

A miniature particle counter (LOAC) under meteorological balloons for the study of the volcanic plume height and particle fluxes near the vent

Damien Vignelles, LPC2E, Orléans, France

Studying volcanic plumes through in-situ measurements remains necessary in order to understand the chemical and dynamical behaviour of volcanic plumes close to the vent. Several authors have demonstrated that measuring chemical plumes properties with drones is feasible. None of these studies employed particle sensors because particle counters remain difficult to deploy due to their weight and consumption. A miniature balloon-borne particle counter called LOAC (Light Optical Aerosol Counter) have been developed at the LPC2E (Laboratoire de Physique et de Chimie de l'Environnement et de l'Espace). This aerosol counter is involved in several programs including the study of volcanic plumes. A first measurement was made during the Icelandic Holuhraun eruption in January 2015. The meteorological balloon carrying the LOAC has crossed the plume 8 km from the vent and allowed us to measure several parameters in a very young plume alongside the vertical balloon ascent.

The top plume altitude measured by the LOAC has been compared to top plume altitude retrieved using IASI (Infrared Atmospheric Sounding Interferometer) and gives a good correlation (2.9 ± 0.2 km for LOAC and 3.0 ± 1.1 km for IASI).

The particle flux has been estimated using a SO₂ DOAS (ground-based UV spectrometer) and assuming a constant ratio between number of particles at the location where the balloon crossed the plume and the mass of sulfur dioxide. A flux of $2 \cdot 10^{15}$ particle per second has been estimated more as a methodologic demonstration than a scientific result.