

An Update from the Community Earth System Model (CESM)

WGCM 24



Equilibrium Climate Sensitivity: Paleoclimate considerations



A couple of parameters are retuned in the cloud microphysics and ice nucleation schemes



Zhu et al. (2021, https://doi.org/10.1002/essoar.10507790.1)



CESM2 Large Ensemble (CESM2-LENS)



Earth System

Research article

A partnership with the Institute for Basic Science (IBS) Center for Climate Physics (ICCP) in Busan, S. Korea

 A 100-member ensemble for the 1850-2100 period, using the SSP-3.70 scenario for the future extension;

 Datasets are already available to the community



Ubiguity of human-induced changes in climate variability

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SMYLE project: Seasonal-to-MultiYear Large Ensemble

- New initialized hindcast set using CESM2
- 2-year, 20-member ensembles, 4 starts/year, 1970-2018
- Improved 2-year La Niña skill compared to CESM1-DPLE



UCAR

Subseasonal-to-Seasonal (S2S) hindcasts & real-time forecasts

- 11-member hindcast set with CESM2(CAM6), 1999-2020; weekly starts; 45-day long simulations
- Similar 5-member hindcast set with CESM2(WACCM6) for winter season only
- Weekly real-time forecasts: 21-member ensemble: since Sep 2020 with CESM2(WACCM6) since Apr 2020 with CESM2(CAM6) Contributing to the operational NOAA week 3-4 Outlook



Richter et al. (2021, JAMES)

CESM high-resolution simulations (0.1° ocn; 0.25° atm)

650-year PI control;

Completed 150-year 1%CO2;

3-member 1850-2100 transient;

All HighResMIP Coupled and AMIP;

5 cycles of 1958-2018 OMIP;

Decadal Predictions (1980 – 2018)

)ata

ngoing

4xCO2 to complete DECK;

Additional members for transient

Release 12 June 2021!

Web site: https://ihesp.tamu.edu

PI Control for years 21-500;

All HighResMIP simulations

1 transient member;

Simulations performed by the International Laboratory for **High-Resolution Earth System** Prediction (iHESP)

Chang et al. (2020, JAMES)

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40

30

20

10

70

60

50

Vertically Integrated Water Vapor (IWV, in mm)



Towards CESM3

Planed updates include:

- A new ocean model (MOM6),
- A new atmospheric dynamical core,
- Increased number of atmospheric vertical levels and higher top,
- New land model,
- New sea-ice model,
- Multiple ice sheets

Driven by demands for actionable science with significant societal benefits:

- State-of-science workhorse Earth system model
- Earth system predictions

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• High-resolution (5-10 km) framework

Variable-resolution grids

CESM (w/ university collaborators) has been developing a library of variable-resolution grids for various scientific applications.



ARCTICGRIS

Suggestions for CMIP7

More time between cycles;

"Weaker" coupling of model development cycle from CMIPs;

More concerted / collaborative efforts to understand model solutions, biases, robustness,;

Higher bars for MIP blessings;

Incentives for collaborative participations to curb model inflation..... Is having more models better than fewer models?

Be mindful of our carbon and pollution footprints





Thank You!





