

Name of research institute or organization:

Department of Geosciences, University of Fribourg

Title of project:

Single particle analysis of aerosols from Saharan dust events

Project leader and team:

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Project description:

Saharan mineral dust has an influence on the Single Scattering Albedo (SSA). During Saharan Dust Events (SDE) an inversion of the wavelength dependence of the SSA is observed (Collaud Coen et al., 2004). Such a behavior of the SSA can be modelled assuming a change in the particle size distribution (PSD) and/or the presence of a strong absorber like hematite (Sokolik and Toon, 1999). Additionally an enhanced ice nuclei number concentration could be detected during SDE's (Bingemer et al., 2009). So far no detailed particle by particle analysis of Saharan dust inducing an inversion of the wavelength dependence of the SSA have been made to corroborate the causes for the inversion put forward. Such sampling campaigns were made in 2008 and 2009.

The year 2010 was mainly used for improving the sampling procedure. Whereas the sampler was switched on manually during the campaigns 2008 and 2009, the device tested in 2010 is able to sample automatically Saharan dust on seven separate filters. The pump of this sampler is triggered by a signal from the computer of the global atmosphere network and turns on when an inversion of the wavelength dependence of the SSA is detected. The system was tested successfully during CLACE 2010 and it was able to sample a SDE, which occurred July 9 and 10 2010. The obtained filter samples were analyzed with automated scanning electron microscopy. In cooperation with the Institute for Atmosphere and Climate, ETHZ, it was also possible to take samples from the same event with an electrostatic sampler. With this device particles precipitate directly on Transmission Electron Microscopy (TEM) grids. Therefore particles can be analyzed with TEM without further preparation. The new tested sampler allows a more systematic characterization of SDE's in future.

First analysis of the filter samples and the particles on the TEM grid confirm the model of Sokolik and Toon, 1999, and the results from samples obtained in 2008 and 2009. A clear increase of coarse ($> 0.5\mu\text{m}$) particles during SDE's can be observed. Most of the mineral particles during a SDE are clay minerals, which contain attached or included hematite (Fe_2O_3) and rutile (TiO_2) particles with diameters between 40 - 200nm. No free hematite particles were found. The presence of very small rutile particles has not been reported so far. They will not affect the SSA in the visible range, but may affect optical properties of the atmosphere in the near UV range. Rutile is a strong absorber in the near UV.

References:

Bingemer, H., H. Klein, S. Schallenberg, The concentration of atmospheric ice nuclei (IN) at Jungfrauoch during events of Saharan dust transport, *Activity report 2009 of International Foundation HFSJG*, <http://www.ifjungo.ch/reports/2009/>, 2009.

Collaud Coen, M., E. Weingartner, D. Schaub, C. Hüglin, C. Corrigan, S. Henning, M. Schwikowski and U. Baltensperger, Saharan dust events at the Jungfrauoch: detection by wavelength dependence of the single scattering albedo and first climatology analysis, *Atmos. Chem. Phys.*, 4, 2465-2480, 2004.

Sokolik I.N. and O.B. Toon, Incorporation of mineralogical composition into models of the radiative properties of mineral aerosol from UV to IR wavelengths. *J. Geophys. Res.*, 104, 9423-9444, 1999.

Key words:

Saharan dust, Mineral dust, Aerosol composition, Aerosol morphology, SEM, TEM

Collaborating partners/networks:

Martine Collaud Coen (MeteoSwiss)

Paul Scherrer Institute (PSI)

Trinational Network: Airborne particles and their health effects

Institut für Atmosphäre und Klima, ETHZ

Scientific publications and public outreach 2010:

Conference papers

Meier, M.F., M. Collaud Coen, G. Wehrle and B. Grobéty, Single Particle Analysis of Saharan Dust Sampled on Jungfrauoch, 20th Annual VM Goldschmidt Conference, Knoxville, Tennessee, USA, June 13-18 2010, *Geochimica et Cosmochimica Acta*, 74, Issue 11, Supplement 1, A695, 2010.

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