

Influence of surf noise on oceanic ambient noise in coastal waters with sandy seabed

Bong-Chae Kim^{1†}, Bok Kyoung Choi¹, Byoung-Nam Kim¹, and Chang-Woong Shin²

¹Maritime Security Research Center, Korea Institute of Ocean Science & Technology;

²Ocean Circulation & Climate Research Division, Korea Institute of Ocean Science & Technology)

1. Introduction

Wave breaking almost always occurs in the surf zone of the ocean. The underwater noise generated by breaking waves in the surf zone is especially called the surf noise. Wilson et al. reported that the surf noise greatly contributes low-frequency oceanic ambient noise in coastal waters [1]. The generation mechanisms of the underwater noise due to breaking waves in the surf zone were studied by Bardyshev [2]. But the characteristic of the surf noise is not well known because of measuring difficulties. The underwater noise was measured to investigate the influence of surf noise on oceanic ambient noise in the eastern sandy coast of the middle part of the Korean Peninsula. The measurement results of ocean noise generated by breaking waves in the surf zone are discussed. And the effect of the surf noise on the oceanic ambient noise is considered.

2. Measurements

The oceanic ambient noise had been measured near the surf zone in the eastern middle coast of the Korean Peninsula during the end of December 2012. The self-recording hydrophones were used to measure ocean noise. They were moored at range of about 640 m, 1250 m, 1880 m, 2500 m, 3750 m, and 6250 m from the shoreline, respectively. **Fig. 1** shows water depth profile along mooring position of the hydrophones and a wave height meter. At this time

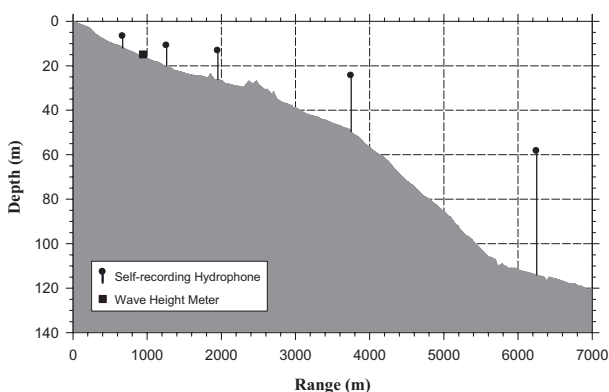


Fig. 1. Depth profile along mooring position of the hydrophones and a wave height meter.

each hydrophone was positioned at the middle of the water depth. The surf zone in this area is thought to be formed within the range about 250 m from the shoreline. As environmental parameters, the wave height and period were measured by a wave height meter (Directional Waverider MK III) moored on the seabed with range of about 940 m from the shoreline. And the sound speed in the sea was obtained by CTD (SBE 19 plus) castings at several points along mooring position of the hydrophones.

3. Results and Discussion

The seabed of the area measured the ocean noise is covered with sand. The significant wave heights were ranged between 1.14 and 2.2 m during noise measurements. And the significant wave periods were distributed between 8 and 9 s. The sound speed was almost same within a 60 m water depth and gradually decreased with increase of depth below a 60 m water depth. **Fig. 2** shows the spectrum levels of oceanic ambient noise measured by the hydrophones at various ranges. The ocean noise levels are increasing with increase of the significant wave height. That is, the highest spectrum levels of ocean noise were measured in the case of 2.2 m wave height, and the lowest noise spectrum levels were measured in the case of 1.14 m wave height. But the pattern of noise spectrum level was different with the range from the shoreline. **Fig. 3** shows the spectrum levels of oceanic ambient noise measured at various significant wave heights. The noise levels are increasing with decrease of the range from the shoreline within range 3750 m, but exceptionally higher noise level was measured at the range 6250 m below frequency 300 Hz. The cause of this phenomena is thought to be due to the influences of the surf noise within the range 3750 m and distant shipping noise at the range 6250 m, respectively. **Fig. 4** shows the band levels of oceanic ambient noise measured at various significant wave heights. The band levels of 50 to 300 Hz frequency are increasing with increase of the wave height within range about 2500 m, but they are not increasing with increase of the wave height in more than range about 2500 m. And the band levels of 300 to 5000 Hz frequency are slightly increasing with increase of the wave height.

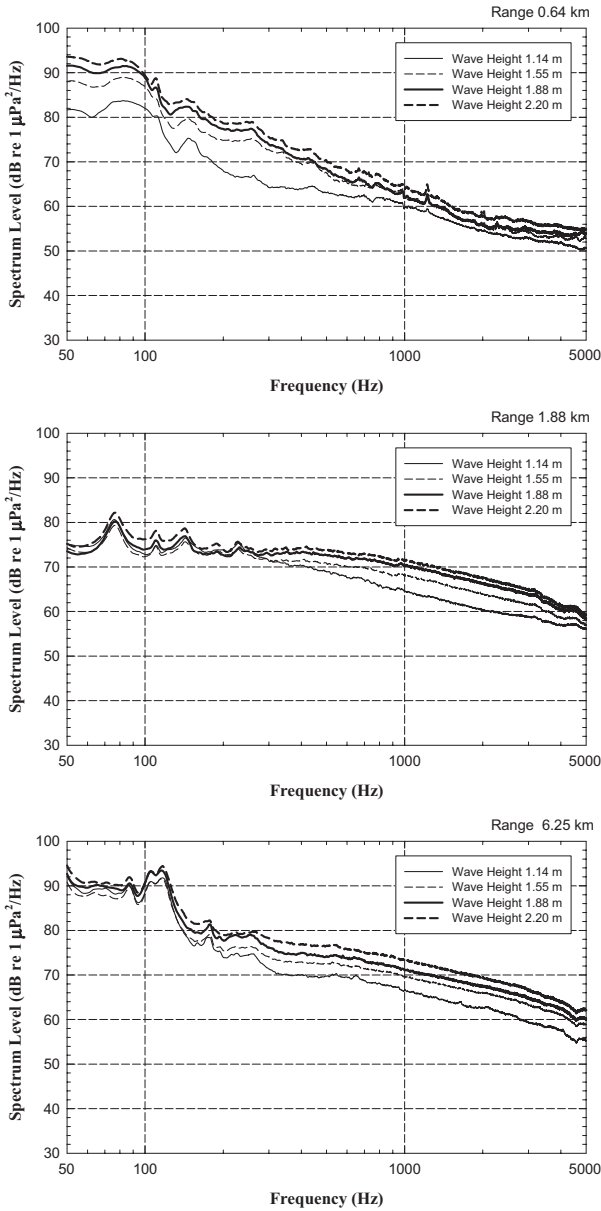


Fig. 2. Oceanic ambient noise spectrum levels measured at various ranges from shoreline.

4. Summary

The surf noise generated in surf zone affects the oceanic ambient noise within range about 2500 m from shoreline in case of significant wave height below 2.2 m.

Acknowledgment

This work was supported by the Korea Institute of Ocean Science and Technology, Project No. PE98824.

References

1. O. B. Wilson, S. N. Wolf and F. Ingenito: *J. Acoust. Soc. Am.* **78** (1985) 190.
2. V. I. Bardyshev: *Acoustical Physics*, **54** (2008) 814.

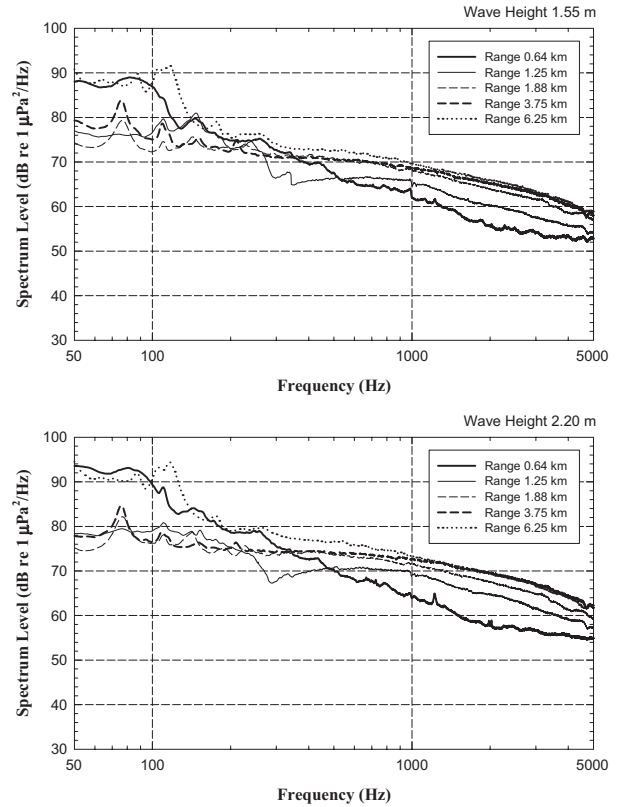


Fig. 3. Oceanic ambient noise spectrum levels measured at various significant wave heights.

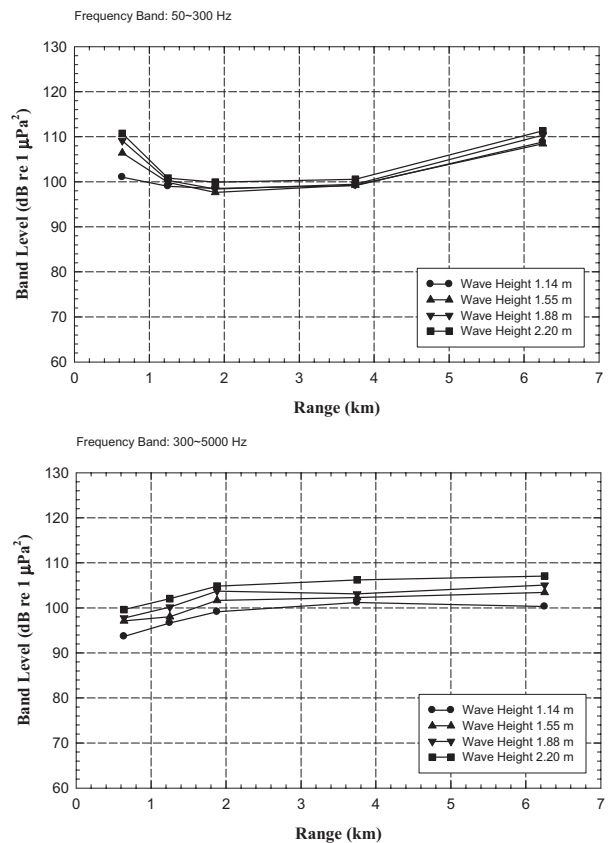


Fig. 4. Band levels of oceanic ambient noise measured at various significant wave heights.