

Triggering sequence of seismicity over Japanese Islands by dynamic stress changes from the 2011 Tohoku-Oki earthquake

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Early post-seismic events triggered by the 2011 Tohoku-Oki earthquake systematically propagated over Japan in a southwestern direction, associated with the strong seismic waves from the source. The propagation front was consistent with the arrivals of large amplitude surface waves traveling at 3.1 to 3.3 km/s and extending to a distance of 1,350 km. There were no observations of triggered earthquakes in the northern direction. Dynamic stress changes toward the north were comparable to or smaller than those necessary for triggering in the southwestern direction. Static stress changes were one to two orders smaller than dynamic stress changes at remote distance, indicating that static stress was not the main mechanism of the triggering. The value necessary for the dynamic triggering is more than about 500 kPa in stress or about 10^{-6} in strain. The early post-seismicity has a different spatial pattern compared to the later post-seismicity that occurred across Japan over the next days to weeks. Also the detection of seismic events triggered by the first arriving P-wave is examined by using a spectral method. P-wave triggering was found in the regions, where non-volcanic tremor was been observed triggered, and some seismic and volcanic regions. The triggering strain due to P-waves is on the order of 10^{-8} to 10^{-7} , which is 1 to 2 orders of magnitude smaller than the triggering strain necessary for the surface wave triggering.

Keywords: 2011 Tohoku-Oki earthquake, Dynamic triggering