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Field-based study of volcanic ash via visible and thermal high-speed imaging of explosive eruptions

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Subaerial explosive volcanic activity ejects a mixture of gas-ash-pyroclasts in the atmosphere. Parameterizing the physical processes responsible for ash injection and plume dynamics is crucial to constrain numerical models and forecasts of potentially hazardous ash dispersal events. In this study we present preliminary results from a new method based on visible and thermal high-speed video processing from Strombolian and Vulcanian explosions. High-speed videos were recorded by a Optronis CR600x2 camera (1280x1024 pixels definition, 500 Hz frame rate) for the visible and by a FLIR SC655 (640x480 pixels definition, 50 Hz frame rate) for the thermal. Qualitatively, different dynamics of ash injection and dispersal can be identified. High speed cameras allow us to observe all the different phases during volcanic plume dispersion with a very good time resolution. Multiple features were already observed about volcanic plumes, but this tool give a better accuracy to our observations and allow us to better define previously observed features and to be able to identify new ones. Quantitatively before using our videos a pre-processing is needed which aim is to isolate the plume from the background by using different types of filters without altering the data, to allow us to use automated procedures to track volcanic plumes. In this study we extract data from these videos (plume height, velocity, temperature, mass, volume,...) using different software tools. Doing this allow us to be able to define and constrain main parameters and processes in function of the observed volcano and explosion type, but also to find correlations between parameters and establish empirical relations. We define range of values for each parameter and their respective impact on plume dynamics and stability, to be able to obtain characteristic fields of values for each case and link it to explosions type and evolution.