Chemistry-Climate Working Group

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Agenda

- 1:30-1:35: Welcome
- 1:35-1:50: Model updates and release and CAM-chem paper (J.-F. Lamarque, NCAR)
- 1:50-2:15: Simulations and evaluation (L. Emmons/D. Kinnison/S. Tilmes, NCAR)
- 2:15-2:30: Hindcast activities (P. Hess, Cornell)
- 2:30-2:45: Methane simulations in CESM using emissions (S. Bhattacharyya, P. J. Cameron-Smith and D. Bergmann, LLNL)
- 2:45-3:00: Methane lifetime in CMIP5 simulations (A. Fiore, GFDL)

- 3:00-3:30: Break

- 3:30-3:45: Biogenic VOC Emissions in CESM (C. Heald, CSU)
- 3:45-4:00: Tropospheric sulfate burdens as a consequence of stratospheric sulfate geoengineering (J. English, CU)
- 4:00-4:15: GeoMIP simulations with CCSM and CESM (S. Tilmes/NCAR)

- 4:15-5:00: General discussion

New release CESM 1.0.3 (June 15)

- Tested and analyzed specified dynamics version of CAM-chem is now released, along with GEOS5 and MERRA datasets

- Full tropospheric chemistry (MOZART-4 + small updates)

- Full tropospheric + stratospheric chemistry (Addition of WACCM chemistry, including updated PSCs)

- Emissions 1992-2010

- Wet removal from J. Neu (JPL) and M. Prather (UC Irvine)

- Updated photolysis lookup table

- Satellite/aircraft/station output capability

- CAM-chem paper to be submitted to Geoscientifc Model Discussions in a few weeks.

  Very large effort since April by L. Emmons, D. Kinnison, S. Tilmes and F. Vitt

Specified dynamics

- Full overwrite of U,V, T, PS

- Use SHFLX, LHFLX, TAUX and TAUY

- Tracer tests indicated the superiority of GEOS products when used in fv CAM-chem

4 Tracer Runs

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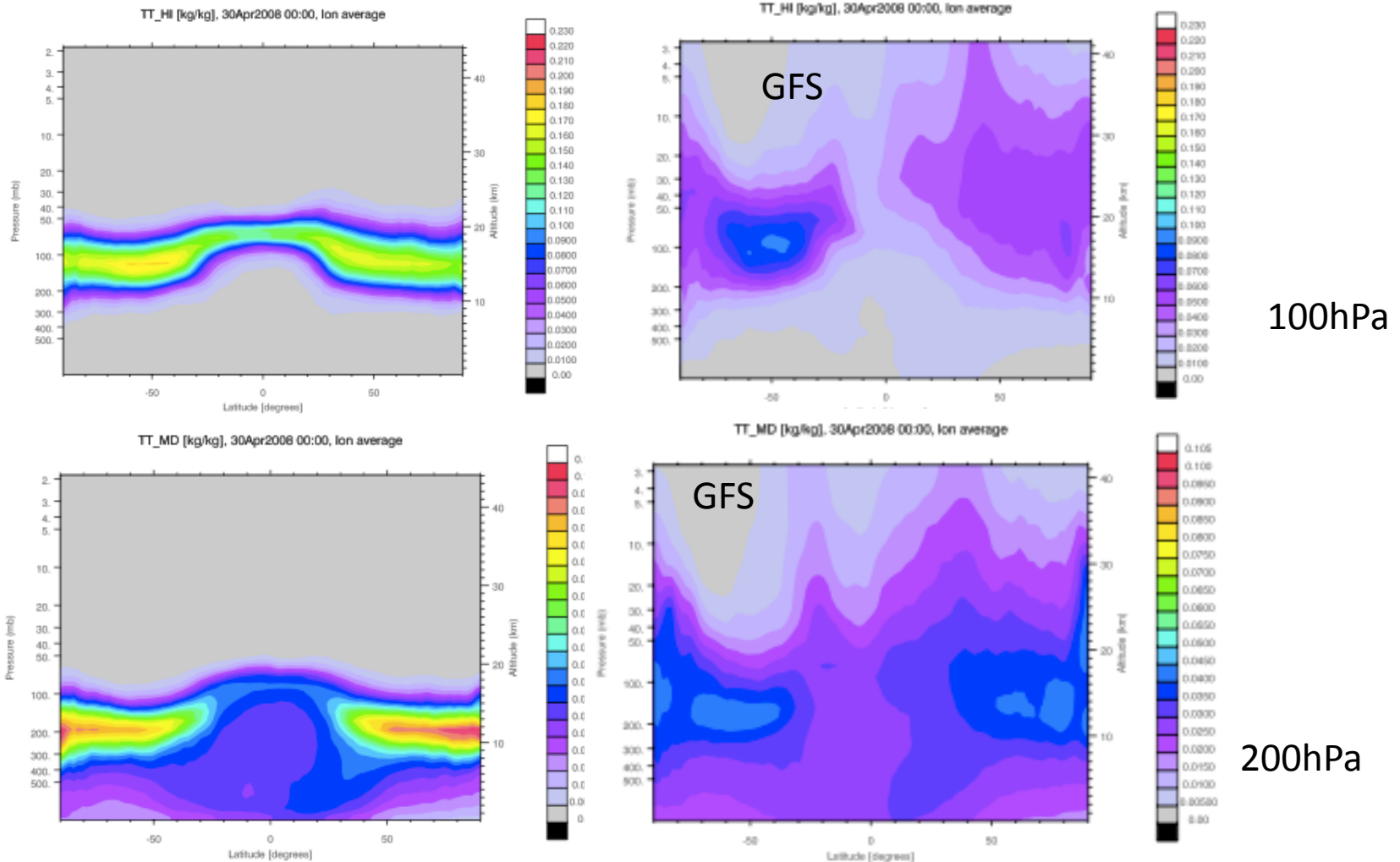
GEOS5/MERRA

- Processed from original resolution (0.5-degree) to 1.9x2.5 and all files are available on ESG
  - MERRA: 1979-present
  - GEOS5:2004-present
- Continued processing and upload to ESG
- All original files are kept to provide other resolutions if needed

Update to photolysis

- Inclusion of wavelengths < 200 nm in all calculations

- Addition of O2 and O3 layer above model top
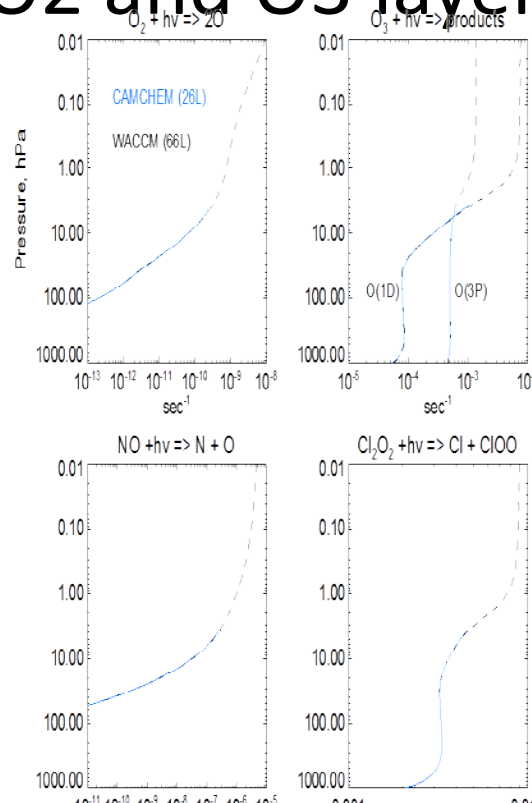
Wet removal

- Better representation of water cycle and consequent uptake to water droplet
- Follows vertical path of precipitation throughout the column
- Henry's law driven (no adjustment necessary)

Blue: Horowitz et al.
Red: Neu and Prather
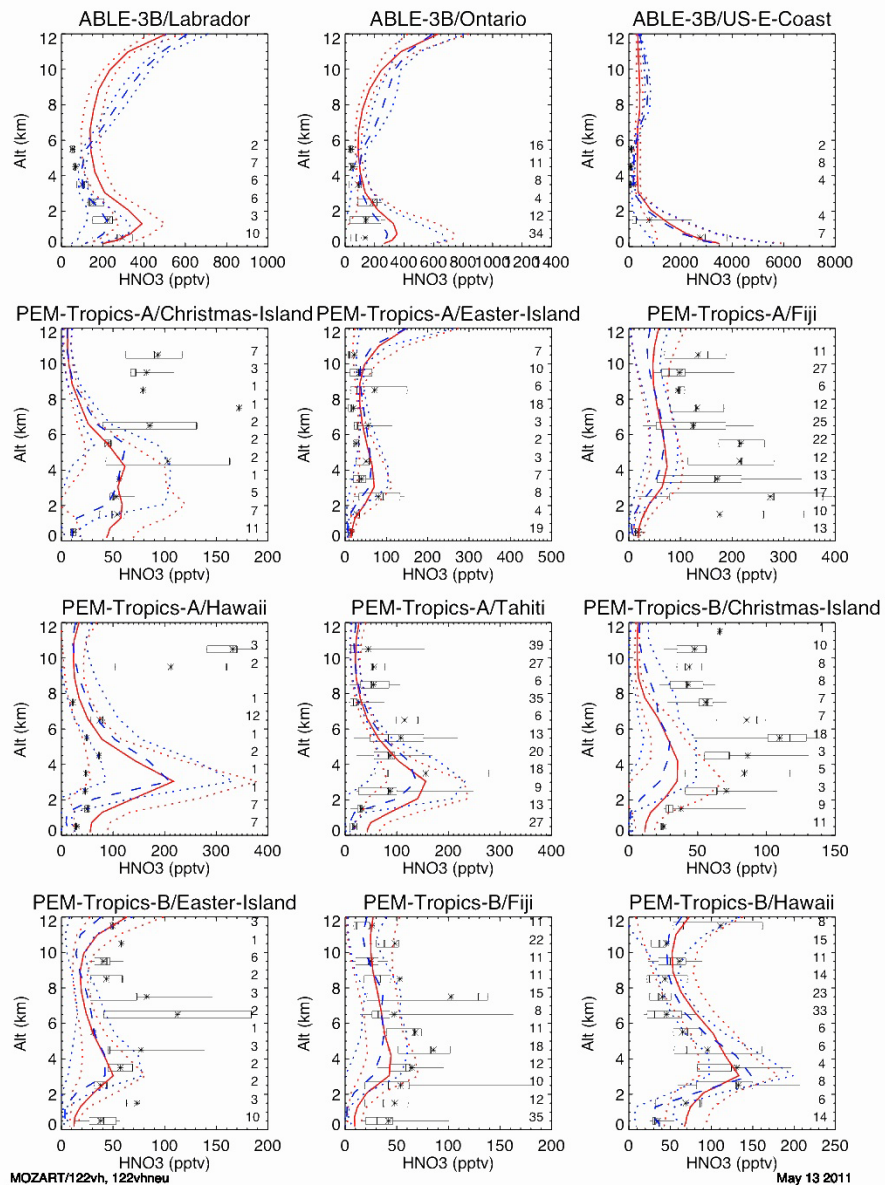
Update to stratospheric chemistry

- CAM3.5 simulations performed for CCMval showed significant underestimate of Antarctic ozone hole extent

- Inclusion of Bry and Cly tracers for better conservation under advection

Simulations

- 1991-2010: online stratosphere-troposphere
- 1997-2010: offline MERRA
- 2004-2010: offline GEOS5

➢All simulations at 1.9x2.5

➢Vertical resolution (26 or 52 levels), all to 3hPa

Comparisons

- Ozonesondes
- Surface CO
- Aircraft campaigns
- Total ozone column
- Stratospheric observations
- Aerosols

Ozonesondes (profiles)
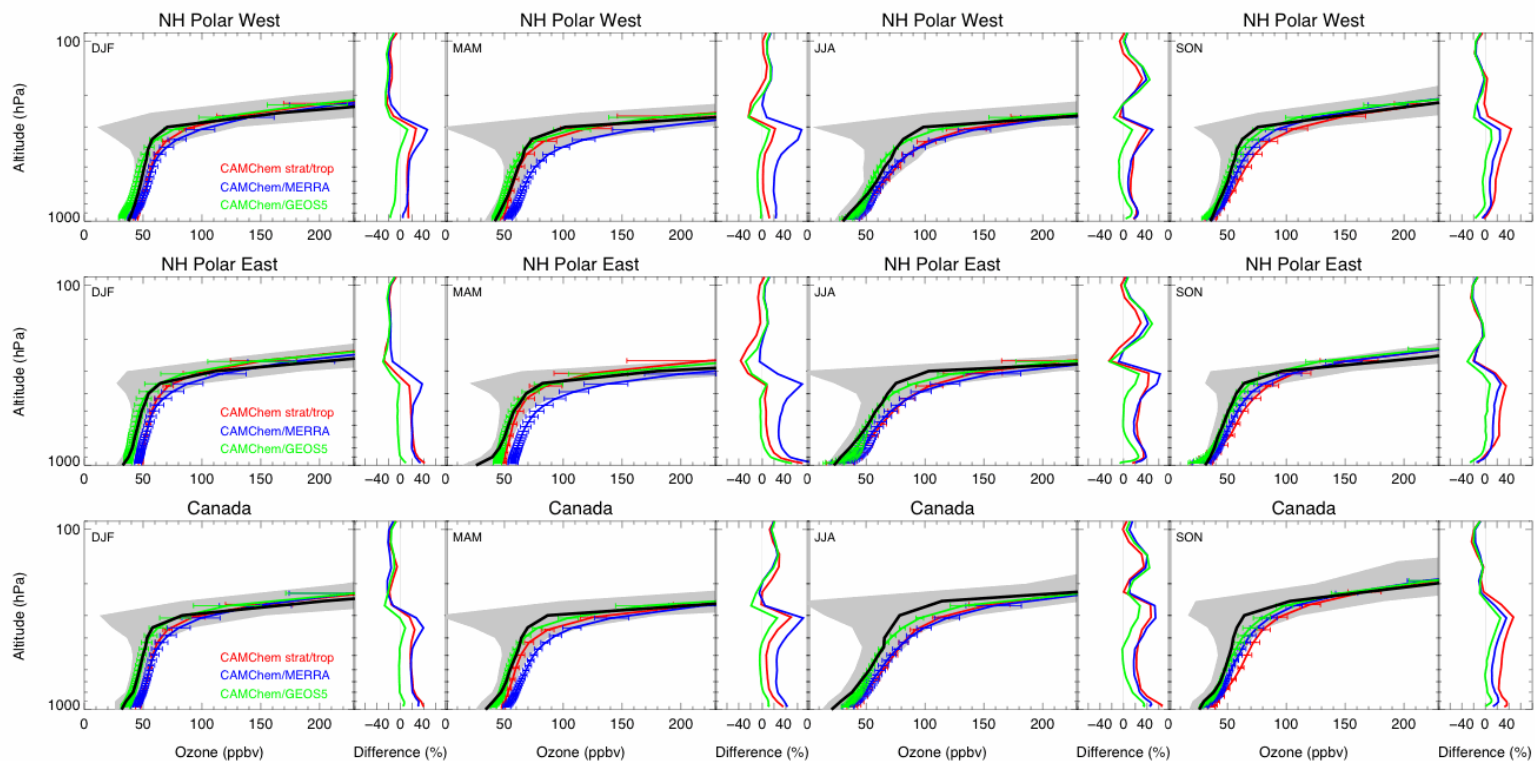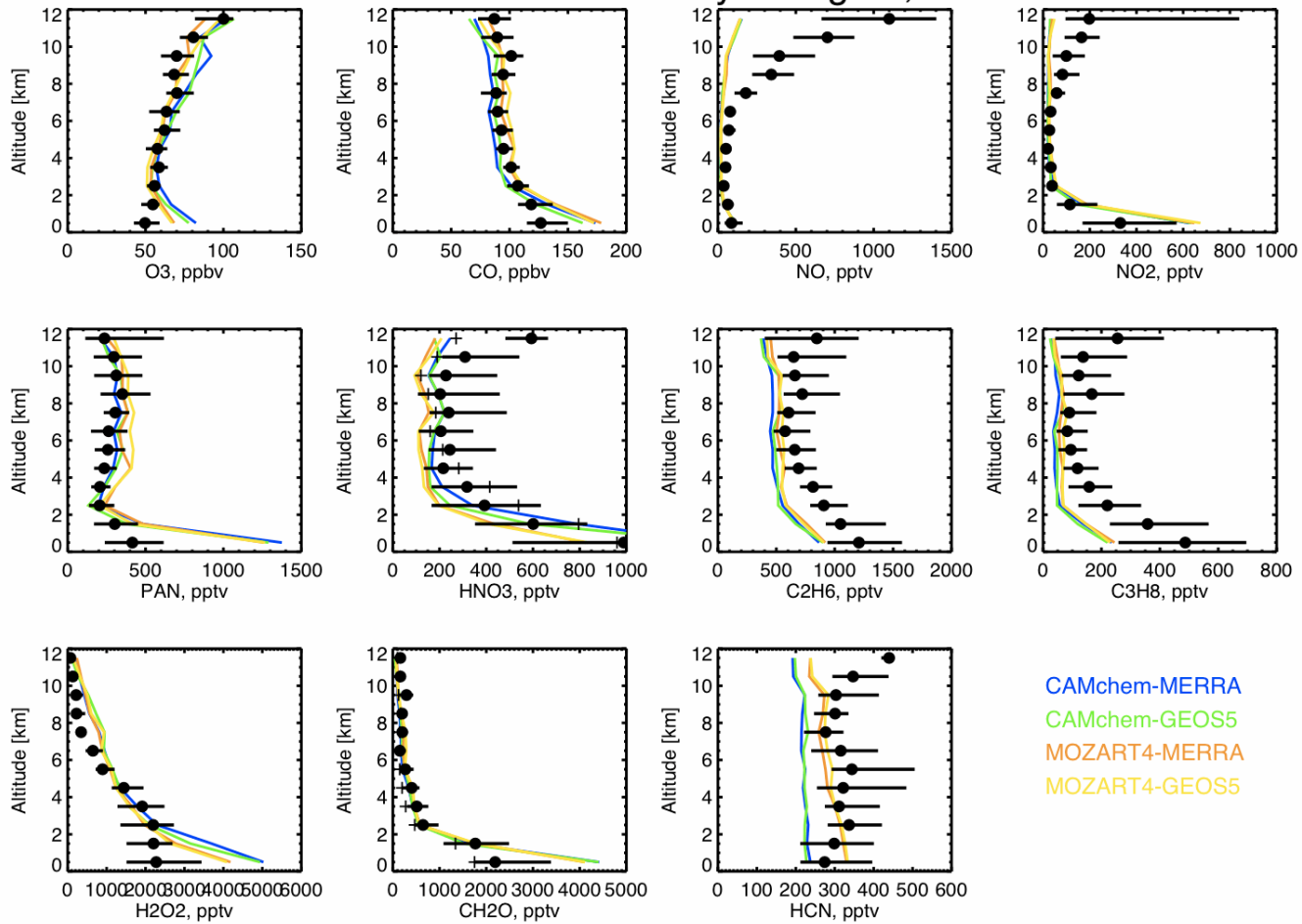
Ozonesondes (profiles)
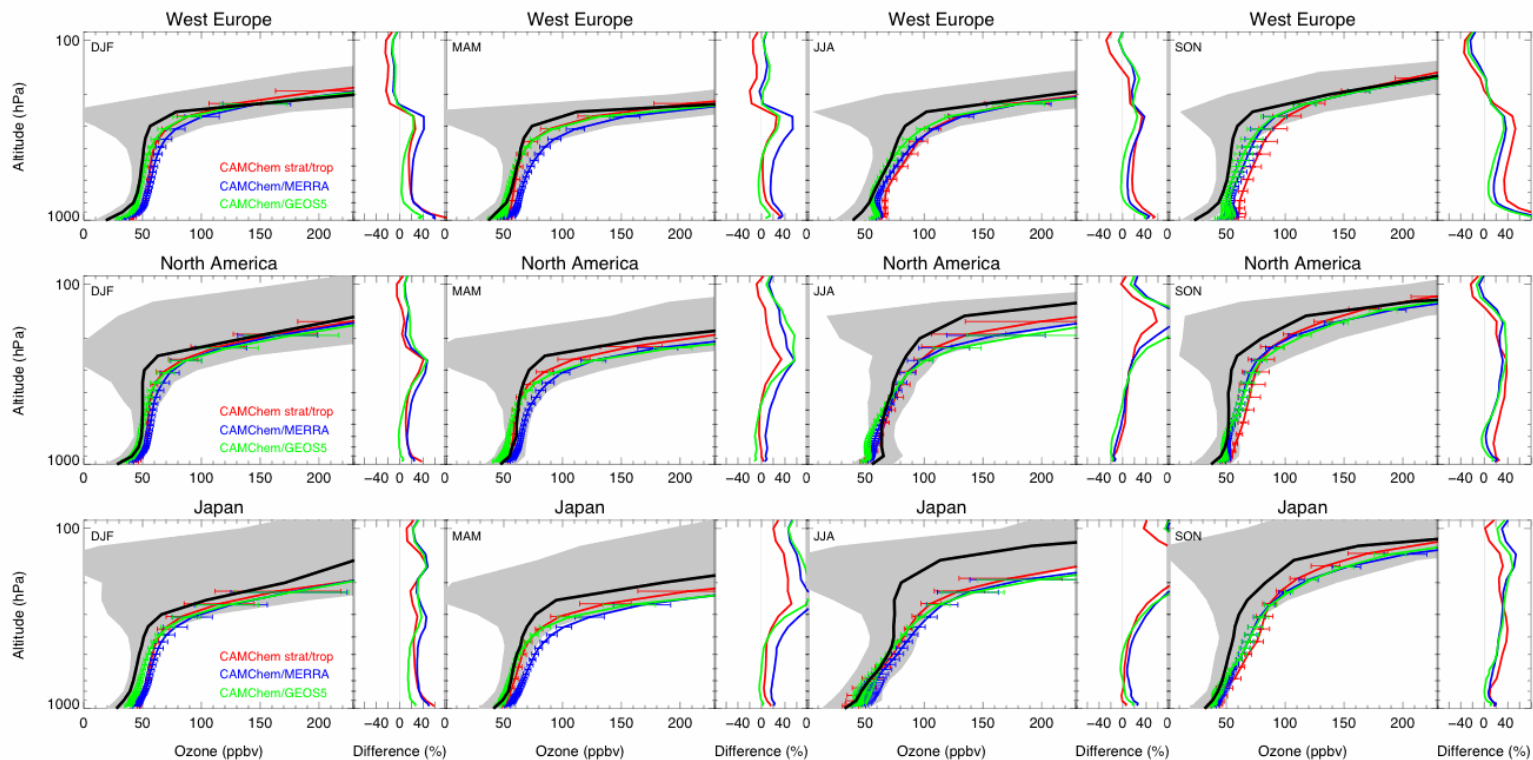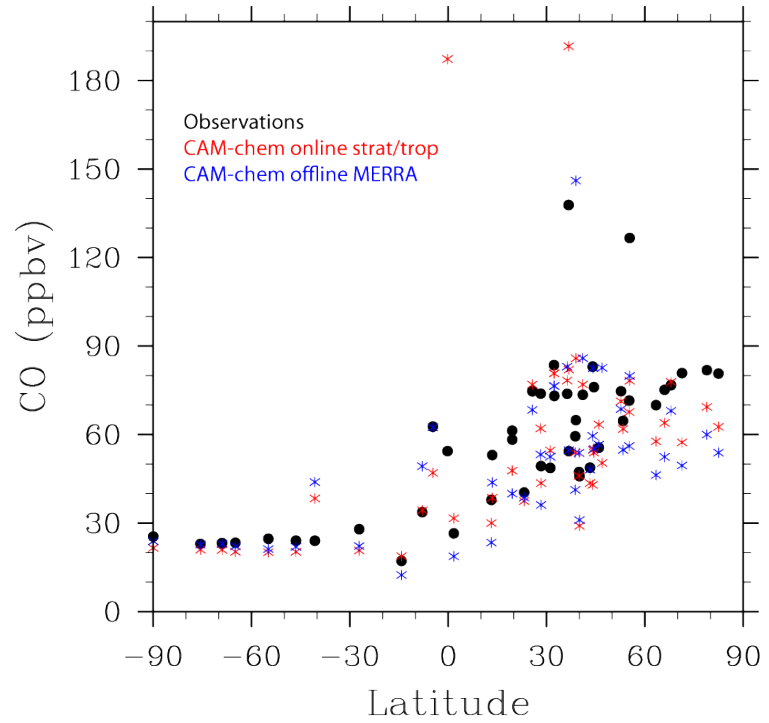
Ozonesondes (profiles)
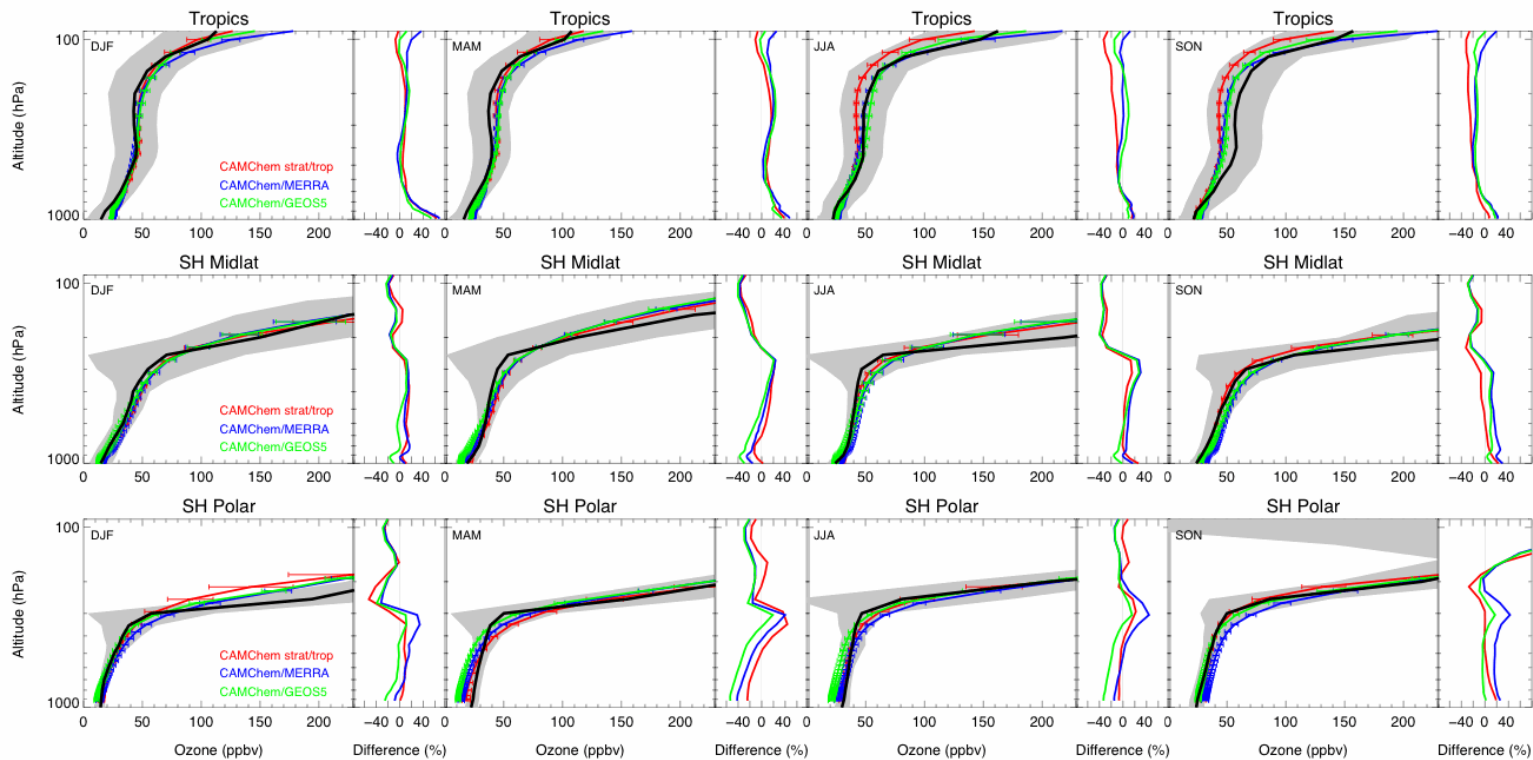
Ozonesondes (seasonal cycle)
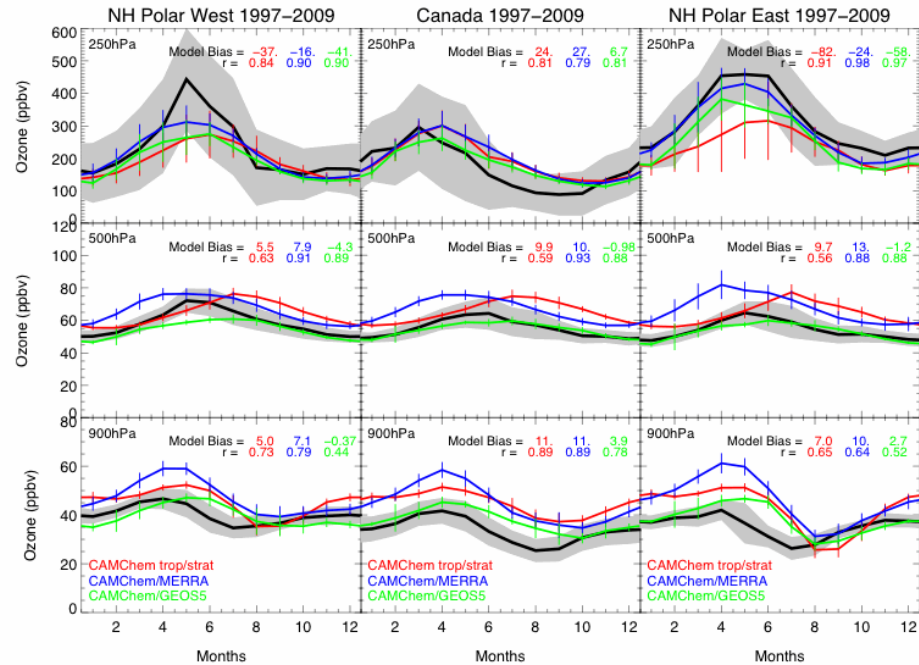
Aircraft

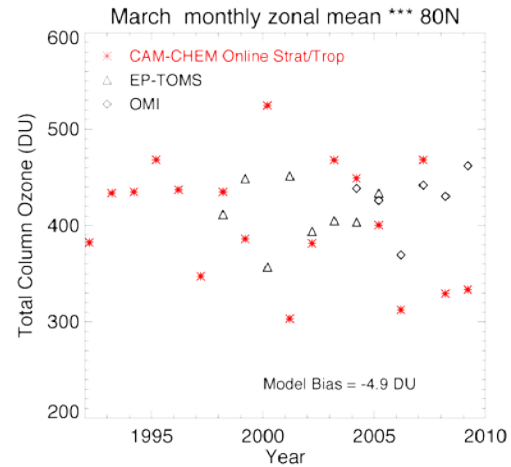INTEX-A Central US July 6-Aug 14, 2004
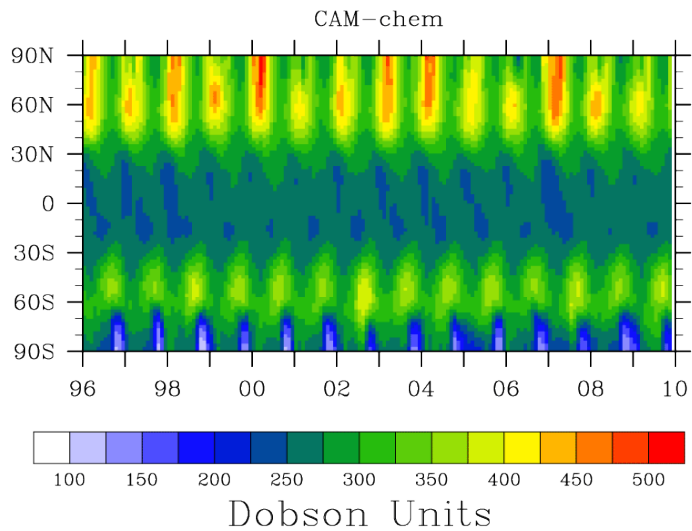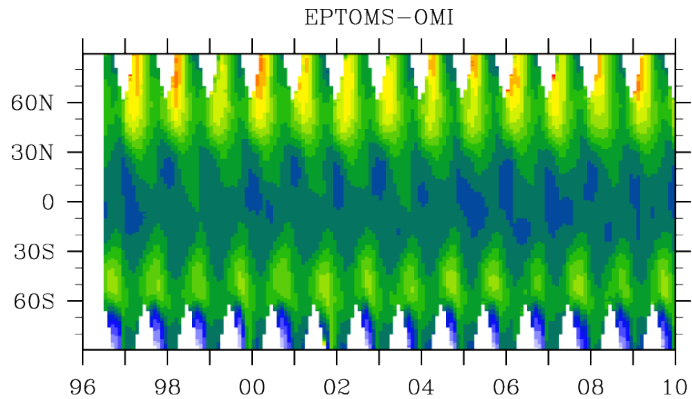
CAMchem-MERRA
CAMchem-GEOS5
MOZART4-MERRA
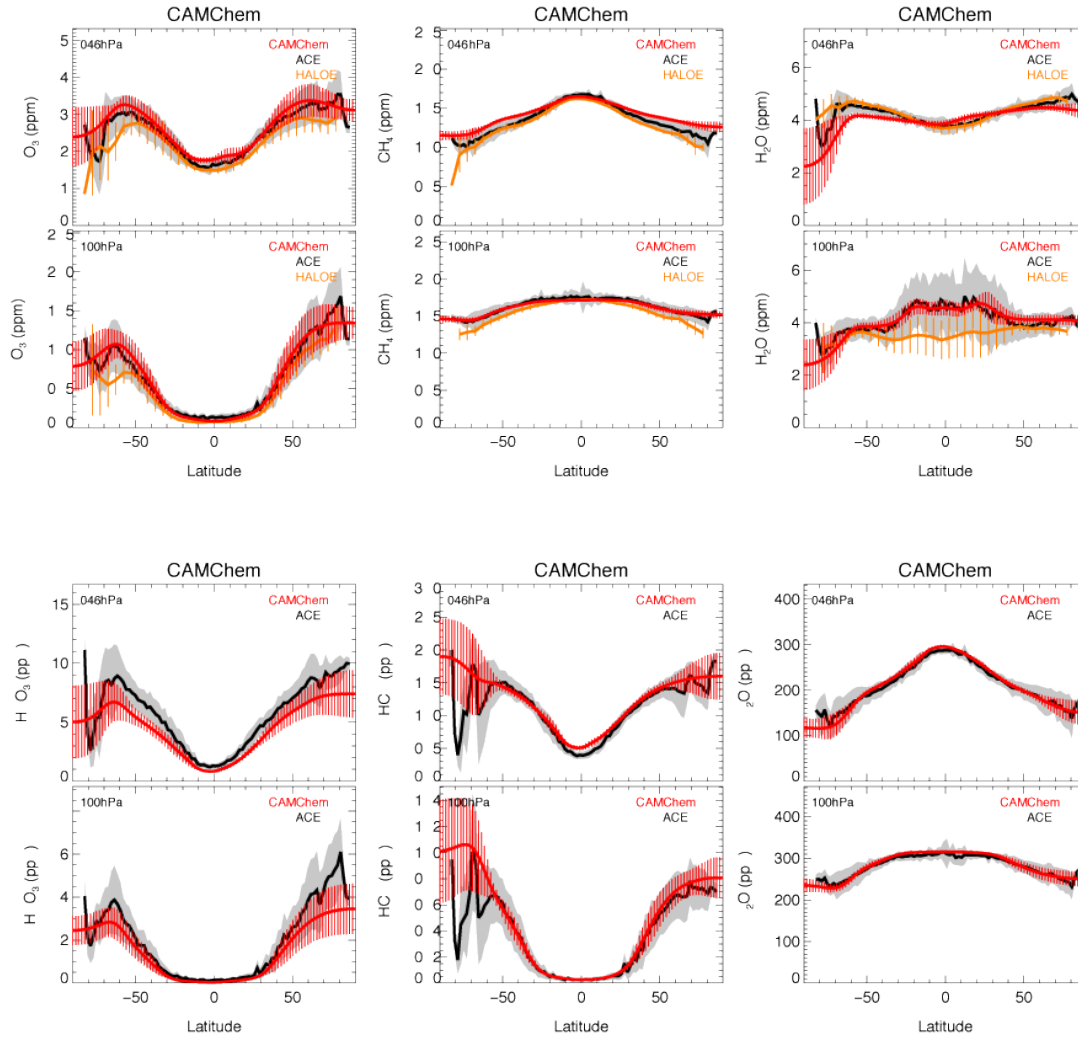MOZART4-GEOS5

Surface CO
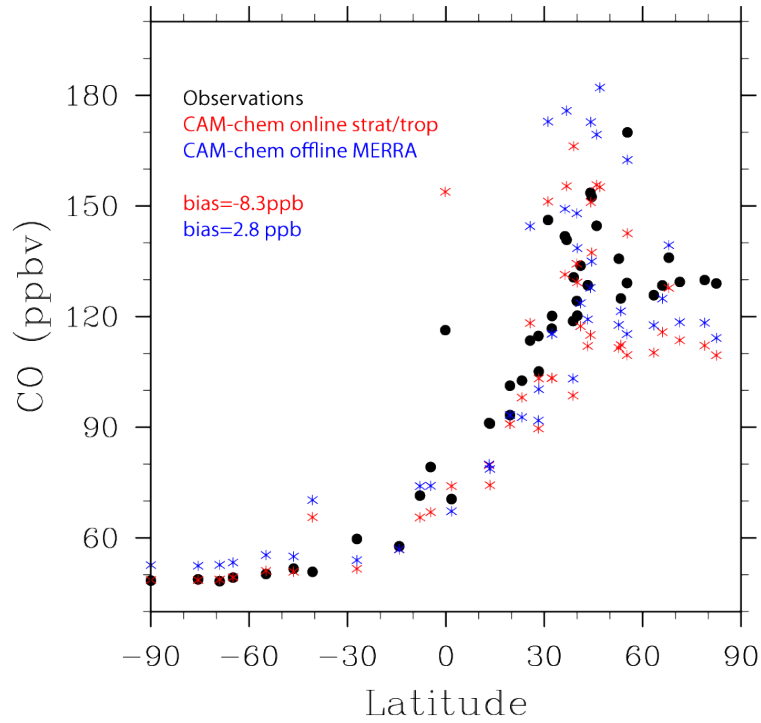
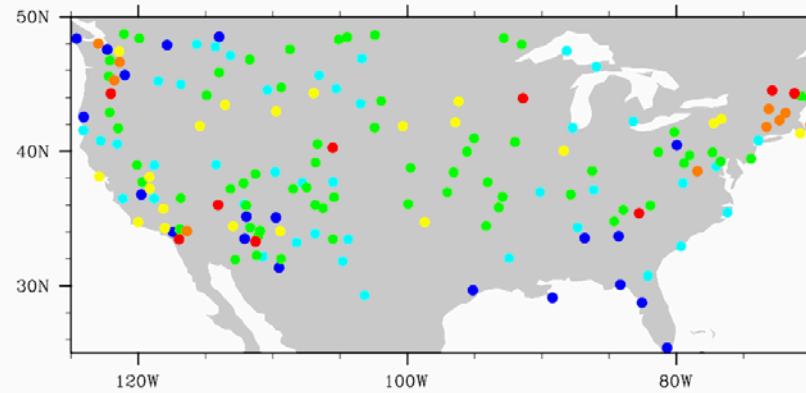Annual mean

Seasonal cycle

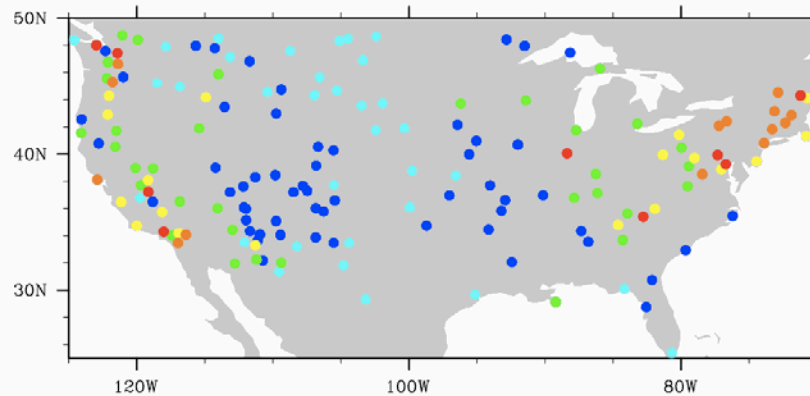# Total ozone column
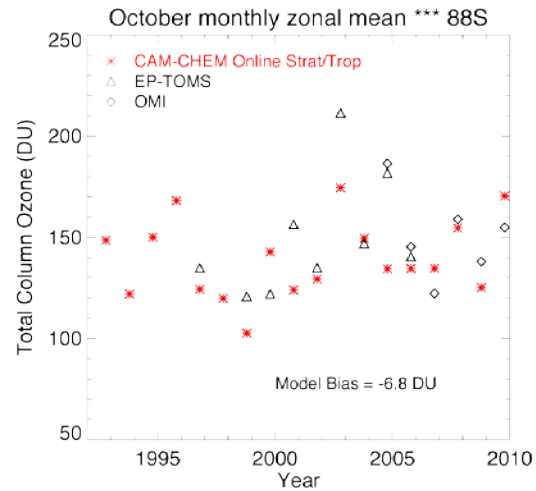
Stratosphere

Aerosols (IMPROVE)

EC

OC

ChemClim Development Plan

- Top Priority
  - Update to MEGAN/include maps when possible
  - Improvements to the dry deposition (better link with CLM)
  - Coupling chemistry with MAM and CAM5 physics
  - HOMME dynamical core

- Medium Priority
  - Update SOA mechanism: Colette Heald's additional SOA species
  - Implementation of FAST-J photolysis rate computation

- Low Priority
  - "Coarse resolution" FV

- Diagnostics:
  - Tools for model result differencing
  - Benchmark numbers: methyl chloroform lifetime, ozone budget terms, methane lifetime, mass-weighted tropospheric OH, lightning NOx, sf(co/nox/isoprene)

  - Things coming up:
  - fires in CLM (public release summer 2012)
  - Methane wetlands (sooner)
  - Soil nitrogen (later)
  - SOA mechanism (LLNL)
  - Aerosols from MAM in fast-j
  - FAST-J vs RRTM photolysis