# Seasonal variation of tidal response of very low frequency earthquakes in the Ryukyu Trench

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Very low frequency earthquakes (VLFEs) occur along the Ryukyu Trench resulting in tidal changes (Nakamura & Kakazu, 2017) with a response magnitude of several years. Temporal changes in the tidal response are caused by two main factors, changes in the hypocenter locations of the VLFE and in the state of the slip at the fault, in addition to atmospheric pressure (AP) and ocean bottom pressure (OBP) changes. This weak but seasonal pressure change can influence VLFE activity. This study investigated whether the tidal response of the VLFEs changes seasonally and estimated the atmospheric and oceanic effects by calculating the stress for their loadings.
VLFEs that occurred in 2002–2015 were analyzed in this study. Data were selected in two-month intervals, and Fourier transform was applied. The results show that the amplitude of the M2 tide in Okinawa was smallest in summer, at 0.3, and largest in winter, at 0.5. Similar results were obtained in Amami.
The stress change was then computed for OBP and AP. The *Circulation* and *Climate* of the Ocean (ECCO) OBP model was used, as was the monthly averaged AP. Then, the loading was computed for the AP in the land area. Some Programs for Ocean Tide Loading (SPOTL) software (Agnew, 2012) was modified and used to enable computation of stresses at depths according to the point loading. The subducting Philippine Sea plate at a depth of 15 km was employed as the fault parameter.
The computed annual amplitude change of the shear stress was 20 Pa and 15 Pa in Amami and Okinawa, respectively. The shear stress reached its peak and trough in the winter and summer, respectively. However, the shears stress change by atmospheric and oceanic loading corresponded to 3% of the tidal stress. Although the stress change for these loadings was approximately one-third of that which can reproduce seasonal change in the tidal response, the trend was able to be reproduced.

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