

Seismic waveform classification for automatic detection and improved location of volcanic events

Charlotte Rowe and Jonathan MacCarthy, Los Alamos National Laboratory, Los Alamos, New Mexico, U.S.A.

Clifford Thurber, University of Wisconsin, Madison, Wisconsin, U.S.A.

Randall White, U.S. Geological Survey, Menlo Park, California, U.S.A.

Flora Giudicepietro, Osservatorio Vesuviano, Naples, Italy

Richard Luckett, Montserrat Volcano Observatory, Salem, Montserrat, West Indies

We present and expand upon a previous detailed analysis of over a dozen hybrid earthquake swarms associated with dome extrusion at Soufriere Hills Volcano in 1995-1996, as well as one swarm of possible VT activity early in the sequence. Waveform cross-correlation methods were used both to identify large seismic swarms and to adjust analyst phase picks to improve event locations. Relocations of hybrid events highlighted very tightly concentrated seismic sources (~50-100 m spatial extent) between 1.3 and 1.6 km depth below the summit. Seismic energy release for the swarms dominated the recorded activity at the volcano during our 8-month catalogue. These swarms have been interpreted as arising from cyclic plug extrusion, which produces isolated concentrations of elevated volatiles near a detachment surface; the volatiles enable excitement of nondestructive, repetitive disturbances in the multiphase system. Ongoing work involves exploration of alternative event classification tools for comparison to our previous, cross-correlation-based method. We explore a variety of clustering schemes as well as artificial neural network classification, and we contrast these methods applied to signals which are pre-processed using a suite of techniques including signal decomposition, adaptive coherency weighting and linear prediction coding. The most effective methods identified in this comparison are combined with the aim of determining a robust tool for near-real-time classification and identification of volcanic seismic activity that is indicative of elevated hazards.

Keywords: Soufriere Hills Volcano, waveform classification, hybrid swarms, dome growth, cross-correlation, neural network

Contact information:

Dr. Charlotte Rowe
EES-11, M.S. D-408
Los Alamos National Laboratory
Los Alamos, new Mexico 87545 U.S.A.

Phone: 1-505-665-6404

FAX: 1-505-667-8487

Email: char@lanl.gov

Presentation preference: Poster

Preferred sessions: Geophysical Monitoring and Interpretation

Second choice of sessions: Comparison with other andesitic volcanoes