Geophysical Research Abstracts
Vol. 14, EGU2012-12110, 2012
EGU General Assembly 2012

Stratospheric transport and age-of-air from CTM simulations with ERA-Interim: agreement with observational trends

B.M. Monge-Sanz (1), M.P. Chipperfield (1), D.P. Dee (2), A.J. Simmons (2), S.M. Uppala (2), and G.P. Stiller (3)

(1) Institute for Climate and Atmospheric Science, University of Leeds, Leeds, U.K. (beatriz@env.leeds.ac.uk), (2) European Centre for Medium-Range Weather Forecasts, Reading, U.K., (3) Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research, Karlsruhe, Germany

Stratospheric simulations carried out with a chemistry transport model (CTM) are used to evaluate the stratospheric Brewer-Dobson circulation and mixing processes in different datasets produced by the European Centre for Medium-Range Weather Forecasts (ECMWF). A comparison between ERA-40 and ERA-Interim shows that the recent ECMWF reanalysis greatly overcomes problems detected in the past for ERA-40. CTM simulations with ERA-Interim provide improved age-of-air (AoA) distributions, in very good agreement with observations in the lower stratosphere.

Our AoA results have been validated against standard observation-based datasets (Ray et al., 1999; Andrews et al., 2001) and also against the new observational AoA dataset derived from recent MIPAS SF6 measurements (Stiller et al., 2011). Our model results with ERA-Interim fields disagree with the decrease tendency in age-of-air widespread in most models (e.g. WMO, 2011), but are in good agreement with recent age-of-air studies based on observations (Engel et al., 2009; Waugh, 2009; Stiller et al., 2011).

We have also performed Lagrangian trajectory runs in the lower stratosphere. The quantification of tropical dispersion from our Lagrangian calculations shows that the constraint of the vertical and horizontal mixing has been very significantly improved in the new ECMWF reanalysis dataset. Tape recorder simulations also confirm this.

Causes of the improvements achieved by the new reanalysis are explored, pointing towards the roles that the assimilation technique and the analysis read-in frequency play in the successful description of stratospheric transport in the CTM. Some of the problems attributed in the past to data assimilation, such as the excess of vertical mixing in the lower stratosphere, are here shown to be also caused by too low read-in frequencies in the CTM simulations. In this study we also show that the implementation of correction techniques, such as the use of forecasts instead of analyses, have a smaller effect in CTM simulations with ERA-Interim than with ERA-40.

References:

Andrews AE, et al. 2001. *J. Geophys. Res.* **106**: 32295–32314.

Engel A, et al. 2009. *Nat. Geosci.* **2**: 28–31.

Ray EA et al. 1999. *J. Geophys. Res.* **104**: 26565–26580.

Stiller GP. 2011. *Atmos. Chem. Phys. Discuss.***11**: 28013–28059.

Waugh D. 2009. *Nat. Geosci.* **2**: 14–16.

WMO. 2011. Global Ozone Research and Monitoring Project -Report No. 52.