

Very low-frequency earthquakes in western Shikoku remotely triggered by the 2016 Mw5.9 off-Kii Peninsula earthquake

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Slow tectonic events are known to be sensitive to external stress perturbations due to passing seismic waves and earth tides. High-amplitude surface waves from large earthquakes have transiently triggered low-frequency earthquakes (LFEs) and slow slip events (SSEs) in subduction zones. However, dynamic triggering of very low-frequency (VLF) earthquakes during the arrival of seismic waves from a large, distant earthquake has not been observed. Because both the VLF earthquake and the surface wave have similar characteristic periods, remote triggering is not easily detected by using existing methods. We developed a particle filter/smoother for time series analysis combined with Markov chain Monte-Carlo methods, to detect seismic signals and estimate the maximum likelihood source parameters of VLF events that might have been remotely triggered. We apply this method to seismic data from the Mw5.9 earthquake, which occurred on 1 April 2016 (UTC), off Kii Peninsula. We found that six VLF events with magnitudes about 4, likely occurred in the seismogenic regions of ambient LFEs, and were likely triggered by the arrivals of high-amplitude surface waves. The triggering stress changes are from 0.4 to 1.5 kPa, which are similar to the values for LFEs triggering reported previously. Since there were no triggered LFEs in western Shikoku following the 2016 earthquake, these VLF earthquakes are more sensitive to stress changes caused by surface waves from large earthquakes.

Keywords: Very low-frequency earthquake, Remote triggering