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Body wave microseisms from a distant storm revealed by Hi-net data

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Although observations of microseisms were firmly established in 1940's [e.g. Gutenberg, 1947], the excitation mechanisms are still old and new problem. Their common excitation sources are ocean wave activities. Microseisms can be categorized into two ones according to the excitation mechanisms. One is primary microseisms from 0.05 to 0.1 Hz, which correspond to a typical frequency of ocean swell. Observed dominance of Love waves of primary microseisms suggests that they are generated by pressure load of ocean swell acting on a sloping coast [Darbyshire and Okeke, 1969]. The other is secondary microseisms from 0.1 to 0.5 Hz, which double the frequency, indicating the generation of the former through nonlinear wave-wave interaction of the latter [Longuet- Higgens, 1950]. Observed amplitudes of secondary microseisms are larger than those of primary microseisms.

Because microseisms are excited by forces acting on the seafloor, surface-wave excitations are dominant. Recently body wave microseisms from a distant storm, however, have been focussed [e.g. Gerstoft et al. 2006, Landes et al. 2010]. They show clear teleseismic P waves excited by distant storms. A back-projection method could constrain source distribution, which gives clues to their excitation mechanisms. Most studies focused, however, only vertical components. In this study, in order to constrain excitation mechanisms of microseisms, we conducted three-component array analysis using the high-sensitive seismograph network (Hi-net) operated by NIED, when a strong weather bomb hit the Atlantic ocean on 12/9th 2014.

We analyzed 3-component velocity-meters with a natural frequency of 1 Hz at 202 stations in Chugoku district. The instrumental response was deconvolved by using inverse filtering technique [Maeda et al. 2011] after reduction of common logger noise [Takagi et al. 2015]. Their frequency-wavenumber spectra [Nishida et al., 2008] were calculated at 0.07 (PM) and 0.15 Hz (SM). The spectra of a vertical component and a radial component at 0.15 Hz show that clear teleseismic P-wave, whereas that of a transverse one does not show body wave. The slowness of about 0.05 [s/km] and the back azimuth of -5 degree are consistent with that of the P wave traveled from the weather bomb in the Atlantic ocean. At 0.07 Hz, no teleseismic p wave was detected, although they show strong Rayleigh wave traveled from north, which is consistent with a past study [Matsuzawa et al., 2012]. Lack of P-wave microseisms in primary microseismic band suggests that shear traction on the seafloor is dominant in the frequency. Although these results are preliminary, we plan to discuss the excitation mechanism based on the array analysis.

Keywords: ambient noise, microseisms