Swell propagation and microseisms on deep seafloor

Ryoichi Iwase[1]; Toshiaki Kikuchi[1]; Koichi Mizutani[2]

[1] JAMSTEC; [2] Intelligent Interaction Tech., Univ. Tsukuba

www.jamstec.go.jp

Microseisms, which are mainly observed as surface waves, have come to be utilized as signal sources for investigating crustal structures. Recently the research on the mechanism of their generation attracts considerable attention. Microseisms grow remarkably under such conditions as approaching typhoons, however, in those cases local wind waves and swells make them fluctuate in complicated way. This time, we report a characteristic temporal fluctuation of microseisms which are generated by propagating swells observed by three seafloor cabled observatories; off Hatsushima Island in Sagami Bay, off Kushiro and Tokachi in Hokkaido and off Muroto Cape in Kochi.

What is called 'Doyo-nami', which is generated by a typhoon located south off Japan and is propagated to the southern coast of Japan, is one kind of swells. A prominent example of 'Doyo-nami' is the one that was generated by No. 4 typhoon in 2001. The typhoon moved westward in the ocean more than 2000 km south of southern coast of Japan. Although the typhoon did not exert direct influence on weather over Japan, the high wave, which was associated with a swell that was generated by the typhoon and was propagated northward, appeared along the southern coast of Japan, i.e. a part of Hokkaido, Tokai, Kyushu and a part of Ryukyu Islands. The ship capsized by the high wave at Hamana port.

At each observatory, a microseism with a spectral peak at 0.13 Hz which was associated with the arrival of a swell was observed. Time difference of appearance time of the microseim is roughly equivalent to the propagation time of deep water wave, with the same significant wave period observed at the coast, over the distance corresponding latitude difference. In other words, it was shown that the swell propagated from south and reached north to Hokkaido. In addition, peak frequency 0.13 Hz corresponds to double frequency of the significant wave frequency which was observed at Omaezaki. In addition, at off Hatsushima observatory, although a fluctuation which corresponded to the swell was observed in the seismometer spectrum, it did not appear in the hydrophone spectrum. This suggests topographical influence on the generation of microseisms by swells.