Geophysical Research Abstracts
Vol. 13, EGU2011-5062, 2011
EGU General Assembly 2011

The new linear scheme for stratospheric ozone COPCAT: A good alternative for long-term simulations with global models

Beatriz Monge-Sanz (1), Martyn Chipperfield (1), Daniel Cariolle (2,3), Wuhu Feng (1), and Johannes Flemming (4)

(1) Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, United Kingdom (beatriz@env.leeds.ac.uk), (2,3) Centre Européen de Recherche et Formation Avancée en Calcul Scientifique and Météo-France, Toulouse, France , (4) European Centre for Medium-Range Weather Forecasts, Reading, United Kingdom

In this work we have tested the current ECMWF ozone parameterisation in the SLIMCAT 3-D chemistry transport model (CTM), and suggested improvements for the current operational scheme. We propose an alternative scheme, based on the same Cariolle and Déqué (CD) linear method (Cariolle and Déqué, 1986), but obtained with a new calculation approach using a consistent treatment of heterogeneous and gas-phase chemistry. Unlike previous linear ozone schemes, the new O_3 parameterisation scheme (COPCAT) has been developed with implicit heterogeneous chemistry and does not need any additional parameter to account for heterogeneous ozone processes. This novel approach is presented here as a suitable improvement for schemes based on the linear Cariolle and Déqué approach, such as the operational European Centre for Medium-Range Weather Forecasts (ECMWF) scheme.

The COPCAT ozone scheme has been obtained from SLIMCAT full-chemistry runs and for the first time it has been possible to compare a linear scheme of this kind with the full chemistry 3-D CTM used to calculate it. This study also shows the sensitivity that these linear schemes present to the meteorology used to derive the coefficients.

The COPCAT scheme has been implemented in a multiannual CTM simulation. Results show that COPCAT is in good overall agreement with SLIMCAT full-chemistry. In particular, the heterogeneous treatment adopted by COPCAT has provided the scheme with a realistic polar loss simulation, showing that the linearisation approach can cope adequately with polar chemical processes. The new COPCAT scheme also shows very good adaptability to different atmospheric conditions, including the unusual meteorological conditions found over the Antarctic in 2002.

The good agreement COPCAT presents with SLIMCAT full-chemistry is encouraging and shows the scheme as a promising alternative to the use of parameterisations with a separate treatment of gas-phase and heterogeneous chemistry. Furthermore, given the agreement between COPCAT, the parent full-chemistry CTM and observations, a scheme like COPCAT can be used to assess the performance of two-way coupled systems including full-chemistry within a NWP model, e.g. the coupled system used by Flemming et al. (2010). Here we will also discuss results from the stratospheric COPCAT parameterisation implemented within the ECMWF Integrated Forecast System (IFS).