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Adaptive passive fathometer processing using ambient noise received by nested vertical array

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1. Introduction

Recently, the coherent technique of ambient noise, called a passive fathometer processing has been exploited to estimate water depth and sub-bottom profile [1]. This processing uses a beamforming technique to amplify the surface generated ambient noise and the echo reflected from the seabed and to suppress unwanted noise. Siderius *et. al.*[2] applied several beamforming techniques to the passive fathometer processing using signals received by a linear-spaced vertical line array, and showed that the results obtained from an adaptive beamforming had better performance than those obtained from a conventional beamforming.

In this paper, the results of passive fathometer processing using ambient noise received by a nested vertical line array (N-VLA) are presented. The adaptive beamforming algorithms are applied to each sub-band in the array and then the nested array processing is performed.

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2. Measurements

Acoustic measurements were made on approximately 10 km off the eastern coast of Korea on July 13, 2009 [Fig. 1]. Ambient noise was measured using the N-VLA called the Portable Ocean Environment System (POEMS), which was deployed from the *R/V* sunjin. The POEMS consists of total 24 hydrophones and 4 sub-bands, covering a water column of 15 m (Fig. 2). Acoustic data were acquired at the sampling rate of 65.536 kHz. During the acoustic experiment, sound speed profiles were frequently measured using expendable bathy thermograph (XBT) and water depths were measured by echo sounder.

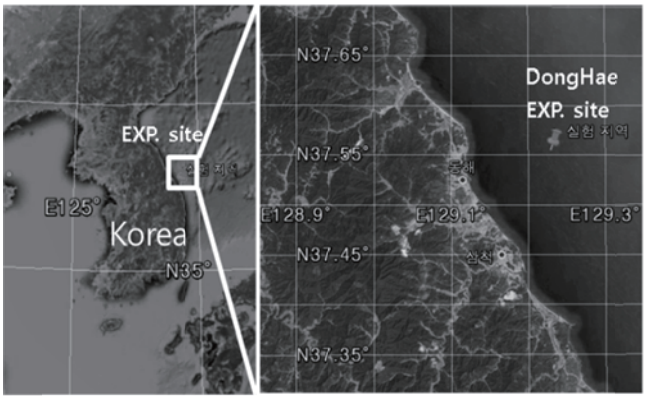

Fig. 1. Experimental site

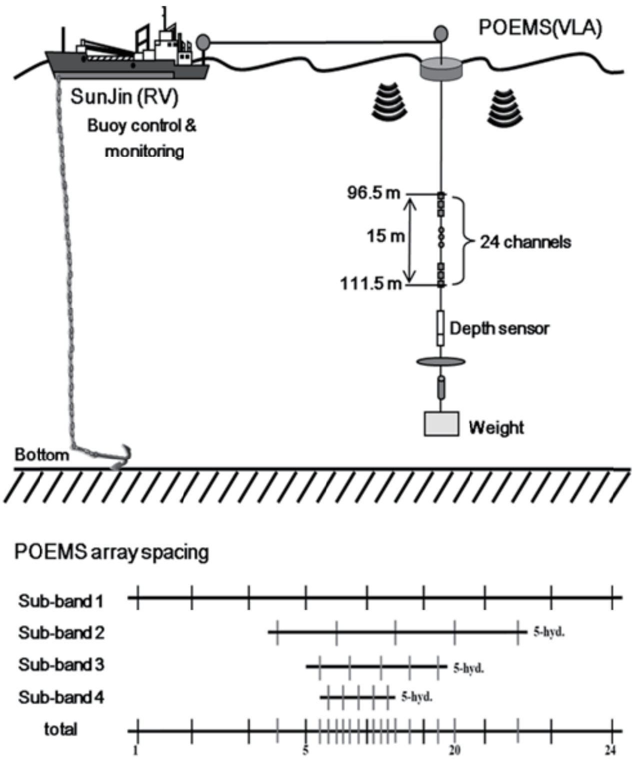

Fig. 2. Experimental layout and POEMS array spacing for 4 sub array bands.

3. Results and discussion

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The beamforming teachnique is used in the passive fathometer processing algorithm. In this paper, MVDR-WNC, which is one of the adaptive beamforming techniques and known to have a outstanding performance, was used.

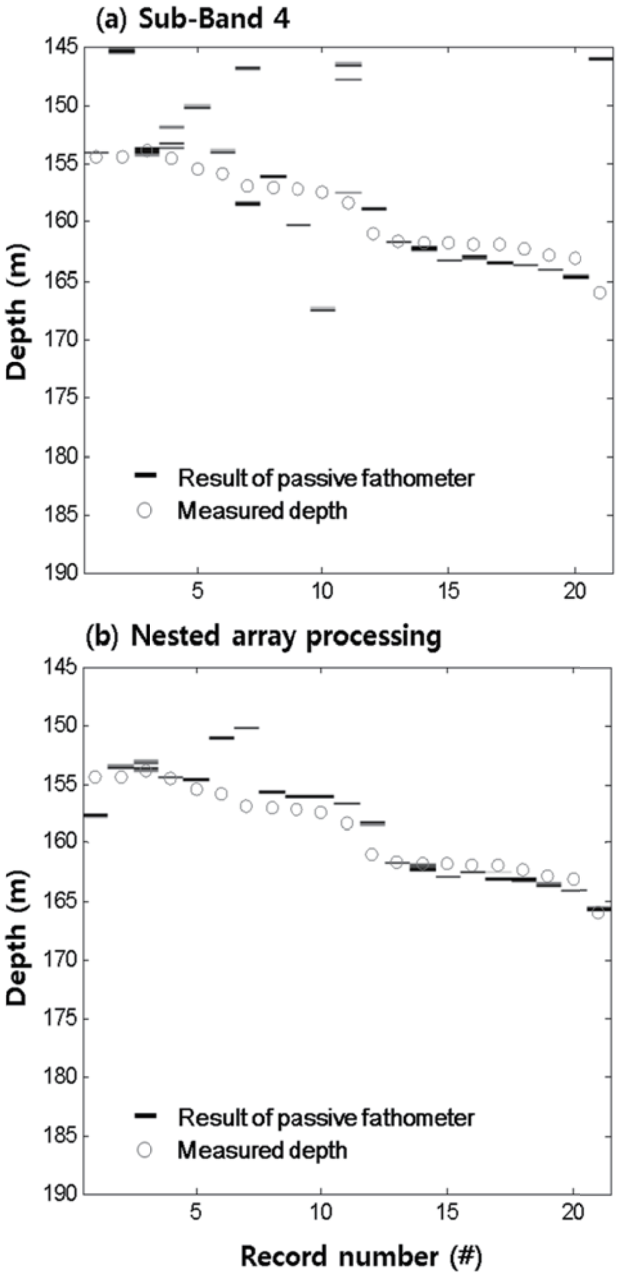

Fig. 3. The results of passive fathometer processing using the MVDR-WNC adaptive beamforming technique (a) the results of passive fathometer processing using a sub-band 4 of which the center frequency is 3.2 kHz and the comparisons to water depths measured by echo sounder. (b) The results of passive fathometer processing including the nested array processing.

Fig. 3(a) shows the results of passive fathometer processing using sub-band 4 of which the center frequency is 3.2 kHz and their comparisons to water depths measured by echo sounder. Although the results of passive fathometer processing seemed to be correlated with the water depths, some mismatches were observed, for example, at record numbers of 2, 5, 7 and 11. Fig. 3(b) shows the results of passive fathometer processing including the nested array processing, which combines the results for 4 sub-bands in frequency domain. The nested array processing can improve the signal-to-noise ratio (SNR) by choosing the bandwidth lower than the frequency at which the grating lobe begins to appear, for each sub-band.

In conclusion, the results obtained from the nested array processing showed the better performance than those of Fig. 3(a).

Acknowledgment

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References

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