WACCM Status

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14th Annual CCSM Workshop

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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

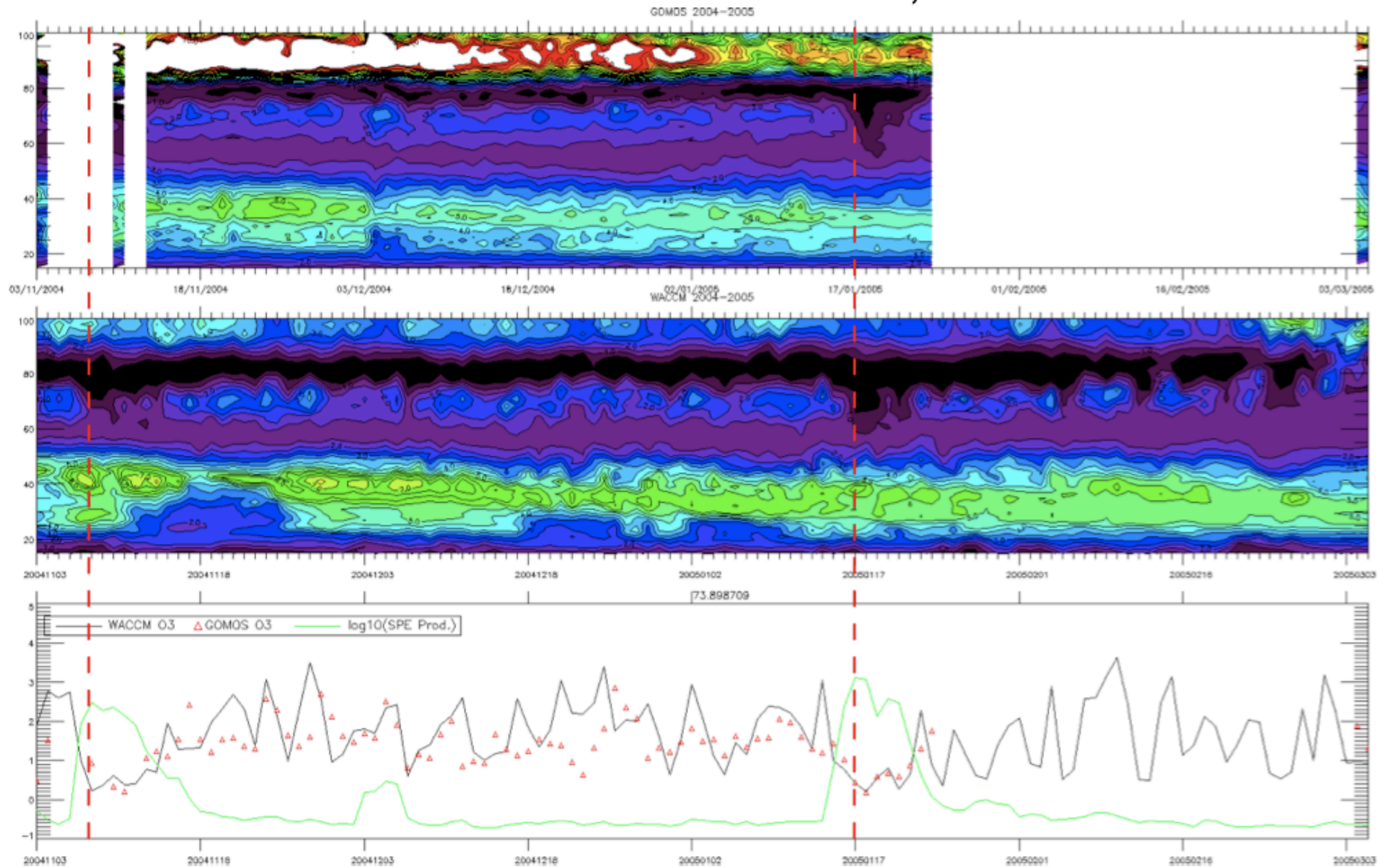- WACCM 4.0 ready to begin 'track 1' testing / tuning

WACCM-PMC (3.1.9)
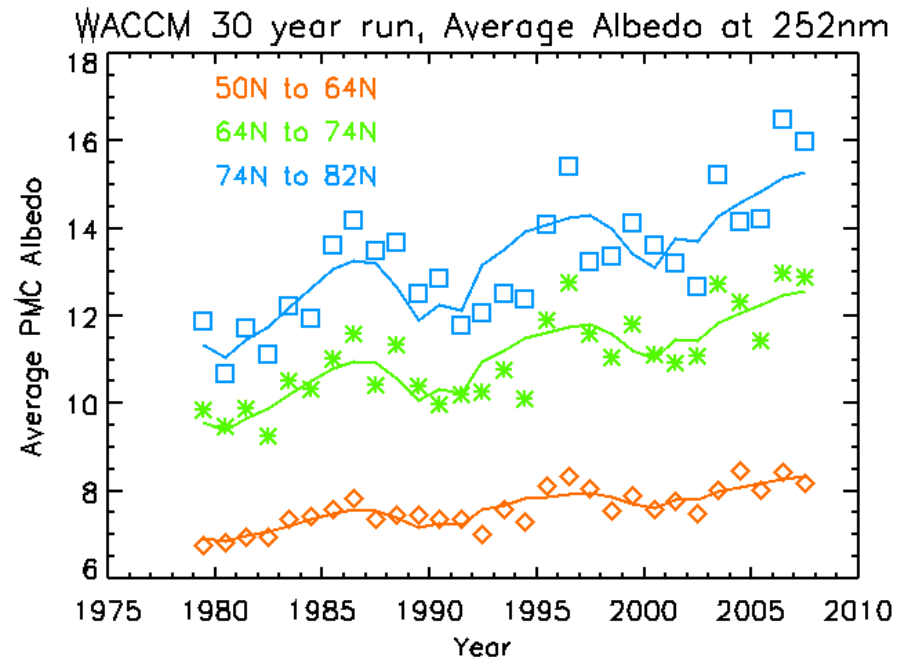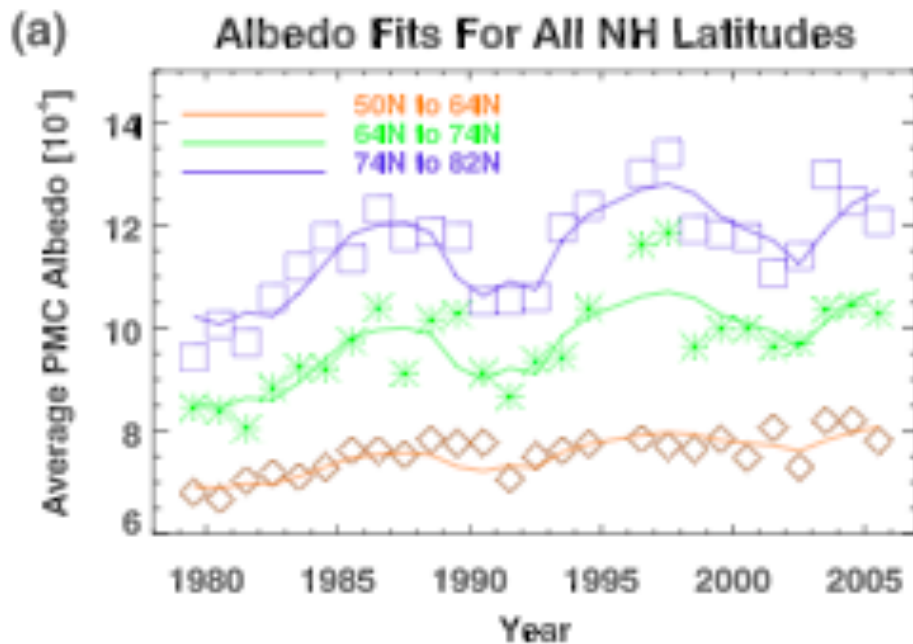
See talk C. Bardeen for more PMC
results using 3.1.9 coupled to CARMA

SD-WACCM SPE study

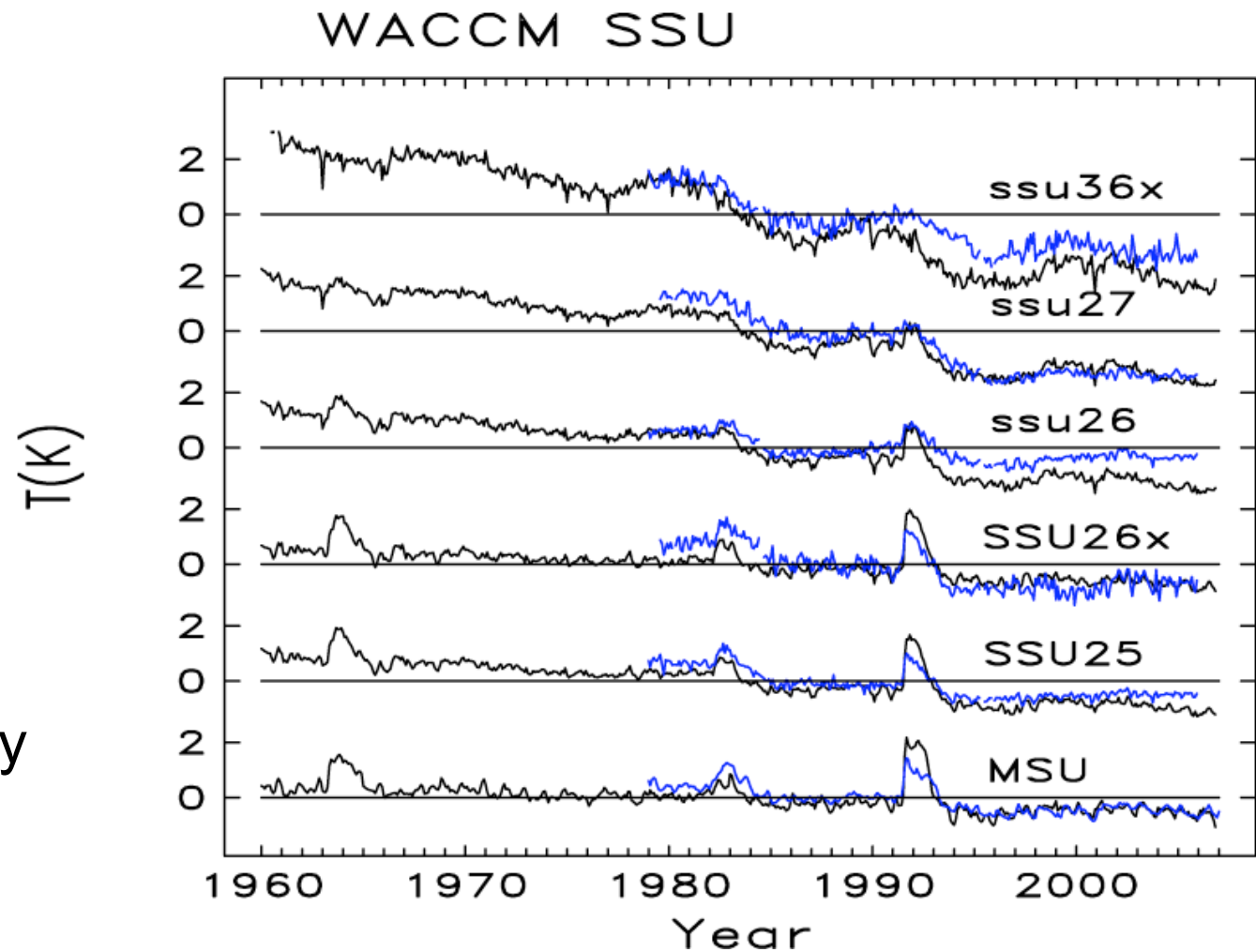## 3 November 2004 - 3 March 2005, 70°N

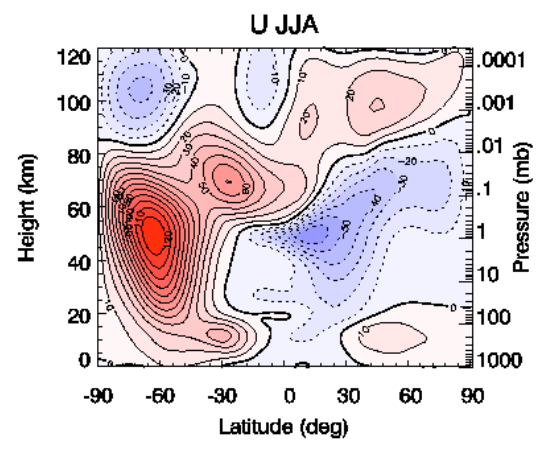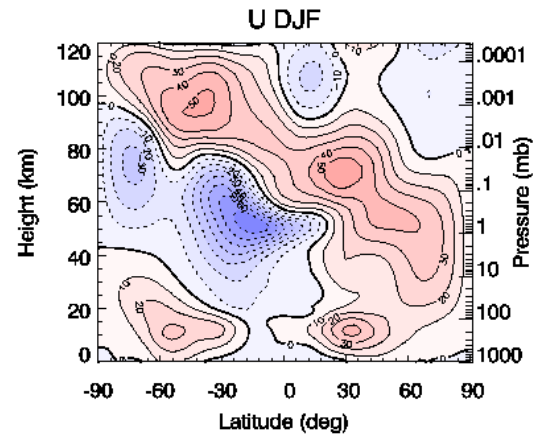# Chemistry-Climate Model Validation (CCMVal) WACCM 3.5.48
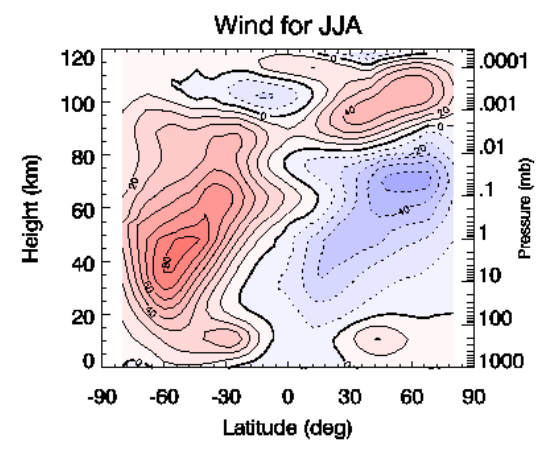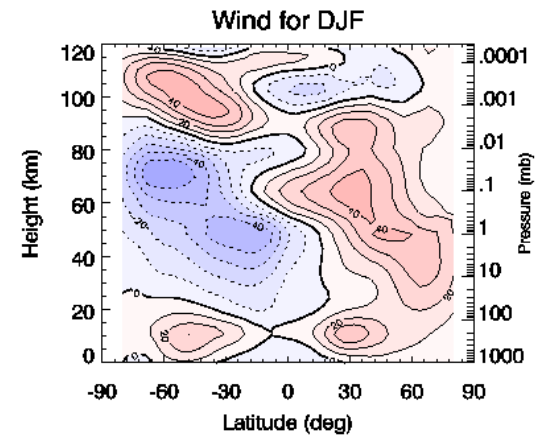
REFB1

Figure courtesy
Bill Randel

WACCM SSU

Zonal winds 0-120 km

WACCM3.6

URAP

Stratospheric warming counts
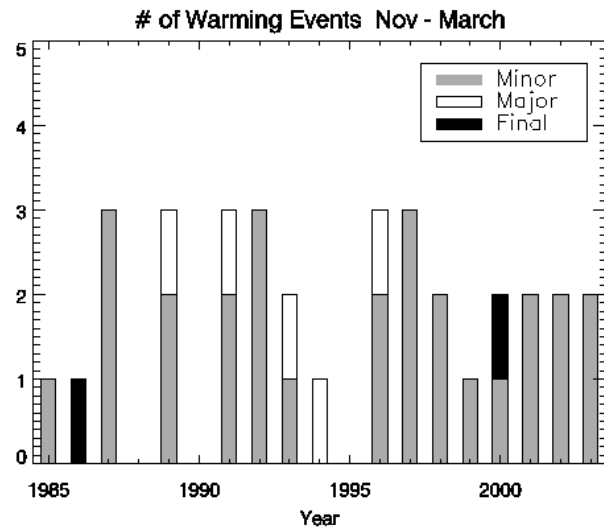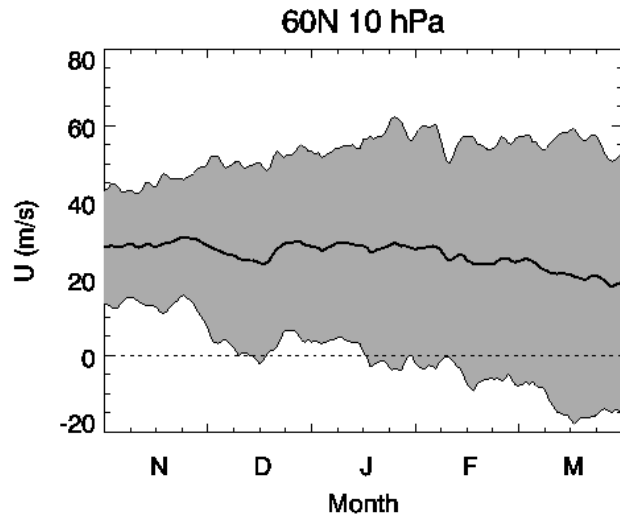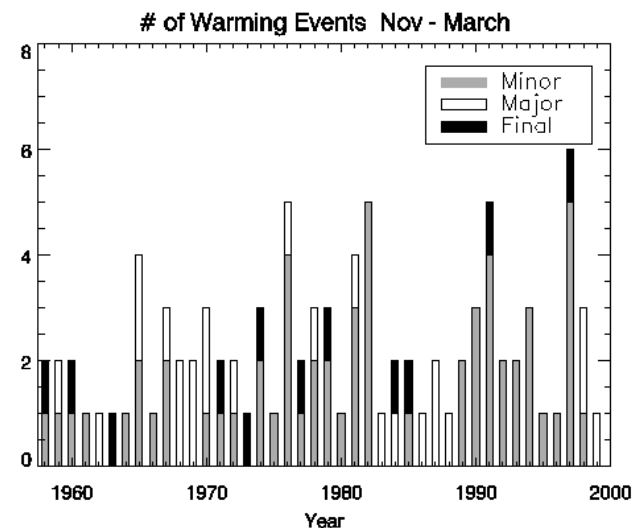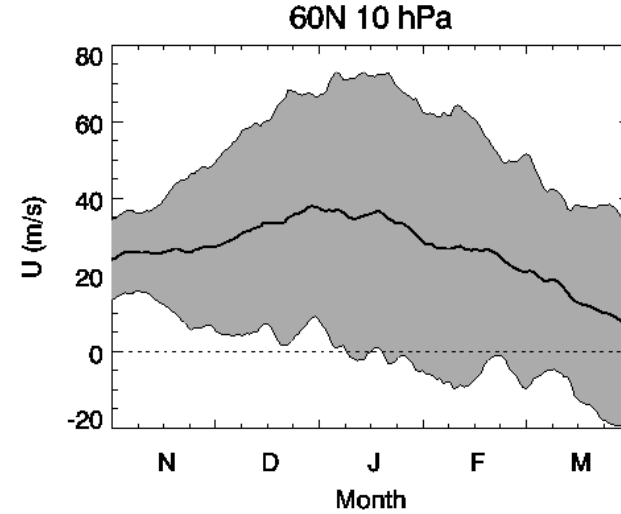
Future studies

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˚?

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

WACCM Community support

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

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

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

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 priorites

- 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

END