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Investigation on the underwater noise from ships in the upper Yangtze River

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Objectives

Most of the current research on underwater radiated noise from ships is focused on the marine environment, and few studies related to radiated noise from ships in inland waterways have been conducted. In this study, the navigation noise of two common ship types in the upper Yangtze River was collected and quantified, aiming to reveal the characteristics of underwater noise from ships, with a view to providing theoretical support for the planning and construction of ecological waterways in the upper Yangtze River.

Methods

Analysis of underwater radiation noise from ships of different speed and tonnage.

(1)Noise reduction: The ship underwater radiation noise is mainly concentrated in the low frequency part, so a low-pass filter is used to reduce the background sound to ensure the accuracy and reliability of the experimental results.

(2)Fast fourier transform: transforms the signal from the time domain to the frequency domain, thus determining the main distribution interval of the underwater radiated noise frequencies of the ship.

(3)Sound pressure level conversion: the voltage signal output from the hydrophone is converted into sound pressure level data.

Results

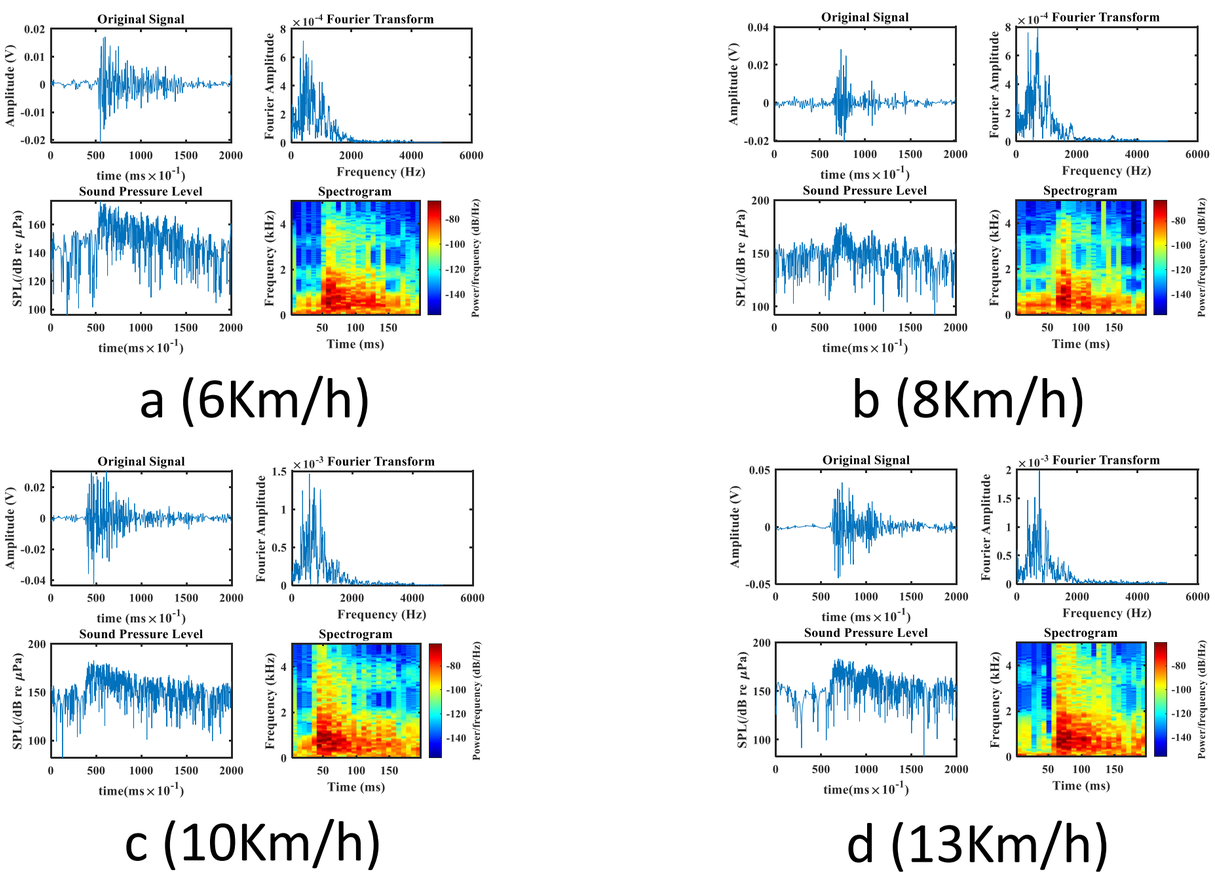

Figure 1. Analysis resaults of container ship

The frequency of underwater radiation noise of container ship is mainly distributed in the range of 500-1200Hz, and the energy of underwater radiation noise of container ship is concentrated in the low frequency part below 1kHz. The frequency band above 1 kHz contains less energy, and shows a trend that the higher the frequency, the less energy it contains.

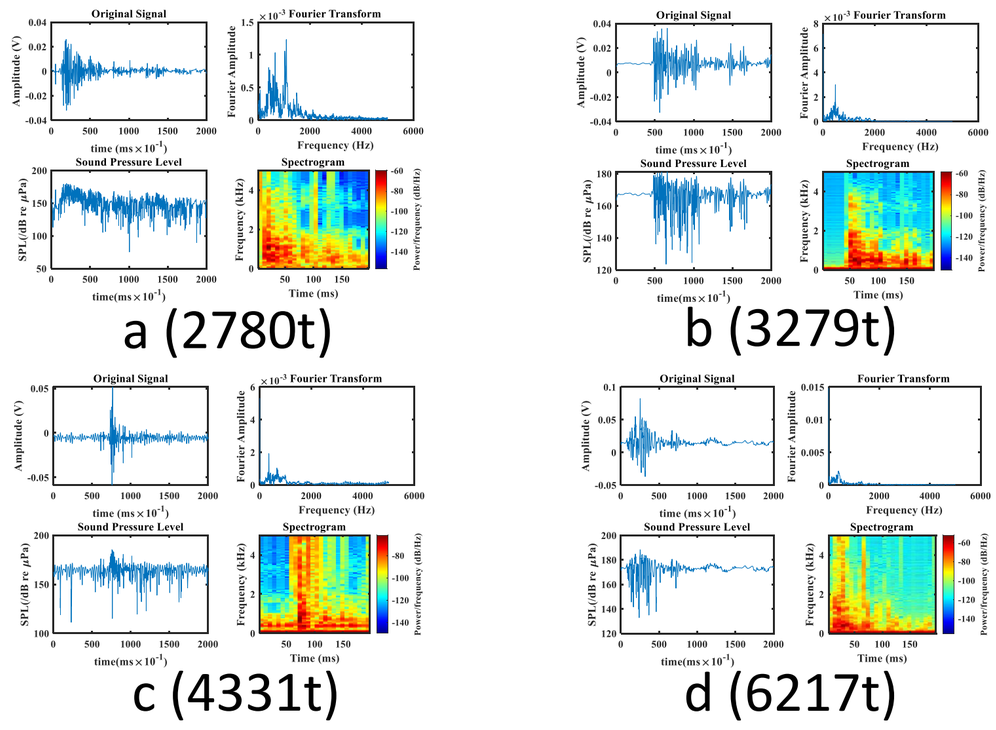

Figure 2. Analysis resaults of bulk carrier

The frequency of underwater radiation noise of bulk carrier is mainly distributed in the range of 200-700Hz, and the energy of underwater radiation noise of bulk carrier is concentrated in the low frequency part below 1kHz. The frequency band above 1 kHz contains less energy, and shows a trend that the higher the frequency, the less energy it contains.

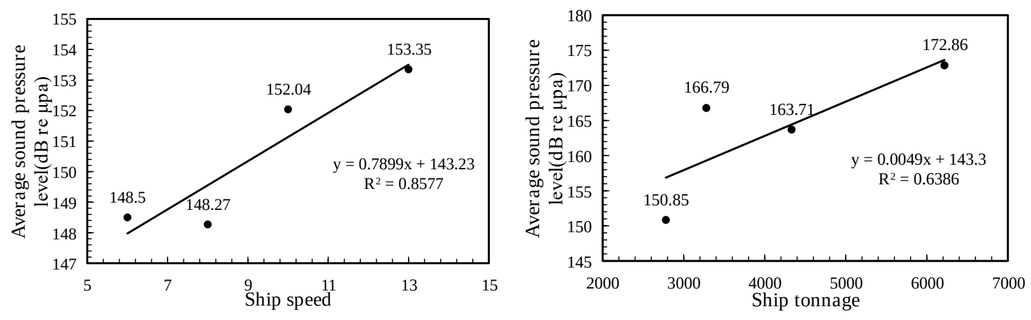

Figure 3. The relationship between sound pressure level and ship speed and tonnage

The sound pressure level of underwater radiated noise of ships is positively correlated with ship speed and tonnage.

Conclusions

(1) The frequency and the sound pressure level of underwater radiated noise from two typical navigation vessels in the upper Yangtze River are mainly distributed in the range of 200-1200Hz and 148.50dB~172.86dB, respectively.

(2) The SPL of underwater noise from ships in the upper Yangtze River is positively correlated with the ship tonnage, while the ship speed has a slight influence on the SPL of underwater noise.

(3) The energy of underwater noise from ships in the upper Yangtze River is mainly concentrated in the low frequency band, especially below 800 Hz; and the higher the sound frequency, the less the energy proportion.