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Insight into setup of typical meteorological conditions for evaluating volcanic ash hazard

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Estimation of ash concentration and deposition is of practical interest in evaluation of volcanic ash risk on critical infrastructure (e.g. Wardman et al. 2012). For estimating ash concentration and deposition, numerical simulations with an ash transport- and deposition-model have become a powerful tool (e.g. Folch 2012). However, the setup of meteorological conditions, which mainly control the ash transport- and deposition- processes in the atmosphere and on the ground, has not been discussed in details.

In the present study, we examine the estimation of ground deposition for a real test case, a volcanic ash hazard in Kanto-area for an eruption at Mt. Fuji, with various meteorological conditions by using an ash transport- and deposition-model, fall3d. The meteorological conditions are generated with the 53 years reanalysis meteorological dataset, CRIEPI-RCM-Era2, which has a temporal- and spatial resolutions of 1 hr and 5 km; the typical and extreme conditions were sampled by using Gumbel plot and an artificial neural network technique.

The ash deposition is invariably limited to the west area of Mt. Fuji, even with the typical wind conditions on summer, while the isopach of ground deposition depicted various distributions, which strongly depends on meteorological conditions. This implies that the concentric circular distribution must not be realistic. Also, a long-term eruption, such as the Hoei eruption during stage3, yields large deposition area due to the diurnal variations of wind direction, suggesting that the attention to the differences between diurnal variation and fluctuations of wind direction on evaluating of volcanic ash risk is vital.

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.

Keywords: Ash transport- and deposition-model, Long-term meteorological reanalysis, Extreme value, Artificial neural network, Advection-diffusion, Numerical simulation