

Session: S01.40 - Advanced Processing Techniques for Geophysical Signals Recorded at Active Volcanoes

The VULCAN.ears project: an Esperanto for the volcano-seismic event recognition as a portable tool for real-time monitoring and eruption forecasting

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The increase of the seismic activity of volcanoes is still the most reliable precursor used for Eruption Forecasting and Early Warning Systems (EWSs). In order to discriminate precursory seismic patterns it is necessary a) to detect relevant events and b) to assign them to classes according to their physical origin, in a process called labeling or classification. While volcano monitoring (VM) centers and EWSs demand real-time operation, manual classification carried out by experts is a time-consuming and not always reliable task, often resulting in the impossibility to properly analyze the seismic evolution during crises.

The aim of the EU-funded [VULCAN.ears](#) project (*Volcano-seismic Unsupervised Labelling and ClAssificatioN Embedded in A Real-time Scenario*) is to build an automatic Volcano Seismic Recognition (VSR) system designed to detect and classify signals in unsupervised scenarios (without having any prior knowledge of the signals to recognize), and portable enough to be easily integrated into any monitoring system. The system is based on state-of-the-art VSR technologies, using a structured modeling via Hidden Markov Models (HMMs) and a parallel approach (Parallel System Architecture, PSA-VSR) composed of specialized channels, each designed to recognize events of a single class from continuous data streams.

Relevant advances have been achieved towards real-time, unsupervised VSR:

- Design of a GUI front-end (*geoStudio*) to easily integrate the automatic VSR into VM centers and EWSs.
- Efficient description of events via robust feature selection in PSA-VSR systems, increasing the recognition class accuracy by more than 40% compared to usual serial VSR (SSA-VSR).
- Joint databases built from several volcanoes allow the building of general models able to classify events from other volcanoes.
- The automatic classification of volcano-seismic events improves the success of prediction approaches, such as the material Failure Forecast Method, when applied to the most relevant event class(es).