Name of research institute or organization:

Institute for Meteorology and Climate Research,
Karlsruhe Institute of Technology

Title of project:

Measurement of biological particles during desert dust events

Project leader and team:

Dr. Martin Schnaiter, project leader
Emre Toprak

Project description:

Within this project the seasonal variability of biological aerosol particles in the free troposphere is investigated. A special focus is put on possible correlations between high biological particle fractions detected in the ambient aerosol and Saharan desert Dust Events (SDE) observed at the High Altitude Research Station Jungfraujoch (JFJ). By using the latest version of the Wide Band Integrated Bioaerosol Sensor (WIBS-4) to measure the biological aerosol number concentration and size distribution at JFJ we have observed an increase of biological aerosol concentration during several SDEs. This investigation is taking advantage of the SDE alert system that has been developed by the Paul Scherrer Institute and which is based on measurements of spectral aerosol light scattering and absorption properties (Coen et al., 2004). DREAM8b dust transport simulations (Perez et al., 2006a,b) were also used to predict the extreme dust loads over JFJ.

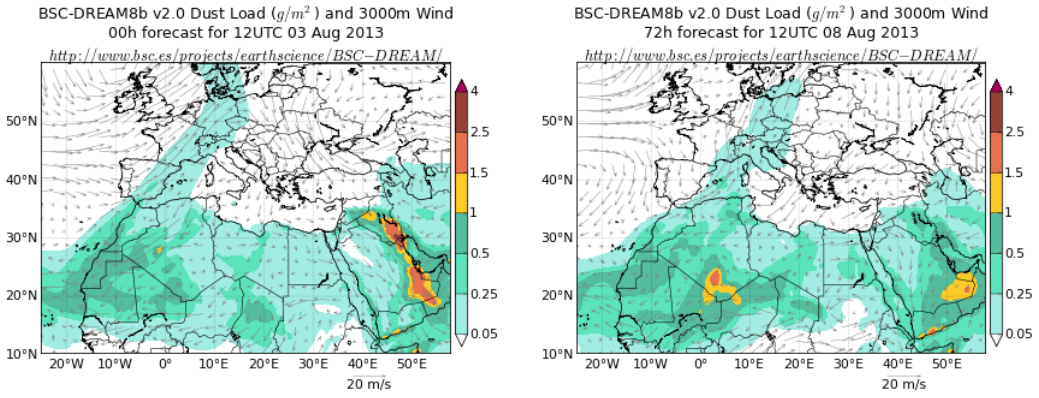

Figure 1. Arrival of Saharan dust at the JFJ station on 03 August 2013.

Following Hallar et al. (2011), we investigated the Saharan dust events from several aspects including their transport history, aerosol number size distributions and the fraction of fluorescent biological aerosol particles. Among other cases, the SDE on August 03 was the strongest event that we observed during the whole sampling period and lasted for almost five days. Corresponding DREAM8b simulations (Figure 1) show the arrival of a dust plume at JFJ on August 03. Time series of the WIBS-4 measurements for this dust event can be seen in Figure 2. After the arrival of the dust plume at JFJ, the bioaerosol number concentration increased from background levels (i.e., 2 to 10 particles per liter) to several hundred particles per liter. These first results clearly show that SDEs carry biological particles in an at least 10 times higher number concentration compared to non-SDE situations. However, further investigations are required to unravel the chemical and mineralogical compositions of the dust that arrives at JFJ during these extreme events. To fulfill this goal a collaborative work with EMPA has been started. In the next future PM10 filters that have been collected during SDEs by EMPA will be investigated by applying several geo- and biochemical methods.

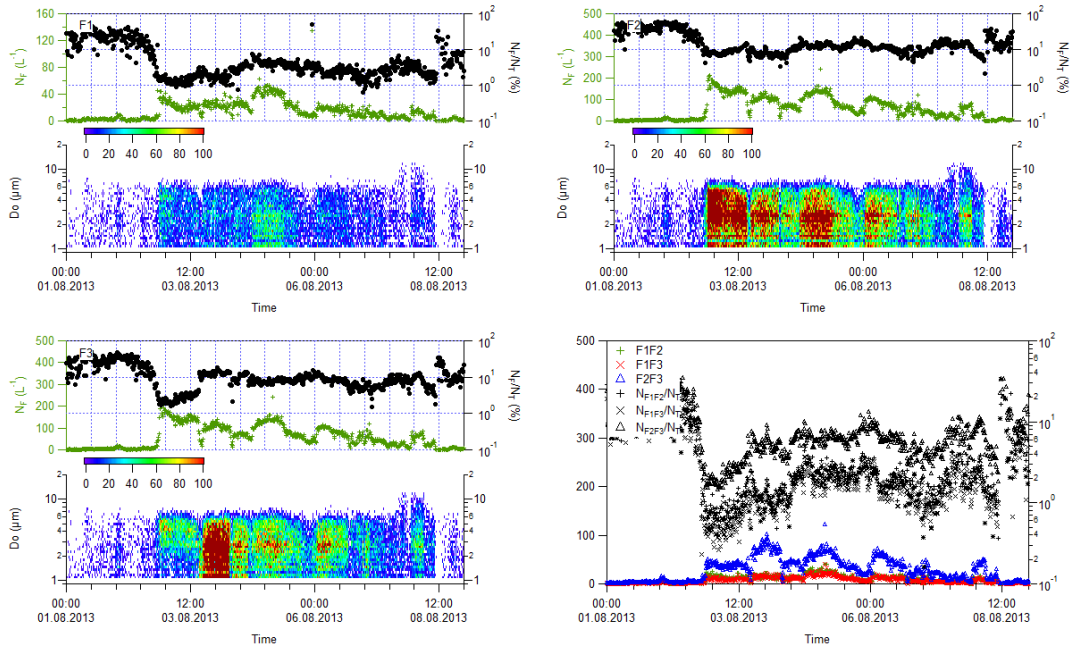

Figure 2. WIBS-4 fluorescence data for the Saharan dust event between 03 and 08 August 2013. Upper panels and the lower panel (left) illustrate the bioaerosol number concentrations and number distributions. Lower panel (right): Bioaerosol number concentrations and number ratios for combinations of fluorescence detection channels.

Key words:

Fluorescent biological aerosol particles, long range transport of Saharan dust

Collaborating partners/networks:

Paul Scherrer Institute, EMPA

Scientific publications and public outreach 2013:

Refereed journal articles and their internet access

Toprak, E. and M. Schnaiter, Saharan dust and bioaerosols over Central Europe (in preparation).

Theses

Toprak, E., Real Time Detection of Primary Biological Aerosol Particles (PBAP) and investigation of interactions between biological aerosols with non-biological aerosols and cloud particles, PhD Thesis, Karlsruhe Institute of Technology (KIT), 2014.

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