

Whole Atmosphere Working Group Agenda

- 8:30 a.m. Mike Mills – WACCM development updates
- 8:50 a.m. Dan Marsh – CMIP5 results
- 9:10 a.m. Doug Kinnison – WACCM4 chemical lifetimes
- 9:30 a.m. Matthias Brakebusch – Modeling polar ozone loss at the University of Colorado
- 9:50 a.m. Ethan Peck – Impacts by solar irradiance and auroral EPP in WACCM
- 10:10 a.m. Yunqian Zhu – Microphysical modeling of polar stratospheric clouds
- 10:30 a.m. Break
- 11:00 a.m. Nicholas Pedatella – Day-to-day nonmigrating tidal variability simulated by WACCM-X
- 11:20 a.m. Hanli Liu – Study of quasi-biennial oscillation using WACCM
- 11:40 a.m. Discussion
- 12:00 p.m. Adjourn





WACCM Development Updates

Michael Mills

WACCM Liaison

WACCM Working Group, CESM Meeting, Breckenridge, June 2012

- CESM1.0.4 release (Feb 21, 2012)
 - WACCM-X
 - bug fixes
- On the developer trunk
 - SD compset updates
 - CARMA bin microphysics
- Development work not yet on the trunk
 - WACCM5 development
 - spectral element dycore

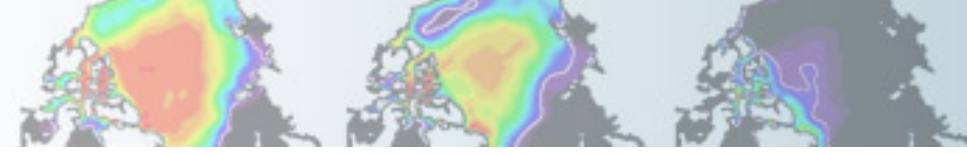


NCAR



WACCM

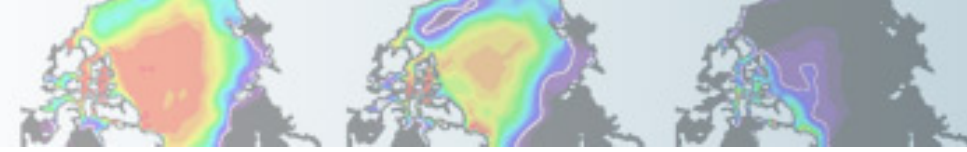
Whole Atmosphere
Community Climate Model



Report of NSF Review of NCAR Earth System Laboratory

July 2011, based on site visit May 8-12, 2011

- “Usage of the Community Earth System Model (CESM) and its predecessors, the Weather Research and Forecasting Model (WRF) and the Whole Atmosphere Community Climate Model (WACCM) by the research community outside of NCAR has increased dramatically over the past decade and particularly over the past five years. It can be said without exaggeration that the availability of NCAR’s community models is transforming the way in which a substantial fraction of the research in atmospheric and Earth system science is being framed and implemented. Providing user support for the models has grown to become one of NCAR’s major outreach activities.”
- “The Whole Atmosphere Community Climate Model (WACCM) model is unique among atmospheric chemical transport models for its capability of chemistry from surface up to 500 km. Results of WACCM simulation contributed to the recent international stratospheric ozone assessments in response to the various climate change scenarios.”
- “The [NSF site visit team] considers NESL’s community modeling effort, culminating in the CESM, the WRF, and the WACCM to be among NCAR’s greatest achievements in its nearly 40-year history. The dramatic improvement in model performance, in combination with the greater modularity and ease of use of the models represents a major advancement of our modeling capability. The availability of these models as tools for investigating phenomena and processes is accelerating the pace of weather, climate, and Earth system research throughout the world. Spearheading this community effort has served to increase the prestige of NCAR in the scientific community.”



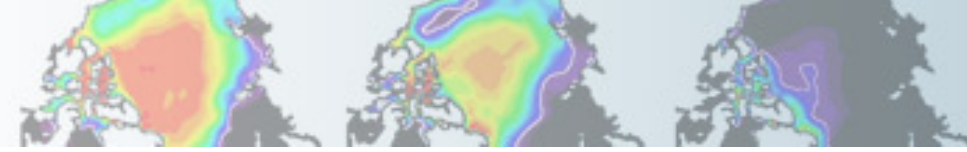
CESM 1.0.4 Release

- Public release February 21, 2012
- Major new feature: WACCM-X
 - Thermosphere extension of WACCM
 - F_2000_WACCMX (FWX) compset (solar max)
 - Control simulation output available on ESG for validation



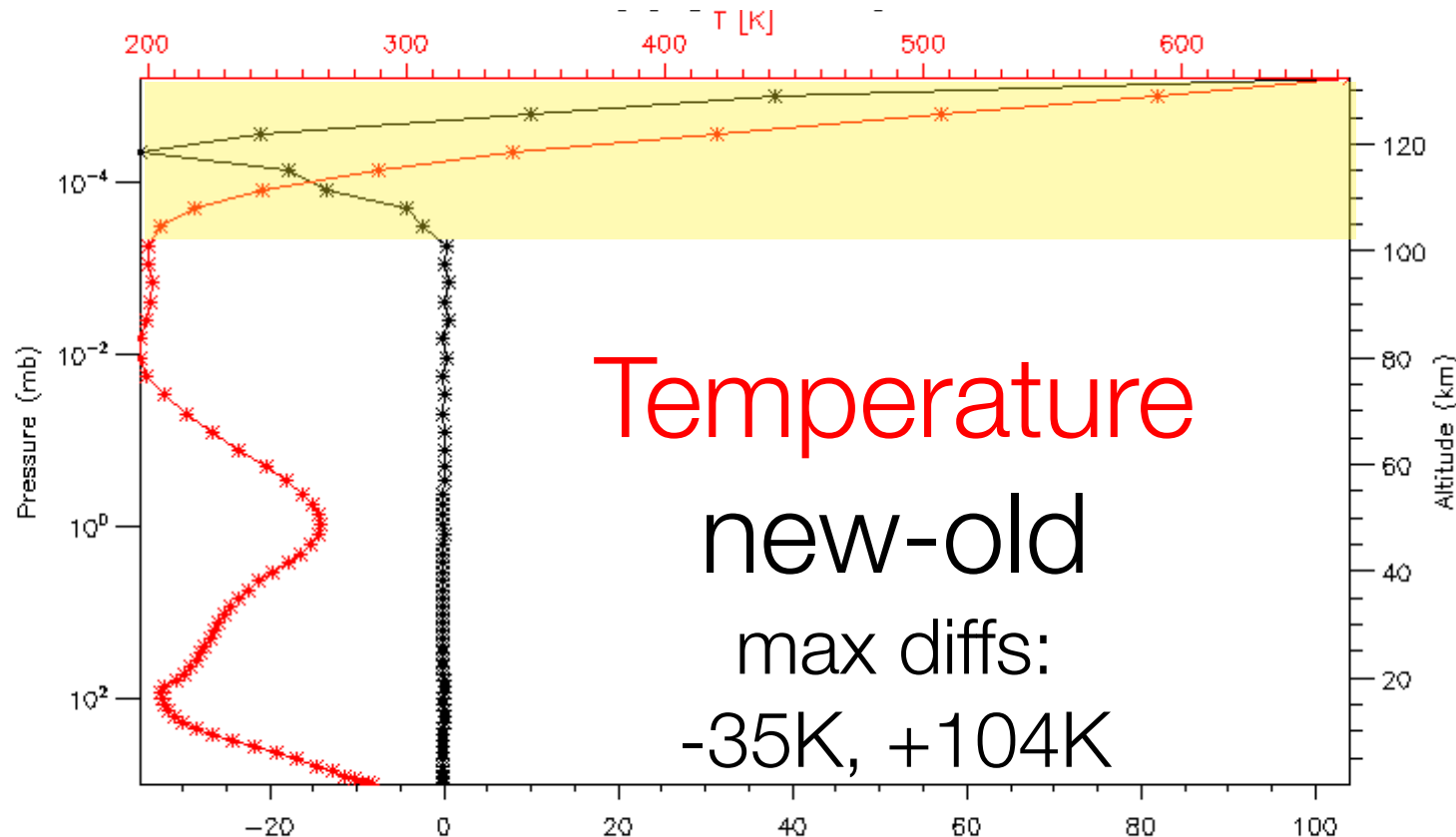
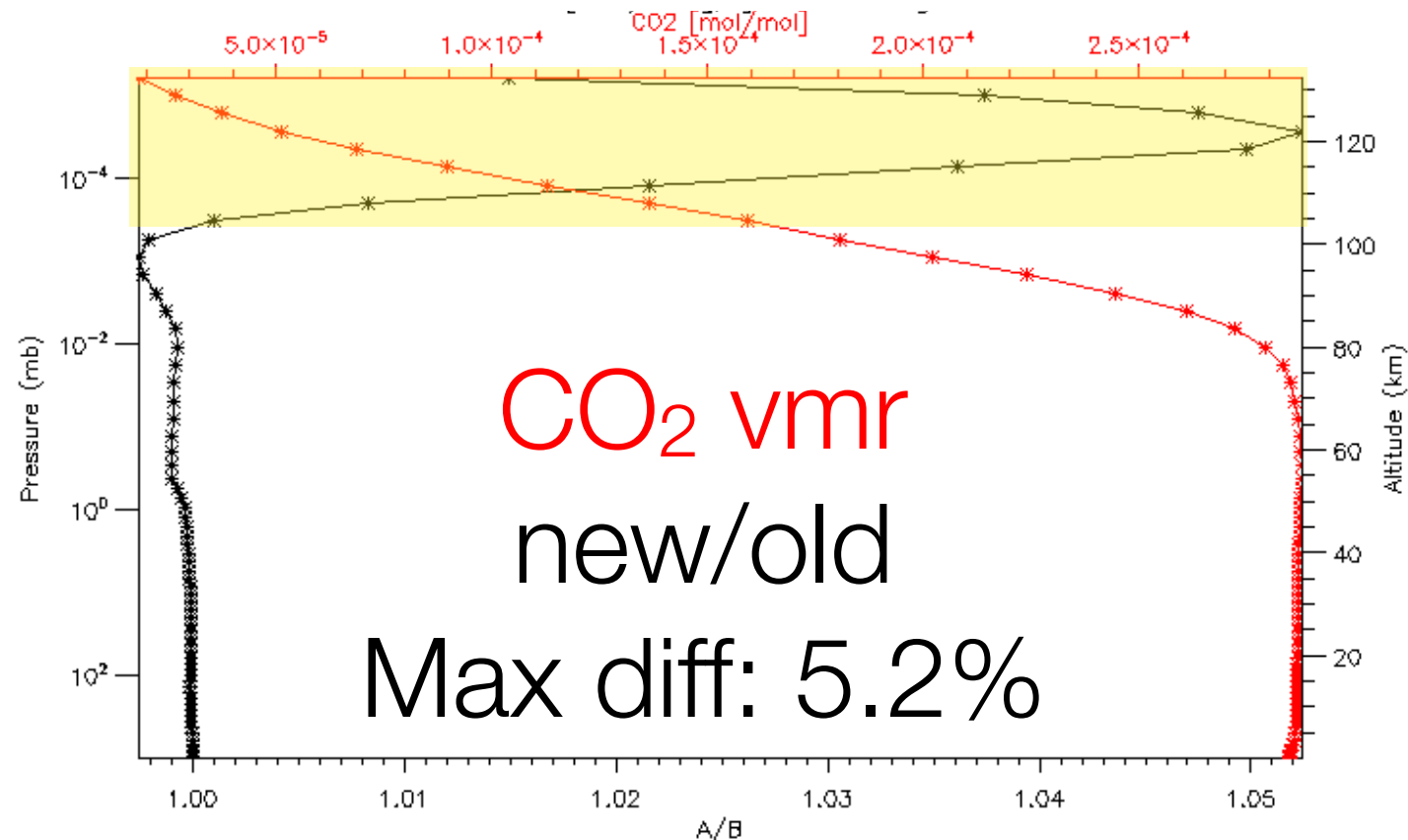
Case Name: [f.e10.FWX.f19_f19.control.001](#)
Machine: [NCAR:bluefire](#)
CMIP5 ID: ----
Compset: [F_2000_WACCMX](#) (publicly available 2/21/12)
Resolution: [1.9x2.5](#) [1.9x2.5](#)
Years: [1/2001-2/2002](#)
Time Frequencies Saved: [Monthly](#), [Daily](#), [Subdaily](#)
Initialization: [startup run type](#)
Start/End Dates: [2/8/12](#), [ongoing](#)
Data Release Date (Full): [2/17/12](#)

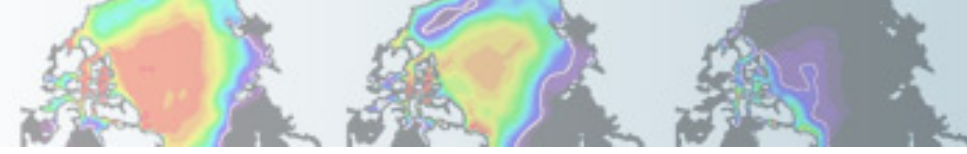
| | | | | | | | |
|---|------------------------|-----|-----|------|-------|-----|------------------|
| CESM1 (WACCM) 2° Pre-Industrial Control Case Name: b40.1850.track1.2deg.wcm.007 Data Availability: ESG (years 156-185) | 156-185 w/observations | Atm | Ice | Land | Ocean | CCR | Ocean Timeseries |
| CESM1 (WACCM-X) 2° Present Day Control Case Name: f.e10.FWX.f19_f19.control.001 Data Availability: CESM | 2001 w/observations | Atm | Ice | Land | --- | --- | --- |



CESM 1.0.4 Release

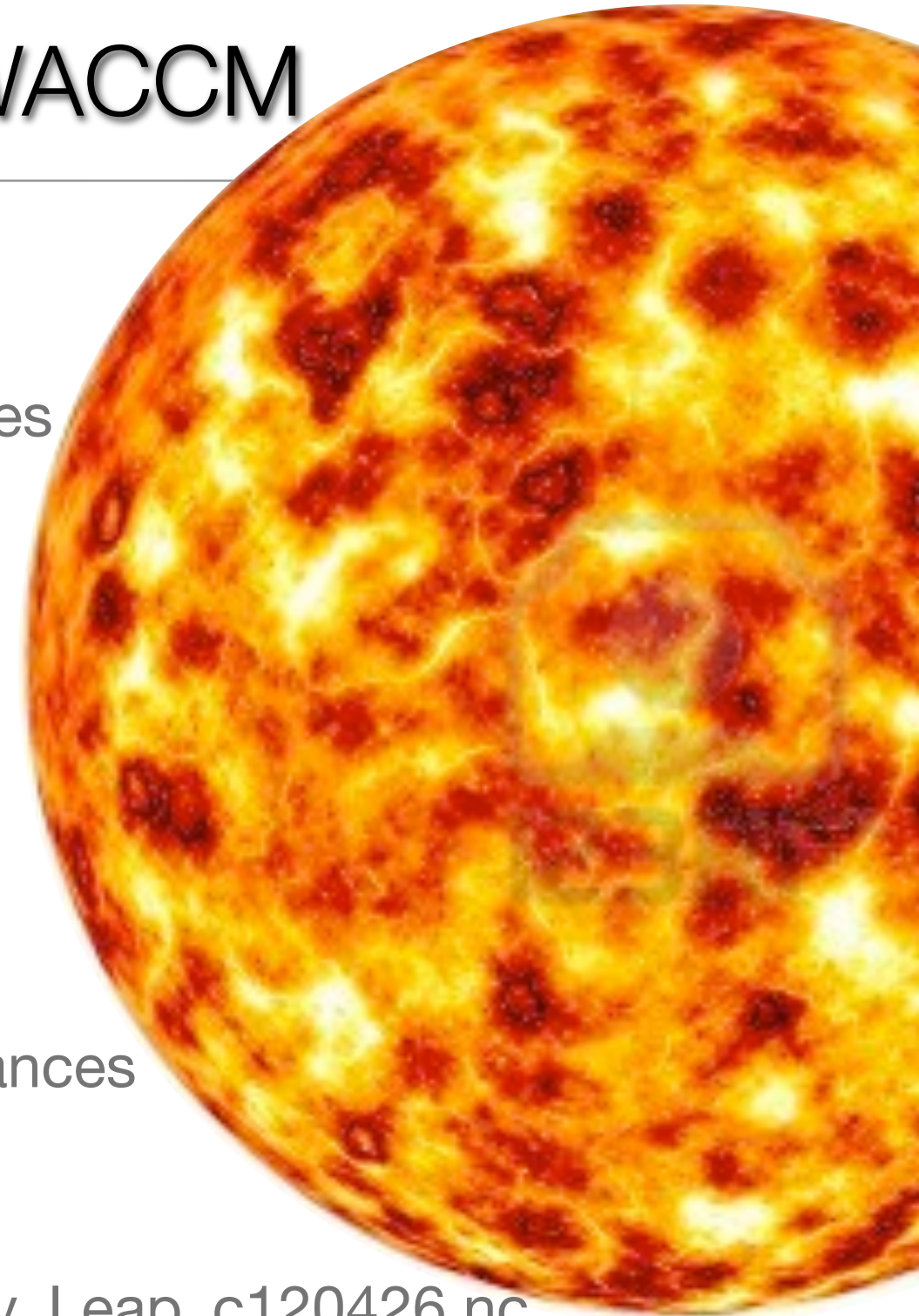
- Bug fixes
 - gravity wave routine: incorrect diffusion parameter had been passed in
 - significant changes to CO₂ & T above 100 km
 - molecular diffusion: number changing at lowest level at which molecular diffusion is turned on (0.55 hPa, ~53 km)

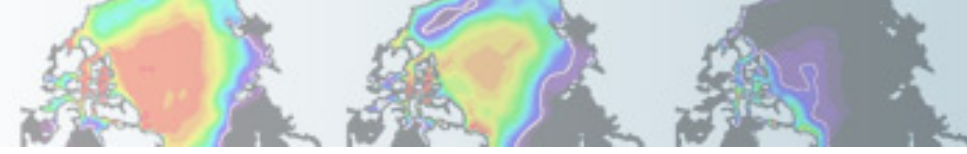




Developer Trunk Updates: SD-WACCM

- Specified Dynamics compset (F_SD_WACCM):
new solar input data files extend through 2011.
 - solar_parms_file: F10.7, F10.7a, Kp, Ap indices
 - dates 1947.04.10-2011.12.22
 - inputdata/atm/waccm/solar/
wasolar_1947-2011_daily_c120227.nc
 - spe_data_file: solar proton events
 - dates 1963.01.01-2012.01.01
 - inputdata/atm/waccm/solar/
spes_1963-2011_c120302.nc
 - solar_data_file: total and spectral solar irradiances
 - dates 1950.01.01-2011.12.31
 - inputdata/atm/cam/solar/
spectral_irradiance_Lean_1950-2011_daily_Leap_c120426.nc
 - details on CGD forum: bb.cgd.ucar.edu

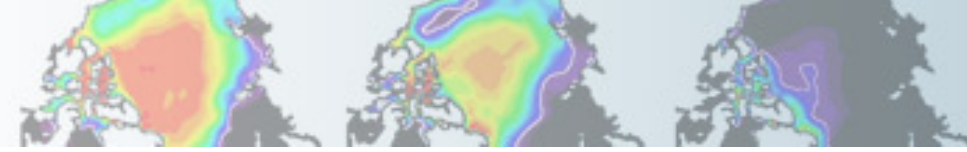




Developer Trunk Updates: CARMA microphysics

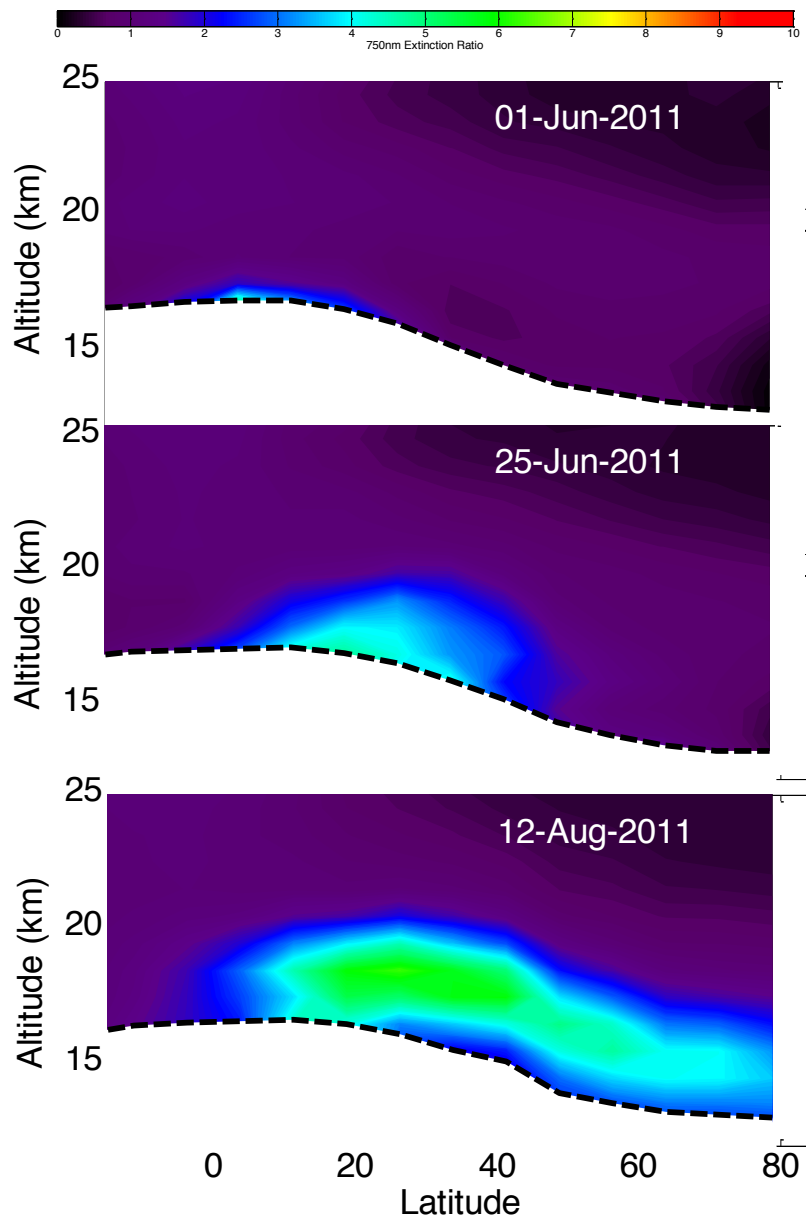
- Community Aerosol and Radiation Model for Atmospheres
 - Flexible and extensible sectional (bin) microphysics package for clouds and aerosols
- Added to CAM development trunk May 8, 2012
 - CAM tag cam5_1_28 (and later)
 - CESM tag cesm1_1_beta15 (and later)
 - CAM Models: sea salt, cirrus
 - WACCM Models: meteor smoke, polar mesospheric cloud, sulfates, black carbon
 - Collaboration required for use of development code
- Other models are being worked on at CU and NCAR
 - CAM Models: dust, sulfates, soot, organics, internally mixed aerosols
 - WACCM Models: polar stratospheric clouds, internally mixed aerosols



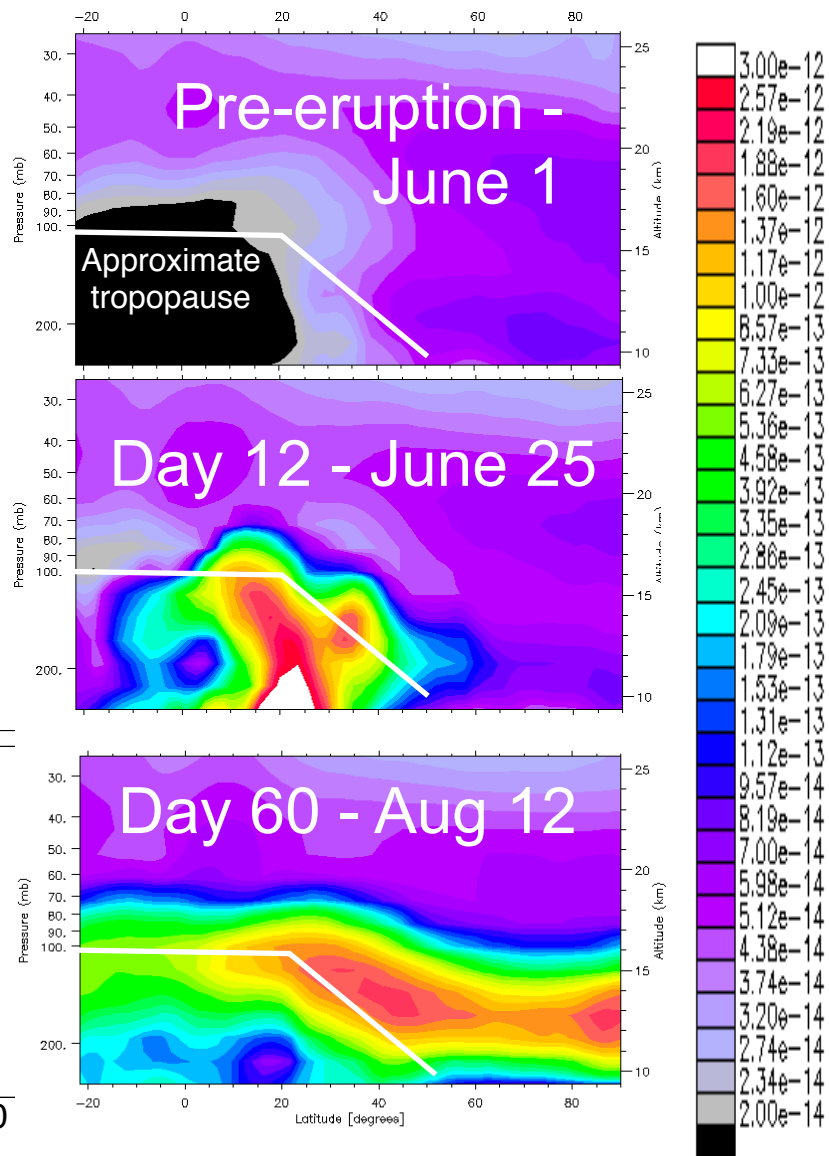


WACCM4/CARMA: Stratospheric Sulfate

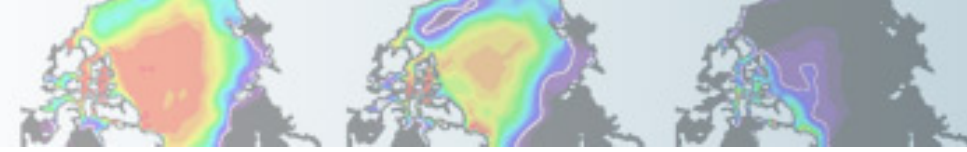
OSIRIS Observations



WACCM-CARMA calculated sulfate (g/cm^3)

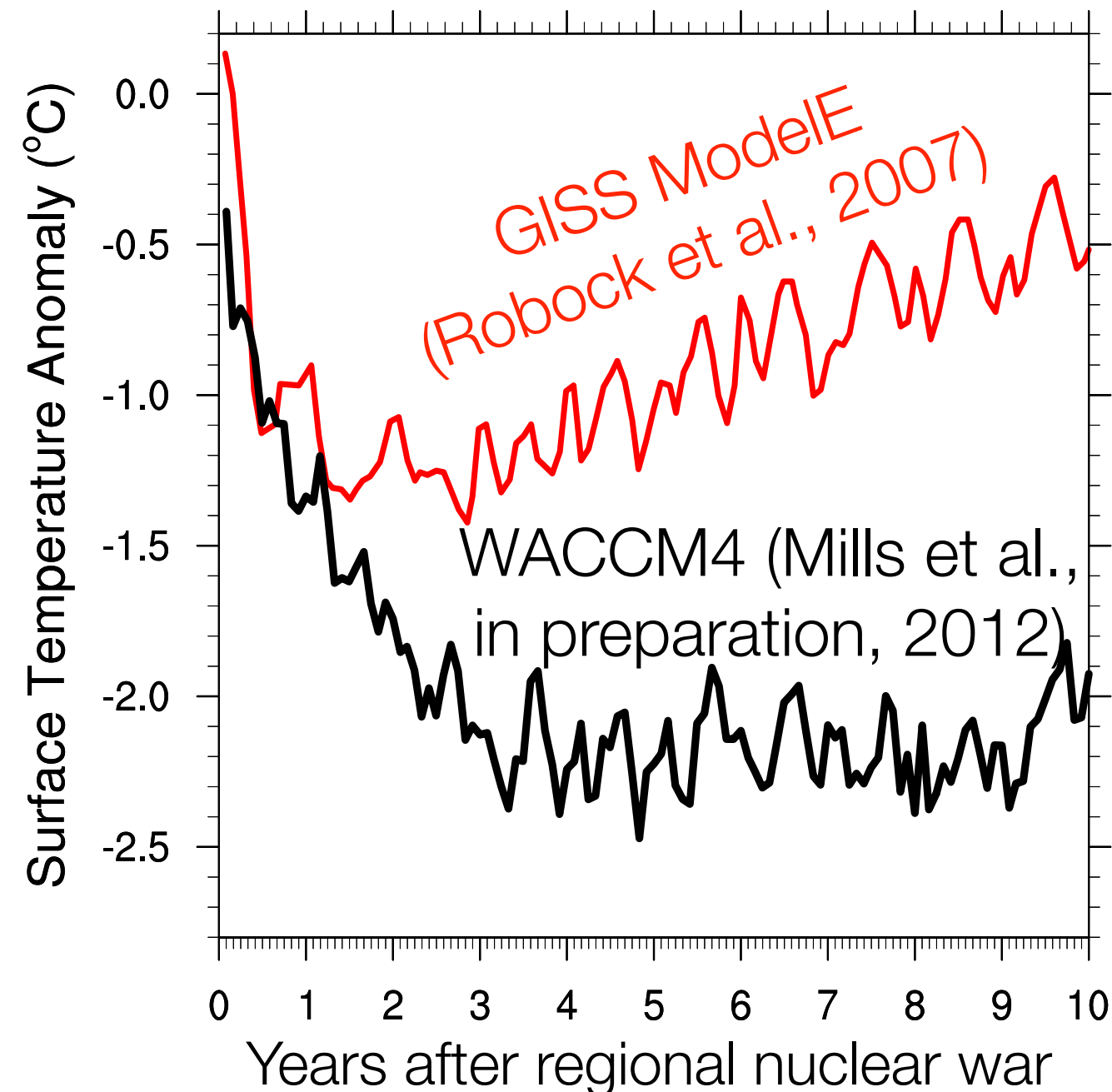


- 7 new sulfur gases added
- 30 sulfate aerosol bins
 - volume ratio: 2.4
- Used to model the 2011 eruption of the Nabro stratovolcano in Eritrea, transport of sulfur gases and aerosols in the troposphere to the Asian monsoon region, and into the stratosphere.
- Contact Mike Mills for collaborative use.

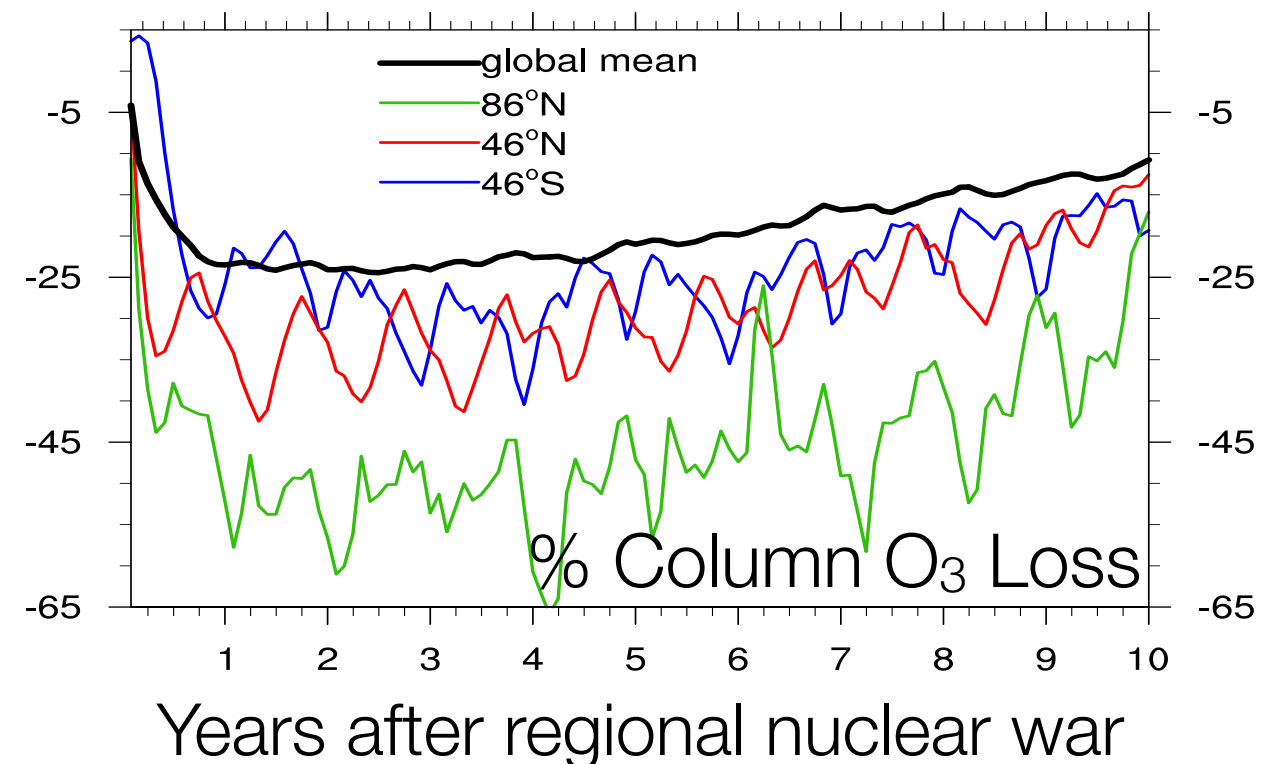


WACCM4/CARMA: Stratospheric Black Carbon

Global Average Surface Temperature



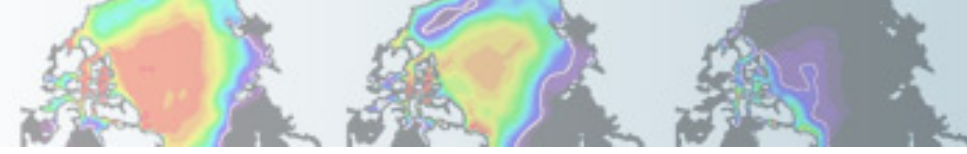
- used for nuclear winter studies
- 1 bin of black carbon, 0.1- μm radius
- uses CAM-RT radiative properties for hydrophobic black carbon
- Contact Mike Mills for collaborative use.





WACCM5 development status

- CAM5 physics added
 - RRTMG radiation scheme added to WACCM4
 - Morrison-Gettelman cloud physics added
 - UW planetary boundary layer (PBL) scheme added
 - limited length scale above 100 hPa to reduce spikes in eddy diffusion coefficient (KVH) where gravity waves break in lower mesosphere
 - UW shallow convection scheme added
 - fixed bug which assumed all tracers > 1 pptm, producing upper atmospheric ions at the surface by roundoff errors, decimating OH
 - Modal aerosols (MAM) added
 - Prognostic MAM for large ensemble runs to compare to CAM
 - Prescribed MAM (not yet validated) will be default for WACCM5?
- Control runs
 - Data ocean present-day (FW) run for development, testing
 - Full ocean pre-industrial (B1850W) being run for climate tuning



Spectral Element: WACCM-SE development

- SE: aka HOMME dycore, cubed sphere
- WACCM-SE branch of CAM 5_1_31 (Sean Santos)
 - control run is being validated
 - Grid-dependent assumptions in WACCM
 - QBO is turned off
 - gravity_wave_sources has two versions, one per dycore
 - no other assumptions about grid in WACCM code!
 - Difficulties
 - initial data files in the HOMME dycore (e.g. there weren't any)
 - WACCM violates assumptions used to tune the HOMME dycore for CAM, such as the range of possible temperatures and wind speeds.
- Improvements for generation of orography inputs for SE grids being developed for CAM will have some effect on WACCM (hopefully positive!).

