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Parameterization of volcanic ash remobilization by wind–tunnel erosion experiments.

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The remobilization of volcanic ash from the ground is one of the many problems posing threat to life and infrastructures during and after the course of an explosive volcanic eruption. A proper management of the risks connected to this problem requires a thorough understanding of the factors that influence and promote the dispersal of particles over large distances.
Towards this target, we conducted a series of experiments aimed at defining first-order processes controlling the remobilization threshold of ash particles by wind erosion.
In the framework of the EU-funded Europlanet project, we joinly used the environmental wind tunnel facility at Aarhus University (DK) and the state-of-the art high-speed imaging equipment of INGV experimental lab (Italy) to capture at unparalleled temporal and spatial resolution the removal dynamics of ash-sized (half-millimetre to micron-sized) particles. A homogenous layer of particles was set at on a plate placed downwind a boundary layer setup. Resuspension processes were filmed at 2000 fps and 50 micron pixel resolution, and the plate weighted pre and post-experiment. Explored variables include: 1) wind speed (from ca. 1 to 7 m/s) and boundary layer structure; 2) particle grain size (from 32-63 to 90-125 micron), and sample sorting); 3) chemical and textural features, using basalt and trachyte samples from Campi Flegrei (Pomici Principali,10 ka) and Eyjafjallajökull (May 2010) eruptions; and 4) temperature and humidity, by conducting experiments either at ambient conditions or with a heated sample. We found that the grain size distribution exerts a strong control on the fundamental dynamics of gas-particle coupling. Particles > 90 micron detach from the particles layer individually, also entering the gas flow individually. Conversely, removal < 63 micron particles occurs in clumps of aggregates. These clumps, once taken in charge by the gas flow, are frequently disaggregated and dispersed rapidly (order of few milliseconds). Our preliminary results shows that, for a given size distribution, the boundary between the two dynamics may shift greatly as a function of ambient humidity.