Long-term study of Cloud Condensation Nuclei (CCN) concentrations associated with New Particle Formation (NPF) events 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. Many 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 measurements of CCN concentrations in the urban background and of NPF events as a source of CCN particles. In order to provide more information about NPF events acting as a source of CCN, a long term study was started in June 2014 in the urban background of Vienna and is planned to continue for the foreseeable future. Concentrations as well as seasonal characteristics of CCN concentrations and NPF events are investigated. 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), is used to measure CCN concentrations and activation ratios at low supersaturations (0,5%). NPF events are identified in a continuous size distribution dataset measured with a Vienna-type DMPS (Differential Mobility Particle Sizer, Winklmayr et al., 1991). NPF event and non-event days are classified using the criteria of Dal Maso et al. (2005). Measurements from June 2014 show that NPF events can enhance CCN concentration (Fig 1).

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 concentration is therefore used to monitor the contribution of traffic emissions and local pollution plumes to the aerosol at the station.

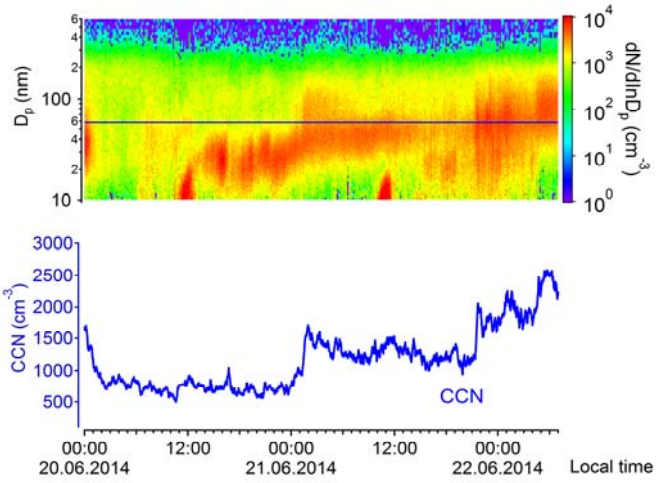

Fig1: CCN concentrations during a NPF event.

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