CESM2 Update / Progress
since the 2017 CESM Annual Meeting
Gokhan Danabasoglu & Jean-Francois Lamarque

Sisyphus
Global-Mean Surface Temperature Time Series

TS Timeseries

TS Anomaly (K)

Year

1860 1890 1920 1950 1980 2010

161
157
125
HadCRUT4
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
Labrador Sea Ice Fraction
Surface Temperature (#227)

Before

Surface Temperature (MODEL - LEVITUS/PHC2)
mean = -0.2905
rms = 1.124

After

Surface Temperature (MODEL - LEVITUS/PHC2)
mean = -0.4715
rms = 1.236

Surface Salinity (#227)

Before

Surface Salinity (MODEL - LEVITUS/PHC2)
mean = -0.2717
rms = 0.7821

After

Surface Salinity (MODEL - LEVITUS/PHC2)
mean = -0.2658
rms = 0.7902
Temperature

Winter-Mean Mixed Layer Depth (m)

Salinity

Max Atlantic Overturning b.e20.B1850.f09_g17.pi_control.all.227
CSM1

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

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CCSM4 FV2
Laborador 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
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
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

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

grid cell mean ice thickness  m  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