EMS Annual Meeting Abstracts
Vol. 8, EMS2011-367, 2011
11th EMS / 10th ECAM

Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

Detection of the Eyjafjallajökull ash cloud by a ceilometer network, its forecast by dispersion models and boundary layer impacts

S. Emeis and the project group "aerosol, climate, heath" Team

Karlsruhe Institute of Technology, Institut für Meteorologie und Klimaforschung - Atmosphärische Umweltforschung (IMK-IFU), Garmisch-Partenkirchen, Germany (stefan.emeis@kit.edu, +49 (0)8821 73573)

A series of major eruptions of the Eyjafjallajökull volcano in Iceland started on 14 April 2010 and continued until the end of May 2010. The spatial structure and the progression speed of the first ash layer from the Icelandic Eyjafjallajökull volcano which reached Germany on 16/17 April has been investigated from remote sensing data and numerical simulations. The ceilometer network of the German Meteorological Service was able to follow the progression of the ash layer over the whole of Germany. Special Raman lidar measurements, trajectory analyses and in-situ observations from mountain observatories helped to confirm the volcanic origin of the detected aerosol layer. Ultralight aircraft measurements permitted the detection of the arrival of a second major flush of volcanic material in Southern Germany. Numerical simulations with the Eulerian meso-scale model MCCM reproduced the temporal and spatial structure of the ash layer. Comparisons of the model results with the ceilometer network data on 17 April and with the ultralight aircraft data on 19 April were satisfying. This is the first example of a model validation study with these ceilometer network data.

Enhanced PM10 and SO_2 concentrations were detected on 17 April at mountain stations as well as in Innsbruck by in situ measurement devices. On 19 April intensive vertical mixing and advection along with clear sky-conditions facilitated the entrainment of volcanic material down to the ground. Consequently, on 19 April and 20 April exceedances of the daily threshold value for particulate matter (PM10) were reported. The chemical analyses of ambient PM10 at monitoring stations of the North Alpine foothills yielded elevated Titanium concentrations on 19/20 April which prove the presence of volcanic plume material. The entrainment of the volcanic plume material mainly affected the concentrations of coarse particles (> 1 μm) - interpreted as volcanic ash - and ultrafine particles (< 100 nm), while the concentrations of accumulation mode aerosol (0.1 - 1 μm) were not changed significantly. With regard to the occurrence of ultrafine particles, it is concluded that their formation was triggered by high sulphuric acid concentrations which are necessarily generated by the photochemical processes in a plume rich in sulphur dioxide under high solar irradiance. It became evident that during the course of several days, the Eyjafjallajökull volcanic emissions influenced the near-surface atmosphere and the ambient air quality and thus may have had minor impacts on human health.