琉球海溝における超低周波地震活動の潮汐応答の季節変化・数年変化
Seasonal and long-term variation in the tidal response of very low frequency earthquakes in the Ryukyu Trench

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The activity of very low -frequency earthquakes in the Ryukyu Trench varies with tide. This activity was the maximum during low tides such that the Coulomb failure Function (DCFS) on the subducted plate interface was the maximum. The amplitude of tidal response (ATR) exhibited seasonal variation. The ATR was the maximum during winter and the minimum during summer. Moreover, the annual ATR varied over a period of several years.

First, I computed the stress change on the plate interface based on atmospheric pressure (AP), water reservoir pressure (WRP), and ocean bottom pressure (OBP) and investigated the relationship between the ATR and stress changes.

Second, I employed the daily global surface atmospheric pressure data and daily ocean bottom pressure data to calculate the DCFS on the plate interface. The OBP model used was ECCO Version 4 Release 3, which is based on a four-dimensional assimilation model.

The RMS amplitude of the DCFS calculated by using AP was in the order of 50 Pa near the Ryukyu Islands and decreased abruptly farther away from the Ryukyu Islands. The RMS amplitude of the DCFS calculated by using OBP was approximately 10 Pa near the trench axis and increased to 60 Pa in the deeper parts of the subducting Philippine Sea plate. The RMS amplitude calculated by using AP+OBP was in the order of 60 Pa near the Ryukyu Islands.

Third, I investigated the seasonal variation of ATR. The maximum ATR (0.4-0.5) was observed from October to February, while the minimum ATR (0.2-0.3) was observed from April to August. Moreover, the annual ATR was lower from 2003 to 2006 and higher from 2007 to 2011. However, it decreased after 2011.

Finally, I computed the slip rate on the plate interface by using ATR and DCFS, and compared the slip rate computed using DCFS with that computed using ATR. The slip rate obtained from the DCFS was moderately correlated (0.4-0.5) with that obtained from the ATR. However, their amplitudes were significantly different. The slip rate fluctuation computed using the ATR was approximately 5-10 times larger than that computed using the DCFS. Moreover, the annual slip rate fluctuation computed using the ATR was similar to that computed using the DCFS. Like the seasonal variation in the slip rate, the slip rate fluctuation computed using the ATR was approximately 10 times larger than that computed using the DCFS.

These results suggest that the sensitivity of the slip rate on the plate interface for periodic loadings would be approximately 10 times larger than that for daily stress loading.

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