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The hidden eruption: 21 may 2023 Etna (Italy)

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We report the results of field and Unoccupied Aerial System (UAS) surveys carried out after the 21 May 2023 eruption of Etna (Italy). This event occurred under terrible weather conditions that prevented its observation by the INGV-OE (Istituto Nazionale di Geofisica e Vulcanologia-Osservatorio Etneo) surveillance video and thermal camera network. After some weeks of Strombolian activity at the South-East Crater (SEC), which started on the 4th of May, a dramatic increase in the volcanic tremor, localized underneath the SEC, marked the onset of lava fountain at 5.30 UTC on the 21st of May. The lava fountain, lasting at least 4 hours, formed a lava flow and a plume about 10 km high, while ash fell on the southwest flank of the volcano. The bad weather condition, that consisted in strong storm and dense clouds covering the summit of Etna, did not permit to observe the phenomenon. Luckily the multi-parameter monitoring stations scattered around the volcano were working. In particular, the volcanic tremor, the clinometric and the borehole dilatometer signals clearly indicated the onset of a lava fountains. An unusual snow fall (considering it was springtime) did not allow any direct survey of the area until two weeks later, and the continuing cloud cover hindered remote observation. When MapLAB staff, of the INGV-OE, finally reached the eruptive scenario to perform a UAS survey, they realized that a volcanoclastic deposit overlapped the middle portion of the lava flow. During the survey, the deposit has been also studied and sampled along its extension. Thanks to a Structure from Motion software a 3D reconstruction of the SEC, the lava flows and the deposit has been done. The data collected allowed for detailed mapping, quantification and characterization of the proximal and distal products (300 m and more than 800 m away from the vent, respectively). The presented results increase knowledge about the SEC instability and collapse phenomena, of which we have become increasingly aware over the past two decades. These hazards could present a significant threat for people walking along touristic path ways near Etna summit craters.