



WACCM

*Whole Atmosphere
Community Climate Model*



WACCM Status

Dan Marsh

14th Annual CCSM Workshop

June 2009



WACCM

Project Goals:

- Develop a state of the art, “high-top”, numerical model with coupled chemistry that will serve the needs of the scientific community
- Conduct research to understand the coupling between atmospheric layers, the role of chemical and physical processes in defining these couplings, and the interaction between the Earth’s atmosphere and the Sun



WACCM Versions

- 3.1.9
 - Released ‘workhorse’ version
- 3.5.48
 - CCMVal simulations (D. Kinnison)
- 3.6.x
 - WACCM/CAM-Chem codes combined (F.Vitt)
- 4.0 / 4.1
 - IPCC AR5 version (A. Gettelman)

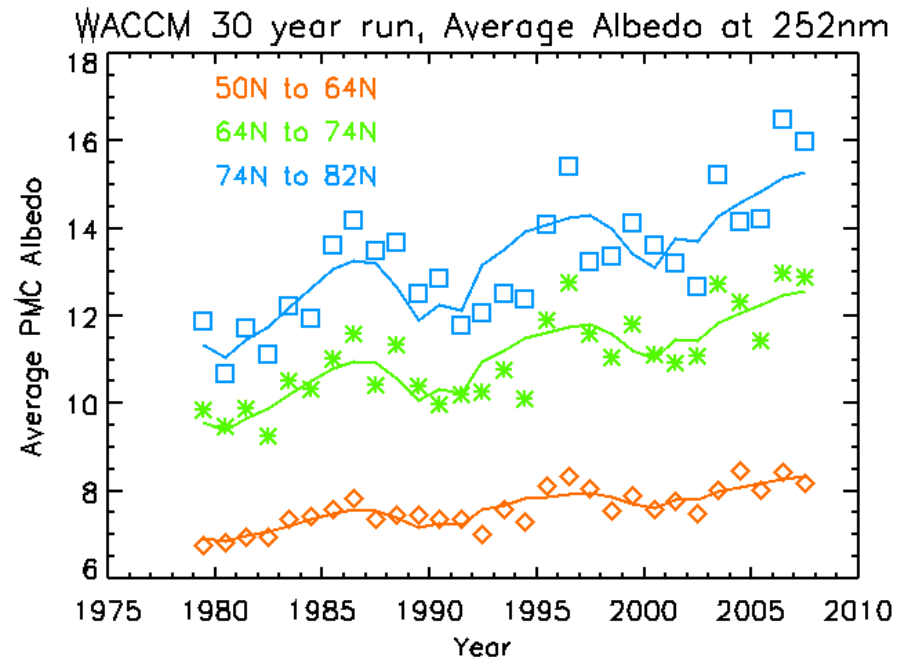
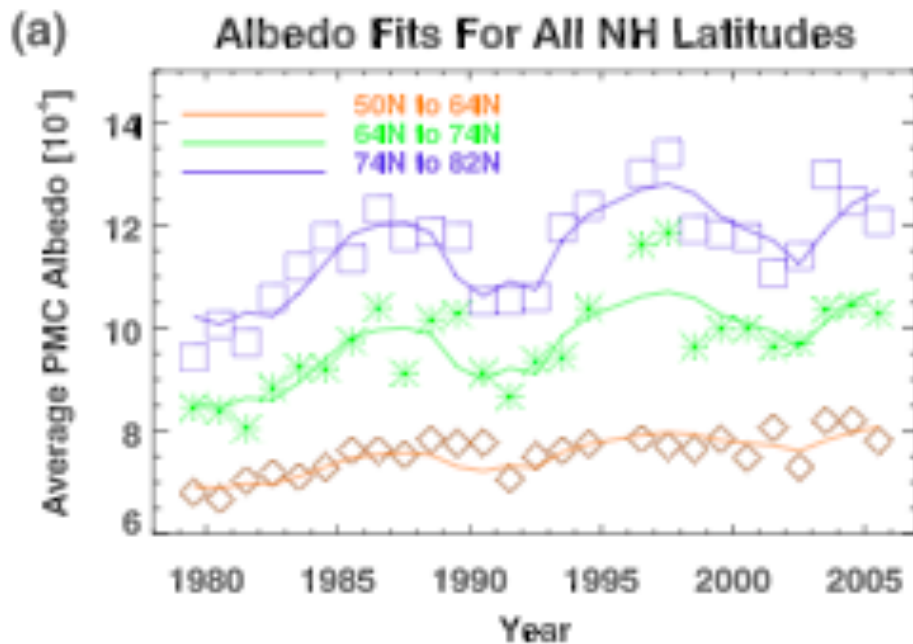


WACCM Status Summary

- CCSM Working Group formed at 13th workshop
- WACCM 3 released to the community 7/2008
- WACCM 3.5 development completed 12/2008
- WAWG meeting in Boulder 3/2009 (presentations on WAWG webpage)
- Majority of CCMVal-2 simulations completed 5/2008
- WACCM-X (thermospheric extension) now producing credible simulations
- WACCM 3.5 running within CCSM using interactive ocean
- WACCM 4.0 ready to begin 'track 1' testing / tuning



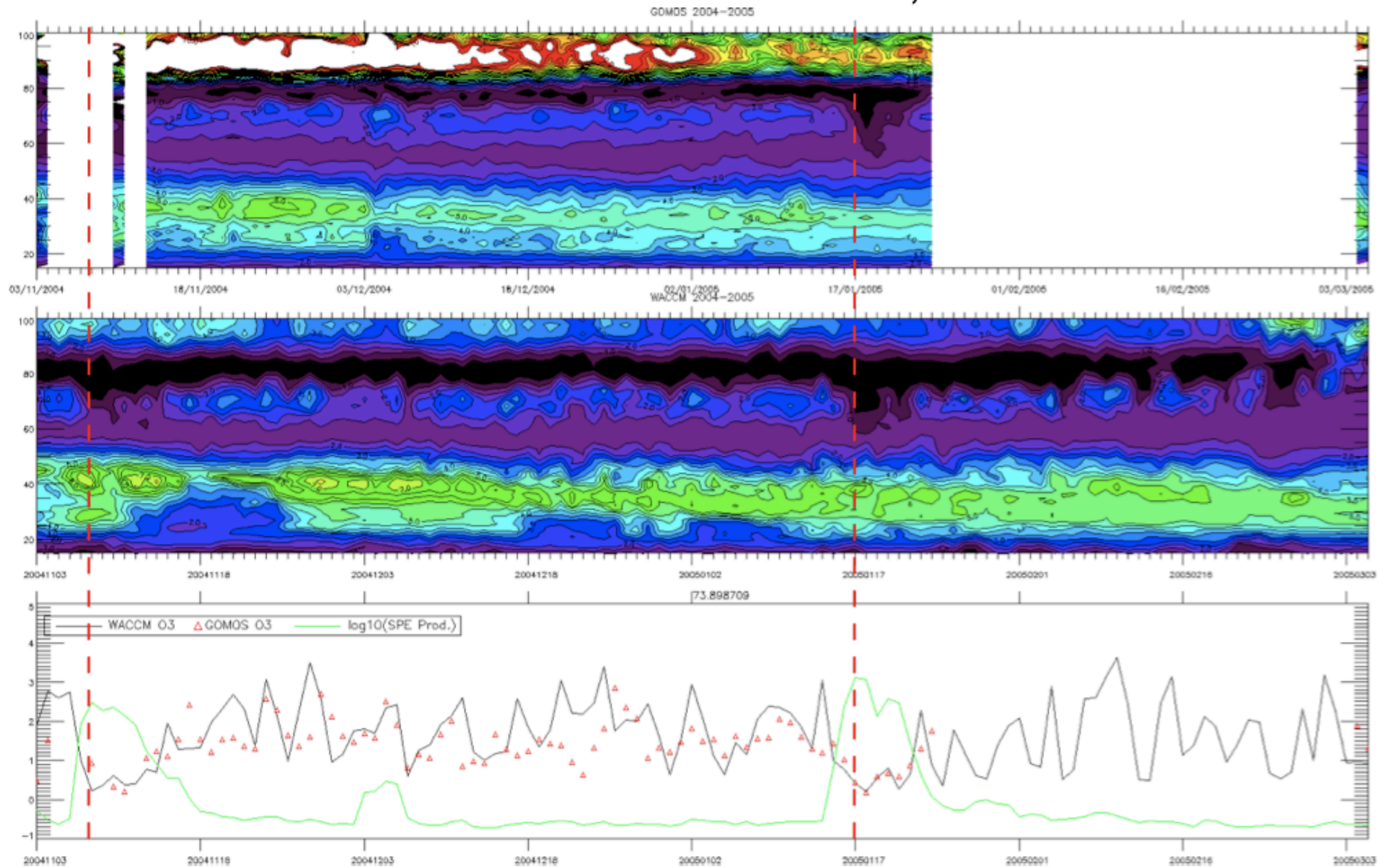
WACCM-PMC (3.1.9)



See talk C. Bardeen for more PMC results using 3.1.9 coupled to CARMA

SD-WACCM SPE study

3 November 2004 - 3 March 2005, 70°N





Chemistry-Climate Model Validation (CCMVal) WACCM 3.5.48

REFB1

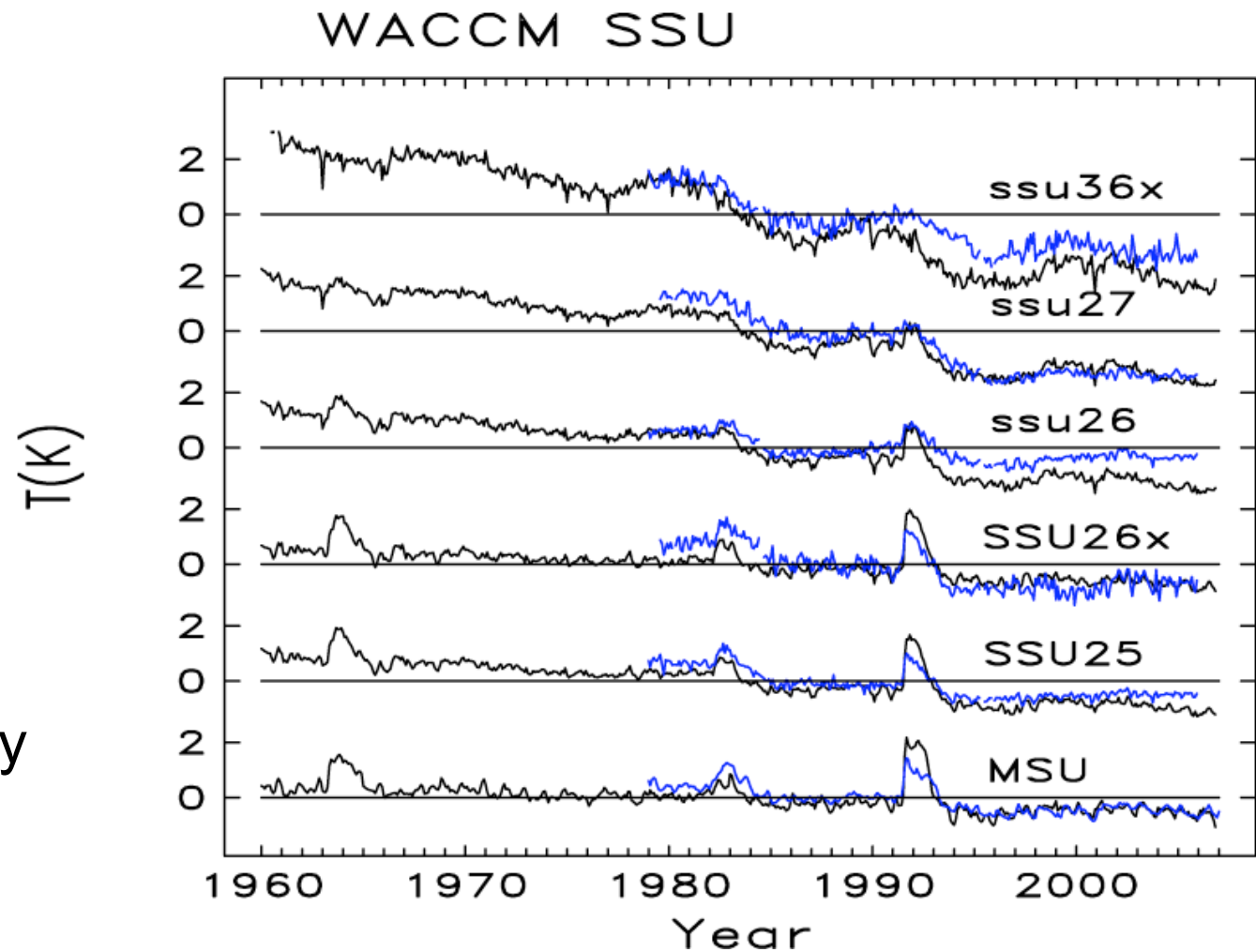
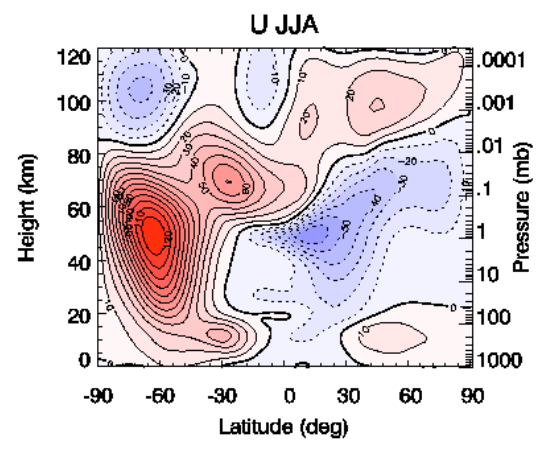
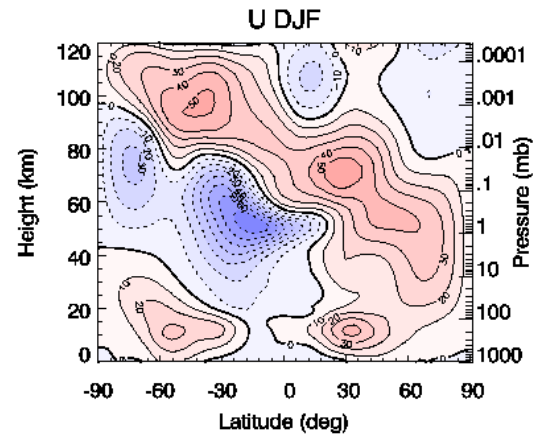


Figure courtesy
Bill Randel

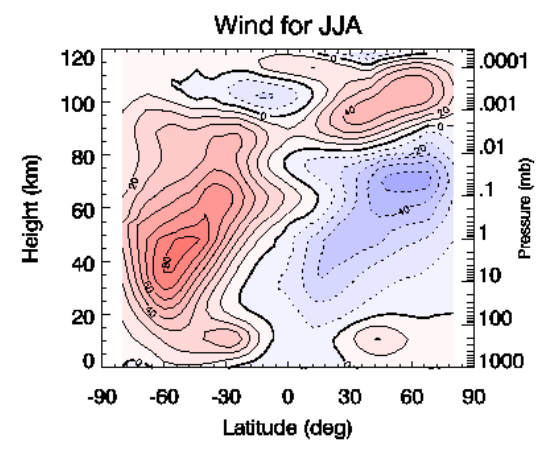
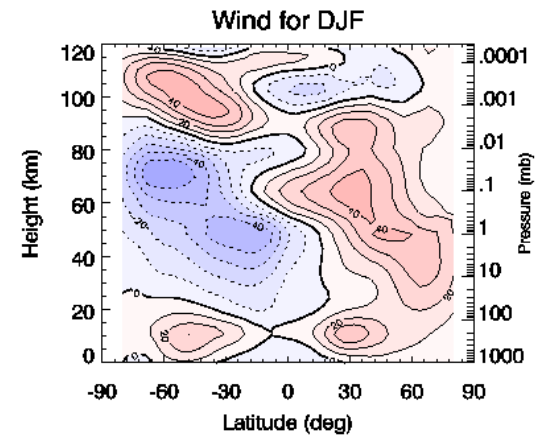


Zonal winds 0-120 km

WACCM3.6

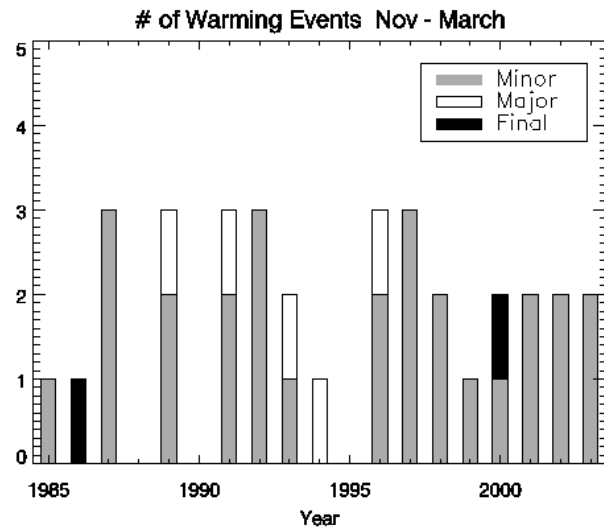
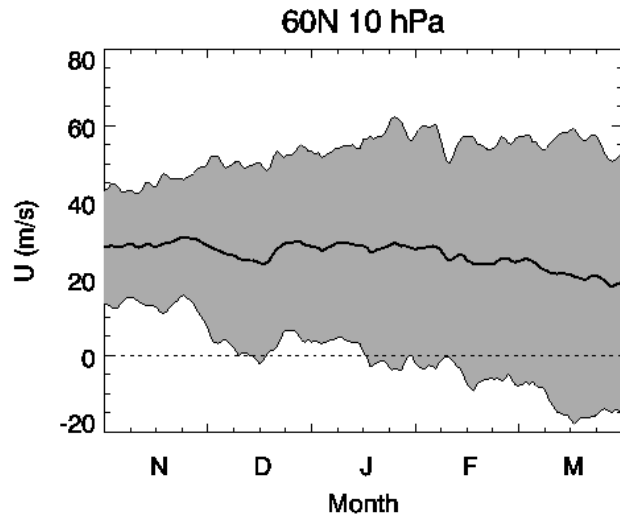


URAP



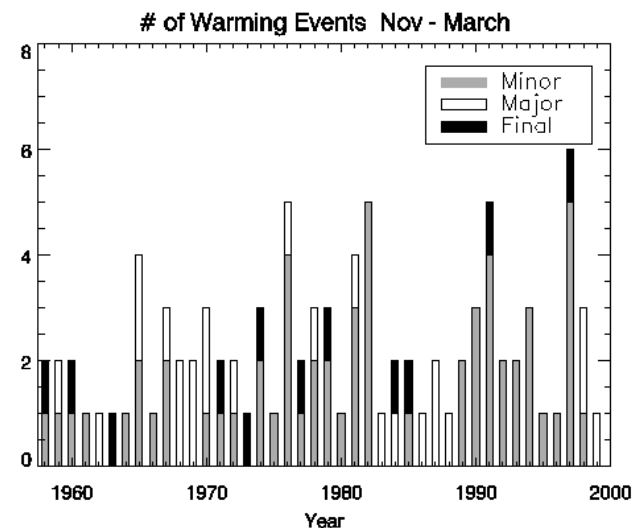
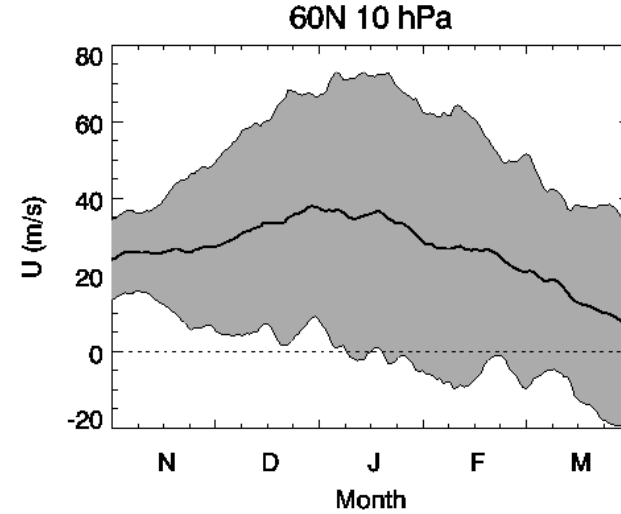
Stratospheric warming counts

WACCM3.6



13.5 minor warmings/decade, and 2.5 major warmings/decade 1.0 major final/decade

ERA40



59 minor warming event(s), 24 major warming event(s) and 12 major final event(s)



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Future studies



WACCM CSL IPCC AR5 Simulations

- WACCM (66 levels / 1.9 x 2.5) within CCSM with fully-interactive ocean
- 1960-2050 20th Century + RCP4.5
- 91yrs x 3 = 431 KGAU
- Track 1 or 5? 1° or 2°?



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WACCM CSL Science Studies 2009-2010

Experiment	Model Configuration (see Notes below)	# of runs	# of years	GAU / year	Total (KGAU)
3.1.1 WACCM4 development	WACCM4-4X	3	50	330	49
	WACCM4	2	50	1320	132
	CCSM/WACCM4	2	50	1580	158
	WACCM4-103L-TC	5	10	3880	194
3.1.2 QBO generation	WACCM4-140 L	2	25	2640	132
3.1.3 SSW climatology	WACCM4	6	30	1320	238
3.1.4 UTLS studies	WACCM-SD	1	5	3320	16
	WACCM-SD-1X	1	5	13,280	66
	WACCM4-103L-TC	2	20	3880	155
3.1.5 Aviation impacts	WACCM4-103L-TC	2	10	3880	78
3.1.6 I/T Variability	WACCM-X	1	3	14,140	42
Total					1,260



Planned science studies outside of CSL

- “World Avoided” simulations – first with an interactive ocean
- “No Climate Change” simulations (WMO assessment)
- Enhanced NMHCs and Organic Bromine
- Asteroid impacts (w/ E. Pierazzo, J. Melosh)
- Energetic particle effects (C.Randall, J.Jackman)
- Geo-engineering studies



WACCM-X

- Version of WACCM extended to the upper thermosphere (~500 km)
- WACCM-X reproduces compositional, thermal, and wind structures and their seasonal variability of the upper atmosphere
- Thermospheric tides and short-term variability are reasonably resolved by the model
- Efforts mainly supported by external funding – new LWS-SC 5 year grant with Tim Fuller-Rowell at CU



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WACCM Community support



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Whole Atmosphere Community Climate Model

Webpage http://www.cesm.ucar.edu/working_groups/WACCM/

Community Climate System Model

Search

CCSM WHOLE ATMOSPHERE MODEL WORKING GROUP

WELCOME TO CCSM

EXPAND COLLAPSE

- About CCSM
- CCSM Administration
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The [Whole-Atmosphere Community Climate Model \(WACCM\)](#) is a comprehensive numerical model, spanning the range of altitude from the Earth's surface to the thermosphere. The development of WACCM is an inter-divisional collaboration that unifies certain aspects of the upper atmospheric modeling of HAO, the middle atmosphere modeling of ACD, and the tropospheric modeling of CGD, using the NCAR Community Climate System Model (CCSM) as a common numerical framework.

Upcoming Meetings

WAWG Meeting, NCAR, Mesa Lab, 6 March 2009 [[announcement](#)]

[14th Annual CCSM Workshop](#), The Village at Breckenridge, Breckenridge, CO, 15-18 June 2009.

WAWG Announcements

The WACCM development team is pleased to announce the public release of version 3 of the Whole Atmosphere Community Climate Model (WACCM3). WACCM3 source code, input datasets, run scripts, and documentation can be downloaded from the [Community Data Portal \[http://cdp.ucar.edu/\]](#). Users are encouraged to participate in meetings of the CCSM WACCM Working Group and to sign up to the mailing list.

WAWG Community Liaison:

TBD

Co-Chair Contact Information:

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Department of Atmospheric, Oceanic, and Space Sciences, 1411B Space Research Building, University of Michigan, 2455 Hayward Street, Ann Arbor, MI 48109-2143

Tel: 734-764-5727, **Fax:** 734-647-3083, **e-mail:** ridley@umich.edu

CCSM PROJECT

The [Community Climate System Model \(CCSM\)](#) is a fully-coupled, global climate model that provides state-of-the-art computer simulations of the Earth's past, present, and future climate states.

CCSM is sponsored by the National Science Foundation (NSF) and the U.S. Department of Energy (DOE). Administration of the CCSM is maintained by the Climate and Global Dynamics Division (CGD) at the National Center for Atmospheric Research (NCAR).

RELATED

- [CCSM Working Group Co-chairs](#)
- [CCSM Working Group Co-Chairs Terms of Reference](#)
- [WACCM wiki](#)

CONTACT INFORMATION

- Email: [CCSM Working Group Co-Chairs](#)
- Email: [CCSM Contact](#)
- Email: [WAWG Members](#)
- [Subscribe to CCSM WAWG List](#)

Hire start
FY2010



WACCM Community Data Portal Traffic

(<http://cdp.ucar.edu/>)

In the first 6 months:

- 2,237 separate downloads (810 GB of data)
- 27 model source code downloads
- This does not include data and code distributed to collaborators

Now >60 WACCM CDP registrations




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WACCM Forum on CCSM Bulletin Board (<http://bb.cgd.ucar.edu/>)



CGD Forum
Whole Atmosphere Modeling with WACCM

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General Announcements	WACCM Working Group Meeting... by drm 01-07-2009 09:56 AM >	3	3
Software and Run-time Issues	WACCM bug in TH2d history... by drm 12-08-2008 07:09 PM >	4	12
Science Issues	Never	0	0

Forum Contains New Posts
 Forum Contains No New Posts

Forum Jump

All times are GMT -6. The time now is 06:09 PM.

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Please use and support this resource



Development Priorities

- Migrate WACCM to CAM4 code base
 - Add solar variability to new RT code
 - Unify photolysis and heating calculations (with CCWG)
 - Provide feedback and evaluation of CCSM4
 - Internally generated QBO
- Contribute to IPCC AR5
 - Evaluate role of the stratosphere in past & future climate
 - Comparisons of CAM, CAM-CHEM and WACCM transient simulations coupled to ocean
- Continued participation in WMO Ozone Assessment, and the WCRP/SPARC CCMVal project
- Evaluate Specified Dynamics WACCM and provide campaign support (AURA, aircraft campaigns)



WACCM-X priorities

- Test and validate WACCM-X 3.5.48
- Merge WACCM-X with the CCSM trunk
- Implement ionospheric electrodynamics
- Implement molecular diffusion in the horizontal direction
- Perform WACCM-X simulations at high spatial resolution (eddy-resolving) to study ionospheric variability and irregularity



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END