Geophysical Research Abstracts
Vol. 15, EGU2013-9883-1, 2013
EGU General Assembly 2013

Linking the IR Christiansen effect to the mean particle size and type of volcanic ash

Simona Scollo (1), Giuseppe A. Baratta (2), Maria Elisabetta Palumbo (2), Stefano Corradini (3), Giuseppe Leto (2), and Giovanni Strazzulla (2)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo, Sezione di Catania, Catania, Italy (simona.scollo@ct.ingv.it), (2) Istituto Nazionale di Astrofisica – Osservatorio Astrofisico di Catania, Italy, (3) Istituto Nazionale di Geofisica e Vulcanologia – Roma, Italy

Infrared transmittance spectra of several volcanic ash samples positioned in the path of a IR beam have been obtained. This technique is widely used in astronomy, in biological applications, in industrial and environmental fields. Nevertheless, in spite of its wide diffusion in several branch of science, up to now only few IR measurements on volcanic ash particles have been carried out in laboratory. In this work, infrared spectroscopy is used to investigate the spectral signature of volcanic ash particles emitted during the 21-24 July 2001 eruption at Mt. Etna, in Italy. A Bruker Equinox-55 FTIR interferometer operating in the range 1.43-16.67 μm is used to analyse the infrared transmittance of ash particles on KBr windows. For every collected spectrum, an image of the volcanic ash particles was recorded in the visible spectral range through the same microscope. These images are then analyzed by standard image analysis software in order to evaluate the main features of the particle shape: the length of the major and minor axes, Feret diameter, area and aspect ratio. We measured the spectrum of only one particle (Single Particle Measurement SPM), the spectrum of a number of particles from two to ten particles (Multi Particle Measurements type 1, MPM1) and of more than a hundred particles (Multi Particle Measurements type 2, MPM2). For SPM, the length of the major and minor axis ranges between 5 and 25 μm and 3.5 and 15 μm, respectively, Feret diameter ranges between 5.5 and 25 μm, while variations of aspect ratio (AR) and area are between 0.5 and 0.95 and between 14 and 285 μmˆ2. For MPM1 and MPM2, the mean values of the length of the minor and major axis are between 3-4 and 10-17 μm, the Feret diameter between 5 and 20 μm, AR between 0.3 and 0.7 and area between 50 and 400 μmˆ2. The optical depth spectra as a function of the wave number showed the presence of the Christiansen effect that produces high transmission at a given wavelength in the infrared region. The ratio between a and b that are respectively the distance in optical depth between the minimum and maximum optical depth values with respect to the continuum, were plotted vs all the shape parameters. We found a linear relationship with the length of the major axis that demonstrates the possibility of evaluating the size distribution of volcanic ash suspended in the atmosphere from infrared spectra. More, we also showed the possibility to use the Christiansen signature (shape and minimum) to characterize the ash type. This additional information can be used to significantly improve the IR remote sensing volcanic ash quantitative estimations.