CVCWG update

Feb 21st, 2023

Co-Chairs: Isla Simpson (NCAR), Aixue Hu (NCAR), Sarah Larson (NC State)
Liasons: Adam Phillips (NCAR), Gary Strand (NCAR)

This material is based upon work supported by the National Center for Atmospheric Research, which is a major facility sponsored by the National Science Foundation under Cooperative Agreement No. 1852977.

CGD code of conduct

Outline

- Recently available simulations (new since the summer meeting)
- Ongoing and future simulations planned in the coming year

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Mechanically decoupled

Sarah Larson and Kay McMonigal (NC State), David Bailey, Nan Rosenbloom

piControl simulation:

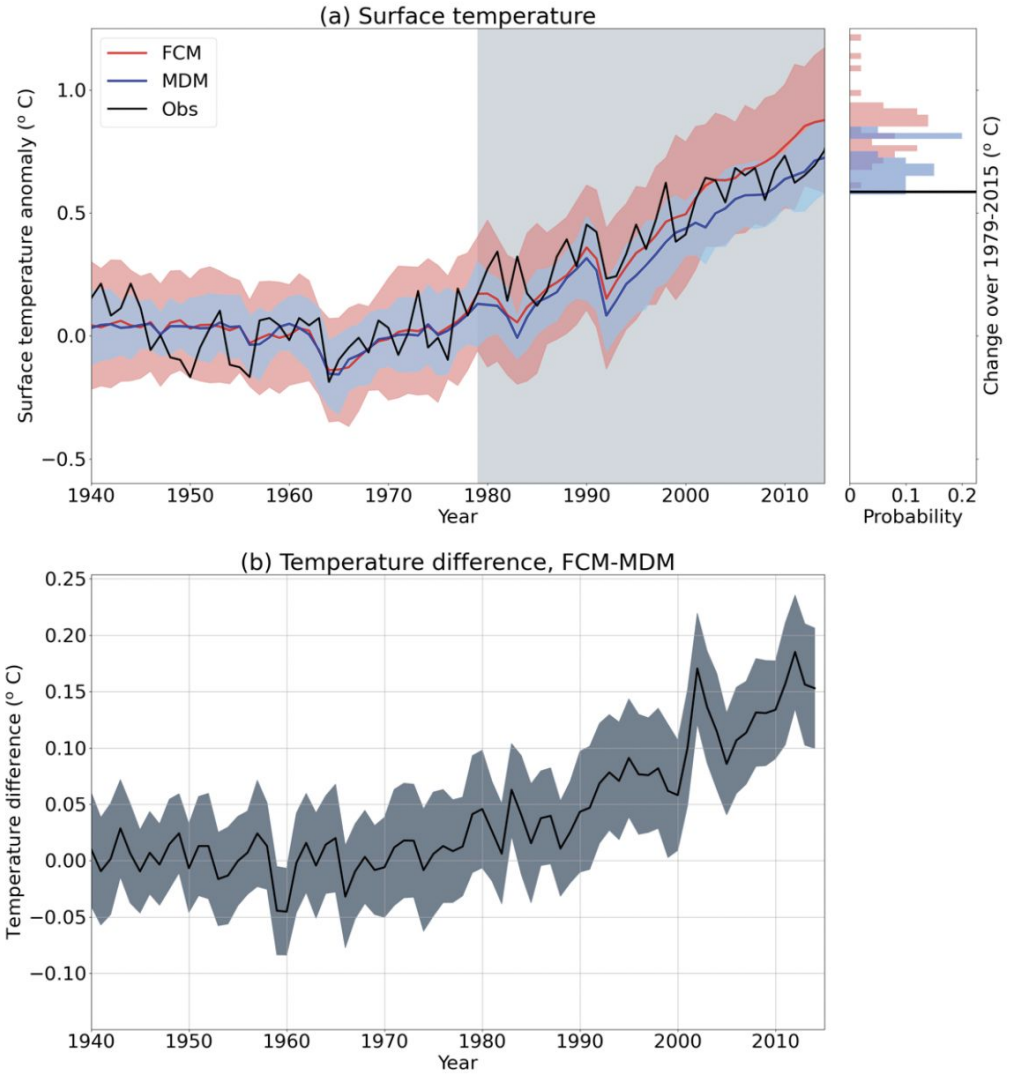
- 500-600 years of the piControl run are now available https://www.earthsystemgrid.org/dataset/ucar.cgd.cesm2.mdpc.html

Historical simulations with smoothed biomass burning:

- 20 members with select monthly data; 5 additional members with all output
- Tune in for Kay McMonigal's talk later!

Future simulations:

- 5 members complete; 5 additional members in progress

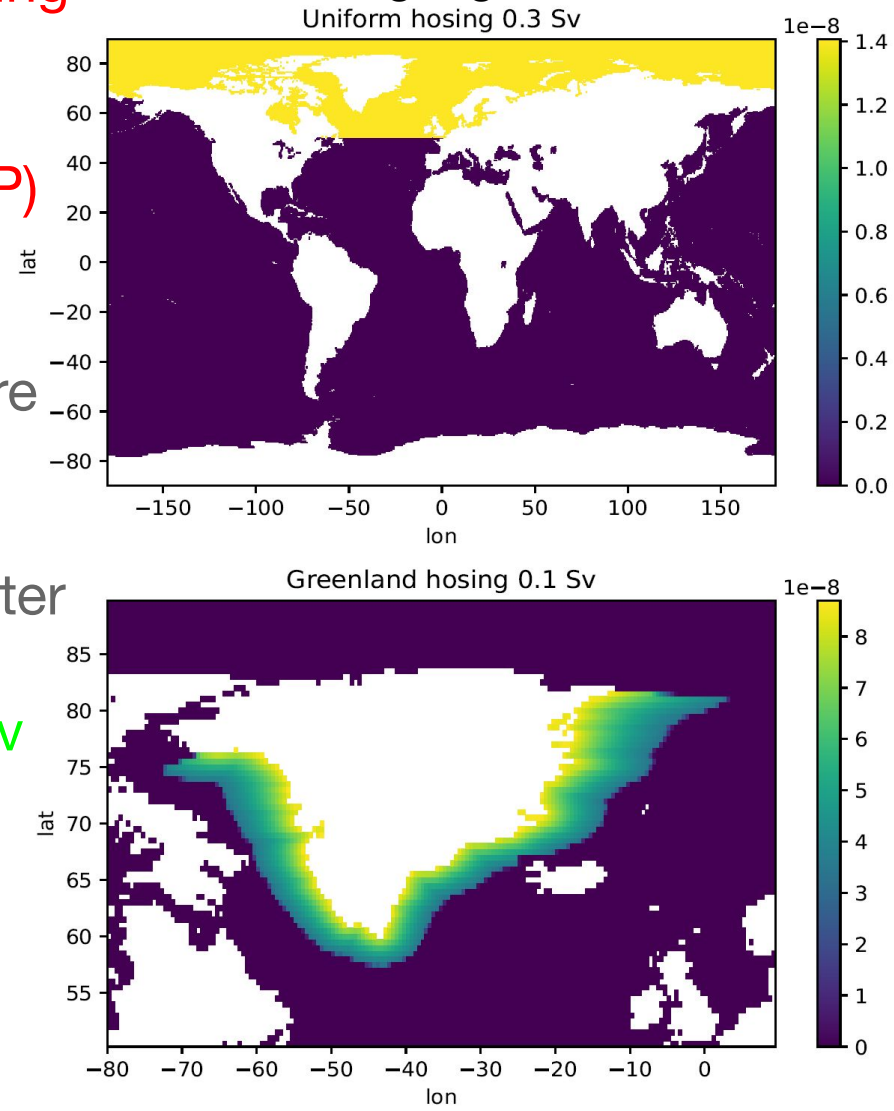


McMonigal et al. (2023), accepted in GRL

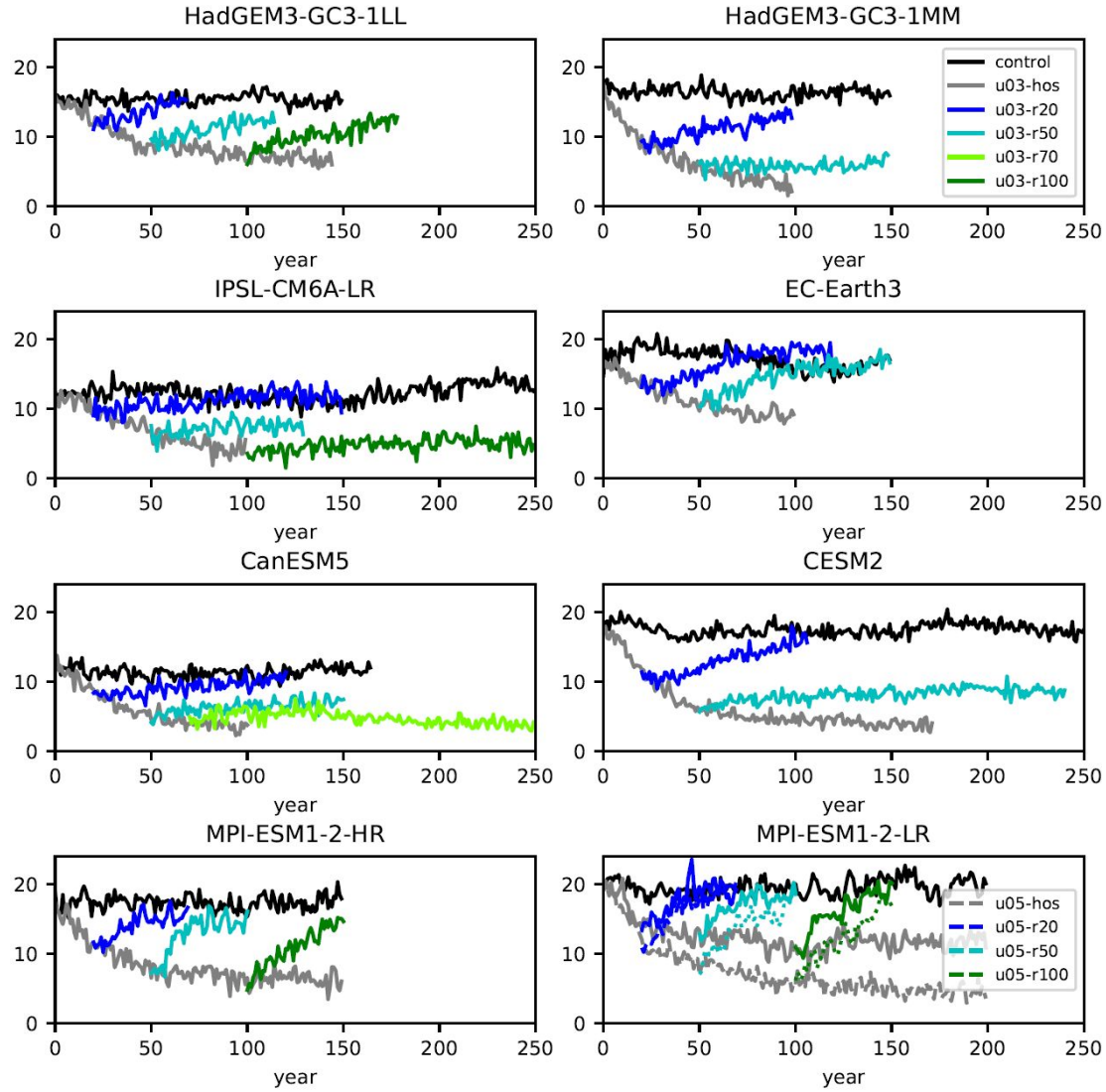
North Atlantic Hosing Model Intercomparison Project

North Atlantic hosing model intercomparison project (NAHosMIP) contains a set of experiments designed to explore AMOC hysteresis and sensitivity to additional freshwater input. Two sets of experiments: 0.3Sv uniform forcing in Arctic-subpolar North Atlantic and 0.1 Sv around Greenland.

Hosing region



AMOC in 0.3 Sv uniform hosing experiment



Jackson et al., 2023, Understanding AMOC stability: the North Atlantic Hosing Model Intercomparison Project, GMD, under review.

Single Forcing Large Ensemble

Thanks to Nan Rosenbloom

Now available https://www.cesm.ucar.edu/working-groups/climate/simulations/cesm2-single-forcing-le

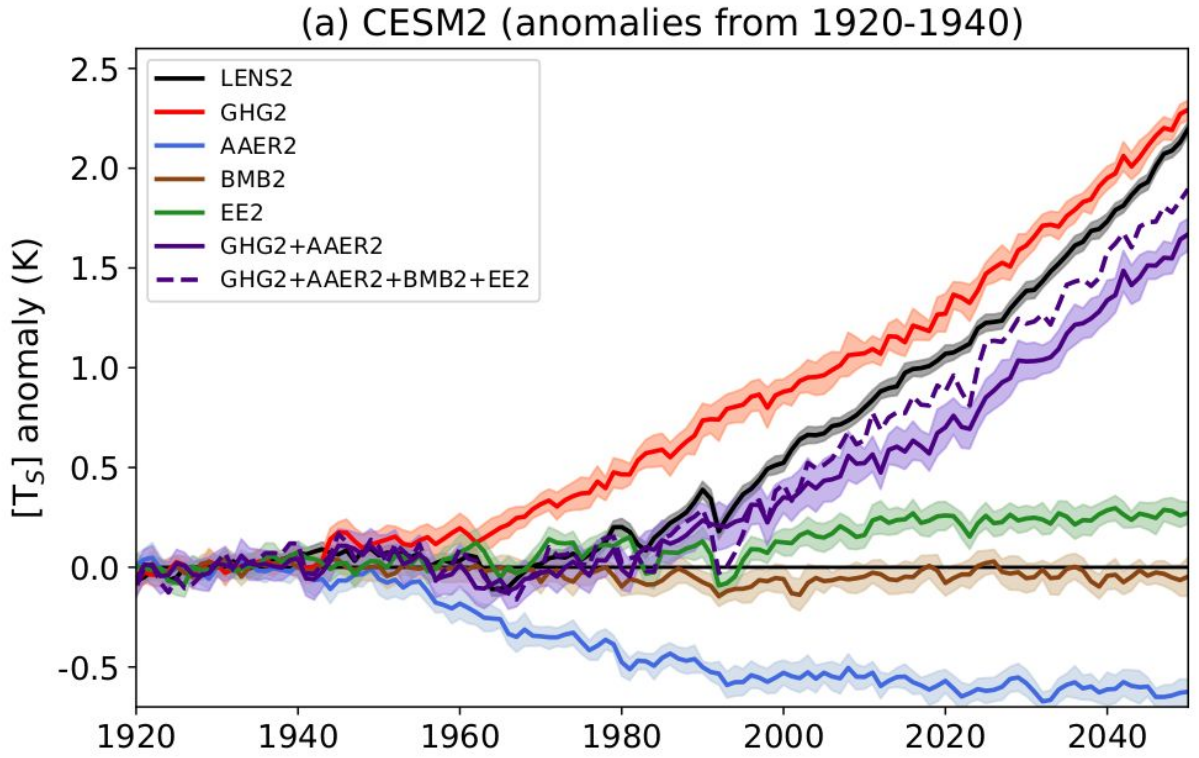
Four primary ensembles, 1850-2050:

AAER (20 members): anthropogenic aerosols evolving, everything else fixed.
GHG (15 members): greenhouse gases evolving, everything else fixed.
BMB (15 members): biomass burning aerosols evolving, everything else fixed.
EE (15 members): all other forcings evolving.

A secondary ensemble, 1920-2050:

xAER (10 members): everything evolving except anthropogenic aerosols (run like CESM1)

Description paper hopefully accepted soon in J. Clim.



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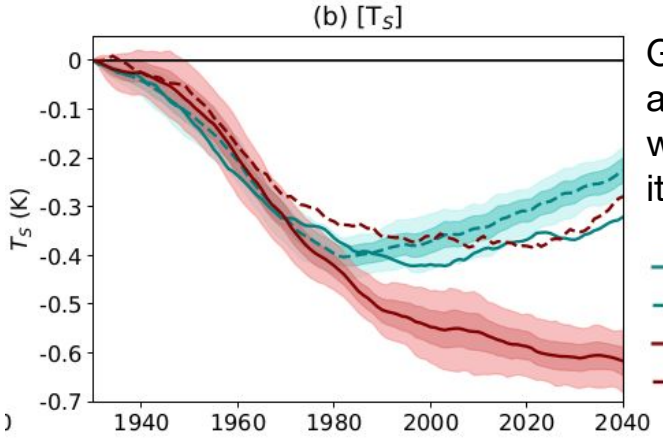
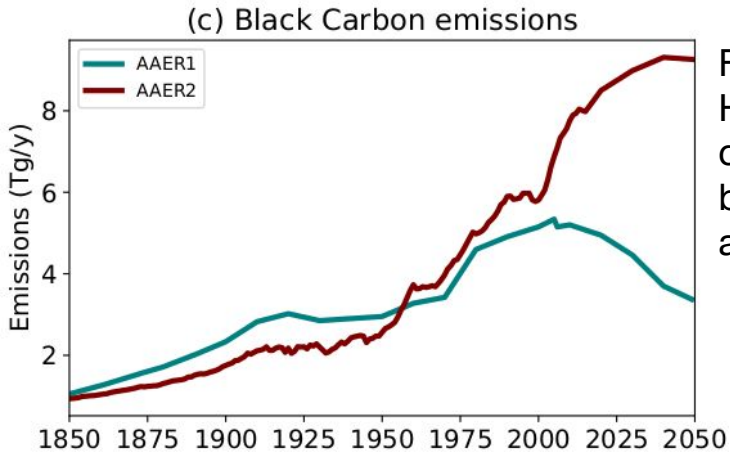
Two experiments motivated by the single forcing large ensemble

- CESM2 single forcing anthropogenic aerosol simulations with CMIP5 forcings.

AAER_CMIP5 (3 members): Only anthropogenic aerosols evolving from 1850-2050 (CMIP5 historical → RCP8.5)
XAAER_CMIP5 (3 members): Everything except anthropogenic aerosols evolving from 1920-2050 (CMIP5 historical → RCP8.5)

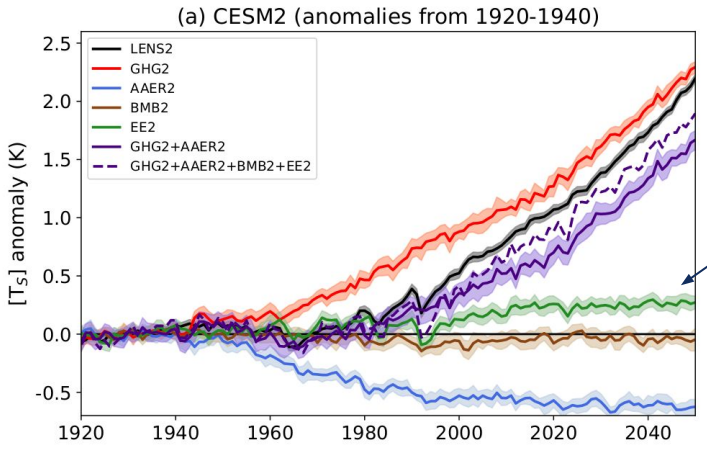


Global mean Ts response to aerosols. In CESM2 it matters which method you use. In CESM1 it matters less.

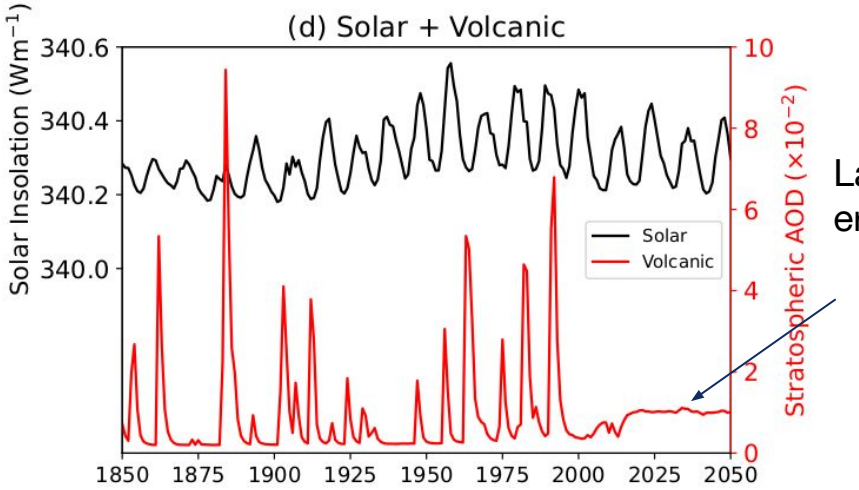


Forcings are really different. How much does that contribute to the different behavior between CESM1 and CESM2?

- CESM2 single forcing with volcanoes only (5 members, 1850-2050)

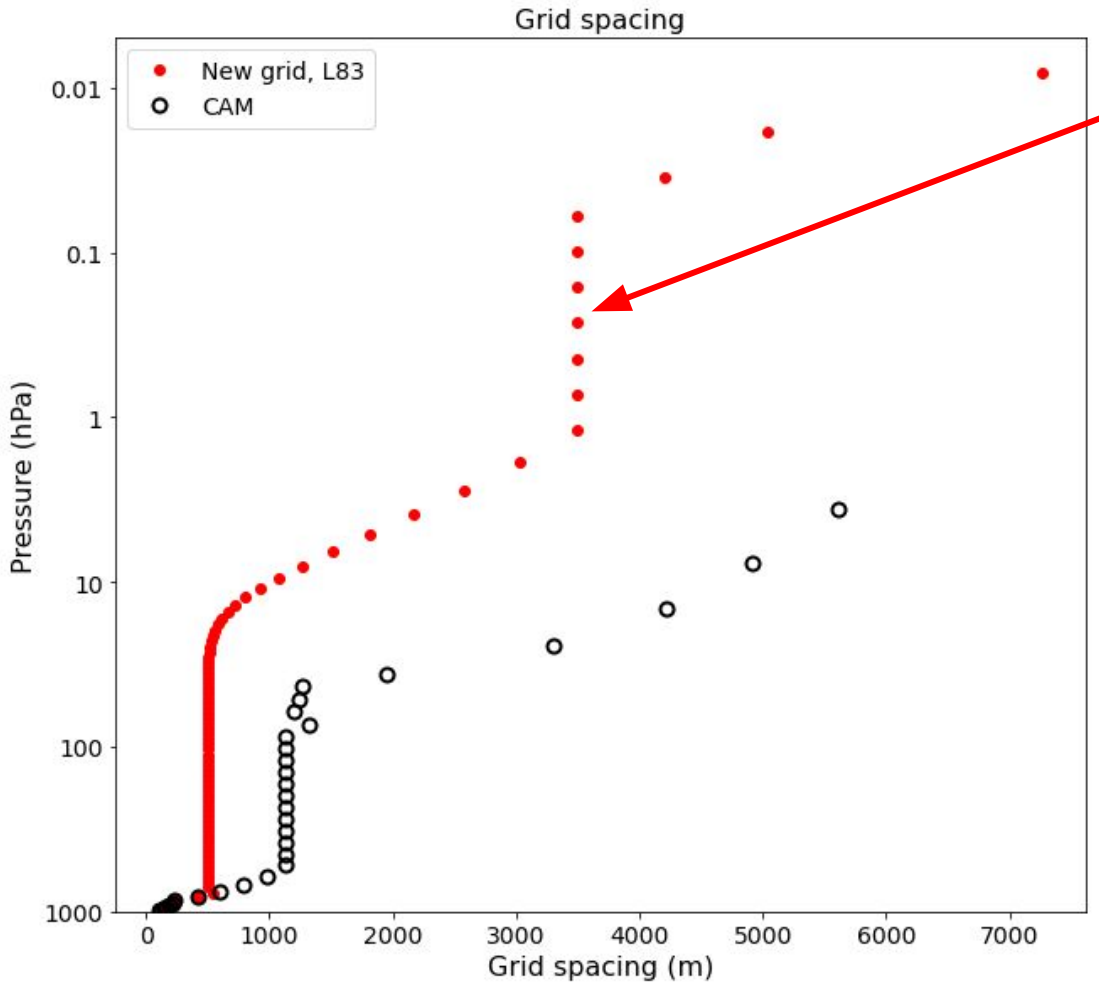


What produces this warming in the everything else simulation?

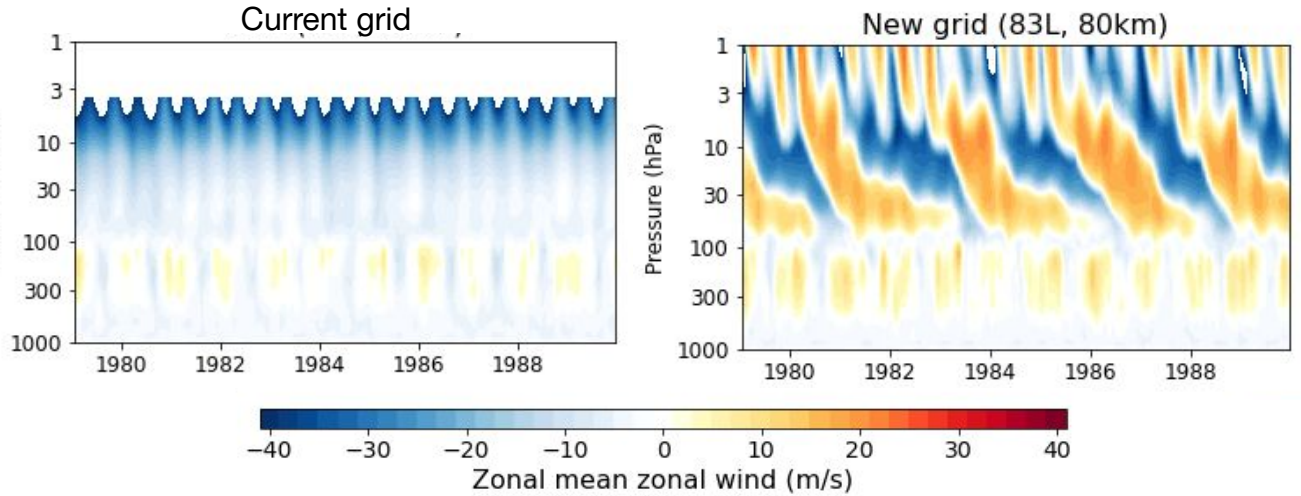


Lack of large volcanic eruptions in the SSP?

L83 coupled historical simulations and QBOi experiments



Next generation grid for CAM (excluding additional levels in the boundary layer)



- 100 year piControl
- 3 coupled historical simulations (1850-2100, historical → SSP3-7.0)
- 3 AMIP simulations (1950-2014)
- Nudged QBO simulations for QBOi

Description paper in prep. This model configuration is also being used in an S2S ensemble prediction experiment (complementary to SMYLE) in a collaboration between Scripps and NCAR

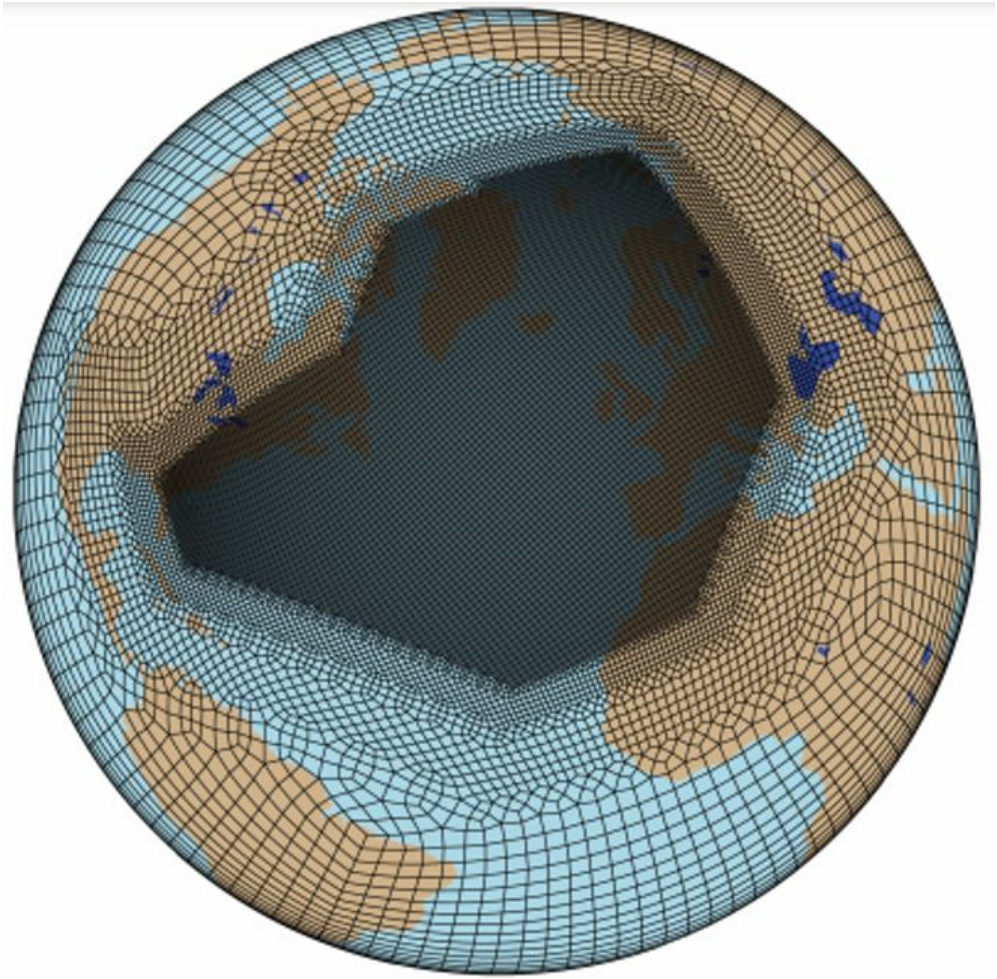
Regionally refined North Atlantic AMIP Simulation

- 1958-present day
- CAM-SE (1/8th degree in the North Atlantic)
- Prescribed SSTs from the iHESP 1/10th degree FOSI simulation

Motivation: How does North Atlantic jet stream variability/eddy mean flow feedbacks change at high resolution? Does ocean → atmosphere coupling change at high resolution?

(simulation is in 1994 at the moment)

A companion 5 member ensemble with 1 degree CAM-SE will be run for comparison.



Thanks to Robb Jnglin Wills, Adam Herrington

CAM6 LIM TOGA

Flavio Lehner, Yan-Ning Kuo (Cornell), Clara Deser, Adam Phillips, Isla Simpson (NCAR), Matt Newman, Sang-Ik Shin (CIRES/NOAA)

Goal:

- Investigate *alternative* historical SST trajectories and their teleconnections w/o relying on coupled models

Setup:

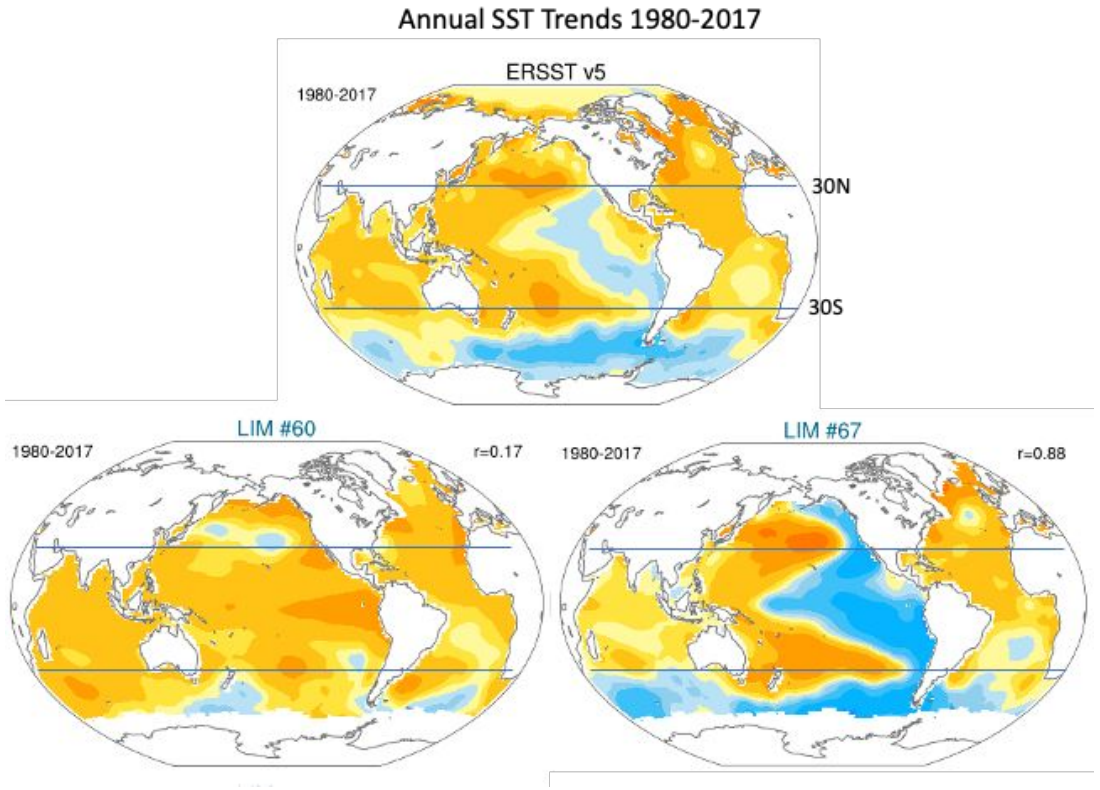
- Tropical Ocean Global Atmosphere (TOGA) simulations with CAM6
- SSTs from select realizations of a Linear Inverse Model (LIM) large ensemble trained on ERSSTv5

Existing simulations (time period 1960-2017):

- 10 members w/ observed SSTs
- 10 members w/ El Niño-like SST trend pattern
- 10 members w/ La Niña-like SST trend pattern

Future simulations (time period 1980-2017):

- Repeat of above with SMBB forcing and refined selection of La Niña- and El Niño-like patterns



Trend patterns of observed SST and the two newly chosen LIM SST realizations.

Regionally refined tropics

(Brian Medeiros)

- Regional refinement to 1/8th degree (14 km) resolution in the tropics. 5 year F2000Climo case currently underway. Purpose: examine the impact of resolution on tropical variability.

SSP5-8.5 medium ensemble

(Nan Rosenbloom, Adam Phillips)

- A 15 member ensemble of simulations with SSP5-8.5 forcings.

This will give us:

- 16 member medium ensemble with SSP2-4.5
- 100 member large ensemble with SSP3-7.0
- 15 member medium ensemble with SSP5-8.5

TBI co-EX

1. Historical pacemaker simulations:
   10 ensemble members from 1850 to 2021 (historical forcing 1850-2014, SSP585 2015-2021);
   Pacemaker simulations: Pacific, Atlantic and Indian Oceans (10 ensemble members each);
   SST full-field relaxation to observations: 10S-10N; transition zone: 10S-30S and 10N-30N.
   Planed in CVCWG CSL allocation and will set up soon.

2. Pacemaker hindcast experiments:
   Initial condition, Global SSTs and SSSs are restored to observations for the period 1982-2021.
   pacemaker runs: Hind_CTRL, Hind_P, Hind_a, Hind_I
   4 start months (Feb 1, May 1, Aug. 1 and Nov. 1), simulations last for 12 months.
   Planned in ESPWG CSL allocation and tests have been done by Steve.

Mechanically decoupled

(Sarah Larson, Kay McMonigal)

1. Historical simulations: Greenhouse gas only (MD_GHG), 10 members

2. Climate sensitivity simulations
   a. 1pct CO2 simulation: CO2 is increased by 1% per year for 150 years (MD_1pct)
   b. 4xCO2 simulation: CO2 is instantaneously quadrupled and integrated for 150 years (MD_4xCO2)

Timeline: climate sensitivity simulations will be run this summer

Questions? Discussion?

Ocean Hierarchy Discussion

1. What are the current gaps in the ocean model hierarchy?

2. Where is the current momentum in ocean model hierarchy development? (building up complexity from simpler models or removing complexity from more complex models)

3. What is more valuable to the community? building in capabilities / code sharing to run simpler ocean experiments or sharing data?

4. Is there interest in a 2-day ocean model hierarchy workshop?