

# **Volcano-Seismic Recognition (VSR) under noisy conditions via waveform reconstruction**

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Volcano-Seismic Recognition (VSR) systems are becoming an essential tool in modern Volcano Monitoring centers: machine learning technologies are able to detect and classify volcano-seismic events in real-time. This allows an on-line tracking of the seismic activity, which plays a key role in volcano forecasting and early warning systems. This work addresses the performance of a VSR system and the evaluation of the robustness of a Hidden Markov Model based recognition system in the presence of noise.

Noisy signals recorded at Deception Island volcano by short period seismometers in the 1995 austral summer have been used to build models in order to detect and classify LP and VT events overlapped on tremor/noise acquired by a broadband station in 2009. Furthermore, the stations were placed in different locations which show a variety of site effects and noises.

To deal with the inherent data waveform variability in this setup, we propose to reconstruct the signals aiming to achieve both modeling standardization and noise reduction objectives. Several reconstruction approaches, each defined by an Empirical Mode Decomposition (EMD) technique and a reconstruction criterion, have been analyzed in order to evaluate their impact on the VSR robustness. The results score an improvement of 16% in recognition accuracy and show the potential of parallel VSR architectures to select the best reconstruction approach independently for each event type, instead of choosing just one EMD solution for the whole system.