Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 5, 107-129, 2005
www.atmos-chem-phys.net/5/107/2005/

An evaluation of the performance of chemistry transport models - Part 2: Detailed comparison with two selected campaigns

D. Brunner[1], J. Staehelin[1], H. L. Rogers[2], M. O. Köhler[2], J. A. Pyle[2], D. A. Hauglustaine[3], L. Jourdain[4], T. K. Berntsen[5], M. Gauss[5], I. S. A. Isaksen[5], E. Meijer[6], P. van Velthoven[6], G. Pitari[7], E. Mancini[7], V. Grewe[8], and R. Sausen[8]

[1]Institute for Atmospheric and Climate Science, ETH, Zürich, Switzerland
[2]Centre for Atmospheric Science, Cambridge University, Cambridge, UK
[3]Laboratoire des Sciences du Climat et de L'Environnement, Gif-sur-Yvette, France
[4]Service d' ?eronomie, Paris, France
[5]Department of Geosciences, University of Oslo, Oslo, Norway
[6]Section of Atmospheric Composition, Royal Netherlands Meteorological Institute, De Bilt, The Netherlands
[7]Dipartimento di Fisica, Università L'Aquila, L'Aquila, Italy
[8]Institut für Physik der Atmosphäre, DLR, Wessling, Germany

Abstract. This is the second part of a rigorous model evaluation study involving five global Chemistry-Transport and two Chemistry-Climate Models operated by different groups in Europe. Simulated trace gas fields were interpolated to the exact times and positions of the observations to account for the actual weather conditions and hence for the specific histories of the sampled air masses. In this part of the study we focus on a detailed comparison with two selected campaigns, PEM-Tropics A and SONEX, contrasting the clean environment of the tropical Pacific with the more polluted North Atlantic region. The study highlights the different strengths and weaknesses of the models in accurately simulating key processes in the UT/LS region including stratosphere-troposphere-exchange, rapid convective transport, lightning emissions, radical chemistry and ozone production. Model simulated Radon, which was used as an idealized tracer for continental influence, was occasionally much better correlated with measured CO than simulated CO pointing towards deficiencies in the used biomass burning emission fields. The abundance and variability of HO_x radicals is in general well represented in the models as inferred directly from the comparison with measured OH and HO_2 and indirectly from the comparison with hydrogen peroxide concentrations. Components of the NO_y family such as PAN, HNO_3 and NO were found to compare less favorably. Interestingly, models showing good agreement with observations in the case of PEM-Tropics A often failed in the case of SONEX and vice versa. A better description of NO_x and NO_y emissions, chemistry and sinks is thought to be key to future model improvements with respect to the representation of chemistry in the UT/LS region.

Final Revised Paper (PDF, 4583 KB) Discussion Paper (ACPD)

Citation: Brunner, D., Staehelin, J., Rogers, H. L., Köhler, M. O., Pyle, J. A., Hauglustaine, D. A., Jourdain, L., Berntsen, T. K., Gauss, M.,

Isaksen, I. S. A., Meijer, E., van Velthoven, P., Pitari, G., Mancini, E., Grewe, V., and Sausen, R.: An evaluation of the performance of chemistry transport models - Part 2: Detailed comparison with two selected campaigns, Atmos. Chem. Phys., 5, 107-129, 2005. Bibtex EndNote Reference Manager