





V23I-0311 - A Multi-Station Warning System for Short-Term Detection of Volcanic Unrest at Etna Volcano (Italy)

 Tuesday, 10 December 2019

 13:40 - 18:00

 Moscone South - Poster Hall

Swirl Topics

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Abstract

The Early-warning of a volcanic unrest requires continuous, reliable information from monitoring before volcanic activity starts. An optimal source of such information are seismic data, which overcome problems due to prohibitive conditions for field surveys or cloud cover that may hinder visibility. Given the large amount of digital data accumulating in short times, techniques of automatic pattern recognition are necessary in the context of effective extraction of information and data reduction. We designed a multi-station warning system based on pattern recognition techniques. In particular, a classification of patterns of volcanic tremor, the background seismic radiation, has been performed. Two unsupervised classifiers, Self-Organizing Maps (SOM) and fuzzy clustering were applied to automatically detect patterns which are typical footprints of an impending volcanic unrest. Plotting the SOM colors on DEM allows us their geographical visualization according to the stations of detection; this spatial location may give hints on areas potentially impacted by eruptive phenomena. The method implies continuous processing of recorded data streams; it was tested and tuned over year-long data streams on the base of eruptive phenomena occurred at Etna, Italy, in recent years. Here we present results of the application of the classifier, which forecasted in hindsight patterns associated with fast-rising magma (typical of lava fountains) as well as a relatively long lead time of the outburst (lava flows from eruptive fractures). The performance of the multi-station system was evaluated by using Receiver Operating Characteristics (ROC) curves; the result is indicative of a good detection accuracy that cannot be achieved from a mere random choice.

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