Wind-tunnel experiment for dynamic of non-spherical particle in upward flow with large velocity fluctuation

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Accurate descriptions of dynamics of ash-fall in a buoyant upward flow are interest in the development of volcanic plume models. Indeed, for estimating terminal velocities of ash-fall, which is a most important parameter of dynamics, 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 non-spherical particles, which mimics volcanic ashes, by employing a digital image analysis technique. We configured the experimental setup based on a shadowgraph particle measurement system of Dantec Dynamics. 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 used a vertical wind-tunnel with active turbulence grids to generate upward flows with large-velocity fluctuations (Hattori et al. 2010); the non-spherical particles were seeded into the test-section of the wind tunnel. The effects of large-velocity fluctuations, which is usually observed in volcanic plumes, on the dynamics, such as terminal velocities and rotations of particles, were investigated. More details will be presented in the presentation, and we believe that our study must be helpful to develop the numerical simulation models for volcanic plume flows.

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