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Temporal decays of induced inland earthquakes associated with the 2011 M=9.0 Tohoku-oki, Japan, earthquake

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To reveal the status of regional stress loading and frictional properties, we take advantage of seismic responses due to static Coulomb stress transfer associated with a large earthquake. Here we examine spatio-temporal changes of inland seismicity after the Tohoku-oki shock, and find that there are two distinct temporal behaviors of induced seismicity: One is a short-lived triggered activity within a few months, and the other shows continuous high seismicity lasting more than a year. Induced seismicity in the later type can be mostly fit by the Omori-Utsu law with a p-value lower than 0.8. Together with their lower background rate of seismicity, extremely longer aftershock durations can be estimated, which is consistent with the rate and state dependent friction of Dieterich (1994). In contrast, the Izu Peninsula and Izu islands, which locate highly strained northern edge of the Philippine Sea plate, is typical to the short-lived induced seismicity. Seismicity beneath Tokyo metropolitan area, underlying multiple plate interfaces, has been moderated by the acceleration of loading rate associated with post-seismic deformation, and is estimated to be lasting its higher rate about 4 years since the main shock.

Keywords: Tohoku-oki earthquake, induced earthquake, Coulomb stress change, aftershocks