



A new procedure to detect short-duration tremor: A tool to identified fault asperities and locking depth

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We have developed a new procedure to detect ambient tremors along a low-seismic-efficiency transfer fault in southwestern Taiwan. The procedure includes bandpass filtering between 2-5Hz, noise reduction, modified normalized cross-correlation of waveform envelopes, amplitude contrast threshold, and waveform spectrogram analyses. The tremors were located by applying the grid-search method with a non-linear cross-correlation weighting technique. Totally 34 ambient tremor events during the year of 2012 with the maximum duration less than 10 minutes were detected in the transfer fault zone based on our new approaches. Our results show that transfer fault zone can be separated into three areas based on the distributions of tremors and earthquakes: the area I with depth of 0-6 km has few tremors and earthquakes; the area II with depth of 6-19 km has both tremors and earthquakes, and the area III with depth below 19 km has only a few tremors but no earthquakes at all. The coexistence of shallow-depth tremor with micro-earthquakes in the seismogenic zone (area II) has never been reported before and they clearly surround fault asperities. We interpreted the area I as the locking zone that agrees well with GPS observations and the area II as a seismogenic zone with mixing mechanical behaviors; i.e. both velocity-weakening friction and conditionally stable friction. The area III may represent an aseismic zone with some velocity-neutral patches embedded in massive velocity-strengthening fault rocks. The presence of short-duration tremor events coexisting with micro-earthquake in the seismogenic zone may be a common feature than a special case, especially in those faults with less seismic efficiency as the one we studied. Hence, they can act as good indicators of fault locking depth and asperities.