



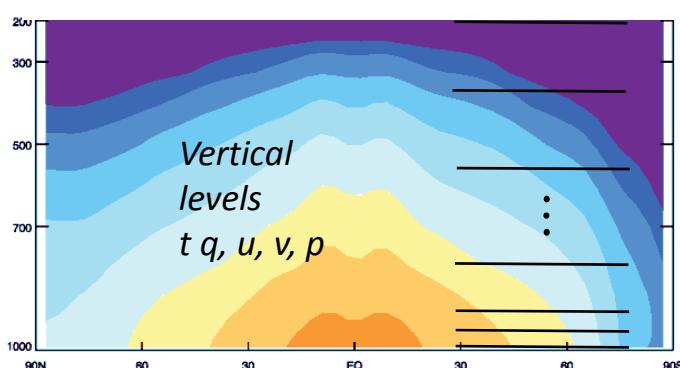
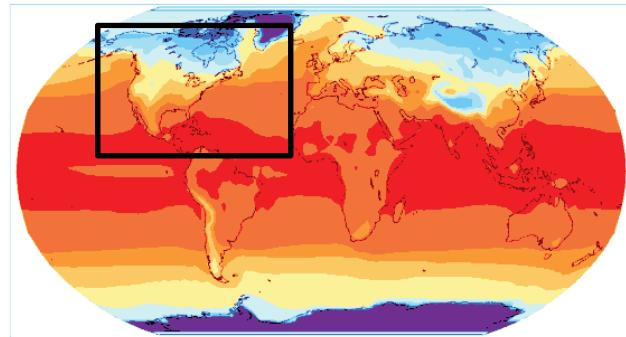
*Regional climate simulations for North America:  
Changes in the mean state and its variability  
under a doubling of CO<sub>2</sub>*

*Steve Hostetler, Jay Alder, and Andrea Schuetz*

# *A/OGCM –RegCM Nesting*

$3.75^{\circ} \times 3.75^{\circ}$

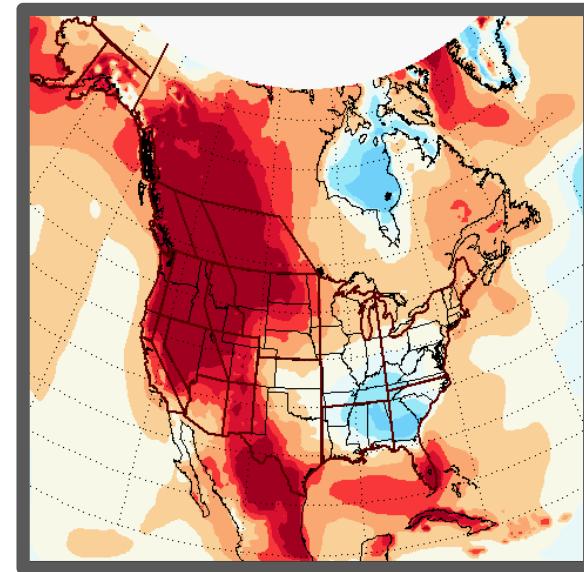
*2-m temperature/SST*



*Specific humidity*

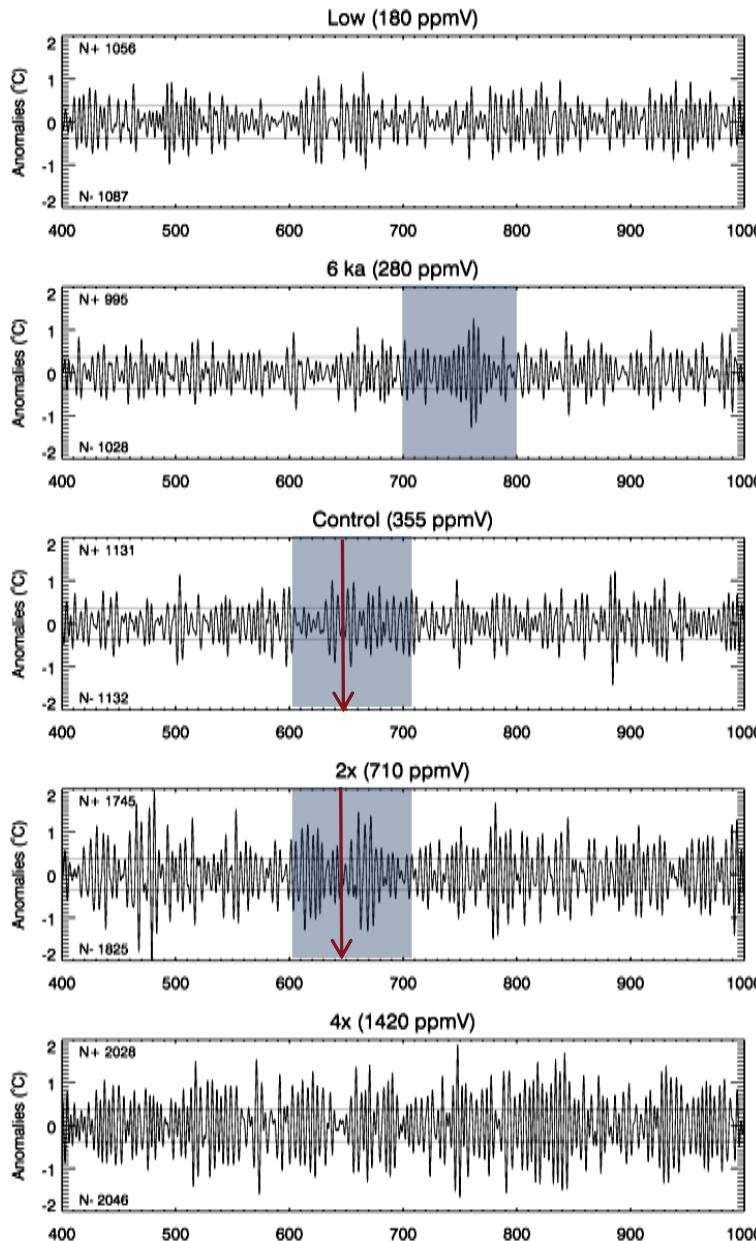
$50 \text{ km}$

*6 hr  
boundary  
conditions*

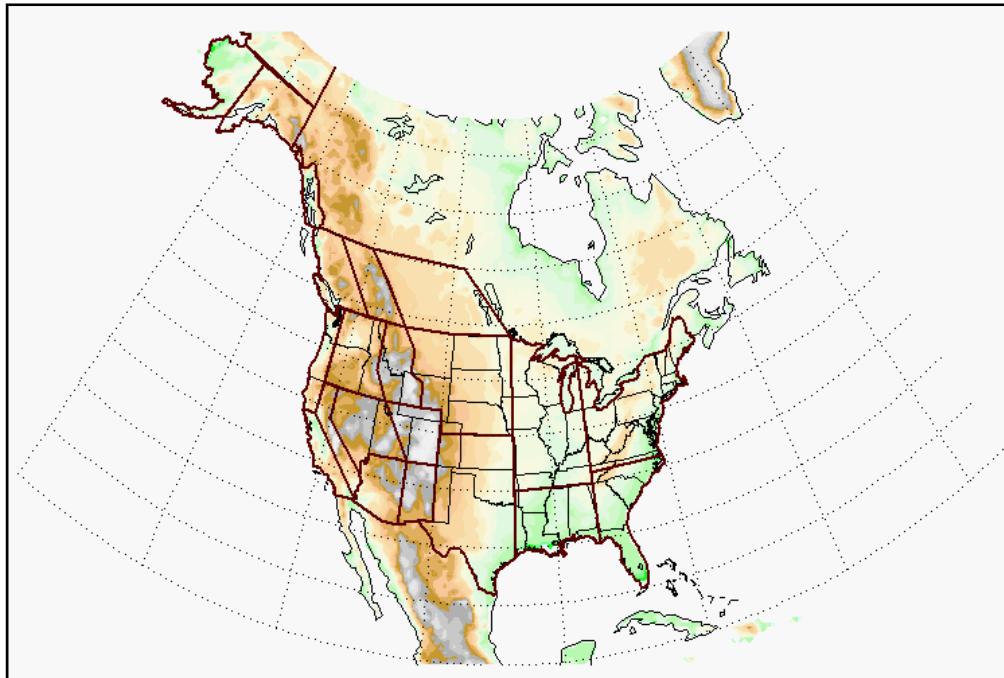


# *Nino 3.4 Sea Surface Temperature Anomalies*

*3-7 yr band pass filtered*

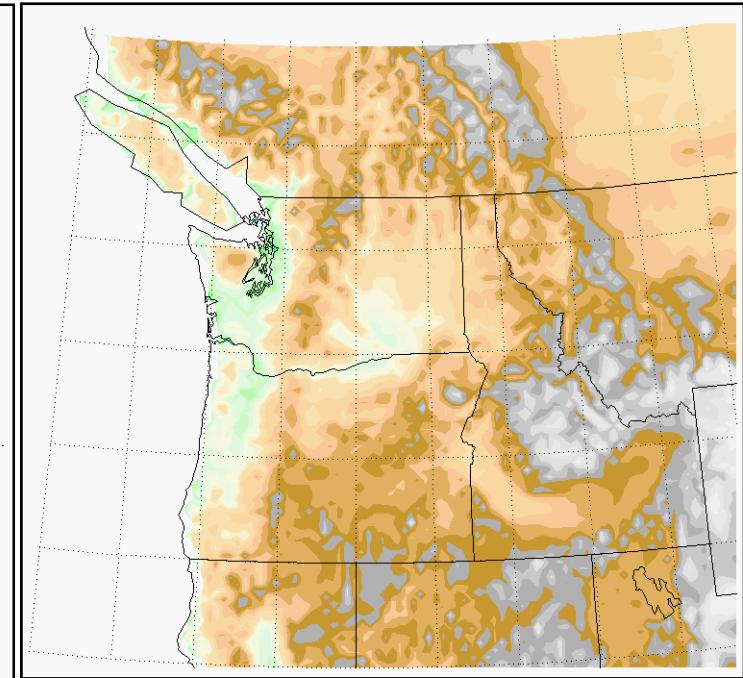


# *Domain Topography*



**50 km**

*131 X 152 grid points 23 vertical levels  
3-hr surface and 6-hr atmosphere history files  
1 simulated yr per day*

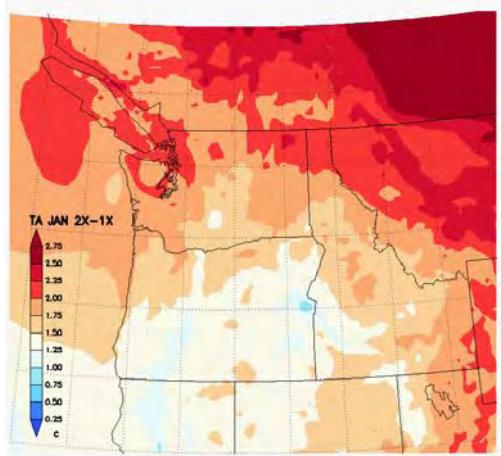


**15 km**

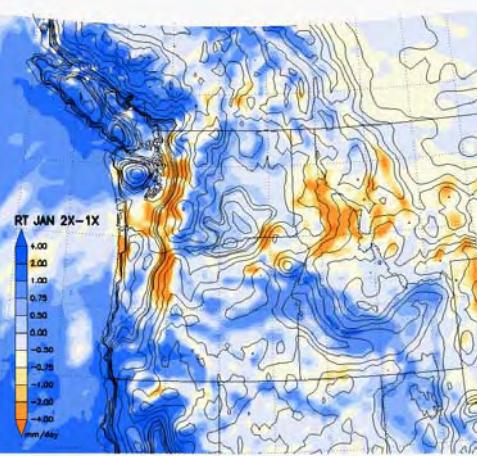
*131 X 160 grid points 23 vertical levels  
3-hr surface and 6-hr atmosphere history files  
4 simulated months per day*

# *2X-1X CO<sub>2</sub> Anomalies 15-km Domain*

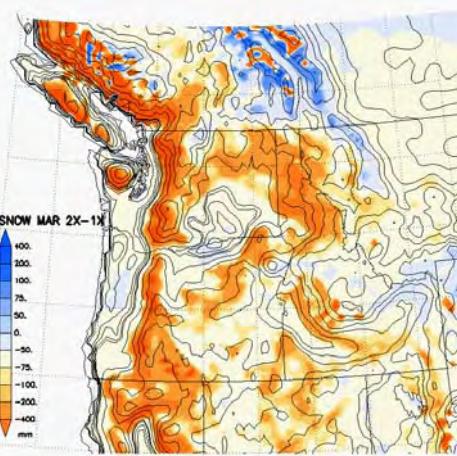
*January Temperature*



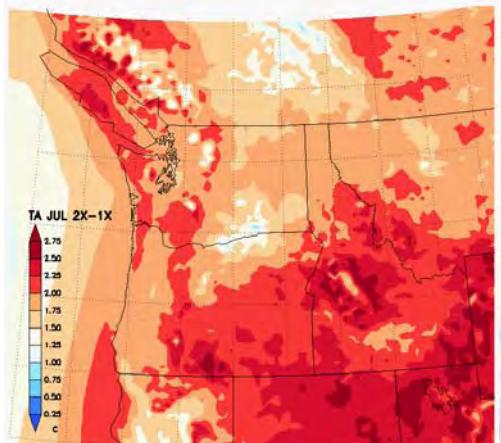
*January Precipitation*



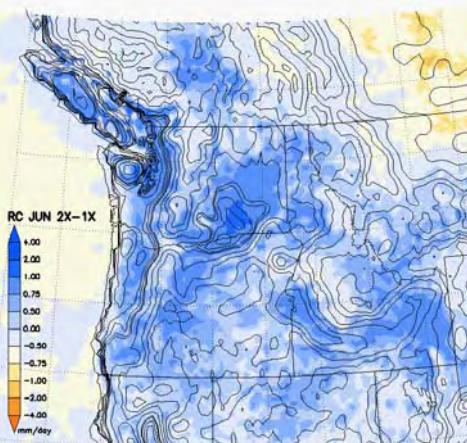
*March SWE*



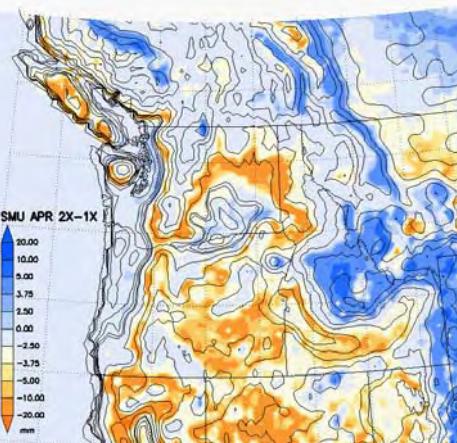
*July Temperature*



*June Convective  
Precipitation*

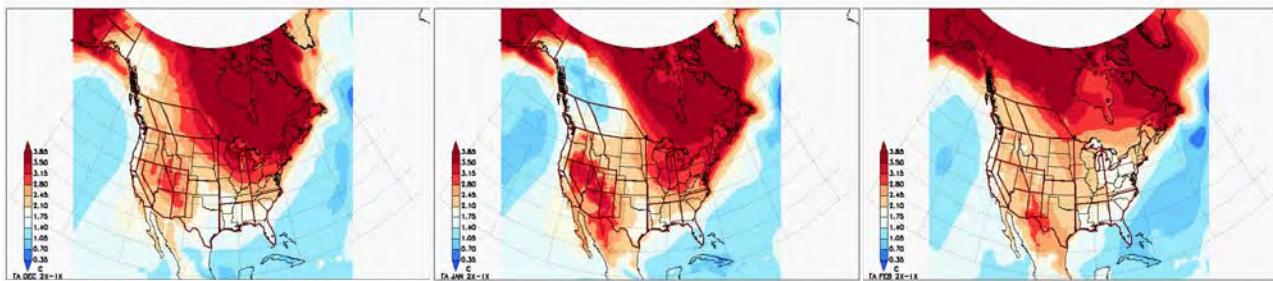


*April Soil Moisture*

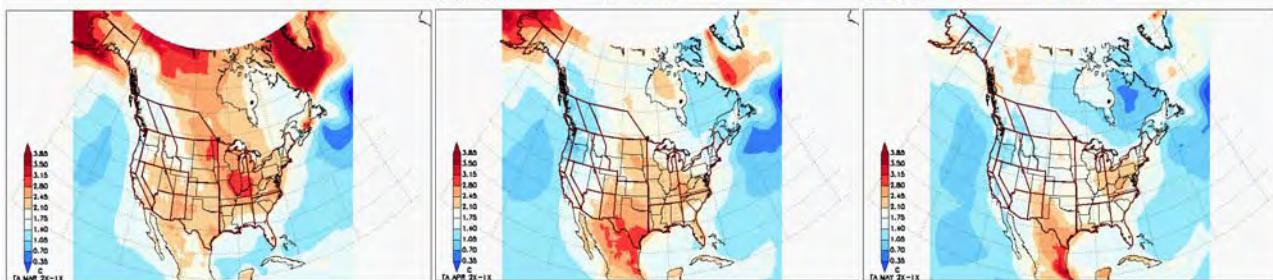


# *2X-1X CO<sub>2</sub> Air Temperature Anomalies*

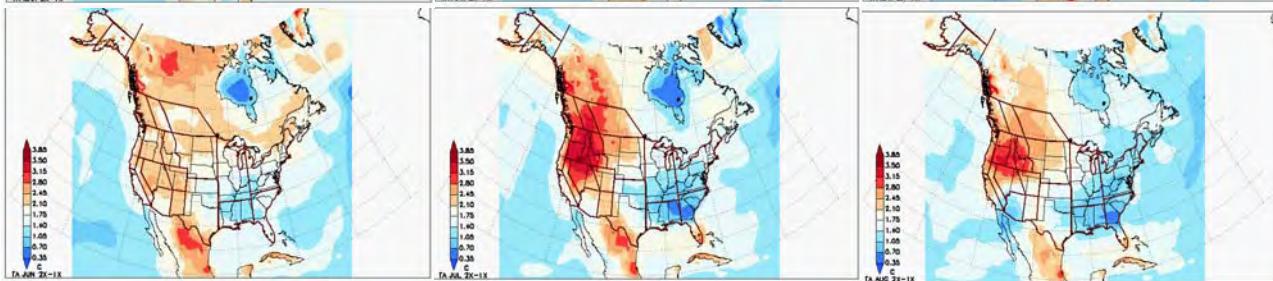
DJF



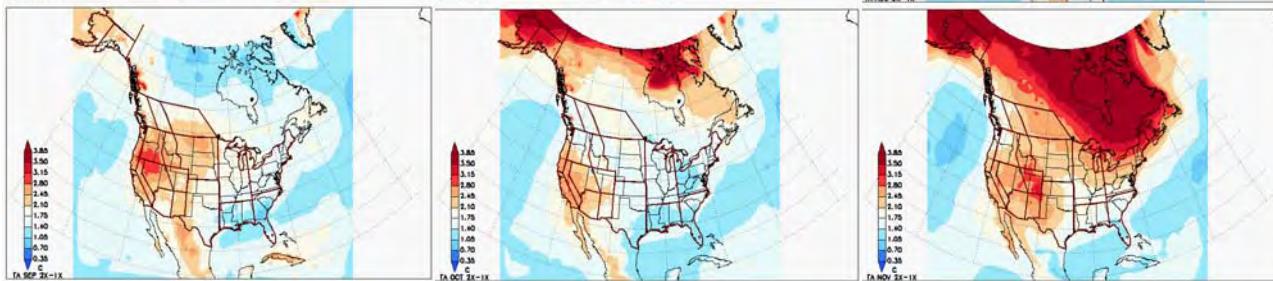
MAM



JJA

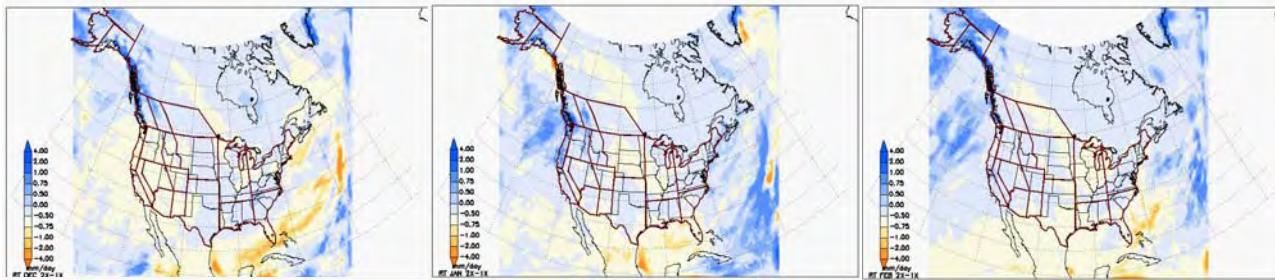


SON

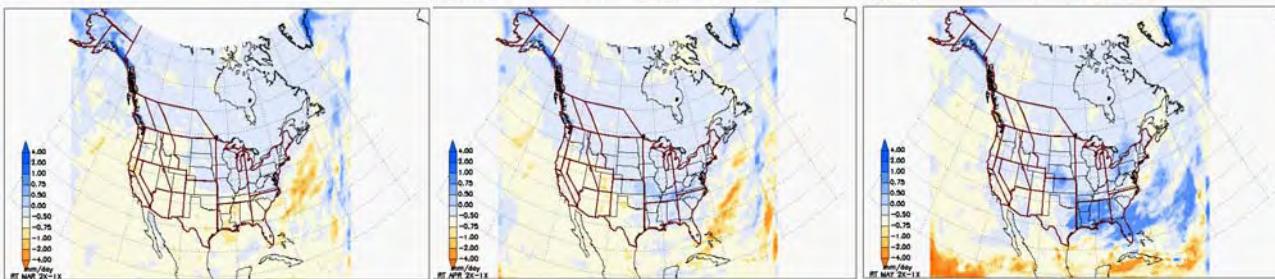


# *2X-1X CO<sub>2</sub> Precipitation Anomalies*

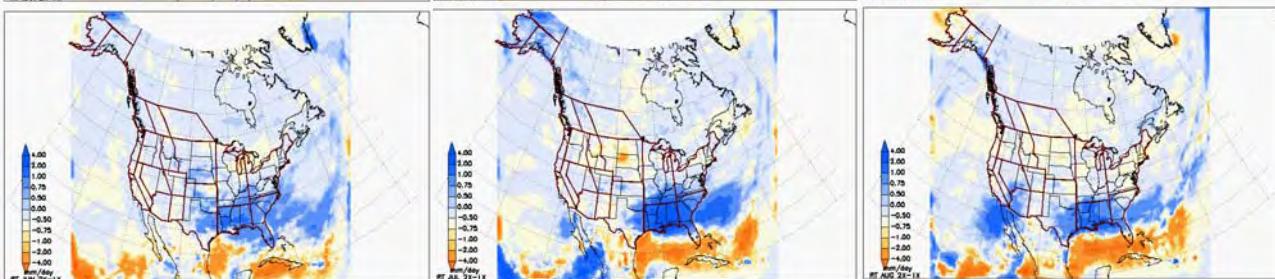
DJF



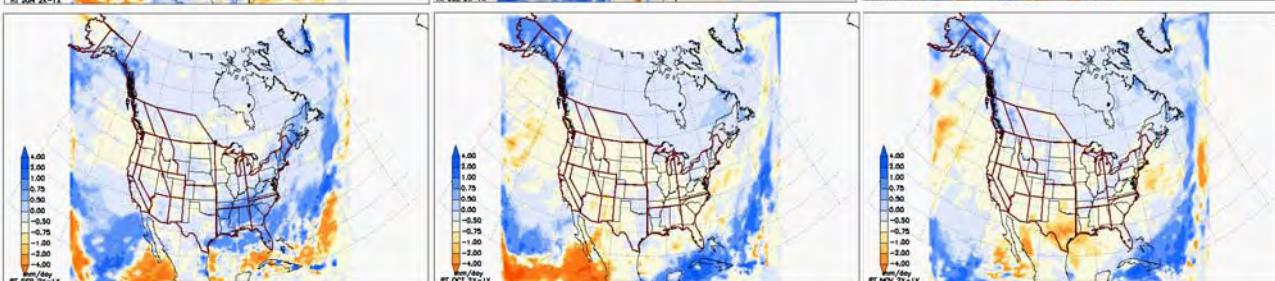
MAM



JJA

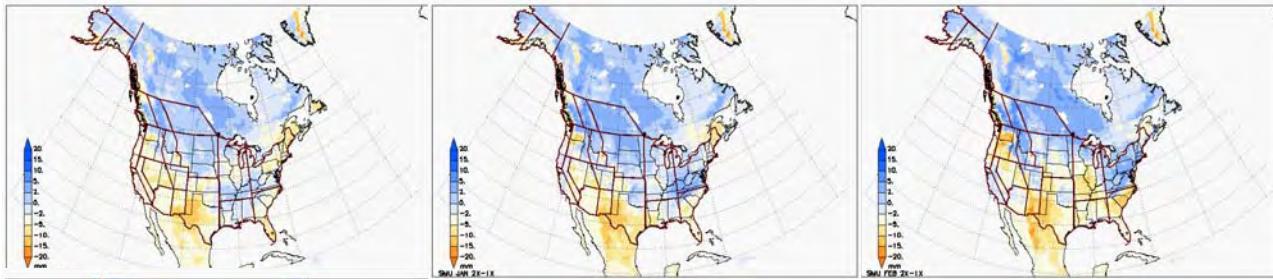


SON

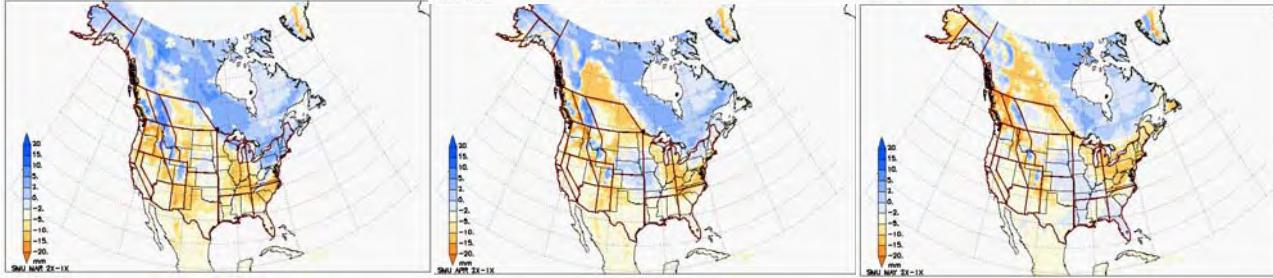


# *2X-1X CO<sub>2</sub> Upper Soil Zone Moisture Anomalies*

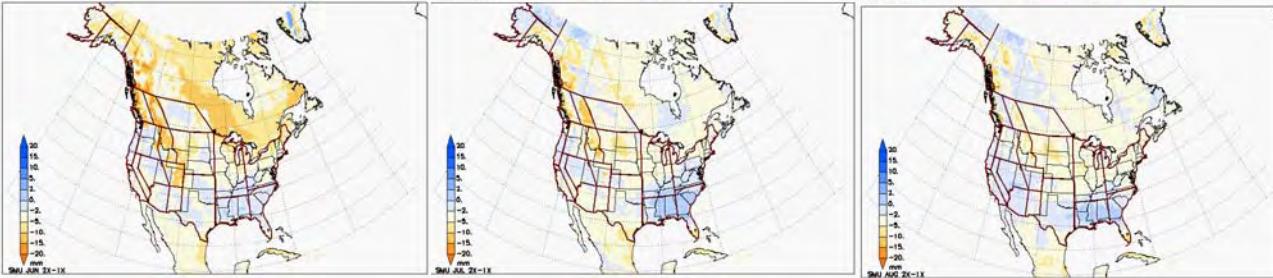
DJF



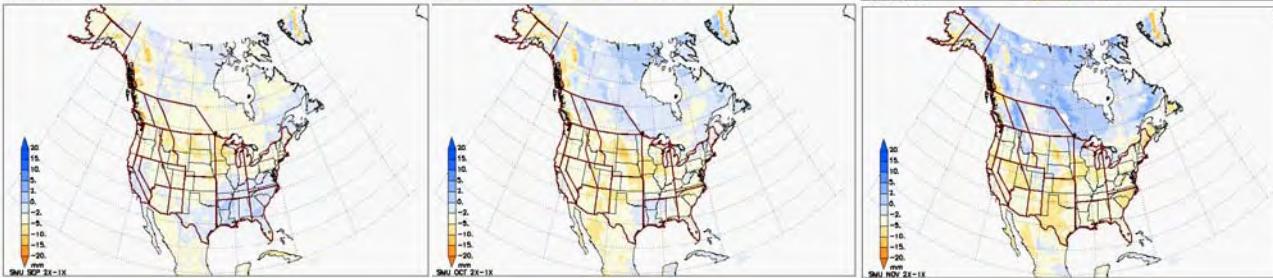
MAM



JJA



SON



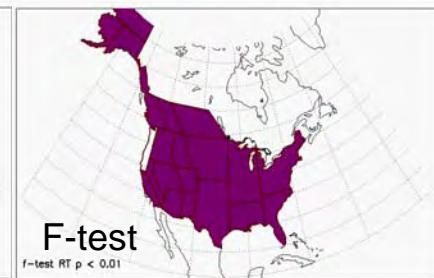
# *Significance of Annual 2X-1X CO<sub>2</sub> Changes*

*green: mean + red: mean -*

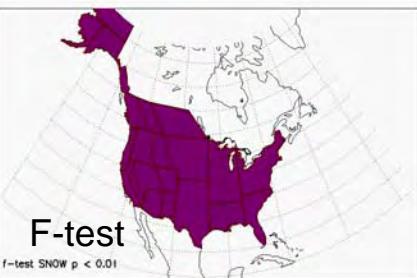
*Air temperature*



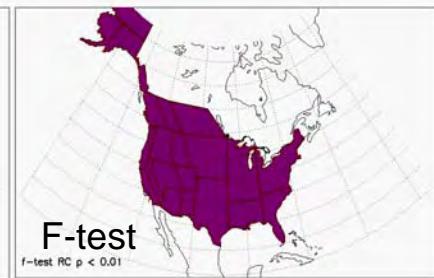
*Total precipitation*



*Snow water equivalent*



*Convective precipitation*



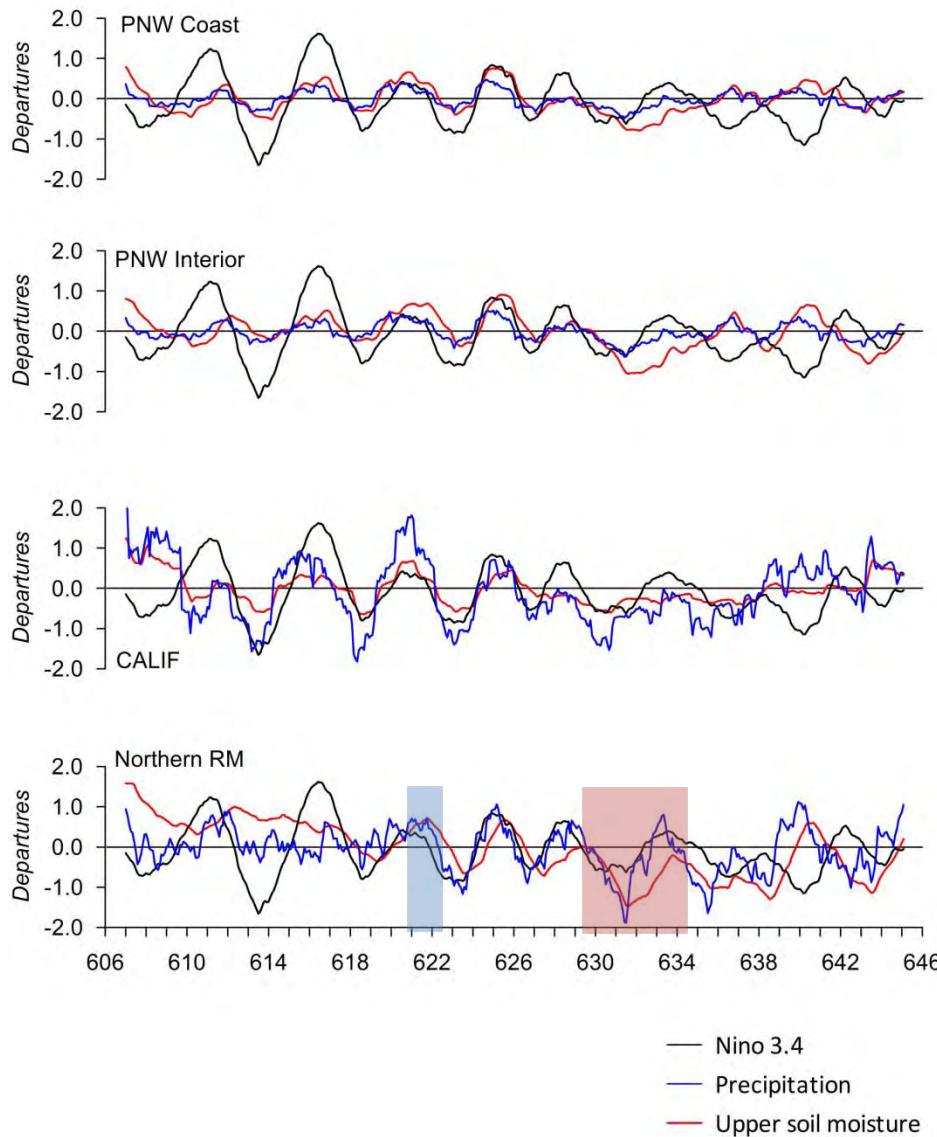
*Evapotranspiration*



*Base Flow*



# *Normalized Nino 3.4 Temperatures and Regional Moisture Fields*



# Upper Atmosphere Anomalies

Winter  
stormtrack

Dry

Wet

Summer  
convection

Dry

Wet

Jan

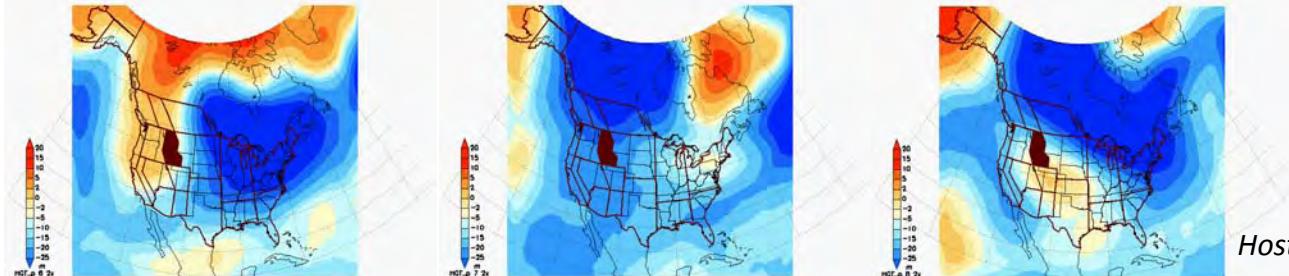
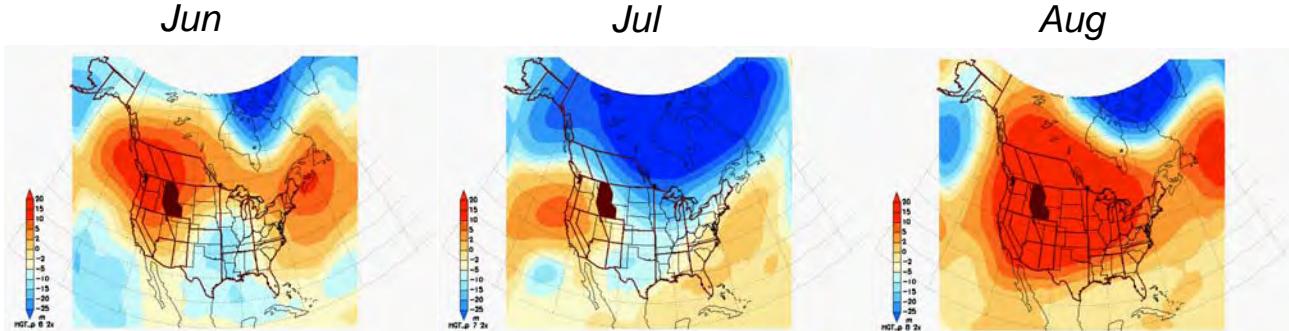
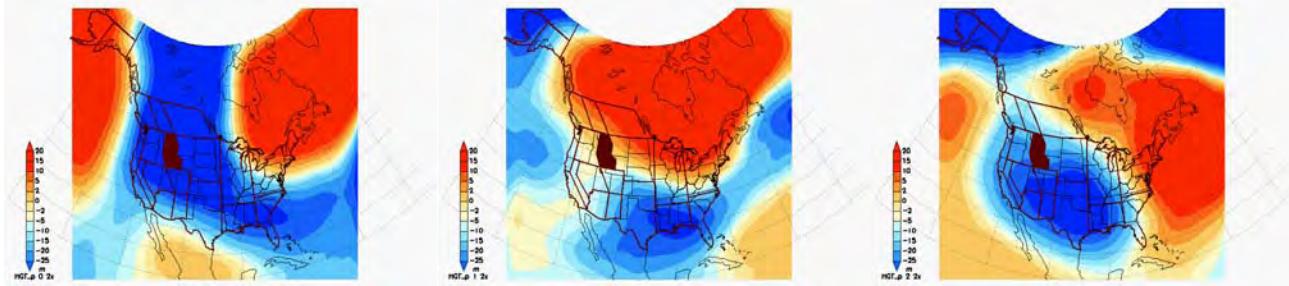
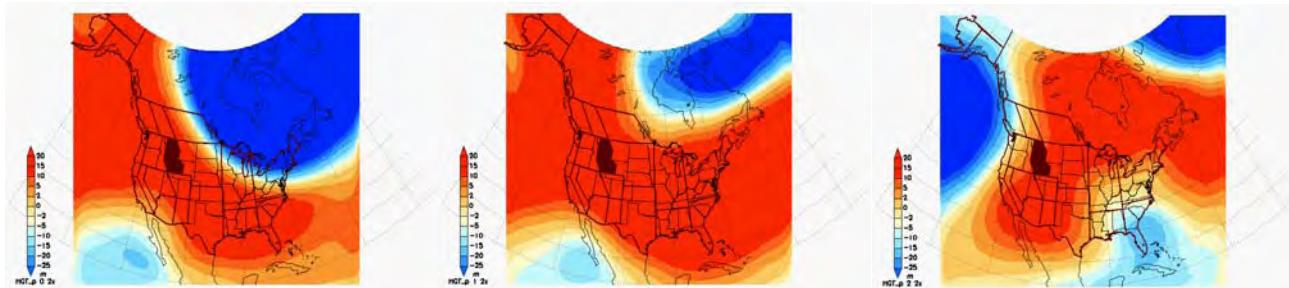
Feb

Mar

Jun

Jul

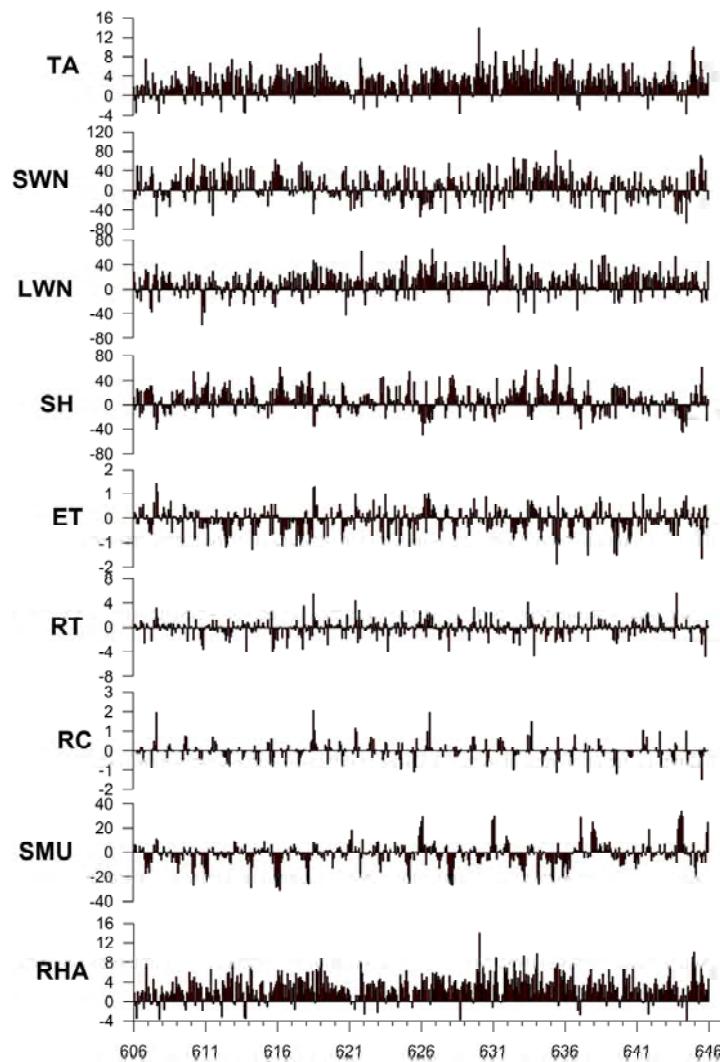
Aug



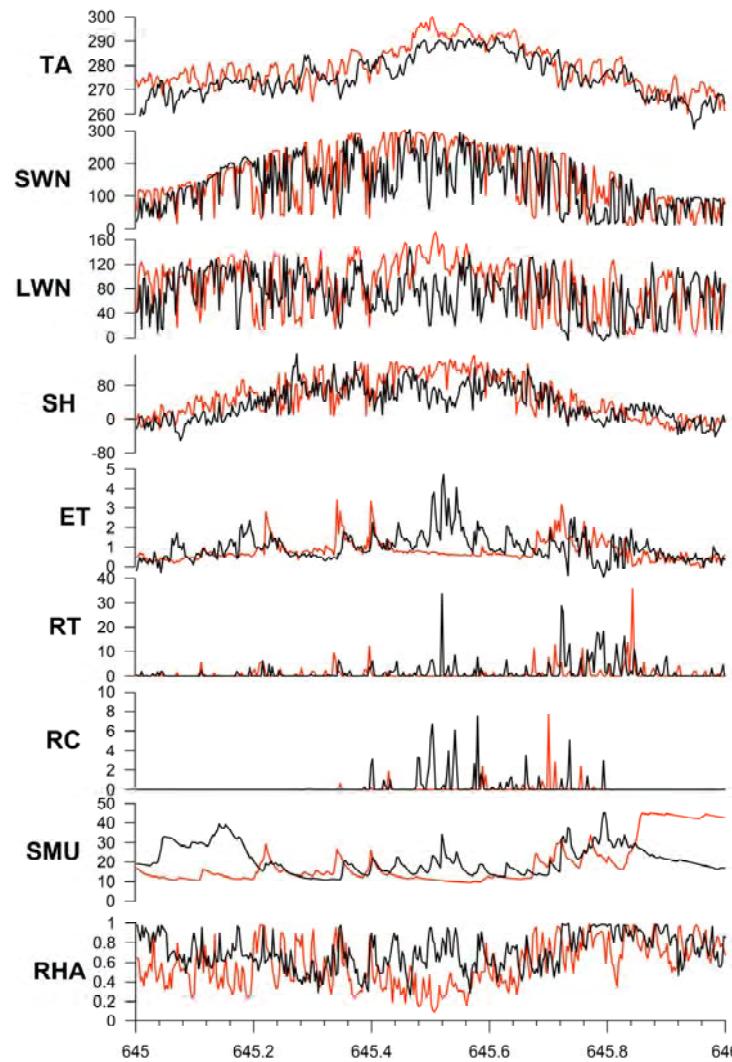
Hostetler, 2009

# Albuquerque

*2X-1X CO<sub>2</sub> Monthly Anomalies (40-yrs)*



*Daily Averages (1-yr)*



TA: 2-m air temperature ( $^{\circ}\text{K}$ )

SWN: net shortwave radiation ( $\text{W m}^{-2}$ )

LWN: net longwave radiation ( $\text{W m}^{-2}$ )

SH: sensible heat flux ( $\text{W m}^{-2}$ )

ET: Evapotranspiration ( $\text{mm d}^{-1}$ )

SMU: Root zone moisture (mm)

RT: Total precipitation ( $\text{mm d}^{-1}$ )

RC: Convective precipitation ( $\text{mm d}^{-1}$ )

RHA: Relative humidity (fraction)

Hostetler, 2009

## *In Progress/Future*

- *run out to 100/20 years*
- *complete analysis tools and analyses (verification)*
- *application to process models (wildfire, vegetation)*
- *more regions at high resolution*
- *one or two IPCC A/OGCMs for input*
- *serve output*