

The 2019 eruptive phase of Stromboli volcano through multiparametric geophysical observations

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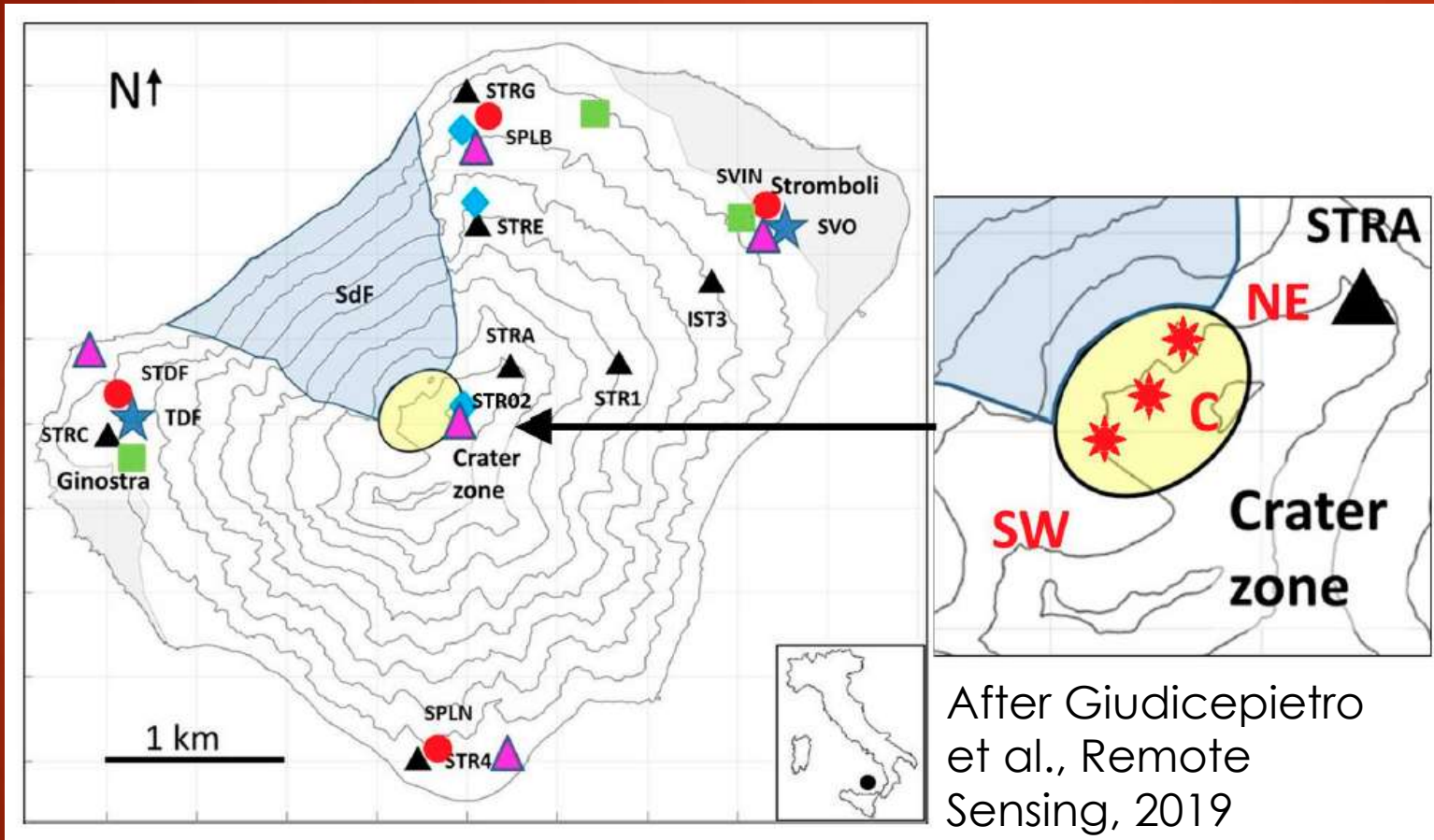
Paroxysmal activity of summer 2019

In summer 2019, two paroxysmal explosions occurred in Stromboli. The first one occurred on July 3, when the Strombolian ordinary eruptive activity did not show a significant intensification. The explosion formed an eruptive column more than 3 km high. A pyroclastic flow ran down the “Sciara del Fuoco” slope causing a victim and some injuries. Moreover, the pyroclastic flow spread over the sea surface for about one kilometer. On August 28 a second paroxysmal explosion occurred, similar to the previous one. Also in this case the eruption formed an eruptive column of more than 3 km and a pyroclastic flow that expanded along the “Sciara del Fuoco” slope and traveled about 1 km on the sea surface.

July 3, 2019 paroxysm



The multiparametric network

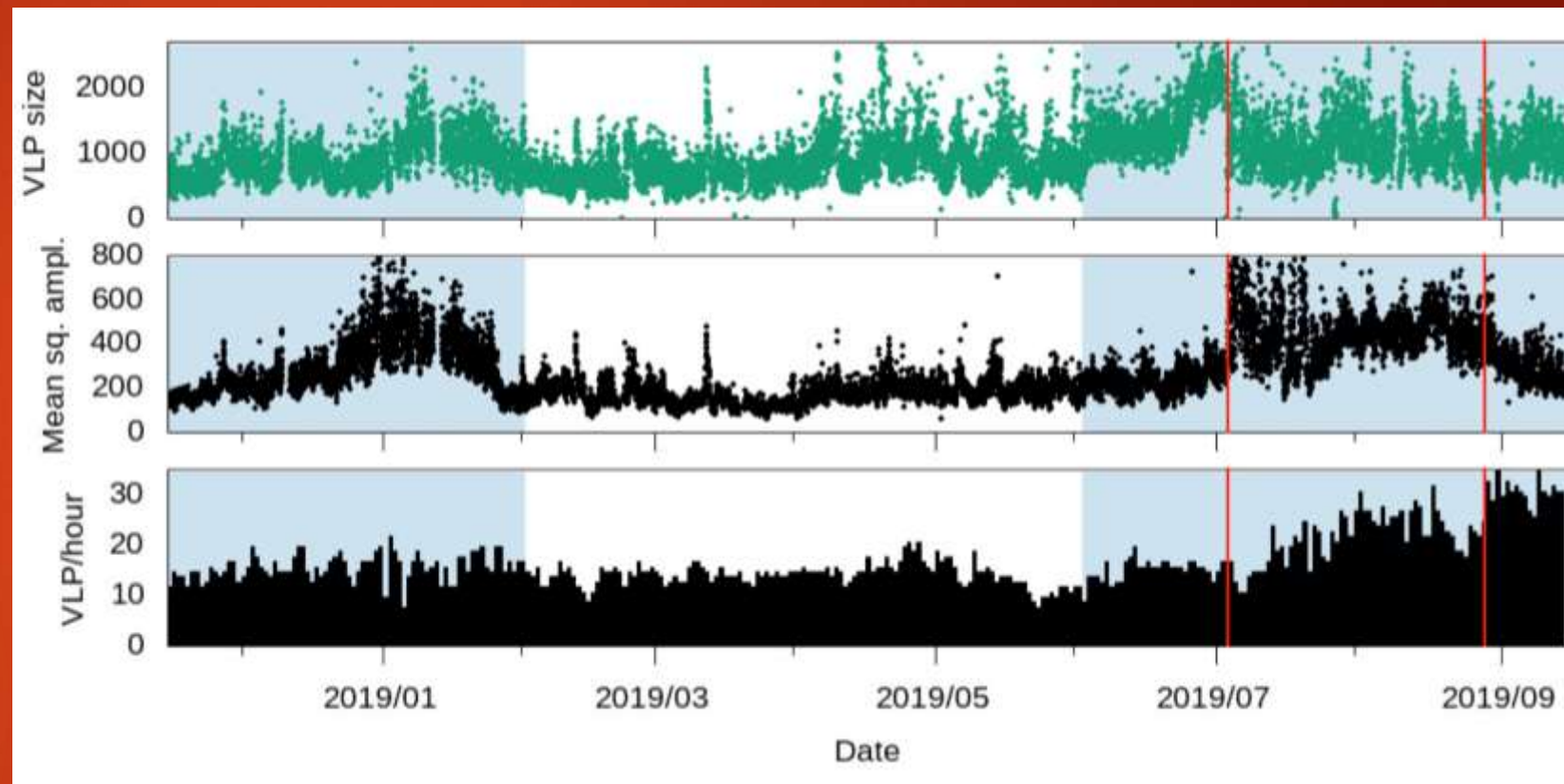


- ▲ Seismic Stations
- Monitoring Cameras
- ★ Strainmeters
- * Vents

After Giudicepietro et al., Remote Sensing, 2019

Precursor Parameters

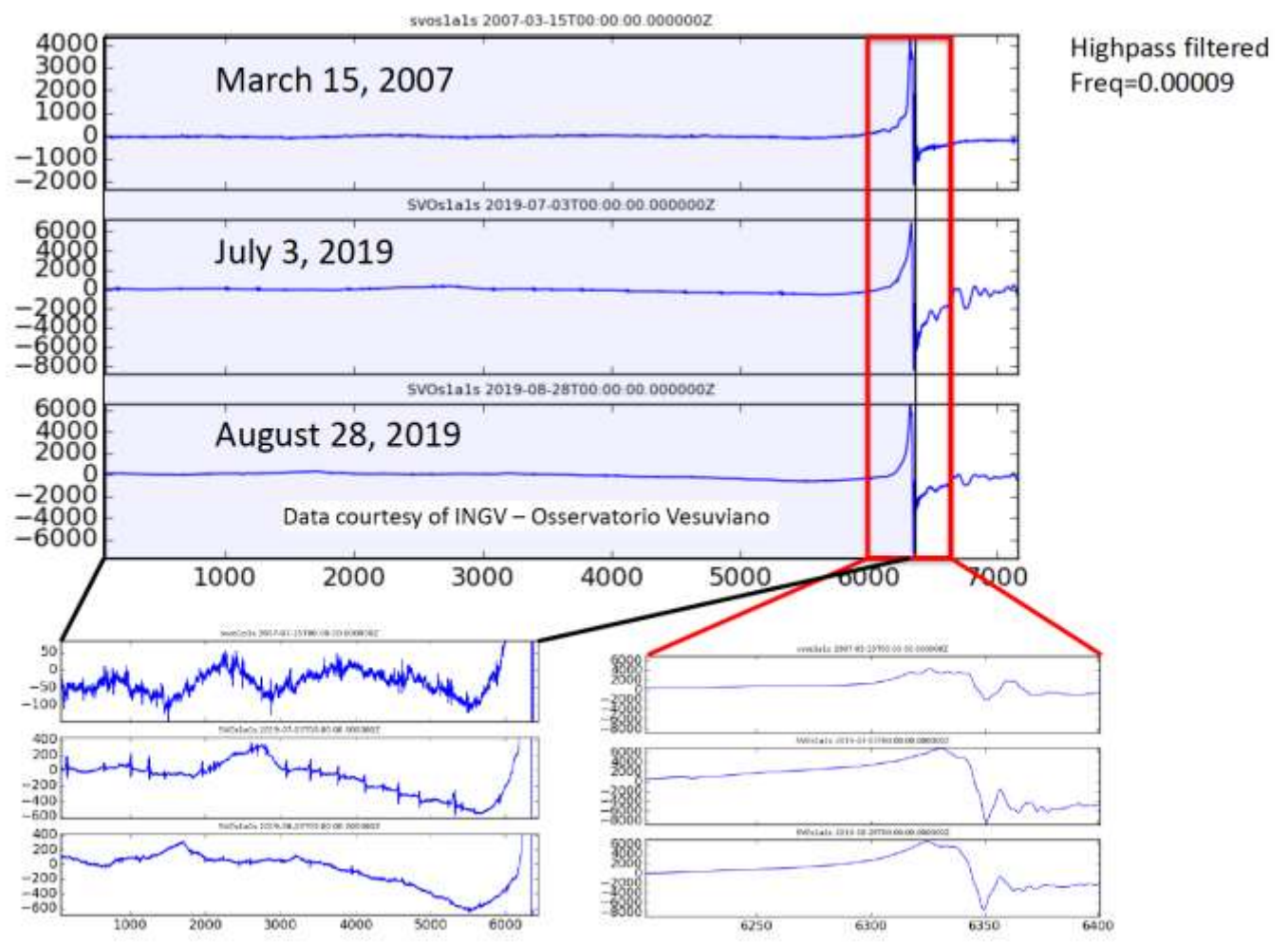
The eruptive phase of summer 2019, which began with the paroxysm of 3 July, was not preceded by significant changes in the routinely monitored parameters (black in figure), such as the hourly frequency (daily average) of the VLP events and the amplitude of the seismic signal (Mean square amplitude). For this reason, we have analyzed the seismic data recorded by the INGV geophysical network in the period November 2018 - September 2019, focusing our attention on other parameters that can give indications on the state of activity of the volcano. We defined the "VLP size" (green in figure), which takes into account the waveform of the VLP events, in terms of both amplitude and duration.



We also applied time varying Fractal Dimension (FD) analysis to the seismic station close to the crater area and we analyzed the polarization of the signal of the same station. We carried out the polarization analysis. We found that the "VLP size", the FD and the polarization parameters showed significant changes about one month before the paroxysm of July 3. The results of this work are currently submitted for publication

Strainmeter signals

Strainmeter data of paroxysms



Strainmeter signals of three paroxysms recorded in Stromboli

Conclusions

- ▶ Stromboli activity changed: first paroxysm recorded by the monitoring network without fissure effusive eruption on July 3, 2019; two paroxysms occurred within 56 days, July 3 and August 28, 2019.
- ▶ Both the 2019 paroxysms produced relatively large pyroclastic flows, that are very hazardous phenomena.
- ▶ We are studying seismic parameters (VLP size, Fractal Dimension, polarization parameters, etc ...) and the strainmeter data to identify paroxysm precursors and to set up an automatic timely alarm system. The work is in progress.
- ▶ We wish to thank all the many colleagues who contribute to the monitoring effort on Stromboli. We are particularly indebted to the INGV technical staff ensuring the regular working of the multidisciplinary monitoring networks. This work benefited from funds of the EU (DG ECHO) Project EVE n. 826292 and was partially supported by the project INGV-FISR-2017 “Sale Operative Integrate e Reti di Monitoraggio del Futuro: l’INGV 2.0”. We also thank the Italian Presidenza del Consiglio dei Ministri-Dipartimento della Protezione Civile (DPC) for supporting the monitoring activities at Stromboli. This presentation does not necessarily represent DPC official opinion and policies.