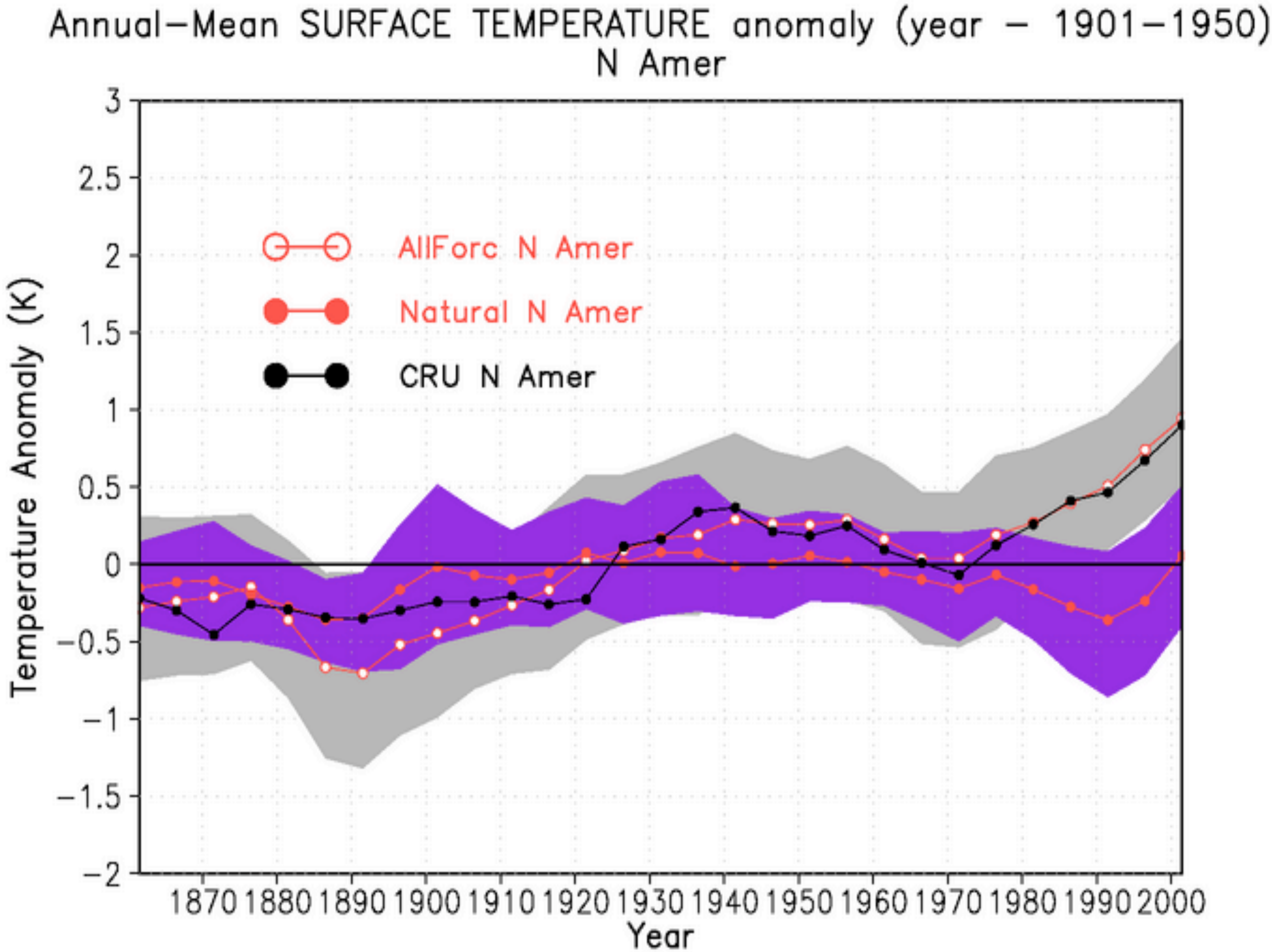
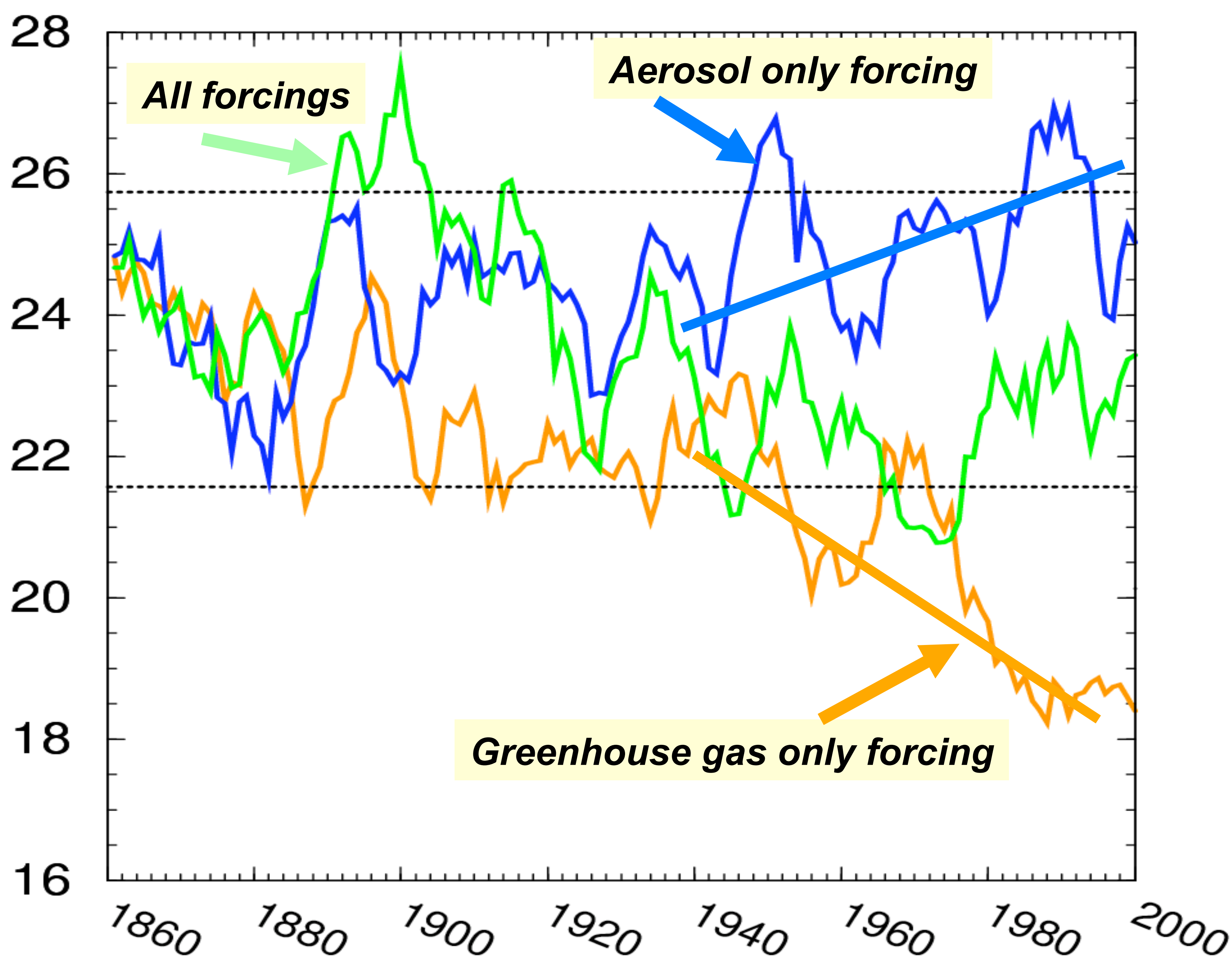


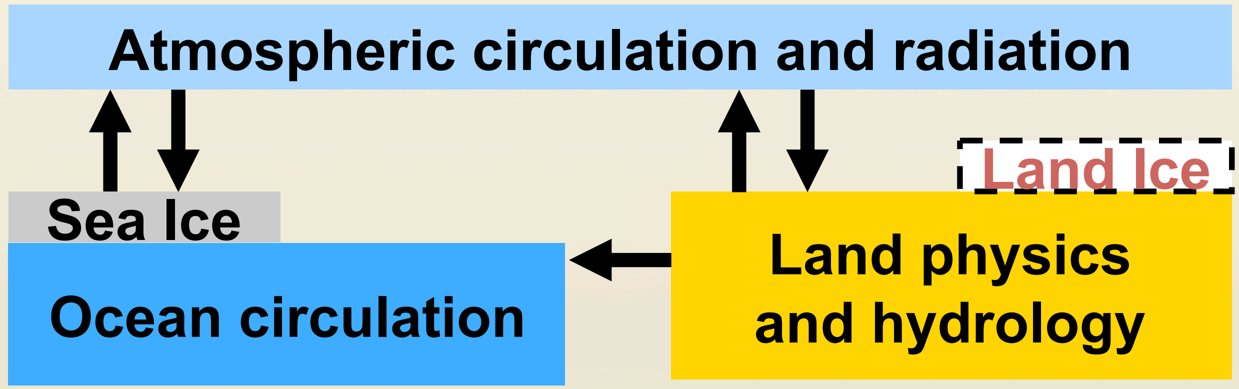
Annual-Mean SURFACE TEMPERATURE anomaly (year - 1901-1950)
N Amer
AllForc N Amer
Natural N Amer
CRU N Amer
Temperature Anomaly (K)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
Year

# Simulated North Atlantic AMOC Index

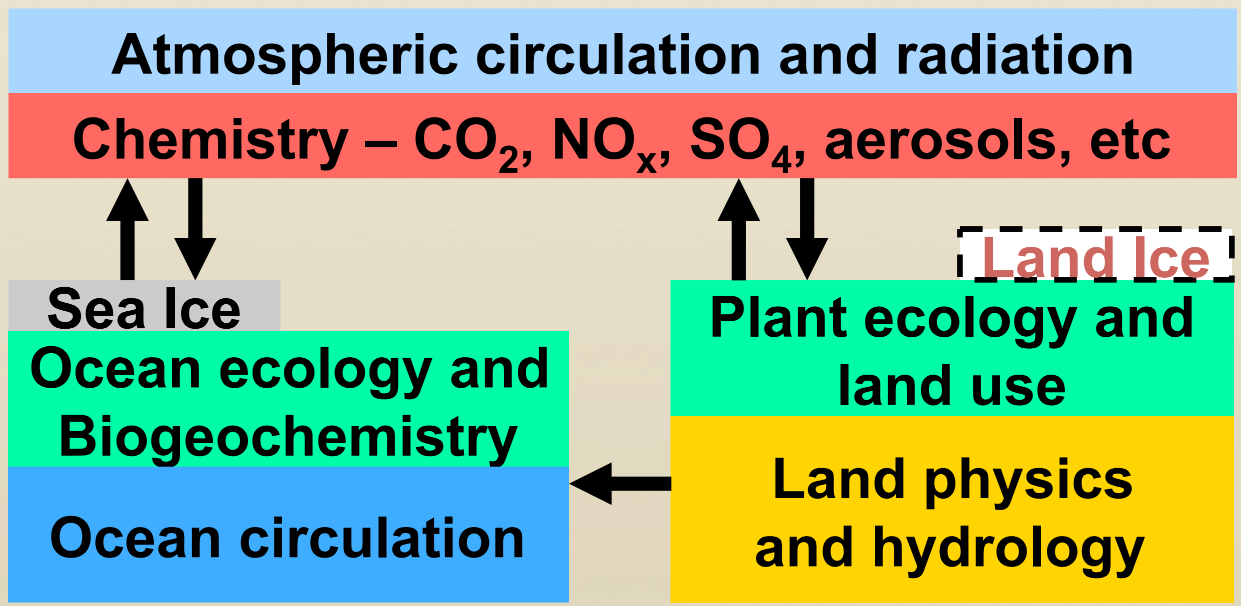


# Climate & Earth System Model (ESM)r

Climate Model

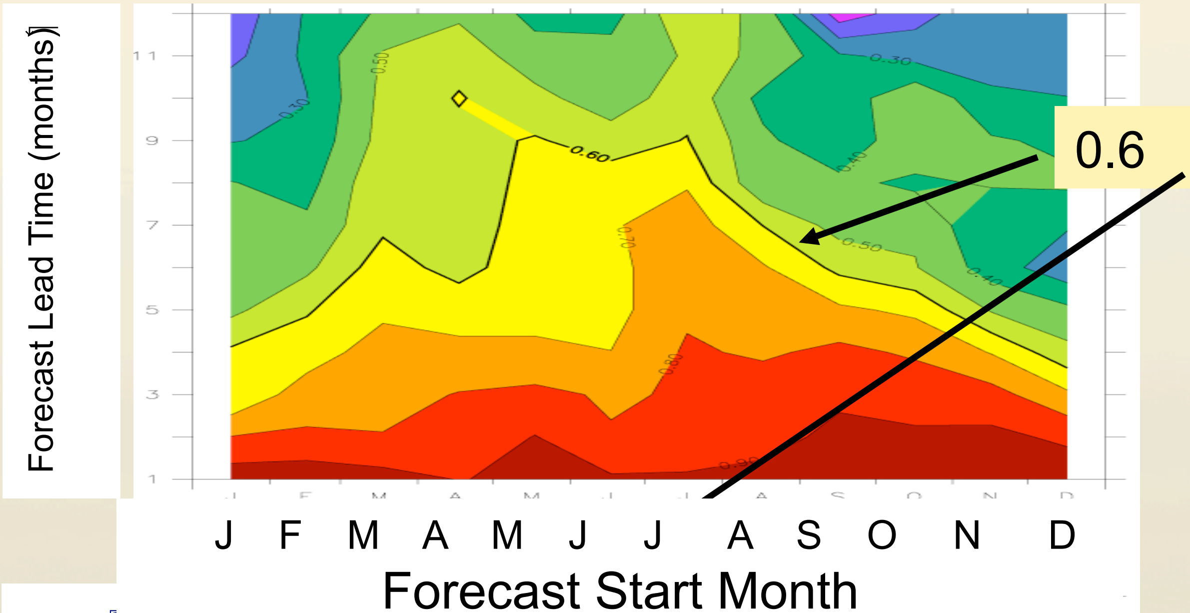



Earth System Model



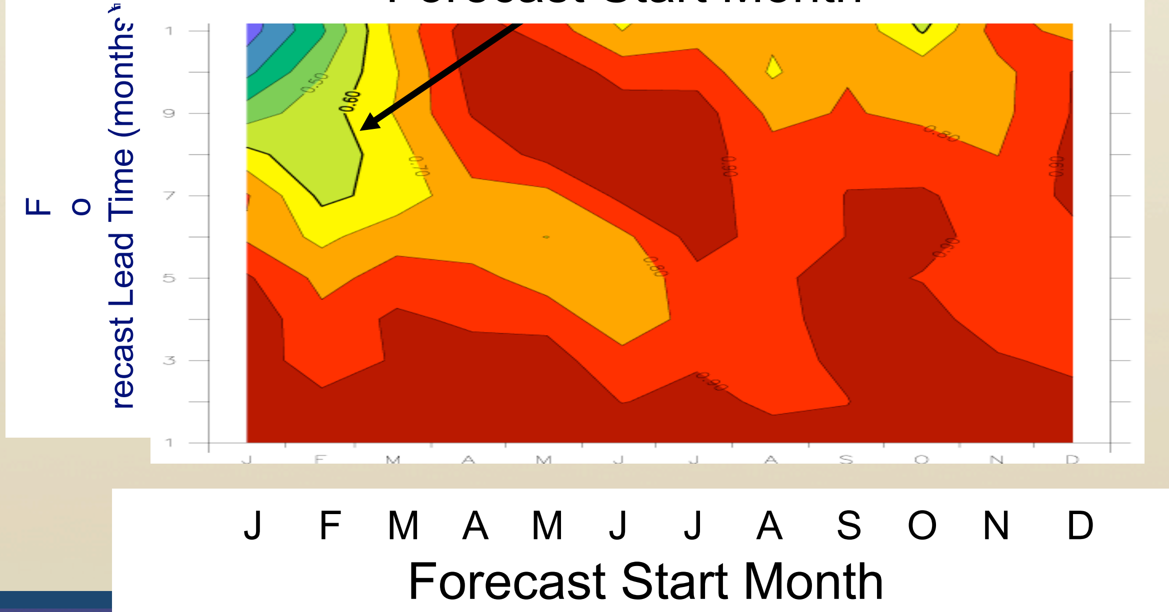
# RECENT HIGHLIGHTS – III

## New coupled assimilation system improves ENSO prediction skill



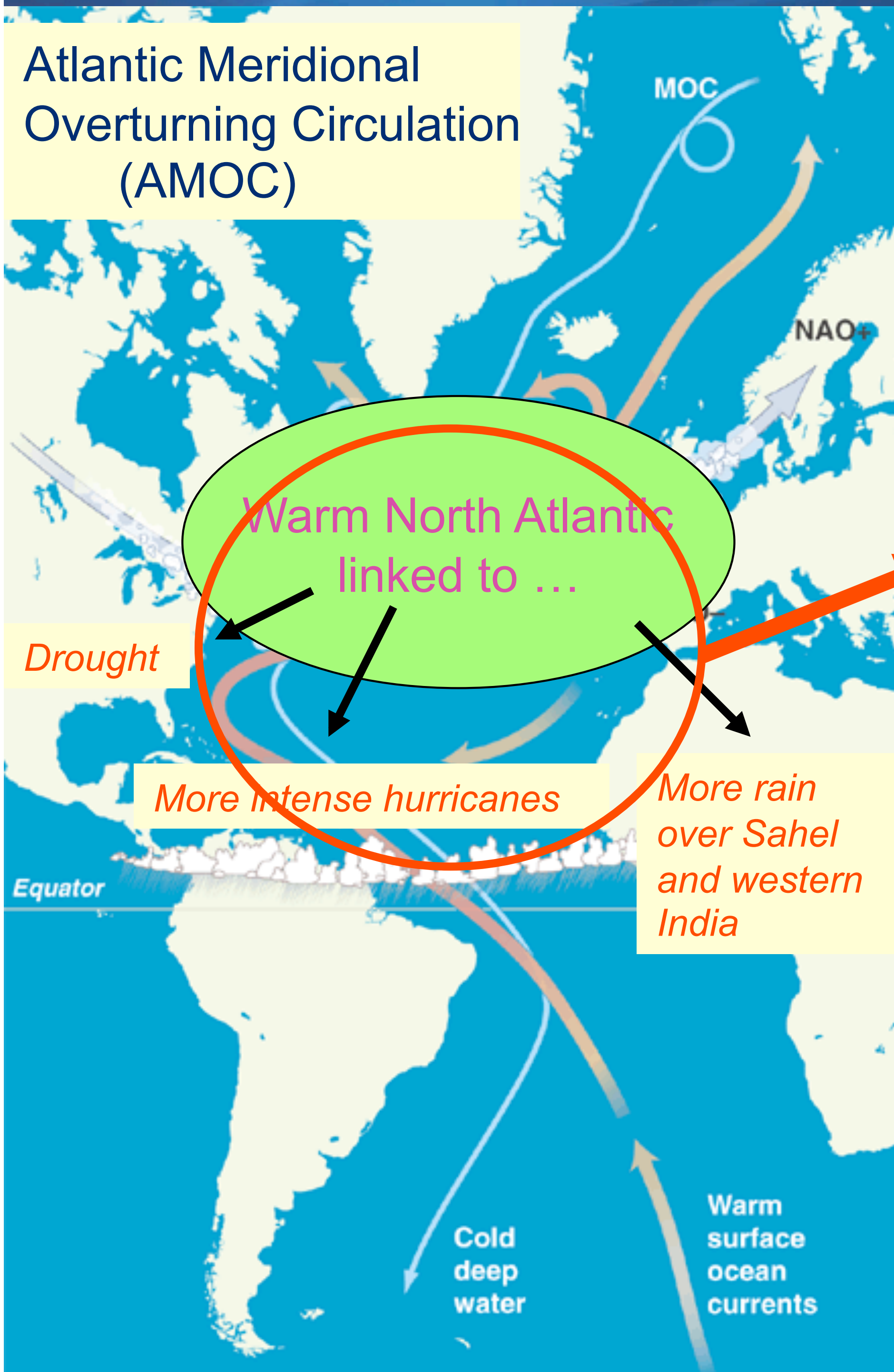

Correlation of observed and predicted NINO3 SST (measure of forecast skill)

3D-variational assimilation system

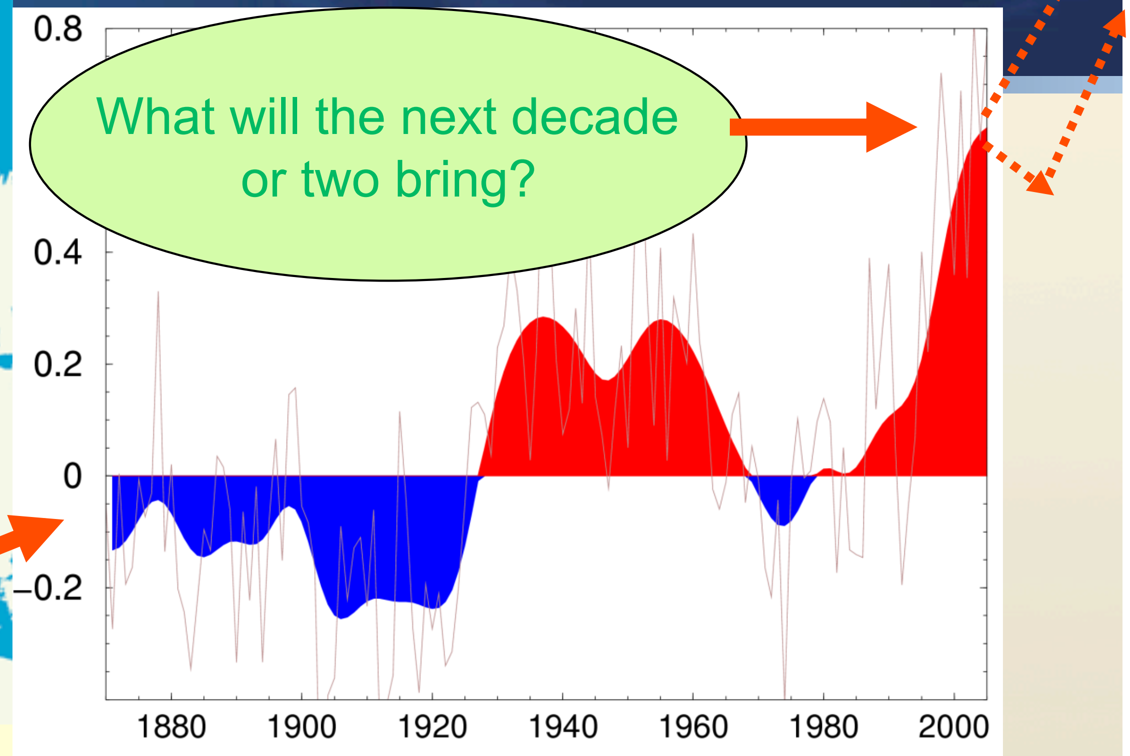



New coupled assimilation system

# Atlantic Meridional Overturning Circulation (AMOC)

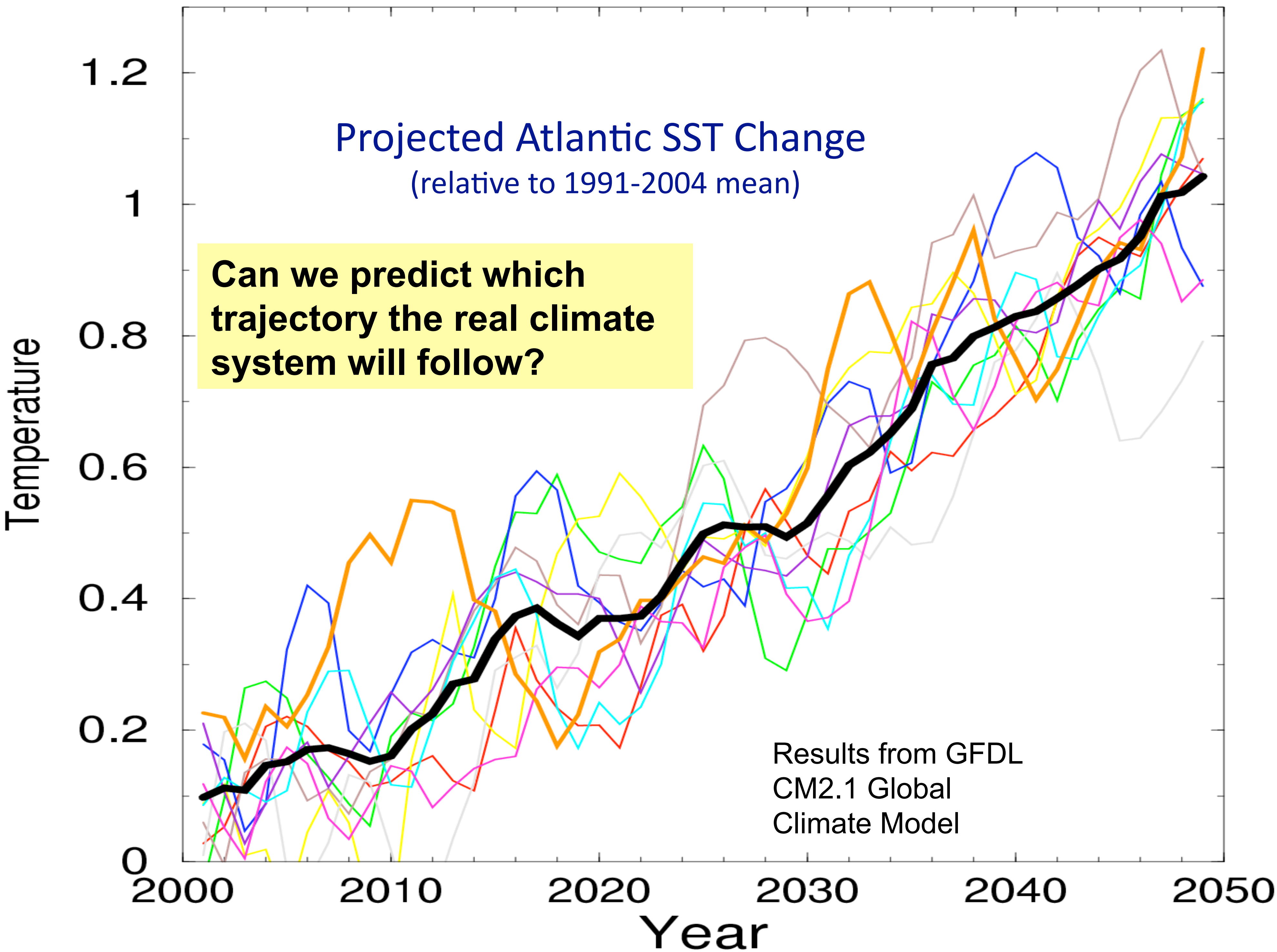



## North Atlantic Temperature




Two important aspects:

a. Decadal-multidecadal fluctuations
b. Long-term trend



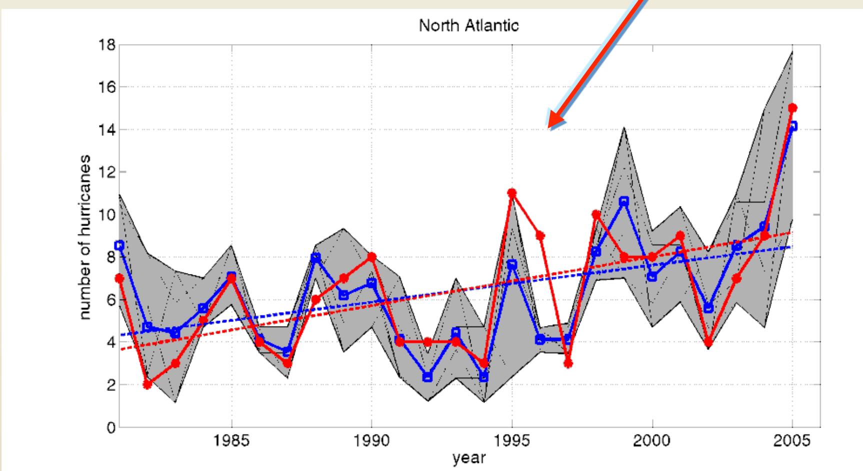
Projected Atlantic SST Change
(relative to 1991-2004 mean)
Can we predict which trajectory the real climate system will follow?
Results from GFDL CM2.1 Global Climate Model
Temperature
Year
0
0.2
0.4
0.6
0.8
1
1.2
2000
2010
2020
2030
2040
2050

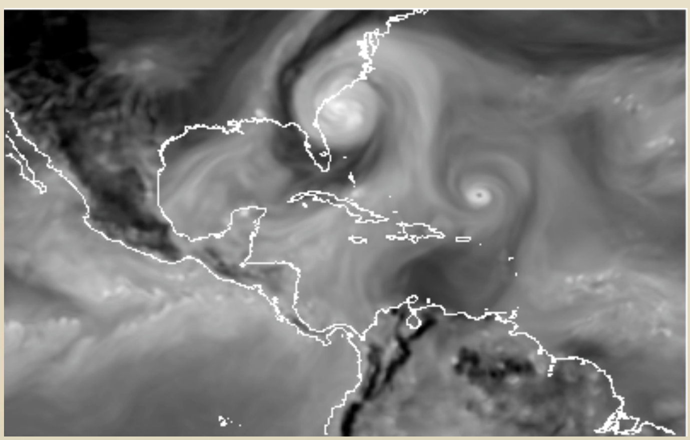
# Decadal Predictability

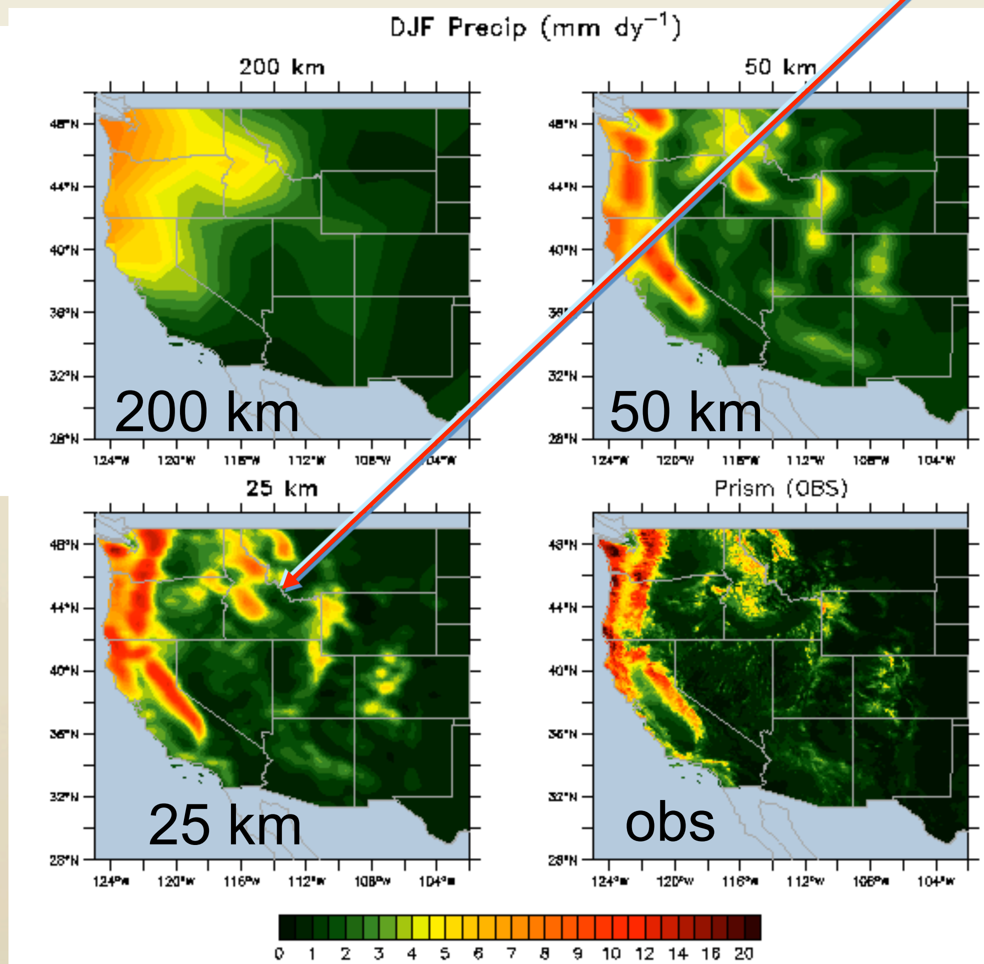
- Decadal prediction/projection is a mixture of boundary forced and initial value problem
- Changing radiative forcing (esp. aerosols) will be a key ingredient
- Some basis for decadal predictability of internal variability, probably originating in ocean
- Some of predictability will arise from unrealized climate change already in the system
- Substantial challenge for models, observations, assimilation systems, and theoretical understanding

# RECENT HIGHLIGHTS – II
## High-resolution global atmospheric modeling

GFDL will contribute “time-slices” to AR5 at 25 km resolution
Initial emphases include tropical storms and regional climate change over US



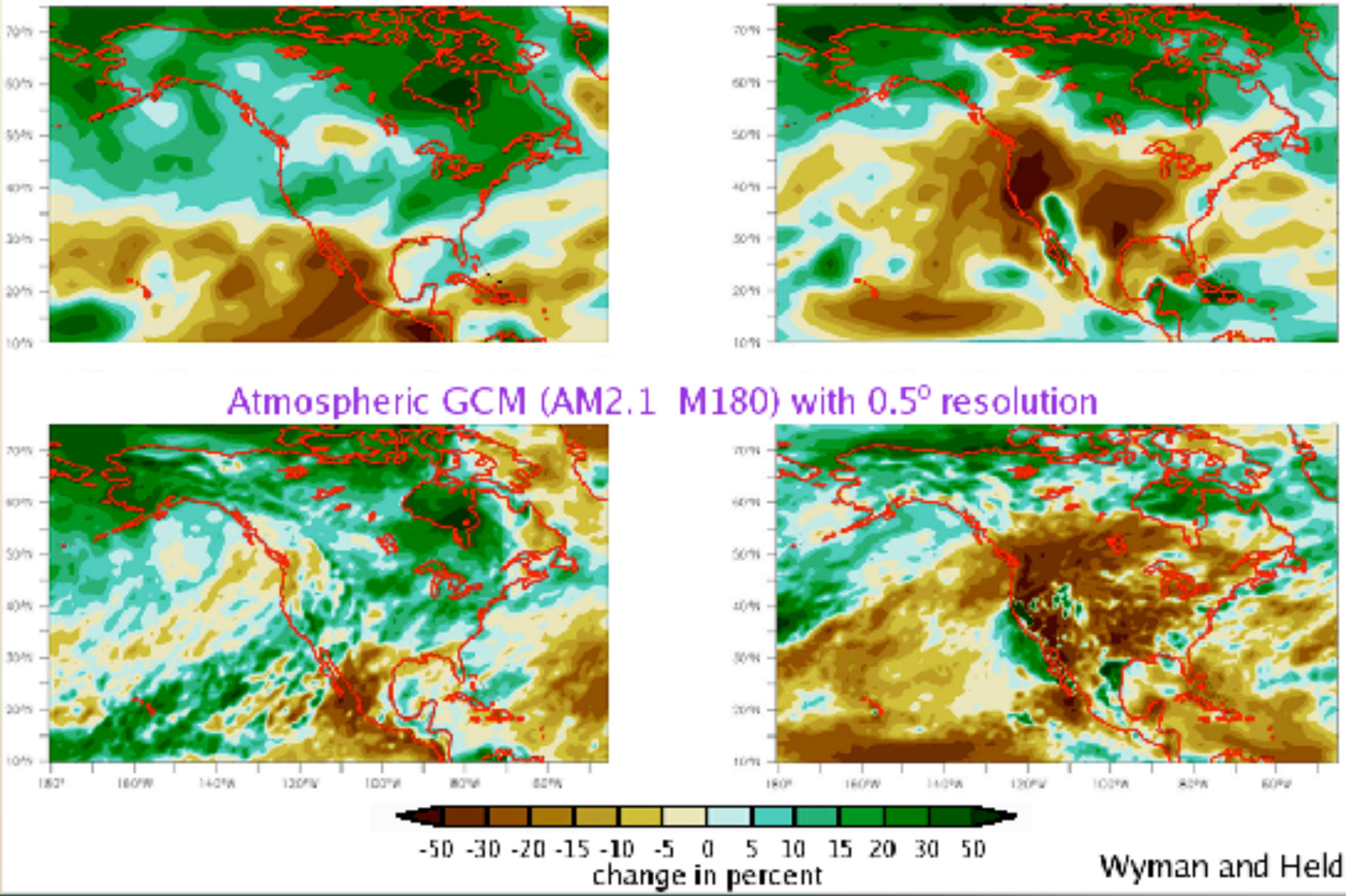


# GFDL Contribution to North American Regional Climate Change Assesment Program

## Precipitation Response

Winter | Summer

Couple Model (CM2.1) with 2° resolution

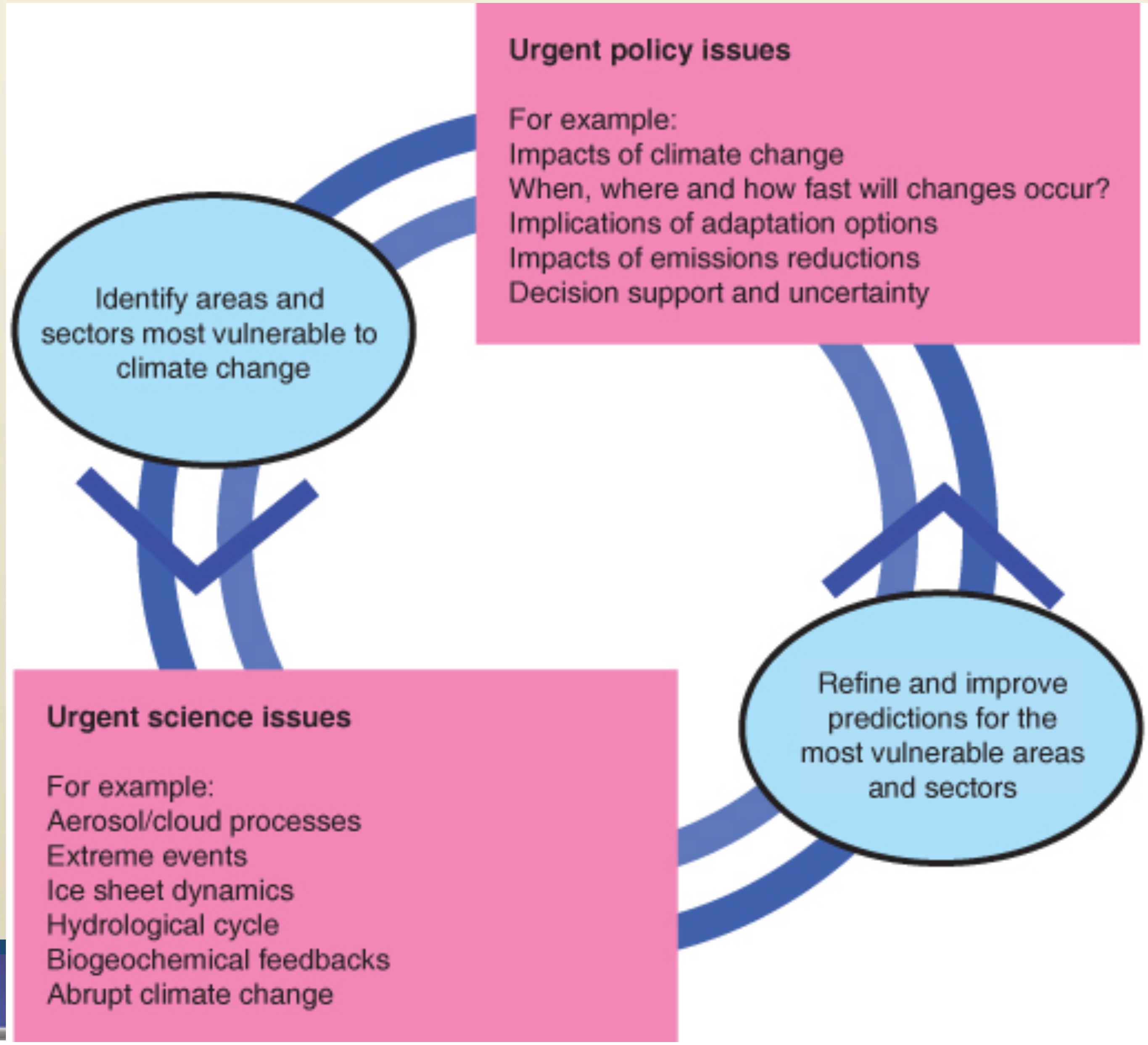



Wyman and Held

# Frame science around impacts, adaptation, mitigation; a risk management framework

***WCRP/GCOS/IGBP***
***Sydney Workshop***
***(October 2007)***
***Lessons from AR4***

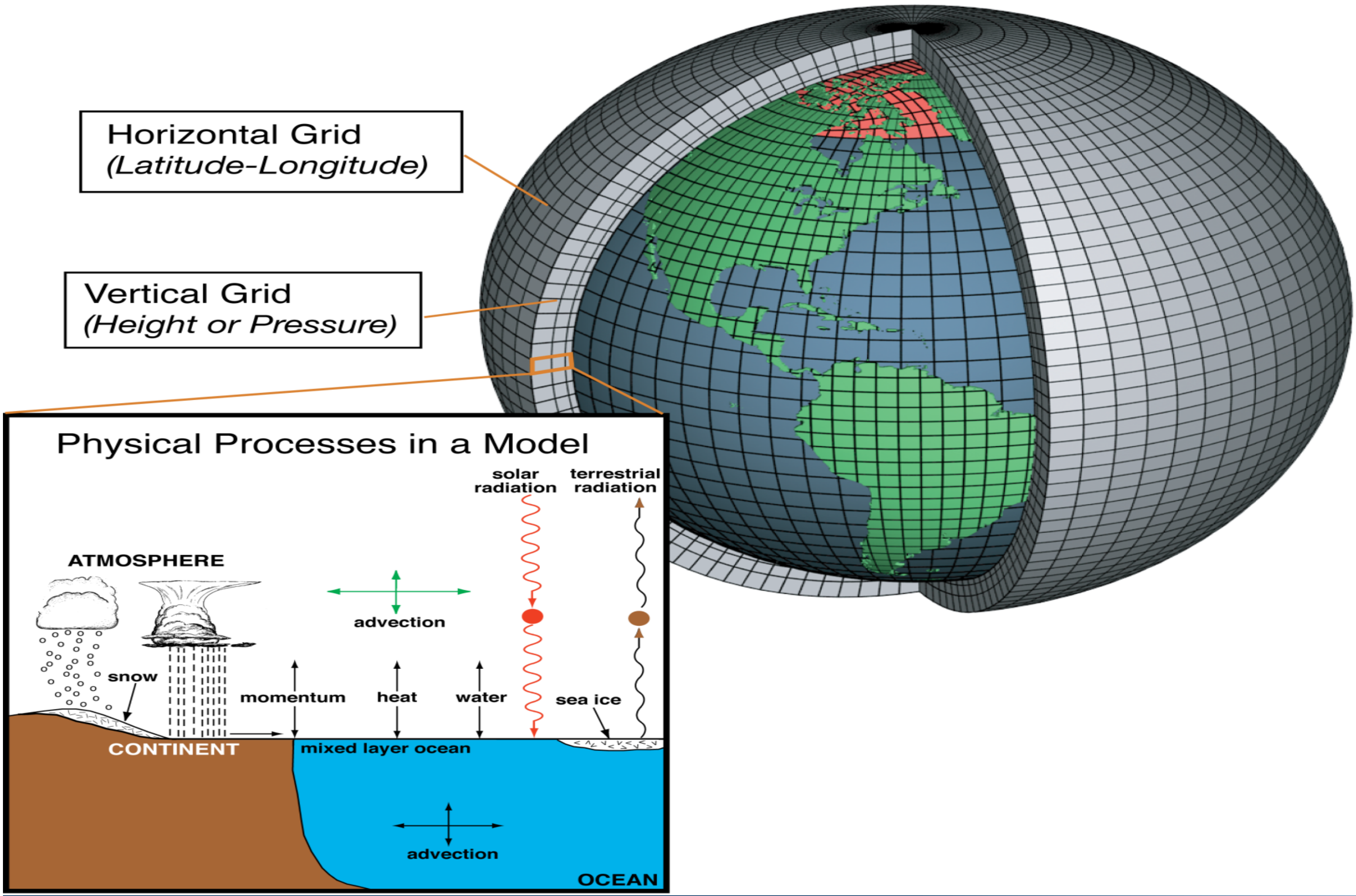
***[Doherty et al., BAMS, 2009]***



# Do-able Pieces

- Improved access to information and data, and sustaining it.
- Increased/better clarifications on uncertainties and quantification of levels of confidence.
- Scientists' engagement in the "applications" of the fundamental advancements to produce information that is usable.
- Clear communication of the state-of-climate-science for Adaptation and Mitigation considerations, with accurate statements on the advances made in the predictive understanding of climate, and on the limitations in the information.
- Working alongside the other "experts" in providing collectively smart inputs into the Adaptation and Mitigation decision processes.

# Schematic for Global Atmospheric Model



# FOUR GFDL Model Streams for AR5: *Differences relative to CM2.1 indicated*
# [CM2.1 components → AM2, LM2, MOM4, SIS]

| | |
|---|---|
| 1. CM3 | New atmosphere model (AM3). Interactive tropospheric and stratospheric chemistry, aerosols & aerosol-cloud interactions.<br>New land model and hydrology (LM3). |
| 2. ESM2 | Carbon biogeochemistry (land and ocean), 2 ocean configurations: MOM4.1 (ESM2M) and GOLD (ESM2G, isopycnal model). |
| 3. CM2.x | Decadal predictability research using GFDL's ensemble coupled data assimilatrion.<br>Begin with CM2.1, possibly advancing to higher resolution/ complexity. |
| 4. HiRAM | High resolution (25 km) time slice integrations with AM2 (incl. alternative physics), forced by SSTs and sea-ice. |