In situ study of volcanic ash resuspension using a portable wind tunnel.

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The resuspension of volcanic ash deposits by wind is a well-known source of hazard following explosive eruptions. Besides the main control exerted by the local wind field, ash resuspension is also influenced by: 1) atmospheric humidity; 2) features of the deposit (grain size distribution, sedimentary structures, etc.), and 3) features of the substrate (i.e. moisture, roughness). Ash resuspension is modeled using numerical simulations, which however require physical characterization and identification of the critical parameters controlling ash resuspension. Wind tunnel studies on volcanic particles are very limited and restricted to laboratory parameterizations, with in-situ effects not been parameterized. We tested field experiments of volcanic ash resuspension developing a portable wind tunnel and deploying on proximal (3 km) ash deposits from the semi-sustained activity of Sakurajima volcano (Japan) and from distal (250 km ca.) ash deposits from the 2011 Cordon Caulle eruption (Chile). The wind tunnel is calibrated with both LDA and pitot tubes measurements. The device allows generating a controlled wind profile within a 110x12x12 cm test section, which is placed directly on an untouched test bed of naturally deposited ash. Two types of experiments were performed: 1) ramp up speed experiments, where the wind speed is increased until reaching the threshold friction speed on four different substrates; 2) constant speed experiments, where three wind speed values where kept for 20 minutes using the same substrate. The threshold friction speed is measured with a hot wire anemometer, and the movement of resuspended ash is detected by means of multiple high speed and high definition digital camcorders. In-situ measured threshold friction speeds are compared to 1) in situ observed episodes of resuspension driven by local winds and 2) laboratory determination of threshold friction speed in controlled environmental conditions, and using the same ash deposited homogeneously.
