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

Volumes and Issues Contents of Issue 5

Atmos. Chem. Phys., 8, 1293-1309, 2008
www.atmos-chem-phys.net/8/1293/2008/

Clouds and aerosols in Puerto Rico – a new evaluation

J. D. Allan[1], D. Baumgardner[2], G. B. Raga[2], O. L. Mayol-Bracero[3], F. Morales-García[3], F. García-García[2], G. Montero-Martínez[2], S. Borrmann[4,5], J. Schneider[5], S. Mertes[6], S. Walter[5], M. Gysel[7,*], U. Dusek[8,**], G. P. Frank[8,***], and M. Krämer[9]

[1]National Centre for Atmospheric Science, University of Manchester, Manchester, UK

[2]Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México, Mexico City, Mexico

[3]Institute for Tropical Ecosystem Studies, University of Puerto Rico, San Juan, Puerto Rico

[4]Institute for Atmospheric Physics, Johannes Gutenberg University, Mainz, Germany

[5]Particle Chemistry Department, Max Planck Institute for Chemistry, Mainz, Germany

[6]Leibniz-Institute for Tropospheric Research, Leipzig, Germany

[7]School of Earth, Atmospheric & Environmental Science, University of Manchester, Manchester, UK

[8]Biogeochemistry Department, Max Planck Institute for Chemistry, Mainz, Germany

[9]Institute for Chemistry and Dynamics of the Geosphere 1: Stratosphere, Forschungszentrum Jülich, Jülich, Germany

[*]now at: Paul Scherrer Institut, Villigen, Switzerland

[**]now at: University of Utrecht, Utrecht, The Netherlands

[***]now at: Department of Physics, Lund University, Lund, Sweden

Abstract. The influence of aerosols, both natural and anthropogenic, remains a major area of uncertainty when predicting the properties and behaviour of clouds and their influence on climate. In an attempt to better understand warm cloud formation in a tropical marine environment, a period of intensive measurements took place in December 2004 in Puerto Rico, using some of the latest developments in online instrumentation such as aerosol mass spectrometers, cloud condensation nuclei counters and a hygroscopicity tandem differential mobility analyser. Simultaneous online measurements of aerosol size distributions, composition, hygroscopicity and optical properties were made near the lighthouse of Cape San Juan in the north-eastern corner of the island and at the top of East Peak mountain (1040 m a.s.l.), the two sites separated by 17 km. Additional measurements of the cloud droplet residual and interstitial aerosol properties were made at the mountain site, accompanied by measurements of cloud droplet size distributions, liquid water content and the chemical composition of cloud and rain water samples.

Both aerosol composition and cloud properties were found to be sensitive to wind sector. Air from the east-northeast (ENE) was mostly free of anthropogenic influences, the submicron fraction being mainly composed of non-sea salt sulphate, while that from the east-southeast (ESE) was found to be moderately influenced by populated islands upwind, adding smaller

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 | ACPD, 03 Nov 2008: Anthropogenic influence on SOA and the resulting radiative forcing

02 | ACPD, 03 Nov 2008: Evidence of mineral dust altering cloud microphysics and precipitation

03 | ACPD, 03 Nov 2008: Technical Note: A new method for the Lagrangian tracking of pollution plumes from source to receptor using gridded model output

04 | ACPD, 03 Nov 2008:

(<100 nm), externally mixed, carbonaceous particles to the aerosol that increased the number concentrations by over a factor of 3. This change in composition was also accompanied with a reduction in the measured hygroscopicity and fractional cloud activation potential of the aerosol. At the mountain site, the average cloud droplet concentrations increased from 193 to 519 cm^{-3}, median volume diameter decreased from 20 to 14 μm and the liquid water content increased from 0.24 to 0.31 g m^{-3} when the winds shifted from the ENE to ESE. Larger numbers of interstitial particles were recorded, most notably at sizes greater than 100 nm, which were absent during clean conditions. The average size of the residual particles and concentrations of cloudwater nitrate, sulphate and insoluble material increased during polluted conditions.

Previous studies in Puerto Rico had reported the presence of a significant non-anthropogenic organic fraction in the aerosols measured and concluded that this was a factor controlling the in situ cloud properties. However, this was not observed in our case. In contrast to the 1.00±0.14 μg m^{-3} of organic carbon measured in 1992 and 1995, the organic matter measured in the current study of 0.17±0.35 μg m^{-3} is many times lower, most of which can be attributed to anthropogenic sources. During clean conditions, the submicron aerosol was observed to be almost entirely inorganic, an observation supported by the hygroscopicity measurements. This suggests that organic aerosols from marine sources may not be completely ubiquitous (either spatially or temporally) in this environment and requires further investigation to quantify their true extent and implications, with more extensive, longer-term sampling in conjunction with wind field analyses.

Final Revised Paper (PDF, 1078 KB) Discussion Paper (ACPD)

Citation: Allan, J. D., Baumgardner, D., Raga, G. B., Mayol-Bracero, O. L., Morales-García, F., García-García, F., Montero-Martínez, G., Borrmann, S., Schneider, J., Mertes, S., Walter, S., Gysel, M., Dusek, U., Frank, G. P., and Krämer, M.: Clouds and aerosols in Puerto Rico – a new evaluation, Atmos. Chem. Phys., 8, 1293-1309, 2008. Bibtex EndNote Reference Manager