

Repeated Acoustic Emission Events before Stick Slip in a Laboratory Earthquake Experiment

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Acoustic Emission (AE) in laboratory earthquake experiments is useful for studying physical mechanisms of earthquakes. Here we conduct an experiment on a 1.1m×1.1m granite with a 1.5m pre-cut diagonal fault interface and 13 AE receivers on the surface with a sample rate of 3MHz. Many AE events are recorded before, during and after each stick-slip event. To obtain a more complete catalog, we apply a waveform-based template matching technique to automatically scan additional AE events with high cross-correlation (CC) values. Template AE events are picked by combining the short-term average to long-term-average ratio (STA/LTA) technique with Autoregressive-Akaike information criterion (AR-AIC) technique and are relocated by a grid search method. After the detection, we obtain 609 AE events, which are about 3 times more than the template AE events. We find a sudden increase of AE rates before the stick slip, followed by an Omori-law type delay, similar to typical aftershock sequences. In addition, we find 60 pairs of repeating events with very high CC values, including one cluster 8 repeated AE events right before the stick slip. These observations are consistent with recent field studies showing possible accelerating aseismic slip preceding mainshocks. Updated results will be presented in the meeting.

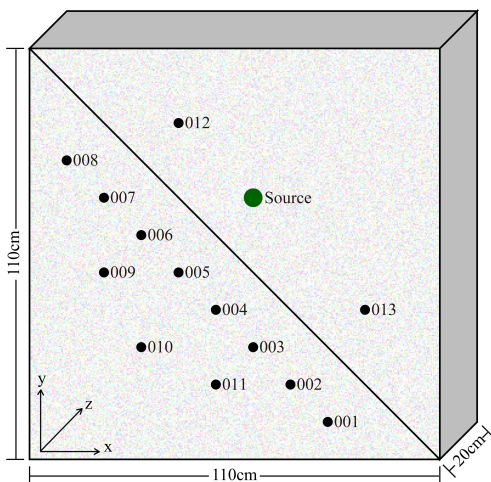


Fig.1 Setup of this experiment. Green dot is a source transducer, black dots represent the receivers, black line represents the pre-cut fault.