IAVCEI (Volcanology, Geochemistry)

VS10/VS11/VS31 Probabilistic Volcano Hazard Analysis / Short-Term Forecasting of Volcanic Hazard: So Far, So Good? / Quantifying and Communicating Uncertainty During Volcanic Crisis

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Abstract content:

Application of a multi-station alert method for short-term forecasting of eruptions at Etna, Italy

From 11 January to 15 November 2011, 18 paroxysmal eruptions occurred at Etna, Italy. These events belong to a long sequence of eruptive episodes, which marked the prevalent explosive style of the volcano since the early 2000s. Applying "KKAnalysis", a software for pattern classification that combines Self-Organizing Maps and fuzzy clustering, to the background seismic radiation (so-called volcanic tremor), we were able to detect critical changes in the spectral characteristics (amplitude and frequency content) at a very early stage of the volcano unrest. The online implementation for surveillance purposes of KKAnalysis provided automatic alert of the impending eruptive events from hours to a few days in advance. In its original version, the classifier analyzed the data stream continuously recorded at a single seismic station. By using offline a modified version of KKAnalysis, here we apply the software to the seismic signal recorded at 11 broadband stations in 2011. The seismic sensors were located at various distances (from 1 to 8 km) from the active craters. The continuous records and the optimal geometry of the seismic network offer us the possibility to track the spectral variations in time and space. We show the new results of pattern classification and propose a revised, more powerful multi-station alert method that now provides short-term forecasting also in the form of animated maps that flag the detection of changes at each station. This allows us to observe how the unrest develops in various sectors of the volcano. We discuss the performance of the method and the robustness of the eruption forecasts in the context of the complex dynamics of a volcanic system such as Etna.

Author(s):

S. Spampinato[1], A. Messina[2], H. Langer[1], S. Falsaperla[1].
[1]Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania- Osservatorio Etneo, Catania, Italy.
[2]Istituto Nazionale di Geofisica e Vulcanologia, Sezione Roma 2, Rome, Italy.

Keywords:
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