

## Tidal triggering of earthquakes after the 2011 Tohoku earthquake

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I examined correlations between the Earth tides and earthquakes off the Pacific coast of eastern Japan for about four years after the 2011 Tohoku earthquake (Mw 9.1). A previous study has reported a high correlation in the northern part of the Tohoku source area, where the mainshock rupture initiated, in about ten years prior to the Tohoku earthquake (Tanaka, 2012). The data I used are the Global Centroid Moment Tensor (CMT) solutions of shallow earthquakes (depths less than 70 km) with Mw 5.0 or larger for the period from 1976 to 2014. For each event, I theoretically calculated tidal shear stresses on the fault plane considering both the solid Earth tides and ocean loading tides (Tanaka et al., 2002). Assigning the tidal phase angle at the origin time of each event, I tested whether they concentrate near some particular angle or not by using the Schuster's test. In this test, the result is evaluated by p-value, which represents the significance level to reject the null hypothesis that the earthquakes occur randomly irrespective of the tidal phase angle. For about four years after the Tohoku earthquake, no significant correlation was found in the area of high correlation before the Tohoku earthquake; p-values there are larger than 30% in the post-Tohoku earthquake period. On the other hand, small p-values were observed off the Iwate prefecture, north of the Tohoku source area. The smallest (2.8%) is near the coast, where large postseismic afterslip has been identified by geodetic measurements (Ozawa et al., 2012). In this region, no significant correlation was found for about 35 years prior to the Tohoku earthquake. Furthermore, the temporal variation of p-value in the post-Tohoku earthquake period revealed that the p-value was smallest (1.4%) just after the Tohoku earthquake, and gradually increased with time. This seems to be correlated with the time evolution of afterslip showing rapid decay over time (Ozawa et al., 2012). These observations suggest that in addition to the precursory stage of a giant earthquake, tidal triggering could occur in the early acceleration stage of large postseismic slip.

Keywords: the 2011 Tohoku earthquake, Earth tides, earthquake triggering, postseismic afterslip