

CESM2 Update / Progress

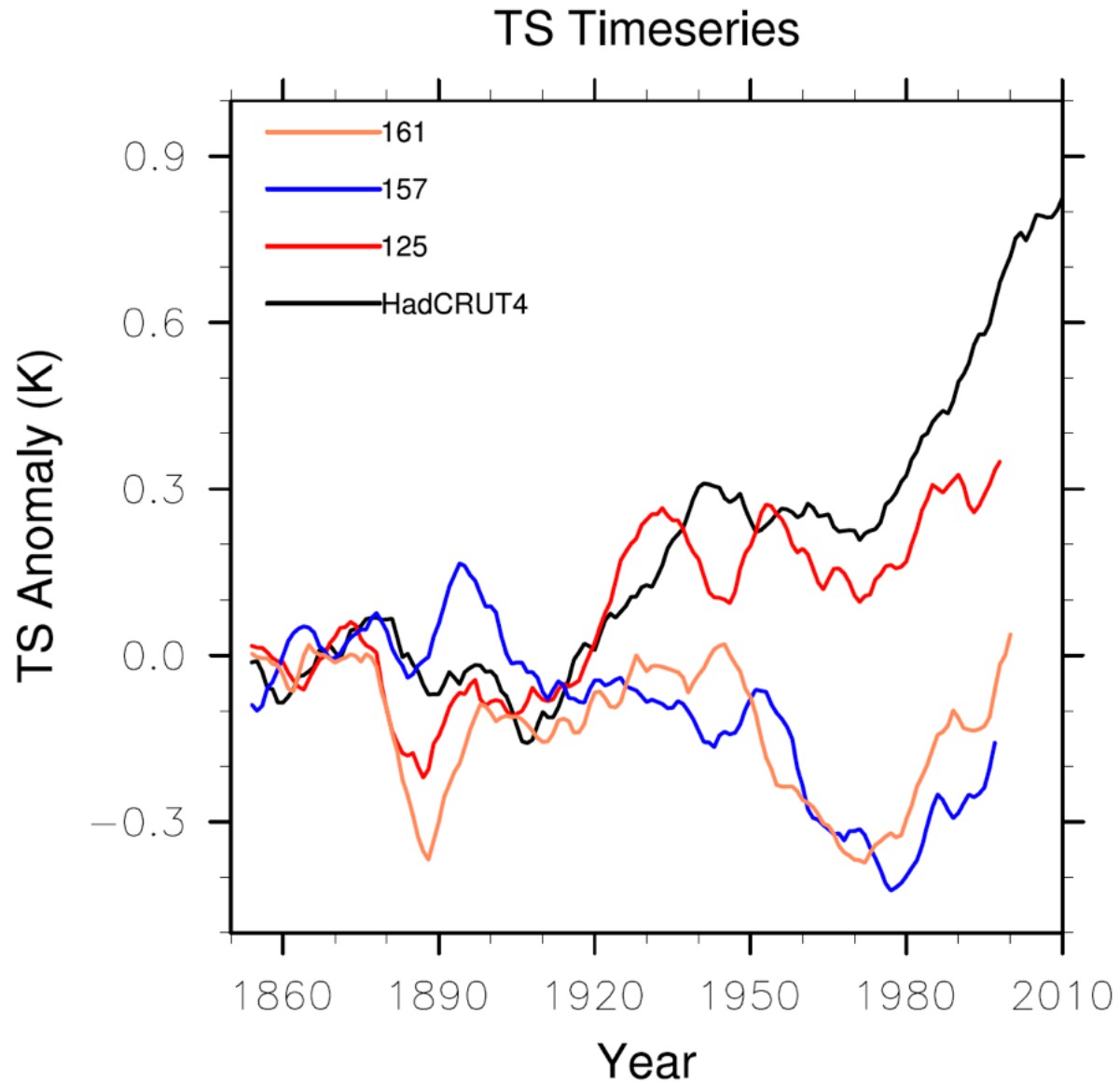
since the 2017 CESM Annual Meeting

Gokhan Danabasoglu & Jean-Francois Lamarque



Sisyphus

Global-Mean Surface Temperature Time Series

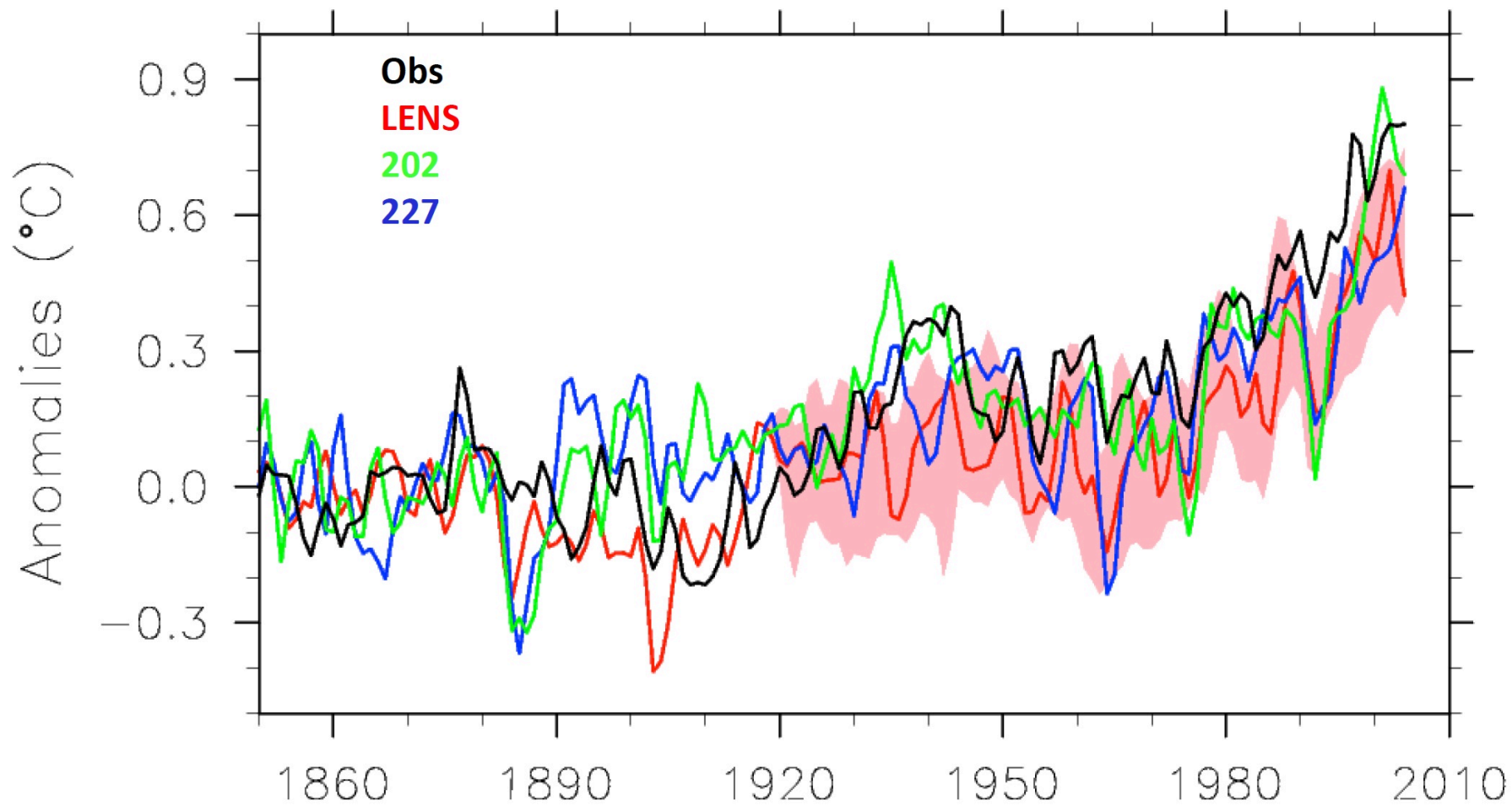


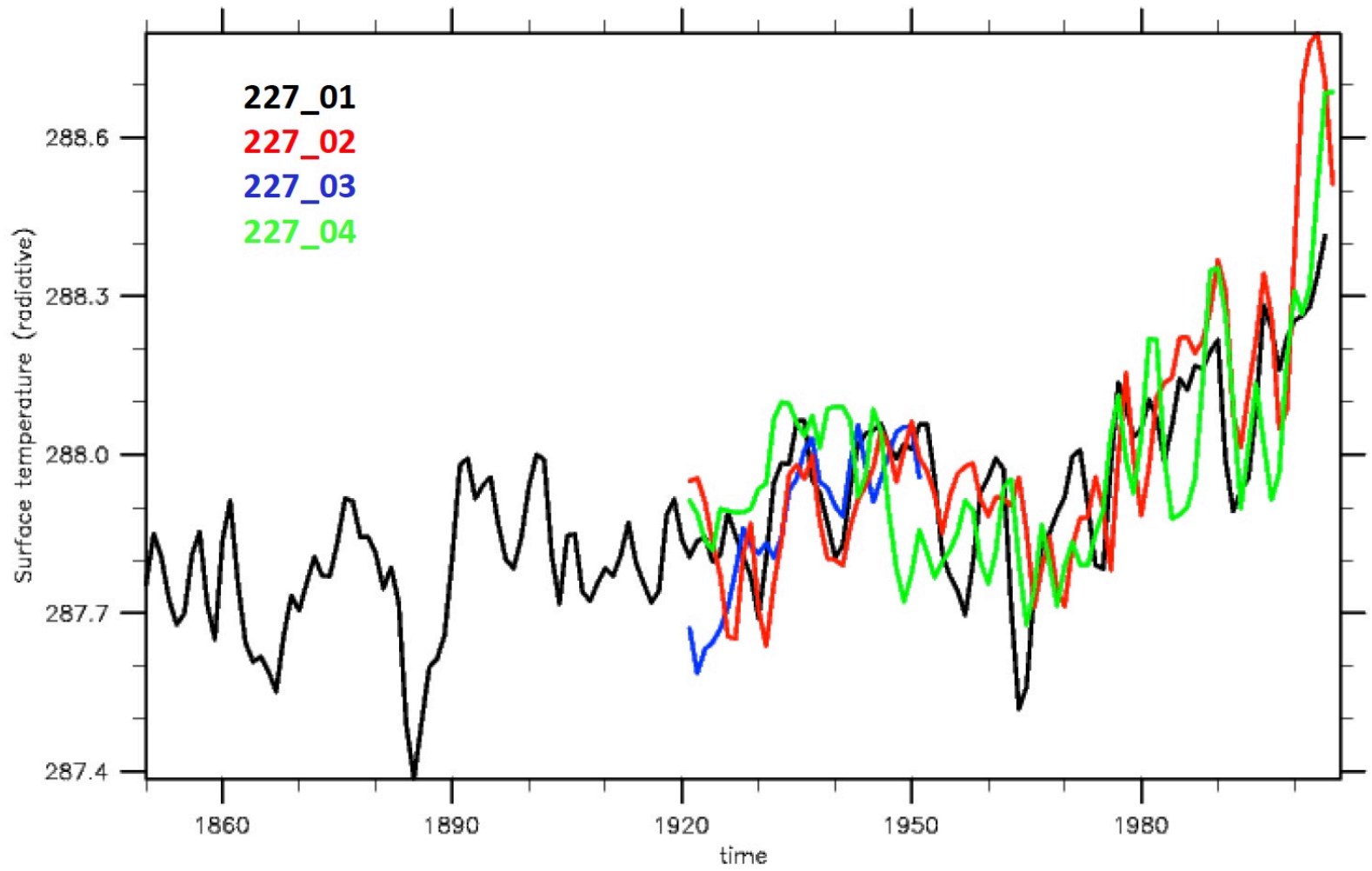


Contrary Temperature Trend Stalls Upgraded Climate Model's Debut

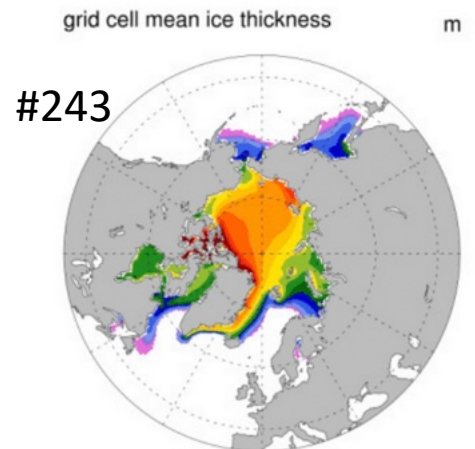
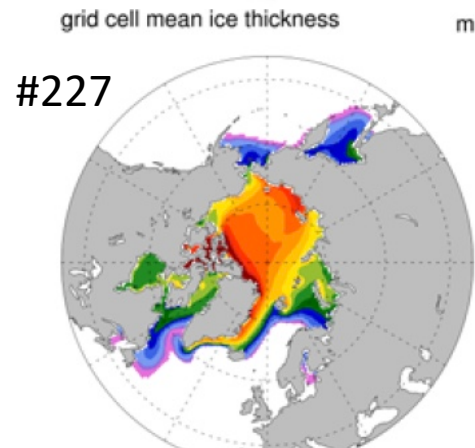
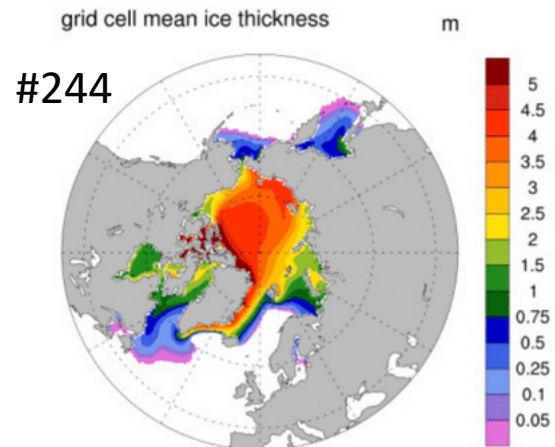
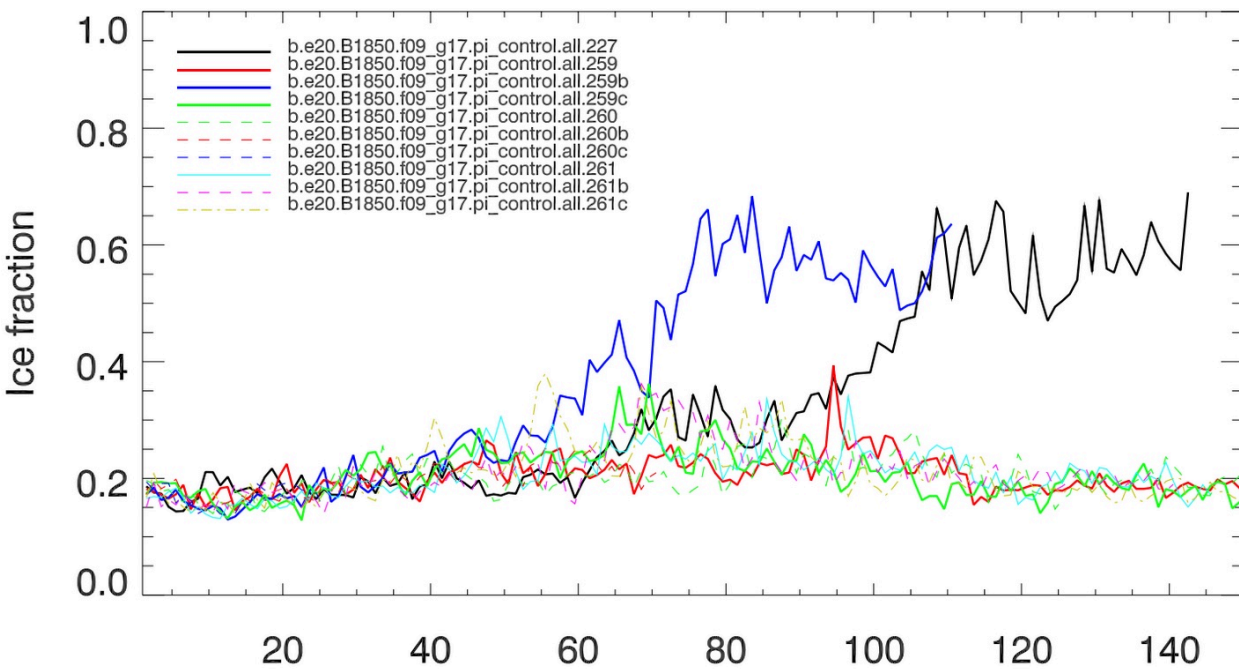
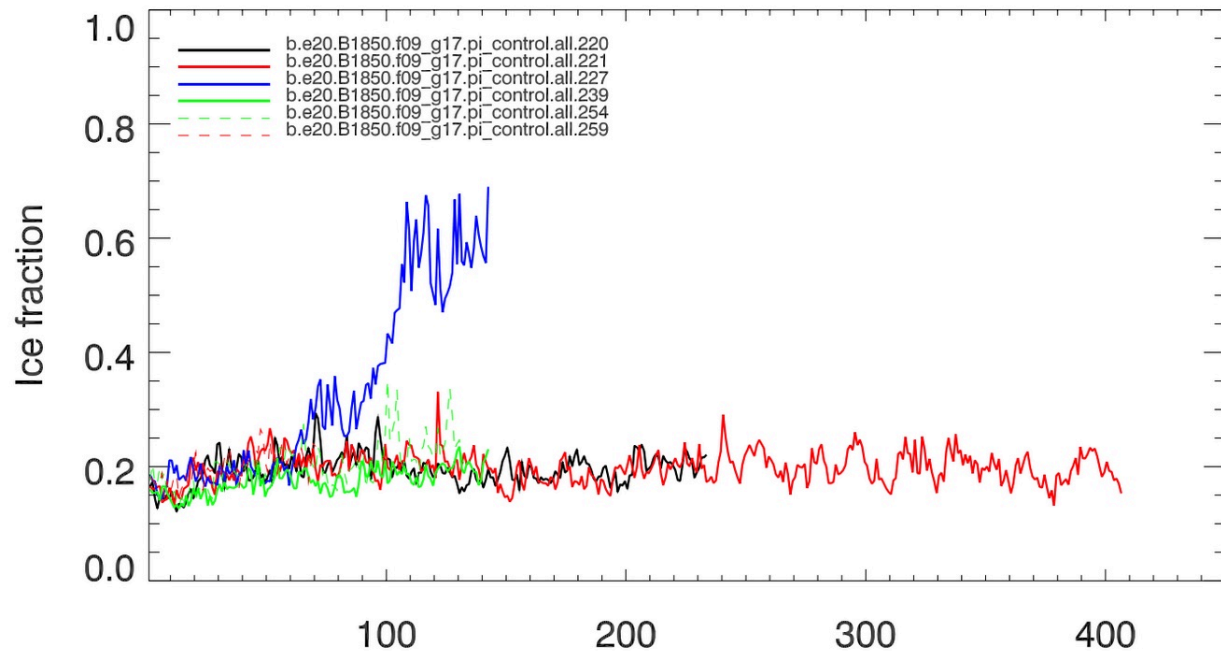
Model builders investigate a puzzling malfunction in what's expected to be the improved next version of the popular Community Earth System Model.

Lucas Joel, EOS v98 (05 July 2017)





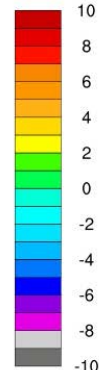
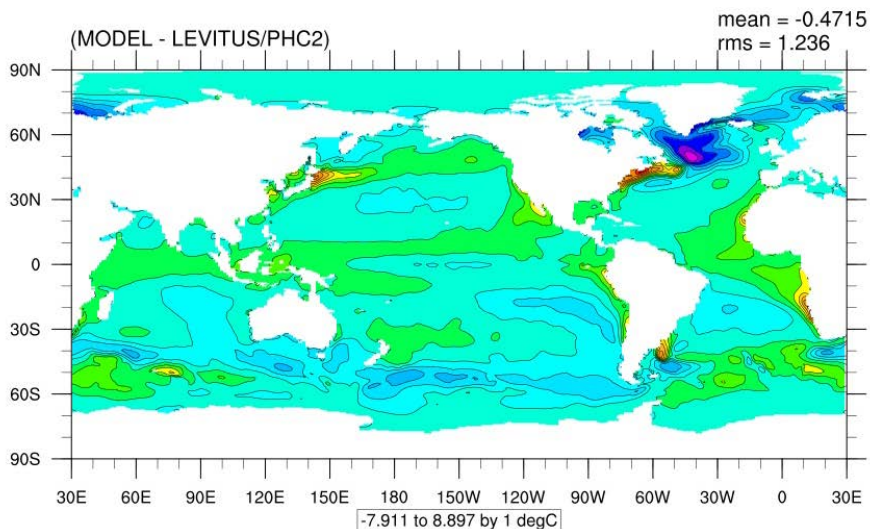
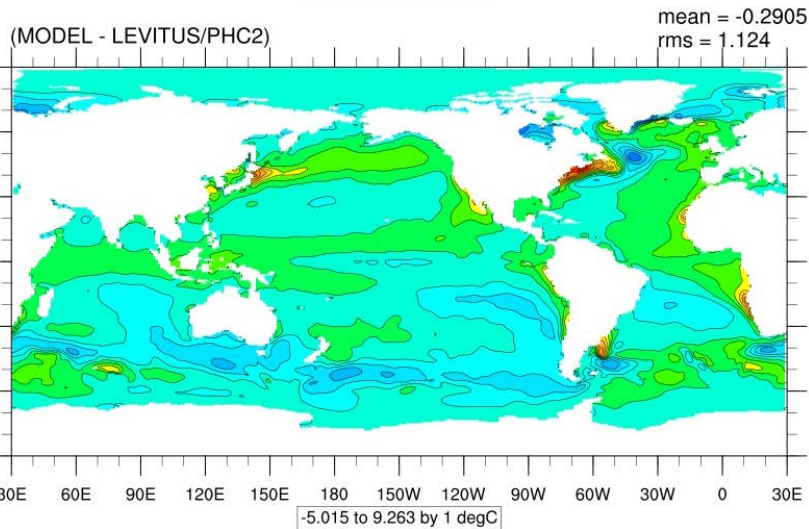
Labrador Sea Ice Fraction



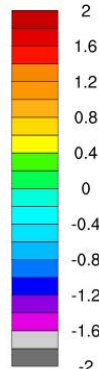
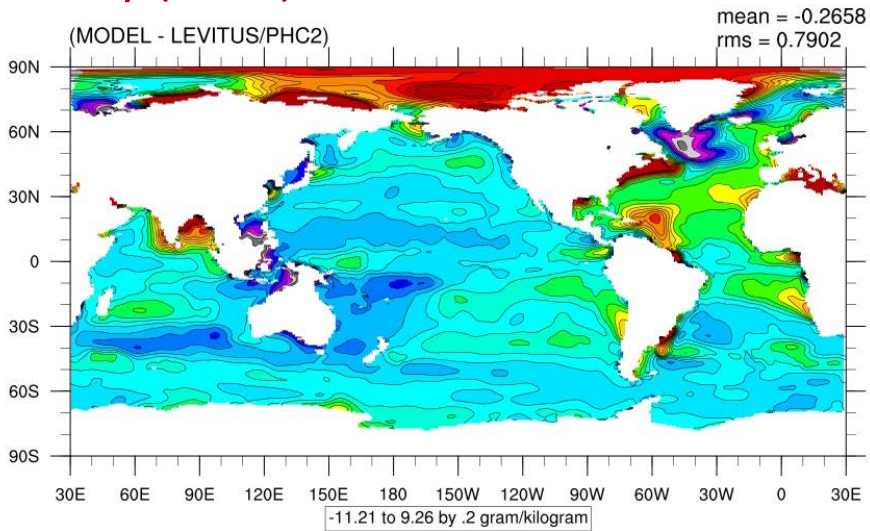
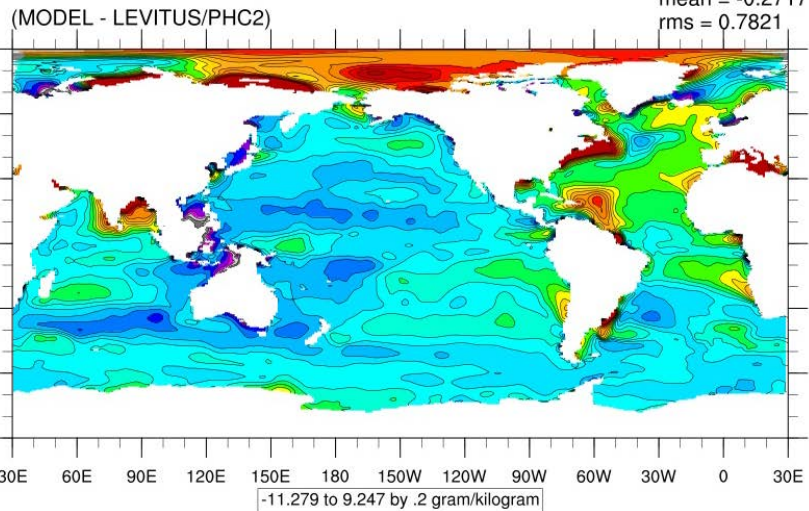
Before

Surface Temperature (#227)

After

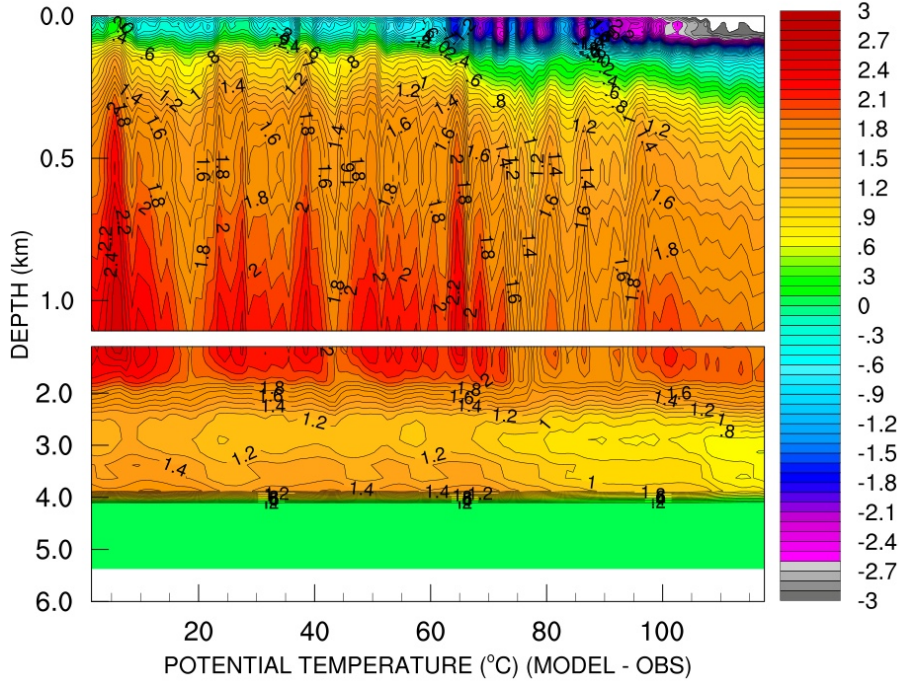


Surface Salinity (#227)



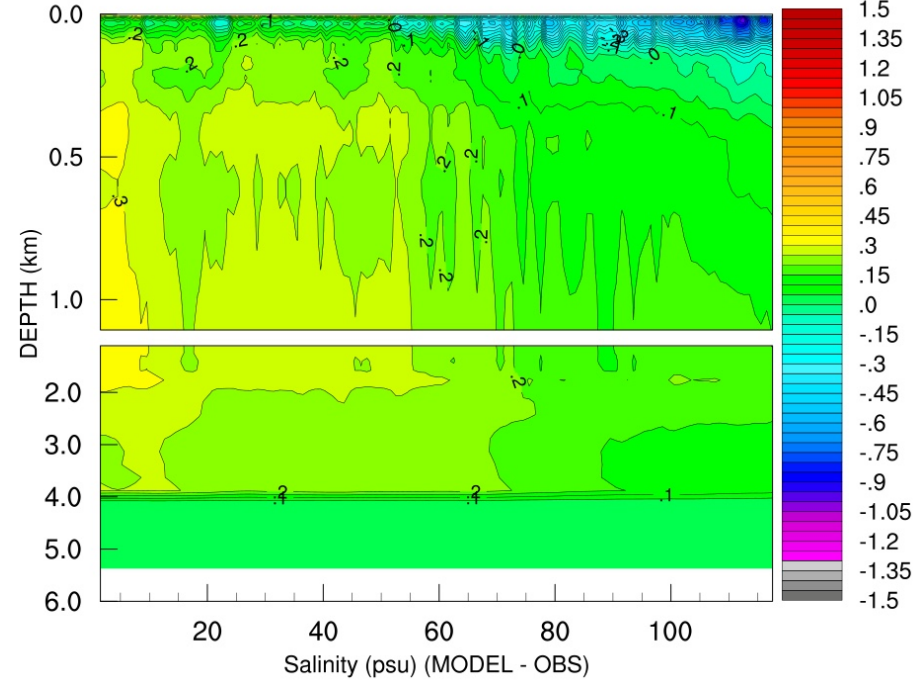
Temperature

b.e20.B1850.f09_g17.pi_control.all.227 LABRADOR BASIN

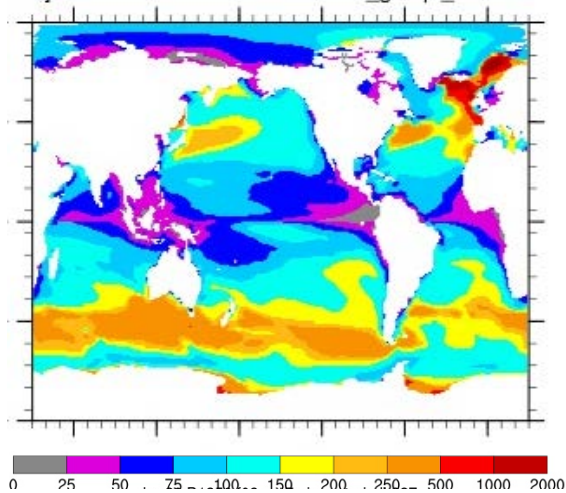


Salinity

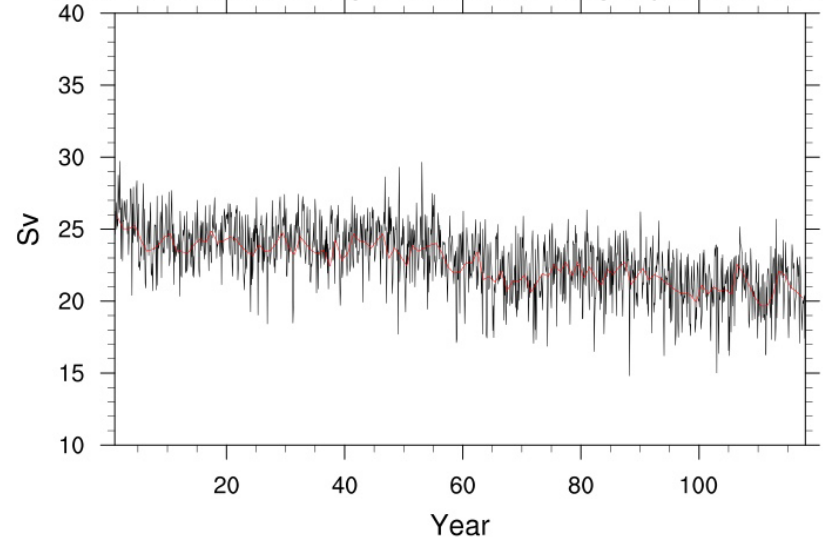
b.e20.B1850.f09_g17.pi_control.all.227 LABRADOR BASIN



Winter-Mean Mixed Layer Depth (m)

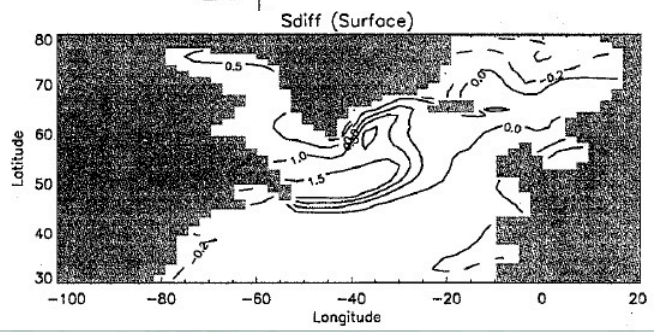
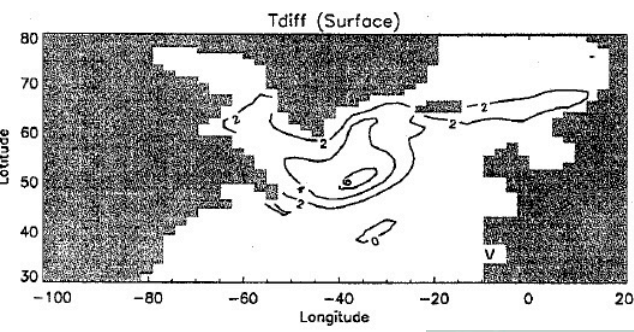
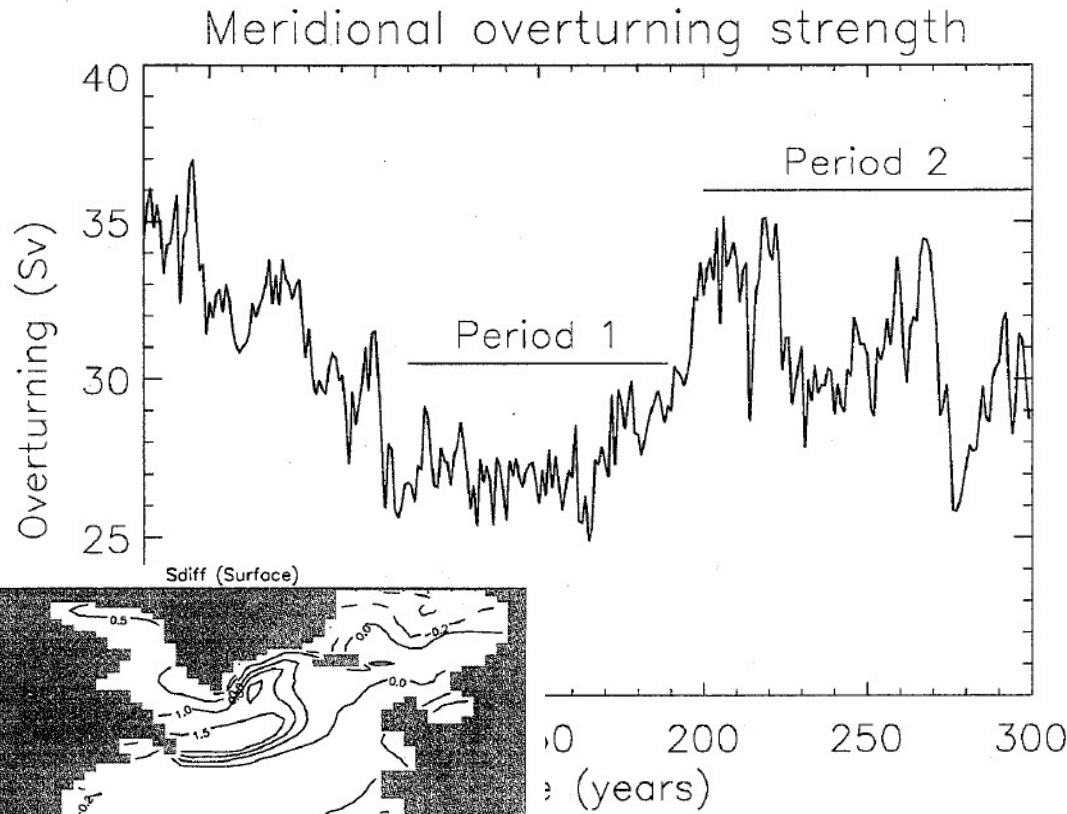


Max Atlantic Overturning b.e20.B1850.f09_g17.pi_control.all.227

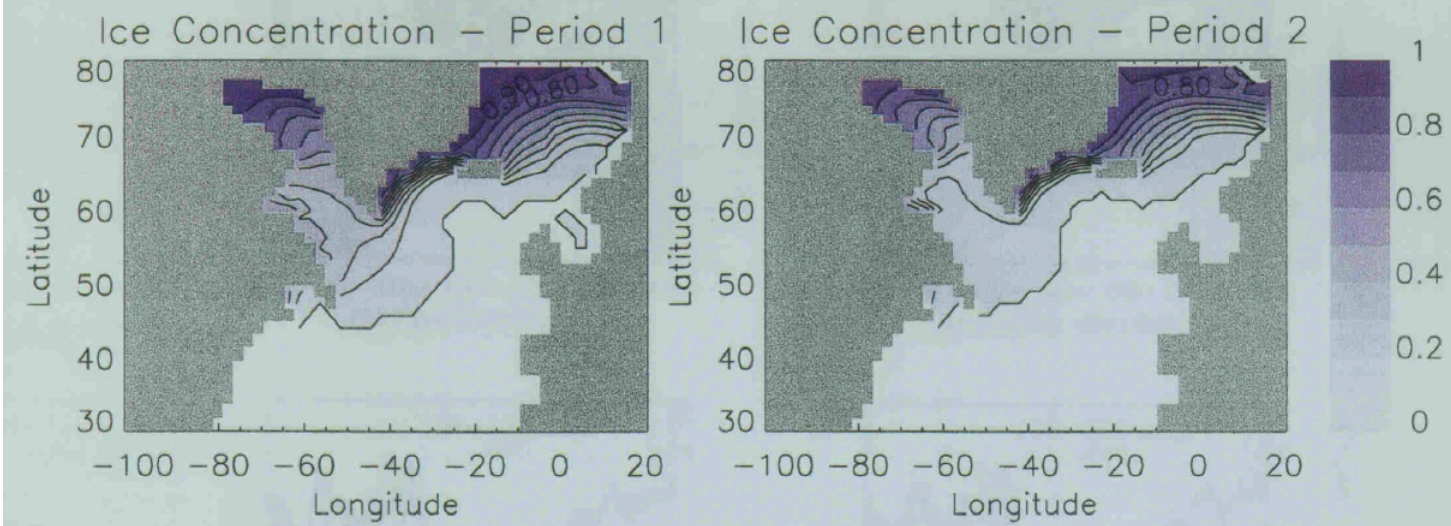


THERMOHALINE CIRCULATION VARIABILITY IN THE NCAR CLIMATE SYSTEM MODEL (CSM)

Antonietta Capotondi
W.R. Holland



P2 - P1



Stochastic Atmospheric Forcing as a Cause of Greenland Climate Transitions

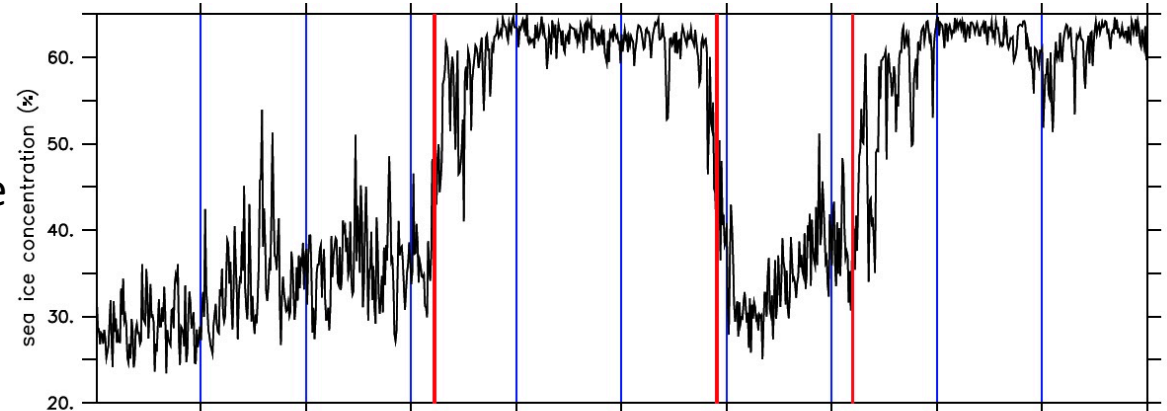
HANNAH KLEPPIN AND MARKUS JOCHUM

Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

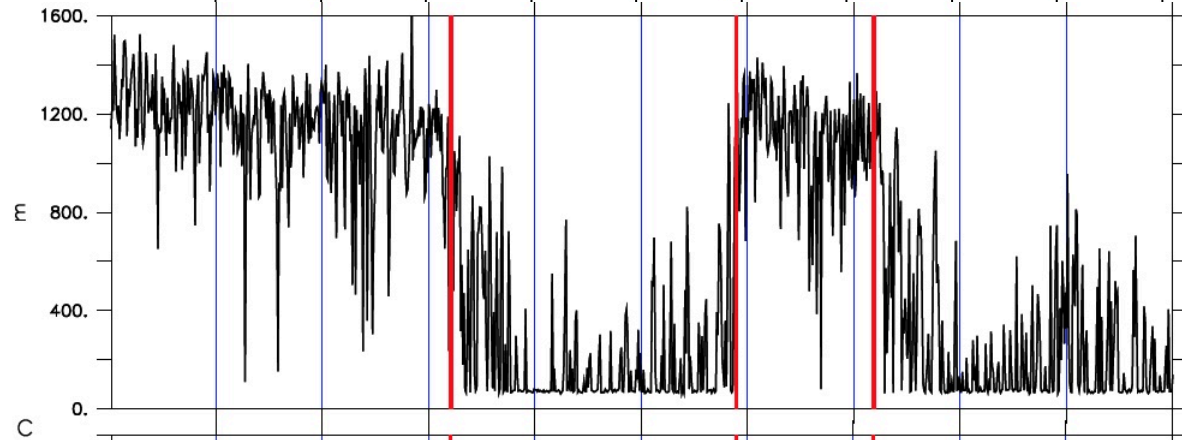
BETTE OTTO-BLIESNER, CHRISTINE A. SHIELDS, AND STEPHEN YEAGER

National Center for Atmospheric Research, Boulder, Colorado

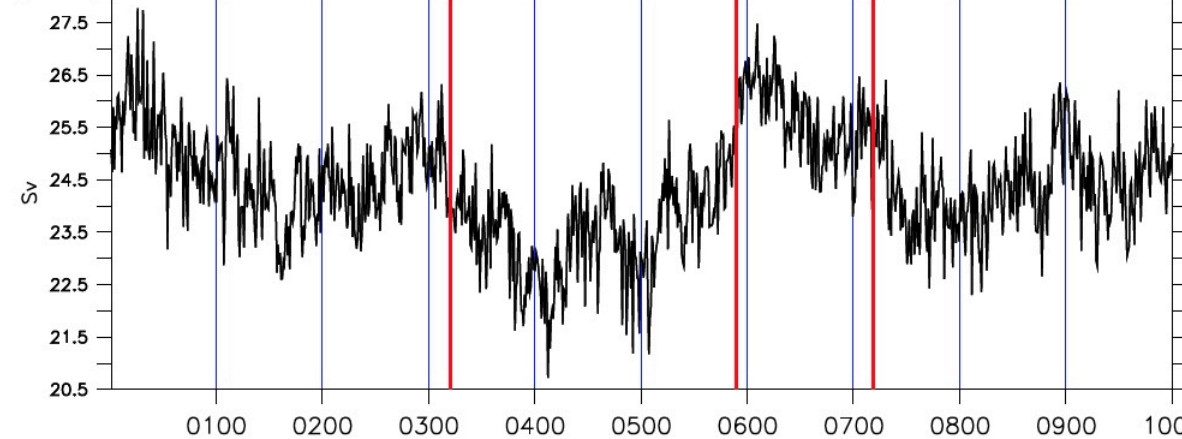
Labrador Sea ice
concentration



March Mixed
Layer Depth



AMOC
Maximum

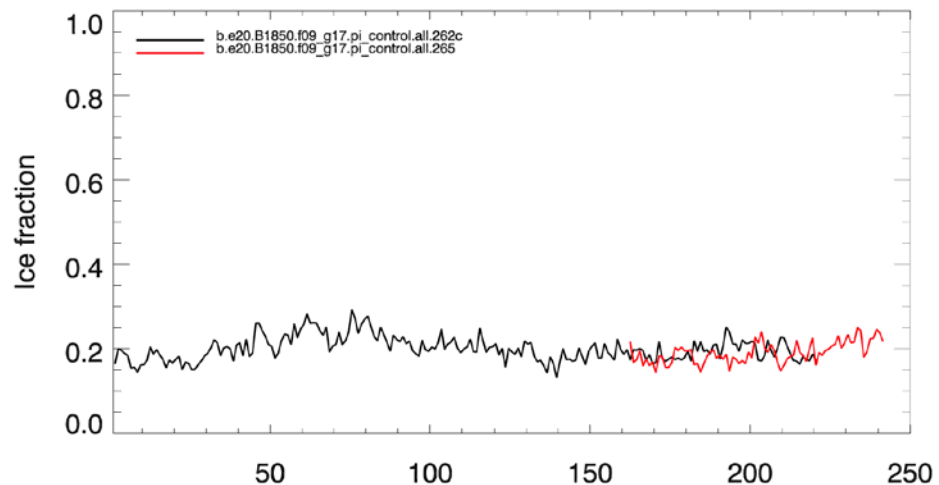
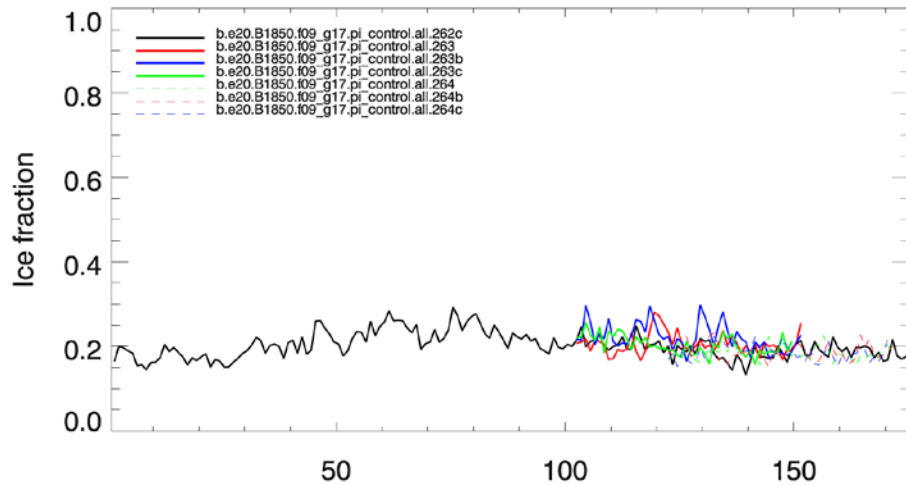
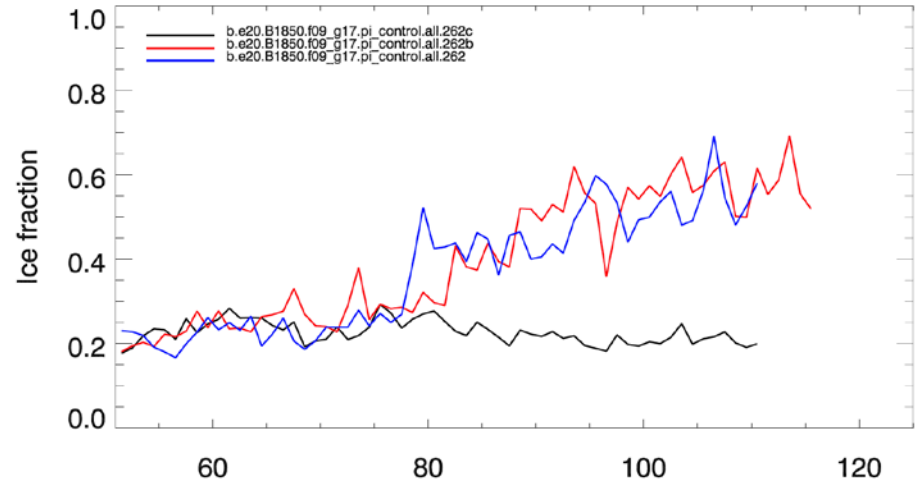
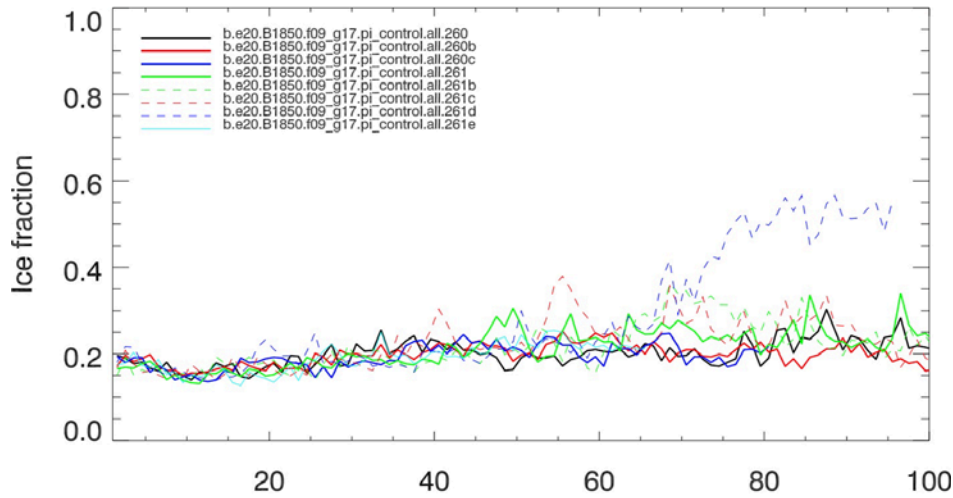


Stochastic atmospheric forcing
(weaker heat flux; weaker winds
and wind stress curl; etc.)

Some Thoughts and a Path Forward

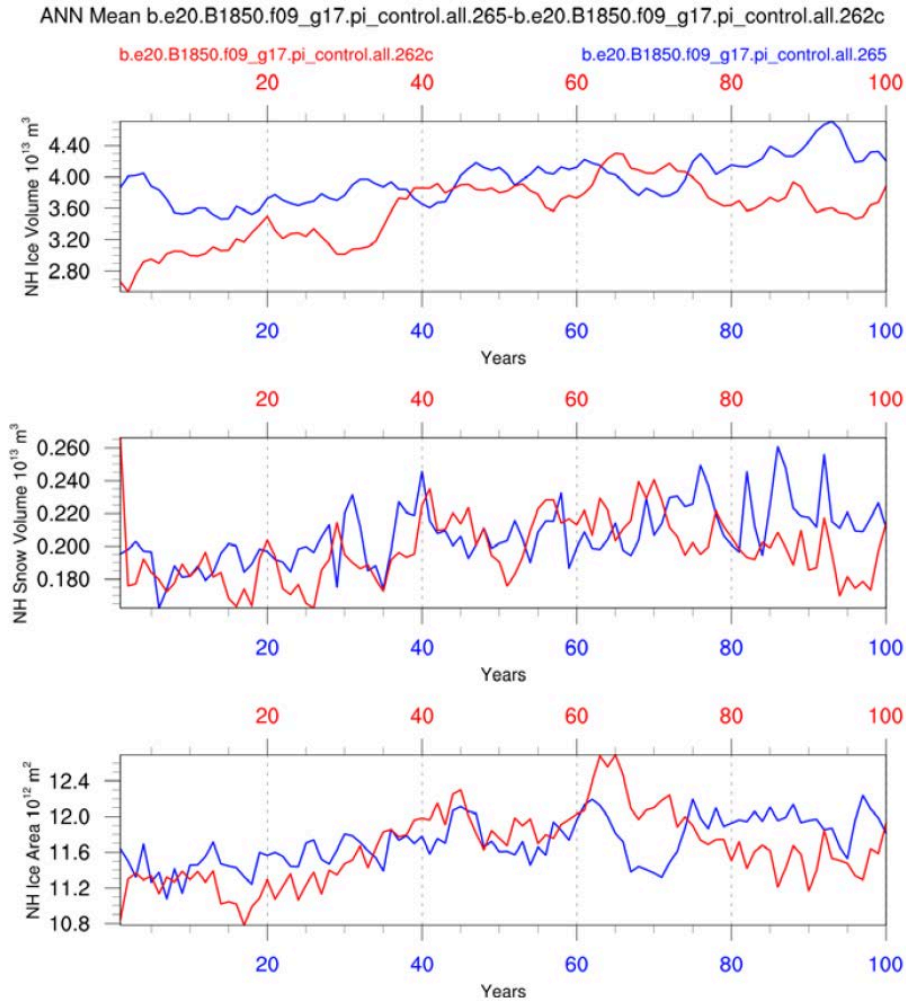
- Some evidence for weaker winds, weaker wind stress curl, smaller latent heat loss; smaller evaporation; etc. in cases with extensive LS ice cover
- Difficult to pin-point what comes first – no silver bullet!
- Modify some aspects of bulk flux calculations to try to enhance heat fluxes, wind stress, etc., hoping to put the simulations more on the LS ice-free side
- Modifications include changes in flux calculations for increased iteration count; enhanced scaling of 10 m winds; and increased maximum value for instability used in the flux profiles
- Start several pre-industrial control simulations in which ensembles are created by round-off level perturbations in the atmospheric temperature
- Designate a state after the LS transient as the pre-industrial initial conditions

Time Series of Labrador Sea Ice Fraction



Round-off level perturbations in the atmospheric temperature

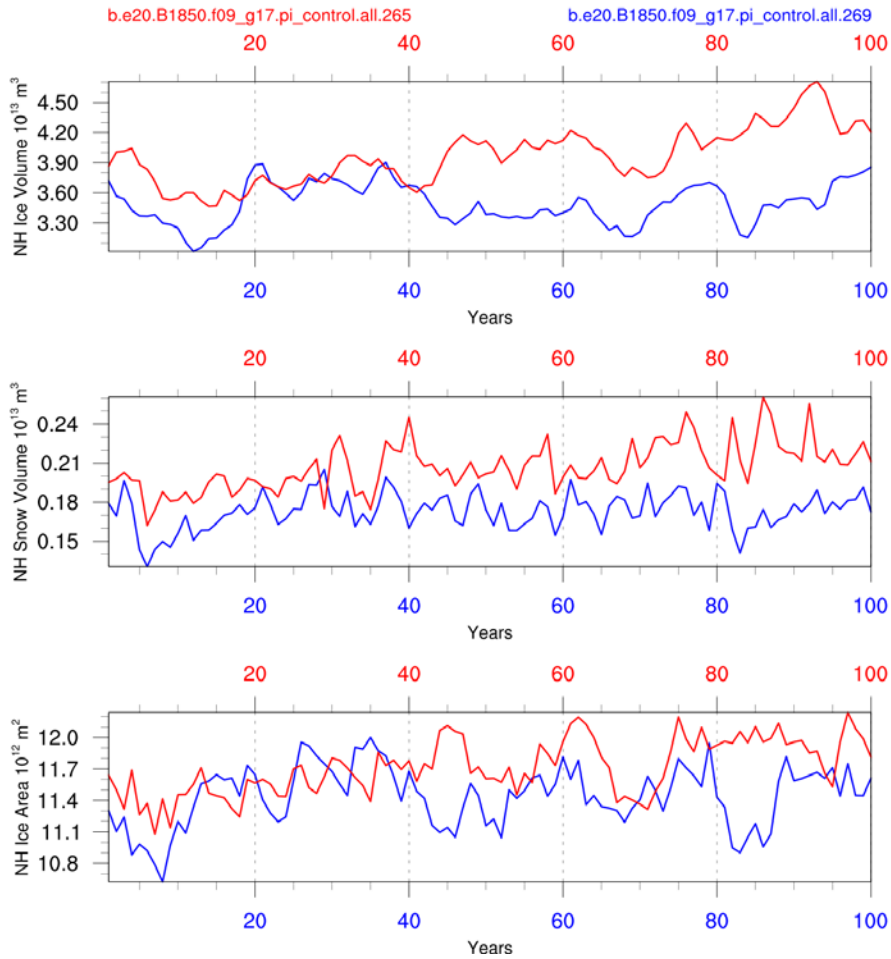
Northern Hemisphere Sea Ice Time Series



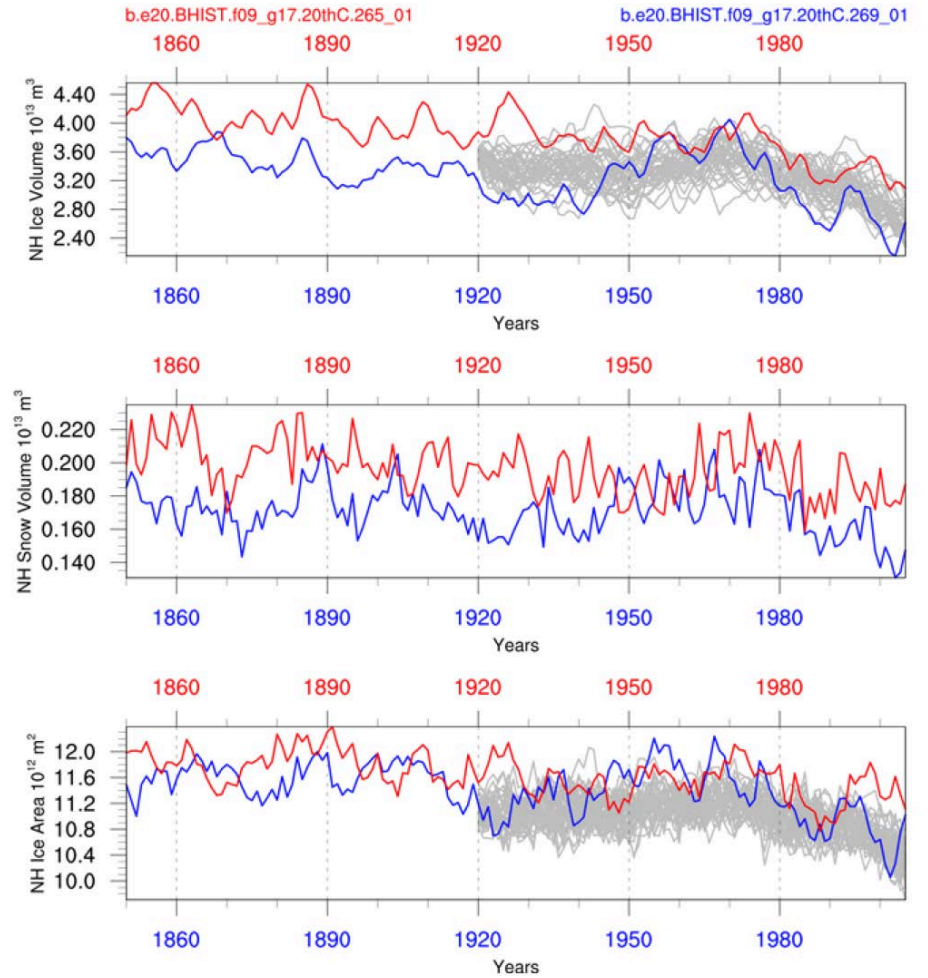
- Reduce sea-ice / snow albedos (#266)
- Retune top-of-atmosphere (TOA)

Northern Hemisphere Sea Ice Time Series

ANN Mean b.e20.B1850.f09_g17.pi_control.all.269-b.e20.B1850.f09_g17.pi_control.all.265



ANN Mean LENS and b.e20.BHIST.f09_g17.20thC.269_01-b.e20.BHIST.f09_g17.20thC.265_01



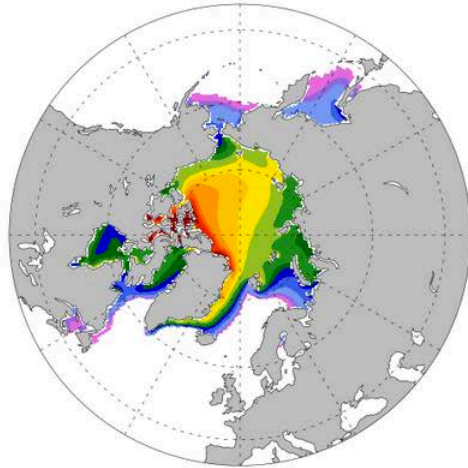
Northern Hemisphere Sea Ice Thickness

ANN Mean

b.e20.BHIST.f09_g17.20thC.269_01 Yrs 1981 - 2005 b.e20.BHIST.f09_g17.20thC.265_01 Yrs 1981 - 2005

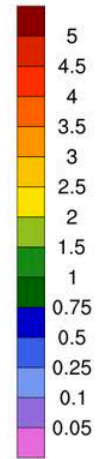
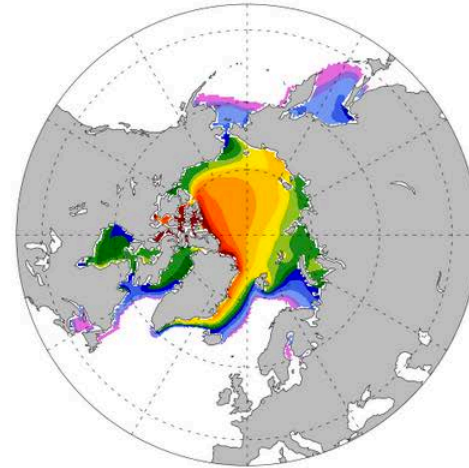
grid cell mean ice thickness

m



grid cell mean ice thickness

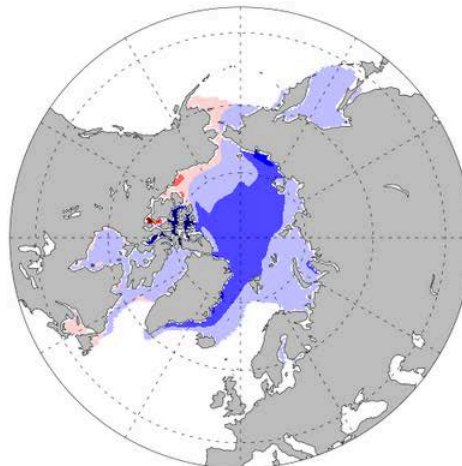
m



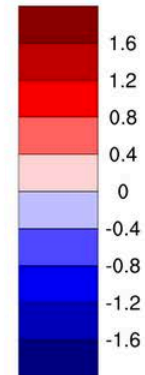
b.e20.BHIST.f09_g17.20thC.269_01 - b.e20.BHIST.f09_g17.20thC.265_01

grid cell mean ice thickness

m



MIN = -12.54 MAX = 3.44



Where are we?

Bugs and Issues:

- (HF) Heat flux non-conservation of order 0.08 W m^{-2} in the land model (RESOLVED)
- (WO) Corrections to a washout scheme in WACCM (RESOLVED)
- To partially remedy the cold bias at the top of the model in CAM:
 - (OZ) Modifications to improve the heating rate associated with the treatment of Ozone between the model top and the top of the atmosphere
 - (GW) Modifications to gravity wave parameterization

Where are we?

Pre-Industrial Control Simulations:

Backup control (#280):

#266

- + HF + WO bug corrections
- + Updated WACCM forcing (from #265)
- + Updated H2O external forcing
- + Updated Nitrogen deposition for the CLM
- + Corrected solar forcing
- + Increased local vertical mixing in overflow regions to reduce tracer extrema

Target control (#281):

#280 + OZ

Scientific curiosity (#282)

#281 + GW

All start from year 161 of #262c