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GOMOS measurements of O_3, NO_2 and NO_3 compared to specified-dynamics WACCM simulations

E. Kyrölä (1), M. E. Andersson (1), P. T. Verronen (1), M. Laine (1), D. R. Marsh (2), and A. K. Smith (2)
(1) Finnish Meteorological Institute, Earth Observation, Helsinki, Finland (erkki.kyrola@fmi.fi), (2) National Center for Atmospheric Research, Boulder, Colorado, USA

The Global Ozone Monitoring by Occultation of Stars (GOMOS) instrument on board the European Space Agency's ENVISAT satellite measured 880 000 stellar occultations during 2002–2012. From UV-Visible and IR spectra of the horizontal transmission vertical profiles of O_3, NO_2 and NO_3, H_2O, O_2 and aerosol extinction can be retrieved. In addition two 1 kHz photometers at blue and red wavelengths make it possible to retrieve high resolution temperature profiles as well as gravity wave and turbulence parameters. Measurements cover altitude region from the cloud top up to 150 km. Atmospherically valid data are obtained generally in 15–100 km. Profile resolution is 2–4 km.

GOMOS ozone profiles have been successfully validated using ground-based instruments. Ozone and other retrieved data have also been compared to other satellite measurements. The best quality of GOMOS observations is achieved during nighttime, when only few other relevant measurements are available for comparison. High resolution atmospheric models provide an interesting additional possibility for GOMOS measurement comparisons. Here we report results form the comparison with the Whole Atmosphere Community Climate Model (WACCM) from the National Center for Atmospheric Research.

WACCM is a chemistry-climate model spanning the range of altitude from Earth's surface to the thermosphere (approximately 140 km) with 88 vertical levels of variable vertical resolution of 1.1 km in the troposphere to 3.5 km above 65 km. Horizontal resolution is 1.9 deg. in latitude by 2.5 deg. in longitude and the model time step is 30 minutes. In the present analysis version 4 of WACCM was run in 'specified dynamics' mode by constraining dynamical fields to Modern-Era Retrospective Analysis for Research and Applications (MERRA) meteorological reanalyses below 1 hPa. This work utilizes newly developed WACCM variants with improved description of energetic particle precipitation and its middle atmospheric effects.

In this work we show an inter-comparison of GOMOS O_3, NO_2 and NO_3 profiles with the collocated WACCM profiles. Comparisons provide important new quality information about GOMOS trace gas products. They also indicate probable development targets for the future WACCM evolution.