



Introductory remarks for joint AMWG/ESPWG/CVCWG/CCWG/WAWG winter meeting

AMWG = ATMOSPHERIC MODEL WORKING GROUP

WAWG = WHOLE ATMOSPHERE WORKING GROUP

CCWG = CHEMISTRY CLIMATE WORKING GROUP

ESPWG = EARTH SYSTEM PREDICTION WORKING GROUP

CVCWG = CLIMATE VARIABILITY AND CHANGE WORKING GROUP

February 3, 2025

Why combine the 5 working group winter meetings into one?

- Increase collaboration across working groups:

model developers <-> model users

- Joint discussion on model performance
- Get community input to inform model development and experiment design in CESM3 and beyond (configurations, bias reduction, ...)
- Reduce meeting load

Structure of joint sessions:

Monday, February 3rd, Main Seminar Room

* All times are MST; **Speakers:** please leave 5 min at the end of your slot for questions.

- Overview from “model development” heavy working groups
- Coupled model evaluation
- Specific features of new model

Time	Topic	Speakers
13:00	Overview of what's new in CAM7	Peter Lauritzen
13:20	Overview of what's new in Chemistry/aerosols	Simone Tilmes
13:40	Overview of what's new in high top modeling	Nick Pedatella/Martina Bramberger
	<i>Coupled model evaluation</i>	
14:00	Current status of CESM development simulations	Isla Simpson
14:20	High frequency variability	Rich Neale
14:40	Assessing the El Niño Southern Oscillation in development versions of the Community Earth System Model (CESM)	Meg Fowler
15:00	BREAK	
15:30	AERO-MAP: A data compilation and modelling approach to understand spatial variability in fine and coarse mode aerosol composition	Natalie Mahowald
	<i>Specific features of new model</i>	
15:50	Update on gravity wave sources for CAM	Julio Bacmeister
16:10	New developments of modeling mineral dust cycle in <u>CESM3/CAM7</u>	Danny Leung
16:30	Impact of vertical resolution and model top height on stratospheric large-scale circulation	Martina Bramberger
16:50	Adjourn to Southern Sun for Happy Hour	

Structure of joint sessions:

- Updates from “model evaluation” and “model user” heavy working groups and talks of interest to all working groups

Time	Topic	Speakers
9:00	CVCWG updates	Isla Simpson/Aixue Hu/Sarah Larson
9:20	An introduction to MethaneMIP: Investigating the climate and health benefits of methane mitigation	Mark England
9:40	Future International Assessment Exercises using the Whole Atmosphere Community Climate Model	Doug Kinneson
10:00	Introduction to ESPAT	Yaga Richter
10:20	ESPWG updates	Steve Yeager/Kathy Pegen
10:20	BREAK	
11:10	Predictability of Temperature Extremes in Multi-Annual Forecasts.	Eirini Tsartsali
11:30	Seasonal Predictability of Vapor Pressure Deficit in the western United States	Melissa Breen
11:50	Advancing Long-Range ENSO Prediction through Large Ensemble Data and Transfer Learning with AI/ML Approaches	Sathish Chandra Akula
12:10	Diagnosing Land-Atmosphere Coupling Strength from MPAS-NoahMP in S2S forecasts	Zhe Zhang

Structure of joint sessions:

- High resolution projects in CESM
- Machine learning in/with CESM

Time	Topic	Speakers
	<i>high resolution modeling</i>	
13:30	<u>MESACLIP</u> project and update	Gokhan Danabasoglu
13:50	EarthWorks Progress	Dave Randall
14:10	Atmospheric rivers driven precipitation extremes in non-hydrostatic CESM simulations over the Western US	Xingying Huang
14:30	AI-empowered Next-generation Multiscale Climate Modeling for Mitigation and Adaptation	Veronika Eyring
14:50	LEAP/M2LInES overview	Dave Lawrence
15:10	BREAK	
	<i>Machine learning</i>	
15:30	CAMulator: Fast Emulation of the Community Atmosphere Model	Will Chapman
15:50	A Roadmap for ML-assisted Ice Microphysics Parameterizations in PUMAS	Joseph Ko
16:10	Implementation of a neural-network convection scheme in the Community Atmosphere Model	Paul O’Gorman
16:30	Probabilistic Machine Learning for Stochastic Parameterization of Deep Convection Triggering	Greta Miller
16:50	Adjourn	

“Less” joint sessions:

Wednesday AM:

ESPWG/CVCWG (Main seminar room) & AMWG (Damon room) parallel sessions

Wednesday PM:

ESPWG/CVCWG (Main seminar room), CCWG/WAWG (Damon room) & AMWG (CLUBB tutorial in ML-Chapman room) parallel sessions

Thursday AM:

CCWG/WAWG (Damon room)

CGD seminar Thursday at 11AM (Main seminar room):

Skillful high-resolution seasonal climate forecasts using model-analogs

Dillon Amaya (NOAA)



What is new in CAM7?

Peter Lauritzen on behalf of all CAM developers (Adam Herrington, Ben Stephens, Brian Eaton, Brian Medeiros, Cheryl Craig, Christina McCluskey, Colin Zarzycki, Courtney Peverley, Dan Marsh, Douglas Kinnison, Francis Vitt, Hanli Liu, Isla Simpson, Jack Chen, Jesse Nusbaumer, Jiang Zhu, Jim Edwards, John Truesdale, Julio Bacmeister, Katherine Thayer-Calder, Keith Lindsay, Martina Bramberger, Meg Fowler, Mijeong Park, Patrick Callaghan, Patrick Callaghan, Qingyuan Yang, Rich Neale, Rolando Garcia, Simone Tilmes, Thomas Toniazzo, Vince Larson, Yuanpu Li, ...)

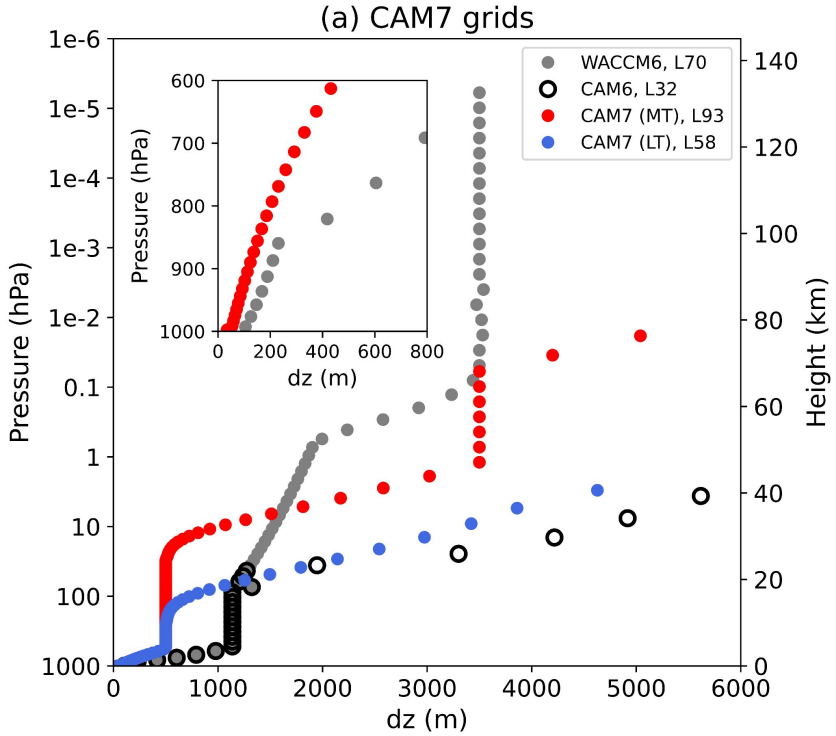
February 3, 2025

What has happened since CAM6 release?

- raise lid and have sufficient resolution for a well-resolved stratosphere
- increase boundary layer resolution
- adopt scalable dynamical core and non-hydrostatic dycore options
- advance existing boundary layer and microphysics schemes
- adopt new parameterizations (e.g., convective gustiness parameterization, new gravity wave source, new dust emission scheme)
- re-ordering physics time-loop
- major steps towards generalized thermodynamics in CAM physics
- continued expansion of simpler models effort
- constantly improving our code base and trying to reduce scope!
- much improved workflow (both simulation tracking, diagnostics and software development, ...)
- adoption of RRTMG-P radiation package
- — and a lot more ...



Raise lid and have sufficient resolution for a well-resolved stratosphere



Free evolving QBO in CAM
(see Martina Bramberger's talk)

[Isla Simpson has submitted manuscript on behalf of the vertical resolution task force]

Adopt scalable dynamical core and non-hydrostatic dycore options

Spectral-element dynamical core using separate physics grid and conservative semi-Lagrangian transport scheme

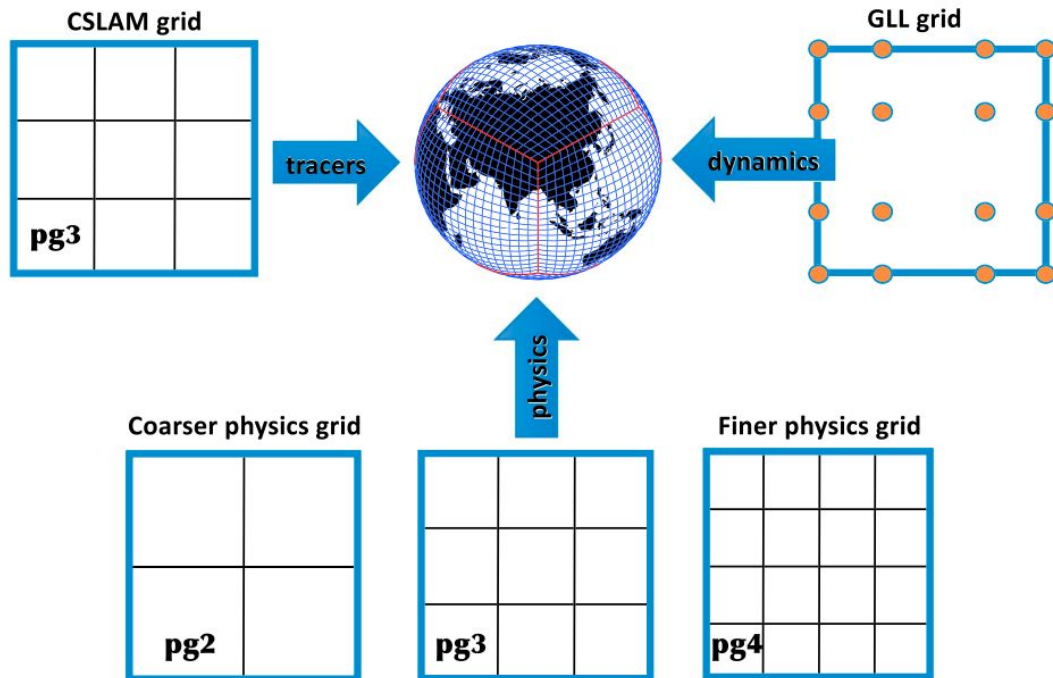


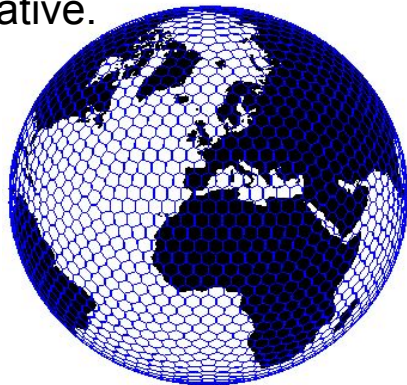
Figure 1. An overview of the different grids in CAM-SE-CSLAM.

- Highly scalable
- More advanced thermodynamics
(variable latent heats, molecular diffusion operators, ...)
- Mesh-refinement capability
- Excellent conservation properties (mass, angular momentum, ...)

Adopt scalable dynamical core and non-hydrostatic dycore options

Model for Prediction Across Scales (MPAS):

- Non-hydrostatic dynamical core developed by NCAR's MMM
- Sustainable implementation
(i.e. dynamical core pulled as an external to CAM)
- Being used in EarthWorks project and NCAR's ESPAT initiative.
(see presentations by Dave Randall and Yaga Richter)
- Deep atmosphere option being developed/explored
- GPU version exists



DOE's E3SM non-hydrostatic dynamical core:

- Being imported into CAM under [StormSPEED](#) project
- Similar to NCAR's CAM-SE dycore in terms of cubed-sphere grid and separate physics grid capability but:
 - *Non-hydrostatic
 - *Ultra-fast semi-Lagrangian transport scheme
 - *C++ version with Kokkos support GPU's
 - *Separate physics grid and semi-Lagrangian transport supported for mesh-refinement

NSF StormSPEED

The 'Storm-resolving SPectral Element Dycore' for CESM3



What has happened since CAM6 release?

Adopt new parameterizations

- Missing process: Convective gustiness parameterization (capture impacts of convective outflows on surface meteorology)

See Meg Fowler's talk

- Missing source of gravity waves: “Moving mountains” (major improvements in stratospheric jet biases)

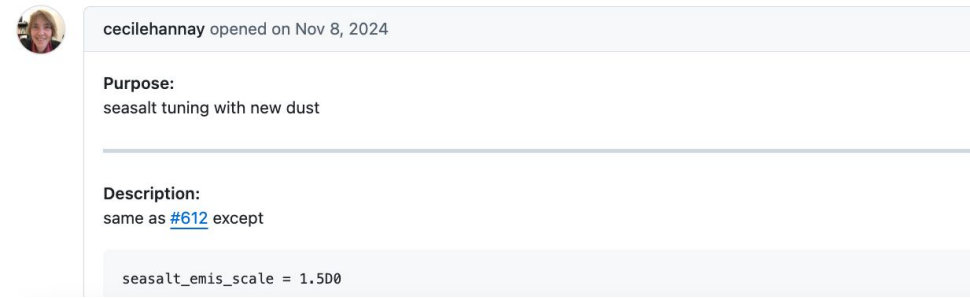
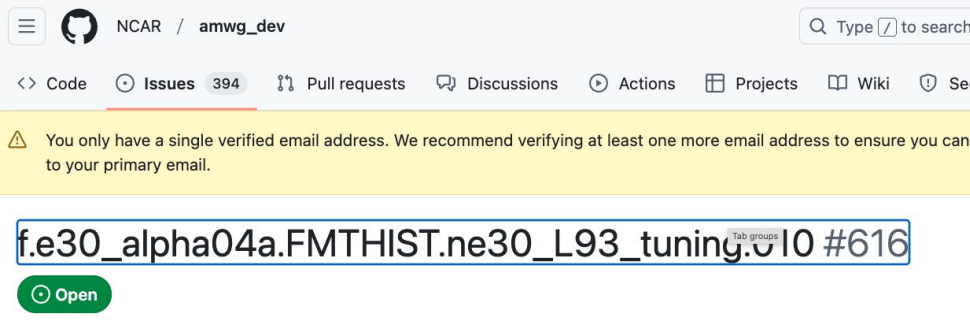
See Julio Bacmeister's talk

- New dust emission scheme: Adding surface rocks and vegetation on inhibiting emission, wind gusts on dust episodes (fixing regional dust biases)

See Danny Leung's talk

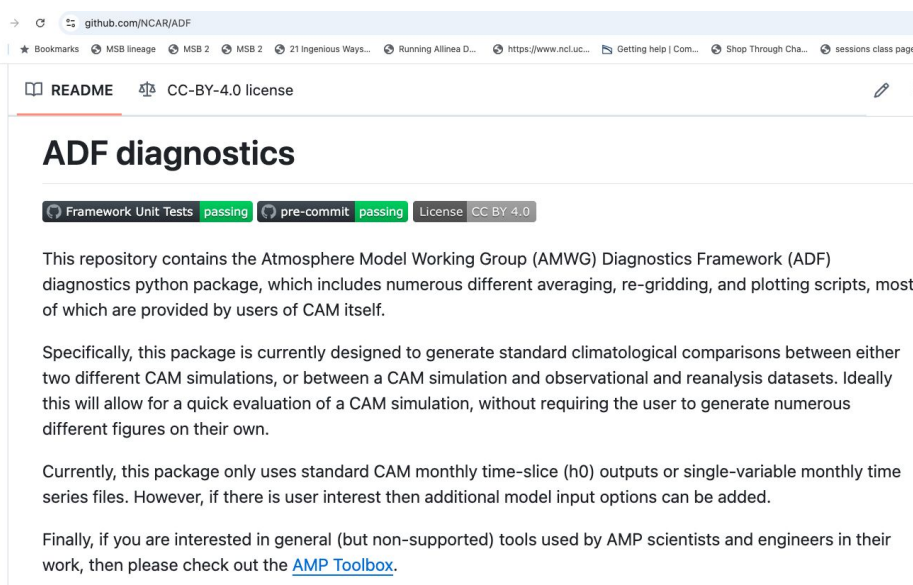


Much improved workflow: Simulation tracking and diagnostics



https://github.com/NCAR/amwg_dev (AMIP-like runs)

https://github.com/NCAR/cesm_dev (coupled runs)



<https://github.com/NCAR/ADF>

optionally run CVDP and MDTF, and is getting integrated with the CUPiD workflow.



What has happened since CAM6 release?

Much improved workflow: Software-science workflow & reduce scope

The screenshot shows the GitHub interface for the ESCOMP/CAM Development project. At the top, there are navigation tabs for 'Backlog', 'CAM-SIMA Issues', 'CAM6.5 Priority', 'CAM6.5 Sub-project', 'SE Workflow', 'Assignee', 'ADF', 'CoupledEval', 'View 18', and 'Brian's priorities'. A search bar is present with the text 'prstatus:Upcoming PR;PR - Review Not Started;PR - Initial Review;PR - Full Review;Next Tag;Tag;Closed (not tagged);CAM Tags'. Below this, there are five Kanban columns: 'PR - Review Not Started' (11 items), 'PR - Initial Review' (2 items), 'PR - Full Review' (6 items), 'Next Tag' (8 items), and 'CAM Tags' (350 items). Each column contains cards representing pull requests or tasks, with details like draft status, reviewer counts, and tags such as 'bug-fix', 'CoupledEval3', and 'enhancement'. The interface is clean and organized, facilitating a structured software-science workflow.

<https://github.com/ESCOMP/CAM>



What has happened since CAM6 release?

Much improved workflow: Software-science workflow & reduce scope

ESCOMP / CAM-SIMA

Type [] to search

<> Code Issues 94 Pull requests 7 Actions Projects Wiki Security Insights

You only have a single verified email address. We recommend verifying at least one more email address to ensure you can recover your account if you lose access to your primary email. [Email settings](#)

CAM-SIMA Public

Edit Pins Unwatch 13 Fork 15 Starred 4

main 2 Branches 5 Tags

Go to file Add file <> Code

peverwheel PR template (#290) 47856bd · 4 months ago 9 Commits

- .github PR template (#290) 4 months ago
- README.md Update README.md 7 months ago

README

About

Community Atmosphere Model - System for Integrated Modeling of the Atmosphere

- Readme
- Activity
- Custom properties
- 4 stars
- 13 watching

<https://github.com/ESCOMP/CAM-SIMA>

6	dependence of some namelist default on the number of vertical levels (lev)? #819	brian-eaton a...	To Do
7	Most converted CESM regression tests are CAM5 - may want to make most CAM7 #258	brian-eaton	To Do



What has happened since CAM6 release?

New product available: “CAM7” high resolution simulations

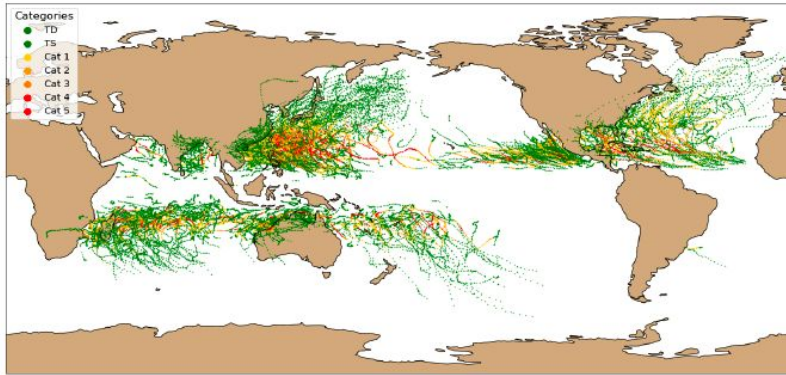
- We have performed “quarter degree” / ne120 / 27km runs with CAM7
- 10 year F-cases with (see https://github.com/NCAR/amwg_dev/ for details):
 - L93, L58 vertical grids, as well as L32 (i.e. CAM6 vertical grid)
 - Sensitivity test with Prognostic CLUBB momentum flux replaced by diagnostic
 - SST and SST+4K
- More questions? Contact Cecile Hannay (hannay@ucar.edu)



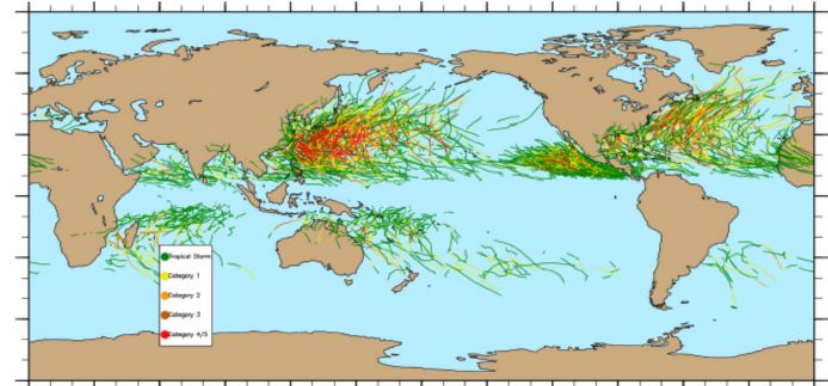
Quarter degree CAM7

- Reasonable **tropical cyclone track** climatology (more from Ben Stephens Wed 11:20)

IBTrACS (2000-2010)



CAM7 (2000-2009)



- Improvement in **southern hemisphere polar vortex** simulation
- **Degradation in some seasonal means** (i.e. monsoon, double ITCZs)

