

Reflections on future heavy precipitation

Greg Carbone, Peng Gao, Junyu Lu, Aashka Patel

Department of Geography & Carolinas Integrated Sciences and Assessments
University of South Carolina



Outline

Reasons to expect heavier precipitation

Lessons from the recent observed record

Challenges with climate models

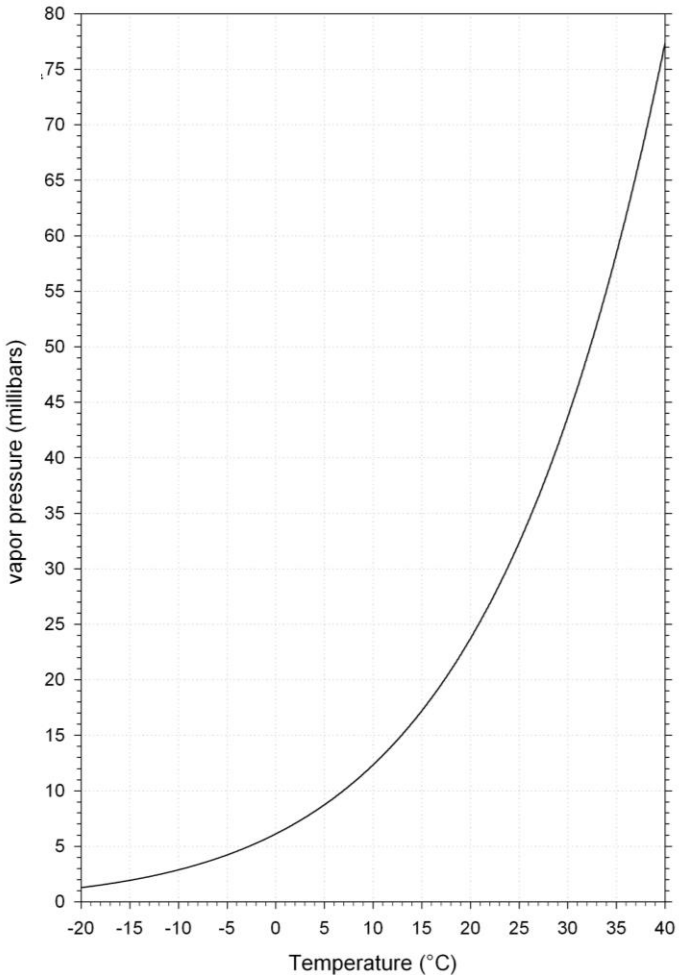


Scaling of intense precipitation:

+7% per 1°C

Com

-
-
-

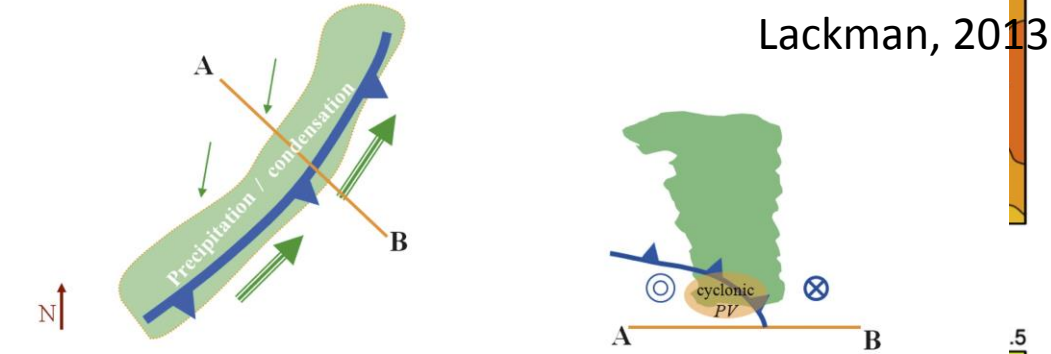


temperatures?

h?

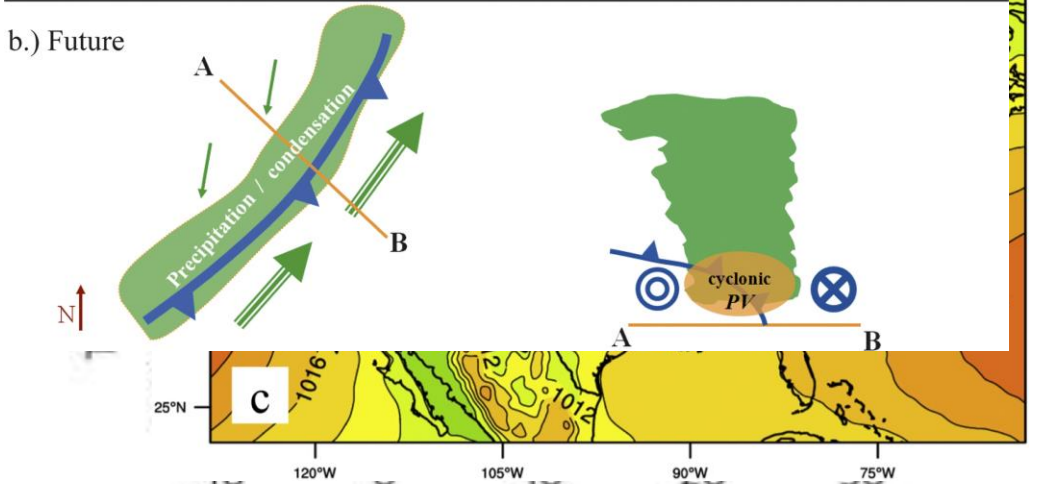
a

a.) Current



Lackman, 2013

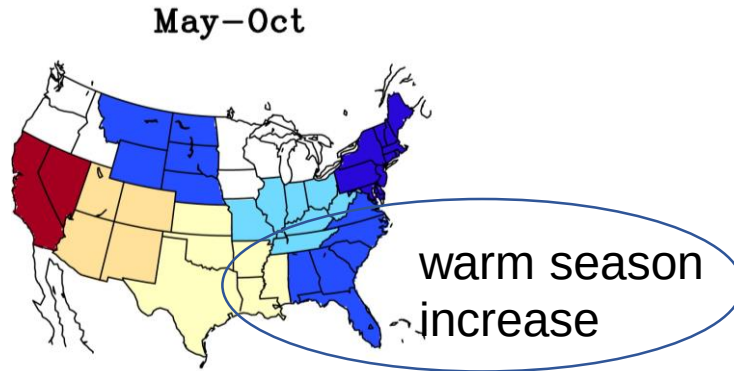
b.) Future



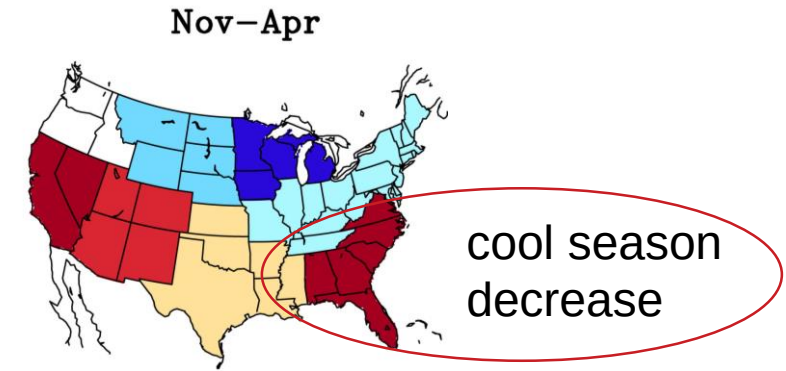
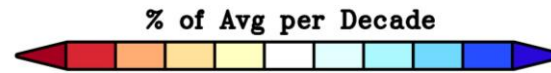
Ferreira et al., 2018

Prein et al., 2017

Changes in heavy precipitation, 1979-2013

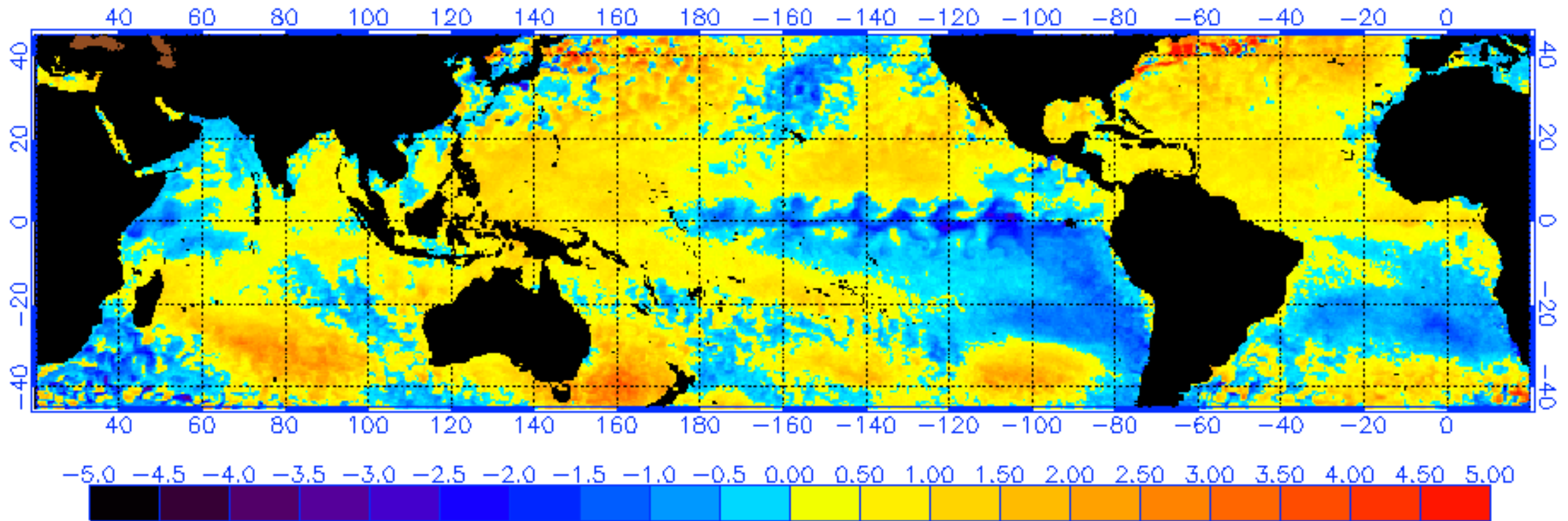


Observed
1979-2013



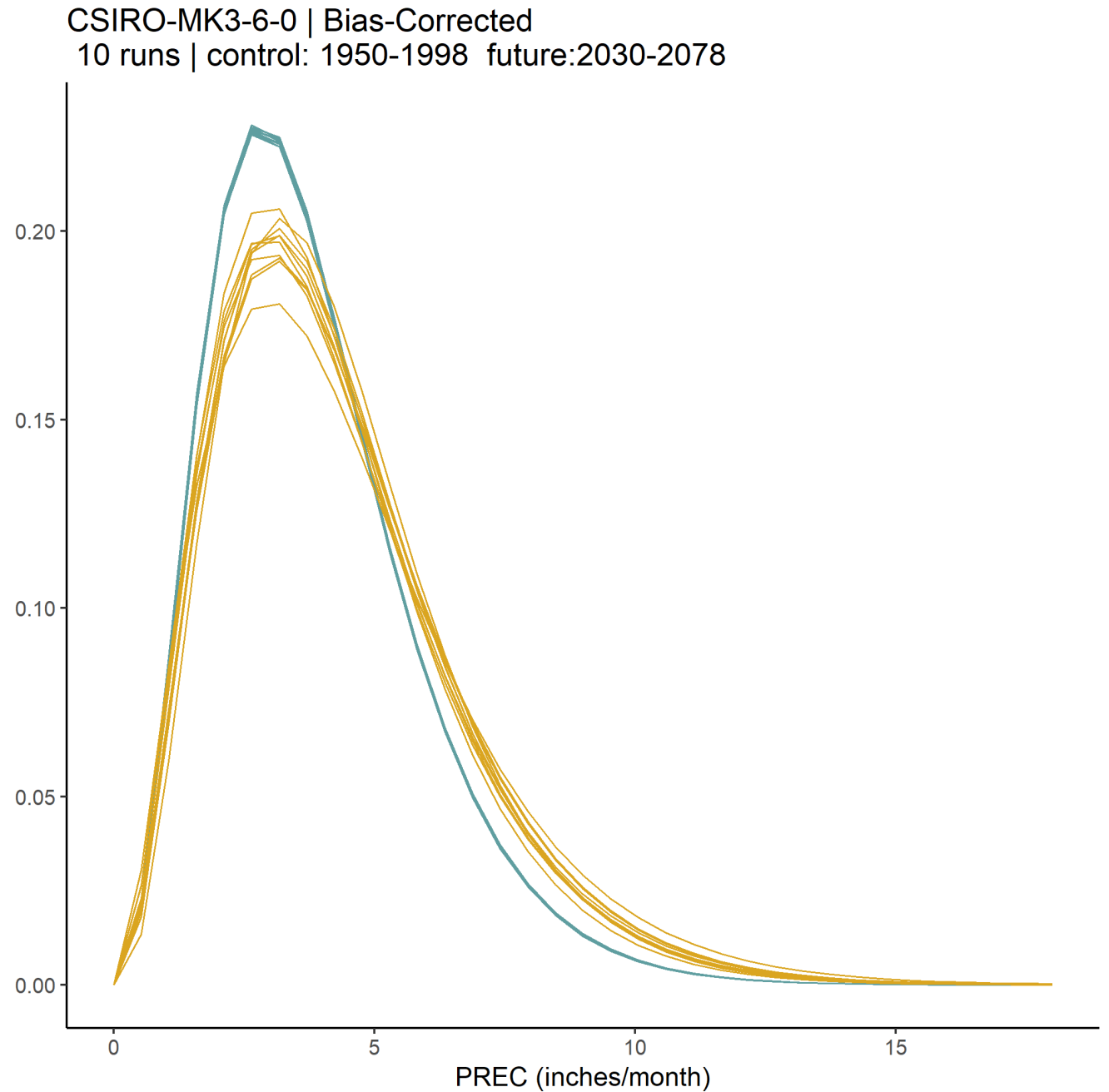
Observed recent heavy precipitation changes can be largely explained by interannual/interdecadal variability

NOAA/NESDIS SST Anomaly (degrees C), 1/1/2018



Climate Models

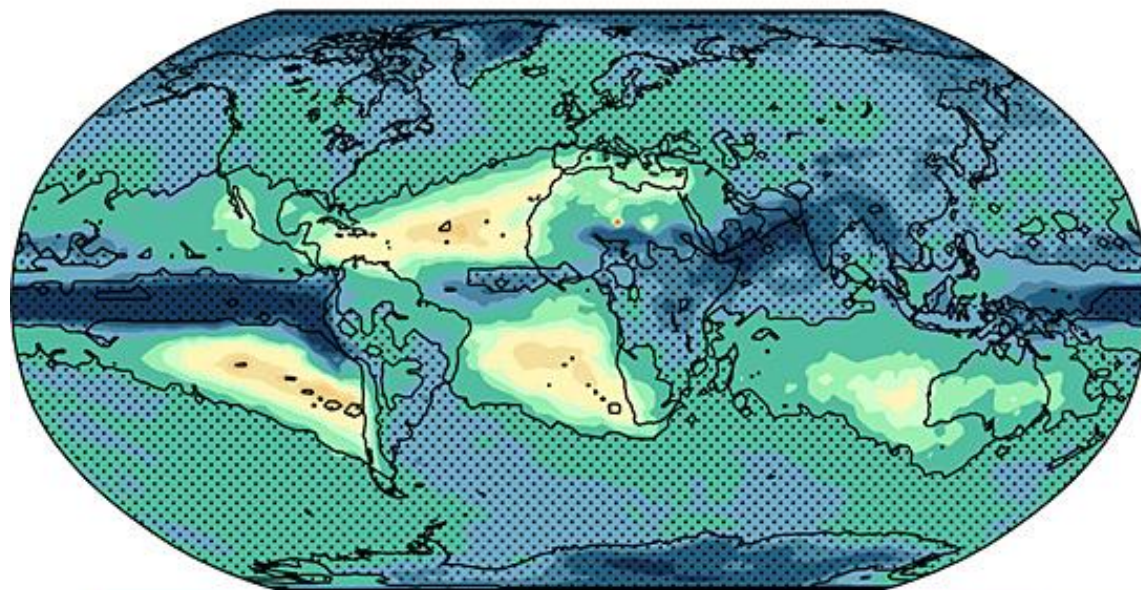
Some consistency
showing wetter
conditions



Model ensemble averages show some agreement in sign (+/-) of change

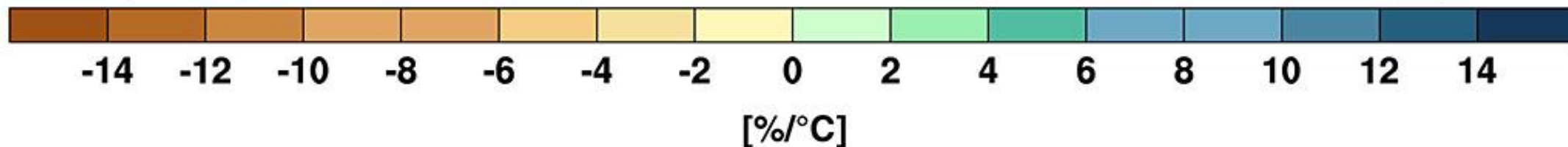
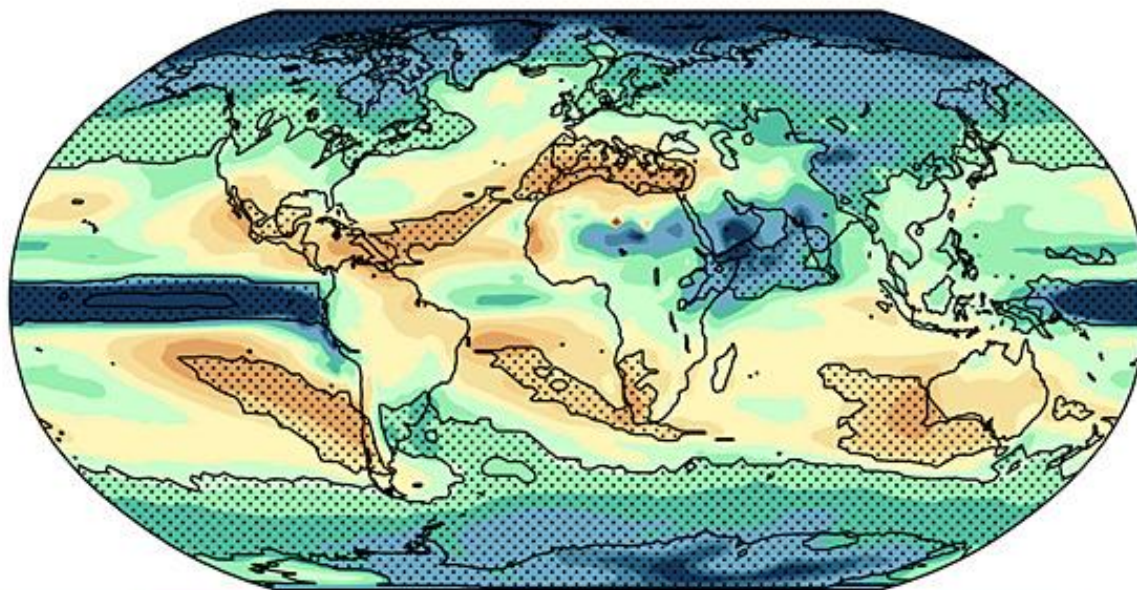
a) Change in heavy precipitation

Stippled area: 73.02%



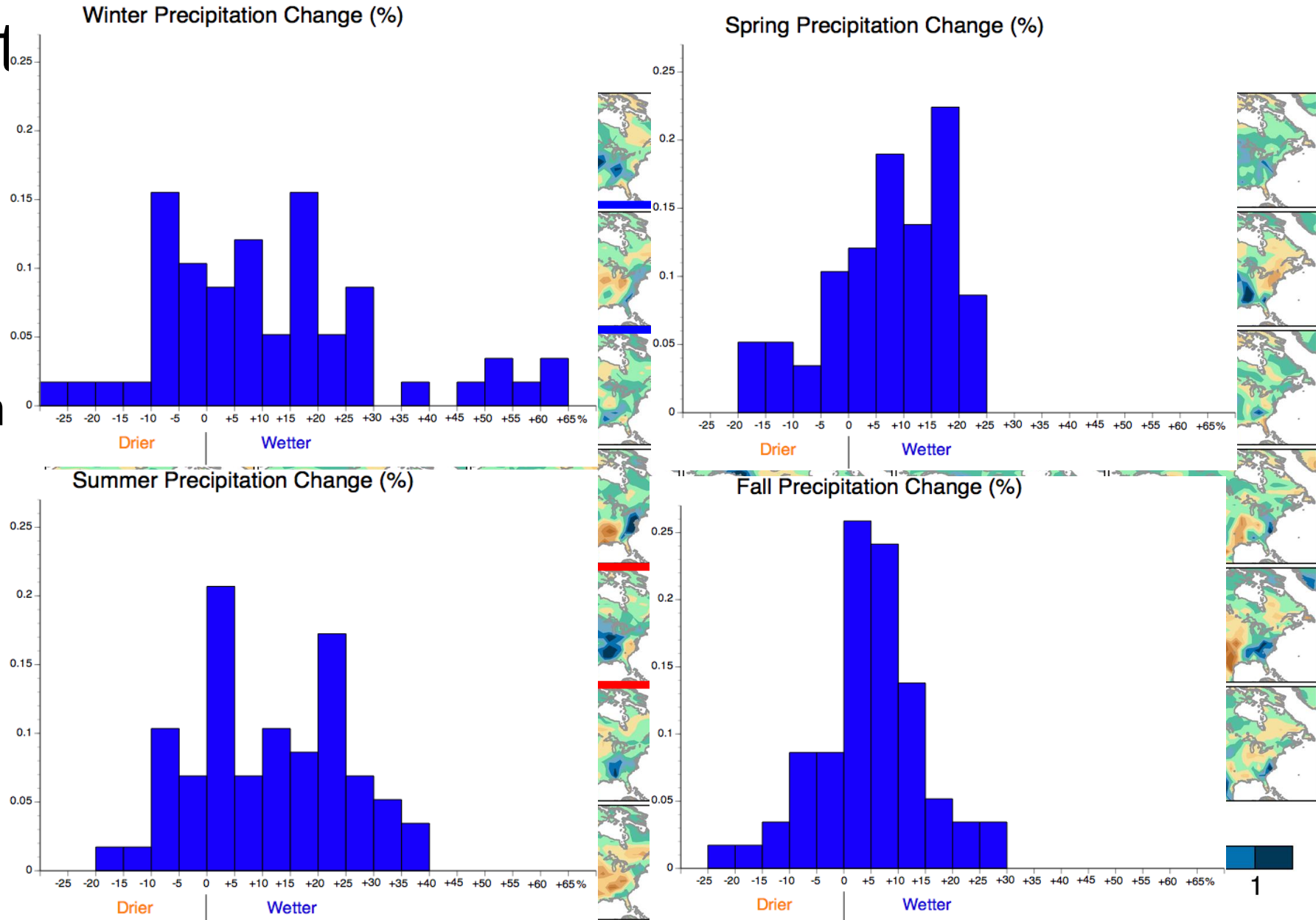
b) Change in annual mean precipitation

Stippled area: 27.36%

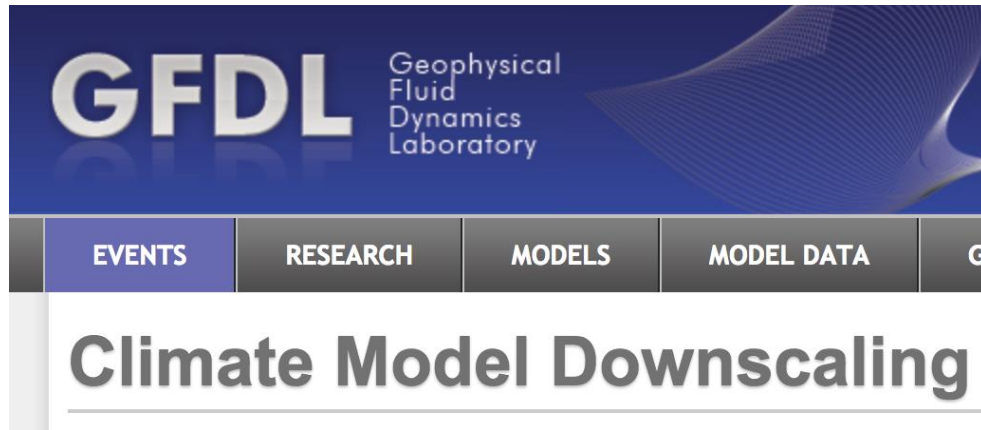


But projections differ across models and with

Projected
summer
precipitation
2010-2060

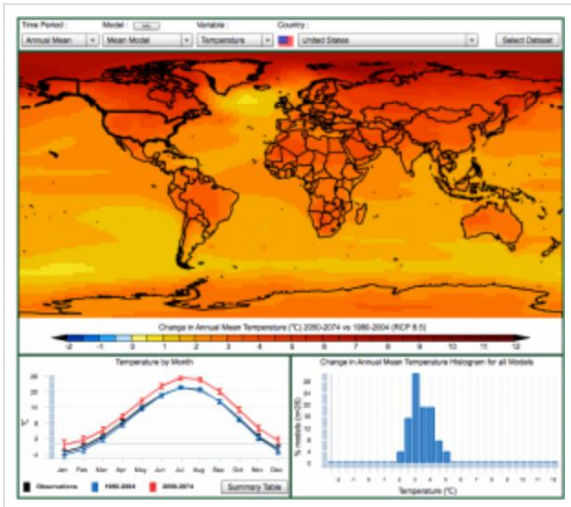


And then, there's downscaling!



GCCV

CMIP5 Global Climate Change Viewer



NARCCAP

Design your Own CSV File of MACA Point Data

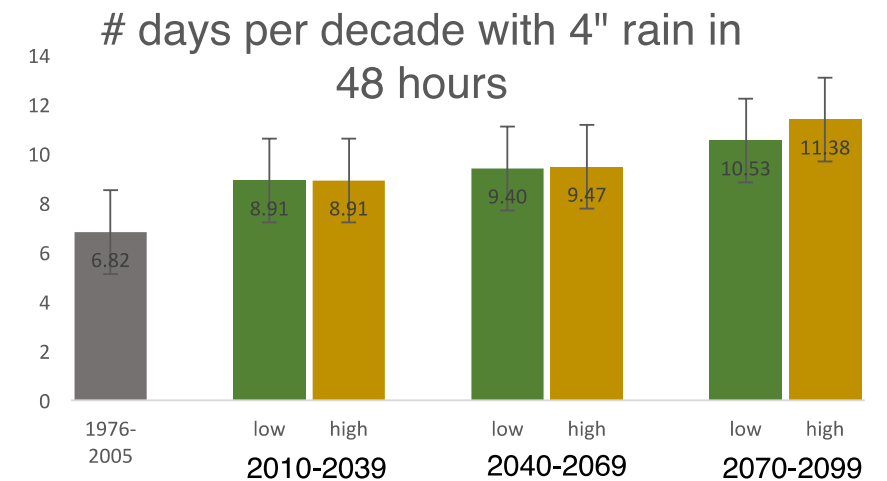
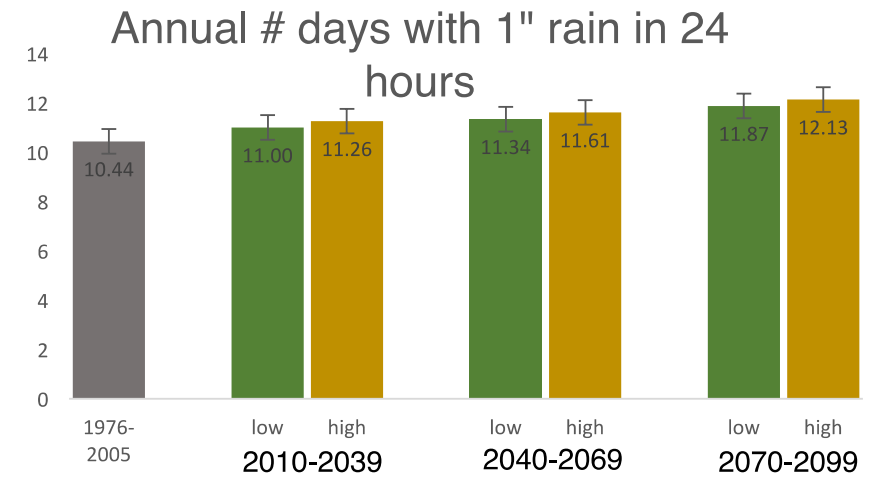
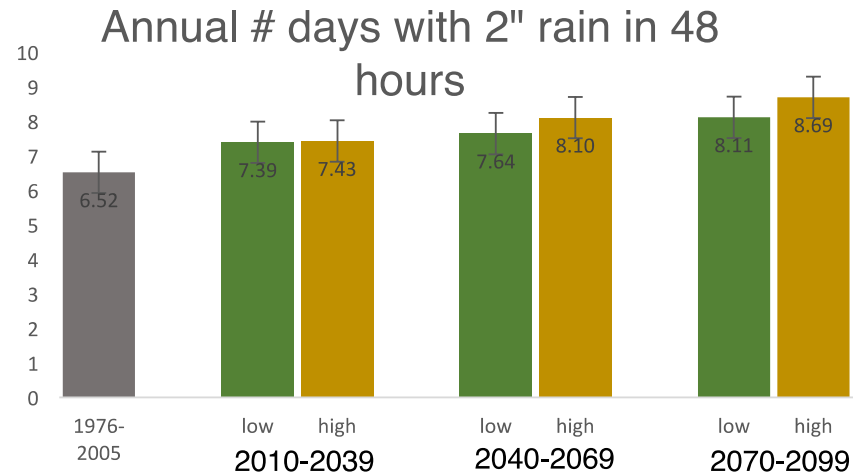
The screenshot shows a web form titled "Design your Own CSV File of MACA Point Data". It is divided into two main sections: "STEP ONE:" and "STEP TWO:". "STEP ONE:" includes dropdown menus for "Select Frequency of Desired Data" (set to "daily data"), "Select Scenario" (set to "historical (1950-2005)"), and "Min Year" (set to "1950"). "STEP TWO:" includes a "Select Point Location for data" dropdown, a "Point Location" input field (set to "33.9794 N, -81.2051 E"), and a "Map" button. To the right of the form is a map of the United States with a red pin indicating the selected location in the Southeast.

National Climate Change Viewer

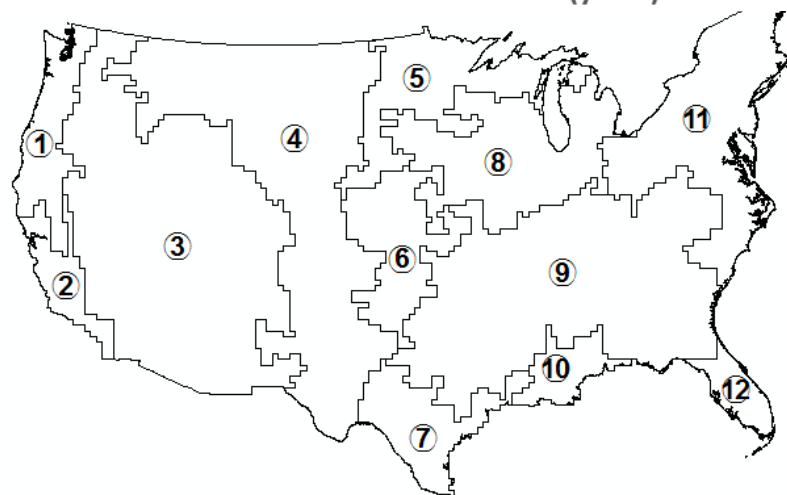
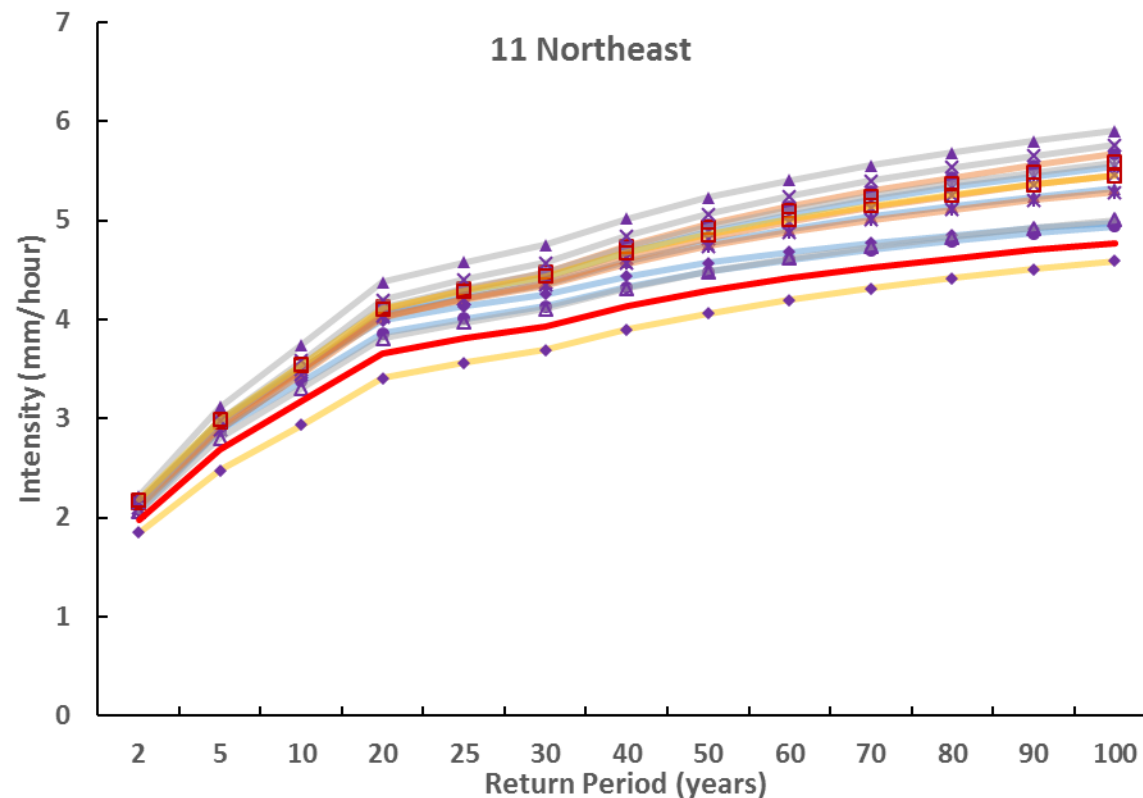
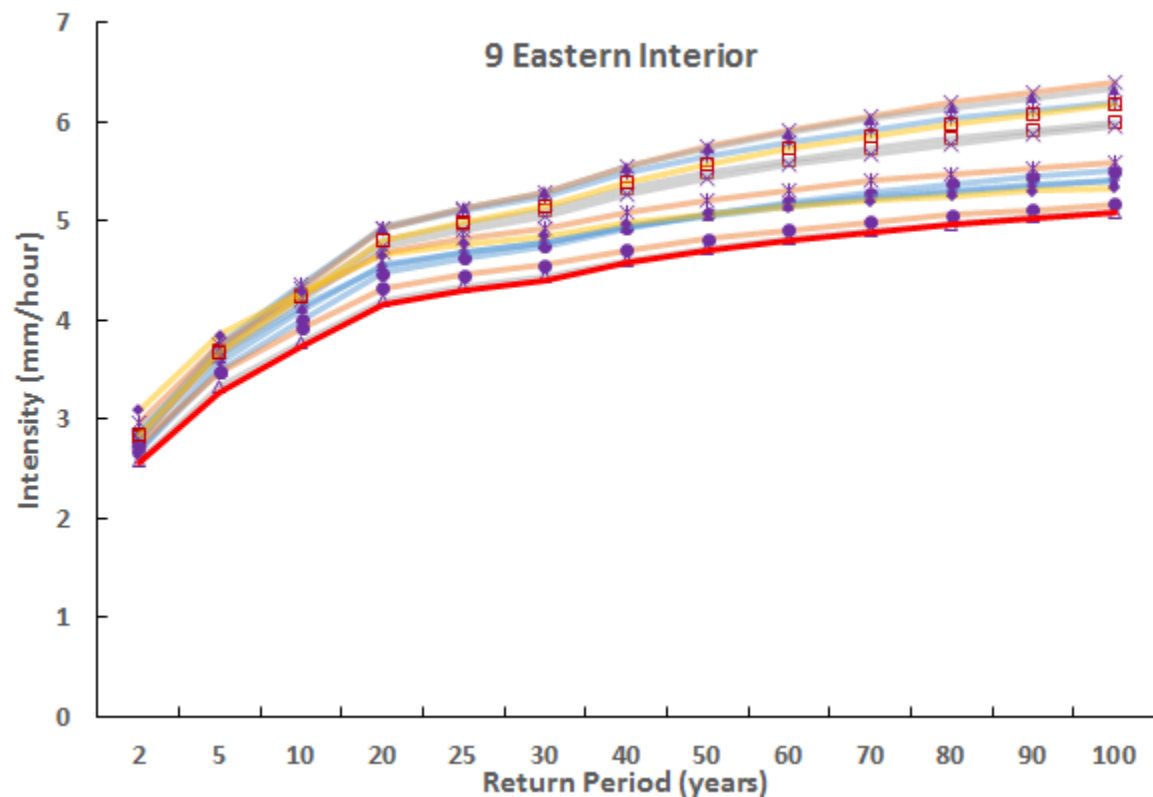
Search Tools

Statistically Downscaled Climate Projections for Georgetown County

(MACA CMIP5)



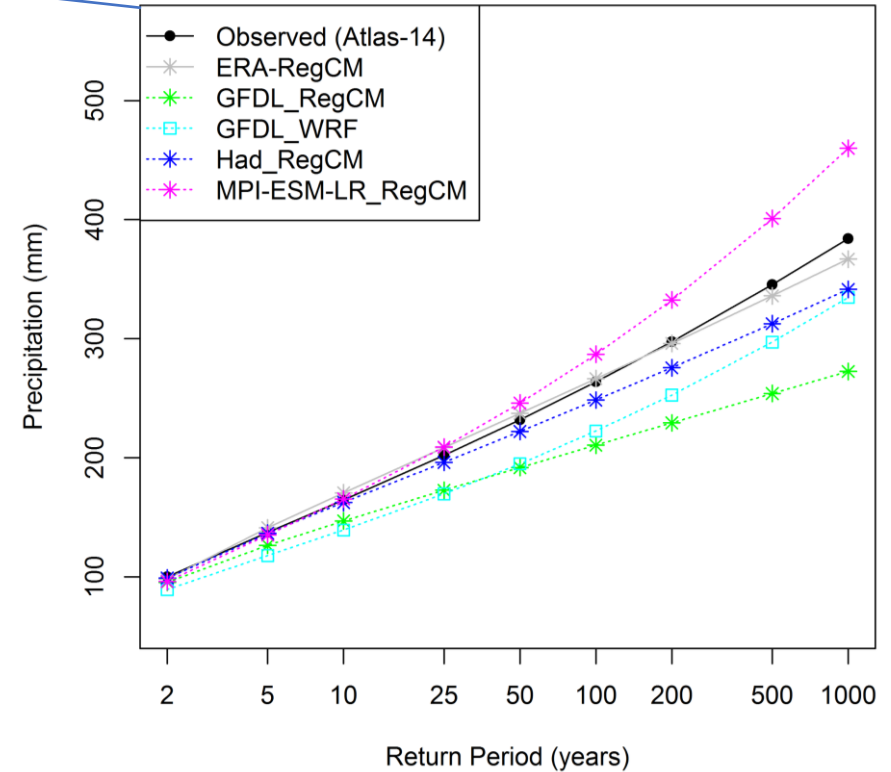
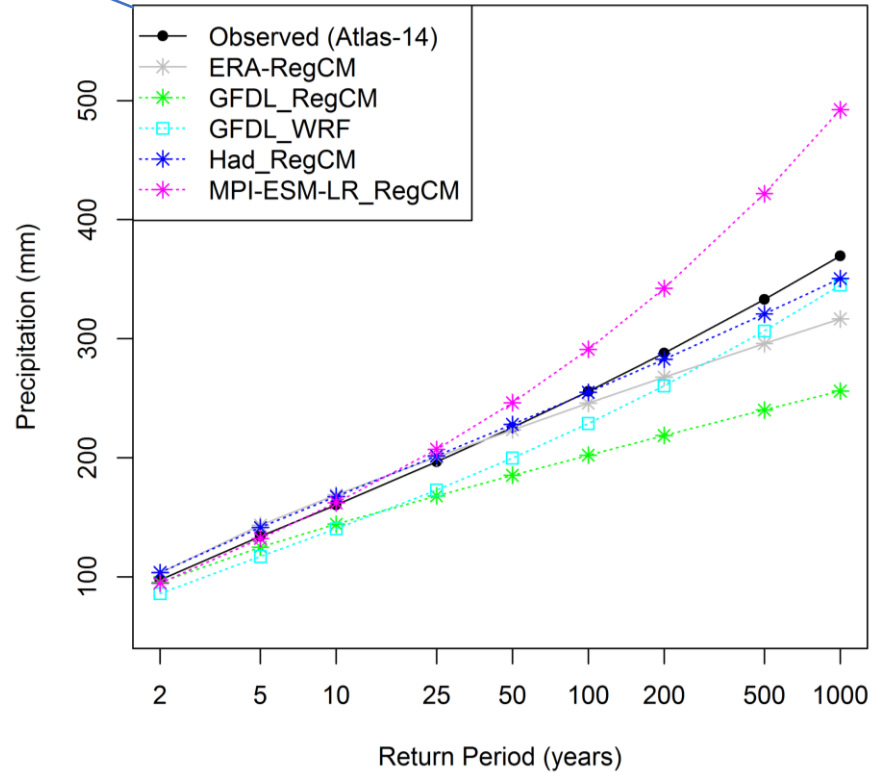
Dynamic downscaling



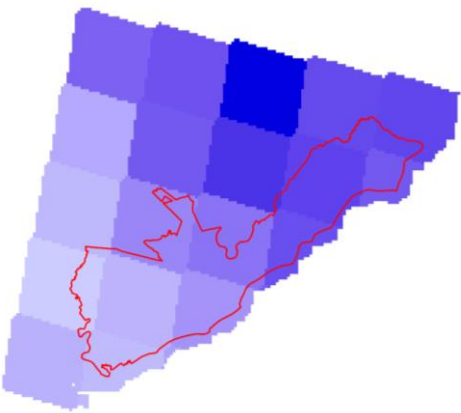
Dynamic downscaling

Large variability across models

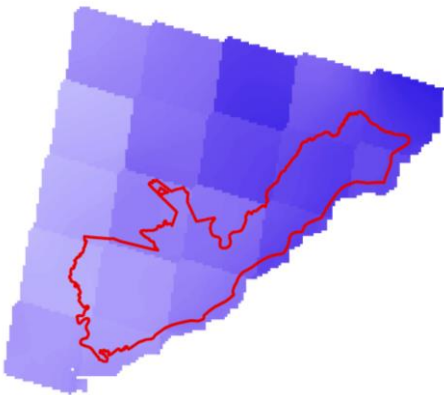
Annual 1-day maxima



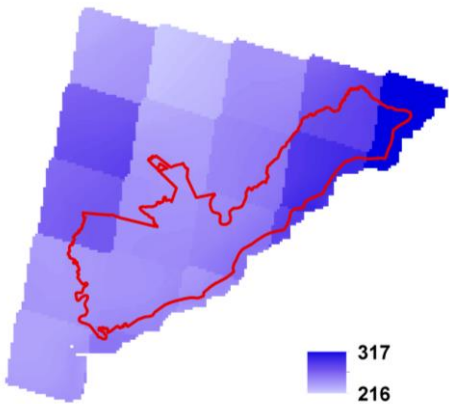
Unrealistic spatial variability



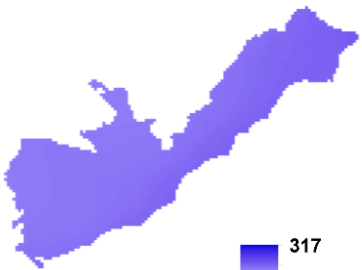
Had-RegCM
(2006-2050, 25)



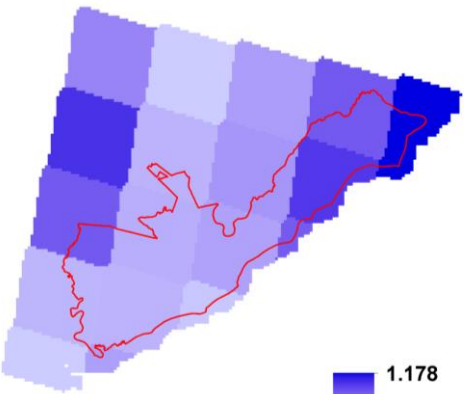
GFDL-WRF
(2006-2050, 25 kr)



Depth (mm)



Depth (mm)



Ratio

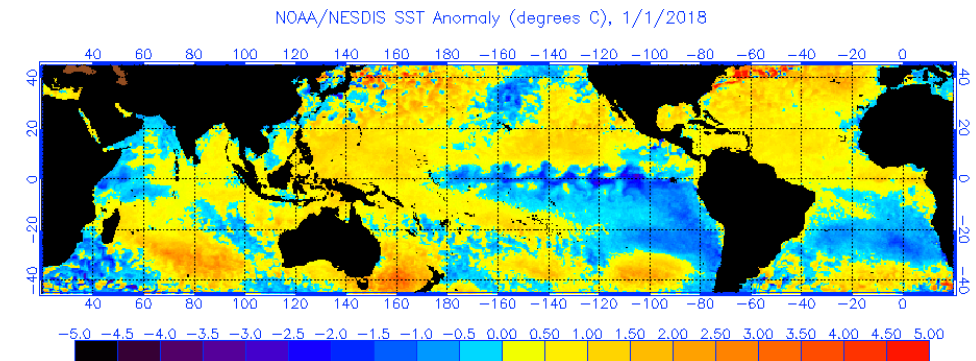
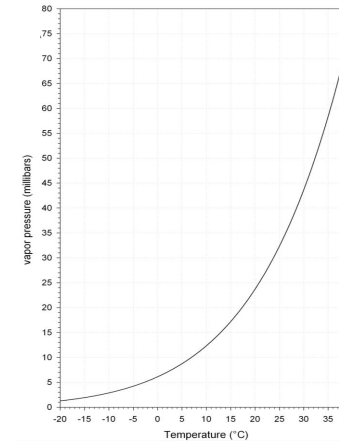
Ratio

Summary

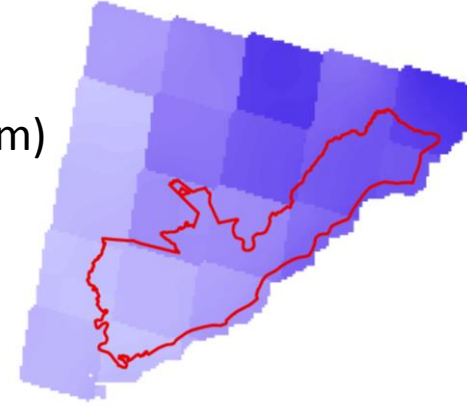
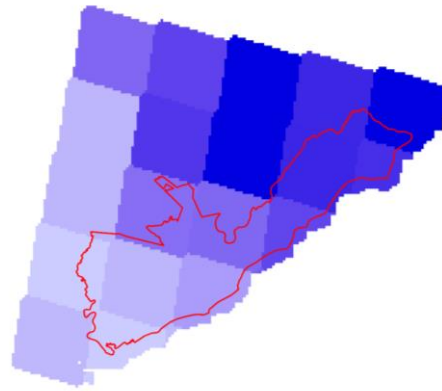
Theoretical reasons to expect heavier precipitation

Recent observations influenced by natural variability

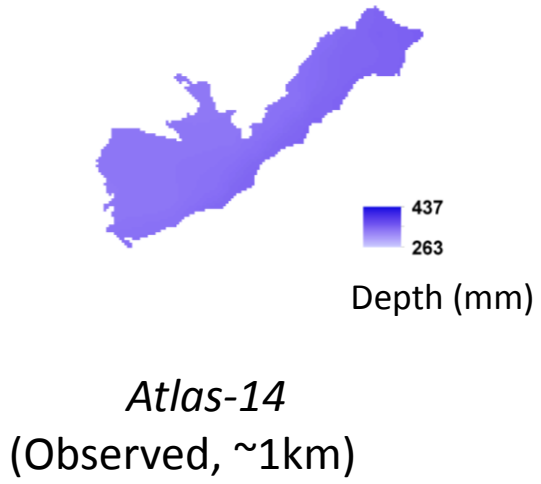
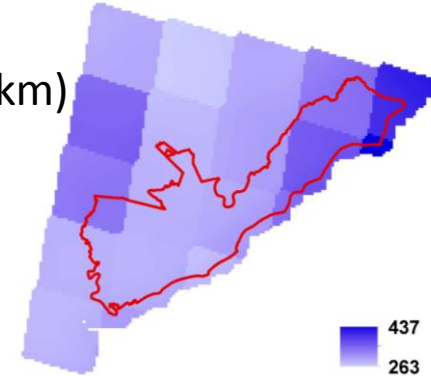
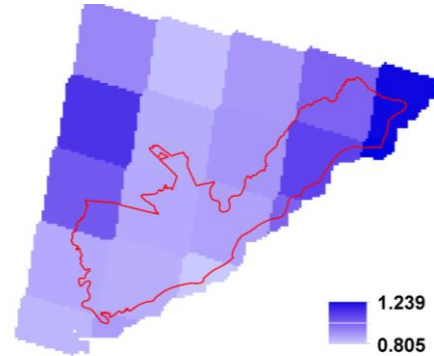
Don't wait for the models to improve



Had-RegCM
(2006-2050, 25 km)



GFDL-WRF
(2006-2050, 25 km)



Ratio

Depth (mm)

Dynamic downscaling

