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Experimental investigation of the aggregation-disaggregation of colliding volcanic ash particles in turbulent, low-humidity suspensions

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We present the results of laboratory experiments on the aggregation and disaggregation of colliding volcanic ash particles. Ash particles of different composition and size <90 μm were held in turbulent suspension and filmed in high-speed while colliding, aggregating, and disaggregating, forming a growing layer of electrostatically-bound particles along a vertical plate. At room conditions and regardless of composition, 60-80% of the colliding particles smaller than 32 μm remained aggregated. In contrast, aggregation of particles larger than 63 μm was less efficient and, when a layer formed, got disaggregated by collisions or drag twice more frequently than that of smaller particles. An empirical relationship linking the aggregation index, i.e, the effective fraction of aggregated particles surviving disaggregation, to the mean particle collision kinetic energy is provided. Our results have potential implications on the dynamics of volcanic plumes and ash mobility in the environment.