Geophysical Research Abstracts, Vol. 8, 03686, 2006
SRef-ID:

Chemical analysis of mineral dusts by aerosol mass spectrometry

S. Gallavardin (1), K. Froyd, (2), D. Cziczo (1), O.Möhler (3), U. Lohman (1)

(1) Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland, (2) NOAA, Boulder, CO, (3) Institute for Meteorology and Climate Research (IMK-AAF), Forschungszentrum Karlsruhe, Germany (stephane.gallavardin@env.ethz.ch)

A large part of the aerosol load in the atmosphere consists of mineral dust which originates from soil erosion, land use and anthropogenic activities. Airborne mineral dust particles have many effects on the environment and the climate. Mineral dust particles represent a catalyzer which modifies the local air composition and chemistry, can bring nutrients (such as iron) to different ecosystems such as oceans and can induce hazardeous health effects on humans. Mineral dust also affects the climate directly by its radiative properties and indirectly by its ice nucleating ability which, in turn, affects the cloud formation processes and coverage. Finally, mineral dust particles can potentially be used as an airmass tracer since it has a unique signature dependant upon the composition of its parent soil.

In order to better quantify the impact of mineral dust on its environment, physical properties such as typical size, shape, density, refractive index and chemical composition have to be measured.

Despite the numerous effects and the high atmospheric load of mineral dust, few chemical studies have been performed in recent years and very few have been done to determinate the chemical composition of airborne mineral dust on a single particle basis. Such measurements are commonly performed by impacting the mineral dust on a filter and analysing the sample by transmission electron microscopy (TEM) or scanning electron microscopy (SEM) combined with an elemental analysis by X-ray fluorescence. These measurements are time consuming to perform in order to obtain a statistical representative description of the mineral dust.

Single aerosol mass spectrometry has the ability to analyze in real time a large num-

ber of particles and thus permits a statistical representative description of the aerosol. Physical properties and chemical composition of the particle can be also determined at the same time. This presentation addresses the first results of a study aimed to differentiate different mineral dust particles such as Arizona Test Dust (ATD), Asian Dust (AD), Saharan Dust (SD), montmorillonite, kaolinite, illite and other aluminosilicate particulate materials and to identify specific markers for each mineral dusts type. The effects of sulfate and organic coatings on the mineral dust particle are also investigated. This work has been conducted with the PALMS instrument (Particle Analysis by Laser Mass Spectrometry) at the AIDA chamber facility (Forschungszentrum Karlsruhe, Germany) and in laboratory at the ETH Zurich.