Direct airborne in-situ aerosols measurements of the Mt. Sakurajima eruption plume and remote sensing plume tracking

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Volcanic eruptions can influence the radiative balance of the atmosphere and can have strong impact to the economy, as it became evident during the Eyjfjallajoekull eruption 2010. The recent eruptions of Icelandic volcanoes demonstrated the strong effect of heavy ash loaded plumes. In order to determine the temporal and spatial dispersion of the plume the liable authorities (VAAC) use a dispersion model and correlate the results with satellite informations. During these eruption periods the simulations often overestimated the concentrations. Since 2011 limit ash concentration values exist for the air traffic. However, so far not many in-situ measurements, which were performed in high concentrations of the plume, are available to evaluate these models or to investigate their accuracy.

To validate the model and satellite results it is necessary to correlate the results with reliable airborne in-situ data and to quantify the down-wind characteristics of gases and particles in the plume and the spatial distribution of the plume emitted by the volcano.

In January 2013 airborne in-situ particle and remote sensing SO2 measurements were performed in the emissions from Sakurajima Volcano Japan, with a light aircraft Cessna 172. In-situ particle characteristics were measured using a Grimm 1.029 SkyOPC (microparticles 0.25-32 microns) and a Turnkey dustmeter (DustMate; microparticles 0.5 -20 microns). For each system a different inlet was used to avoid systematic errors. In parallel to the in-situ measurements the SO2 column density was measured using a vertically pointing differential absorption spectrometer (DOAS). A GPS was used for positioning the aircraft.

Through down wind transect measurements below and through Sakurajimas plume, aerosol concentrations up to 15 and 20 mg/m-3 were detected within the dispersing plume. By the use of a combination of in-situ and DOAS measurements the plume boundaries were tracked.

During the research flights the distance dependence of the aerosol size distribution could be investigated as well as the dispersion of the plume.Moreover, by parallel measurements a separation of the ash and SO2 into two plumes could be detected in horizontal and vertical direction.