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Characterization of low frequency seismicity at Etna Volcano during 2010 eruption, using advanced automatic analysis algorithms

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In volcano seismology, analyses of low frequency seismicity play an important role in determining the internal volcano dynamics and in understanding the unrest state of a volcano. In particular, the Long Period (LP) events are of crucial interest in volcano monitoring due to their strictly link with the magmatic dynamics within volcanoes. In addition, understanding the origin and periodicity of LP events can be fundamental for volcanoes activities monitoring, as they commonly precede and accompany volcanic eruptions, and could forecast volcanic crisis through early-warning monitoring systems.
Aimed to these purposes, we applied advanced algorithm in order to perform an automatic analysis of long period events (LP) in continuous seismic records. In particular, we applied the SALPED algorithm (García et al., 2017) to the continuous raw seismic signals recorded on Mt. Etna Volcano during the 2010 summer. The first result, performing this analysis, was to find different LP families. The second step was to apply on this new dataset a new automatic algorithm in order to cluster the LP recorded during the period under study within the different families previously found. Such new algorithm, that uses a window-based quantification of the changes of amplitude and frequency within the event duration, permits to identify different temporal evolutions corresponding to each of the four families. These differences in the waveform shape between the families could be caused by a different source position and/or source mechanism.
We observed that these four families were not recorded continuously throughout the period under study, due probably to the volcanic activities occurred during august 2010. In particular, we suppose that the waveforms change was due a modification in the plumbing system, caused by the eruptive activity occurred at summit craters, can justify it.
According to LP event source models, the generation of these signals could require geometrical discontinuities along the magmatic transport system such as changes in conduit diameter, pipe elbow, and interlocking. On this basis, we think that the LP events were due to a given discontinuity within the shallow plumbing system, which was partially modified by the eruptive activity.
The proposed approach will open interesting perspective toward utilization of this algorithm to find seismic signals that are relevant to monitor volcanoes and forecast their activity through the analysis of existing big seismic data records.
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