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Ground-based volcanic ash detection with low-cost sensors – a case study at the 2021 Cumbre Vieja eruption

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The Tajogaite eruption of Cumbre Vieja volcano, in 2021, was a basaltic fissure eruption characterised by a variety of eruptive styles ranging from the predominantly strombolian activity, to lava fountaining, ash emission and effusive activity. The eruption lasted nearly 3 months, produced an extensive lava field and about 45.10^6 m^3 of tephra. Although its intensity varied throughout the entire duration of the eruption, the eruptive plume had a typical height of about 3500 m asl and reached a maximum of 8500 m asl just hours before the end of the eruption, on the 13th of December. Ash is, therefore, a significant hazard to consider not only during the eruption, but also on the post-eruption phase.

To measure ash in the air around the volcano, during the last stage of the eruption and the following weeks, an experiment was devised based on a proximal network of several ground-based low-cost sensors, measuring suspended particulate matter (PM_{10}, $PM_{2.5}$) concentration, air temperature, and relative humidity.

The results showed that, during the documented period, the daily mass concentration of particulate matter in the air reproduced the peak on the eruptive column high at the end of the eruption. After the eruption several significant resuspension events were detected simultaneously in several stations; in addition, after the eruption, a major event of “calima” dust intrusion largely exceeded all recorded eruptive events. Overall, even after the eruption, the 24-hour average exposure to $PM_{2.5}$ surpassed the guidelines of the World Health Organization.

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