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Airborne in-situ measurements of the Eyjafjallojökull ash plume with a small aircraft and optical particle spectrometers over north-western Germany - comparison between the aircraft measurements and the VAAC-model calculations

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The eruption of the volcano Eyjafjallajökull (Iceland) in 2010 has caused a transportation of an ash dust plume over large areas of Europe. In April 2010 many airports in Europe were closed for several days because of the volcano ash plume and even in May 2010 several German and European airports were closed for shorter periods because of the danger caused by the volcanic ash dust. The VAAC (Volcanic Ash Advisory Center), London, has continuously published graphics of the predicted spread and dispersion of the volcanic ash plume, which were partly basis for the air traffic restrictions in Germany.
In this situation the Laboratory for Environmental Measurement Techniques of the University of Applied Sciences in Duesseldorf has performed 14 measurement flights starting from April 23 2010 to May 21 2010 to get real airborne in-situ dust measurement data over the north-western part of Germany and for comparison with the predicted ash dispersion model data of the VAAC of London in Germany. Moreover, airborne passive DOAS remote sensing measurements have been performed by a mini-DOAS system for SO2-measurements within the plume.

In this paper the results of the airborne optical ash particle measurements as well as the remote sensing SO2 measurements will be reported for situations with and without the volcanic plume over northern Germany in detail. Moreover, the measured dust data will be compared with the model dispersion predictions for the ash plume by the VAAC and with European limit concentrations.

Main conclusions are:

The „ash plume“, found by the aircraft measurement of the Duesseldorf University of Applied Sciences over north western Germany in the “red zone” predicted by the VAAC turned out to be inhomogeneous during the measurement flights
Clusters of ash plume sometimes had only a height extension of several hundred meters or less
Ash substructures with a horizontal extension of ten kilometres up to several tenth of kilometres could be found
Vertical double structures of ash plume could be measured by spiral flights and could be observed visually in horizontal direction
Ash plume could be observed visually as small brown layer in horizontal direction
Particles collected during flight could be identified as ash particles by electron microscope analysis and chemical analysis