Supporting Online Material for

Slow Earthquakes Linked Along Dip in the Nankai Subduction Zone
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We identified and located tremor sources using NIED Hi-net data (S1) by a clustering procedure after a hybrid method based on travel time differences measured by cross-correlating envelope waveforms of tremor and amplitudes of tremor (S2,S3). This procedure is an automated procedure that uses continuous seismometer data recorded at a group of Hi-net stations. See (S2,S3) for additional details. We counted the number of tremor sources located in two areas in the Bungo channel (red and blue dots in Fig. 1B) in order to plot the cumulative number of tremors in Fig. 1A.

For the determination of shallow VLFEs, a seismic array processing method was applied to Hi-net high-sensitivity accelerometer (tiltmeter) data (S4). We defined a number of arrays of Hi-net stations and determined an apparent slowness vector at each array every 15 s. The slowness vectors are inverted in order to find a source location. See (S4) for additional details. The number of shallow VLFEs that are located to the south, off Cape Ashizuri, is counted for Fig. 1A (pink).

We used GEONET GPS position data (F3 solutions) provided by the Geospatial Information Authority of Japan. All of the coordinates were transformed as displacements with respect to the Kamitsushima station located on Tsushima Island northwest of Kyushu (red square in the inset of Fig. 1B). To emphasize transient deformations, we removed a linear trend and an annual component that are fitted to the data from 2007 to 2009 and corrected steps caused by station maintenance and large earthquakes.

We use the Hi-net tiltmeter data and the GEONET GPS data around the Bungo channel to estimate a fault model for the 2010 long-term SSE. A tilt change caused by the long-term SSE at each station was measured from a detrended and detided tiltmeter record for the time window from February 18 to June 12, 2010, which includes the acceleration phase of the long-term SSE. A surface displacement caused by the long-term SSE was measured from the detrended GPS data for the same time window. A rectangular fault in an elastic half-space was estimated based on the measured tilt changes and surface displacements (S5).

We used the ocean depth data provided by the Japan Oceanographic Data Center for Fig. 1B.

References


S4. Y. Asano, K. Obara, Y. Ito, Spatiotemporal distribution of very-low frequency
earthquakes in Tokachi-oki near the junction of the Kuril and Japan trenches revealed by using array signal processing, *Earth Planet Space* 60, 871–875 (2008).