POLMIP
POLARCAT Model Intercomparison

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POLARCAT

Polar Study using Aircraft, Remote Sensing, Surface Measurements and Models, of Climate, Chemistry, Aerosols, and Transport

Many aircraft campaigns in Arctic in Spring and Summer 2008

- NASA ARCTAS (Alaska – April; Canada – June, July)
- NOAA ARCPAC (Alaska – April)
- DOE ISDAC (Alaska – April)
- CNRS (Kiruna – April, Greenland – July)
- DLR-GRACE (Kiruna – April, Greenland – July)
- YAK (Siberia – July)

Satellite and surface measurements also

Mission Goals:

Spring: Arctic haze, long-range transport of pollution to Arctic, stratospheric influence

Summer: Biomass burning

Models

- MOZART-4/GFS & GEOS5 (NCAR, L. Emmons)
- CAM-chem/GEOS5 (NCAR, S. Tilmes)
- TOMCAT/ECMWF (Leeds, S. Arnold)
- CAM-chem/ECMWF (Leeds, S. Arnold)
- LMDZ-INCA (LATMOS-IPSL, S. Turquety & K. Law)
- GEOS-chem (Harvard-Princeton, J. Mao)
- GMI (NASA Goddard, B. Duncan)
- STEM (U. Iowa, G. Carmichael)
- WRF-chem (PNNL, J. Fast)
- MACC (ECMWF, J. Flemming)
- TM5 (KNMI, V. Huijnen)

Same emissions used by all models for this activity

POLMIP Motivation and Goals

HTAP model simulations show poor agreement to Arctic surface measurements

The numerous aircraft measurements of POLARCAT hopefully will help identify model limitations and how to improve them

Focus on ozone chemistry and precursors, transport pathways, biomass burning

Meeting in 2 weeks

Multi-model assessment of pollution transport to the Arctic: D. T. Shindell et al.
ACP, 2008

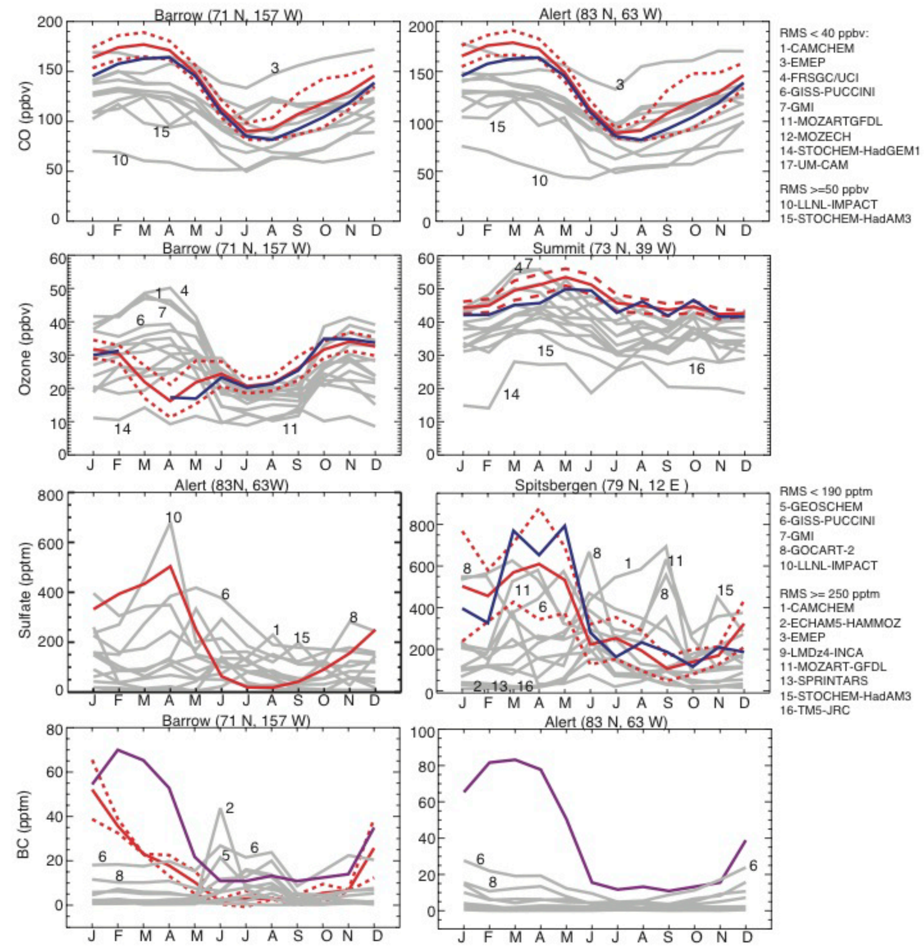


Fig. 7. Observed and modeled seasonal cycles of trace species surface concentrations at the indicated Arctic sites. Model results in all panels are in grey. Plots for CO (top row) and ozone (second row) show observations from the NOAA Global Monitoring Division, with 1992-2006 means and standard deviations in red (except for Summit O_3, which is 2000–2006) and 2001 in blue. Sulfate plots (third row) show observations from Alert during 1980-1995 (left) and from the EMEP site in Spitsbergen during 1999-2005 in red, with 2001 Spitsbergen data in blue. BC data (bottom row) are from the IMPROVE site at Barrow during 1996-1998 (red), and from Sharma et al. (2006) for both Barrow and Alert using equivalent BC over 1989-2003 (purple). Models are listed by RMS error scores to the right of each row using the groupings discussed in the text. Models that are separated from others are labeled with the numbers as in the text at right (or Table 1).

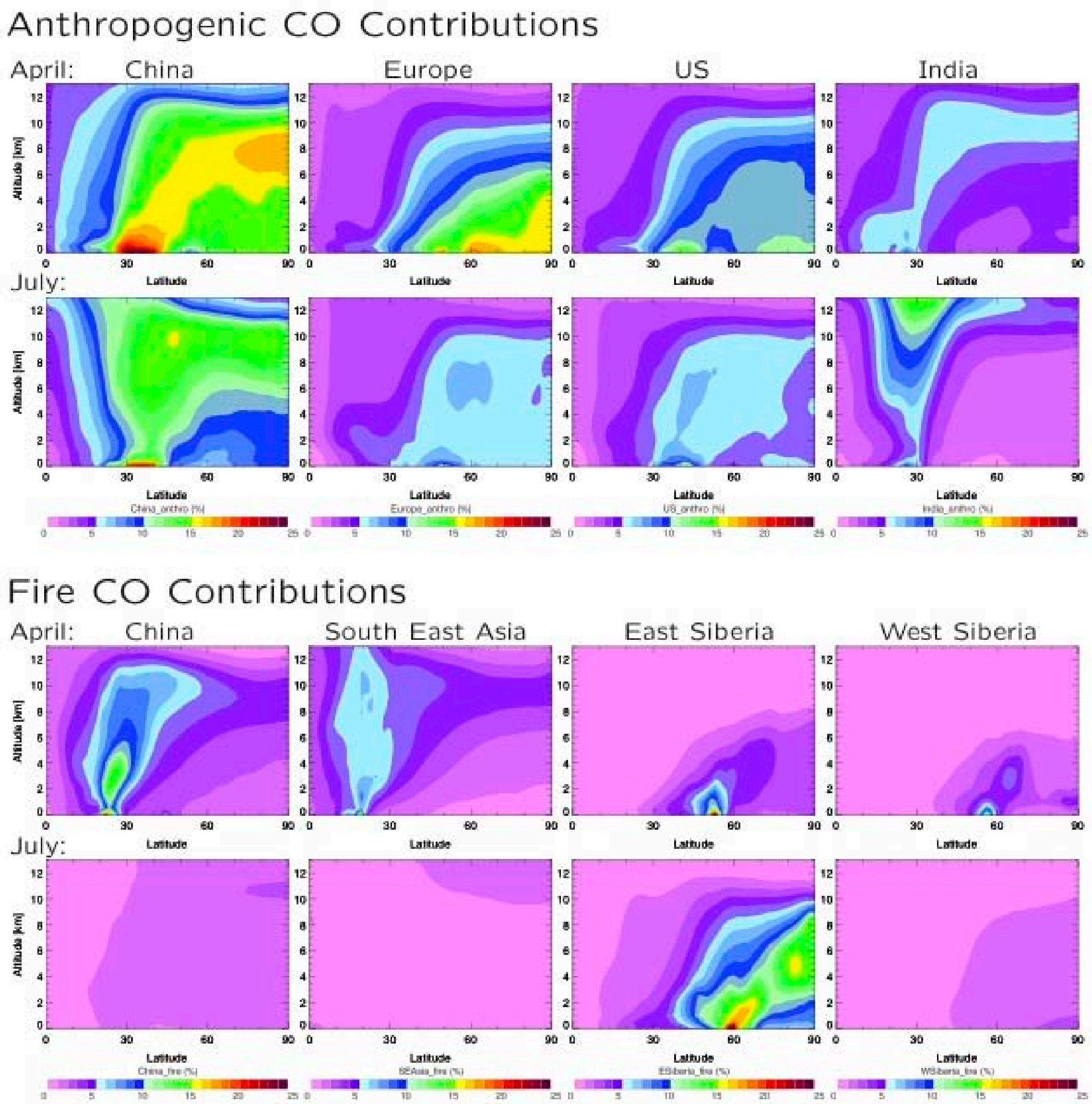


Fig. 14. Zonally averaged vertical distribution of the relative CO anthropogenic and fire contributions for different source regions (see Fig. 3) for the Northern Hemisphere in April and July 2008 calculated by MOZART-4.

Tilmes et al., ACPD, 11, 5935–5983, 2011

Comparison of
MOZART-4/GFS/FTUV (2.8°x2.8°) and
CAM-chem (trop_mozart) / GEOS5 / LUT (1.9°x2.5°)
to ARCTAS NASA DC-8 observations

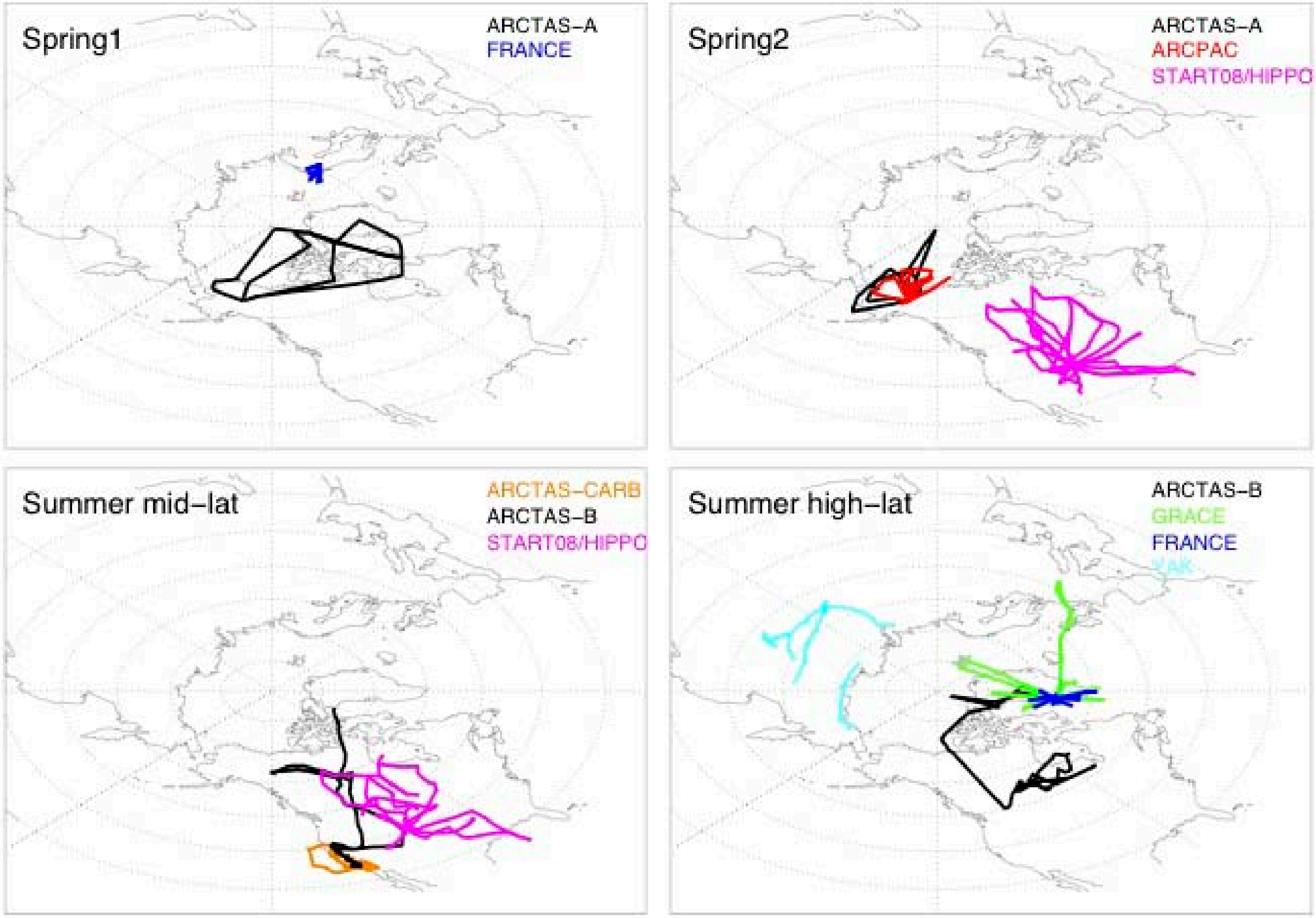
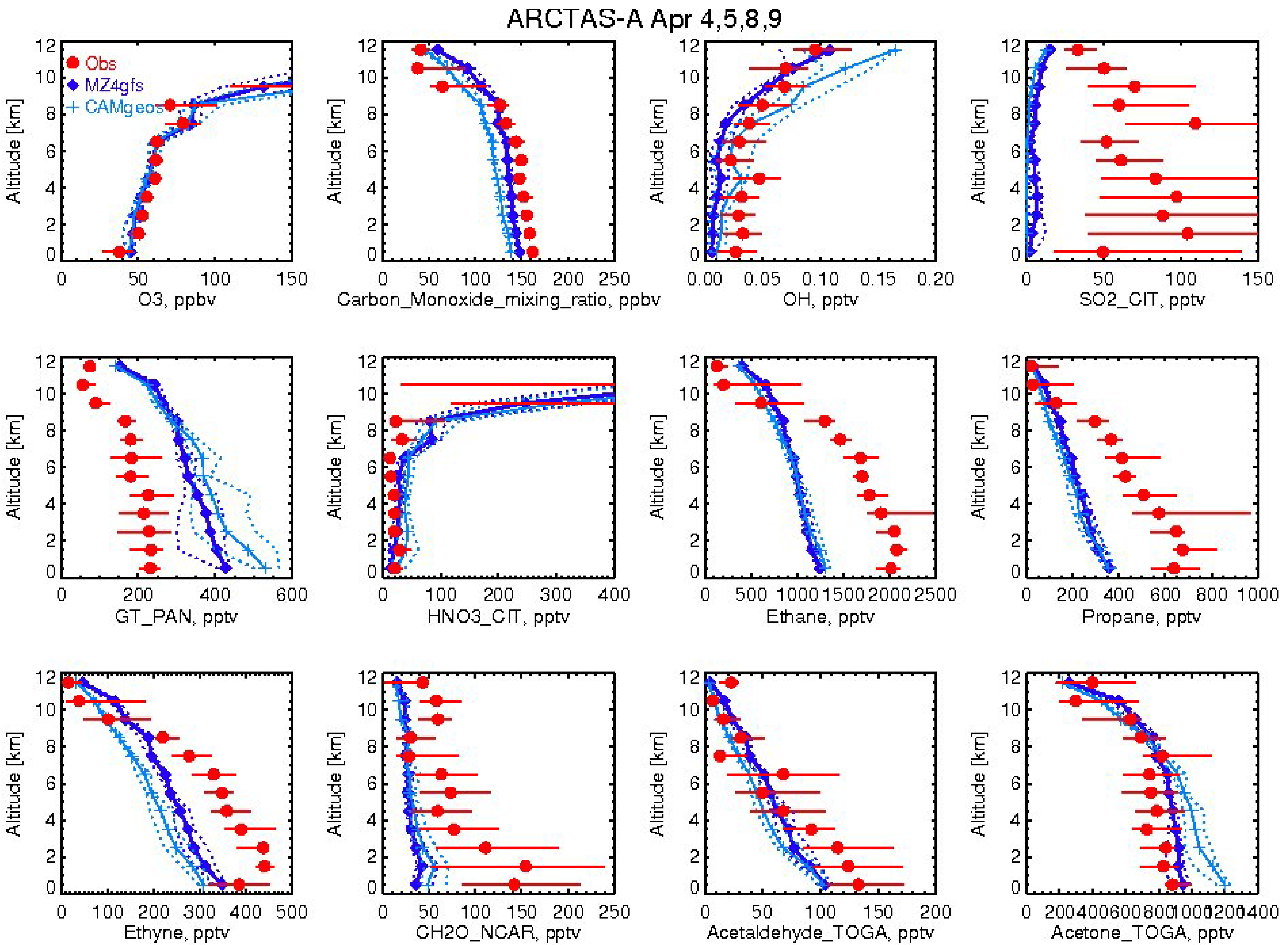


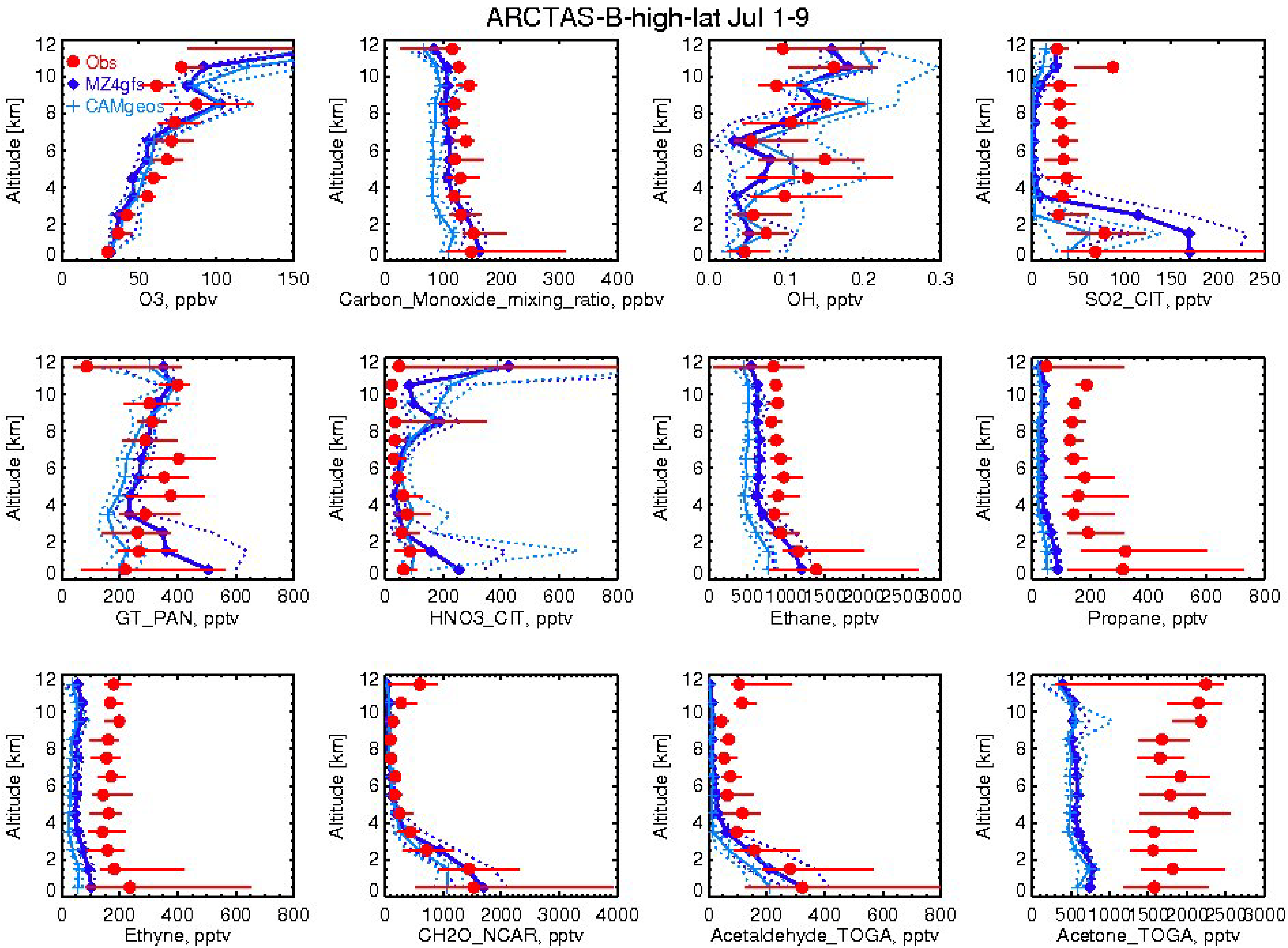
Fig. 1. Spacial coverage of the aircraft observations included in this study between April and July 2008. Aircraft data grouped with regard to mission, location and timing (as described in Table 1) are shown in different colors.

Tilmes et al., ACPD, 11, 5935–5983, 2011

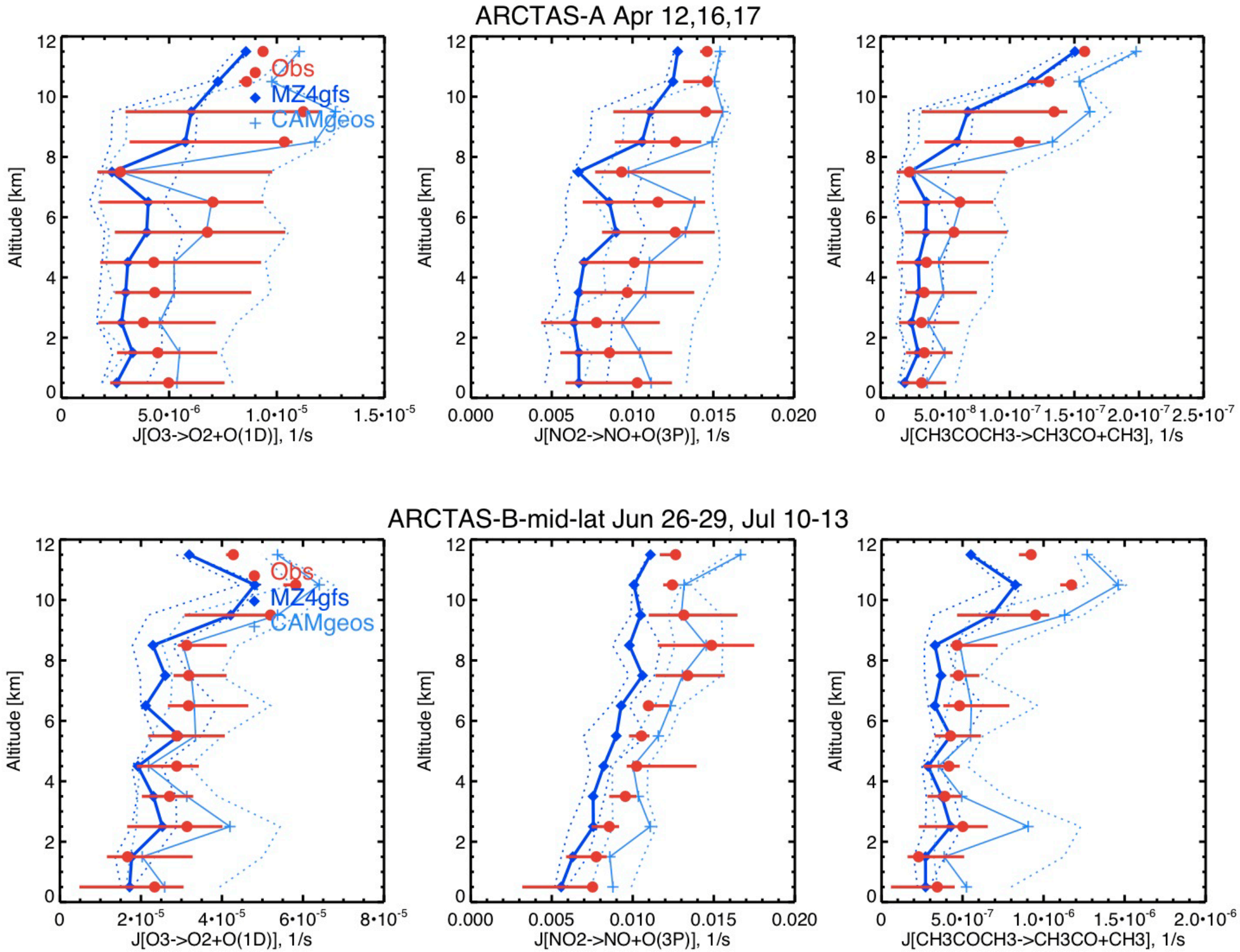
DC-8 Flights between Alaska and Greenland



DC-8 Flights over Canada and Greenland



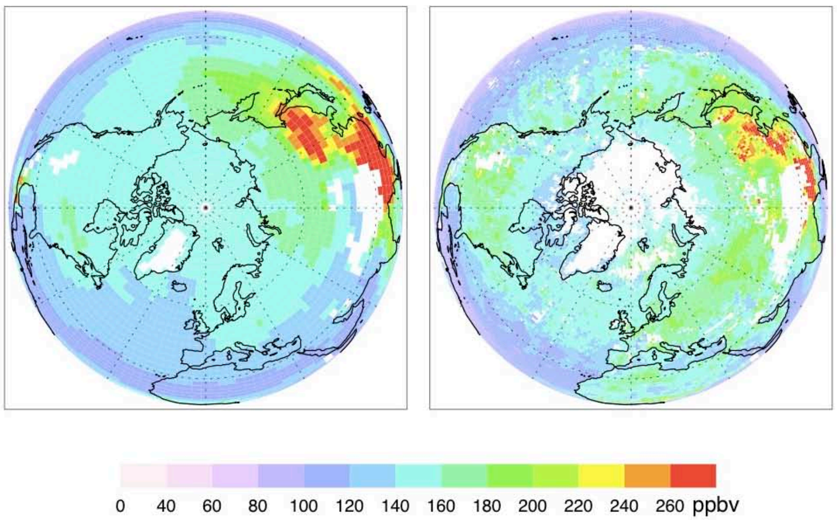
Model photolysis rates compared to TUV calculations from actinic flux measurements



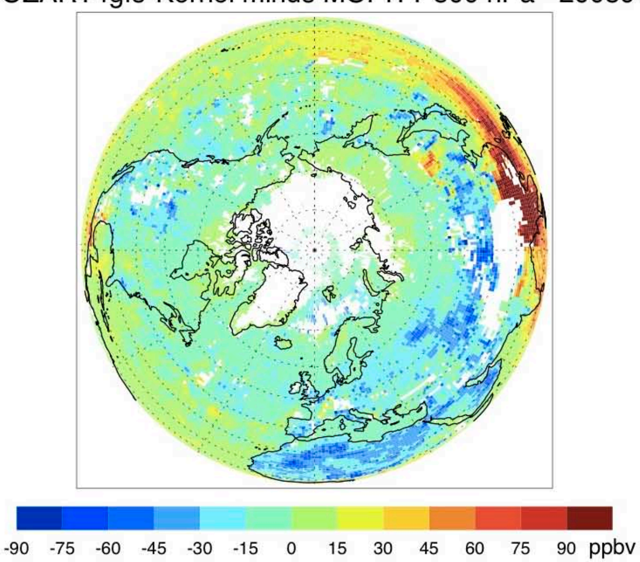
MOPITT – 800 hPa

MOZART-4/GFS April 2008

MOZART4gfs800 hPa 200804 MOPITT-V4/L3 800 hPa 200804

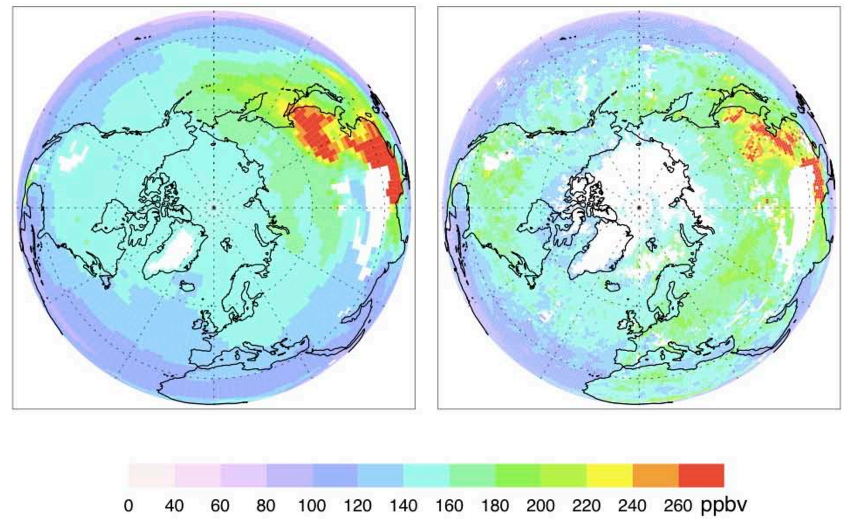


MOZART4gfs*Kernel minus MOPITT 800 hPa - 200804

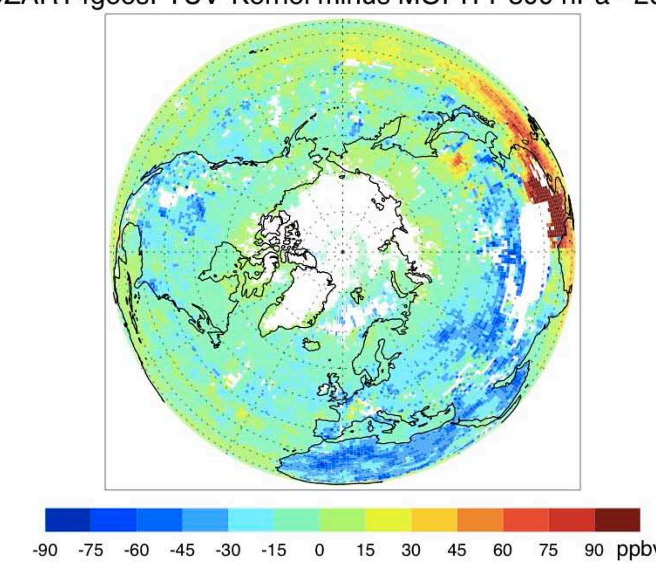


MOZART-4/GEOS5 April 2008

MOZART4geosFTUV800 hPa 200804MOPITT-V4/L3 800 hPa 200804

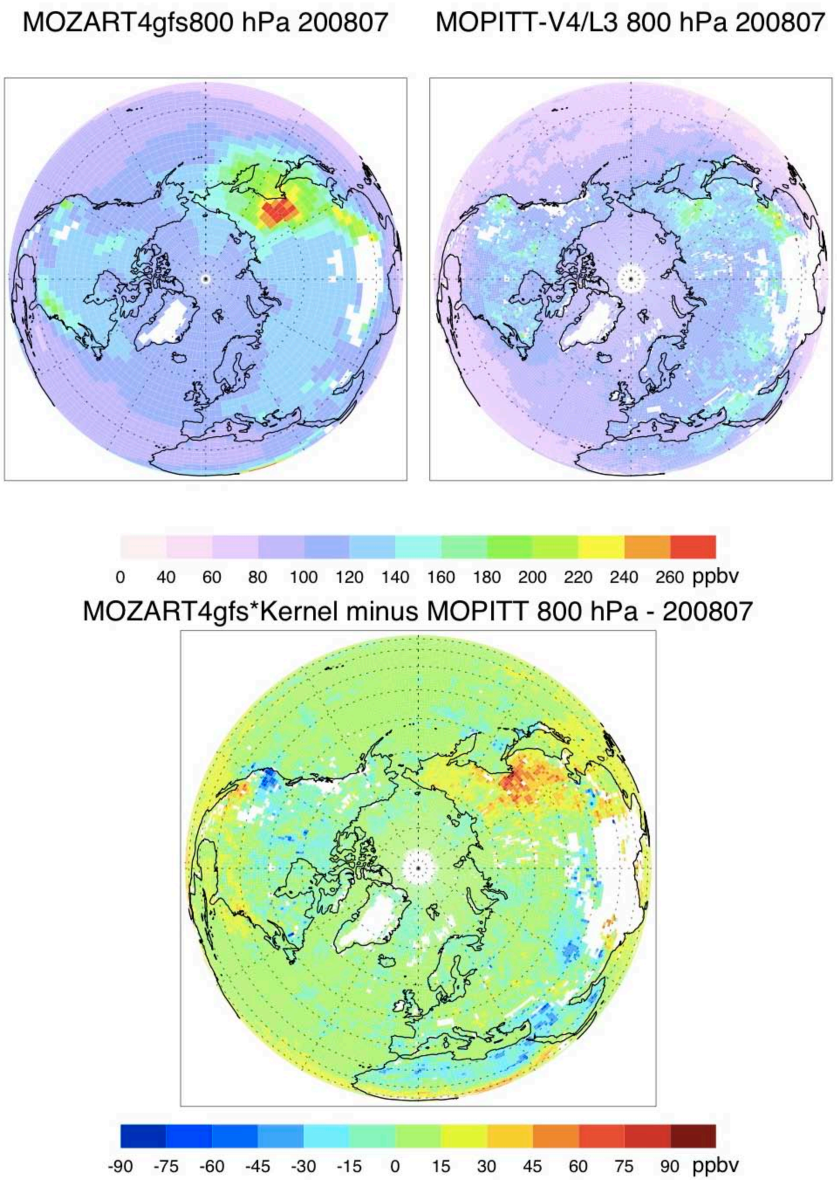


MOZART4geosFTUV*Kernel minus MOPITT 800 hPa - 200804

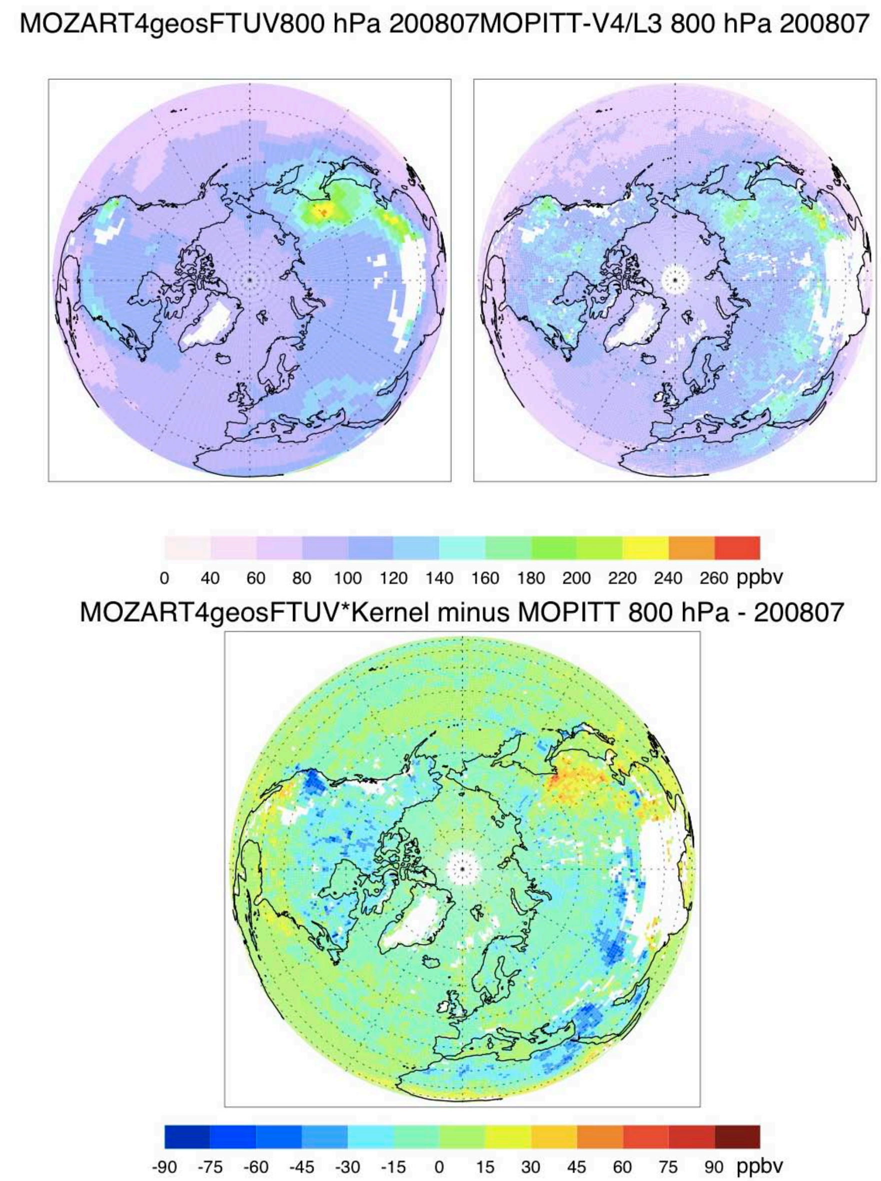


MOPITT – 800 hPa

MOZART-4/GFS July 2008

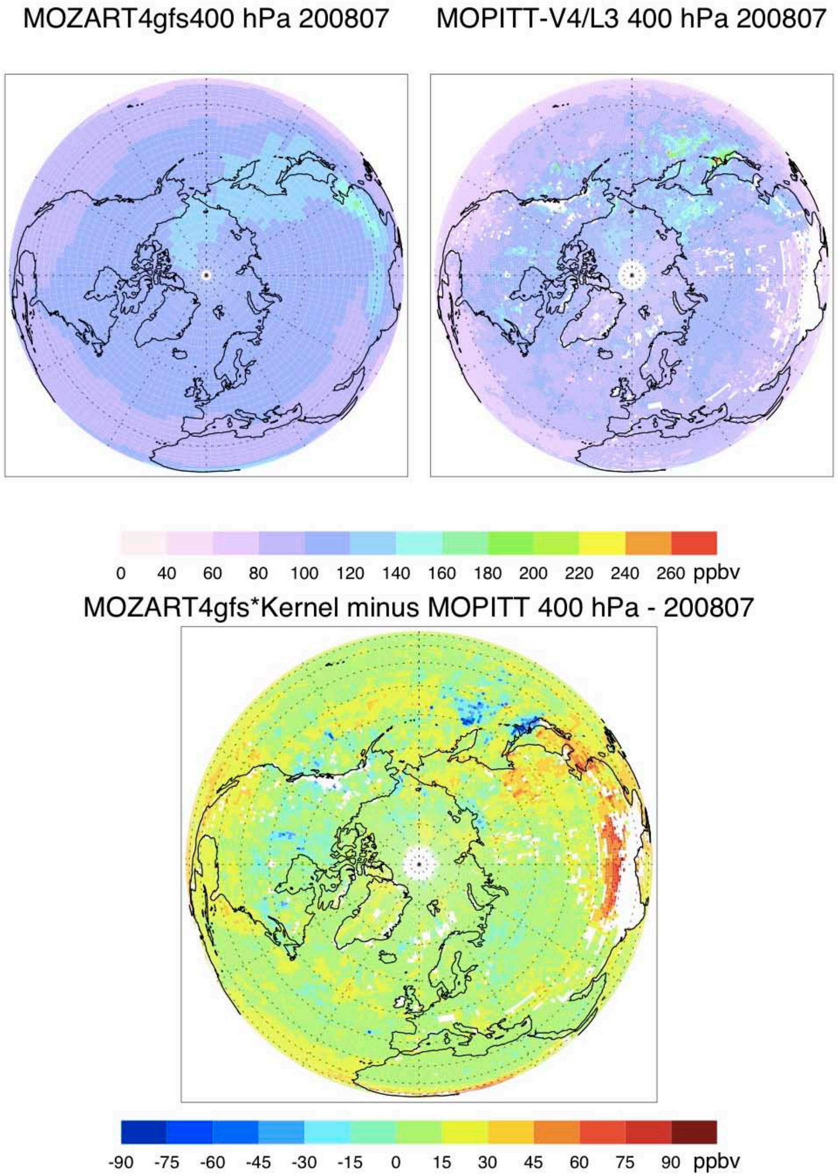


MOZART-4/GEOS5 July 2008

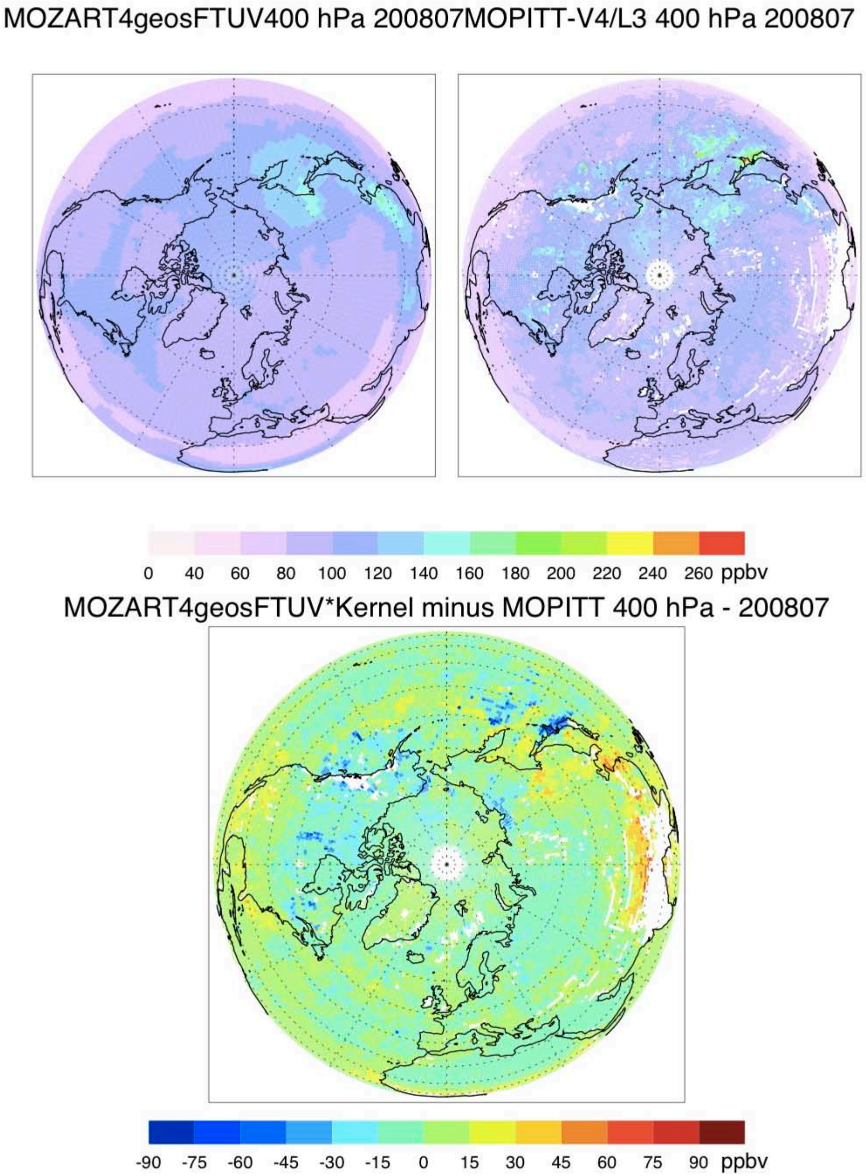


MOPITT – 400 hPa

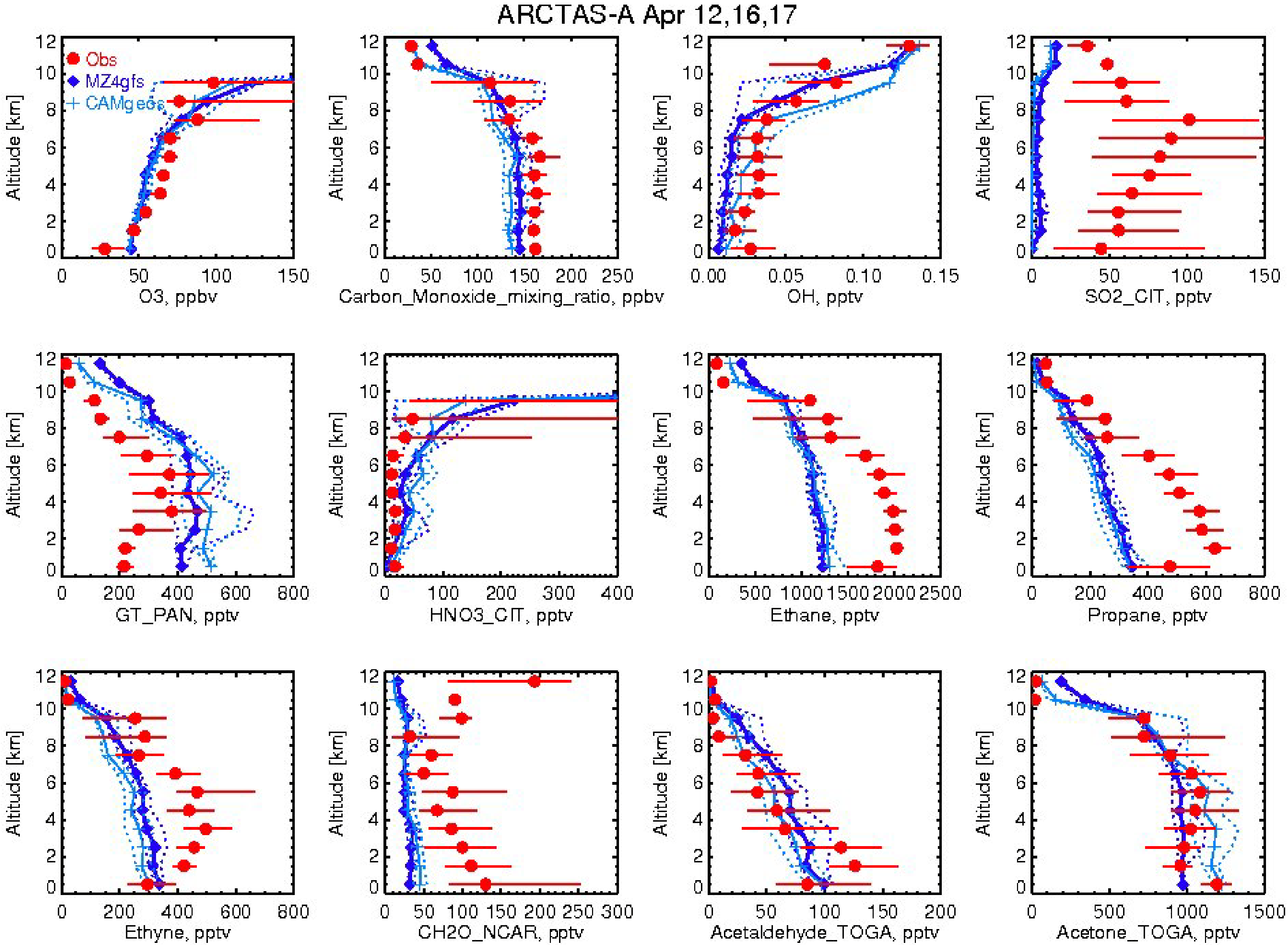
MOZART-4/GFS July 2008



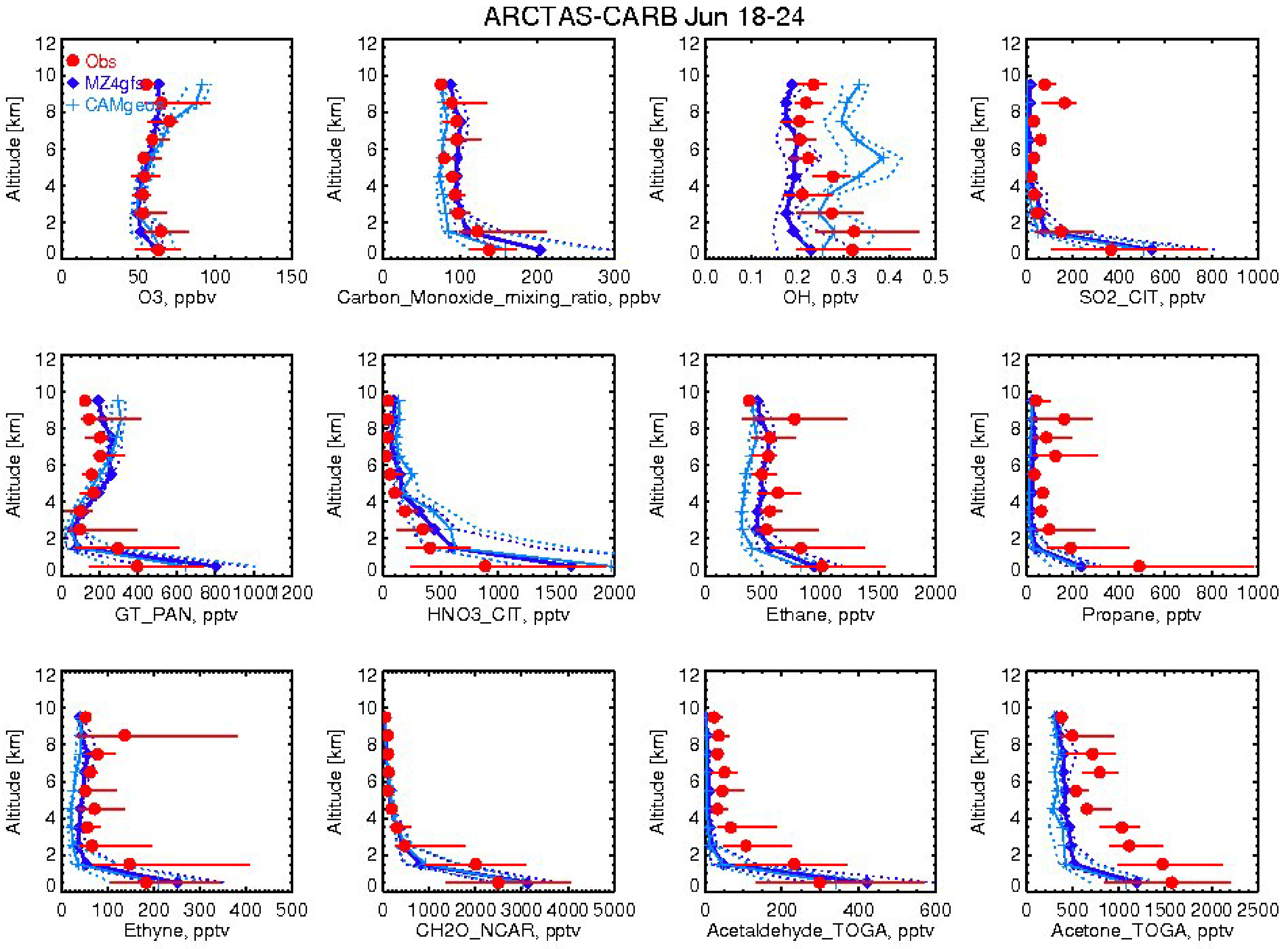
MOZART-4/GEOS5 July 2008



DC-8 Flights over Alaska and northward



DC-8 Flights over California



DC-8 Flights over Canada, near fires