

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

Impact
Factor
4.865

ISI
indexed



Volumes and Issues Contents of Issue 12

Atmos. Chem. Phys., 5, 3233-3250, 2005
www.atmos-chem-phys.net/5/3233/2005/

© Author(s) 2005. This work is licensed
under a Creative Commons License.

A global off-line model of size-resolved aerosol microphysics: II. Identification of key uncertainties

D. V. Spracklen, K. J. Pringle, K. S. Carslaw, M. P. Chipperfield, and G. W. Mann

Institute for Atmospheric Science, School of Earth and Environment, University of Leeds, UK

Abstract. We use the new GLOMAP model of global aerosol microphysics to investigate the sensitivity of modelled sulfate and sea salt aerosol properties to uncertainties in the driving microphysical processes and compare these uncertainties with those associated with aerosol and precursor gas emissions. Overall, we conclude that uncertainties in microphysical processes have a larger effect on global sulfate and sea salt derived condensation nuclei (CN) and cloud condensation nuclei (CCN) concentrations than uncertainties in present-day sulfur emissions. Our simulations suggest that uncertainties in predicted sulfate and sea salt CCN abundances due to poorly constrained microphysical processes are likely to be of a similar magnitude to long-term changes in sulfate and sea salt CCN due to changes in anthropogenic emissions. A microphysical treatment of the global sulfate aerosol allows the uncertainty in climate-relevant aerosol properties to be attributed to specific processes in a way that has not been possible with simpler aerosol schemes. In particular we conclude that: (1) changes in the binary $\text{H}_2\text{SO}_4\text{-H}_2\text{O}$ nucleation rate and condensation rate of gaseous H_2SO_4 cause a shift in the vertical location of the upper tropospheric CN layer by as much as 3 km, while the shape of the CN profile is essentially pre-served (2) uncertainties in the binary $\text{H}_2\text{SO}_4\text{-H}_2\text{O}$ nucleation rate have a relatively insignificant effect on marine boundary layer (MBL) aerosol properties; (3) emitting a fraction of anthropogenic SO_2 as particulates (to represent production of sulfate particles in power plant plumes below the scale of the model grid (which is of the order of 300 km)) has the potential to change the global mean MBL sulfate-derived CN concentrations by up to 72%, and changes of up to a factor 20 can occur in polluted continental regions; (4) predicted global mean MBL sulfate and sea salt CCN concentrations change by 10 to 60% when several microphysical processes are changed within reasonable uncertainty ranges; (5) sulfate and sea salt derived CCN concentrations are particularly sensitive to primary particle emissions, with global mean MBL sulfate and sea salt CCN changing by up to 27% and local concentrations over continental regions changing by more than 100% when the percentage of anthropogenic SO_2 emitted as particulates is changed from 0 to 5%; (6) large changes in sea spray flux have insignificant effects on global sulfate aerosol except when the mass accommodation coefficient of sulfuric acid on the salt particles is set unrealistically low.

Copernicus Publications
The Innovative Open Access Publisher

Search ACP

Library Search

Author Search

News

- Sister Journals AMT & GMD
- Financial Support for Authors
- Journal Impact Factor
- Public Relations & Background Information

Recent Papers

01 | ACP, 19 Feb 2009:
Relating observations of
contrail persistence to
numerical weather analysis
output

02 | ACP, 19 Feb 2009:
Increasing ozone in marine
boundary layer inflow at the
west coasts of North America
and Europe

03 | ACP, 19 Feb 2009:
Influence of non-ideality on
condensation to aerosol

04 | ACP, 19 Feb 2009:
Uncertainty in global CCN

▣ [Final Revised Paper](#) (PDF, 2670 KB) ▣ [Discussion Paper](#) (ACPD)

Citation: Spracklen, D. V., Pringle, K. J., Carslaw, K. S., Chipperfield, M. P., and Mann, G. W.: A global off-line model of size-resolved aerosol microphysics: II. Identification of key uncertainties, Atmos. Chem. Phys., 5, 3233-3250, 2005. ▣ [Bibtex](#) ▣ [EndNote](#) ▣ [Reference Manager](#)