

Characterization of volcanic ash samples from Sakurajima volcano by CCD camera image

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In order to conduct a petrologic monitoring of ongoing eruption, a speedy and simple characterization method of volcanic ash particle is needed. We develop a new simple system for quantitatively characterizing of volcanic ash properties that analyzes CCD camera images, and apply the method to volcanic ash samples from Showa crater of Sakurajima. Our method characterizes volcanic ash particles by 1) apparent luminance through RGB filters and 2) irregularity of the shape of ash particles. Using a monochromatic CCD camera (Starshoot by Orion Co. LTD.) attached to a stereoscopic microscope, we captured images of ash particles set on white colored paper. These images are taken through three kinds of filters (Red, Green and Blue) under incandescent light with constant brightness. The images are analyzed by Adobe photoshop and Scion Image software. Apparent luminance of the ash particle images are represented by 256 tones for each pixel, and the average, median and standard deviation are measured for each ash particle for each filtered image in Adobe photoshop. Luminance is calibrated by taking images of white and black colored paper. Binary image converted from the 256 tones through Red filter is used for the analysis of the FF (Form Factor: $4 \cdot \pi \cdot A / \text{perimeter}^2$; A is cross sectional area) of ash particles by Scion Image program.

To compare a result of the image analysis and a classification under stereoscopic microscope, we characterized a day (January 13, 2010) sample of volcanic ash from Showa crater of Sakurajima volcano. Firstly, we divide volcanic ash into 11 types of particle under the stereoscopic microscope. Subsequently, we quantify the luminance and FF for the each type of the ash particles. The results show that the distributions of luminance and FF differ for different type of the ash particles. This suggests that classification using luminance and FF is quite useful to quantitatively distinguish and group the volcanic ash samples, and suitable for the petrologic monitoring of ongoing eruption.

Keywords: Volcanic ash, Classification method, CCD camera, Image analysis, Monitoring of ongoing eruption