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A fullwaveform seismic event location method for volcano monitoring operations

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Automated seismic event location procedures are very important tasks in almost all seismological applications, including seismic monitoring of volcano activity. The large datasets produced during these operations pushed the development of new automated location methods. Seismic waveforms recorded in volcanic environments are often characterized by low signal-to-noise ratio, thus a successful data analysis requires noise robust automated location procedures. Standard automated location methods based on automated picking of the main seismic phases (generally only P and S first onsets) are prone to fail with noisy data, limiting the location performance. In this work we apply the waveform stacking location method developed by Grigoli et al. (2013, 2014) to volcanic environments. This is a noise robust and picking free location method that exploits the full waveform information content of seismic recordings. Starting from raw seismograms, the first step of the location process consists in the computation of a P-phase and a S-phase stacking functions. For the P phase we use the STA/LTA of the vertical energy trace, whereas for the S we use the STA/LTA of a trace obtained using the principal eigenvalue of the instantaneous covariance matrix (Vidale 1991). For a given source location, we sum both P and S stacking functions along the theoretical travel times corresponding to the selected hypocenter. To locate a seismic event we iterate this procedure for all samples of the recorded traces and for all possible source locations within a predetermined seismogenic volume. In this way we retrieve a multidimensional coherence matrix whose absolute maximum corresponds to the spatio-temporal coordinates of the seismic event. Here we present an application to a sample dataset for the 2011 unrest at Kirishima volcano, Japan. We show that this automated location method is particularly suitable for volcano monitoring applications, where large datasets are produced and need to be processed fastly.

キーワード: Seismic event location, Volcano seismology, Microseismic monitoring
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