Long-term study of New Particle Formation (NPF) events as a source of Cloud Condensation Nuclei (CCN) concentrations in the urban background of Vienna

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Atmospheric aerosols have profound impacts on global climate directly by scattering and absorbing solar radiation and indirectly by modifying and altering cloud properties. The indirect aerosol effects occur due to aerosol particles acting as cloud condensation nuclei (CCN) and as ice nuclei. They constitute the largest uncertainty in estimating the aerosol radiative forcing and global climate change. In order to better quantify the global CCN budget, it is necessary to determine the sources responsible for atmospheric CCN. Observations and model studies (e.g. Kerminen et al., 2012) have demonstrated that New Particle Formation (NPF) events can be an important source of CCN in the atmosphere. Only few studies (e.g. Asmi et al., 2011), however, have linked observed NPF and growth events directly to increases in measured CCN concentrations. Most of these studies were performed in remote or background locations. There is a lack of continuous long-term parallel measurements of CCN concentrations and of NPF events in urban aerosols. In order to provide more information about NPF events as a possible source of CCN, a long term study was done from June 2014 to December 2015 in the urban background of Vienna Measurements of size distributions and CCN concentrations are performed at the aerosol laboratory located on the roof (35m above ground) of the Physics building of the University of Vienna in central Vienna.

A CCNC (Cloud Condensation Nuclei Counter) designed at the University of Vienna and operating on the principle of a static thermal diffusion chamber (Giebl et al., 2002), was used to measure CCN concentrations and activation ratios at low supersaturations (0,5%). NPF events were identified in a continuous size distribution dataset measured with a Vienna-type DMPS (Differential Mobility Particle Sizer, Winklmayr et al., 1991) and a SMPS 3082(TSI, Inc.). NPF event and non-event days are classified using the criteria of Dal Maso et al. (2005).

NPF events and the continuing growth of the newly-formed particles are sometimes superposed by local pollution plumes. Traffic emissions could additionally increase the concentration of CCN-active particles during a NPF event. A Multi Angle Absorption Photometer (MAAP) measuring black carbon concentrations is therefore used to monitor the contribution of traffic emissions and local pollution plumes to the aerosol at the station. Weather conditions during NPF events were also taken into account. For this study, events and CCN concentrations were considered only when weather conditions and black carbon concentrations stayed constant before, during and after the event.

The results indicate that in some cases NPF events enhanced CCN concentrations (Fig 1), but in other cases no increase of CCN concentrations could be seen.

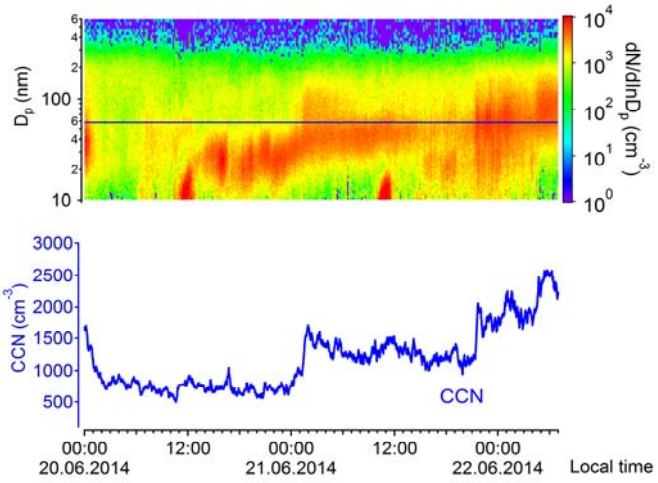

Fig1: CCN concentrations during a NPF event.

Asmi, E., N. Kivekäs, V. M. Kerminen, M. Komppula, A. P. Hyvärinen, J. Hatakka, Y. Viisanen, and H. Lihavainen. 2011. "Secondary New Particle Formation in Northern Finland Pallas Site between the Years 2000 and 2010." *Atmospheric Chemistry and Physics* 11: 12959–72.

Dal Maso, M, M. Kulmala, I. Riipinen, R. Wagner, T. Hussein, P.P. Aalto, and Kari E. J. Lehtinen. 2005. "Formation and Growth of Fresh Atmospheric Aerosols: Eight Years of Aerosol Size Distribution Data from SMEAR II, Hyytiälä, Finland." *Boreal Environment Research* 10 (October): 323–36.

Giebl, H, A. Berner, G Reischl, H Puxbaum, A. Kasper-Giebl, and R Hitzenberger. 2002. "CCN Activation of Oxalic and Malonic Acid Test Aerosols with the University of Vienna Cloud Condensation Nuclei Counter." *Journal of Aerosol Science* 33 (12): 1623–34.

Kerminen, V. M., M. Paramonov, T. Anttila, I. Riipinen, C. Fountoukis, H. Korhonen, E. Asmi, et al. 2012. "Cloud Condensation Nuclei Production Associated with Atmospheric Nucleation: A Synthesis Based on Existing Literature and New Results." *Atmospheric Chemistry and Physics* 12: 12037–59..

Winklmayr, W., G.P. Reischl, A.O. Lindner, and A. Berner. 1991. "A New Electromobility Spectrometer for the Measurement of Aerosol Size Distributions in the Size Range from 1 to 1000 Nm." *Journal of Aerosol Science* 22 (3): 289–96.