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Modelling gas dispersal phenomena at La Soufrière volcano (Guadeloupe, Lesser Antilles)

Silvia Massaro[1], Fabio Dioguardi[2], Laura Sandri[1], Giancarlo Tamburello[1], Jacopo Selva[1], Sèverine Moune[3,4], David Jessop[3,4], Roberto Moretti[3,4], Jean-Christophe Komorowski[3], and Antonio Costa[1]
[1]Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Bologna, Italy (silvia.massaro@ingv.it)
[2]British Geological Survey, The Lyell Centre, Edinburgh, UK
[3]Observatorie Volcanologique et Sismologique de Guadeloupe, Institut de Physique du Globe de Paris, Gourbeyre, Guadeloupe
[4]Universitè Clermont Auvergne, CNRS, IRD, OPGC Laboratoire Magmas et Volcans, Clermont-Ferrand, France

In recent decades, reliable computational models have significantly advanced, and now represent a valuable tool to make quantitative and testable predictions, supporting gas dispersal forecasting and hazard assessments for public safety. In this study, we carried out a number of tests aimed to validate the modelling of gas dispersal at La Soufrière de Guadeloupe volcano (Lesser Antilles), which has shown quasi-permanent degassing of low-temperature hydrothermal nature since its last magmatic eruption in 1530 AD. In particular, we focused on the distribution of CO_2 and H_2S discharged from the three main present-day fumarolic sources at the summit, using the MultiGAS measurements of continuous gas concentrations collected during March-April 2017. We implemented the open-source Eulerian code DISGAS-2.0 for passive gas dispersion coupled with the mass consistent Diagnostic Wind Model (DWM), using wind measurements and atmospheric stability information from a local meteorological station and the ECMWF-ERA5 reanalysis data. We found that model outputs are highly dependent on the resolution of the topographic data, which affect mainly the reliability of DWM meteorological fields, especially on and around the steep dome. Our results satisfactory reproduce the observed data, indicating the potential usefulness of DISGAS-2.0 as a tool for quantifying gas hazard and reproducing the fumarolic degassing and at La Soufrière de Guadeloupe.