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Alternative stratospheric ozone parameterisation suitable for seamless prediction systems

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This study evaluates effects and applications of a new linear parameterisation for stratospheric ozone over time scales that range from weather to climate. The new ozone parameterisation scheme (COPCAT), based on a linear approach as the Cariolle and Déqué (CD) scheme, has been developed to provide a consistent treatment of both gas-phase and heterogeneous chemistry, therefore, with the advantage of not needing an additional heterogeneous term.

We have assessed the performance of the new scheme in the SLIMCAT 3-D chemical transport model (CTM) and in the European Centre for Medium-Range Weather Forecasts (ECMWF) forecast and data assimilation systems. In our model runs we compare the performance of the new scheme with that of the CD scheme currently used by default in the ECMWF model.

Results from a long multiannual CTM simulation confirm that the heterogeneous chemistry treatment adopted by COPCAT has provided the scheme with a realistic polar loss simulation, also able to adapt to different atmospheric conditions, including the unusual meteorological conditions found over the Antarctic in 2002.

To assess the impact on meteorological variables of having prognostic ozone interactive with radiation, runs with COPCAT in the ECMWF Integrated Forecast System (IFS) have been performed, both with the ozone scheme interactive with radiation and non-interactive.

With the more realistic new ozone scheme, the use of assimilated observations in the ECMWF system can also be more efficient. To quantify this aspect several data assimilation experiments have been performed for the period August-November 2012.

For cases in which the implementation of full-chemistry is not feasible, the new COPCAT scheme is a realistic alternative representation of stratospheric ozone for different time scales and applications.