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The chemical composition of ice nuclei in mixed phase clouds

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The 2001 *IPCC* report notes that one of the largest uncertainties in our current understanding of climate change can be attributed to a poor understanding of the complex relationship between aerosol particles and clouds. It is generally understood how changes in aerosols (e.g., number density, size distribution, and chemical composition) can impact cloud properties (e.g., lifetime, optical depth, and glaciation) but specific cause and effect links are almost completely lacking.

A number of recent advances in instrumentation have allowed us to tackle this problem in a new way. Inertial separation techniques, such as counterflow virtual impaction, are now much better understood and this allows for the efficient separation of cloud elements. Single particle mass spectrometers, first successfully implemented in the 1990's, now permit the determination of the chemical composition of the particles which formed these cloud elements *in situ* and in real time.

Using these techniques we have been able to study those aerosols which nucleate ice in several cloud types. Studies conducted during 2005 and 2006 at the high Alpine research station Jungfraujoch permitted investigation of ice nucleation within mixed-phase clouds. The composition of the ice nuclei was dominated by mineral dust with lesser contributions of other insoluble species. These results are important in any attempt to model the mixed-phase cloud system which is known to be important to our understanding of the initiation of global precipitation.