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A comparison of ground-based and satellite-derived radiative heat flux at Mt Etna: the 12 August lava fountain case study

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The recent eruptive activity at Mt Etna has been characterized by quiet frequent, intermittent episodes of lava fountains associated with small lava flow output, occurring especially at the SE Crater. During 2011, 18 paroxysmal lava fountains were produced by a new cone, named "Sturiale Cone", on the east flank of the SE Crater. Given the high hazard posed by this activity, and the need of improving detection, description and knowledge of these events, remote monitoring through fixed cameras and satellites has becoming crucial, especially using thermal sensors. We here focus on the 12 August 2011 episode, the strongest of the lava fountains occurred in 2011, and also the best monitored, given the clear sky, absence of clouds, and possibility to collect also images from a close-up view. We disposed of a total of 8 fixed cameras working around the volcano, three of them offering a thermal view of the episode. Moreover, as satellite observations, we could use the complete data set from the SEVIRI sensor, which has a temporal resolution of 15 minutes.

To compare the field- and satellite-derived radiative heat flux curves, thermal images were registered by taking into account a DEM, the GPS camera position, the relative camera rotations and first order lens distortion parameters. Moreover, it was performed a pixel by pixel correction from path length and atmospheric effects. Finally, a temperature threshold was fixed to identify the active lava area and the amount of heat lost by radiation from all the pixels covered by lava was computed. SEVIRI data were analyzed by the HOTSAT thermal monitoring system. Through automatic hot-spot detection algorithm based on dynamic thresholds, we are able to provide an estimate of the radiant heat flux for each thermally anomalous pixel and possibly convert it into time averaged discharge rate.

Preliminary results showed a good agreement on timing, shape and amplitude of the radiative heat flux time series between thermal camera and SEVIRI data. Moreover, we could identify different phases of the eruptive activity: the initial Strombolian explosive activity, the lava fountain episode, the lava flow emission and its final cooling. Eventually, from the cooling curve the total lava volume was estimated, finding that 2.8 million of cubic meters of lava were erupted with a mean output rate of about 200 cubic meters per second.