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MOZART stratospheric performance in GEMS

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The MOZART CTM adds detailed stratospheric chemistry of reactive gases to the Global Environmental Monitoring using satellite and in-situ data (GEMS) forecast system. GEMS is a European integrated project with a vision to build an operational forecasting and analysis system for atmospheric composition by 2012 (see http://gems.ecmwf.int). Adequate simulation of the distribution of stratospheric tracers requires above all an appropriate representation of stratospheric meteorology: species concentrations are sensitive to slight variations of wind and temperature and to the degree of isolation of the polar vortex systems. For the Antarctic ozone hole formation, ozone destruction on PSCs plays a crucial role. Finally, the initial chemical state of the simulation should be known as accurate as possible due to the long stratospheric timescales.

We investigate the performance of the MOZART CTM (Kinnison et al. 2007) and of the coupled ECMWF Integrated Forecasting System (IFS)-MOZART model for the GEMS reanalysis period 2003/2004. The coupled IFS-MOZART model exchanges meteorological fields and some species concentrations every hour and contains a module for 4D-VAR assimilation of chemical species. Both models have 60 vertical hybrid levels reaching from the surface to 0.1 hPa. The initial chemical fields of the simulations are obtained by merging MOZART fields with results from the Belgian Assimilation System for Chemical Observations from Envisat (BASCOE) stratospheric CTM. Neither of the two models is able to capture the full depth of the Antarctic ozone holes in 2003 and 2004 respectively as compared to satellite observations. The influence of vortex dynamics and PSC parameterization is discussed as well as the influence of the data assimilation. We also analyse the dependence of the ozone hole results 2003 and 2004 on different initial conditions.

Kinnison, D. E., et al. (2007), J. Geophys. Res, 112, D20302, doi:10.1029/2006JD007879, 2007.