Geophysical Research Abstracts, Vol. 9, 06109, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06109

Chemical analysis of ambient aerosol particles and ice nuclei in mixed phase clouds by single particle laser ablation mass spectrometry

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Heterogeneous ice formation is the dominating process at higher temperatures but it is still unknown which chemical substances have the highest efficiency in acting as ice nuclei. During the CLACE 5 and CLACE 6 campaign (February to March 2006 and 2007) the single particle mass spectrometer of University of Mainz / Max-Planck Institute for Chemistry was operated in the Sphinx observatory at the Jungfraujoch, Switzerland. This station is located 3560 m a.s.l. and therefore temporarily in the free troposphere and often surrounded by mixed-phase clouds. During cloud events ice crystals up to 20 μm were collected and the ice was melted with dry air. This technique of providing ice nuclei was operated by the Institute for Tropospheric Research, Leipzig. An intensive laser pulse at 193 nm ablates and ionizes previously sized particles inside the ionisation region of a mass spectrometer. The positive and negative ions are accelerated into a bipolar high resolution time-of-flight mass spectrometer and for every single particle size and chemical information is obtained. The particle size diameters covered range from 0.3 to 3.0 μm. Application of a laser ablation and ionization leaves refractory components amenable for analysis, which is not possible with flash vaporization techniques as used by the Aerodyne Aerosol Mass Spectrometer. Therefore possibly important ice nuclei compounds like minerals, metals and black carbon can be detected. In this presentation first results of single particle mass spectrometric analyses of ambient and cloud residual aerosol particles are shown from the CLACE 5 (2006) and CLACE 6 (2007) campaigns.