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

Atmos. Chem. Phys., 3, 107-118, 2003
www.atmos-chem-phys.net/3/107/2003/

A discussion on the determination of atmospheric OH and its trends

P. Jöckel[1], C. A. M. Brenninkmeijer[1], and P. J. Crutzen[1,2]
[1]Max Planck Institute for Chemistry, POB 3060, 55020 Mainz, Germany
[2]Scripps Institution of Oceanographicy, University of California, San Diego, USA

Abstract. The oxidation efficiency of the troposphere is largely determined by the hydroxyl radical and its global distribution. Its presence limits the lifetime of most trace gases. Because of the great importance of several of these gases for climate, ozone budget and OH itself, it is of fundamental importance to acquire knowledge about atmospheric OH and possible trends in its concentrations. In the past, average concentrations of OH and trends were largely derived using industrially produced CH_3CCl_3 as a chemical tracer. The analyses have given valuable, but also rather uncertain results. In this paper we describe an idealized computer aided tracer experiment which has as one of its goals to derive tracer concentration weighted, global average $<k(OH)>$, where the temporal and spatial OH distribution is prescribed and k is the reaction rate coefficient of OH with a hitherto never produced (Gedanken) tracer, which is injected at a number of surface sites in the atmosphere in well known amounts over a given time period. Using a three-dimensional (3-D) time-dependent chemistry transport model, $<k(OH)>$ can be accurately determined from the calculated 3-D tracer distribution. It is next explored how well $<k(OH)>$ can be retrieved solely from tracer measurements at a limited number of surface sites. The results from this analysis are encouraging enough to actually think about the feasibility to carry out a global dedicated tracer experiment to derive $<k(OH)>$ and its temporal trends. However, before that, we propose to test the methods that are used to derive $<k(OH)>$, so far largely using CH_3CCl_3, with an idealized tracer experiment, in which a global chemistry transport model is used to calculate the ``Gedanken'' tracer distribution, representing the real 3-D world, from which $<k(OH)>$ is derived, using only the tracer information from a limited set of surface sites. We propose here that research groups which are, or will be, involved in global average OH studies to participate in such an inter-comparison of methods, organized and over-seen by a committee appointed by the International Global Atmospheric Chemistry (IGAC) program.

Final Revised Paper (PDF, 673 KB) Discussion Paper (ACPD)

Citation: Jöckel, P., Brenninkmeijer, C. A. M., and Crutzen, P. J.: A discussion on the determination of atmospheric OH and its trends, Atmos. Chem. Phys., 3, 107-118, 2003. Bibtex EndNote Reference Manager