Recent Highlights From the Whole Atmosphere Community Climate Model – eXtended (WACCM-X) 2.0

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Summary

- WACCM-X Version 2.0 released June 8, 2018
- Available from the CESM 2.0 Series Public Release webpage (www.cesm.ucar.edu/models/cesm2.0)
- A number of recent highlights presented here
- Multi-year simulations available
- See www2.hao.ucar.edu/modeling/waccm-x for more details

What is WACCM-X?

- Comprehensive self-consistent numerical global climate model of the Earth's atmosphere - vertical range from the surface to the upper thermosphere
- Full thermosphere with recently added full ionosphere and electrodynamics

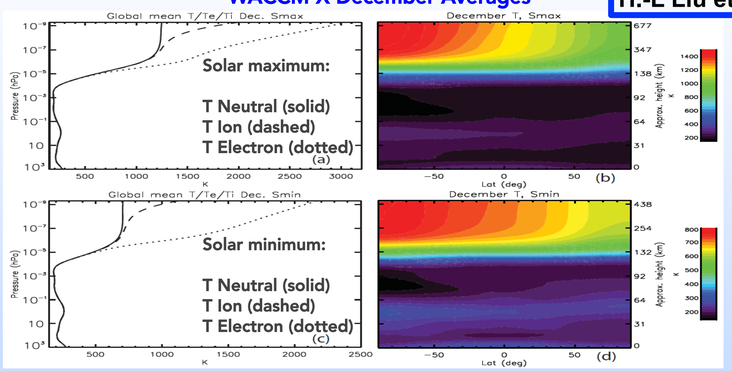
Available WACCM-X Simulation Results

- Simulation using specified dynamics meteorology in the lower atmosphere 2000-2014 (FXSD configuration)
- Free running simulation 2000-2014 (FXHIST configuration)
- Constant solar condition simulations for solar minimum, medium, maximum (FX2000 configurations)

Thermal Electron Neutral Atmosphere Heating

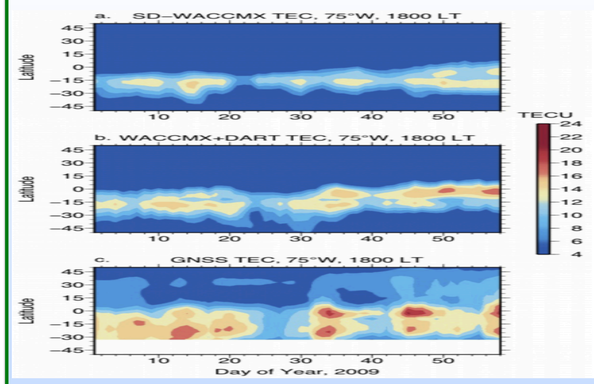
WACCM-X December Averages

H.-L Liu et al., 2018



Heating of the neutral atmosphere by thermal electrons is the dominant heating source in the upper thermosphere..

WACCM-X SD, DART, GNSS TEC & SSW

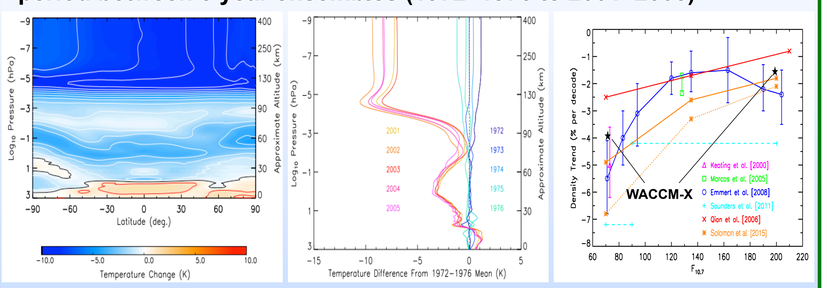


Total electron content (TEC) time series at 75W geographic longitude and 1800 local time, 2009

Pedatella et al., 2018

Temperature/Density Trends – 1970s to 2000s

Solar minimum low solar activity conditions, 29 year simulation period between 5 year ensembles (1972–1976 to 2001–2005)



Zonal Mean Annual Mean ΔT

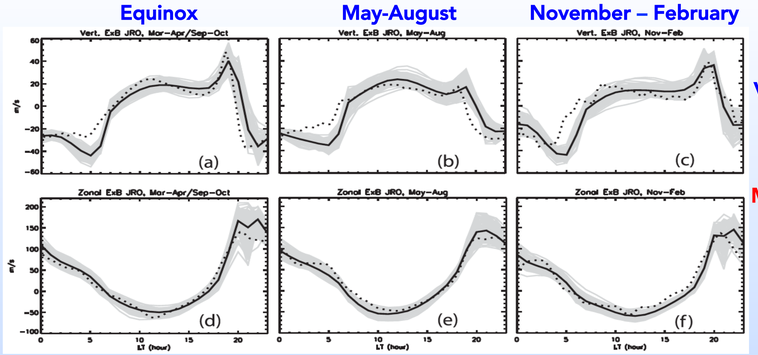
Solomon et al., 2018

Interannual variability of global mean annual mean temperatures

Decadal rates of global mean density change at 400 km

WACCM-X and Jicamarca ExB Drifts

Equinox | May-August | November – February



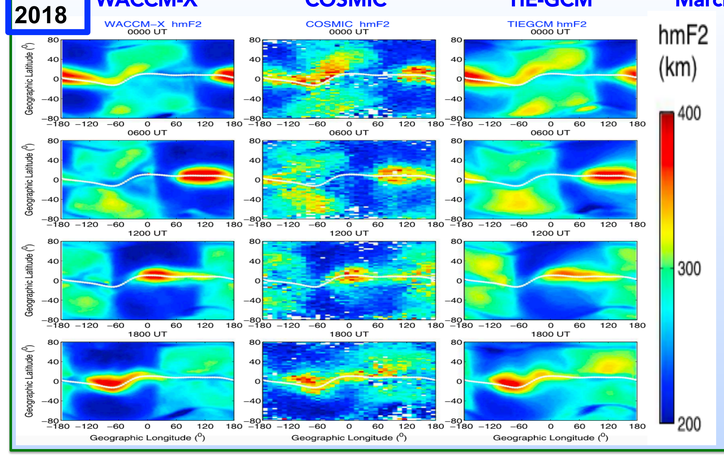
WACCM-X (black solid lines: seasonal average, and grey solid lines: daily values) and Jicamarca Radio Observatory climatology (dotted lines). The diurnal variation and seasonal variation of the drifts, in particular the seasonal variation of the pre-reversal enhancement (PRE), are in good agreement.

H.-L Liu et al., 2018

WACCM-X/COSMIC/TIE-GCM hmF2

J. Liu et al., 2018

WACCM-X | COSMIC | TIE-GCM | March 2008



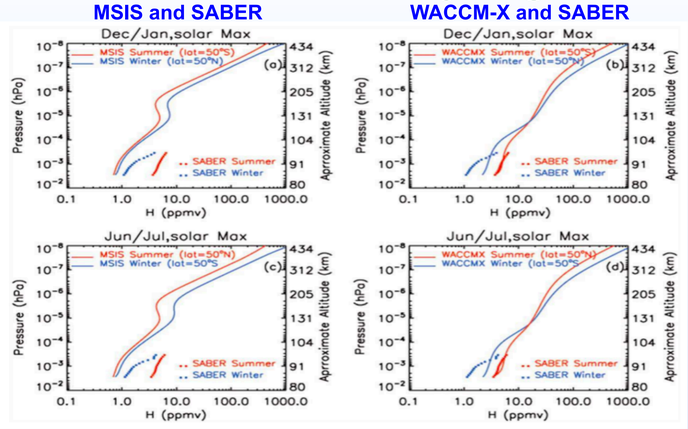
Future Development

- Support of upcoming satellite missions (ICON, GOLD, and COSMIC-2) and other observations with data assimilation
- Merge up to WACCM6 / CAM6 physics and use 1° resolution as default
- Develop generic 3D mapping capability between WACCM-X dynamical core grids and geomagnetic grid
- Ion transport on geomagnetic grid
- Include D-region chemistry
- Helium as a major species
- Develop WACCM-X with mesoscale-resolving capability
- Plasmasphere and magnetosphere model coupling
- AMIE and Weimer in addition to Heelis for high latitudes

WACCM-X Zonal Mean Hydrogen 50°S & 50°N

MSIS and SABER | WACCM-X and SABER

Qian et al., 2018

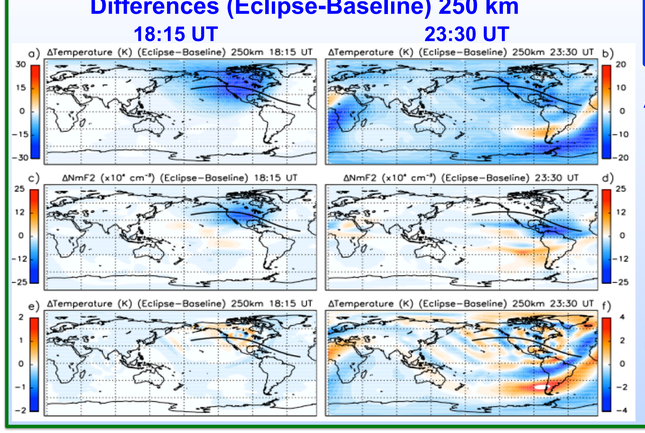


WACCM-X and August 21, 2017 Eclipse

Differences (Eclipse-Baseline) 250 km

18:15 UT | 23:30 UT

McInerney et al., 2018



Highlight References

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