High-speed migration of tremor along the Nankai subduction zone, Japan

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As an underlying source physics of episodic tremors and slip (ETS), a diffusion process of stress or fluid along plate boundary fault has been proposed as one of plausible mechanism [e.g., Houston et al., 2011]. Most rapid migration phenomenon is categorized as high-speed tremor migration features, where the propagation speed of tremor-front rises up to ~ 100 km/h. However, there is little constraint on spatio-temporal evolution of high-speed tremor migration features. To reveal spatio-temporal evolution of high-speed tremors migrations, we applied a matched-filter technique to continuous seismograms during 6 years, using relocated template low-frequency earthquakes (LFEs) at the western part of Shikoku Island. We newly detected about 60 times the number of template LFE events, which is fairly larger than ones obtained by conventional envelope cross correlation method. We identified hundreds of repetitive sequences of high-speed tremor migrations, which evolve in a diffusional manner with diffusion constant to be 10^5 m2/s. The length scale of the fast diffusion is relatively short, up to ~20 km. Most of the rapid migrations seems to be triggered by ocean and solid Earth tides. As a fundamental elements for diffusive propagation of ETS, stress diffusion on the background ductile shear zone [Ando et al., 2012] or slip and fluid diffusion [Shelly, 2015] is considered to be a likely explanation of the high-speed tremor migrations.

