Particle detection and velocity prediction for volcanic eruptions : a preliminary study

Maxime Bombrun[1], Vincent Barra[1], Andrew Harris[2]

[1]Clermont-Universite, Universite Blaise Pascal, LIMOS, France, [2]Clermont-Universite, Universite Blaise Pascal, LMV, France

E-mail: maxime.bombrun@gmail.com

Measuring parameters of all particles as they exit the vent during an explosive eruption is the best way to gather size, shape, velocity and mass statistics for the solid (particulate) fraction of the plume. We propose to compute velocities, particle size distributions and mass fluxes using high spatial resolution (cm-to-mm pixel) thermal infrared imagery collected at 200 Hz for small explosive eruptions at Stromboli (Italy). In order to tackle this problem, we developed a new method based on a pyramidal Lucas and Kanade optical flow algorithm. This allows particles to be detected, and velocities to be predicted, through time. First, a corner detection algorithm is used to allow segmentation of the whole image. This procedure of feature identification is based on the motion of the particle. Then, a differential method is used: the Lucas-Kanade algorithm. This provides a solution of the optical flow equation. Thus, it enables the computation of the local velocity vector that can be used as an indicator for the tracking step. Using this method, we were able to obtain both the distribution of particle sizes and velocities. We examined during one eruption around 650 particles per frame which, for 2637 frames, resulted in around 2152639 particles.