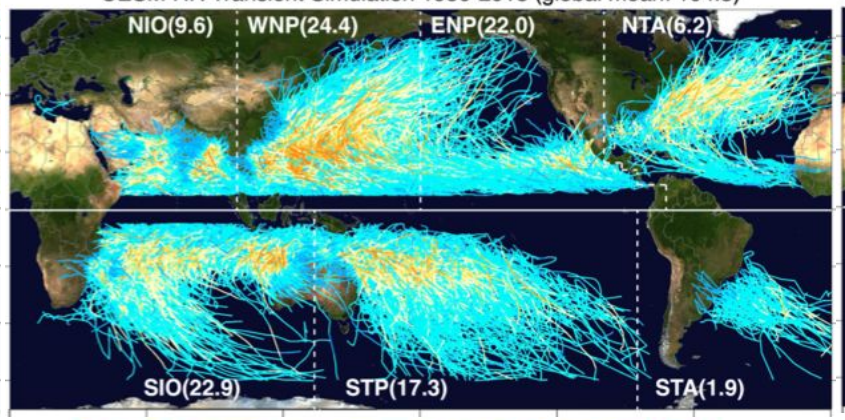
Courtesy of Dan Fu

Tropical Cyclones (TCs)

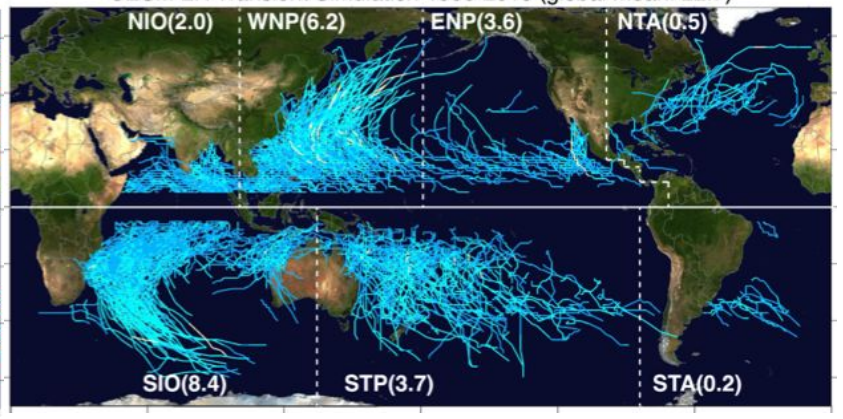
IBTrACS Observations



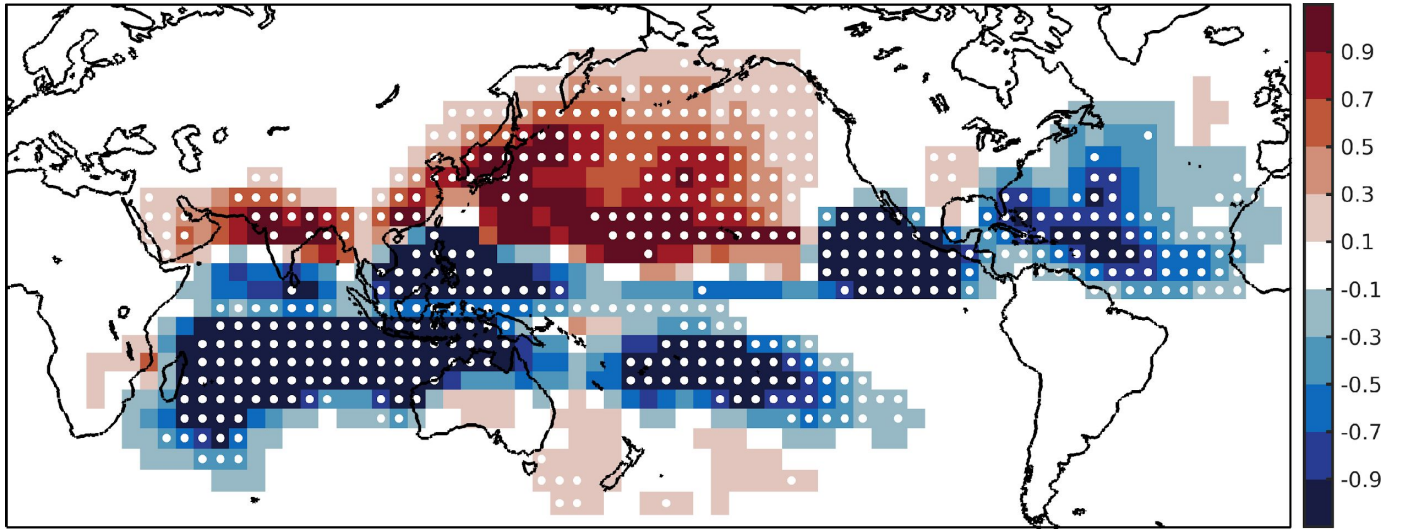
CESM HR



CESM LR

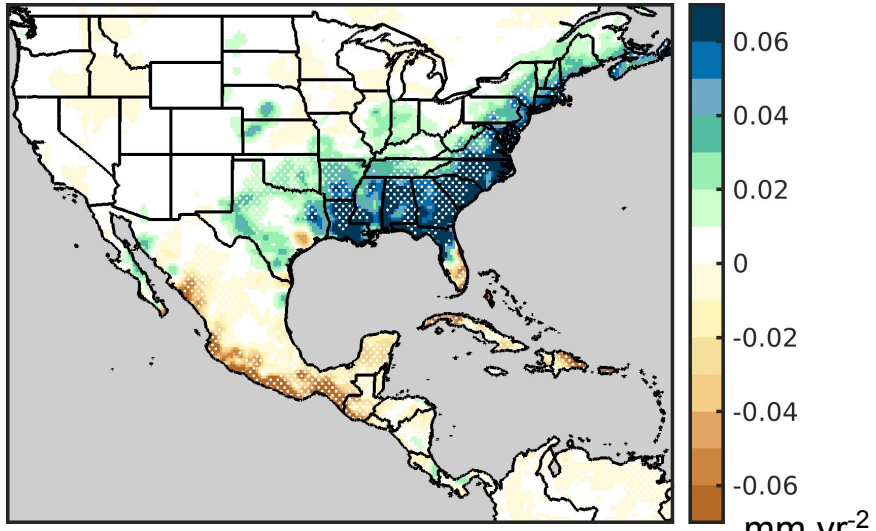


Change in TC Occurrence (2070-2100 minus 1950-1980)



Fu et al. (2025, in preparation)

Trend of Annual-Mean TC-Induced Rainfall (1980-2100)



SST Linear Trend (1980-2022) in Each Ensemble Member