Relation between tidal triggering effect and interplate seismicity along the Tonga-Kermadec trench: Part 3

*Fuyuki Hirose[1], Osamu Kamigaichi[2], Kenji Maeda[2]

1. Seismology and Tsunami Research Department, Meteorological Research Institute, 2. Seismology and Volcanology Department, Japan Meteorological Agency

We have investigated the correlation between the Earth tide and event occurrence for interplate earthquakes along the Tonga-Kermadec trench. We found that earthquake tend to occur at local maximum of tidal index by paying attention to tidal phase angle [Hirose et al., 2015, JpGU; 2017, CSEP-Japan]. However, values larger than the local maximum appear frequently for the long term. Therefore, it is easy to interpret tidal triggering of seismicity physically by paying attention to value itself rather than phase angle of tidal index.

In this study, we focused on value itself of tidal index. We target interplate earthquakes along the Tonga-Kermadec trench in the global CMT catalogue (latitude is 15-35˚S, period is 1977-2016, Mw >= 5.5, depth <= 70 km, strike angle is 150-230˚, dip angle is 0-90˚, rake angle is 55-125˚). Theoretical tidal response on hypocenter was considered both of the earth tide and ocean tidal loading effect. We considered tidal responses of volumetric strain, shear stress, normal stress, and the change in the Coulomb failure function (ΔCFF) on the fault plane, where we assumed values of 0.1, 0.4, and 0.7 for the apparent friction coefficient. We defined expansion/dilatation as positive and contraction/compression as negative for volumetric strain and normal stress, and we defined shear stress as positive when it promoted the fault slip.

In comparison the frequency distribution of tidal values at occurrence times of earthquakes with background tidal frequency distribution which is composed of tidal value every 15 minutes during 183 days before and after each event, we found that earthquakes tend to occur selectively under the state with positive sign. Especially, the more significant absolute value is, the stronger the tendency is. Furthermore, we divided the region into 4 areas every 5˚ in latitude in north-south direction and performed the same analysis. As the result, it showed strong tidal triggering in 20-30˚S, and weak tidal triggering in 30-35˚S. This spatial dependency might be caused by the existence of slab-bending-related hydration [Nishikawa & Ide, 2015, GRL], not roughness on plate interface related to subducting seamounts at ~26˚S [Scholz & Small, 1997, Geology]. It showed reverse sense in 15-20˚S, but we have no idea to interpret it.

Keywords: Earth tide, Ocean tidal loading effect, Tonga-Kermadec trench

