

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
4.927

ISI
indexed



Volumes and Issues Contents of Issue 4

Atmos. Chem. Phys., 10, 1635-1647, 2010

www.atmos-chem-phys.net/10/1635/2010/

© Author(s) 2010. This work is distributed under the Creative Commons Attribution 3.0 License.

Results from the CERN pilot CLOUD experiment

J. Duplissy¹, M. B. Enghoff², K. L. Aplin³, F. Arnold⁴, H. Aufmhoff⁴, M. Avngaard², U. Baltensperger⁵, T. Bondo², R. Bingham³, K. Carslaw⁶, J. Curtius⁷, A. David¹, B. Fastrup⁸, S. Gagné⁹, F. Hahn¹, R. G. Harrison¹⁰, B. Kelleth³, J. Kirkby¹, M. Kulmala⁹, L. Laakso⁹, A. Laaksonen¹¹, E. Lillestol¹², M. Lockwood³, J. Mäkelä¹³, V. Makhmutov¹⁴, N. D. Marsh², T. Nieminen⁹, A. Onnela¹, E. Pedersen⁸, J. O. P. Pedersen², J. Polny², U. Reichl⁴, J. H. Seinfeld¹⁵, M. Sipilä⁹, Y. Stozhkov¹⁴, F. Stratmann¹⁶, H. Svensmark², J. Svensmark², R. Veenhof¹, B. Verheggen⁵, Y. Viisanen¹⁷, P. E. Wagner¹⁸, G. Wehrle⁵, E. Weingartner⁵, H. Wex¹⁶, M. Wilhelmsson¹, and P. M. Winkler¹⁸

¹CERN, PH Department, Geneva, Switzerland

²DTU Space, National Space Institute, Center for Sun-Climate Research, Copenhagen, Denmark

³Rutherford Appleton Laboratory, Space Science & Technology Department, Chilton, UK

⁴Max-Planck Institute for Nuclear Physics, Heidelberg, Germany

⁵Paul Scherrer Institut, Laboratory of Atmospheric Chemistry, Villigen, Switzerland

⁶University of Leeds, School of Earth and Environment, Leeds, UK

⁷Goethe-University of Frankfurt, Institute for Atmospheric and Environmental Sciences, Frankfurt am Main, Germany

⁸University of Aarhus, Institute of Physics and Astronomy, Aarhus, Denmark

⁹Helsinki Institute of Physics and University of Helsinki, Department of Physics, Helsinki, Finland

¹⁰University of Reading, Department of Meteorology, Reading, UK

¹¹University of Kuopio, Department of Physics, Kuopio, Finland

¹²University of Bergen, Institute of Physics, Bergen, Norway

¹³Tampere University of Technology, Department of Physics, Tampere, Finland

¹⁴Lebedev Physical Institute, Solar and Cosmic Ray Research Laboratory, Moscow, Russia

¹⁵California Institute of Technology, Division of Chemistry and Chemical Engineering, Pasadena, USA

¹⁶Leibniz Institute for Tropospheric Research, Leipzig, Germany

¹⁷Finnish Meteorological Institute, Helsinki, Finland

¹⁸University of Vienna, Institute for Experimental Physics, Vienna, Austria

Abstract. During a 4-week run in October–November 2006, a pilot experiment was performed at the CERN Proton Synchrotron in preparation for the Cosmics Leaving Outdoor Droplets (CLOUD) experiment, whose aim is to study the possible influence of cosmic rays on clouds. The purpose of the pilot experiment was firstly to carry out exploratory measurements of the effect of ionising particle radiation on aerosol formation from trace H₂SO₄ vapour and secondly to provide technical input for the CLOUD design. A total of 44 nucleation bursts were produced and recorded, with formation rates of particles above the 3 nm detection threshold of between 0.1 and 100 cm⁻³s⁻¹, and growth rates between 2 and 37 nm h⁻¹. The corresponding H₂O concentrations were typically around 10⁶ cm⁻³ or less. The experimentally-measured formation rates and H₂SO₄ concentrations are comparable to those found in the atmosphere,

Search ACP

Library Search

Author Search

News

- Bringing Down Geoscientific Barriers
- New Tax Regulation for Service Charges
- Sister Journals AMT & GMD
- Public Relations & Background Information

Recent Papers

01 | ACP, 19 Feb 2010:
Tropospheric photooxidation of CF₃CH₂CHO and CF₃(CH₂)₂CHO initiated by Cl atoms and OH radicals

02 | ACP, 19 Feb 2010:
Estimations of climate sensitivity based on top-of-atmosphere radiation imbalance

03 | ACP, 19 Feb 2010:
Numerical simulations of contrail-to-cirrus transition – Part 2: Impact of initial ice crystal number, radiation, stratification, secondary nucleation and layer depth

supporting the idea that sulphuric acid is involved in the nucleation of atmospheric aerosols. However, sulphuric acid alone is not able to explain the observed rapid growth rates, which suggests the presence of additional trace vapours in the aerosol chamber, whose identity is unknown. By analysing the charged fraction, a few of the aerosol bursts appear to have a contribution from ion-induced nucleation and ion-ion recombination to form neutral clusters. Some indications were also found for the accelerator beam timing and intensity to influence the aerosol particle formation rate at the highest experimental SO₂ concentrations of 6 ppb, although none was found at lower concentrations. Overall, the exploratory measurements provide suggestive evidence for ion-induced nucleation or ion-ion recombination as sources of aerosol particles. However in order to quantify the conditions under which ion processes become significant, improvements are needed in controlling the experimental variables and in the reproducibility of the experiments. Finally, concerning technical aspects, the most important lessons for the CLOUD design include the stringent requirement of internal cleanliness of the aerosol chamber, as well as maintenance of extremely stable temperatures (variations below 0.1 °C

▣ [Final Revised Paper](#) (PDF, 3840 KB) ▣ [Discussion Paper](#) (ACPD)

Citation: Duplissy, J., Enghoff, M. B., Aplin, K. L., Arnold, F., Aufmhoff, H., Avngaard, M., Baltensperger, U., Bondo, T., Bingham, R., Carslaw, K., Curtius, J., David, A., Fastrup, B., Gagné, S., Hahn, F., Harrison, R. G., Kellett, B., Kirkby, J., Kulmala, M., Laakso, L., Laaksonen, A., Lillestol, E., Lockwood, M., Mäkelä, J., Makhmutov, V., Marsh, N. D., Nieminen, T., Onnela, A., Pedersen, E., Pedersen, J. O. P., Polny, J., Reichl, U., Seinfeld, J. H., Sipilä, M., Stozhkov, Y., Stratmann, F., Svensmark, H., Svensmark, J., Veenhof, R., Verheggen, B., Viisanen, Y., Wagner, P. E., Wehrle, G., Weingartner, E., Wex, H., Wilhelmsson, M., and Winkler, P. M.: Results from the CERN pilot CLOUD experiment, *Atmos. Chem. Phys.*, 10, 1635-1647, 2010. ▣ [Bibtex](#) ▣ [EndNote](#) ▣ [Reference Manager](#)