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Ocean bottom seismometer observations of microseisms generated by two consecutive super typhoons, Trami and Kong-Rey, in 2018

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Remote seismometers can detect the most powerful ambient seismic noise such as typhoon-generated microseisms, which occur as a result of the intricate energy coupling and transfer among the atmosphere, ocean, and solid earth spheres. However, our knowledge of the processes that generate the microseisms accompanying typhoons is restricted, and numerical modelling of wind fields and ocean waves is hindered. Here we present a comprehensive investigation of microseisms generated by two consecutive typhoons, Trami and Kong-Rey, formed in September and October, 2018, respectively. This study is the first of its kind to examine the impact of typhoon-generated microseisms recorded by more than twenty ocean bottom seismometers (OBSs) in the Northern Hemisphere during a couple of successive super typhoons that passed across these ocean bottom observatories. Our datasets include continuous three-component seismic and hydrophone records from 24 OBSs and 8 land-based stations along with the significant wave height (SWH) model data from ERA5 of the European Environment Agency and the microseism source excitation model (p2l) data from WAVEWATCH III. We coduct a frequency dependent polarisation analysis to track the locations of double-frequency (DF) microseism source regions. Frequency spectrum analysis and power spectrum density are used for unraveling the temporal behaviour of microseismic noise. Both the super typhoons are dispersive in nature as observed in both short-period double frequency (SPDF, 2-6 s) and long-period double frequency (LPDF, 6-10 s). Additionally, their energy increases abruptly on Sept. 28 and Oct. 3 when Typhoon Trami and Kong-Rey respectively approached the OBSs, exhibiting a distinct LPDF peak on both the pressure and vertical acceleration of OBSs. There exists a significant correlation between pressure energy of OBSs and sea surface pressure, whereas the ocean wave heights are also remarkably correlated with the vertical component of OBSs. On Oct. 2, the LPDF microseismic sources associated with Typhoon Trami interfered with those of Typhoon Kong-Rey, resulting in the generation of a unique mechanism classified as class III (generally excited when a storm swell interferes with another storm swell). On the remaining days, each typhoon's microseismic sources dominated their respective propagations, giving rise to a class I mechanism (i.e. when microseism source follows the propagating storm path) in the generation of microseismic sources.

Keywords: Super-typhoon generated microseism, Ocean Bottom Seismometer, Typhoon Tami and Kong-Rey