

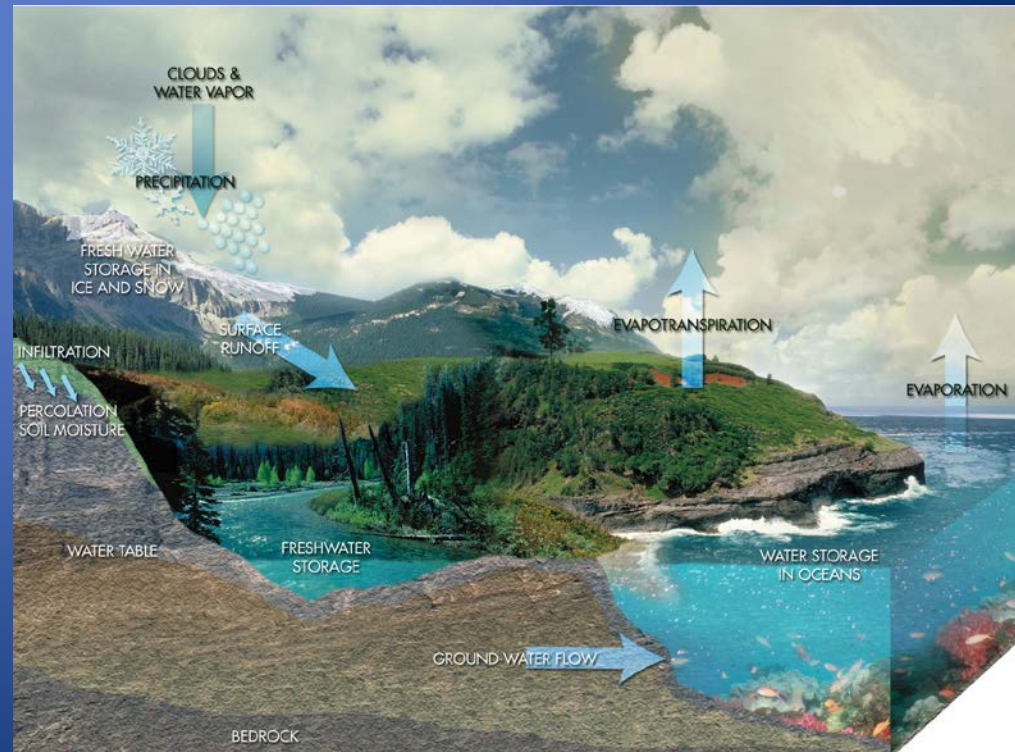
Simulating Earth's Hydrological Cycle

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NCAR

Outline

- Goals of Research
- Preliminary Results
- Future Pathways

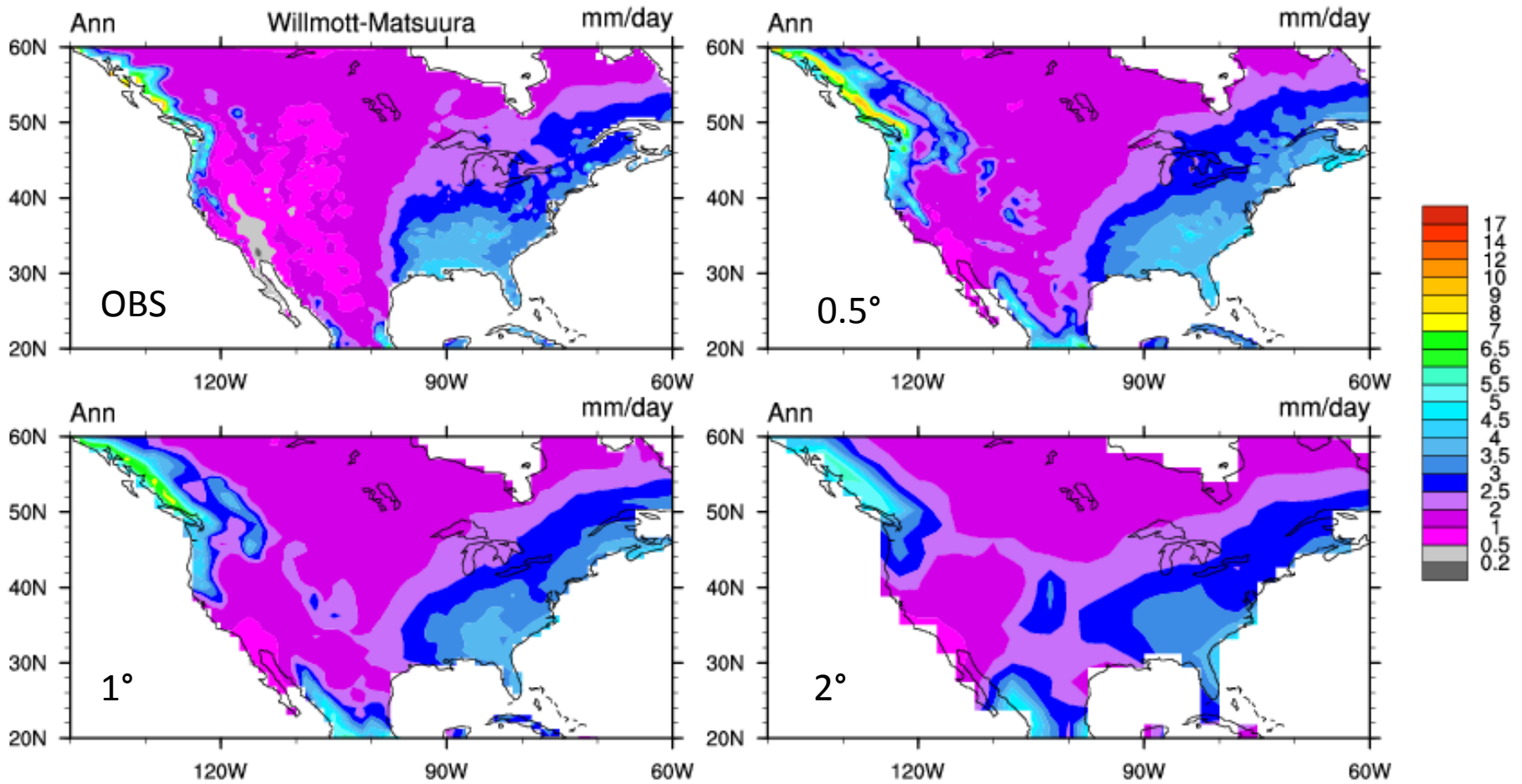


Goals of Research

- Develop a comprehensive and self-consistent analysis of present and future changes in hydrological cycle from CCSM/CESM simulations (ATM resolutions of 2° , 1° , $\frac{1}{2}^\circ$ and $\frac{1}{4}^\circ$)
- Analyze feedback processes that modulate changes to Earth's hydrological cycle
- Use observations for present simulations to gauge the model's ability to simulate regional aspects of hydrological processes
- Focus is on U.S. climate

Preliminary Results*

1850 USA Precipitation

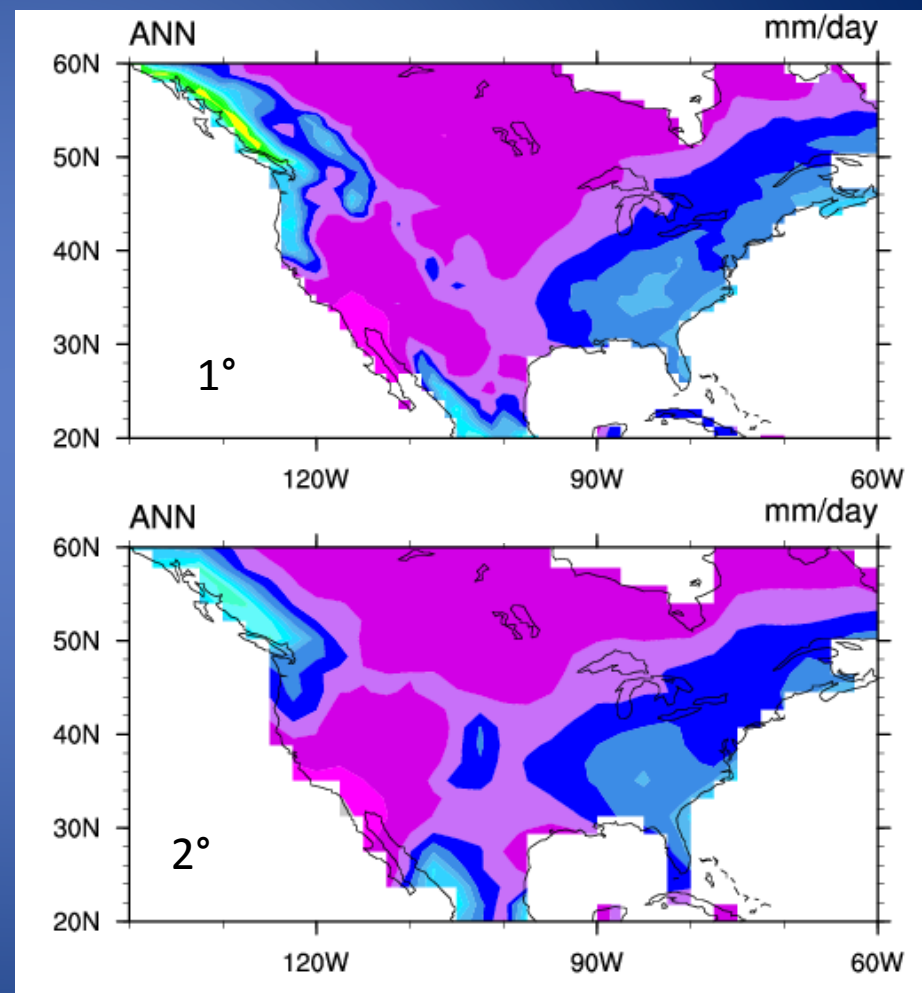
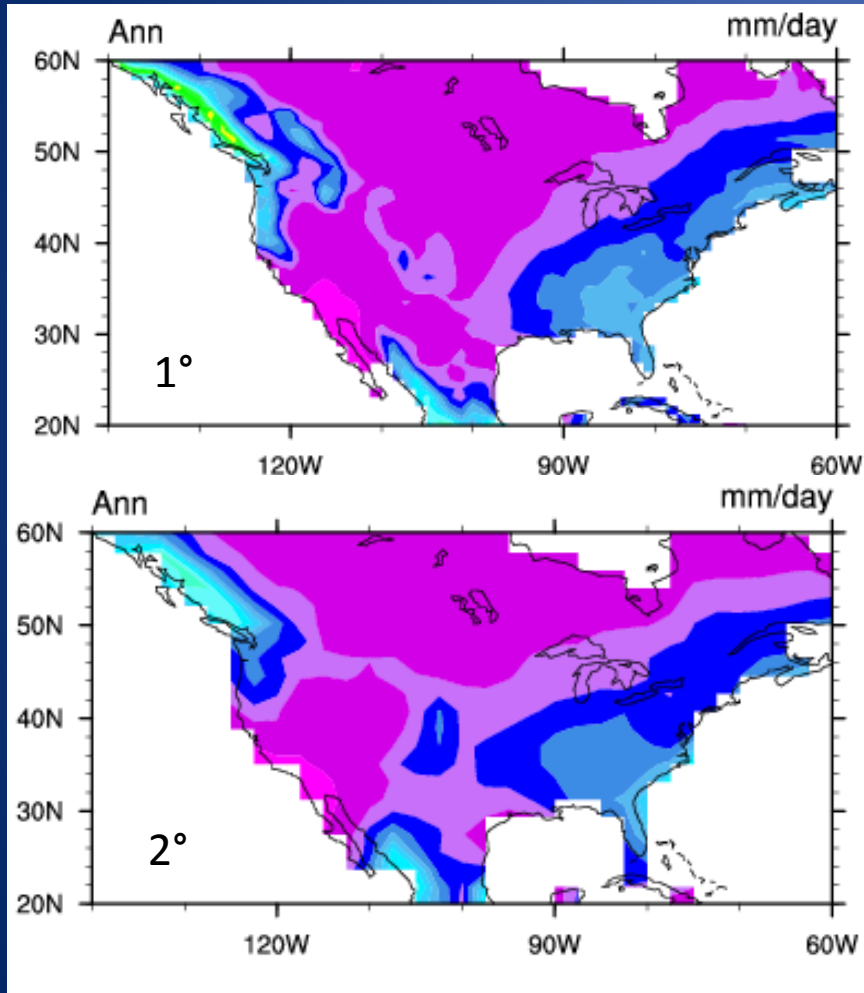


*limited to existing CCSM4 simulations for 1850 controls and 20th simulations

Comparison of 1850 control to end 20th century CCSM4 simulations

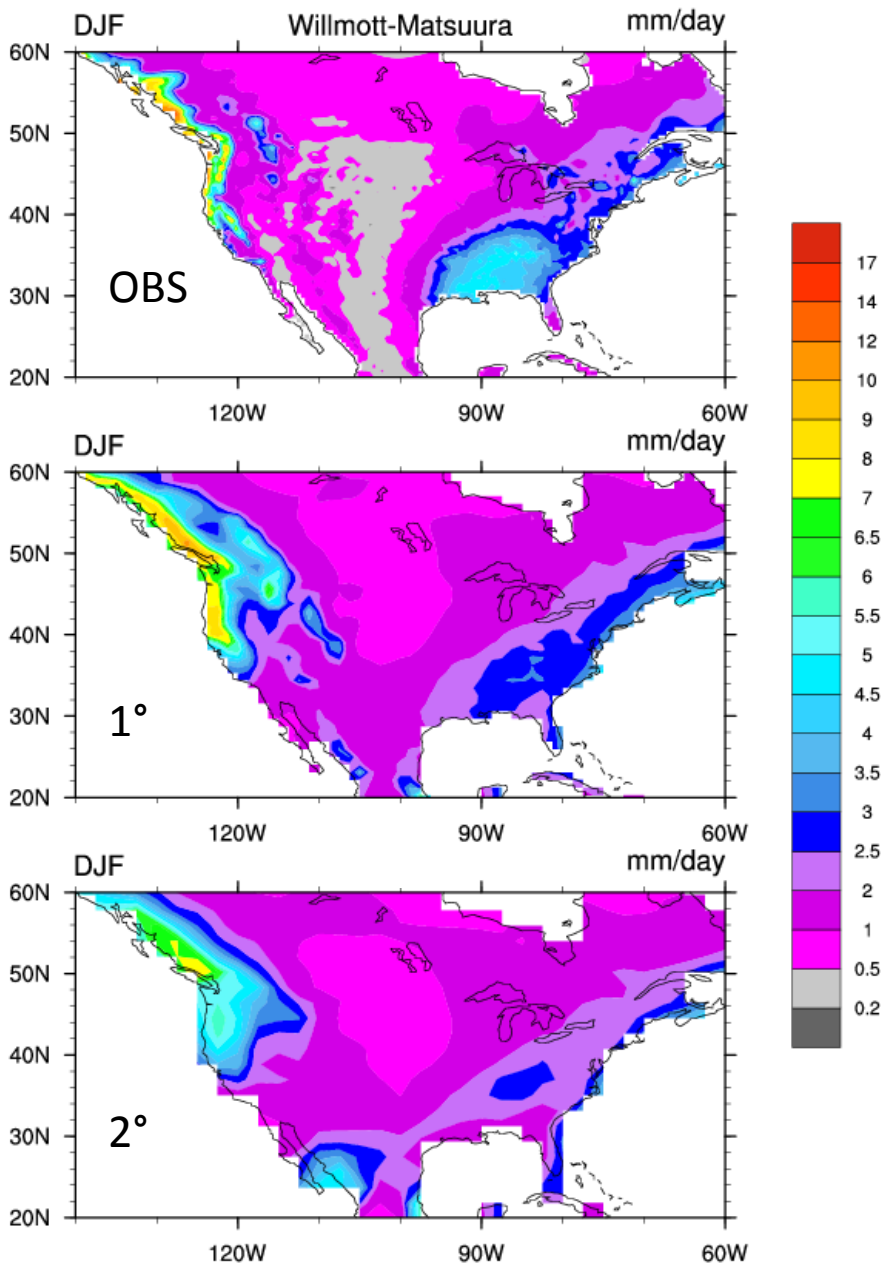
1850 ANN Precip

1986-2005 ANN Precip

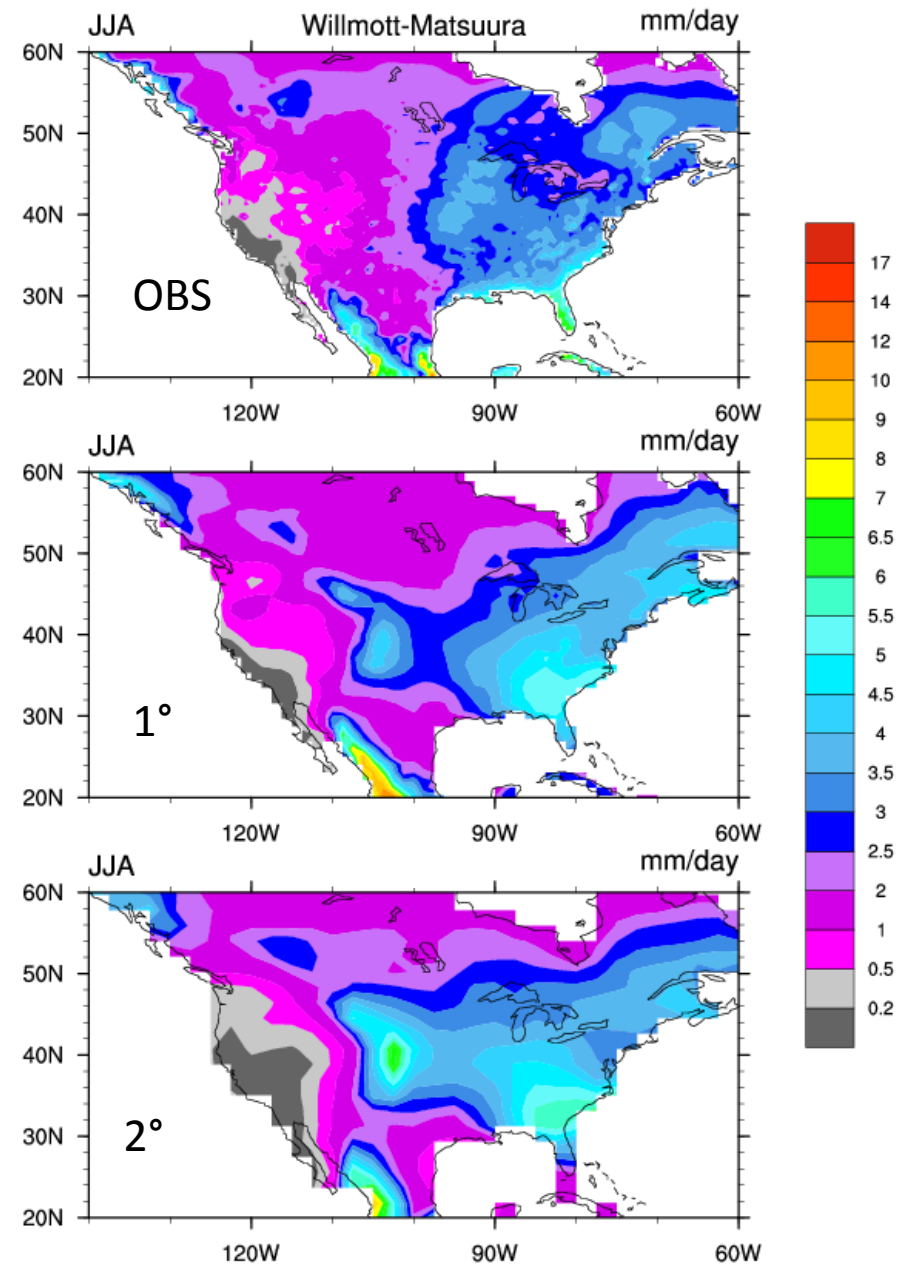


Seasonal CCSM4 Precipitation Simulations

1986-2005 USA DJF Precipitation

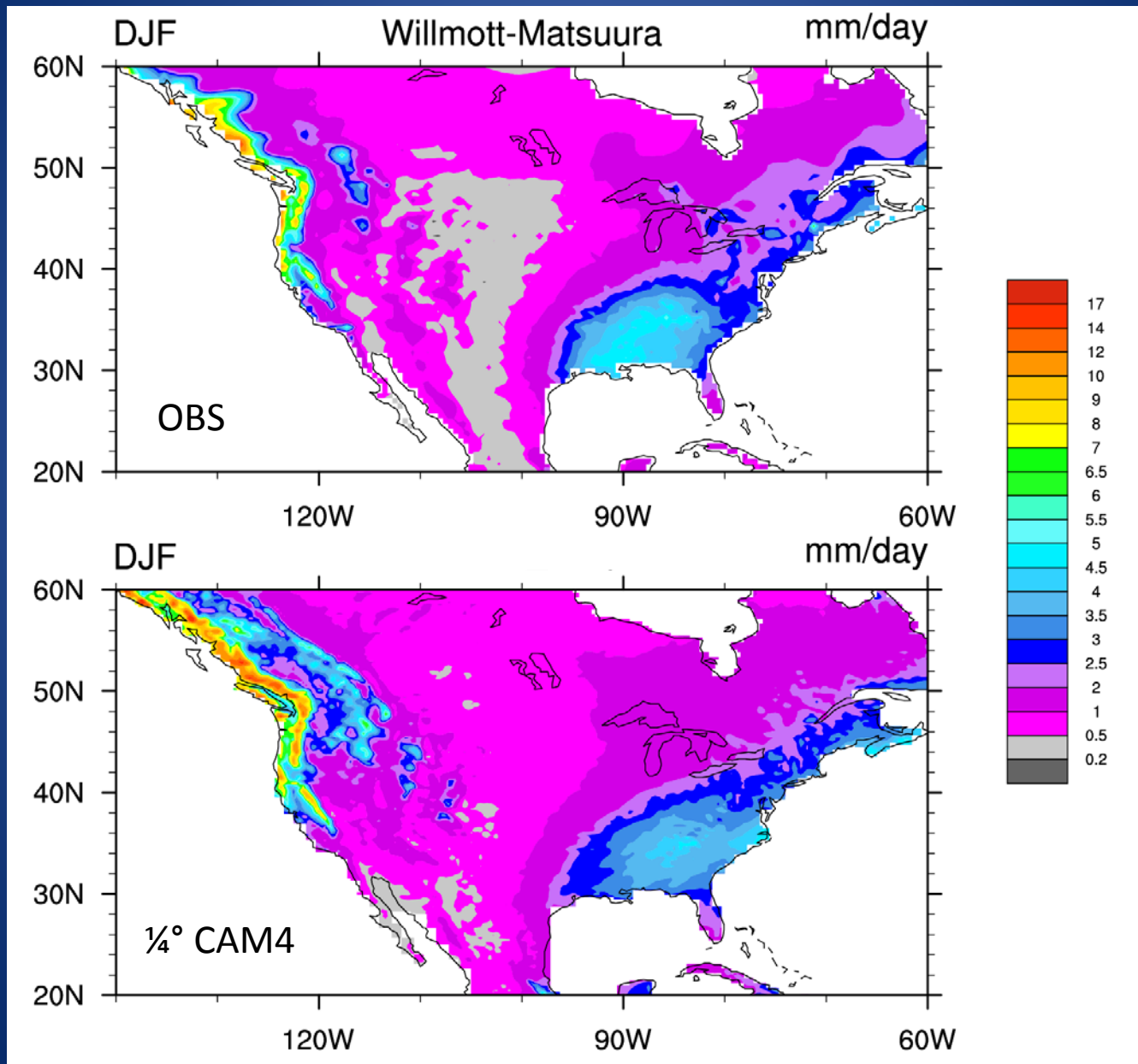


1986-2005 USA JJA Precipitation



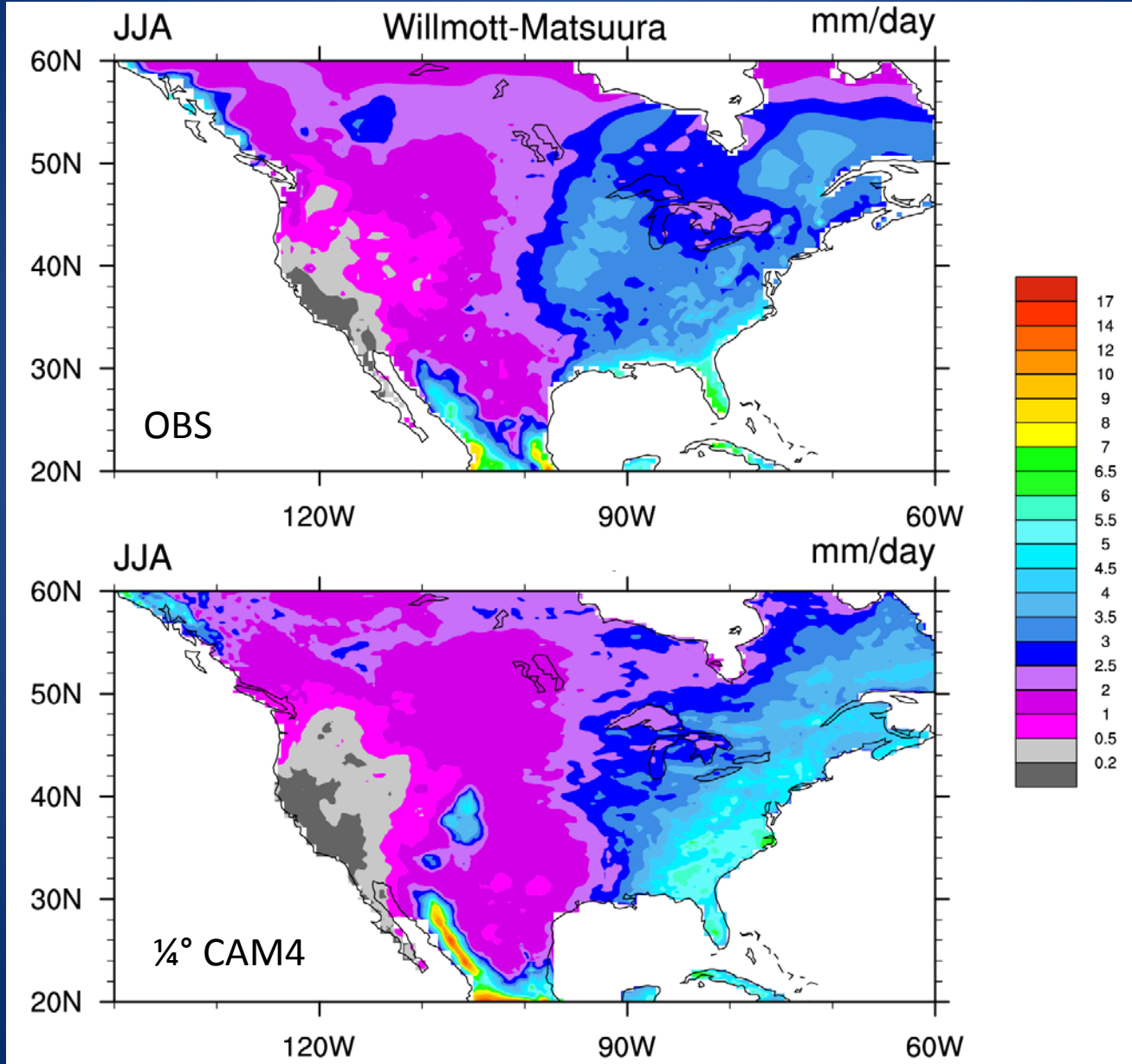
1/4° CAM4 AMIP Simulations 1996 – 2005*

*Julio Bacmeister & Cecile Hannay



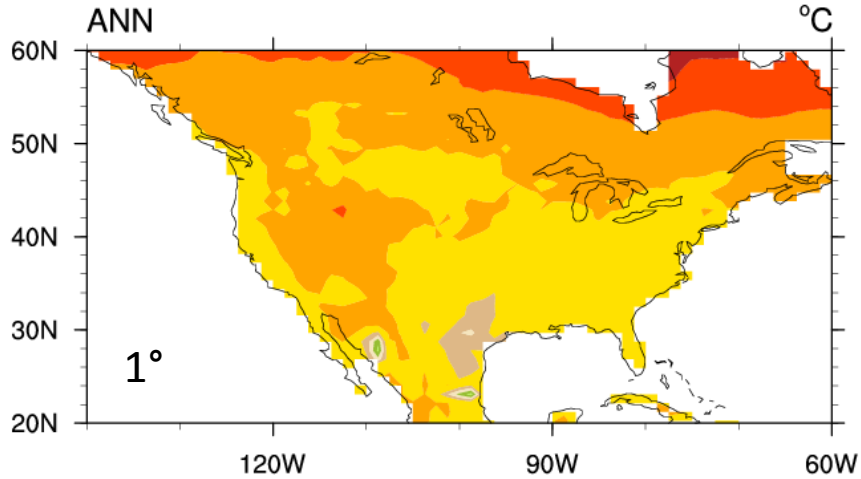
1/4° CAM4 AMIP Simulations 1996 – 2005*

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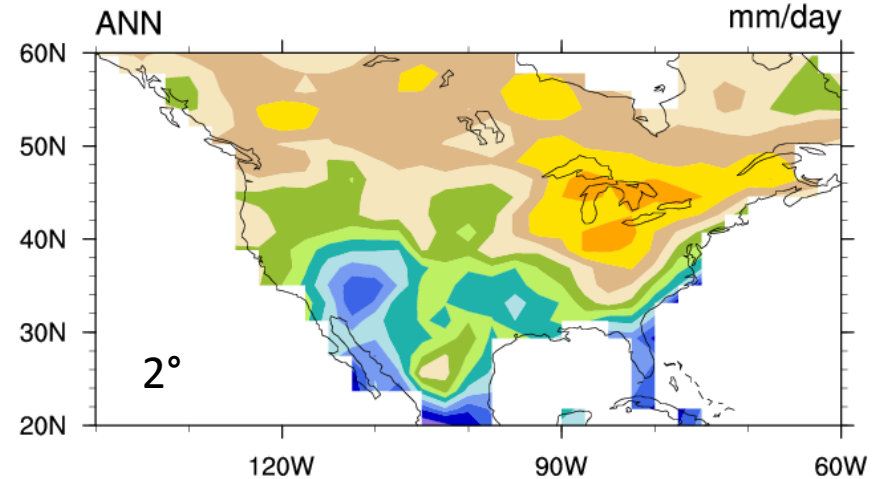
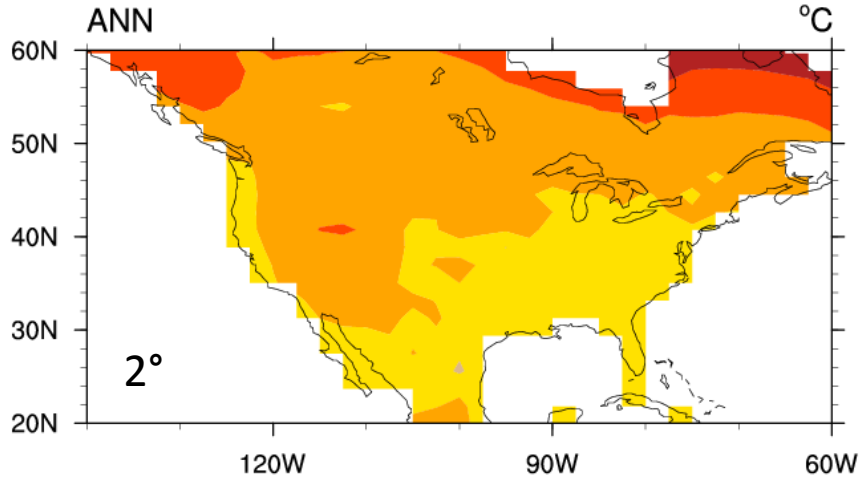
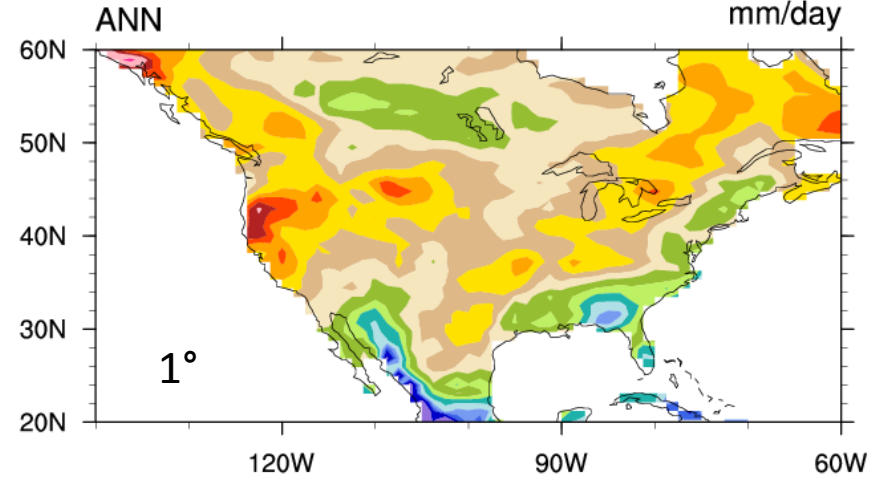


Change in Temperature and Precipitation (End 20th Cent. - 1850)

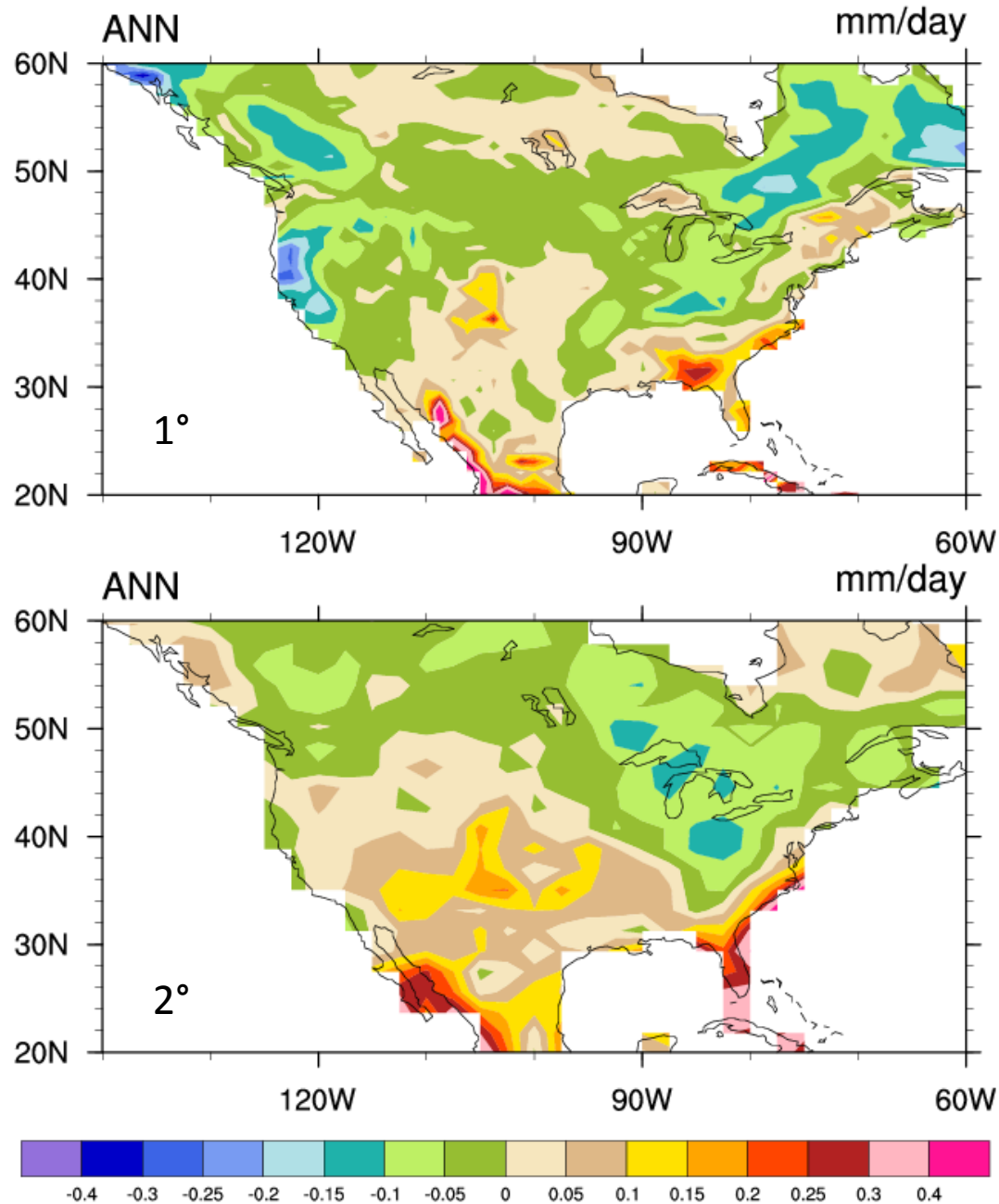
Modern-1850 2m Air Temperature



Modern-1850 Precipitation



Change in (Evap – Precip) End 20th Cent - 1850

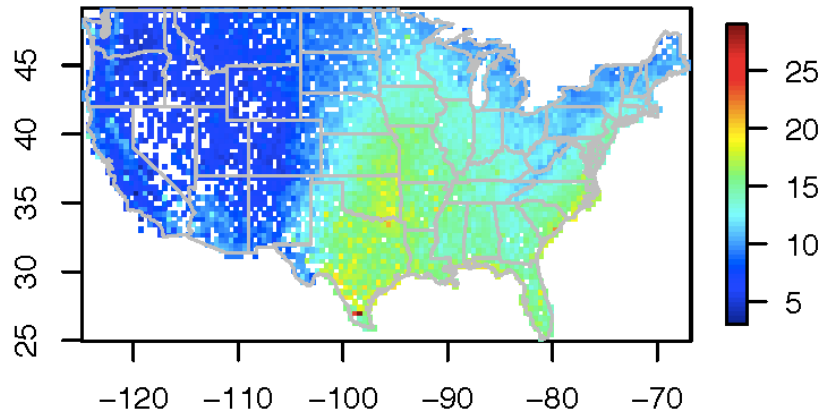


Future Pathways

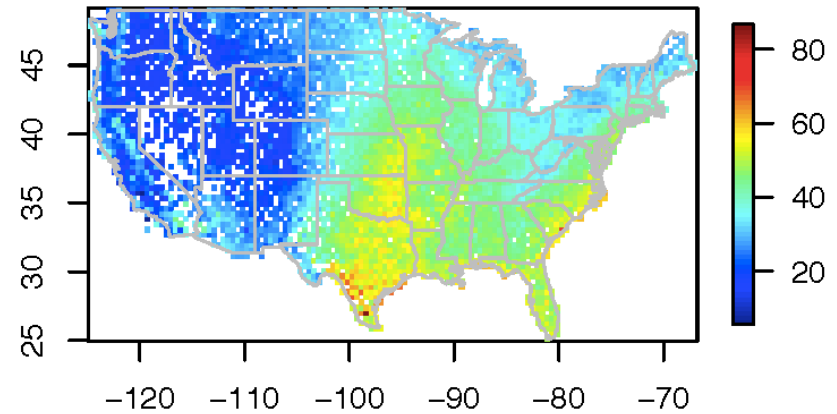
- Complete consistent set of simulations, i.e. 20th century simulations for $\frac{1}{2}^\circ$ CCSM4
- Use analysis tools for moisture and energy budgets with breakdown into thermodynamic and dynamic components (e.g. Seager et al. 2010, Muller and O’Gorman 2011)
- Carry out time-slice ($\frac{1}{2}^\circ$ and $\frac{1}{4}^\circ$) CAM4(5) simulations for future RCPs
- Look beyond mean statistics

Observed Extreme Statistics in Precipitation*

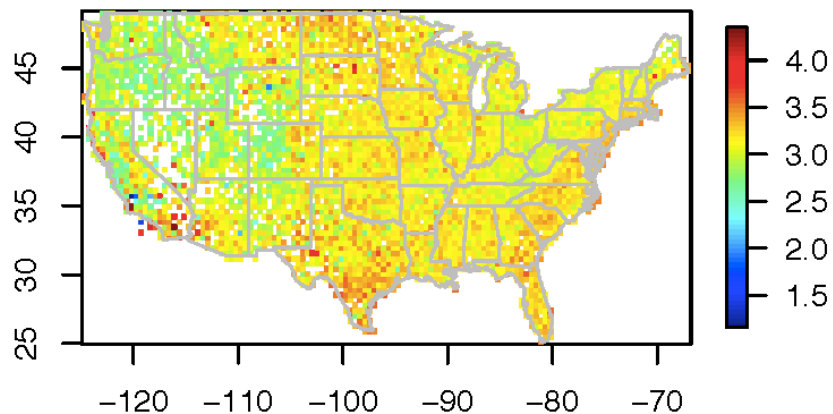
mean daily precip (threshold .1 mm) JJAS



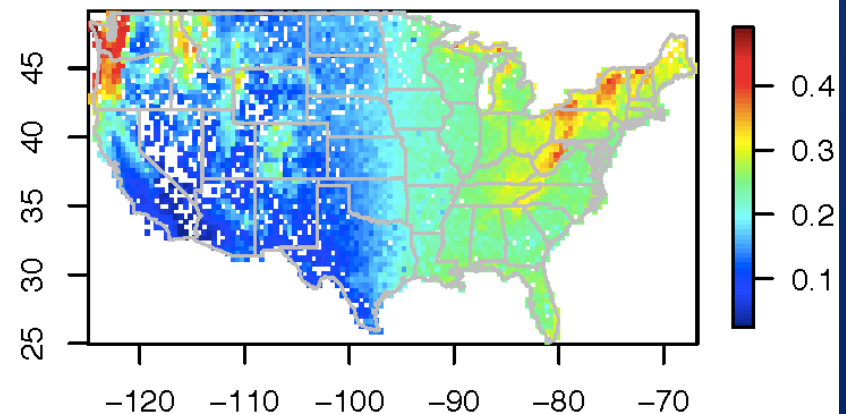
95 percentile (threshold .1 mm) JJAS



Q95/mean (threshold .1 mm) JJAS



freq of wet days (> .1 mm), JJAS



*Courtesy of Doug Nychka (IMAGE/NCAR)

THE END