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A trial of measurement for shape and velocity of ash-fall by using a digital image analysis technique

HATTORI, Yasuo[1*] ; NAKAO, Keisuke[1] ; SUTO, Hitoshi[1]

[1]Central Research Institute of Electric Power Industry

Accurate descriptions of terminal velocity of ash-fall are practical interest in volcanic ash risk assessment on critical infrastructure (e.g. Wardman et al. 2012). Numerical simulations with an ash transport- and deposition-model, which has a capability to estimate spatial- and temporal-distributions of ash concentration and deposition, have become a powerful tool of the risk assessment (e.g. Folch 2012). Such simulations give the solution of governing equations on ash transport processes with numerical procedures. The governing equations include some empirical formulas with assumptions. Also for the estimation of terminal velocity of ash-fall, many empirical formulas have been already reported, but there exists considerable scattering of calculations among them (e.g Folch 2012).

In the present study, we examined a measurement for shape and velocity of ash-fall by employing a digital image analysis technique. We configured the experimental setup based on a shadowgraph particle measurement system of Dantec Dynamics to deal with non-spherical particles. The particles were illuminated by high-intensity pulsed lasers, Nd: YAG laser, with an optical diffuser. A CCD camera was placed in front of the light source, and the camera was equipped with a long-distance microscope lens to obtain visualized images of small particles. We carried out a trial measurement for sedimentation of corrected ash and discussed the optimization of measurement parameters and relationship between shape and velocity of ash-fall in a laboratory test. More details will be presented in the presentation, and we believe that our study must be helpful to develop the numerical simulations for evaluation of volcanic ash risk.

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Keywords: Terminal fall velocity, Particle image velocimetry, Laboratory test, Ash transport- and deposition-model