Analysis of Climate Models specific to River Herring: Regional Climate Projections over the Eastern US

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Regional Climate Change

- Most Global Climate models (GCM) currently have a course resolution (on the order of 100-200 km)

- One method to obtain higher resolution is through Dynamical Downscaling
  - Use finer scale physical models in a region where boundary conditions are provided by GCMs

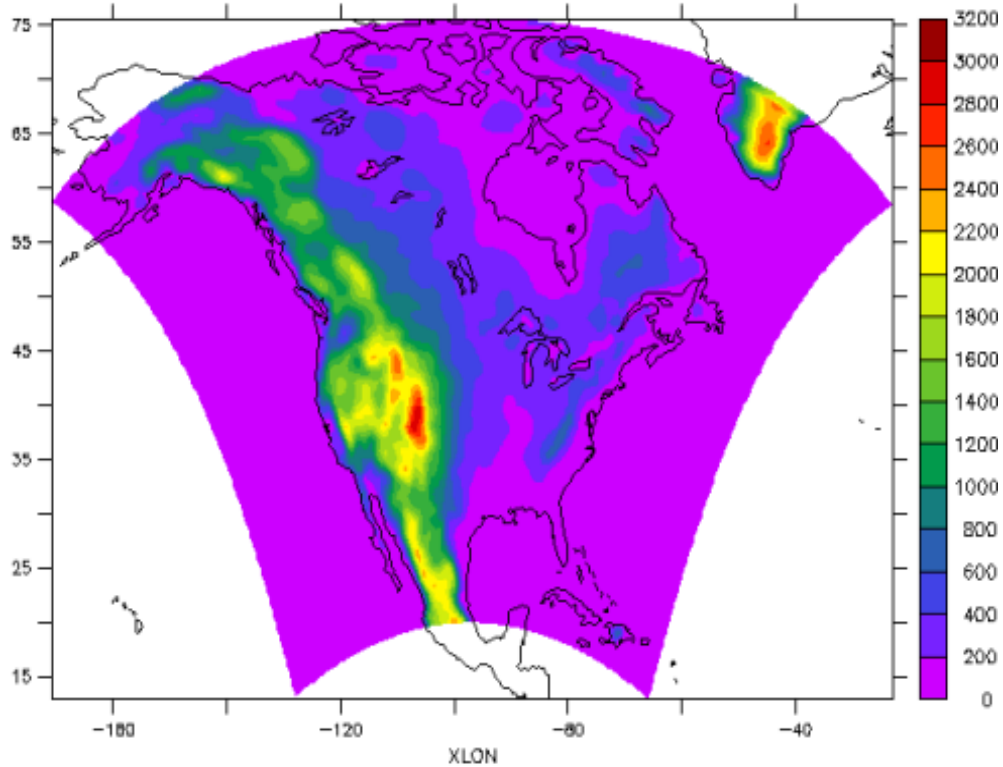
- North American Regional Climate Change Assessment Program (NARCCAP)
  - Uses multiple climate models with multiple regional atmospheric models to simulate climate change over North America at 50 km resolution

NARCCAP Experiment Design

- 20th Century Simulations : 1968-1999
- 21st Century Simulations : 2038-2069
  - Using "A2",(High CO_2)Scenario (~825 PPM $C0_2$ by 2100)

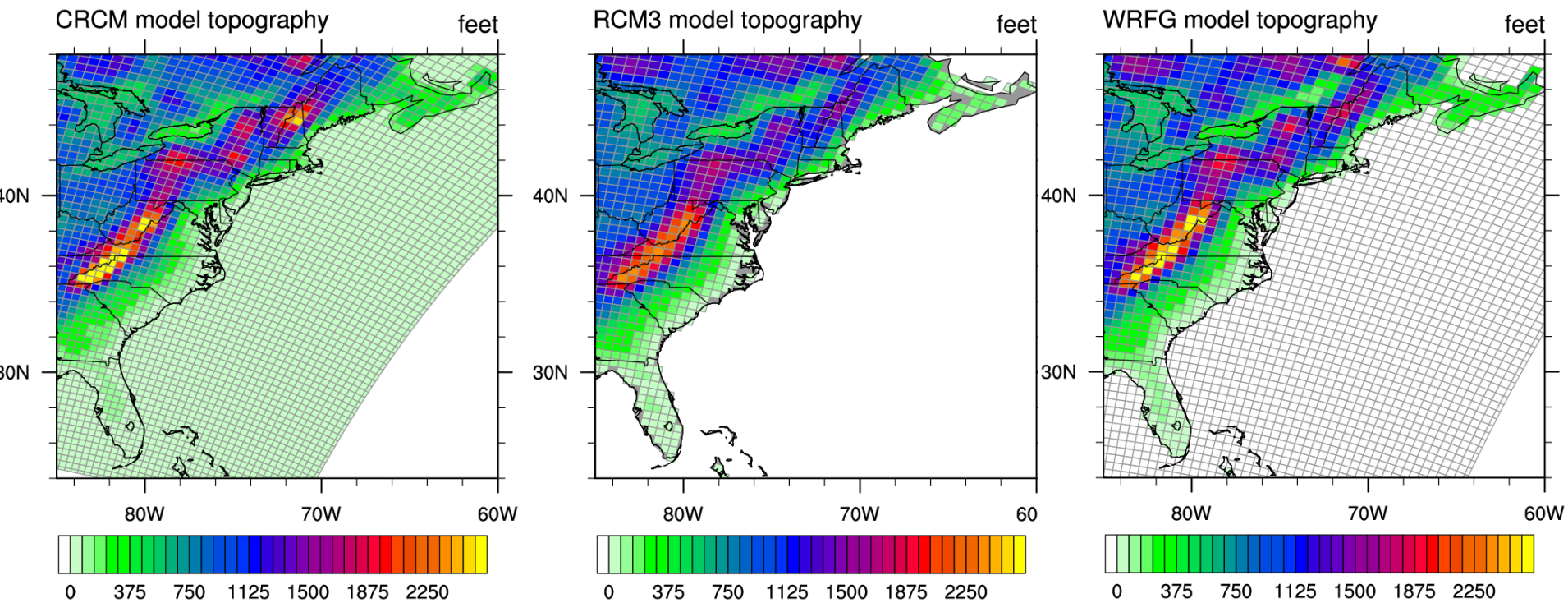
GCM-RCM combinations used:

- GFDL-RCM3
- CGCM3-RCM3
- CGCM3-WRF
- CGCM3-CRCM
- CCSM-CRCM
- CCSM-WRF
- Include land models with River routing schemes

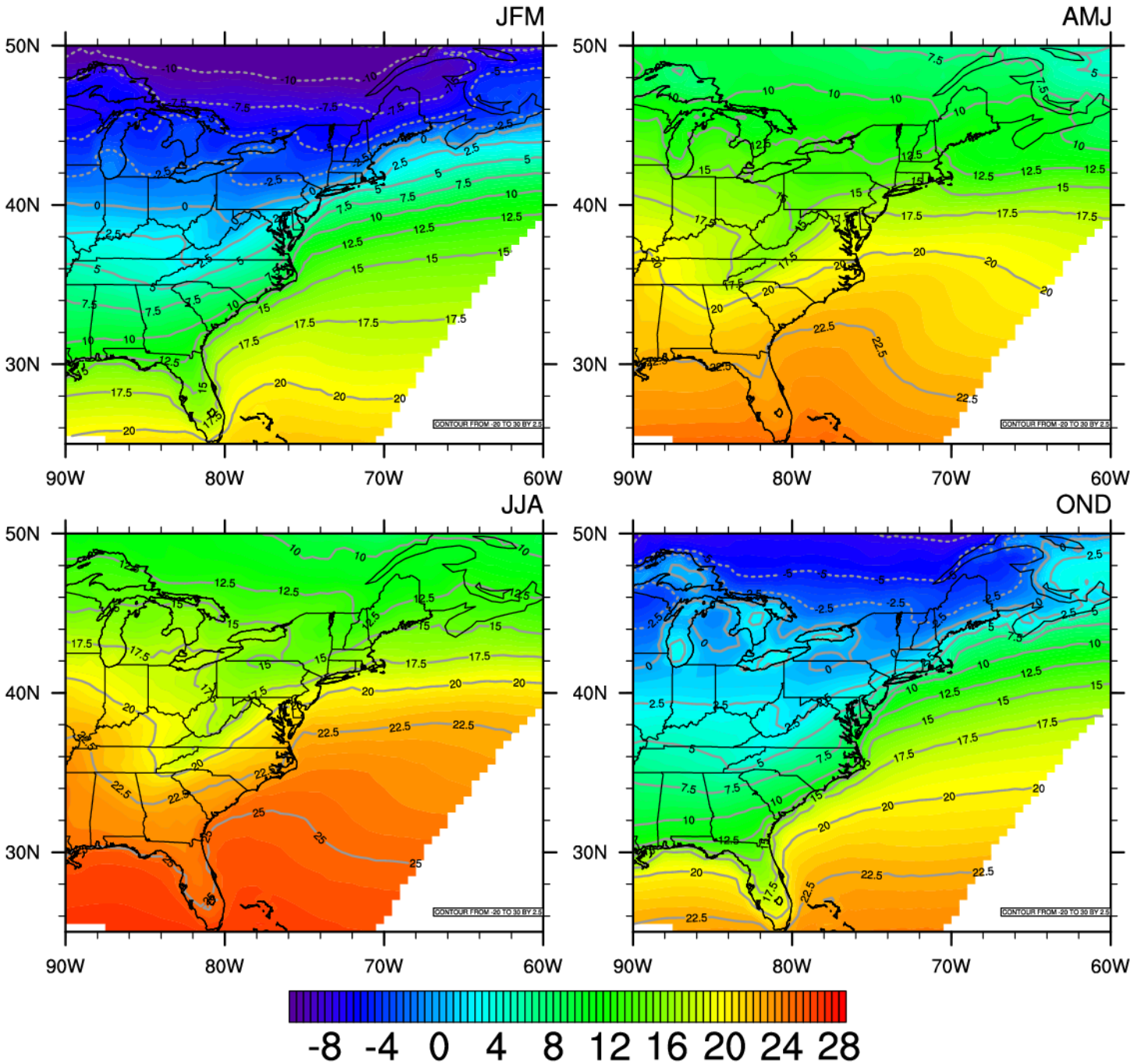


Regional Climate model domain

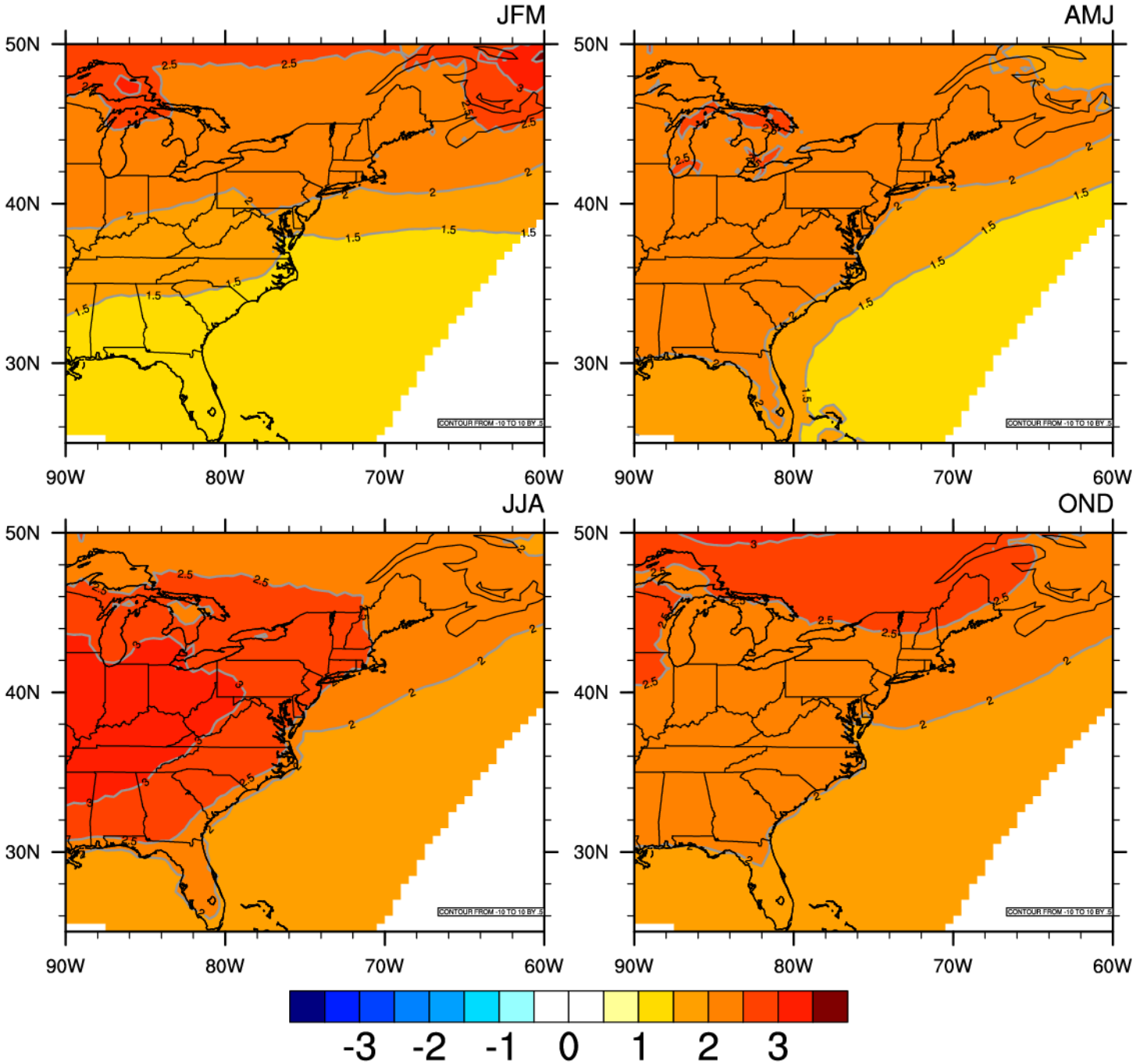
Representation of Topography by the Regional Climate models



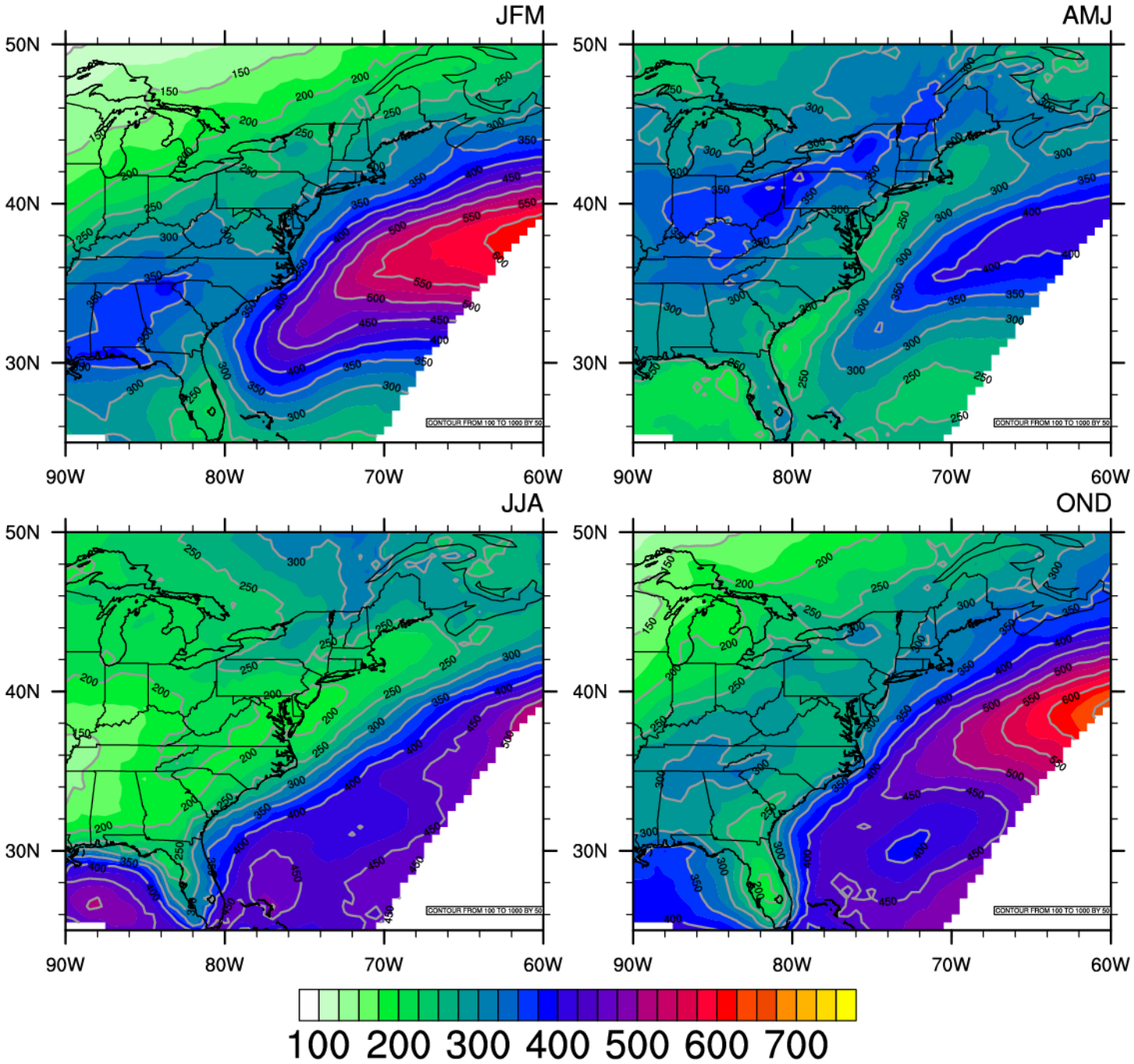
NARCCAP Ensemble Mean Sfc Air Temp (°C) 1968-1999 Clim



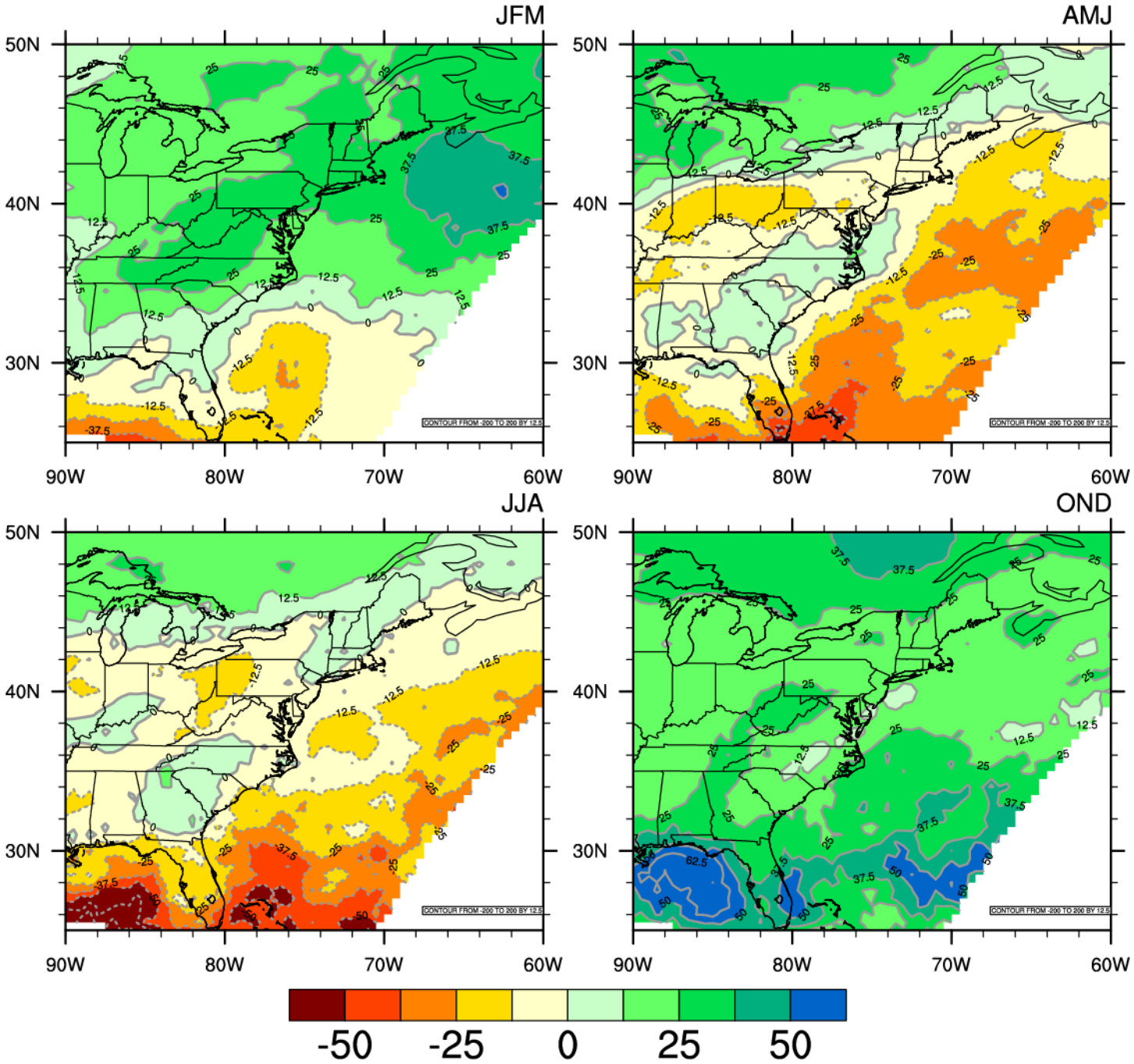
NARCCAP Ensemble Mean Sfc Air Temp (°C) Clim Δ (21stC-20thC)

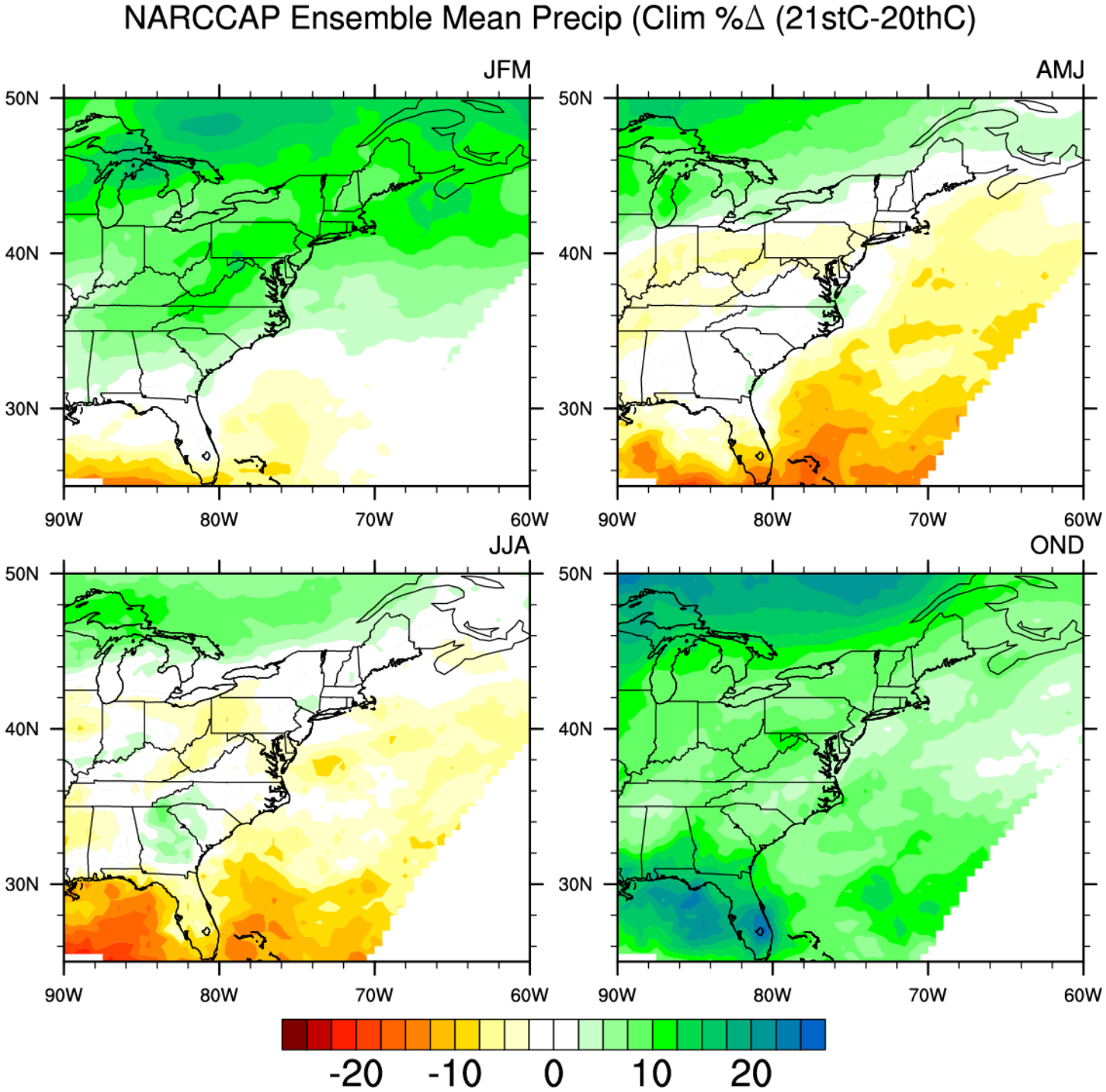


NARCCAP Ensemble Mean Precip (mm/seas) 1968-1999 Clim

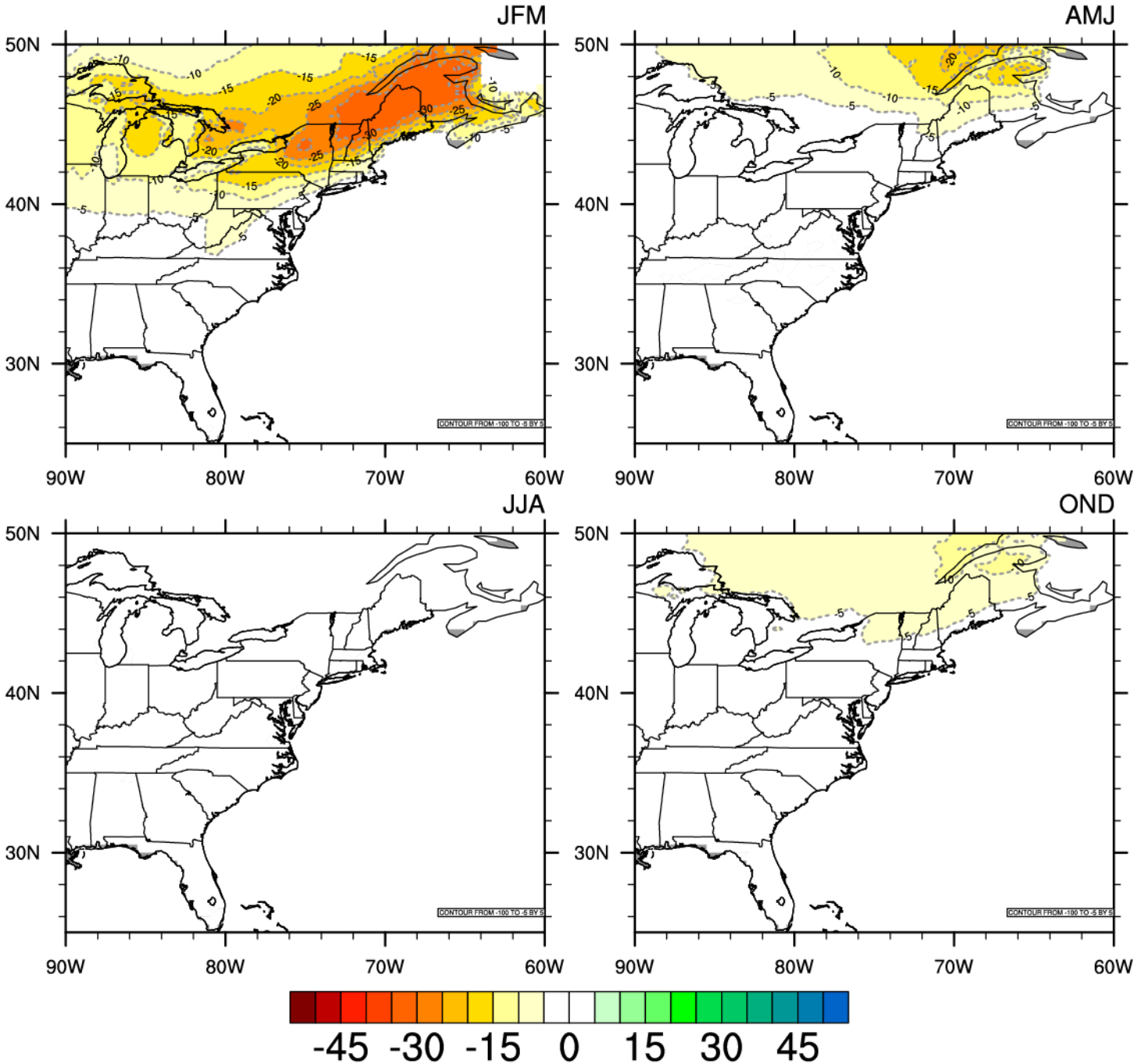


NARCCAP Ensemble Mean Precip (mm/seas) Clim Δ (21stC-20thC)

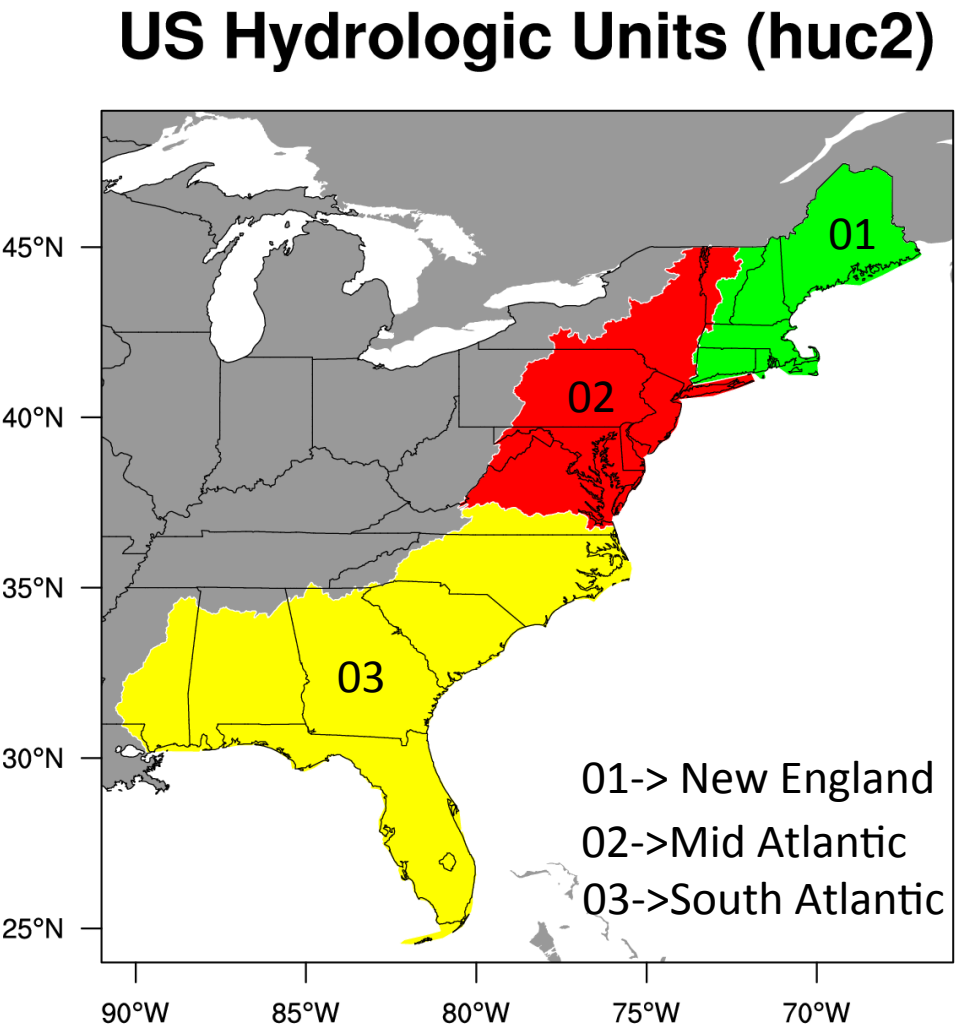


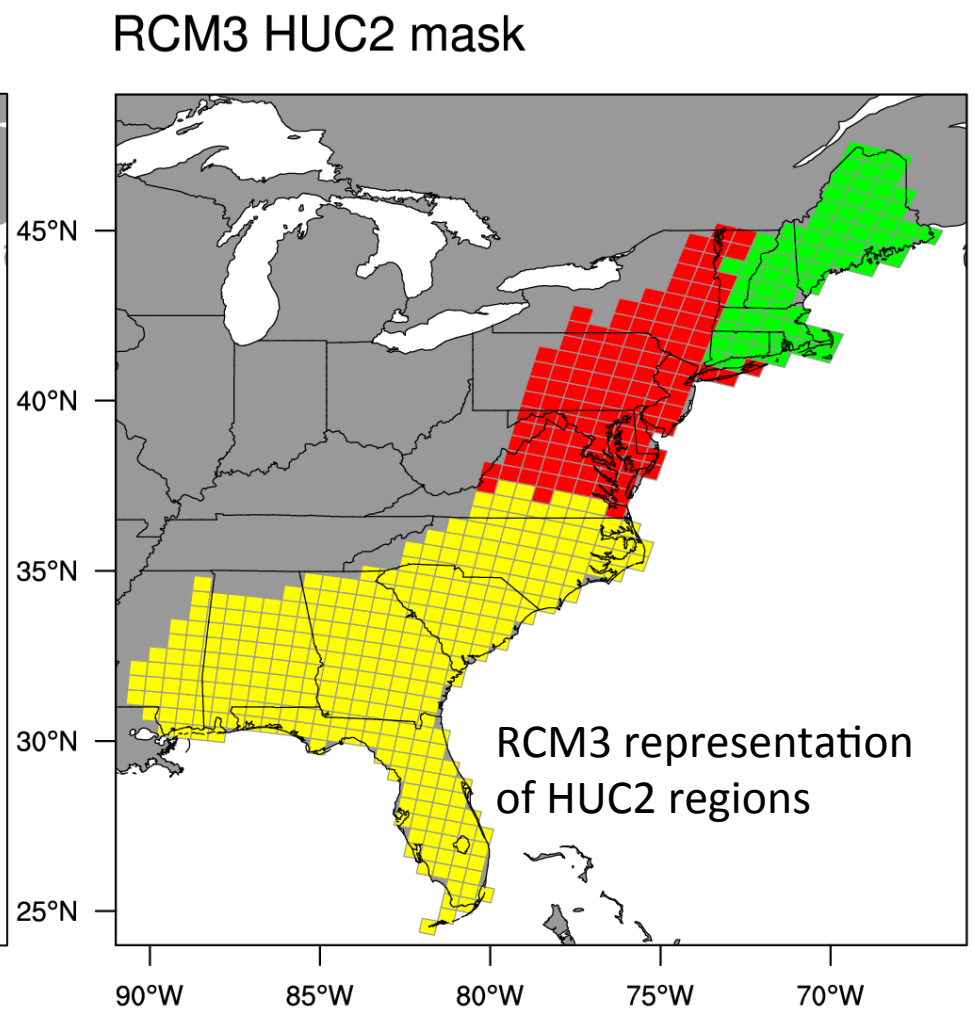

NARCCAP Ensemble Mean Precip (Clim %Δ (21stC-20thC)
JFM
AMJ
JJA
OND
50N
40N
30N
90W
80W
70W
60W
-20
-10
0
10
20

NARCCAP Ensemble Mean Snow Depth (mm) Clim Δ (21stC-20thC)



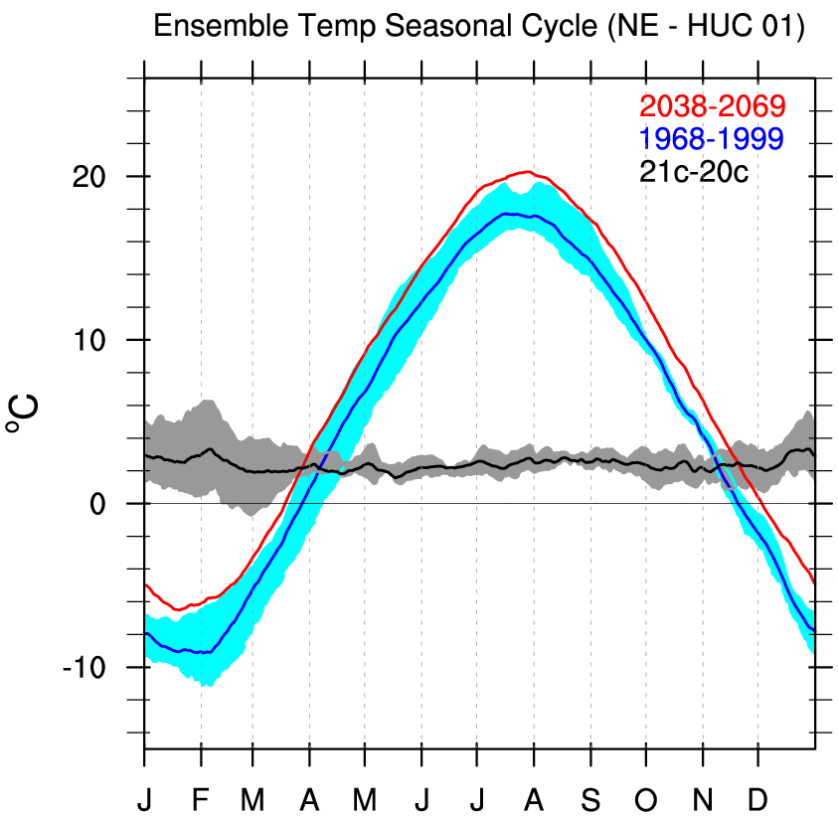
Regional Watersheds

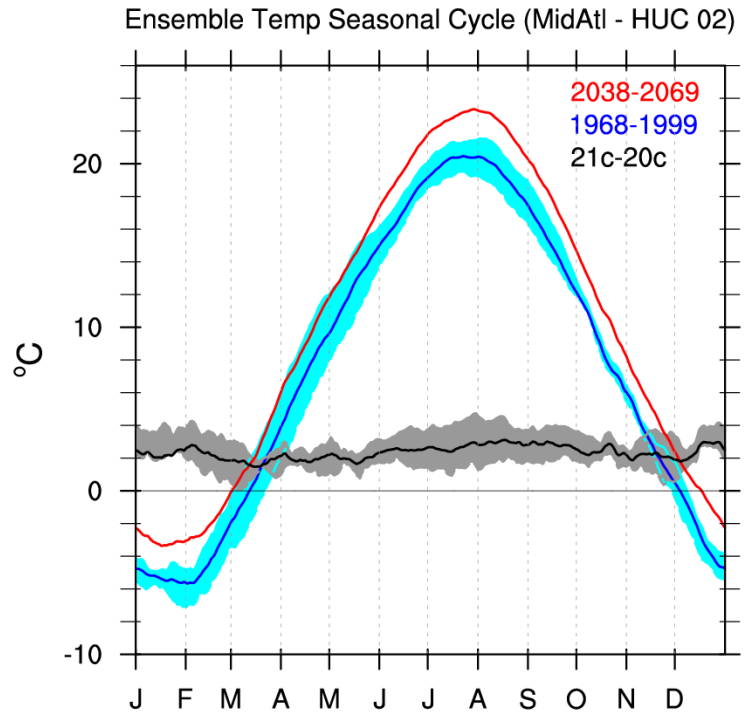


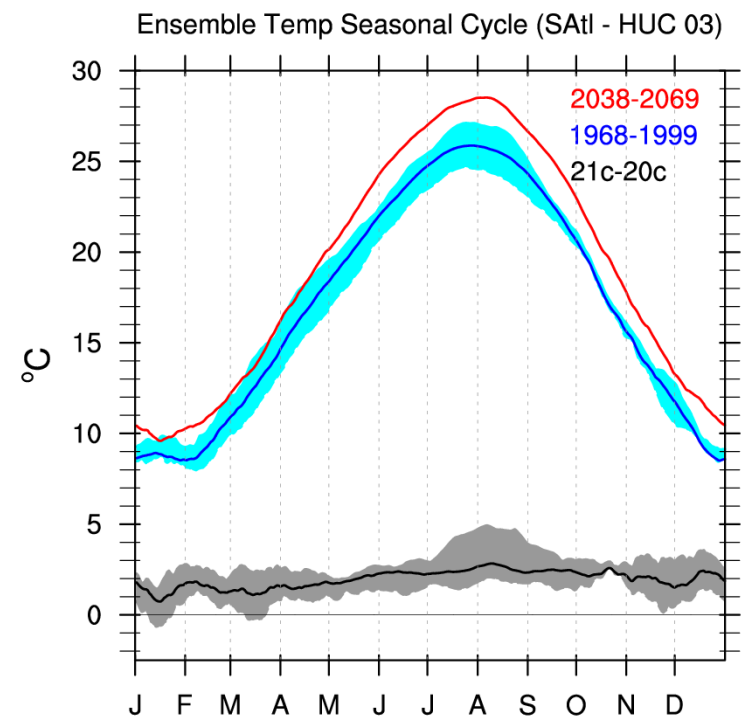


NARCCAP Ensemble Mean Temperature Seasonal Cycles for HUC Regions

20th Century climate
20th Century 17th-83rd percentile range
21st Century climate
21st Century – 20th Century difference



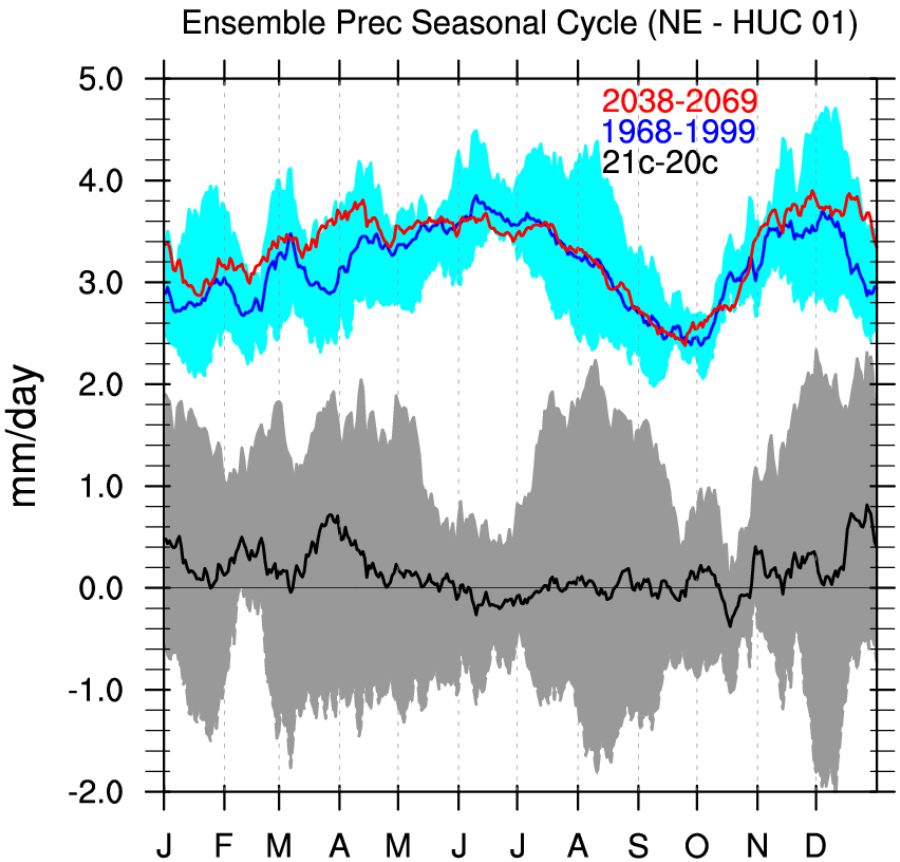


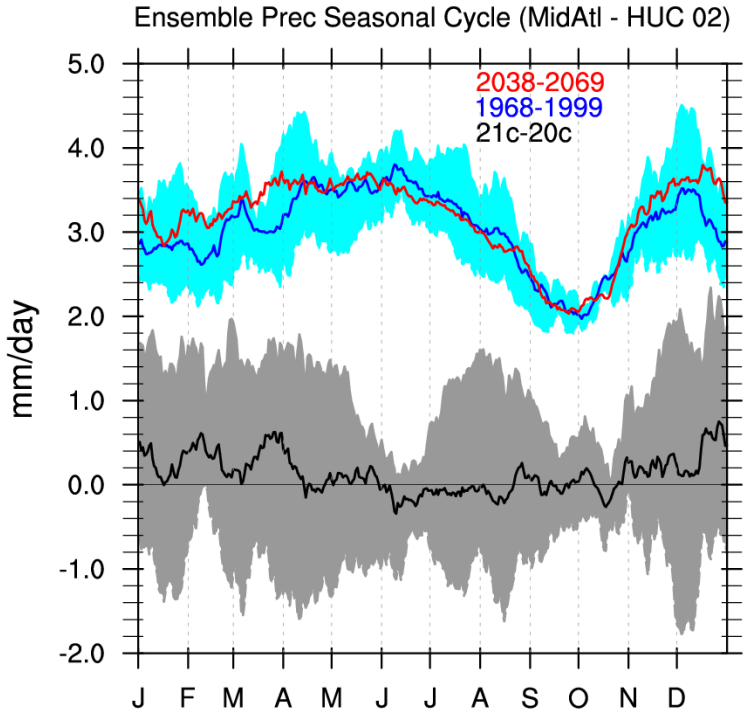


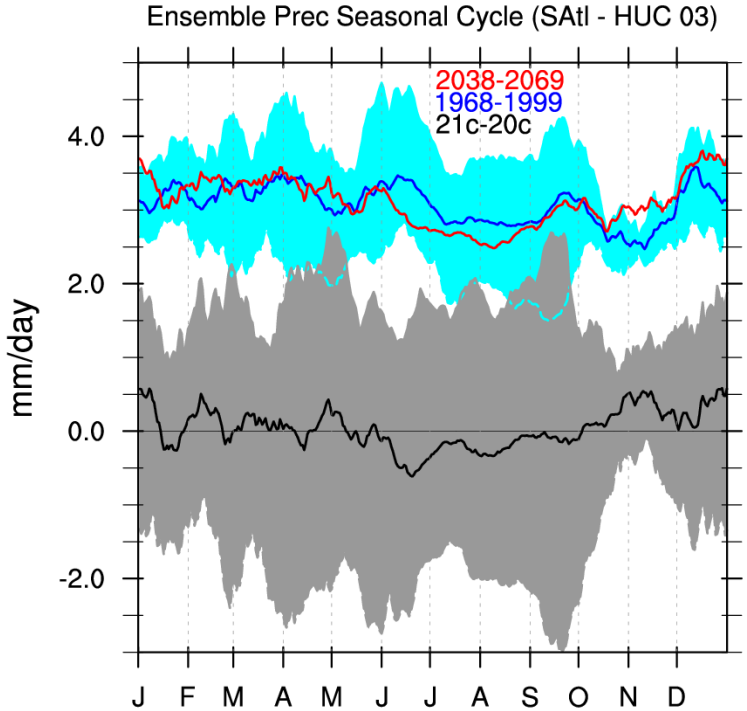
Smoothed using 15-day running mean

NARCCAP Ensemble Mean Precipitation Seasonal Cycles for HUC Regions

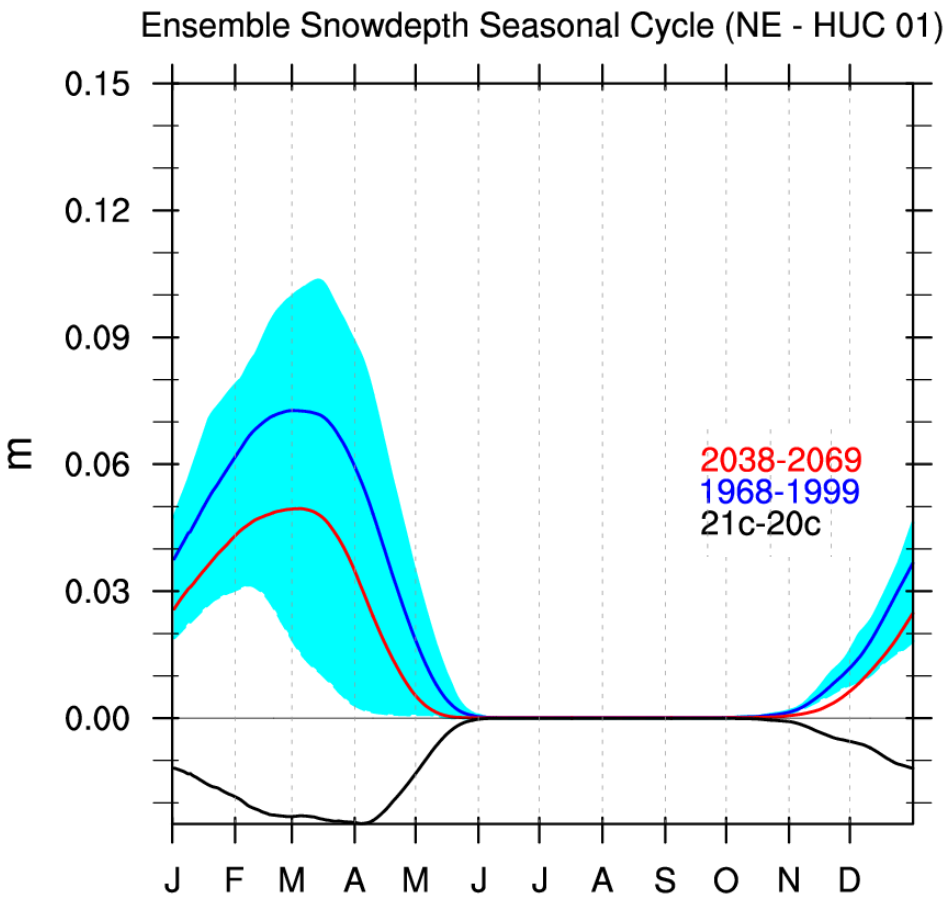
20th Century climate
20th Century 17th-83rd percentile range
21st Century climate
21st Century – 20th Century difference

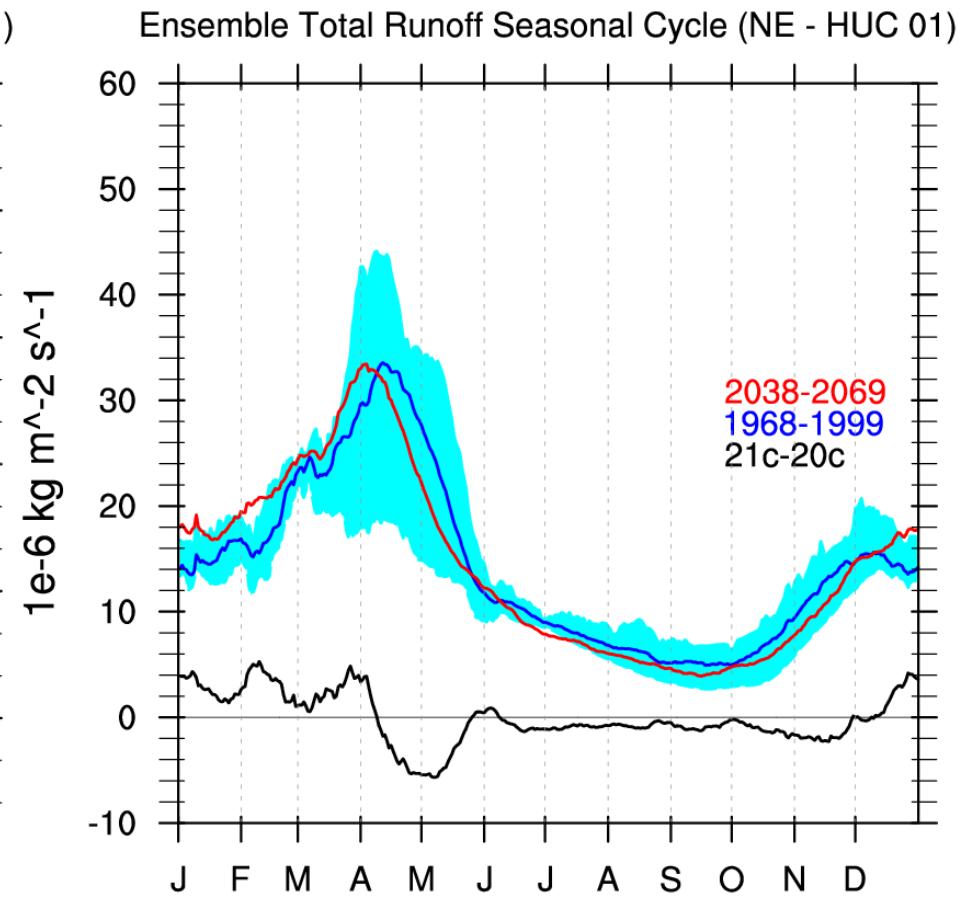


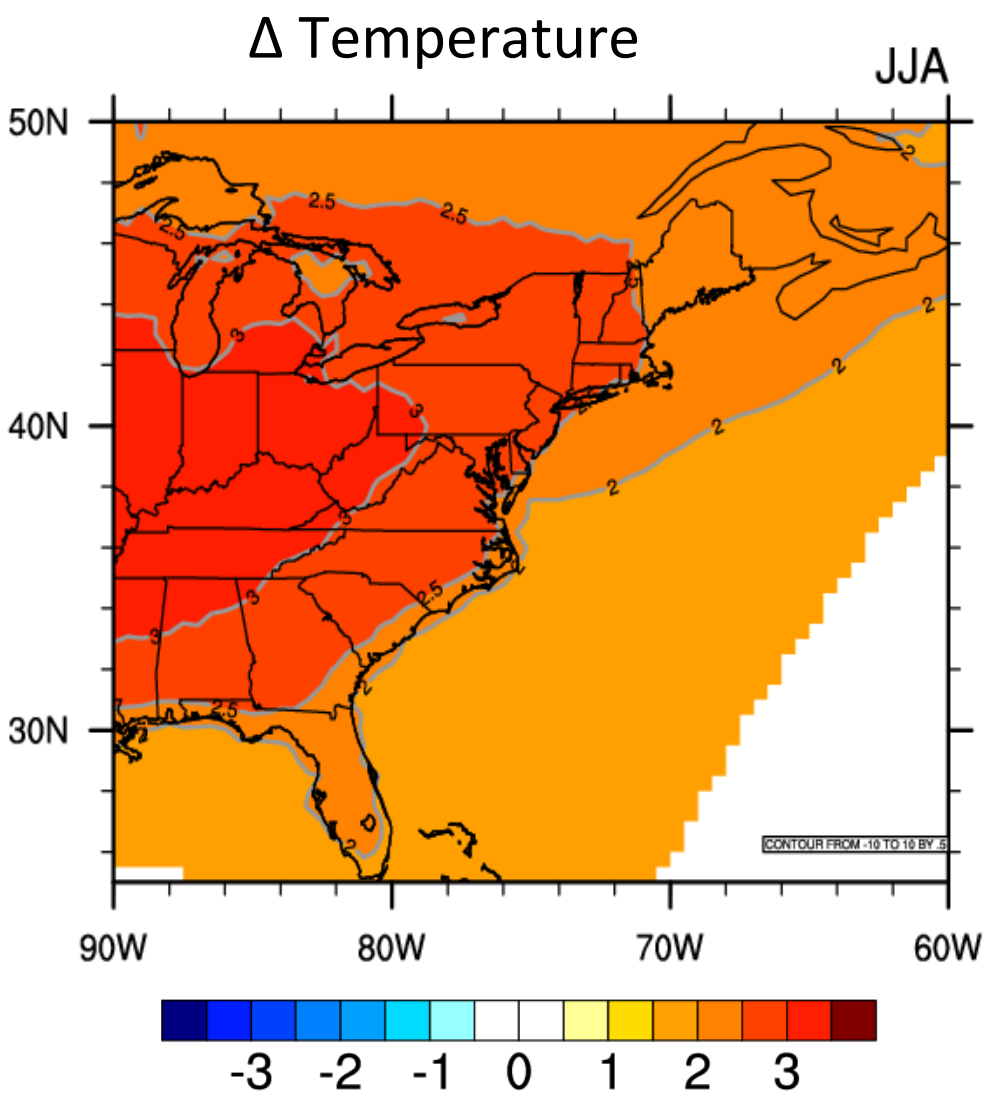




NE HUC1 Snow & Depth Runoff





Summary

- Used regional models to downscale climate change over the eastern US
- Robust – warming throughout the eastern US ~2-3°C, stronger over land in mid 21st century to late 20th century
- Enhanced precipitation in eastern US in fall and winter but much greater uncertainty than temperature.
- Reduced snow depth in northeast and earlier snow melt but large spread across the model simulations
- Greater warming in the ocean at the surface than at depth leads to enhanced stratification (shown on Monday)