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

Atmos. Chem. Phys., 4, 1-17, 2004
www.atmos-chem-phys.net/4/1/2004/

Sensitivities in global scale modeling of isoprene

R. von Kuhlmann[1], M. G. Lawrence[1], U. Pöschl[2], and P. J. Crutzen[1,3]
[1]Max-Planck-Institut für Chemie, Postfach 3060, 55020 Mainz, Germany
[2]Institut für Wasserchemie, Technische Universität München, München, Germany
[3]Scripps Institution of Oceanography, UC San Diego, La Jolla, CA, USA

Abstract. A sensitivity study of the treatment of isoprene and related parameters in 3D atmospheric models was conducted using the global model of tropospheric chemistry MATCH-MPIC. A total of twelve sensitivity scenarios which can be grouped into four thematic categories were performed. These four categories consist of simulations with different chemical mechanisms, different assumptions concerning the deposition characteristics of intermediate products, assumptions concerning the nitrates from the oxidation of isoprene and variations of the source strengths. The largest differences in ozone compared to the reference simulation occured when a different isoprene oxidation scheme was used (up to 30-60% or about 10 nmol/mol). The largest differences in the abundance of peroxyacetylnitrate (PAN) were found when the isoprene emission strength was reduced by 50% and in tests with increased or decreased efficiency of the deposition of intermediates. The deposition assumptions were also found to have a significant effect on the upper tropospheric HO_x production. Different implicit assumptions about the loss of intermediate products were identified as a major reason for the deviations among the tested isoprene oxidation schemes. The total tropospheric burden of O_3 calculated in the sensitivity runs is increased compared to the background methane chemistry by 26±9 Tg(O_3) from 273 to an average from the sensitivity runs of 299 Tg(O_3). % revised Thus, there is a spread of ± 35% of the overall effect of isoprene in the model among the tested scenarios. This range of uncertainty and the much larger local deviations found in the test runs suggest that the treatment of isoprene in global models can only be seen as a first order estimate at present, and points towards specific processes in need of focused future work.

Final Revised Paper (PDF, 1514 KB) Discussion Paper (ACPD)

Citation: von Kuhlmann, R., Lawrence, M. G., Pöschl, U., and Crutzen, P. J.: Sensitivities in global scale modeling of isoprene, Atmos. Chem. Phys., 4, 1-17, 2004. Bibtex EndNote Reference Manager