Geophysical Research Abstracts
Vol. 14, EGU2012-7216, 2012
EGU General Assembly 2012

Particle analysis of volcanic ash with Electron Microscopy

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Since the airspace closure over Europe due to the Eyjafjalla eruption in 2010, volcanic ash has come more in the focus of atmospheric science. The airspace closure accompanying the Grímsvötn eruption in 2011 clearly indicates that there is still a great need to increase the scientific understanding of the properties and impacts of volcanic ash particles. Determination of particle characteristics, preferably in near real time, serves as an important input to transport models in operational use for decision support and guidance of authorities. We collected particles before and after the Grímsvötn volcanic ash arrived at Copenhagen, Denmark, between 23 May and 31 May 2011, as well as at a number of other locations. The analysis of meteorological conditions shows that the particle collection performed before arrival of the volcanic ash may serve as a good reference sample. We have thus been able to identify significant differences in aerosol chemical composition during a volcanic ash event over Copenhagen. These results are compared to volcanic ash particles collected on Iceland. We provide unique data about single-particle structure, chemical composition, size and morphology of volcanic ash particles. Single-particle analysis by SEM, and mineralogical studies by XRD and TEM prove that the particles are composed of glass of a characteristic composition and small, nm sized minerals attached to the large (up to tens of μm) glass fragments. The derived information about volcanic ash particles can be used by transport models, resulting in improved information to the authorities in case of new volcanic ash events over Scandinavia or Europe.