Fortnightly tidal modulation of shallow very low frequency earthquakes in Hyuga-nada and off Cape Ashizuri

*田中 佐千子[1]、浅野 陽一[1]、松澤 孝紀[1]、小原 一成[2]
*Sachiko Tanaka[1], Youichi Asano[1], Takanori Matsuzawa[1], Kazushige Obara[2]

1. 防災科学技術研究所、2. 東京大学地震研究所
1. National Research Institute for Earth Science and Disaster Resilience, 2. Earthquake Research Institute, The University of Tokyo

We investigated correlations between fortnightly tides and shallow very low frequency (VLF) earthquakes in Hyuga-nada and off Cape Ashizuri. We focused on three active swarms in 2003, 2010, and 2015, for which strong correlations with semidiurnal tides have been observed (Tanaka et al., 2011, 2015). We detected and located VLF earthquakes by applying a cross correlation technique (Asano et al., 2015) to the seismograms recorded by the F-net broadband seismograph network. For each event, we calculated tidal Coulomb stresses with a friction coefficient of 0.2 (Tanaka et al., 2002), and assigned a fortnightly tidal phase at the time of occurrence from the smoothed stress amplitude envelope (Curchin and Pennington, 1987). For the fault plane, we assumed a landward-dipping reverse fault from a well-determined focal mechanism solution by using the centroid moment method (Ito and Obara, 2006). Based on the distribution of tidal phases, we 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 VLF earthquakes occur randomly irrespective of tidal phase angle. As a result of analysis, we observed significantly small p-values for all the three swarms; the p-values for 2003 (N = 423), 2010 (N = 1506), and 2015 (N = 739) swarms are 4E-16, 7E-52, and 7E-15, respectively. The frequency distributions of tidal phases exhibit a peak where the tidal stress amplitude is at its maximum. 65%, 68%, and 69% of the events occurred during the half (50%) of tidal phase range with large stress amplitudes. These results indicate that the occurrence of VLF earthquakes is strongly modulated by fortnightly tidal stress variations and is well correlated with large tidal stresses.

Acknowledgment: This work was supported by JSPS KAKENHI Grant Number JP16H06473.

キーワード：浅部超低周波地震、地球潮汐、トリガー作用
Keywords: shallow very low frequency earthquakes, Earth tides, triggering

