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Segmentation and Interaction of Low-Frequency Earthquake Activity Along the Strike of Subducting Slab in Shikoku, Japan

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Abstract:

Low-frequency earthquakes (LFEs) are short-duration impulsive transient seismic events within slow earthquakes family observed in the transition region of the subduction zones or active faults. LFEs are generally associated to the tectonic tremor as they often appear mixed within complex signal during tremor sequences or episodic tremor and slip (ETS) events. More and more evidences indicate that generation of slow earthquakes is fluid-enhanced and that LFEs are more likely to occur in un-drained condition. Thus, LFEs may act as markers of increased transient fluid pore pressure along fault interfaces. An improved characterization of the LFE activity in space and time, and their relation to other slow earthquake phenomena, is thus important for understanding the state of fault interface and implication of fluids in the physics of slow earthquakes.

Here we present a catalog of LFEs in western and central Shikoku, Japan, derived by applying a full waveform coherency-based detection and location method to the four years (2013-2016) of continuous data recorded at selected Hi-net stations of NIED. This region in Shikoku is characterized by the highest ratio of deep low-frequency tremor energy release along the Nankai through.

The derived catalogue allows a detailed statistical and correlation-based analysis of LFE activity patterns during isolated tectonic tremor sequences, ETS events and inter-sequence periods. This allows to quantify the segmentation of LFE activity distribution along the strike of subducting slab, and examine the migration, clustering and interaction patterns during the tremor sequences and inter-sequence periods. We confirm that along-strike segments highly productive in LFE generation, also correspond to the previously identified spots of tectonic tremor triggered by teleseismic earthquakes' surface waves supporting a fluid-rich environment and fluid transients.

Our observations point out that a more detailed statistical analysis of the space-time variability of along-strike LFE activity clustering and migration patterns, in connection to the geodetically observed short-term slow slip events, may provide information allowing to quantify "fast" pressure transients that might be associated with slow earthquakes activity.

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