



Composition and evolution of volcanic aerosol following three eruptions in 2008 - 2010

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Measurements of atmospheric aerosols by the CARIBIC (Civil Aircraft for Regular Investigation of the atmosphere Based on an Instrument Container) platform following the Kasatochi (Alaska), Sarychev (Russia) and Eyjafjallajökull (Iceland) eruptions in the period 2008-2010 are presented. The CARIBIC platform operates on a Lufthansa passenger aircraft usually on monthly inter-continental flights, measuring the atmospheric composition in the UT/LS at 8-12 km altitude (Brenninkmeijer et al., 2007). After the eruption of Kasatochi, analyses of the stratospheric aerosol composition showed enhanced concentrations of sulfur and carbon for several months. On the other hand the ash component, clearly seen in a sample seven days after the eruption, was not detected a month later (Martinsson et al., 2009). To further investigate the composition of the volcanic aerosol three flights through the volcanic plume of the Eyjafjallajökull eruption were carried out on April 20, May 16 and May 19, 2010.

Aerosol sampling was performed by an impaction technique with a cut-off diameter of 2 μm (Nguyen et al., 2006). Collected samples were analyzed by quantitative multi-elemental analysis by PIXE (Particle-Induced X-ray Emission), to obtain concentrations of elements with atomic number larger than 13, and PESA (Particle Elastic Scattering Analysis) for concentrations of hydrogen, carbon, nitrogen and oxygen (Nguyen and Martinsson, 2007).

Three samples taken during the special flights to study the Eyjafjallajökull eruption contained unusually high concentrations of elements pointing to crustal origin. The composition of these samples was compared to ash from a fall out sample (Sigmundsson et al., 2010). The ratio of detected elements to iron in both sample types showed good agreement for most of the elements for all three aerosol samples. Volcanically influenced aerosol following the eruptions of Sarychev and Kasatochi were identified by high concentrations of sulfur and by using air mass trajectories and CALIPSO lidar images. The ash component in these samples could be recognized by comparing to the composition of the aerosol from Eyjafjallajökull. By these methods volcanically influenced aerosol collected up to more than 100 days after the eruptions were identified. The ash to sulfur ratio in these samples showed an exponential decrease in time after the eruptions. The residence time of SO_2 in the stratosphere following the Sarychev eruption was estimated to be 52 days.

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