CVCWG update

June 14th, 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.

Upcoming workshops and hackathons

ForceSMIP Hackathon

August 29-31, 2023

ETH Zürich, Zurich, Switzerland
AND
National Center for Atmospheric Research, Boulder, USA

Workshop and Hackathon

Leveraging climate model large ensembles to develop and assess statistical methods for isolating the forced response in observations.

Lectures and tutorials by: Elizabeth Barnes, Clara Deser, Robb Jnglin-Wills, Matt Newmann, Sebastian Sippel, Laurent Terray

General Information: https://sites.google.com/ethz.ch/forcesmip/
Registration: https://sites.google.com/ethz.ch/forcesmip/hackathon

(Register by July 3rd (early-bird), until July 31st if space is available)

Organizing committee: C. Deser, K. McKinnon, A. Phillips, S. Po-Chedley, S. Sippel, R. Wills

US CLIVAR

Workshop on "Confronting climate model trends with observations: the good, the bad, and the ugly"

NCAR Mesa Lab

March 13th-15th 2024

Flyer and website coming soon

Organizing committee: T. Shaw, I. Simpson, P. Ceppi, A. Clement, E. Fischer, K. Grise, A. Pendergrass, J. Screen, R. Wills, T. Woollings

Single Forcing Large Ensemble

Thanks to Nan Rosenbloom

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

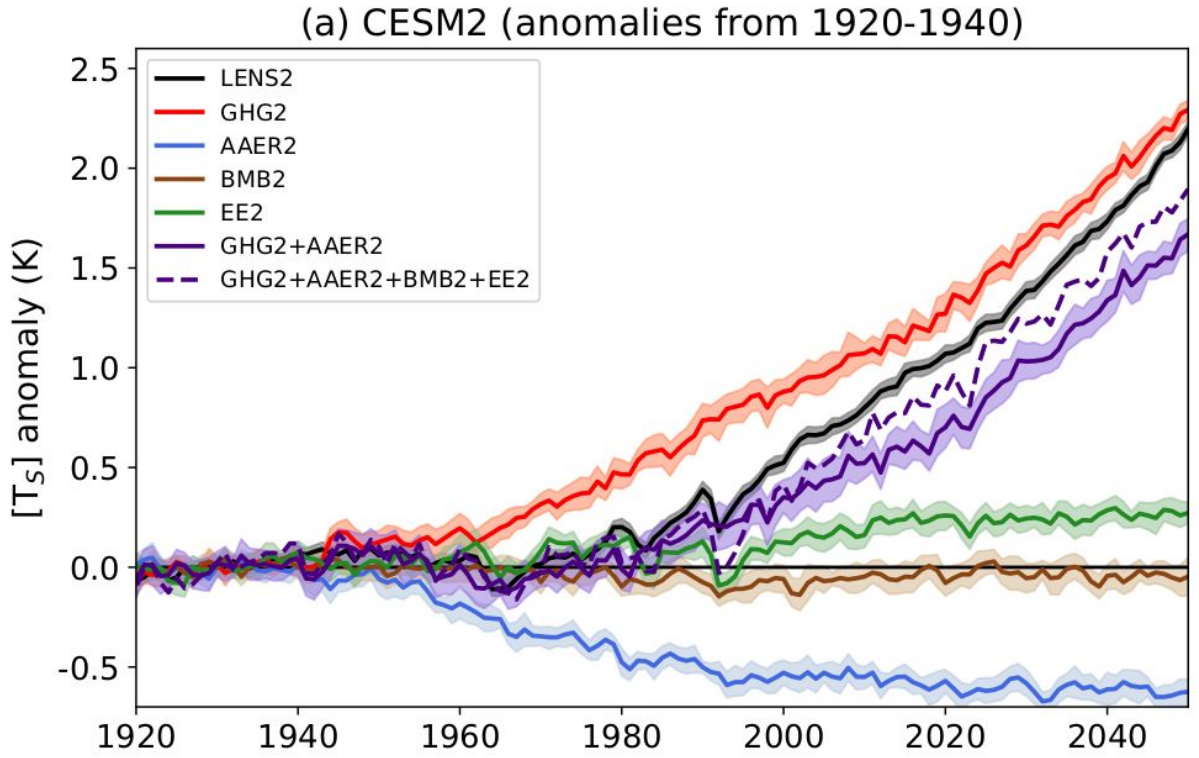
Four primary ensembles, 1850-2050:

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 accepted in J. Clim.



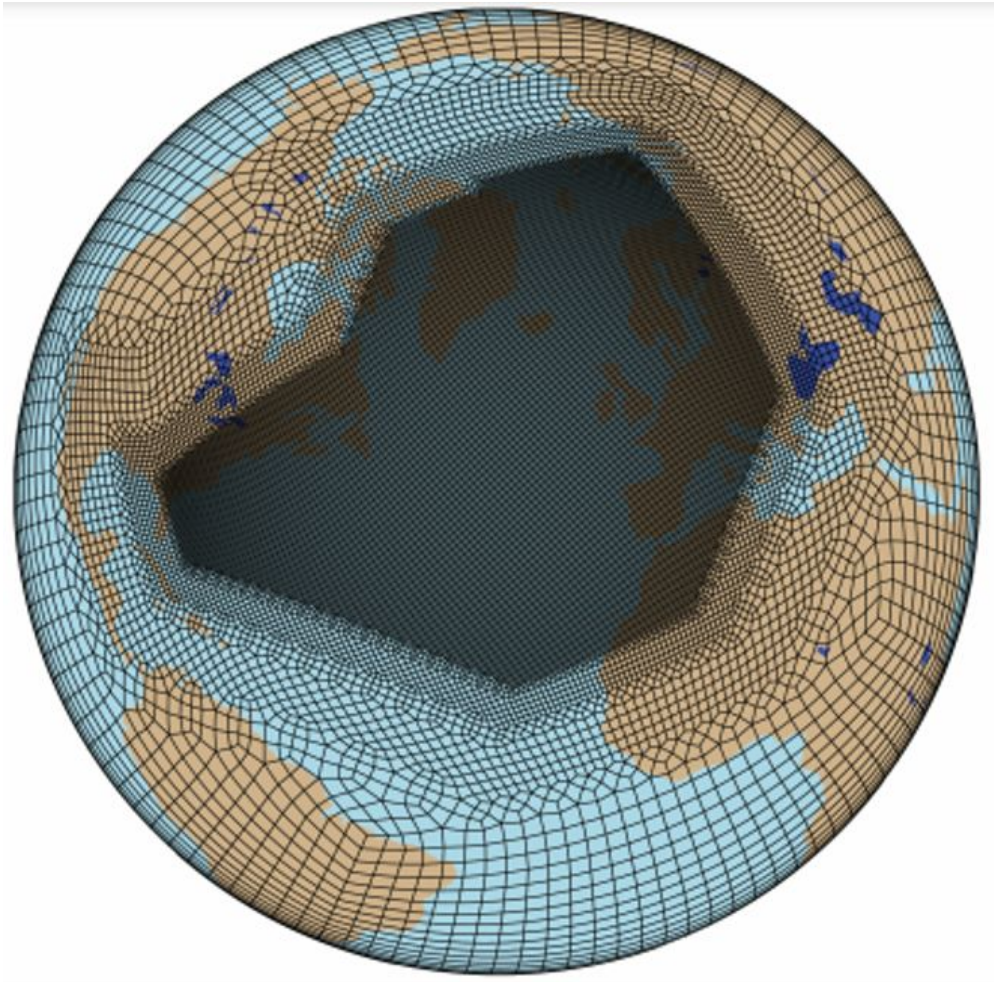
Regionally refined North Atlantic AMIP Simulation

- 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?

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

Simulation is currently at 1991. Cheyenne instabilities causing slow progress but hoping to get it finished this year

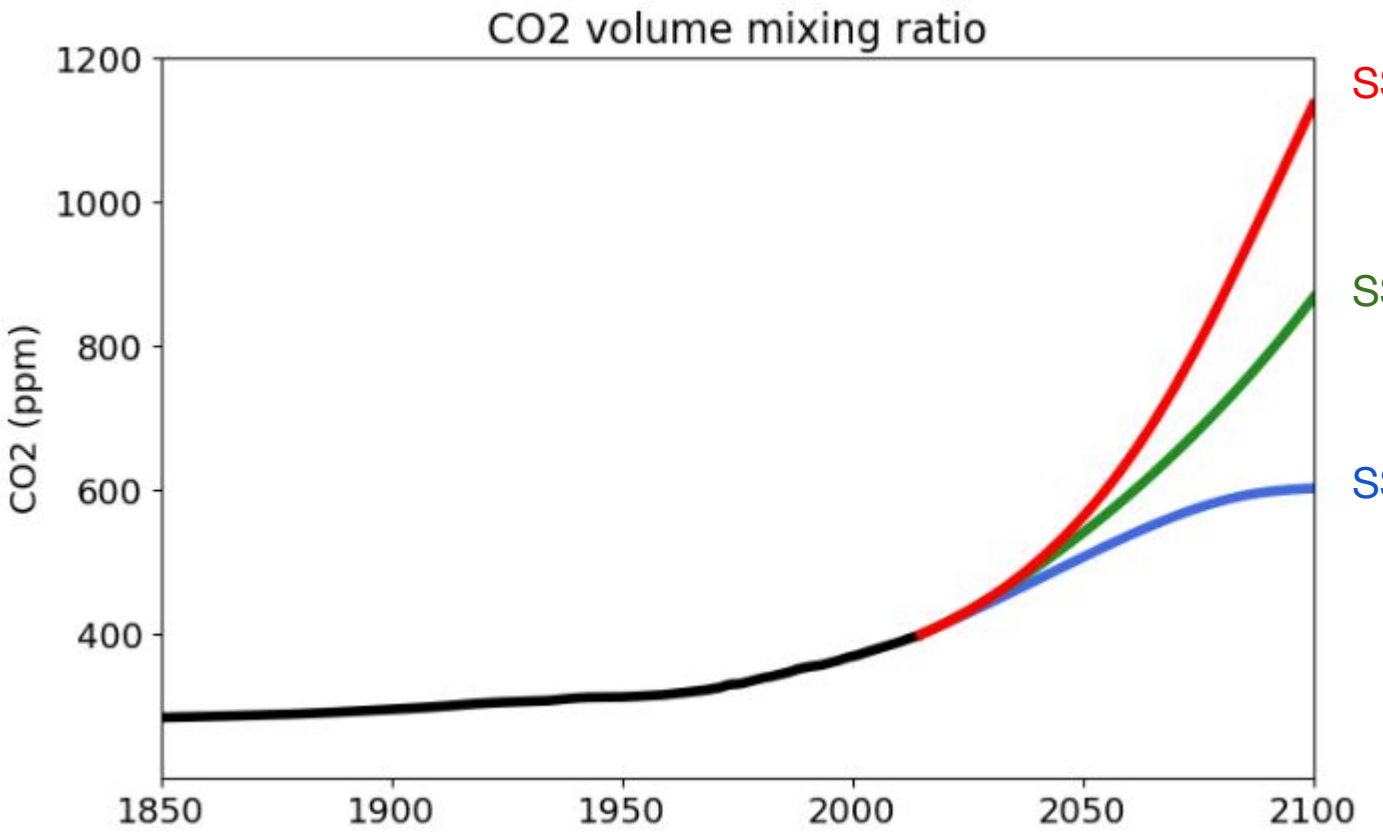


Thanks to Robb Jnglin Wills, Adam Herrington

SSP5-8.5 ensemble

Adam Phillips, Nan Rosenbloom

A new SSP5-8.5 scenario medium (15 member) ensemble is coming very soon - runs are almost done



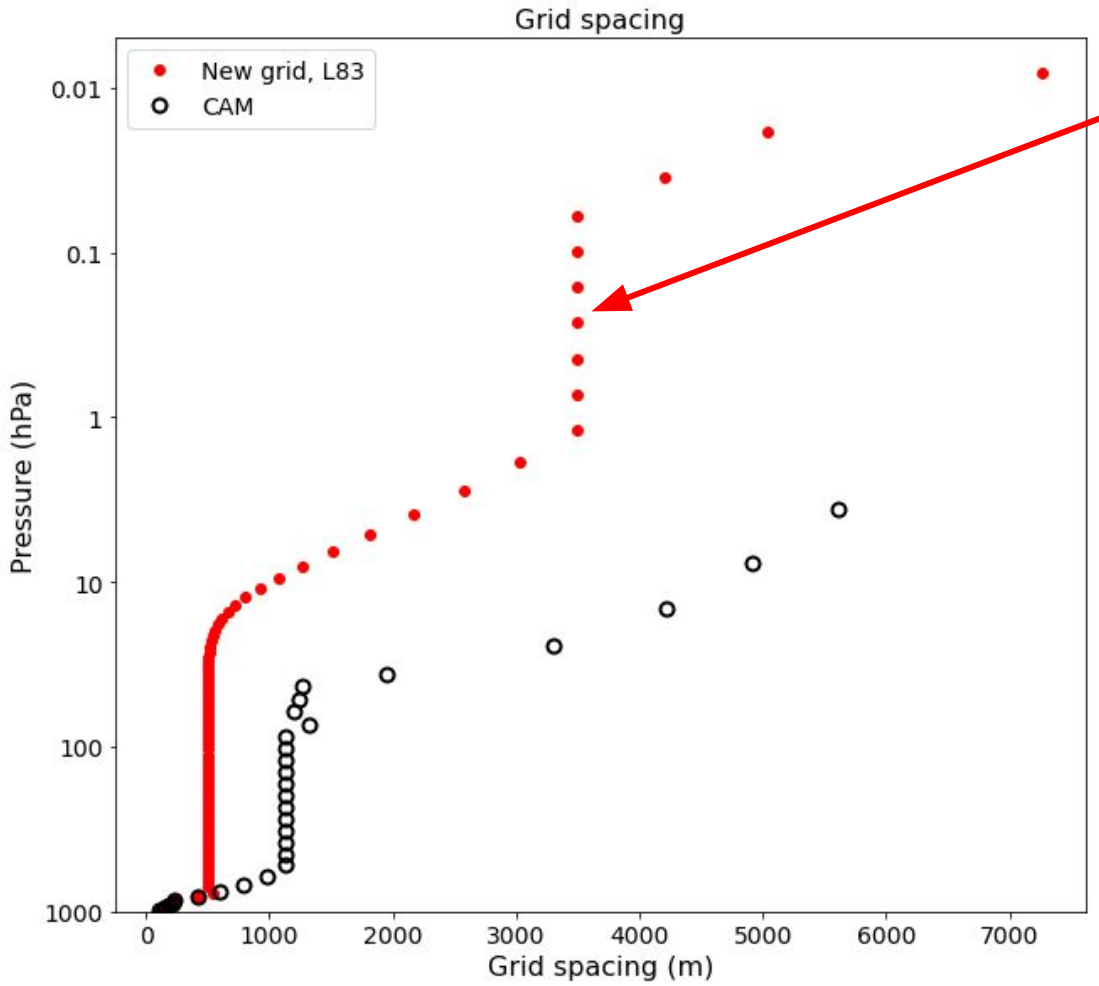
Then we'll have…

SSP5-8.5 (15 members)

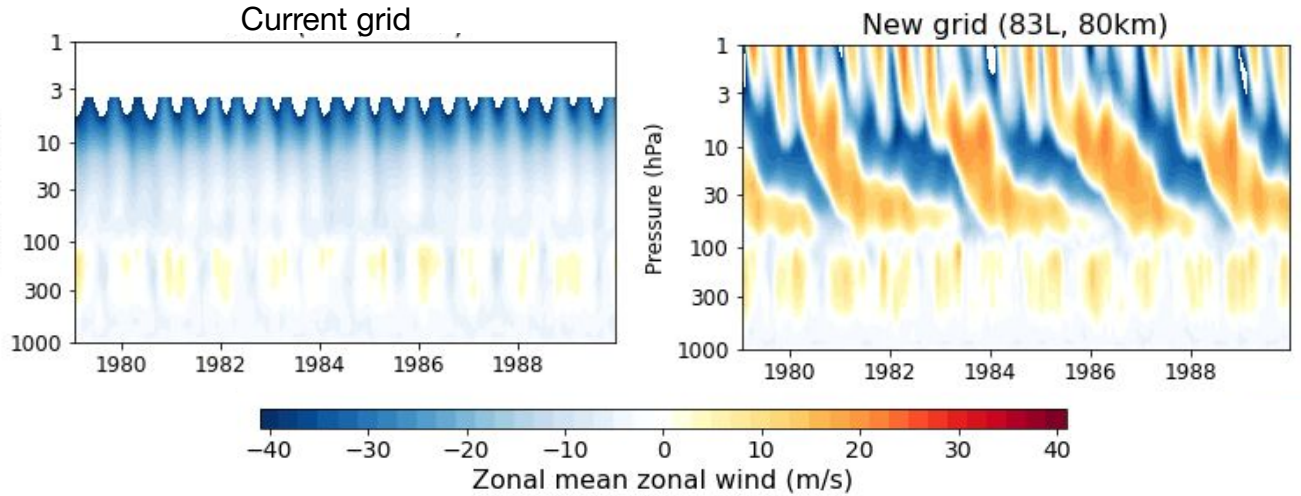
SSP3-7.0 (100 members)

SSP2-4.5 (16 members)

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

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:

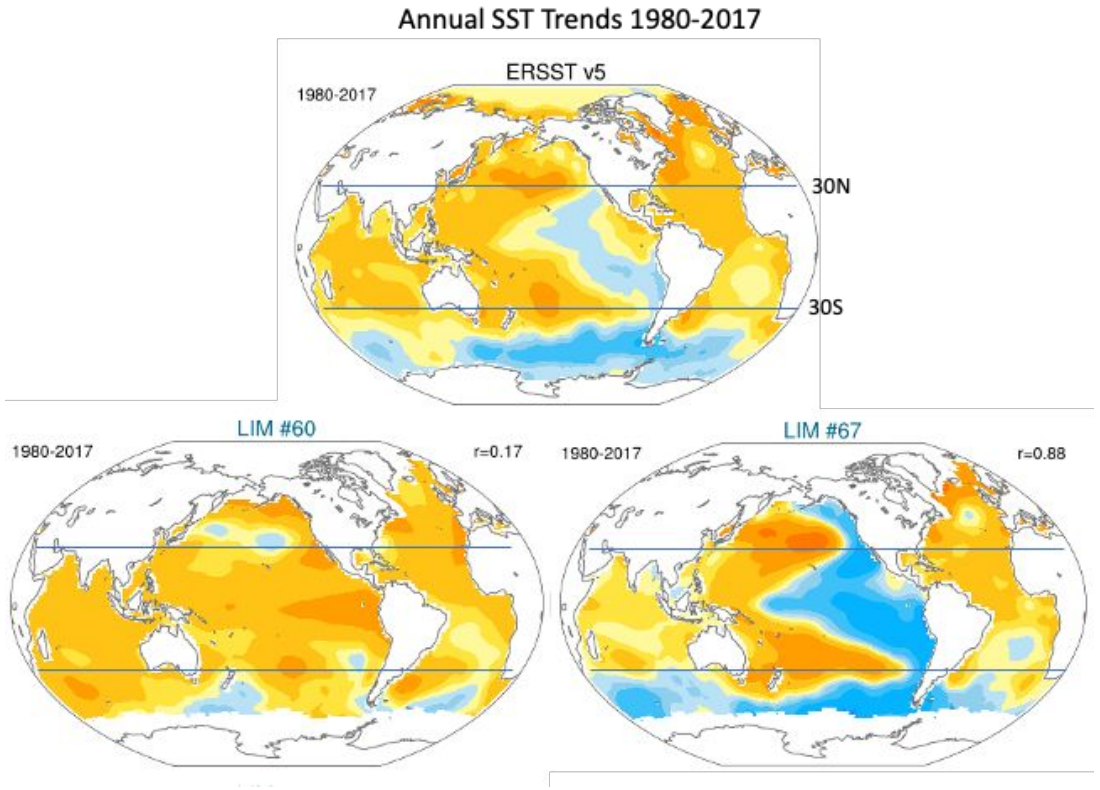
- Tropical Ocean Global Atmosphere (TOGA) simulations with CAM6
- SSTs from select realizations of a Linear Inverse Model (LIM) large ensemble trained on ERSSTv5

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.

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

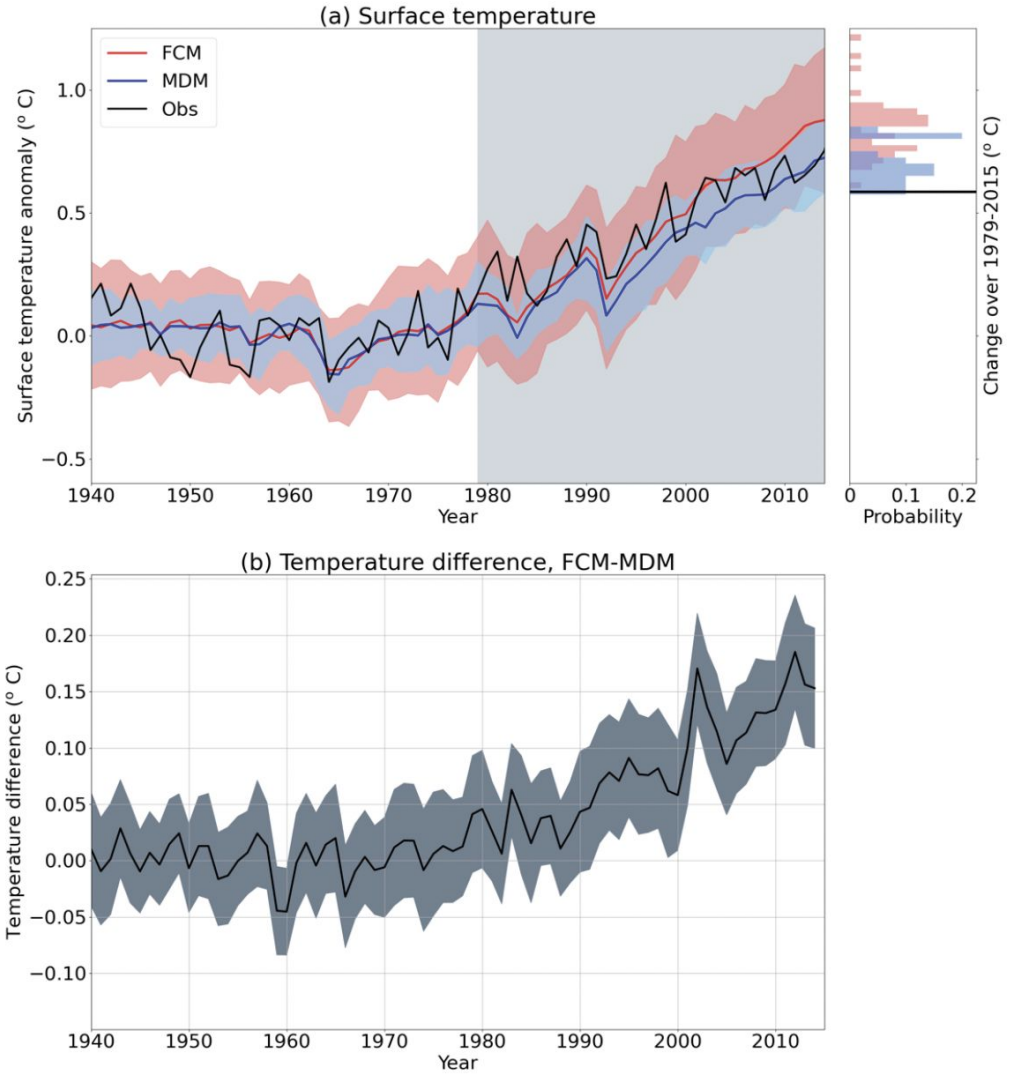
Historical simulations with smoothed biomass burning:

- 20 members with select monthly data; 5 additional members with all output

Future simulations (SSP370):

- 10 members complete

Science Collaborators: Yu-Chiao Liang, Shineng Hu



McMonigal et al. (2023, GRL)

CVCWG planned simulations and discussion

June 14th, 2023

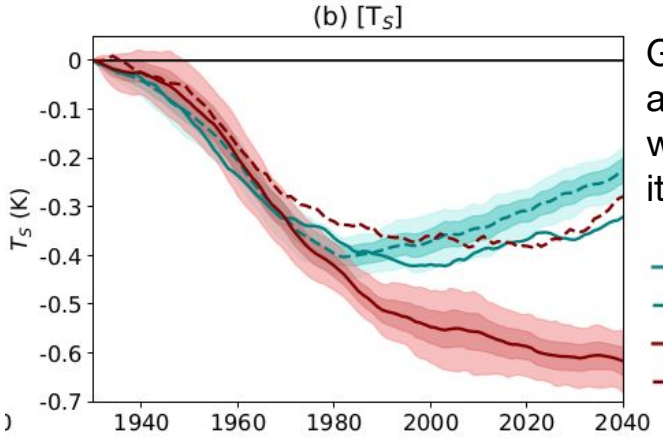
Co-Chairs: Isla Simpson (NCAR), Aixue Hu (NCAR), Sarah Larson (NC State)
Liasons: Adam Phillips (NCAR), Gary Strand (NCAR)

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.

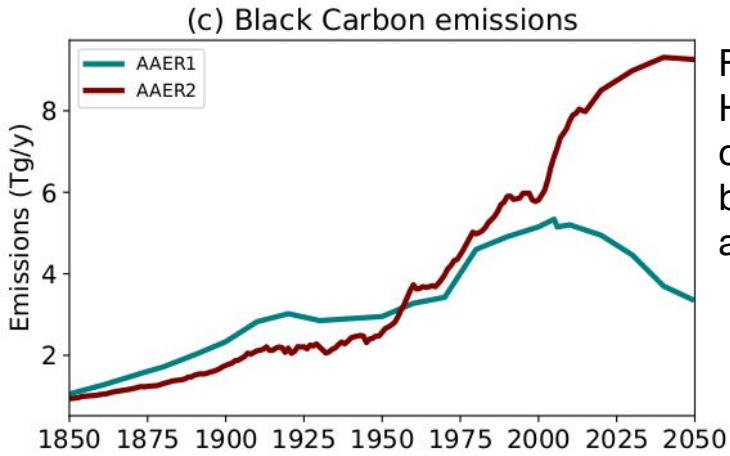
Two experiments motivated by the single forcing large ensemble

- 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)

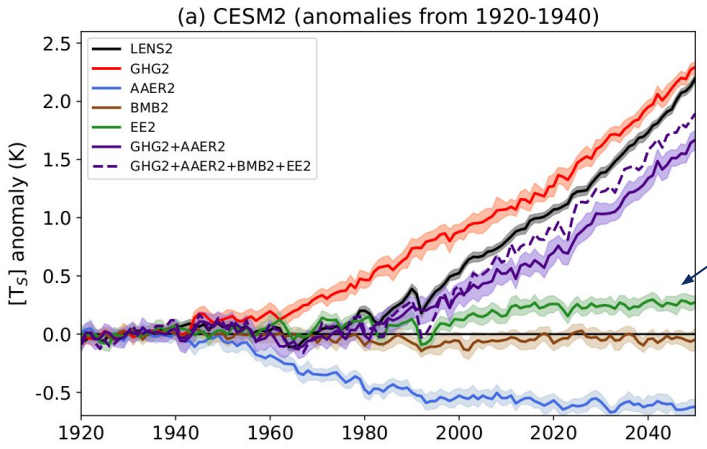


Global mean Ts response to aerosols. In CESM2 it matters which method you use. In CESM1 it matters less.

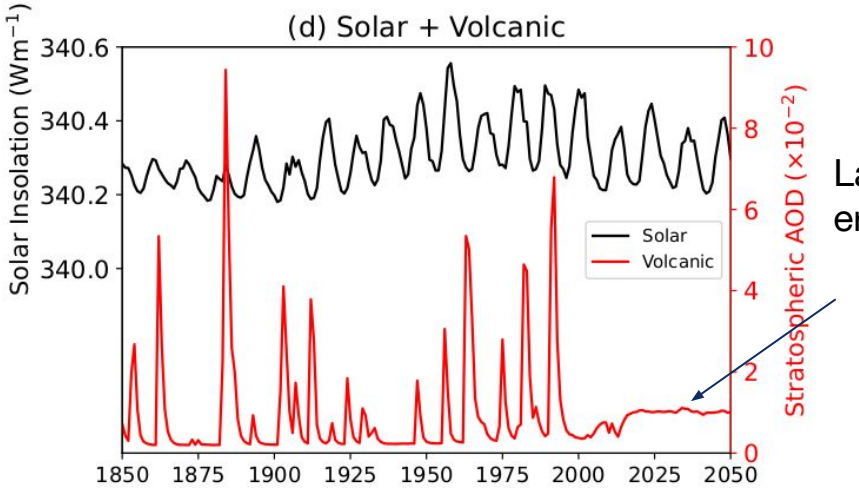


Forcings are really different. How much does that contribute to the different behavior between CESM1 and CESM2?

- 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?

Regionally refined North Pacific

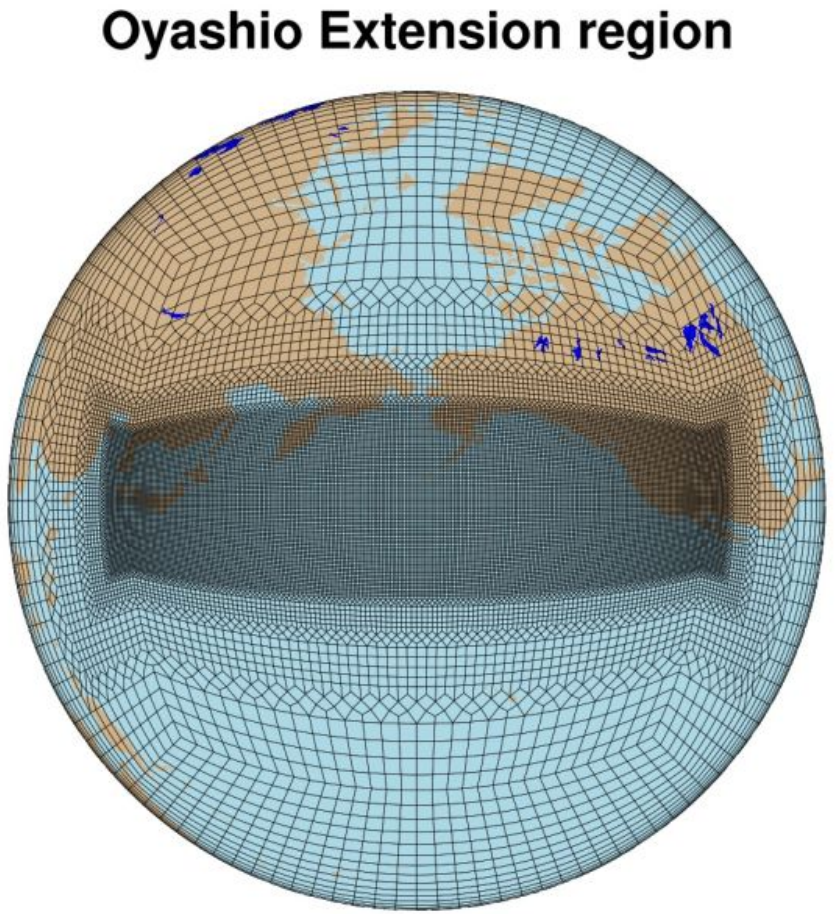
(Jeremy Klavans, Pedro DiNezio)

Plans to explore regional refinement of the North Pacific in year 2 of the CSL proposal

Building on/complementary to work in Young-Oh Kwon's group at WHOI

Idealized timeslice experiments to explore impact of anomalies in the Kuroshio-Oyashio Extension region on the atmospheric circulation and impacts

Potentially followed by historical simulation.



Adam Herrington, Young-Oh Kwon

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: 15S-15N (10S-10N for Atlantic); transition zone: 15-30 North and South (10-30 North and South for Atlantic).

Planed in CVCWG CSL allocation and will set up soon.

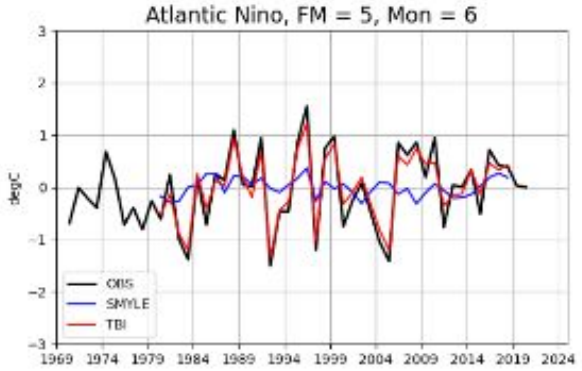
2.Pacemaker hindcast experiments:

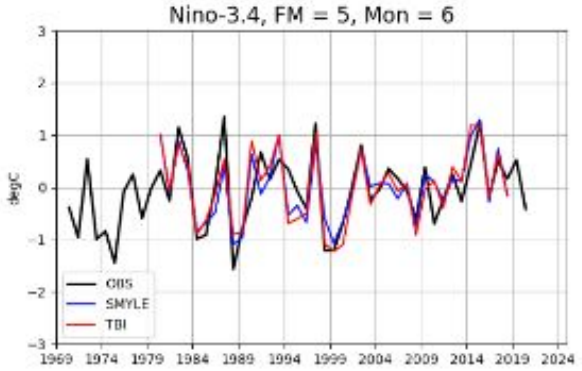
Initial condition, Global SSTs and SSSs are restored to observations for the period 1982-2021.

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.





Left Figure shows that SMYLE can simulate ENSO variability well, but not Atlantic Nino, but TBI Atlantic experiment can, suggesting that simply started from an ocean state close to observations in the tropical Atlantic is not good enough to predict Atlantic Nino. certain improvement to reduce the tropical Atlantic model drift is needed.

Mechanically decoupled

(Sarah Larson, Kay McMonigal)

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

2. Climate sensitivity simulations - this summer
   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)

Questions? Discussion?

Other ideas for future directions:

- Exploration of interactive biomass burning capabilities (some core hours allocated for this in y2 of CSL proposal)
- Build on high resolution CESM1 results and explore the impacts of high res ocean versus high res atmosphere in isolation
- Build upon forthcoming results with regionally refined simulations e.g., what resolution is enough to capture differences, does having underlying high resolution SSTs matter?
- More of your thoughts…