CAM-chem Updates

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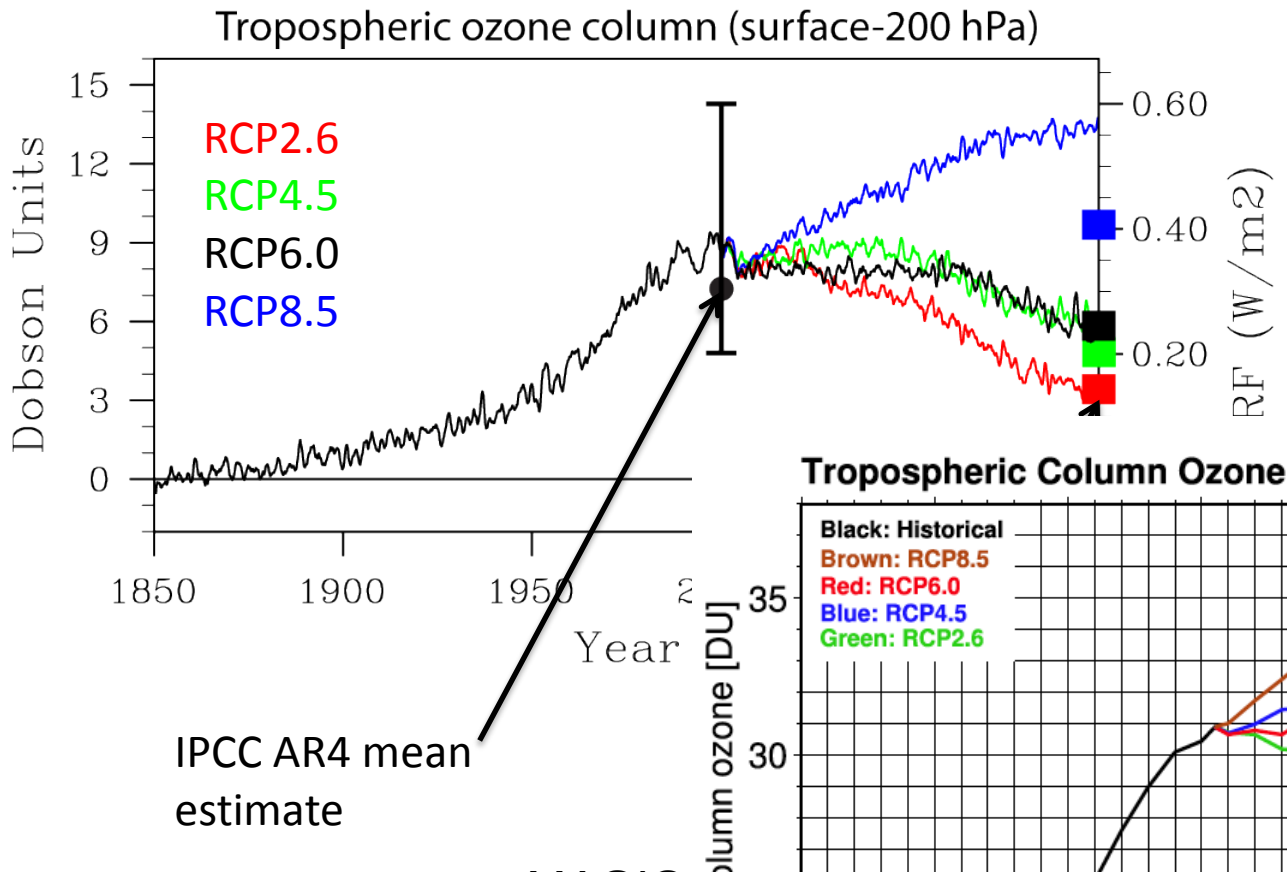
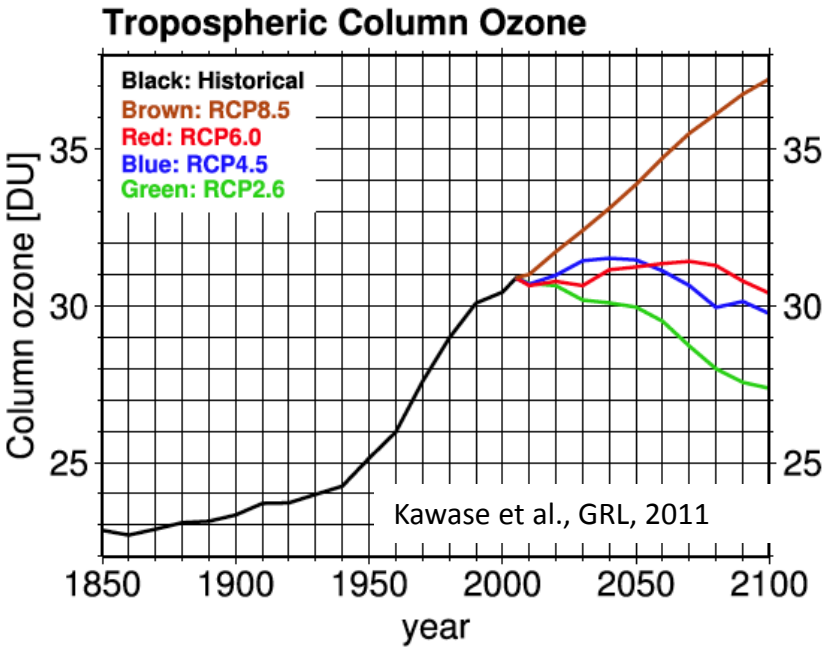
RECENT RESULTS: CCSM4 CMIP5 SIMULATIONS

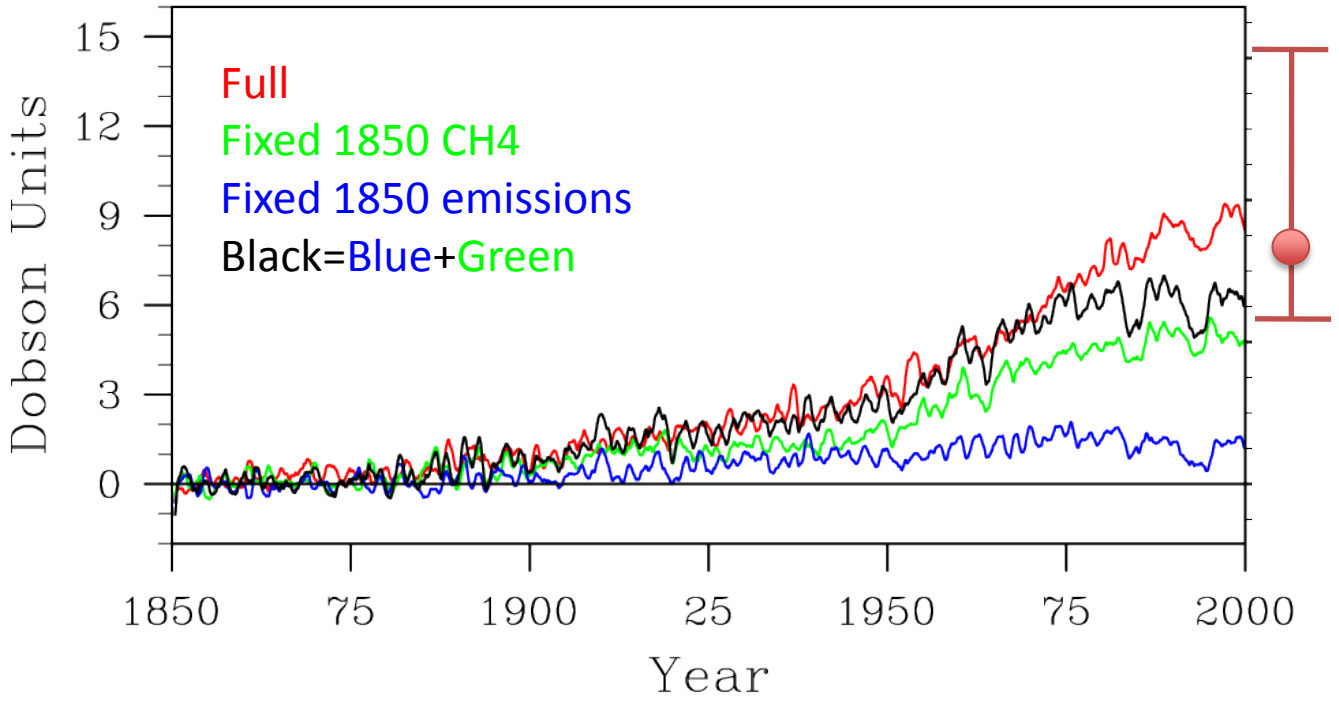
Tropospheric ozone: future





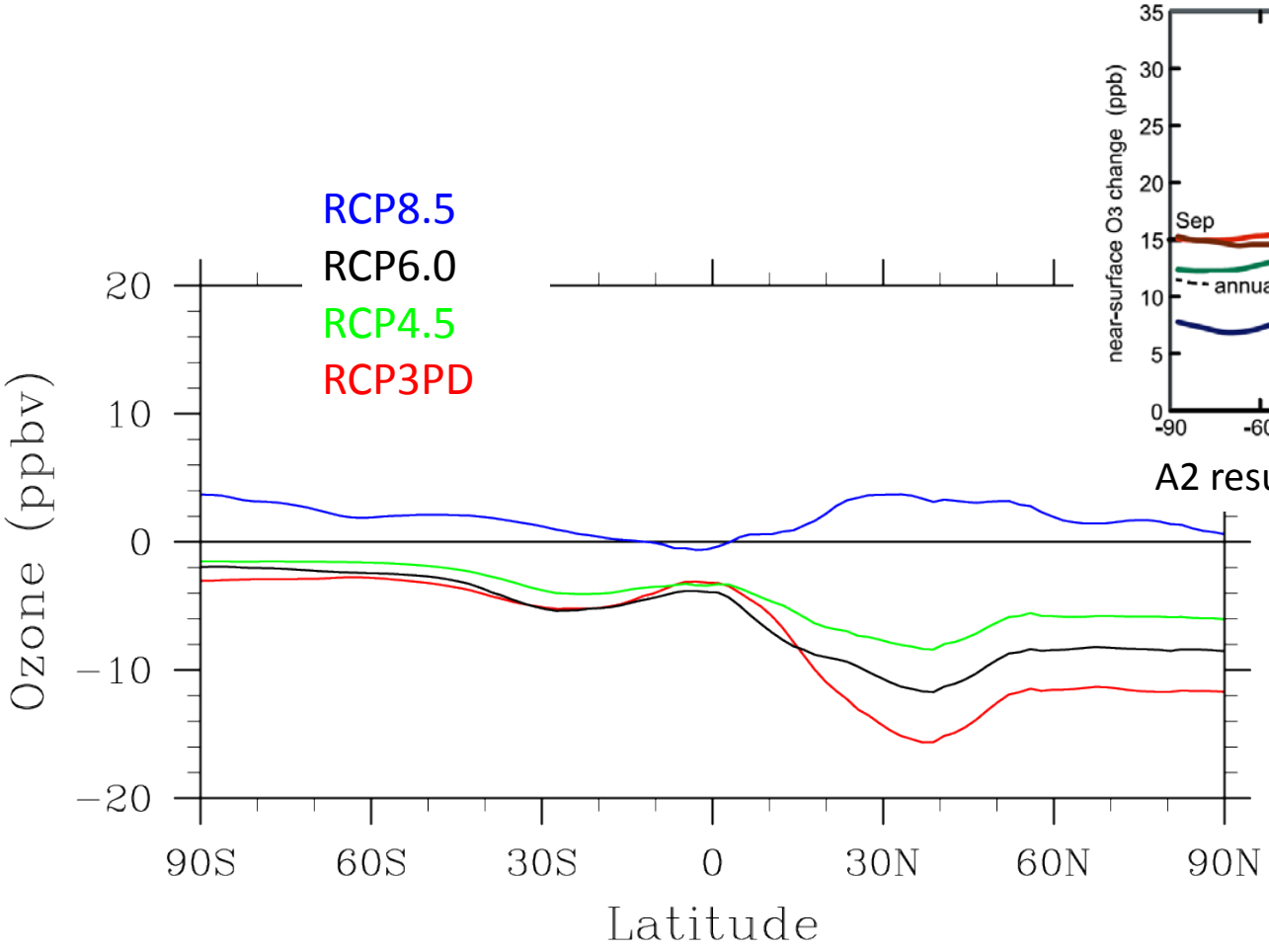
Lamarque et al., Climatic Change, 2011

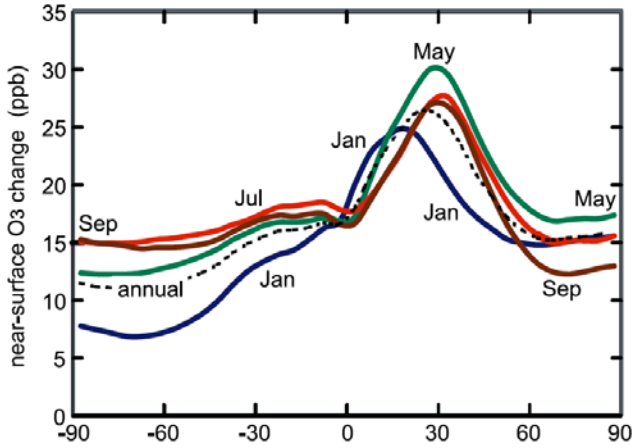
Tropospheric ozone column



Tropospheric (200 hPa-surface)

Surface ozone: 2100-2000

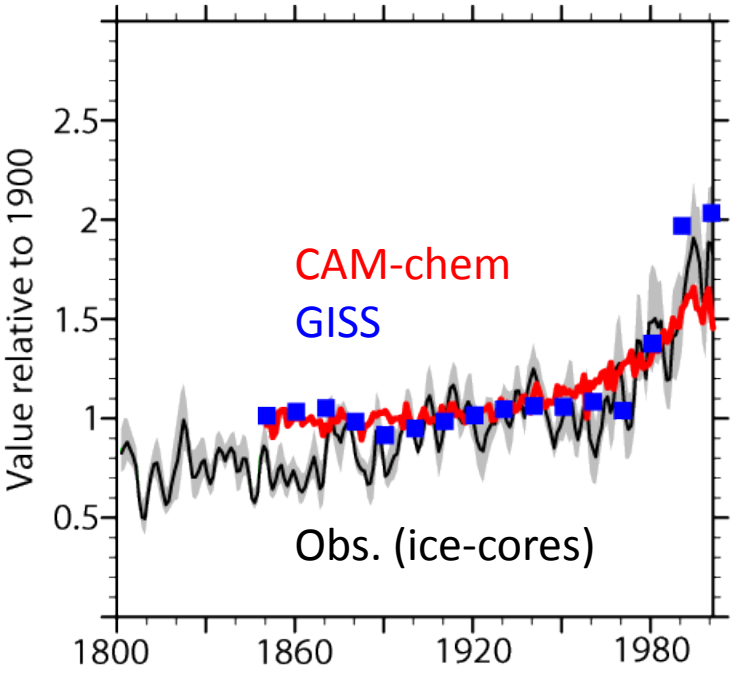




A2 results: Prather et al., 2003

Lamarque et al, Climatic Change, 2011

Antarctic H_2O_2



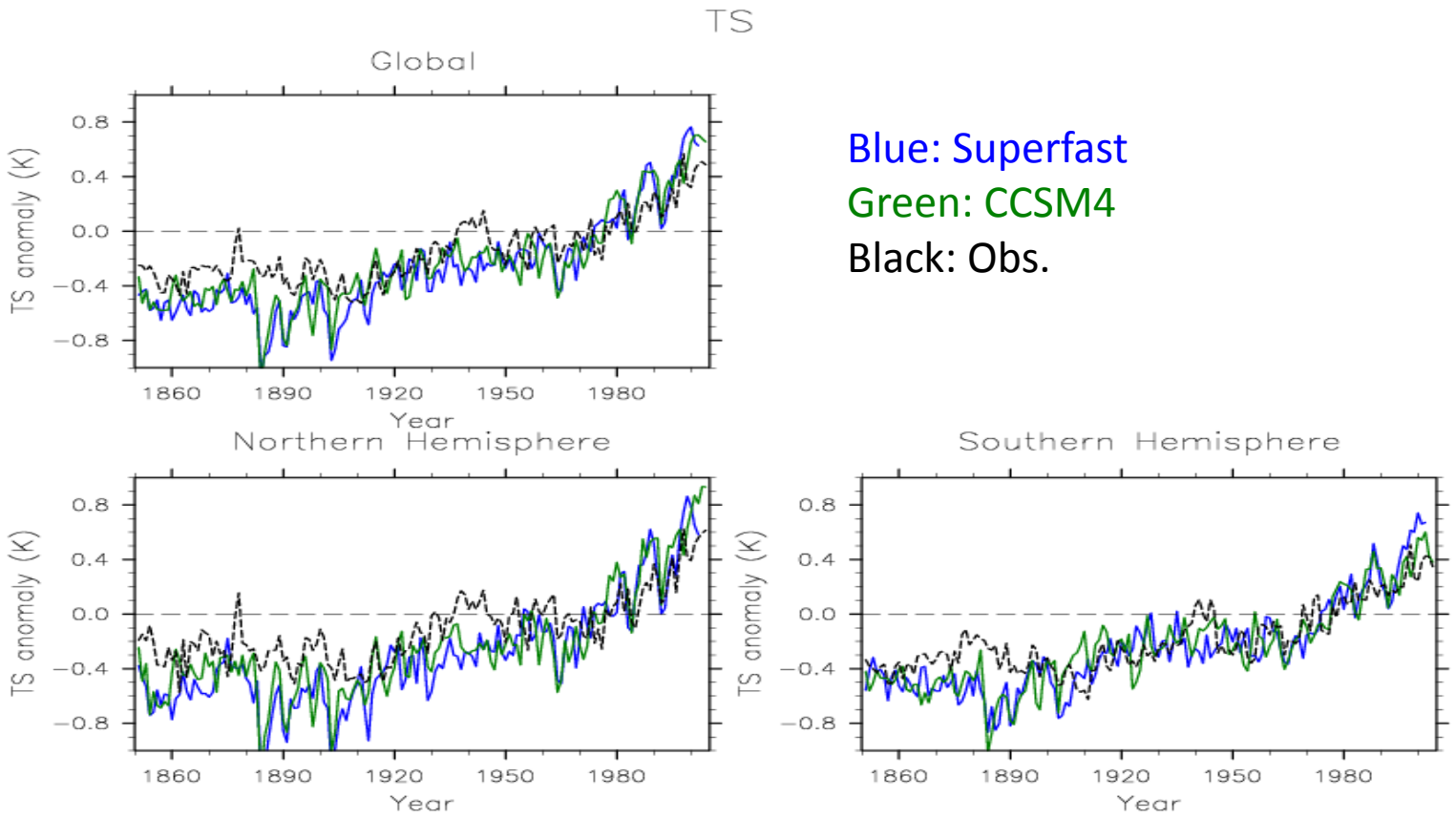
Lamarque et al., GRL, 2011

RECENT RESULTS: CHEMISTRY IN CESM1 FOR CMIP5

Model version

- CCSM4 0.9x1.25
- Super-fast chemistry in troposphere
- LINOZ + Cariolle in stratosphere
- CH_4 prescribed everywhere from CAM3.5
- Fully coupled
- 1850 control (250 years)
- 3 20^{th} century simulations

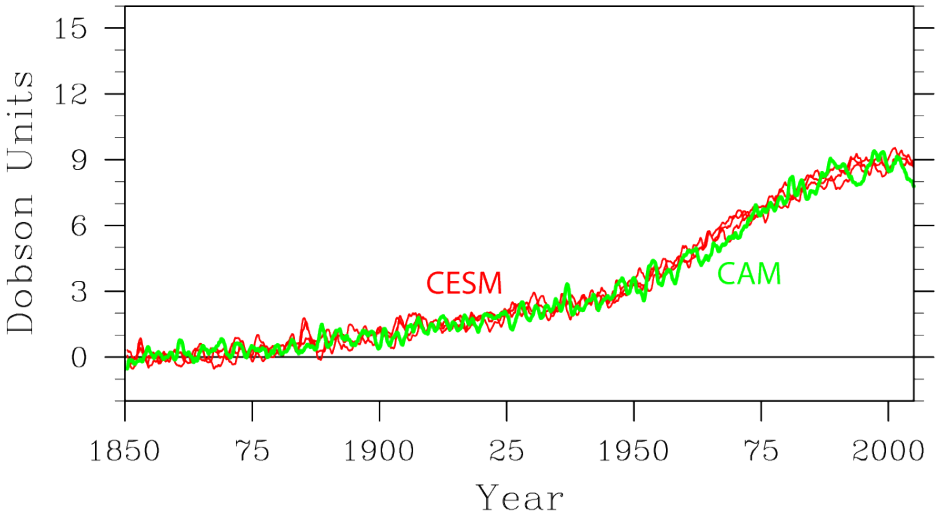
SST from CCSM4 w/ superfast chemistry



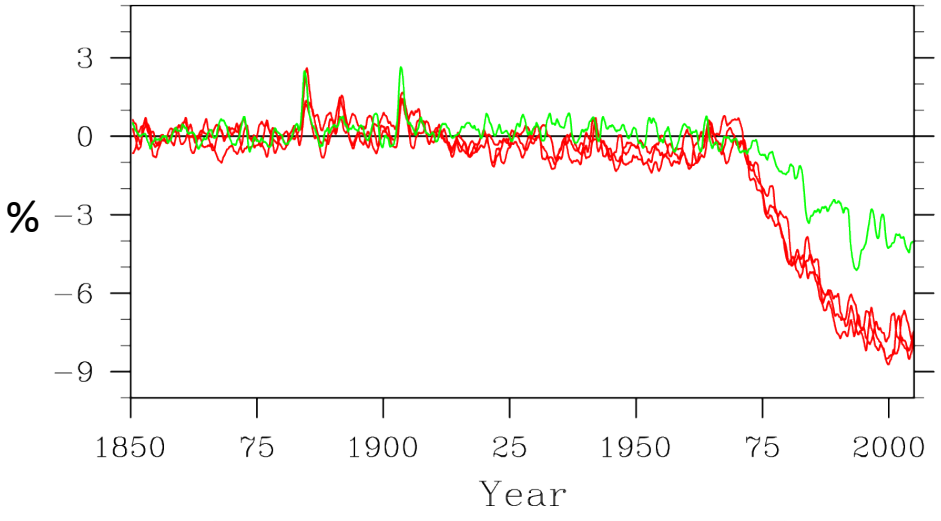
Blue: Superfast
Green: CCSM4
Black: Obs.

Ozone: historical change

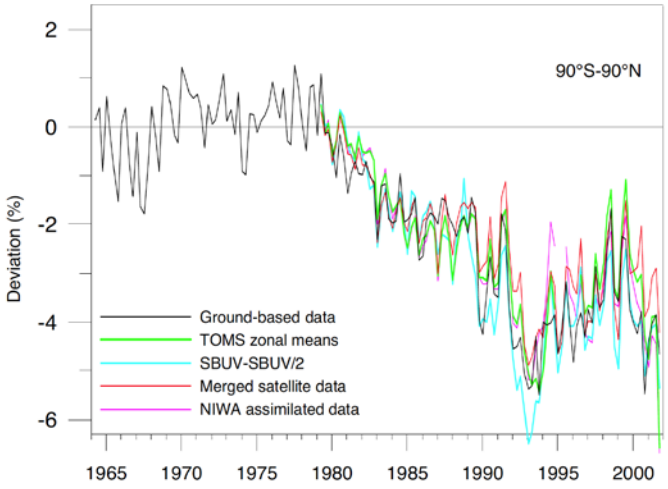
Tropospheric (200 hPa-surface)



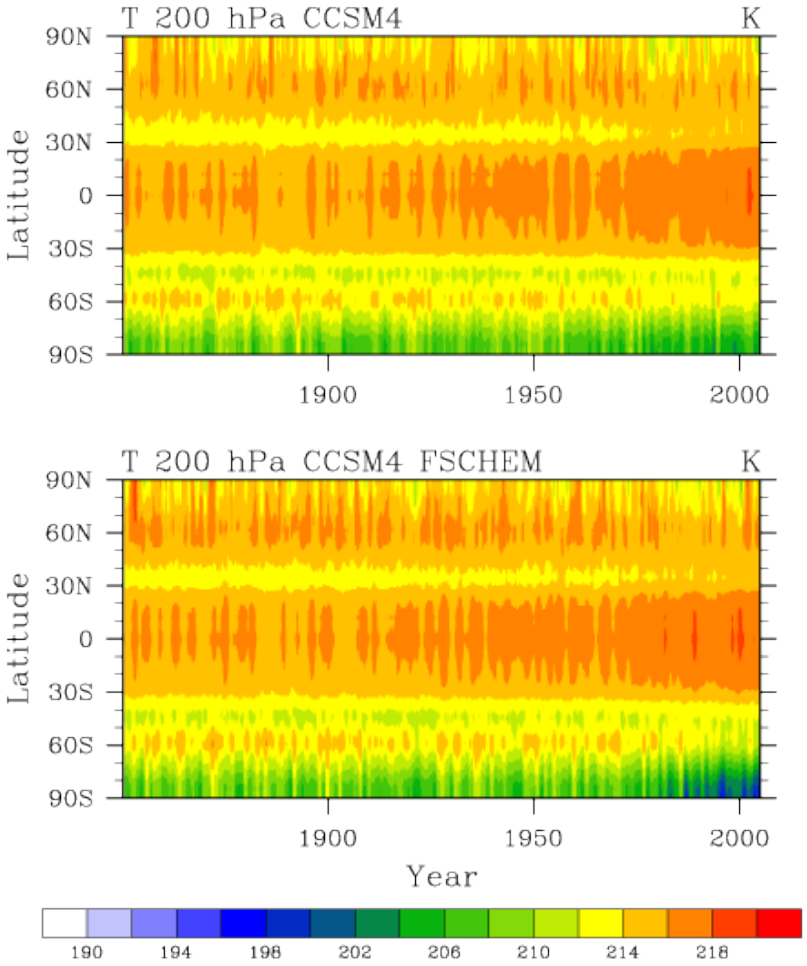
Stratospheric (Top-200 hPa)

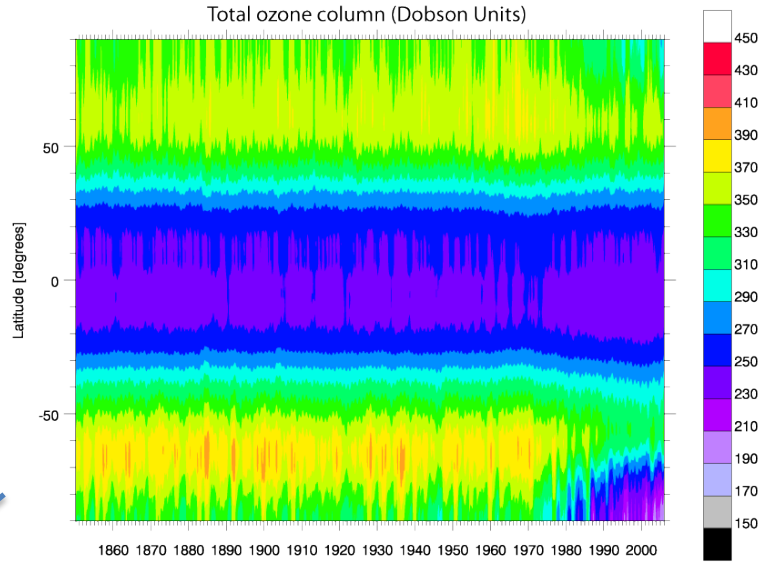


From WMO, 2002

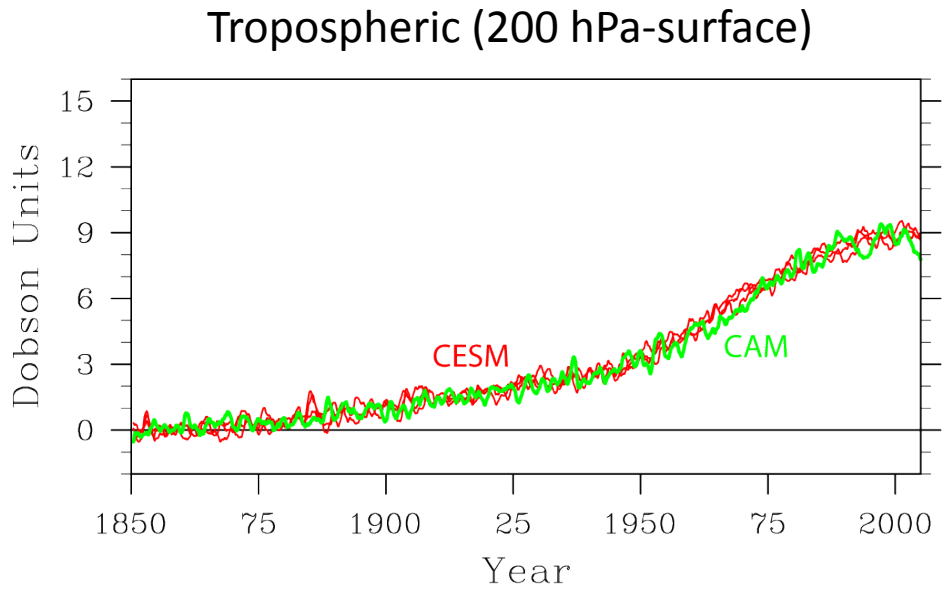


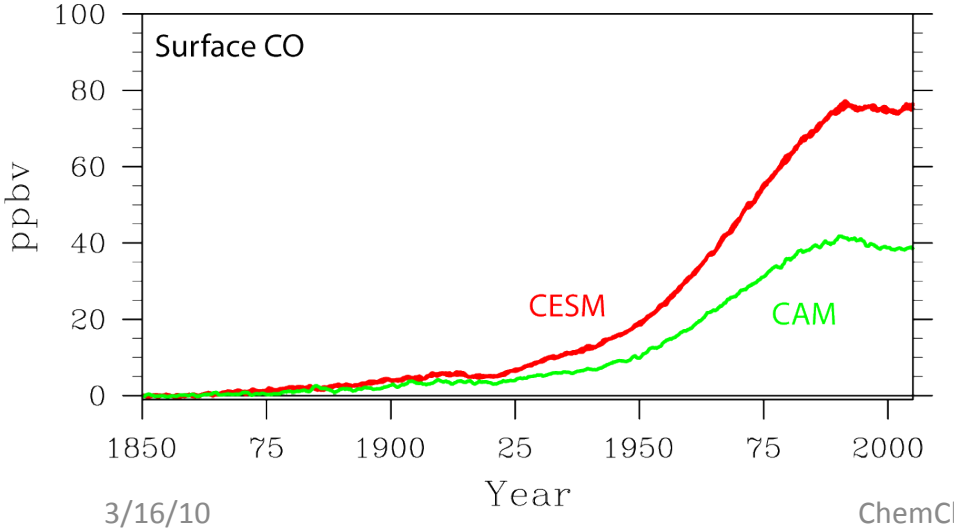
Ozone hole in CESM1

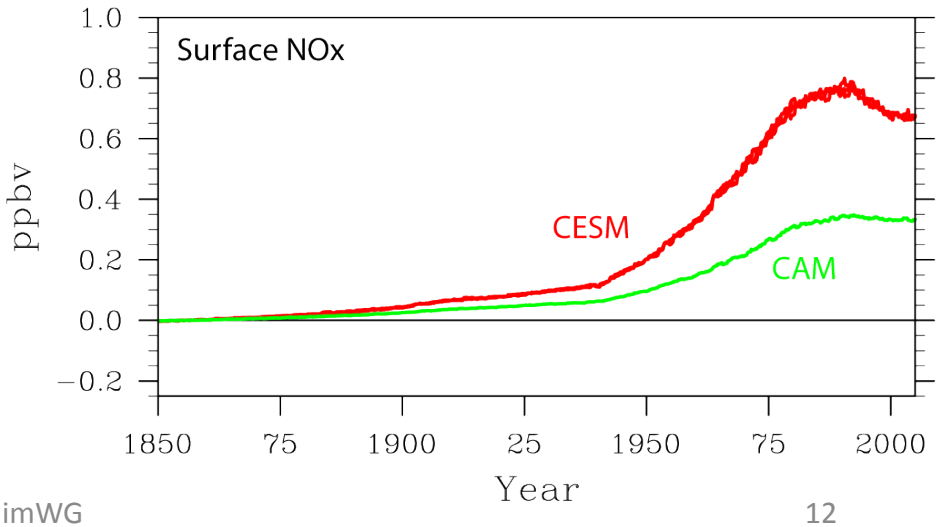




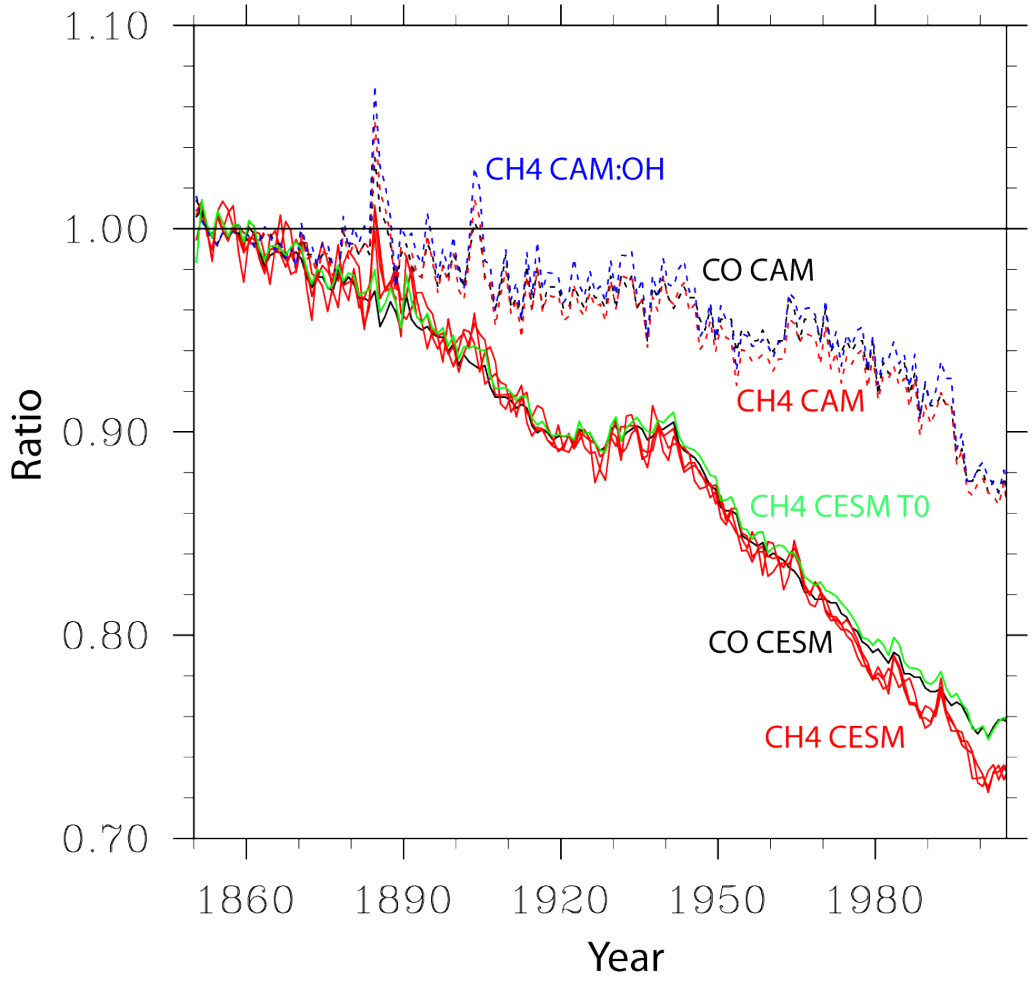
Tropospheric ozone change







CH_4 & CO lifetimes: historical



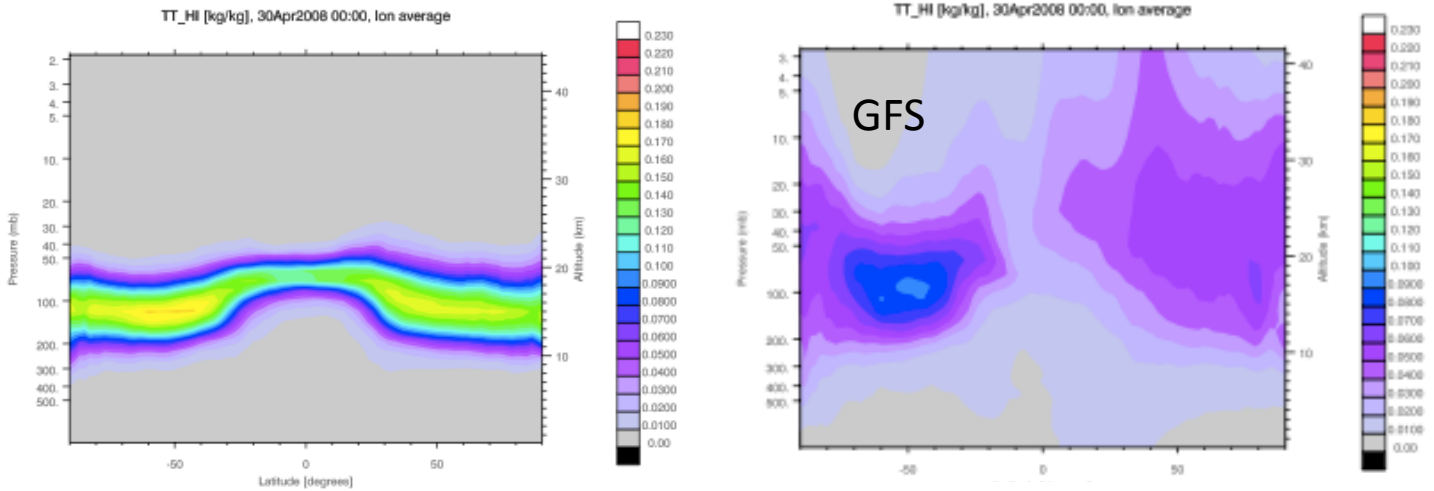
Lifetime with respect to OH loss only, integrated from surface to 200 hPa, normalized by 1850-1859 average

$$\text{Ratio} = \frac{\text{Lifetime(year)}}{\text{Lifetime(1850s)}}$$

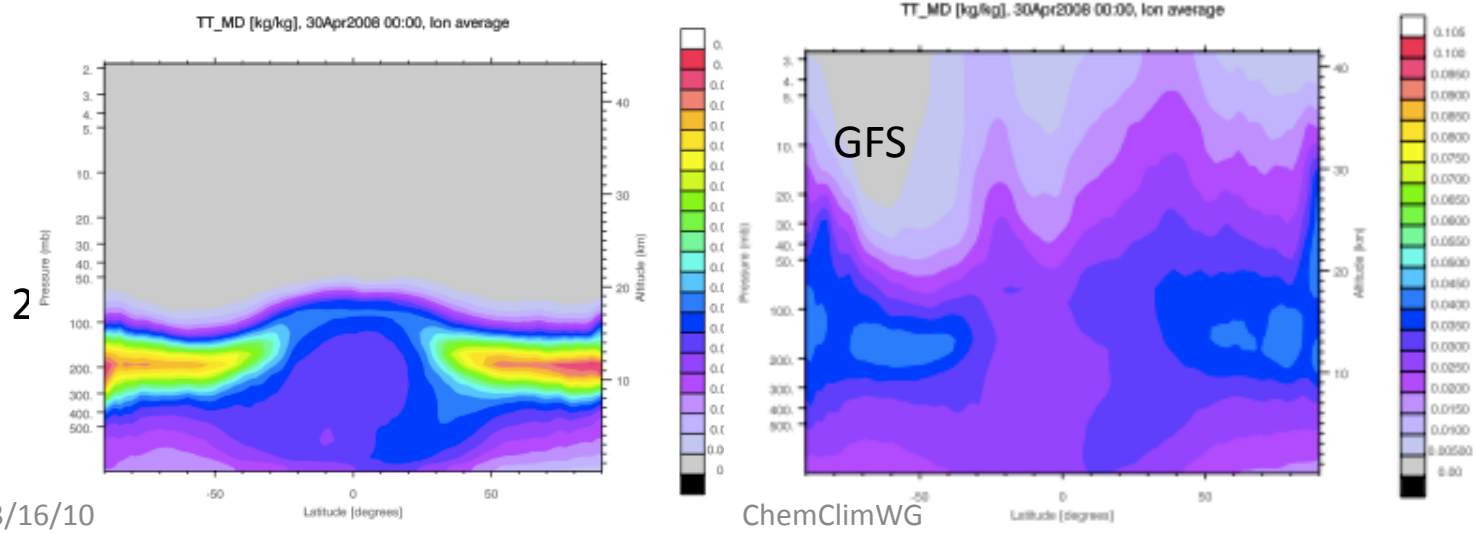
RECENT DEVELOPMENTS

Offline wind tests

- GEOS5.1 linear interpolation: override every miter time step
- GFS linear interpolation: override every miter time step



100hPa



200hPa

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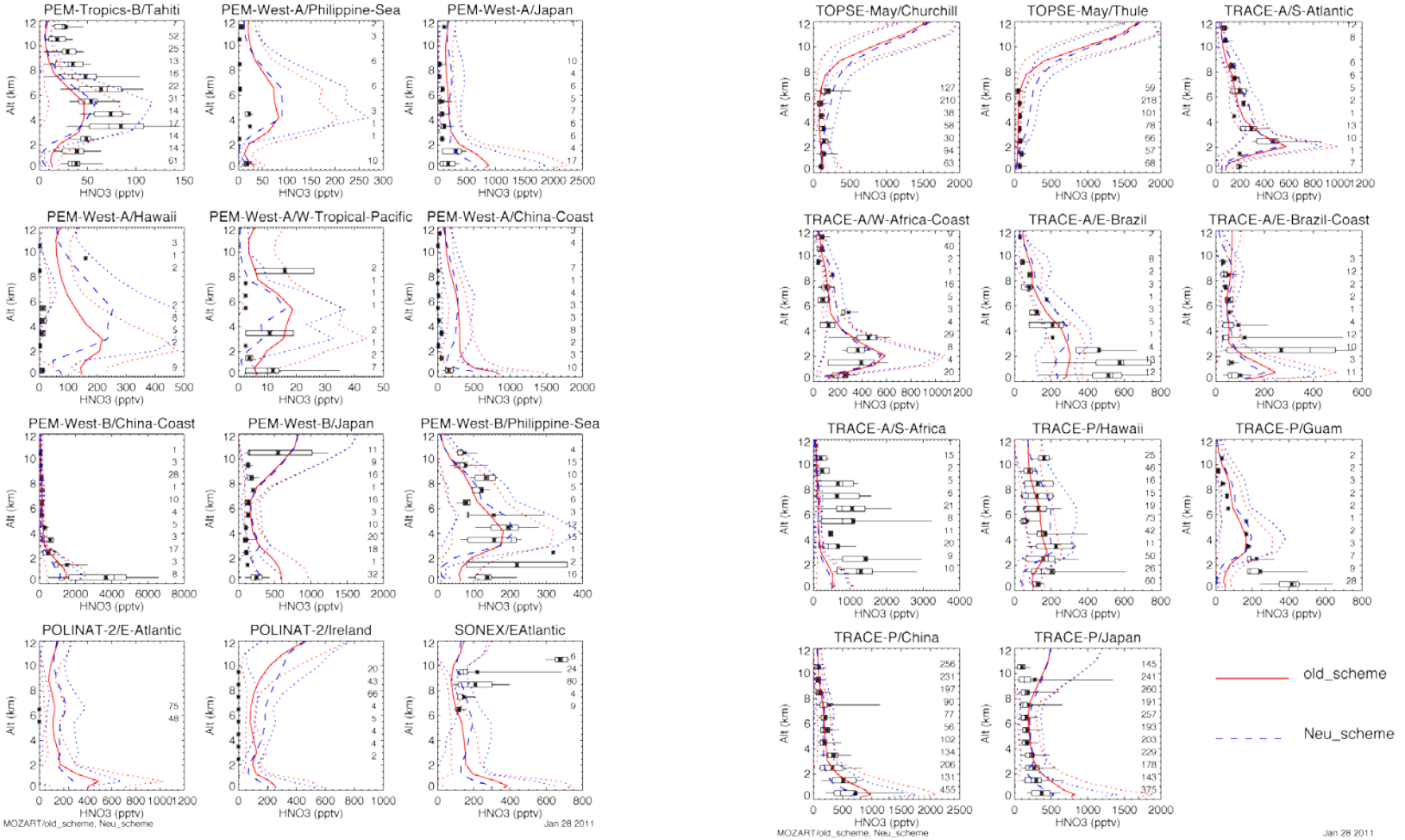
Code updates

- Master lists for wetdep and drydep
- Time-varying stratospheric climatologies from WACCM runs
- Aircraft/Satellite & local time output
- Addition of cycle_yr parameter for all datasets
- Addition of photolysis for wavelengths < 200 nm (overhead column)
- New representation of stratospheric aerosols
- Neu wet removal (finalizing)

HNO3


PEM-Tropics-B/Tahiti
PEM-West-A/Philippine-Sea
PEM-West-A/Japan
PEM-West-A/Hawaii
PEM-West-A/W-Tropical-Pacific
PEM-West-A/China-Coast
PEM-West-B/China-Coast
PEM-West-B/Japan
PEM-West-B/Philippine-Sea
POLINAT-2/E-Atlantic
POLINAT-2/Ireland
SONEX/EAtlantic
TOPSE-May/Churchill
TOPSE-May/Thule
TRACE-A/S-Atlantic
TRACE-A/W-Africa-Coast
TRACE-A/E-Brazil
TRACE-A/E-Brazil-Coast
TRACE-A/S-Africa
TRACE-P/Hawaii
TRACE-P/Guam
TRACE-P/China
TRACE-P/Japan
Alt (km)
HNO3 (pptv)
old_scheme
Neu_scheme
MOZART/old_scheme, Neu_scheme
Jan 28 2011

Mechanism updates

- HCN and CH3CN in MOZART mechanism (103 species) + other minor updates (reaction rates, additional species for isoprene oxidation + JPL-06)
- MOZART+STRAT: 133 species (includes Cl_y)
- NO_x tagging available in MOZART+STRAT
- Update to JPL-09 underway

Emissions

- MOZART mechanism
  - 1992-2010: L. Emmons
  - RCP emissions (2000-2100): M. Val Martin (CSU)
- Reduced NMHCs
  - 1850-2000
  - RCPs: 2000-2100

Remaining issues

- Too much ozone in the high Northern latitudes in free running CAM-chem (possibly due to much too low H_2O) with trop_mozart
- Low OC/BC lifetimes: change was made to aerosol wet removal and tuning may have to be redone
- Too much NO_y in lower stratosphere in MOZART-strat: maybe denitrification issue

Updated web site

- Need list of publications
- Highlights?

Timeline for release

- May 15 is the plan date for a significant CESM release
- Will release
  - MOZART mechanism
  - MOZART-strat mechanism
  - Reduced NMHCs + strat?
  - Offline version
- Results will be documented in a GMD paper

After May 15

- Update to MEGAN
- Coupling with MAM
- Fully-coupled CESM simulations
- Improvements to the dry deposition (better link with CLM)
- “Coarse resolution” FV
- HOMME dynamical core and CAM5 physics next 18 months
- ?