

## Detection of long period events of the Aso volcano applying a matched filter technique to F-net broadband seismic data

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It has been reported that long period seismic waves above the period of 10 s are excited at the Aso volcano (Kaneshima et al., 1996, Science). These events have been activated from the summer in 2014. We are now developing a monitoring system of these events, applying a matched filter technique to F-net broadband seismic data (e.g., Asano et al., 2015, GRL).

In this method, cross correlation (CC) values between a template event and target data are calculated using three component continuous data of nine F-net broadband seismometers around the Aso volcano. Long period events are detected, if average value of CC exceeds threshold values. Assuming that the epicenter is within the volcano, only origin times of the events are estimated in this analysis, while Asano et al. (2015) estimated origin time and epicenters of shallow very low frequency earthquakes simultaneously. We selected the event at 6:05am on Mar. 31, 2009, as a template event, in this study. Waveforms are band-pass-filtered between 10 s and 20 s. Then, averaged value of CC of all components at all stations is calculated. If maximum value of averaged CC within 1 minute exceeds threshold values, the signal is detected as an event. In the following of this study, we show results from Apr. 2003 to Jan. 2015, assuming 0.3 and 0.5 as the threshold values. To measure the size of events, averaged amplitude ratio (AAR) is given by logarithmical average of ratios of maximum amplitude between target period and a template event. Daily values of AAR and number of events are defined by median of values in one day. We use these daily values in the following discussion. Daily number of events with threshold of 0.3 and 0.5 is denoted by N03 and N05, respectively.

In our result, long period events are relatively quiescent from Aug. 2010 to Feb. 2012. Number of events and AAR start to increase in Aug. 2014. After Oct. 10, 2014, N03 and AAR frequently exceed 500 and 2, respectively. Then, N05 and AAR decreases after the end of Nov. 2014. However, N03 is kept high. This suggests that number of events is still large, while the amplitude becomes low.

It remains some problems to be improved in our simple method. For example, CC value tends to be low, when far field large earthquakes occur. In addition, detectability of events may be saturated, when long period events recur within 1 minute, which is the length of the time window to select an event. Threshold value also should be examined, while we adopt the values of 0.3 and 0.5 in this study. However, as our method can quantitatively evaluate the activity of long period events, number of events and AAR are still useful parameters to evaluate the activity of the Aso volcano.

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