Home
Online Library ACP
- Recent Final Revised Papers
- Volumes and Issues
- Special Issues
- Library Search
- Title and Author Search

Online Library ACPD
Alerts & RSS Feeds
General Information
Submission
Review
Production
Subscription
Comment on a Paper



Volumes and Issues | Contents of Issue 12

Atmos. Chem. Phys., 6, 5445-5474, 2006
www.atmos-chem-phys.net/6/5445/2006/


# The ASSET intercomparison of ozone analyses: method and first results

A. J. Geer[1,10], W. A. Lahoz[1], S. Bekki[2], N. Bormann[3], Q. Errera[4], H. J. Eskes[5], D. Fonteyn[4], D. R. Jackson[6], M. N. Juckes[7], S. Massart[8], V.-H. Peuch[9], S. Rharmili[2], and A. Segers[5]

[1]Data Assimilation Research Centre, University of Reading, Reading, UK
[2]CNRS Service Aeronomie, Université Pierre et Marie Curie, Paris, France
[3]European Centre for Medium-Range Weather Forecasts, Reading, UK
[4]Institut d'Aéronomie Spatiale de Belgique, Brussels, Belgium
[5]Royal Netherlands Meteorological Institute, De Bilt, The Netherlands
[6]Met Office, Exeter, UK
[7]British Atmospheric Data Centre, Rutherford Appleton Laboratory, Chilton, nr Didcot, UK
[8]CERFACS, Toulouse, France
[9]CNRM-GAME, Météo-France and CNRS URA 1357, Toulouse, France
[10]Now at European Centre for Medium-Range Weather Forecasts, Reading, UK

Abstract. This paper aims to summarise the current performance of ozone data assimilation (DA) systems, to show where they can be improved, and to quantify their errors. It examines 11 sets of ozone analyses from 7 different DA systems. Two are numerical weather prediction (NWP) systems based on general circulation models (GCMs); the other five use chemistry transport models (CTMs). The systems examined contain either linearised or detailed ozone chemistry, or no chemistry at all. In most analyses, MIPAS (Michelson Interferometer for Passive Atmospheric Sounding) ozone data are assimilated; two assimilate SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Chartography) observations instead. Analyses are compared to independent ozone observations covering the troposphere, stratosphere and lower mesosphere during the period July to November 2003.

Biases and standard deviations are largest, and show the largest divergence between systems, in the troposphere, in the upper-troposphere/lower-stratosphere, in the upper-stratosphere and mesosphere, and the Antarctic ozone hole region. However, in any particular area, apart from the troposphere, at least one system can be found that agrees well with independent data. In general, none of the differences can be linked to the assimilation technique (Kalman filter, three or four dimensional variational methods, direct inversion) or the system (CTM or NWP system). Where results diverge, a main explanation is the way ozone is modelled. It is important to correctly model transport at the tropical tropopause, to avoid positive biases and excessive structure in the ozone field. In the southern hemisphere ozone hole, only the analyses which correctly model heterogeneous ozone depletion are able to reproduce the near-complete ozone destruction over the pole. In the upper-stratosphere and mesosphere (above 5 hPa), some ozone photochemistry schemes caused large but easily remedied biases. The diurnal cycle of ozone in the mesosphere is not captured, except by the one system that includes a detailed treatment of mesospheric chemistry. These results indicate that when good observations are available for assimilation, the first priority for improving ozone DA systems is to improve the models.

The analyses benefit strongly from the good quality of the MIPAS ozone observations. Using the analyses as a transfer standard, it is seen that MIPAS is ~5% higher than HALOE (Halogen Occultation Experiment) in the mid and upper stratosphere and mesosphere (above 30 hPa), and of order 10% higher than ozonesonde and HALOE in the lower stratosphere (100 hPa to 30 hPa). Analyses based on SCIAMACHY total column are almost as good as the MIPAS analyses; analyses based on SCIAMACHY limb profiles are worse in some areas, due to problems in the SCIAMACHY retrievals.

Final Revised Paper (PDF, 3383 KB) Discussion Paper (ACPD)

Citation: Geer, A. J., Lahoz, W. A., Bekki, S., Bormann, N., Errera, Q., Eskes, H. J., Fonteyn, D., Jackson, D. R., Juckes, M. N., Massart, S., Peuch, V.-H., Rharmili, S., and Segers, A.: The ASSET intercomparison of ozone analyses: method and first results, Atmos. Chem. Phys., 6, 5445-5474, 2006. Bibtex EndNote Reference Manager