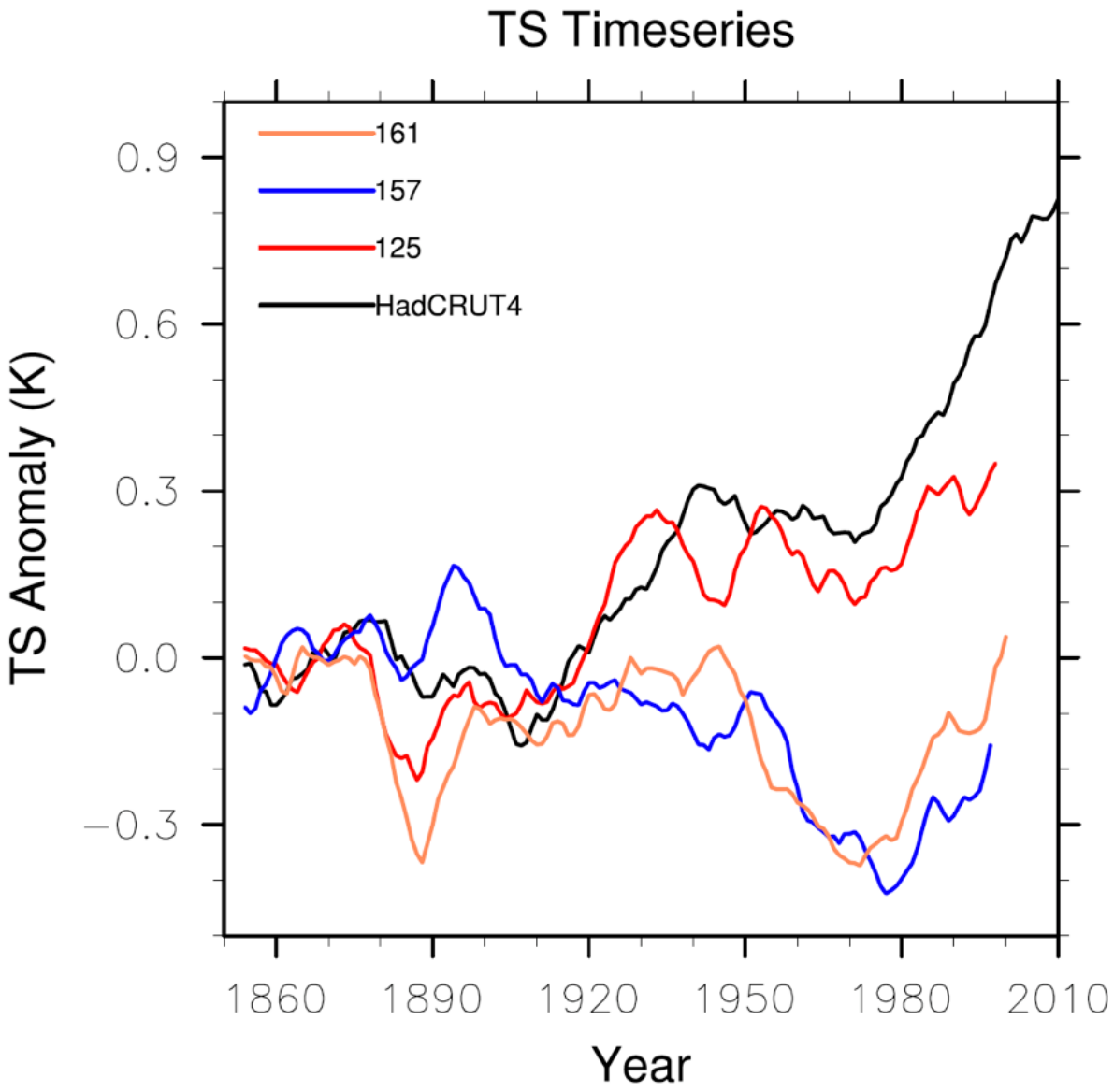
CESM2 Update / Progress

since the 2017 CESM Annual Meeting

Global-Mean Surface Temperature Time Series



CLIMATE CHANGE

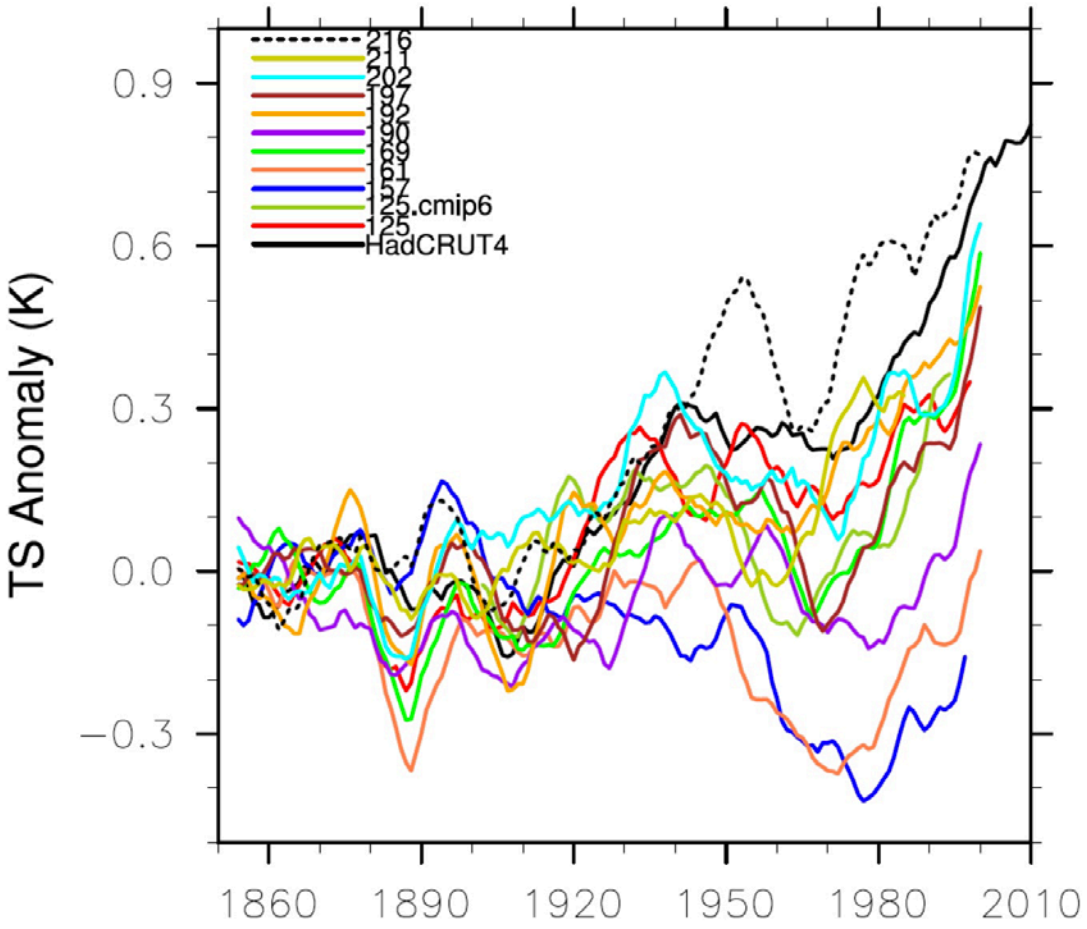
News

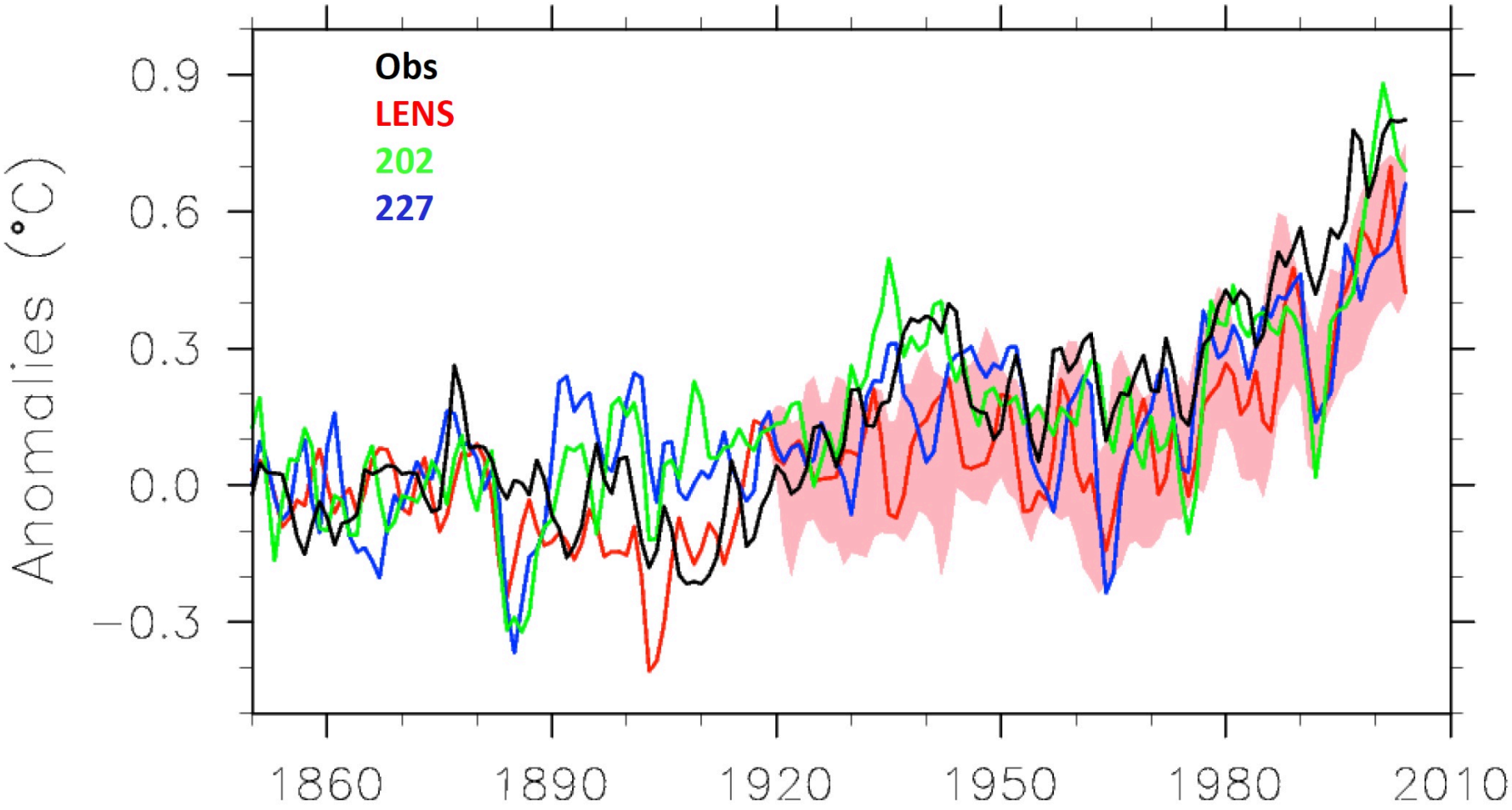
Contrary Temperature Trend Stalls Upgraded Climate Model's Debut

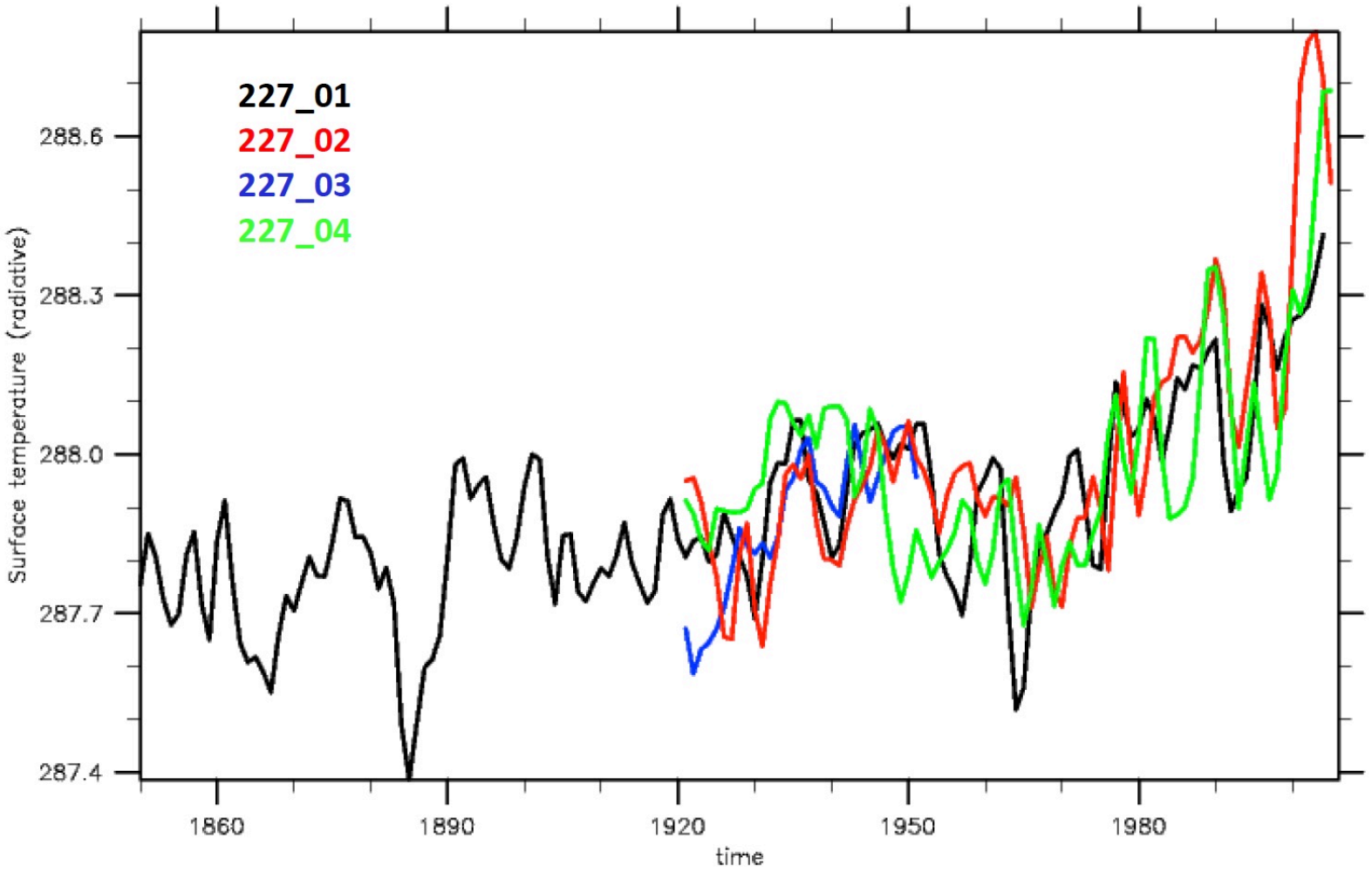
Model builders investigate a puzzling malfunction in what's expected to be the improved next version of the popular Community Earth System Model.

Lucas Joel, EOS v98 (05 July 2017)

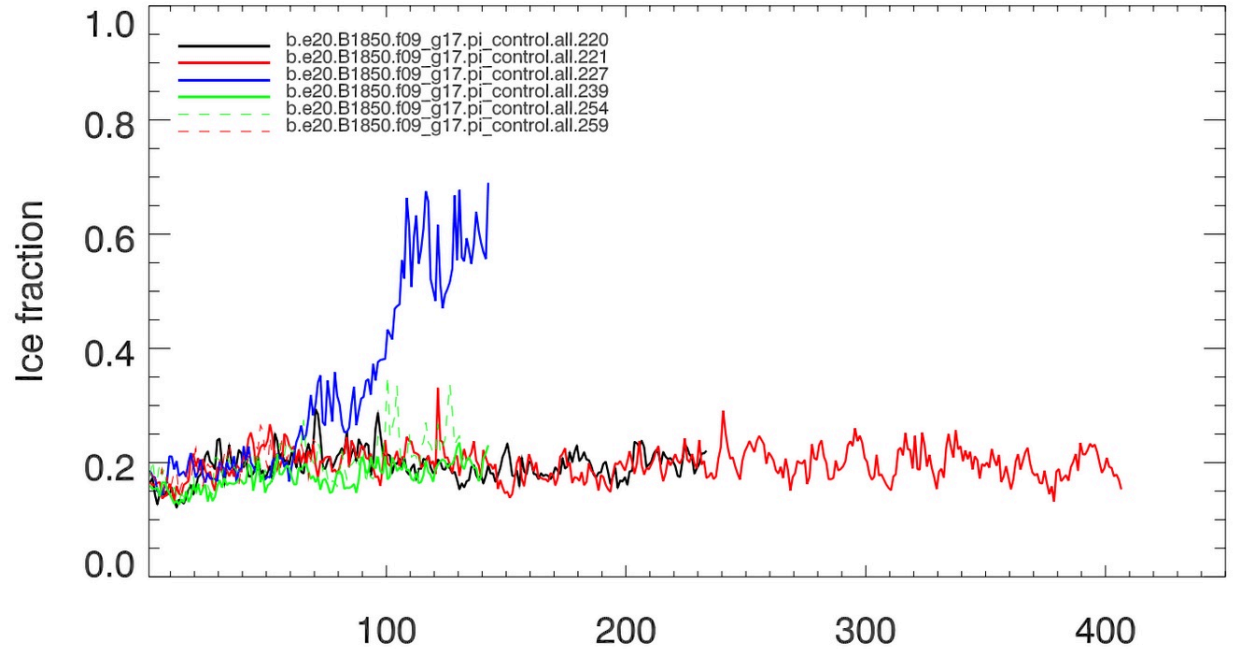
- Corrected CMIP6 emissions
- Modifications in the cloud – aerosol interactions in the atmospheric model related to aerosol indirect effects

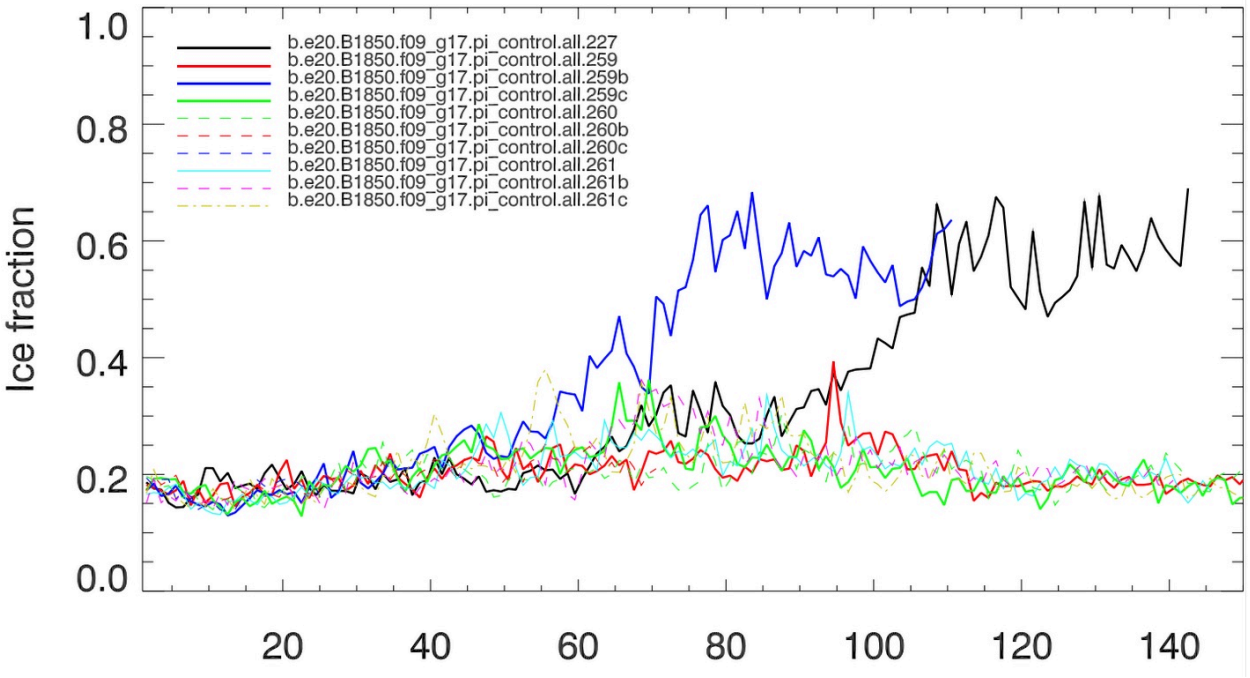


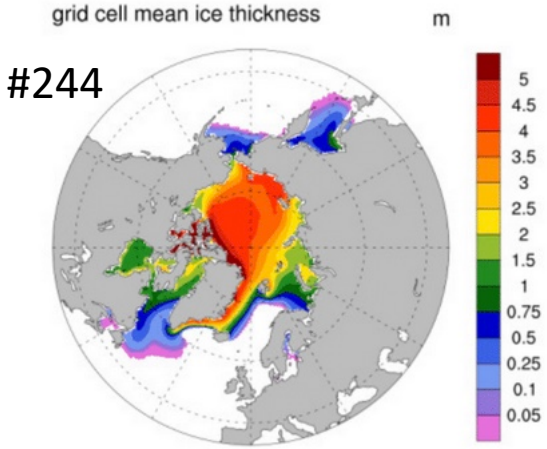

Obs
LENS
202
227
Anomalies (°C)
0.9
0.6
0.3
0.0
−0.3
1860
1890
1920
1950
1980
2010

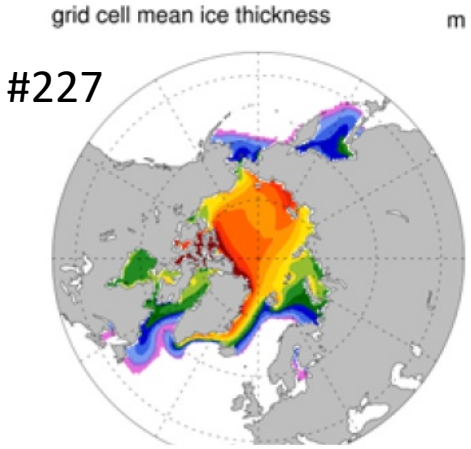

227_01
227_02
227_03
227_04
Surface temperature (radiative)
288.6
288.3
288.0
287.7
287.4
1860
1890
1920
1950
1980
time

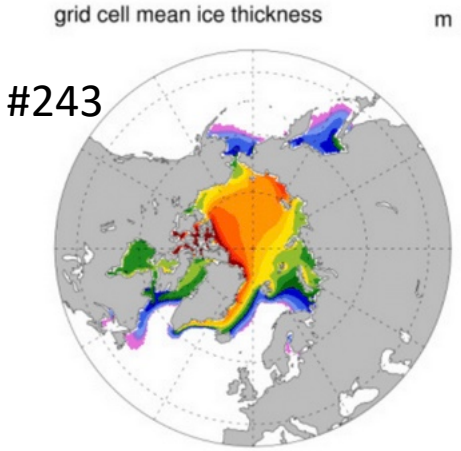
Labrador Sea Ice Fraction





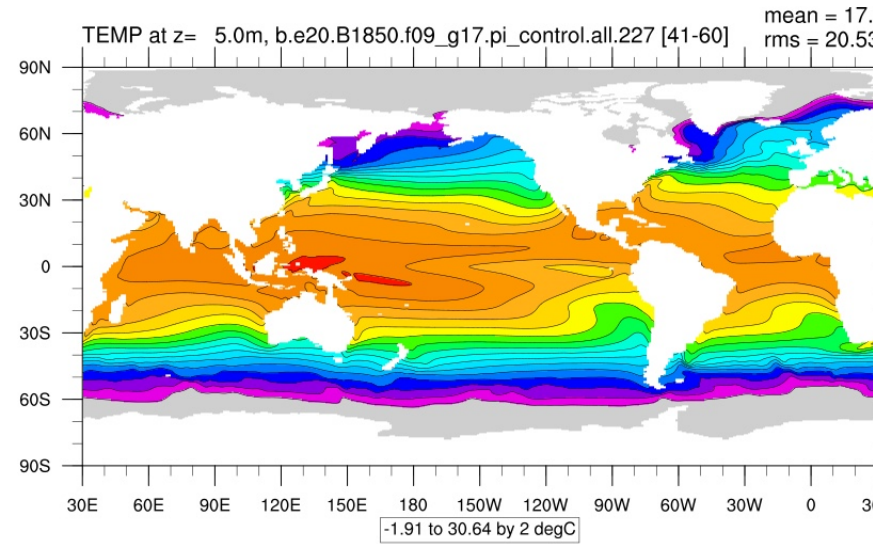


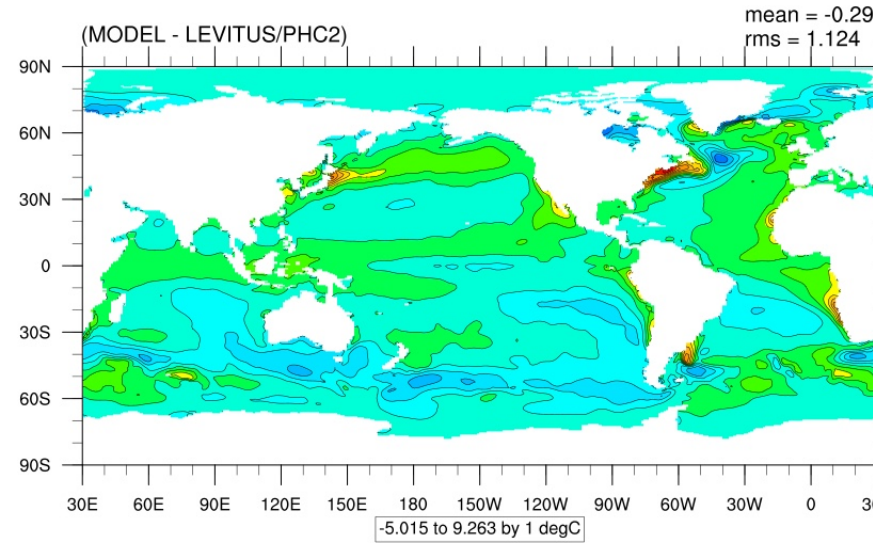




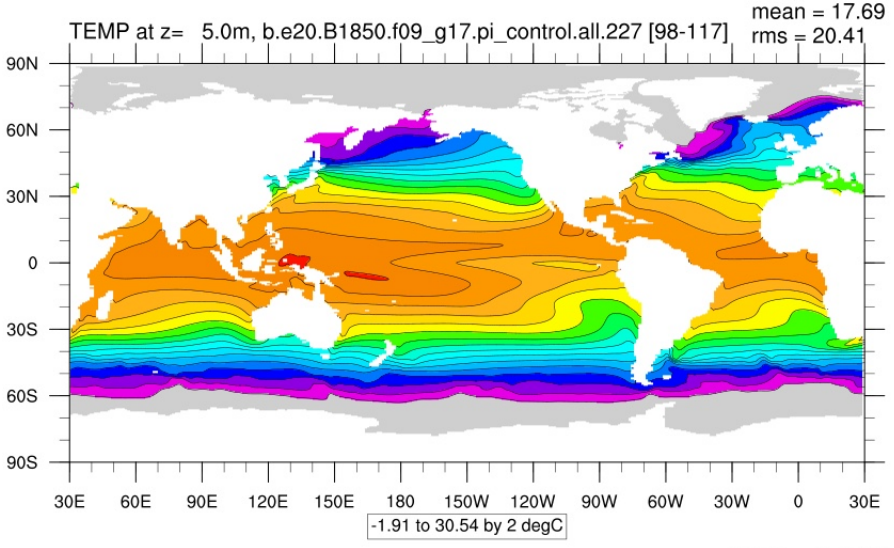
Surface Temperature from #227

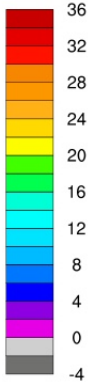
Before

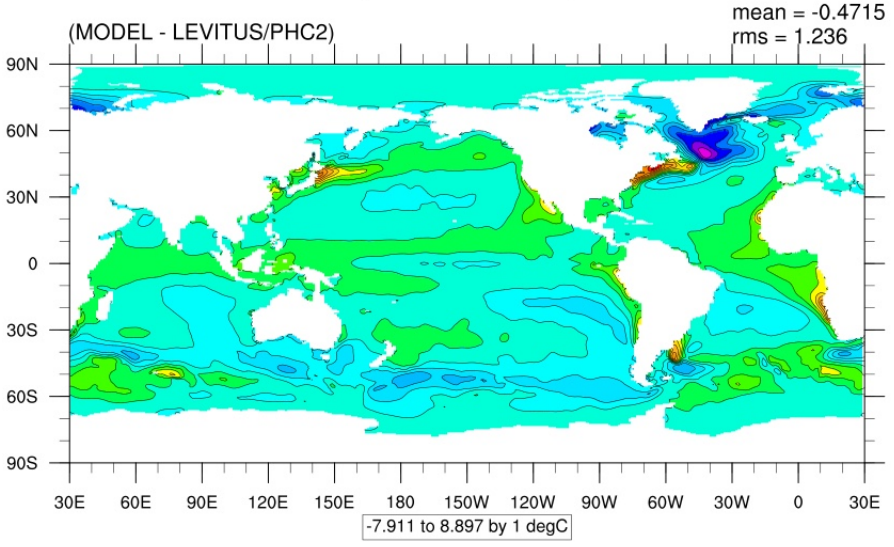


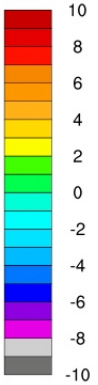


After



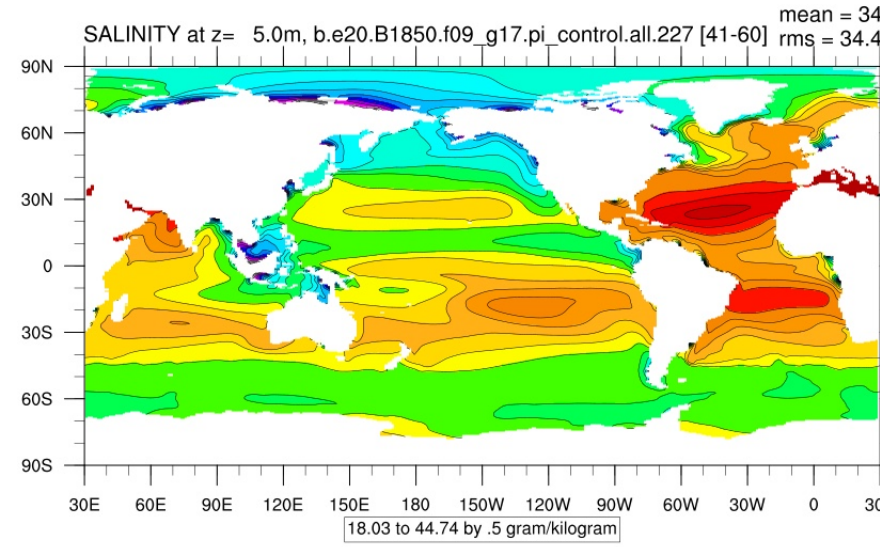




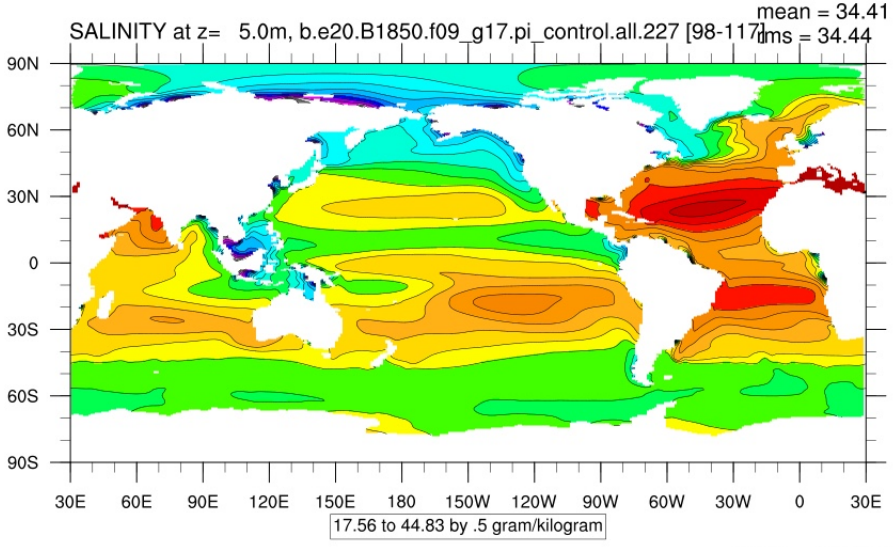


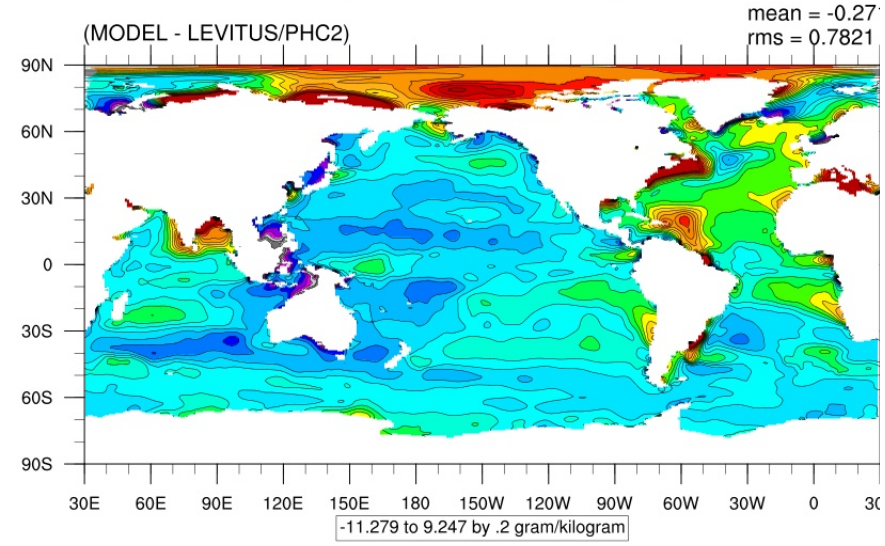
Surface Salinity from #227

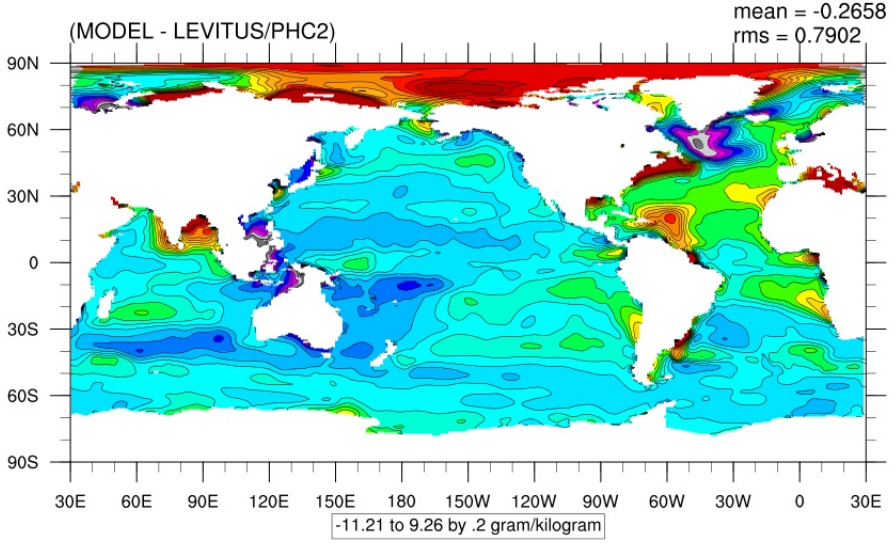
Before



After

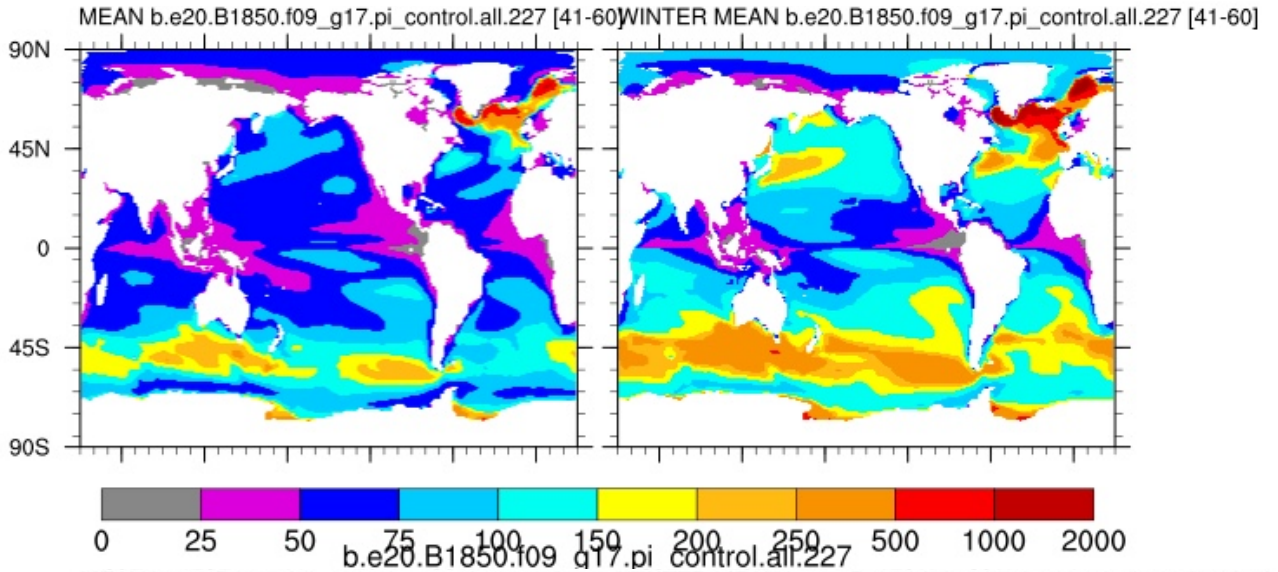




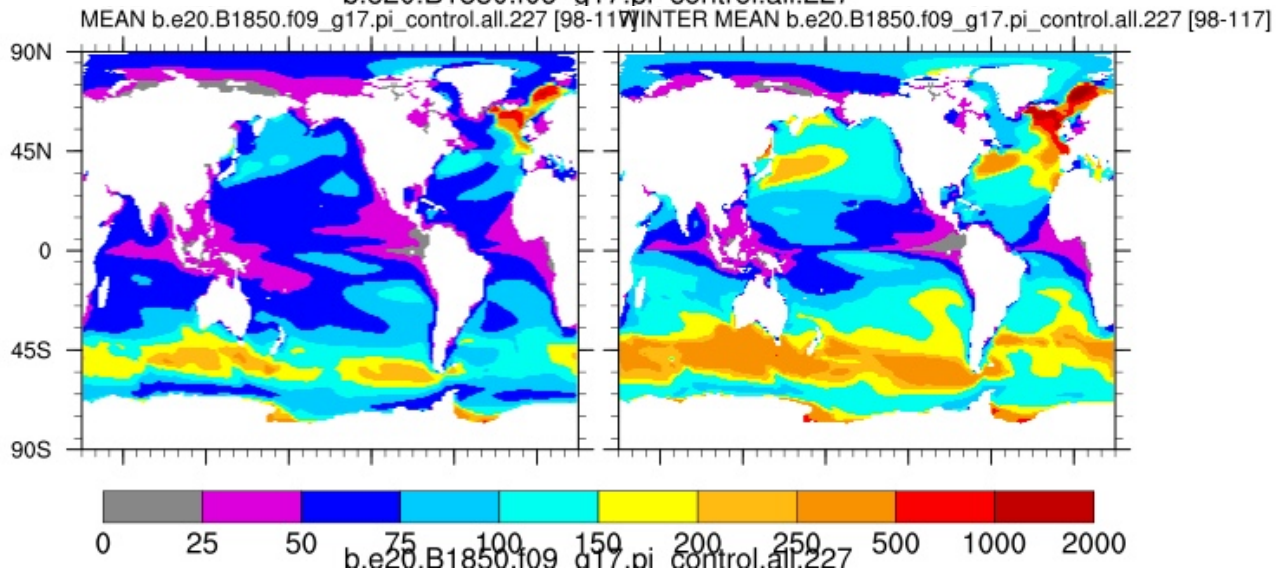


Mixed Layer Depth from #227

Before

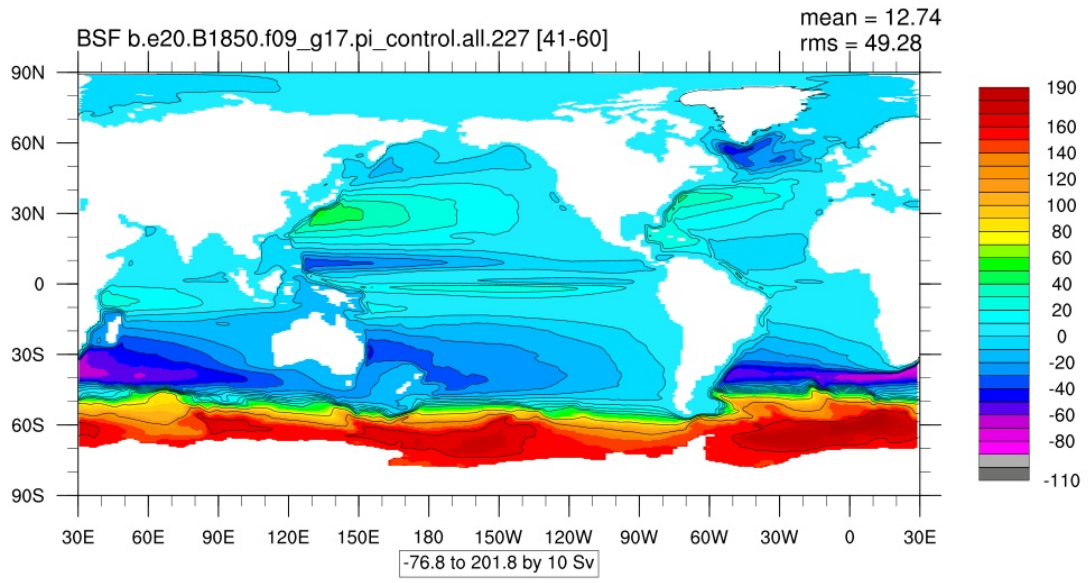


After

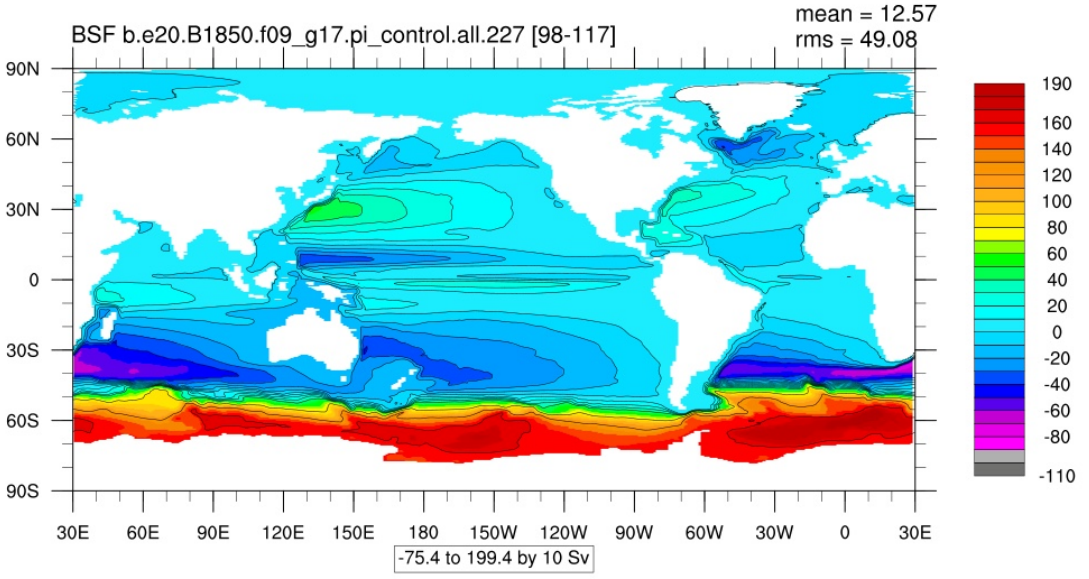


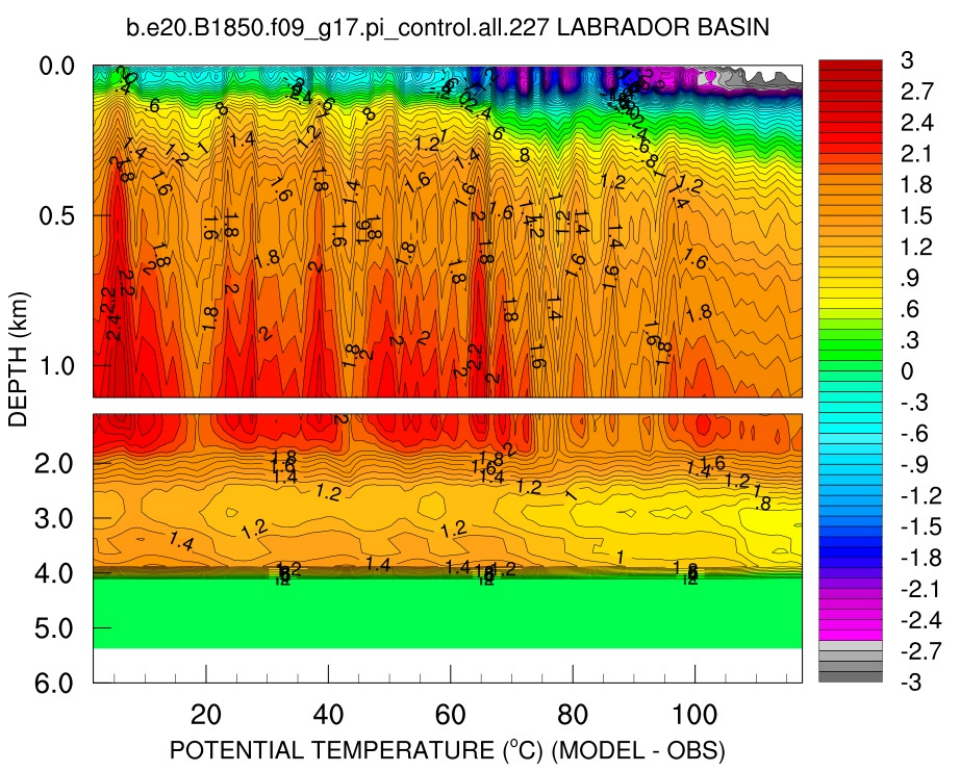
Barotropic Streamfunction from #227

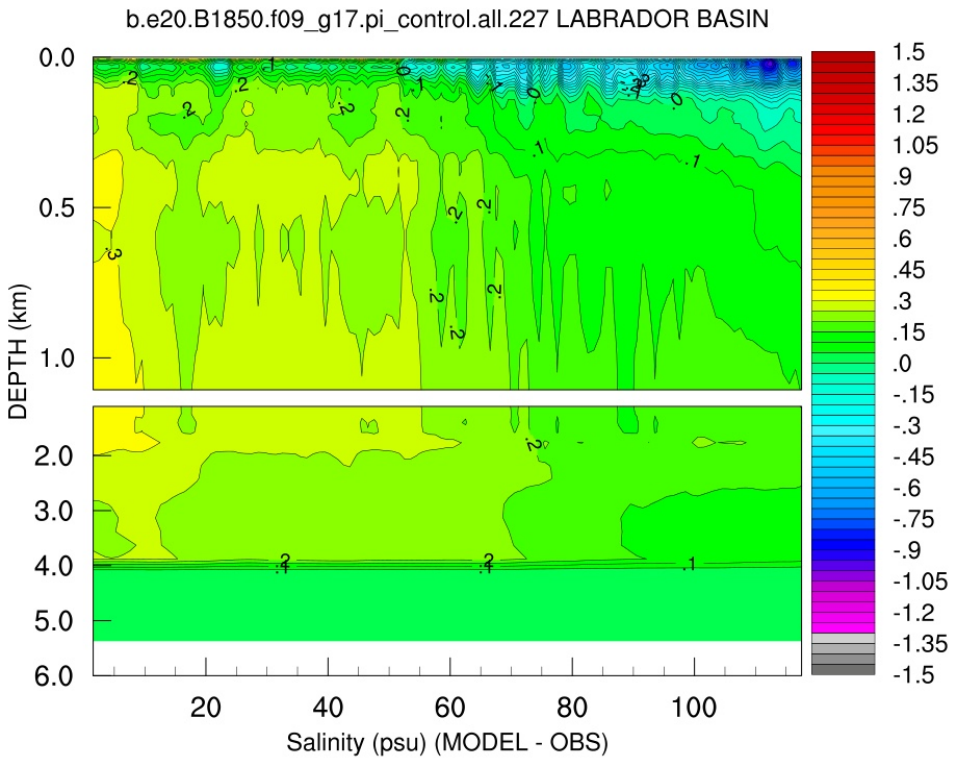
Before

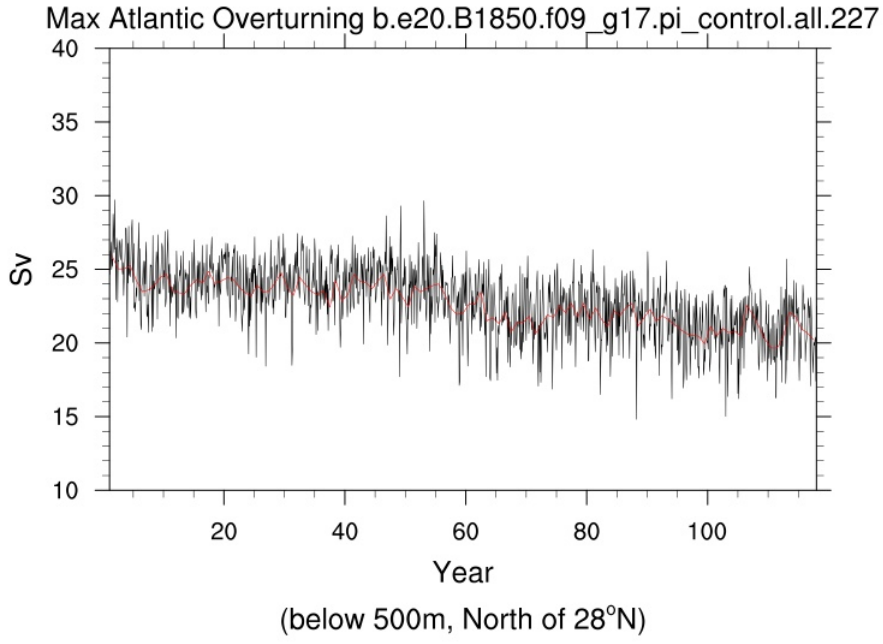


After




b.e20.B1850.f09_g17.pi_control.all.227 LABRADOR BASIN
DEPTH (km)
POTENTIAL TEMPERATURE (°C) (MODEL - OBS)


b.e20.B1850.f09_g17.pi_control.all.227 LABRADOR BASIN
DEPTH (km)
Salinity (psu) (MODEL - OBS)

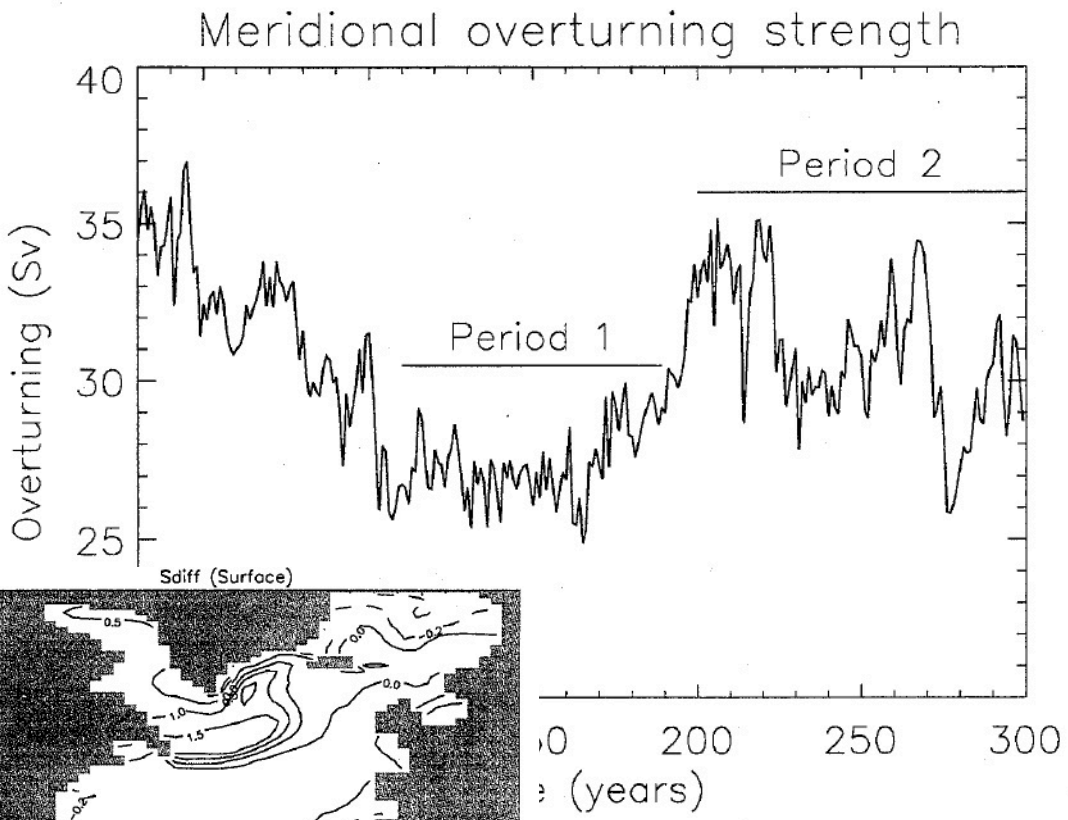

Max Atlantic Overturning b.e20.B1850.f09_g17.pi_control.all.227
Sv
Year
(below 500m, North of 28°N)

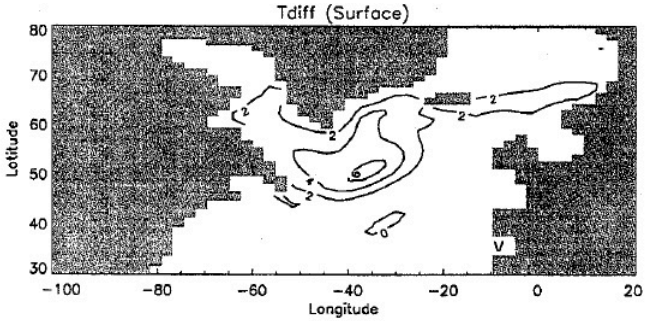
CSM1

NCAR/TN-445+STR
NCAR TECHNICAL NOTE
May 1998

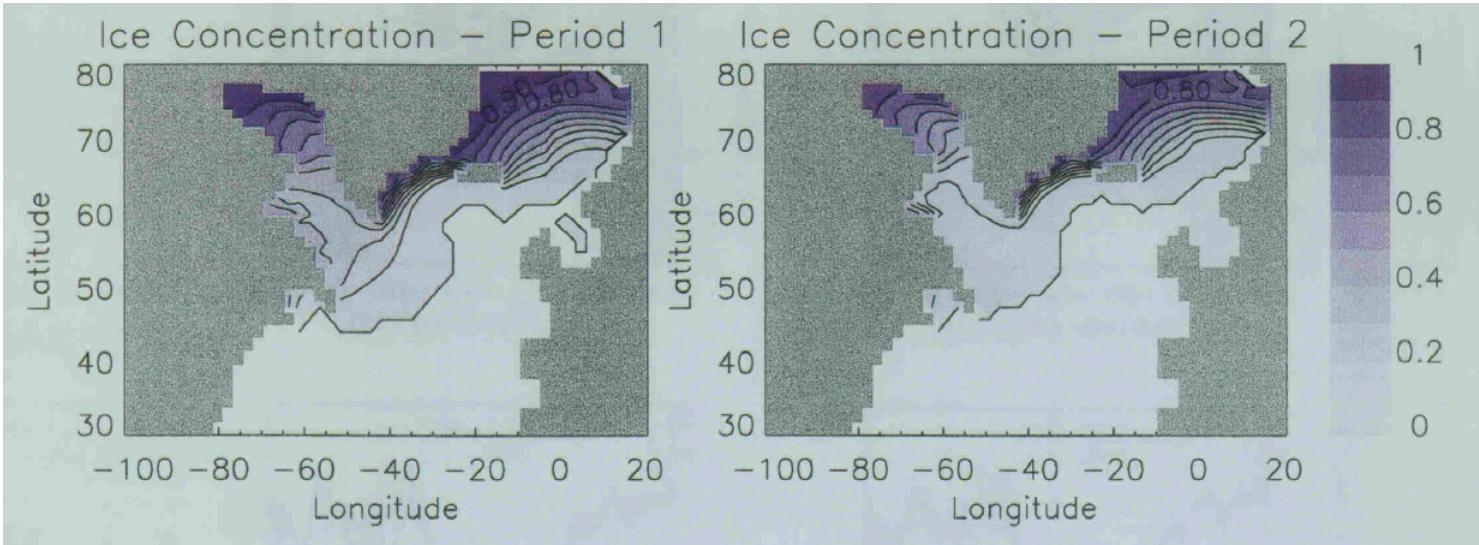
THERMOHALINE CIRCULATION VARIABILITY IN THE NCAR CLIMATE SYSTEM MODEL (CSM)

Antonietta Capotondi
W.R. Holland





P2 – P1



Stochastic Atmospheric Forcing as a Cause of Greenland Climate Transitions

HANNAH KLEPPIN AND MARKUS JOCHUM
Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark
BETTE OTTO-BLIESNER, CHRISTINE A. SHIELDS, AND STEPHEN YEAGER
National Center for Atmospheric Research, Boulder, Colorado

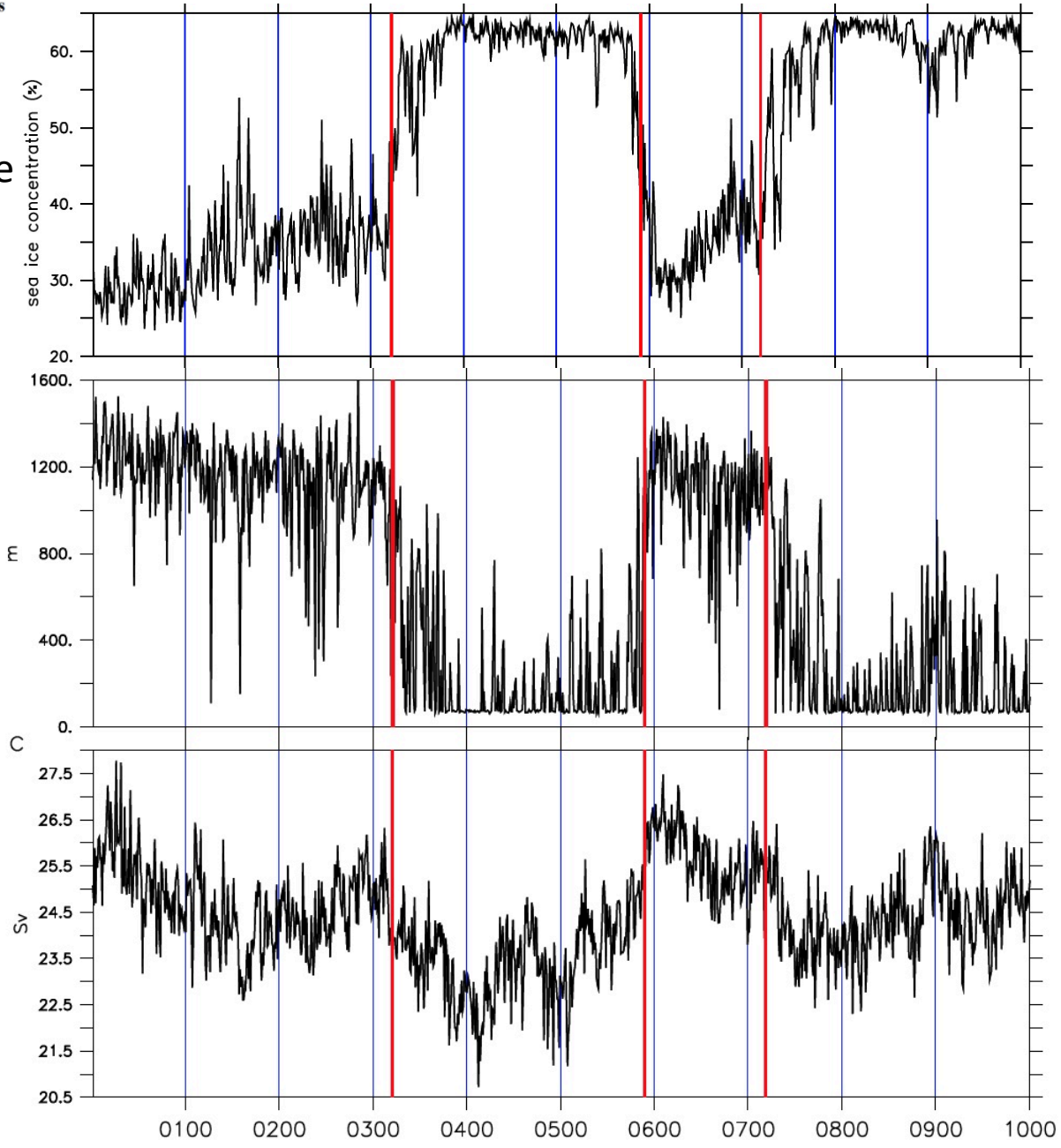
CCSM4 FV2

Labrador Sea ice concentration

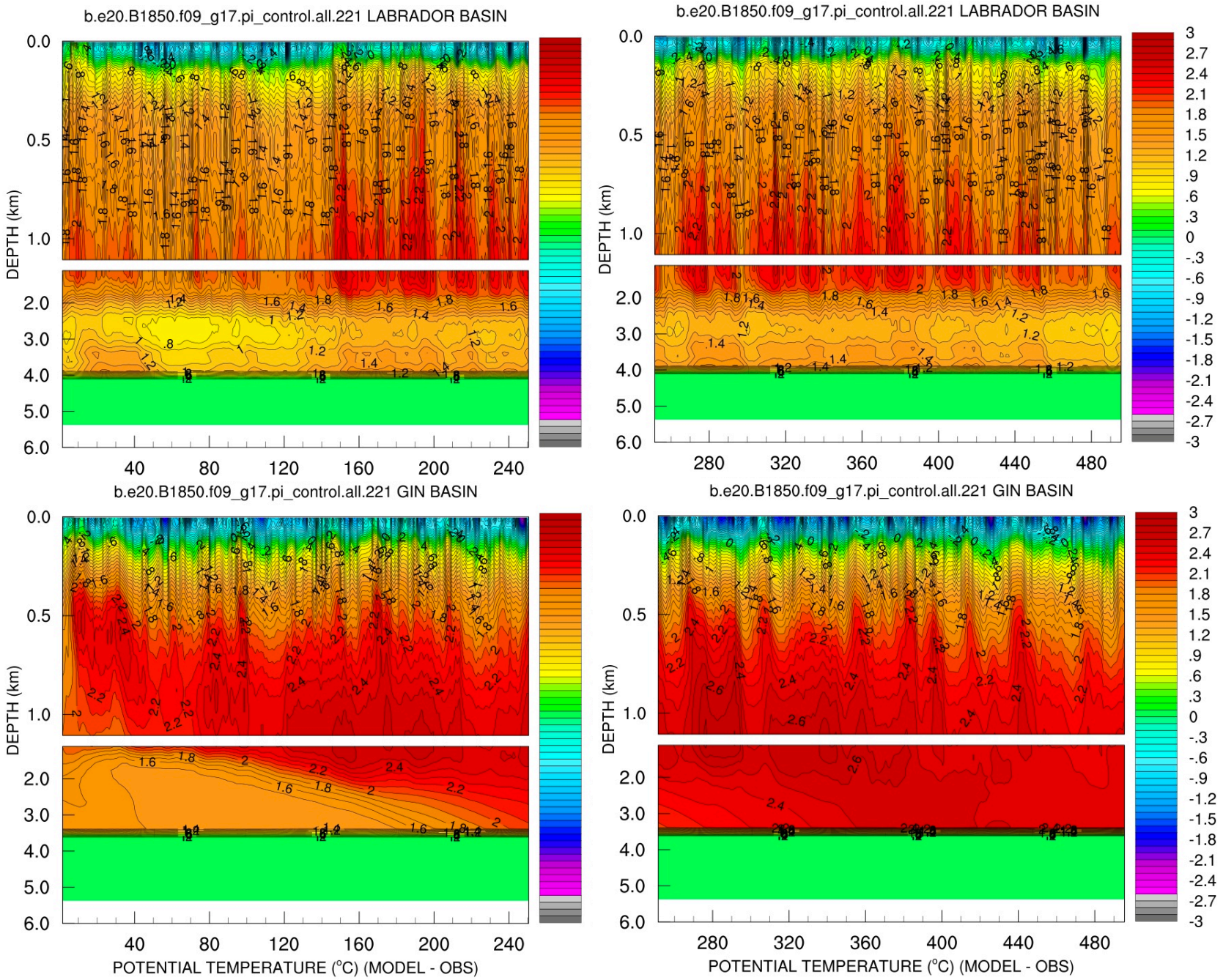
March Mixed Layer Depth

AMOC Maximum

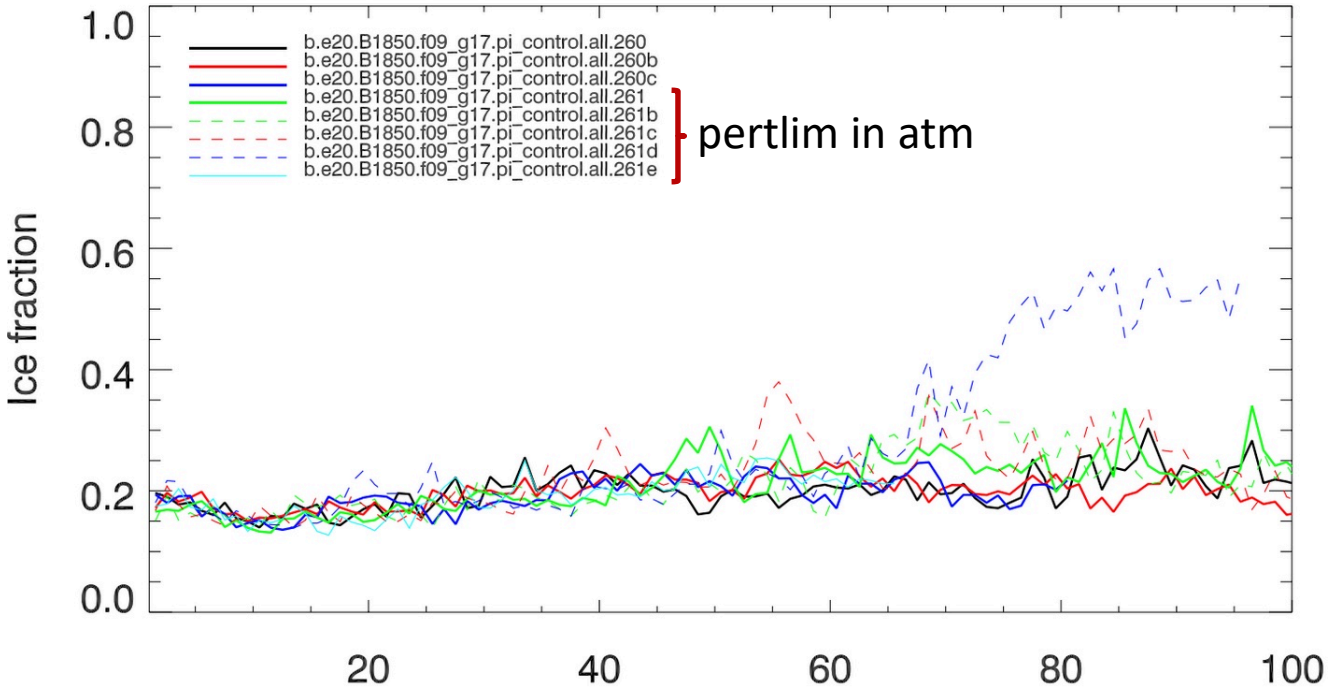
Stochastic atmospheric forcing (weaker heat flux; weaker winds and wind stress curl; etc.)



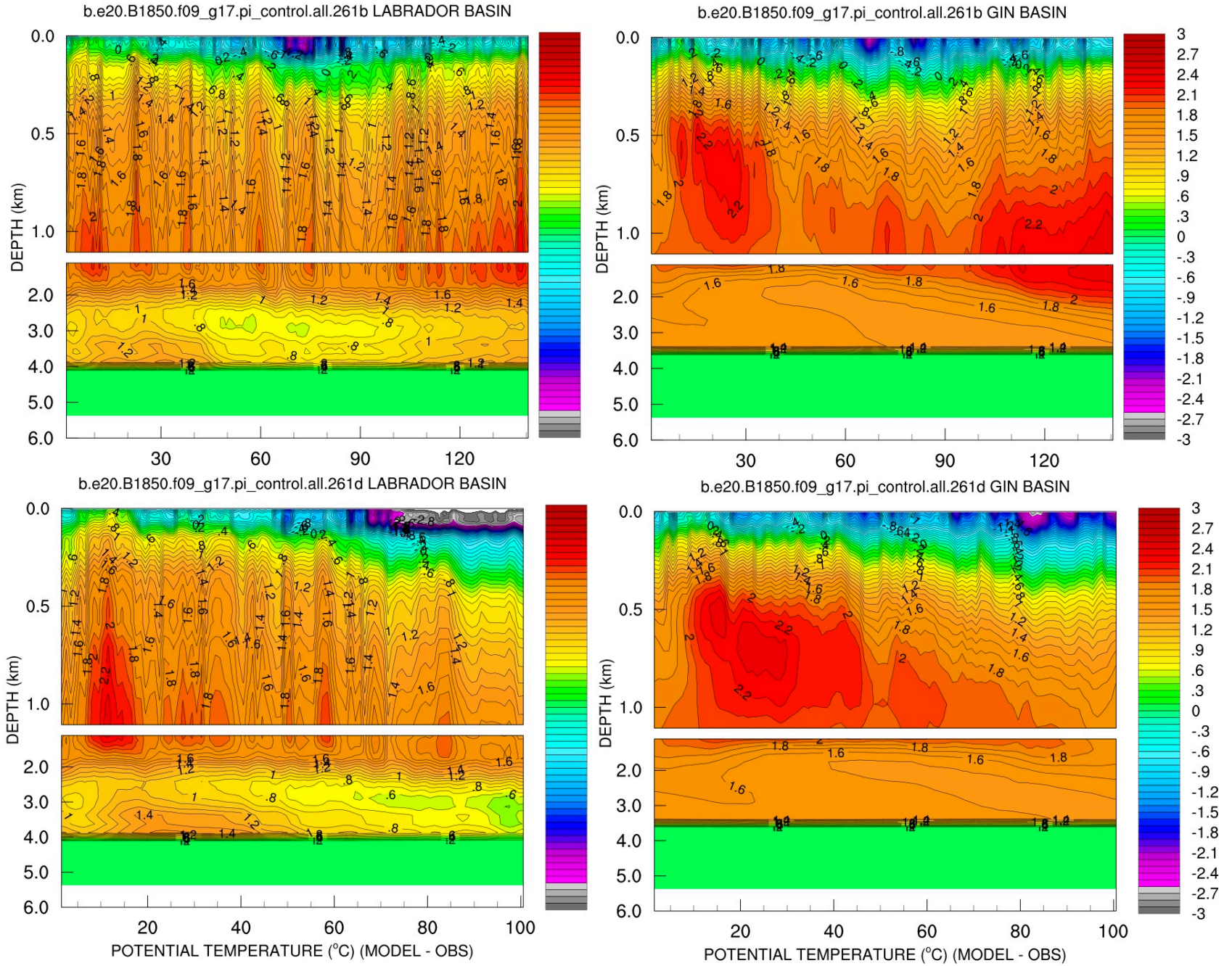
Labrador and GIN Seas Horizontal-Mean Temperature Timeseries from #221 (no LS Freeze)



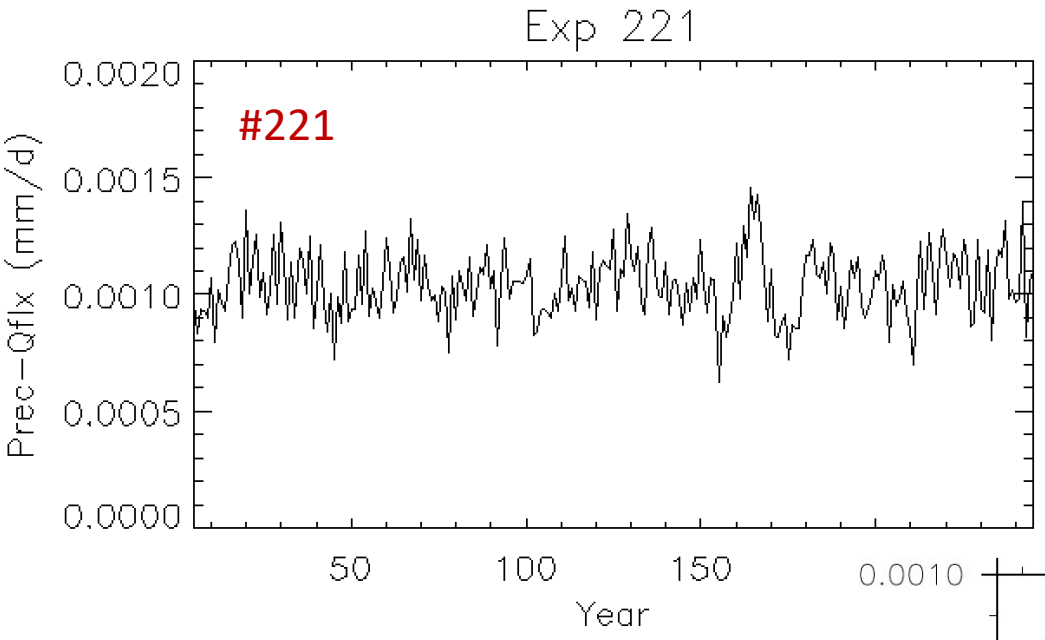
- Some evidence for weaker winds, weaker wind stress curl, smaller latent heat loss; smaller evaporation; etc. in cases with extensive LS ice cover
- Difficult to pin-point what comes first – no silver bullet!
- Modify some aspects of bulk flux calculations to try to enhance heat fluxes, wind stress, etc., hoping to put the simulations more on the LS ice-free side



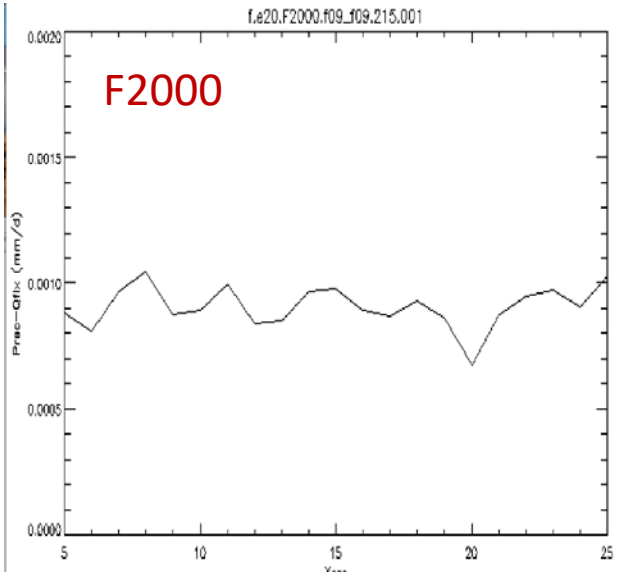
Labrador and GIN Seas Horizontal-Mean Temperature Timeseries from #261b and #261d

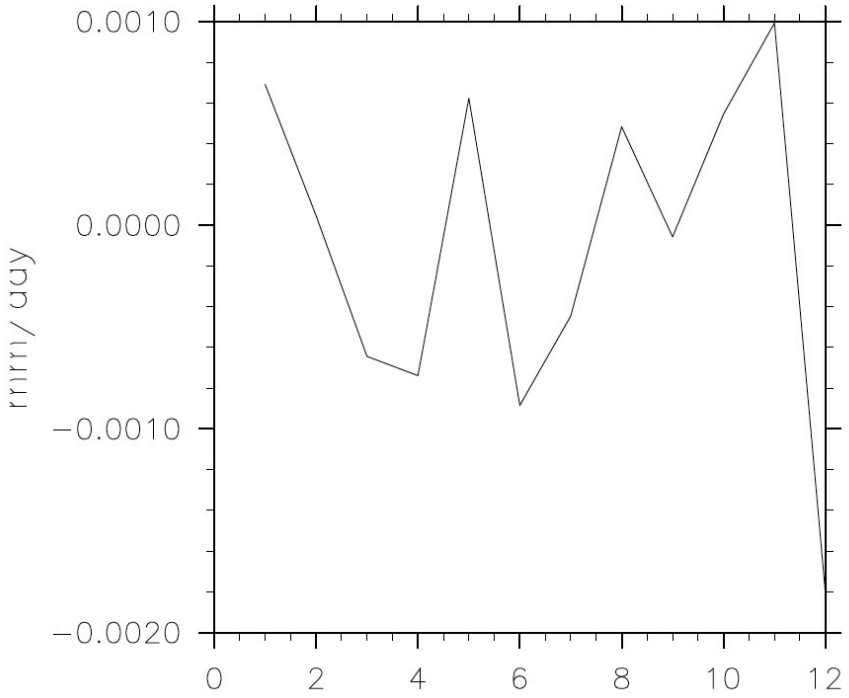


Freshwater Conservation in the Atmospheric Model



SLR (mm/yr)
Imbalance: 0.5-0.6
Global warming: 2-3

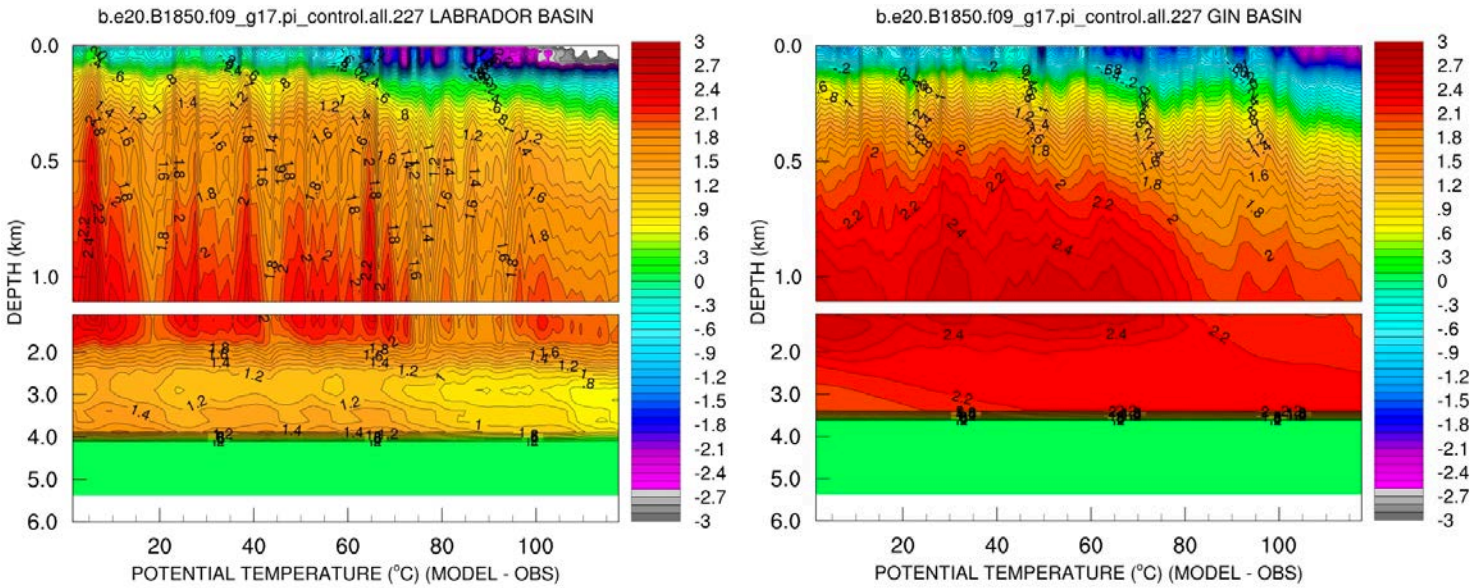




series

Current Plan Forward

- New CESM tag with #260 physics which includes changes in flux calculations for increased iteration count; enhanced scaling of 10m winds; and increased maximum value for instability used in the flux profiles
- Start several pre-industrial control simulations
- Start 20th century simulations from a few of the ensemble members which do not exhibit extensive sea-ice cover in LS
- Designate a state after the LS transient as the pre-industrial initial conditions
- Check the impacts of the corrected freshwater imbalance in the coupled simulations



CMIP6: revised timeline and workflow