

E3SM Water Cycle Status, Plans, Next Emphasis, Blockers

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v1 Simulation Campaign

Simulation	Duration	Resolution	Notes
Pre-industrial (1850) control	500 years	LR	DECK
Historical transient (1850- 2014)	165 years per ensemble member	LR	DECK - minimum of 3, ideally 5 ensemble members.
Abrupt 4xCO2	150 years	LR	DECK
1%/yr CO2 increase	150 years	LR	DECK
AMIP (1970-2014)	45 years	LR	DECK - possibility of starting earlier (1870) and performing multiple ensemble members
1950 control	50 years	LR, HR	HighResMIP like
1950-2050 (all forcings)	100 years	LR, HR	HighResMIP like - 3 ensemble members
1950-2050 (GHG-only)	100 years	LR, HR	HighResMIP like - 3 ensemble members
AMIP (2000-2010)	10 years	¼ degree, global	Atmosphere-only global high-resolution simulation
AMIP (2000-2010)	10 years	¹ ∕₃ degree, RRM	Atmosphere-only high-resolution simulation over North America using RRM





v1 Simulation Campaign

Availability of output

- DECK + historical v1 simulations
 - Entire output available now on NERSC HPSS
 - Selected output on ESGF
 - native format
 - CMORized for CMIP6
 - > Entire CMIP6 data publication scheduled for completion by 4/30/2019.
- High-res 1950 control simulation
 - Selected output on ESGF
 - More data to be released when manuscript is ready.





v1 Simulation Campaign

Next set of simulations

- Low-resolution
 - Future projections up to 2050 (or 2100): extend 5 historical ensemble members
 - GHGs only: 1850-2050 (or 2100): up to 5 members
 - Waiting on future scenario compset
- High-res
 - 1950-2050 historical + projection
 - 1950 control simulation (100 years)
 - Waiting on future scenario compset
- Beyond high-res
 - AMIP 2000-2010 1/8 deg globally uniform and RRM
 - Subject to sufficient computational resources





v1 Analysis

- Low-res overview paper
 - Accepted in JAMES (E3SM Special Collection)
- High-res overview paper
 - Peter Caldwell leading the effort
 - Breakout session, Thursday at 10:00am
- Other v1 analysis papers
 - Many already published, submitted or nearly ready
 - Looking for additional v1 Analysis ideas
 - Breakout session, Wednesday at 1:00pm





E3SMv1 vs CMIP5 models

Global RMSE against observations for 1981-2005:

- ensemble of 45 CMIP5 models (box and whiskers)
- E3SMv1 coupled historical

E3SMv1 AMIP



Note: it's not a fair comparison! Newer vs older!

Golaz et al. (2019)



U.S. DEPARTMENT OF

E3SMv1 climatology: TOA radiation, precipitation

Observations



Coupled - obs



Annual net TOA radiation

CERES-EBAF Jan 2000-Dec 2015

90°N

(a)

Max 100.08

Mean 0.86

Min -127.19

W/m2







E3SMv1 Variability



ENSO







E3SMv1 - Yet another strong aerosol forcing, high sensitivity model

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Timeline for v2 (from Rob Jacob)

- 30 Jun 2019: feature freeze for features to be used in v2 simulations. E3SM v2-alpha made after PRs are integrated. Start component-level tuning (F-cases, I-cases, G-cases)
- **30 Sep 2019**: Finish component level tuning. E3SM v2-Beta made. All initial/BC files should be finished and in inputdata server. Start coupled tuning.
- **31 Dec 2019**: Coupled tuning finished. Start coupled runs. May have additional beta tags after this. (Development during this time can't change answers for coupled runs).
- 24 Mar 2021: v2 data and model release





• v2 will rely more heavily on regionally refined modeling (RRM) capabilities

North America grid

Proposed atmosphere

Proposed ocean grid



Unveiling during Water Cycle breakout this afternoon at 1:00pm





Atmosphere

- Semi-Lagrangian transport + QLT for conservation/monotonicity
- NH dynamical core
- Evaluation of alternate physics for consideration in v2
- Minimalist "scale-aware" physics package for RRM (collaboration with CMDV-RRM)
- New faster version of CLUBB
- ZM with ULL (unrestricted launch level)
- Retuning of gravity wave drag for improved MJO
- Improved dust aerosol physics
- Alternate surface flux formulation based on Fairall et al (2003)



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Ocean

- KPP physics improvements (Langmuir mixing)
- Test and implement KPP implementation port to GPU
- Test and Evaluate Scale-aware Gent-McWilliams mesoscale eddy parameterization
- Redi mixing implementation through University Project

Land

- Water management model and MOSART inundation
- Plant hydraulics
- Should we update the land model beyond satellite phenology (SP)?

More during the breakout this afternoon at 3:00pm





Questions?



