Geophysical Research Abstracts,
Vol. 11, EGU2009-11107-2, 2009
EGU General Assembly 2009
© Author(s) 2009

Cloud parcel modelling of CCN activation in megacity air based on observations from Beijing and Guangzhou

H. Su (1), P. Reutter (1,2), J. Trentmann (2), D. Rose (1), S. Gunthe (1), M. Simmel (3), A. Nowak (3), A. Wiedensohler (3), T. Zhu (4), U. Pöschl (1), and the whole Team

(1) Max Planck Institute for Chemistry, Biogeochemistry Department, Mainz, Germany (hang.g.su@gmail.com), (2) Johannes Gutenberg University Mainz, Institute for Atmospheric Physics, Mainz, Germany, (3) Leibniz Institute for Tropospheric Research, Leipzig, Germany, (4) College of Environmental Sciences and Engineering, Peking University, Beijing, China

The other team members are P. Achtert (3), M. Hu (4), M. Shao (4), and Y.H. Zhang (4).

The activation of cloud condensation nuclei (CCN) determines the initial number of cloud droplets, and thus influences the evolution of the cloud and formation of precipitation. Characterizing the CCN activation process by parcel model studies with detailed cloud microphysics and dynamics provides useful information for parameterizing the activation process in meso-scale and global-scale models.

During the CAREBEIJING 2006 campaign in Beijing and the PRIDE-PRD2006 campaign in Guangzhou, fast condensational growth of particles was frequently observed and the CCN size distribution was sometimes dominated by the growing nucleation mode (Aitken Mode) rather than by the accumulation mode. In this study we investigated the implications of the experimental findings using a cloud parcel model with detailed spectral cloud microphysics and with the κ-Köhler model approach for efficient and realistic description of the effective hygroscopicity and CCN activity of aerosol particles. The number of droplets formed at the cloud base was examined for a wide range of updraft velocities and aerosol particle number concentrations. Moreover, the impact of aerosol hygroscopicity, size distribution and giant CCN were also evaluated.

References:

Reutter, P., Trentmann, J., Su, H., Simmel M., Rose, D., Wernli, H., Andreae, M. O., and Pöschl, U.: Activation of aerosol particles as cloud condensation nuclei (CCN) under smoky and pyro-convective conditions, manuscript in preparation, 2009

Rose, D., Gunthe, S. S., Mikhailov, E., Frank, G. P., Dusek, U., Andreae, M. O., and Pöschl, U.: Calibration and measurement uncertainties of a continuous-flow cloud condensation nuclei counter (DMT-CCNC): CCN activation of ammonium sulfate and sodium chloride aerosol particles in theory and experiment, Atmos. Chem. Phys., 8, 1153-1179, 2008.

Rose, D., Nowak, A., Achtert, P., Wiedensohler, A., Hu, M., Shao, M., Zhang, Y., Andreae, M. O., and Pöschl, U.: Cloud condensation nuclei in polluted air and biomass burning smoke near the mega-city Guangzhou, China – Part 1: Size-resolved measurements and implications for the modeling of aerosol particle hygroscopicity and CCN activity, Atmos. Chem. Phys. Discuss., 8, 17343-17392, 2008.

Simmel, M. and Wurzler, S.: Condensation and activation in sectional cloud microphysical models., Atmospheric Research 80(2-3): 218-236., 2006.

Wiedensohler, A., Cheng, Y. F., Nowak, A., Wehner, B., Achtert, P., Berghof, M., Birmili, W., Wu, Z. J., Hu, M., Zhu, T., Takegawa, N., Kita, K., Kondo, Y., Lou, S. R., Hofzumahaus, A., Holland, F., Wahner, A., Gunthe, S., Rose, D., and Pöschl, U.: Rapid Aerosol Particle Growth and Increase of Cloud Condensation Nucleus

(CCN) Activity by Secondary Aerosol Formation: a Case Study for Regional Air Pollution in North Eastern China, J. Geophys. Res., submitted, 2008