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Ash concentration of Sabancaya volcanic plumes retrieved from a 95 GHz radar and a disdrometer

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We have carried out an experiment using a 3.2 mm-wavelength scanning Doppler radar and a laser disdrometer to investigate ash plumes of Sabancaya volcano (Peru) in May 2018. Our main objectives were to retrieve the mass loading parameters (concentration, mass flux) which are critical for the modelling of ash dispersal, as well as to study the dimensions and internal dynamics of the eruptive columns, plumes and fallout. The radar and the disdrometer were respectively located at 4.5 km NNE and 4.5 km E from the vent. Multiple radar sounding configurations were tested either in fixed-pointing mode, generally close to the source, or using scans across various regions of the plumes.
Particle Size Distribution, shapes and density were characterized from microphysical analyses, sieving and water pycnometry of ash samples collected on the ground. A Parsivel2 disdrometer also recorded the sizes, and settling velocities of fallout, allowing us to estimate sedimentation rates on the ground and to derive an empirical law relating calculated ash concentrations and reflectivities. Comparing the latter with reflectivities measured by the radar at unprecedented space-time resolutions (down to 12.5 m and 0.25 s) allowed us to obtain the internal mass distribution of eruptive columns, plumes, and fallout at various distances from the emission source.