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Analysis on typhoon-induced microseisms from ocean bottom seismometer array

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Ocean-bottom seismometer (OBS) is usually used for active sources and passive listening experiments, such as air guns, explosives, earthquakes and other signals. In fact, the seismometer records not only the seismic waveforms but also noises generated by winds, waves, tides and other external forces. From the end of August to early September 2011, 15 OBSs were deployed offshore northeastern Taiwan for a recording period of about 20 days. At the end of August, the typhoon NANMADOL formed in the western Pacific and moved northwestward from the East Philippines and finally landed on the island of Taiwan. Due to storms or pressure changes caused by the typhoon, elastic waves would be directly or indirectly produced and recorded by the seismometers. In this study, by analyzing the seismic signals collected by the OBSs and the BATS stations, we investigate the influence induced by the changes of typhoon path and intensity on the submarine seismic noises.

Preliminary results indicate that the seismic energy change related to the typhoon occurred mainly at 0.2-0.5 Hz, which is a relatively low frequency compared to that of earthquakes. The amplitude of this low-frequency noise increased when the distance between the typhoon and seismometer decreased. By comparing the seismic waves with the data collected from the marine weather buoy, we observed a positive correlation between the power of the low frequency microseisms and the wave height. This clearly indicates that the typhoon was the main source of microseisms during their passing. Owing to the ocean waves generated by the typhoon, the pressure altered by the water column change and recorded by the seismometers as seismic waves before being transmitted to the sea?oor. The spectrum analysis shows the presence of a high energy signals at 0.2-1 Hz with a period of about 12 hours which could be related to the tidal movements. In addition, the amplitude of the recorded microseisms is also affected by the depth of seismometers. In general, the deeper the seismometer is located, the smaller the amplitude of microseisms it recorded. All these observations show the seismic signal can respond to the wave and wind changes. However, some exceptions, probably induced by site effect, are observed.

Analysis based on the data recorded by hydrophones and inland stations displays consistent results with that of geophones, showing that ocean wave heights appear to be the main origin of the low frequency microseisms signals. Therefore, we suggest that the low frequency ground motions are mostly induced by nearby water pressure ?elds, and transmitted through the rock to the stations.