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Oceanic ambient noise generated by breaking surf in the sandy coast

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1. Introduction

Low-frequency ocean noise has recently been of concern with relation to behavior of marine mammals [1]. It is reported that underwater noise generated by breaking waves in surf zone greatly contributes low-frequency oceanic ambient noise in coastal waters [2]. Generation mechanisms of underwater noise due to breaking waves in surf zone have been studied by some researchers [3, 4]. Underwater noise was measured to investigate the effect of surf noise on oceanic ambient noise in the eastern sandy coast of the middle part of the Korean Peninsula. The measurements results of ocean noise generated by breaking waves in the surf zone are discussed. And it is considered that the effect of the surf noise on the oceanic ambient noise.

2. Measurements

Oceanic ambient noise had been measured near the surf zone in the eastern middle coast of the Korean Peninsula during July 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. At this time each hydrophone was positioned at the middle of the water depth. As environmetal parameters, the wave height and period were measured by a wave height meter (Directional Waverider MK III) moored on the sea bottom 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.

3. Results and Discussion

Sea bottom of the area measured ocean noise is covered with sand. The significant wave heights were ranged between 0.1 and 0.7 m during noise measurements. And the wave periods were distributed between 5 and 6 s. **Figure 1** shows water depth profile and contours of sound speed in the sea along mooring position of the hydrophones. The sound speeds were well layered horizontally and had very strong negative gradients with depth.

Figure 2 shows contours of sound propagation loss calculated by RAM (range-dependent acoustic model) in order to investigate propagation phenomena of ocean noise generated in the surf zone. Here sound frequency is 200 Hz, and sound source is assumed to locate at a range of 250 m and a depth of 1 m. The surf noise only well propagates below the middle depth along sea bottom with repeating bottom-reflections due to negative gradient of sound speed.

Figure 3 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 within range of 3750 m. At range of 6250 m, the noise levels are increasing with increase of the wave height below frequency 400 Hz, but they are not increasing with increase of the height above frequency 400 Hz due to poor propagation in the high frequency region.

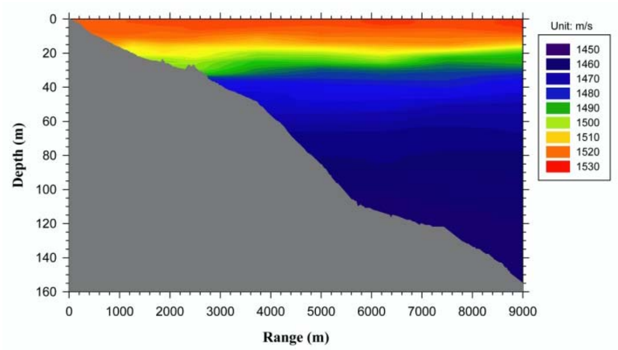

Fig. 1. Depth profile and sound speed contours along mooring position of the hydrophones.

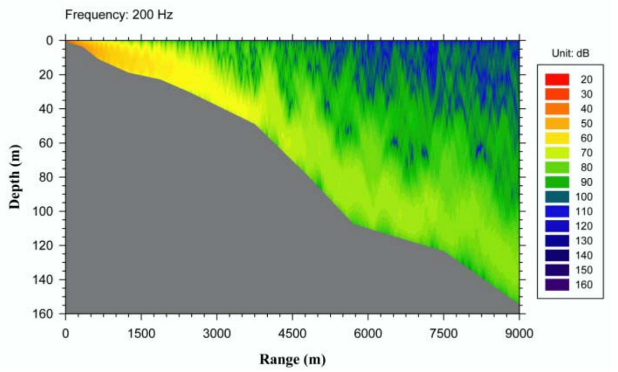

Fig. 2. Propagation loss contours calculated by RAM with a source of 250 m range and 1 m depth.

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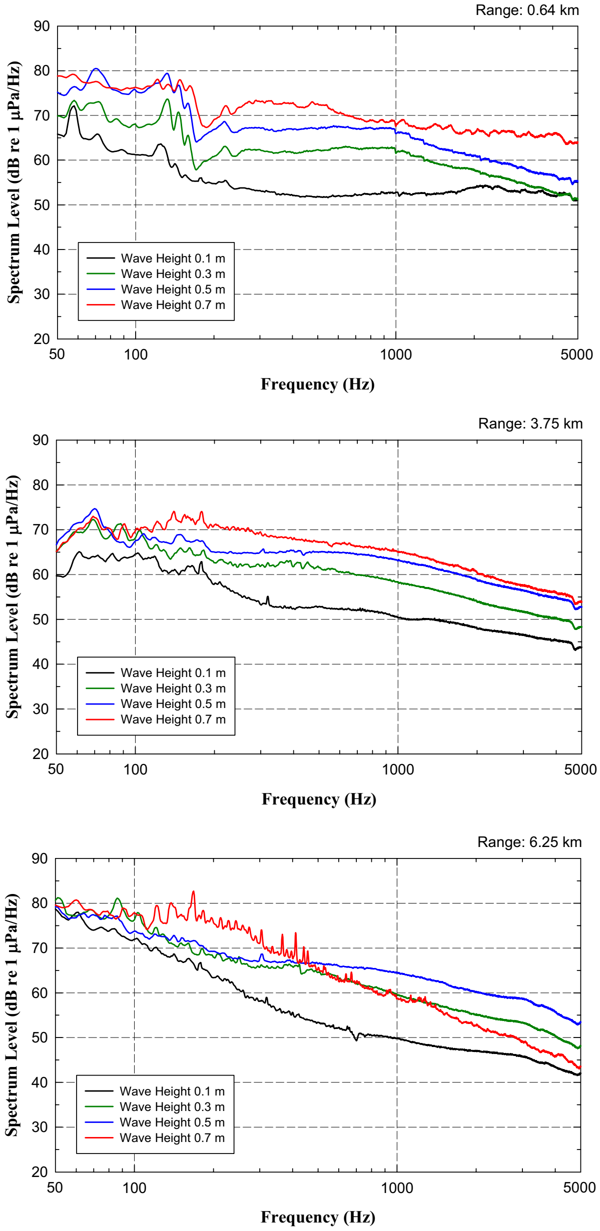

Fig. 3. Oceanic ambient noise spectrum levels measured at various ranges from shoreline.

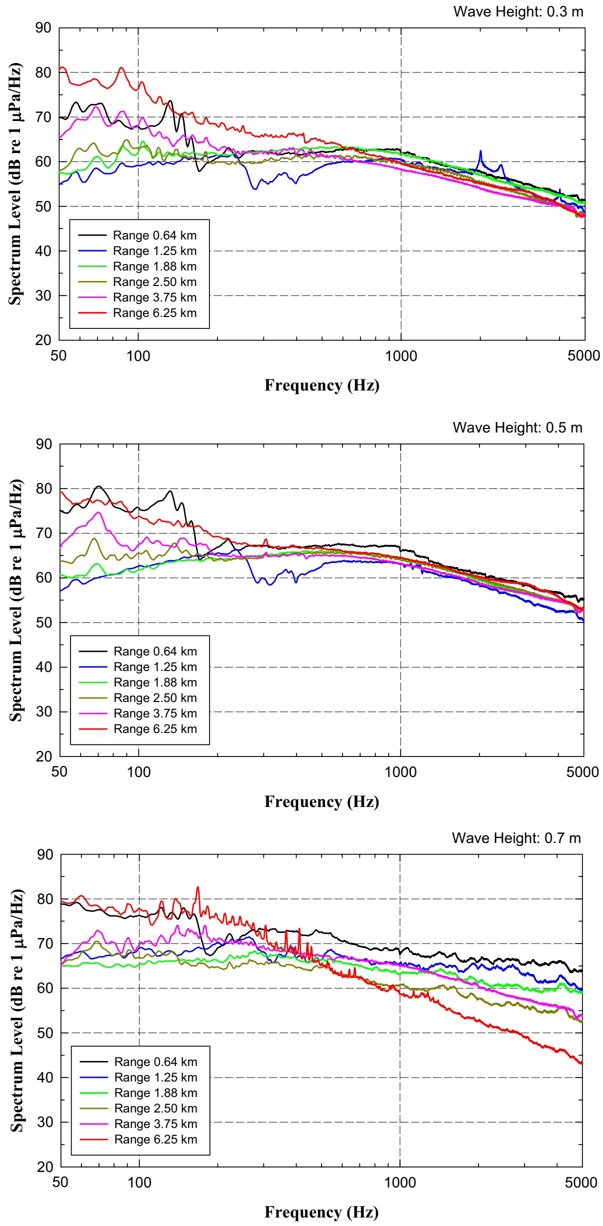

Fig. 4. Oceanic ambient noise spectrum levels measured at various significant wave heights.

Figure 4 shows the spectrum levels of oceanic ambient noise measured at various significant wave heights. The noise levels are increasing with increase of the wave height within range of 3750 m. And this phenomena are more remarkable at wave height 0.7 m and high frequency region than 400 Hz.

4. Summary

The ocean noise generated in the surf zone affects the underwater noise within range of 3750 m from the shoreline in case of the significant wave height below 0.7 m in the summertime.

Acknowledgment

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