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Volcanic ash aggregation: new insights from field and numerical experiments

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Particle aggregation is considered as a key process that may affect dispersal and sedimentation of volcanic ash, with significant implications for the associated hazards. So far the theoretical description of volcanic ash aggregation is commonly related to the solution of the Smoluchowski Coagulation Equations, a set of Ordinary Differential Equations (ODEs) which basically describe the change in time of an initial grain-size distribution due to the interaction of "single" particles. Nevertheless, field data show that this general description lacks of completeness, mainly due to the peculiarities of the volcanic context with respect to other fields (aerosol and pollution sciences). We propose an improvement of the general theoretical model in order to take into account the new insights from field observations. In particular, we focused on the problem of different densities between single particles and aggregates. This algorithm has been applied to observed volcanic eruptions (i.e. Eyjafjallajokull 2010, Sakurajima 2013 and Mt. Saint Helens 1980) in order to investigate the sensitiveness of the model with respect to the input parameters (total grain-size distribution, collision kernels, sticking efficiencies). Constrains on these parameters come from field observations and laboratory experiments.