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Ocean Science Discussions

Interactive comment on "Modeling of ships as a source of underwater noise" *by* Jukka-Pekka Jalkanen et al.

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General comments

The manuscript presents a methodology for modelling the underwater noise source levels from shipping, with an example of application in the Baltic Sea for the year 2015. The topic is highly relevant in the context of ongoing efforts to monitor the ambient noise in the European and global waters, for the understanding of the anthropogenic contributions to the continuous underwater noise, of which the shipping noise is the main constituent. The proposed methodology combines a noise source model, incorporating several ship-specific parameters for predicting the source level of individual ships, with a ship traffic model (adapted from the authors' previous model for emissions

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assessment) that essentially incorporates AIS data, in order to produce noise source maps. As the authors dutifully acknowledge, these source maps are not a representative description of the underwater noise, as they do not incorporate the propagation of noise. As such, they cannot be directly used to quantify the contribution of shipping noise sources in relation with the natural noise background. Nevertheless, they could represent a useful tool for a quick assessment of the pressure from shipping sources. While these source maps are not meant to used as direct input to propagation modelling, true shipping noise maps could be produced in principle by adding a sound propagation module to the model; as such, the methodology presented here is quite relevant for the mapping of the shipping noise itself.

Specific comments

It would be useful to compare or at least comment of the differences between the Wittekind source model used here and other models previously used in literature. For example, many shipping noise mapping methodologies might be based on the old Ross (1976) model that uses only the vessel speed and length to estimate the source levels of individual ships. Of course, a meaningful assessment would ultimately require a comparison of the noise maps based on the two source models and their statistical analysis; but even a comparison based on the noise source maps as produced by the methodology presented here might provide useful insights into the merits of using a more sophisticated source model.

The Block coefficient should be introduced or explained earlier in the text (currently it is explained that is a function of the hull shape only on its third mention, on page 5, line 26).

I am not an expert on ship source models, but it seems to me that the machinery noise source level would scale with the engine power rather than engine mass (of course, with appropriate scaling factors for different engine types). It appears that for two and four strokes engines, these scaling factors are as such that one can replace engine

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power with mass and use just one scaling factor (namely the coefficient 15, in equation 4). But for turbine machinery, this no longer holds, as the authors indicate that there is no correlation between engine mass and power. However, the important question here is if a correlation does exist between the source levels and the engine power; if this is indeed the case, then an appropriate version of equation 4 should be used for such machinery, rather than plugging in the same mass dependency with the arbitrary factor of 0.001 ton/kW.

The finding related to containerships (that they are responsible for 25% of the noise energy) is quite interesting, but I'm not sure what is meant by them representing "about three percent of the ships in the Baltic Sea during 2015" – is this 3% of the total number of ships ever reported in 2015 in the area? Is the disproportionately high contribution of containerships to the total noise energy due to e.g. the greater number of "active" days per ship in this category than for ships in other categories (that might have been present or active only sporadically during the year), or perhaps this is due to more subtle factors related to source characteristics of containerships?

The noise source "map" concept is a modelling product that has both the spatial dimensions and the dimension of time. Figure 3 presents a spatial output, cumulated in time; the subsequent figures show information that was also cumulated in time. It would be perhaps informative to present some outputs that expose the time-dimension, be it locally or spatially averaged, for different ship types or for all – if such outputs showed anything interesting or insightful.

Minor technical corrections

Missing space "battlefield(warships)" on page 2 line 11

On page 4, line 5, "for which 10 000 tons should be used" – this is not really a recommendation, but a definition – use more decisive language, like "which is 10 000 tons".

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Both “tons” and “tonnes” appear in the manuscript – is this correct? (tonnes are unambiguous, being a S.I. metric unit, while tons could be either “short” or “long” though this is probably the British “long ton” which is 1016 kg, used even in US in the naval context, and closer to the metric “tonne” than the U.S. “short ton”, which is 907.2 kg)

Page 4, lines 21-21, “because all two stroke engines the cylinder arrangement is of in-line type” – does not read well. On page 8, line 26, “methodology how underwater noise[. . .]” – perhaps use “methodology describing how underwater noise[. . .]”

The Summary section could be tweaked – it sounds a bit too informal, the style is too “oral” like the conclusions of a presentation (e.g. “Our conclusions concerning this work are the following.”, “It is evident that routine monitoring is required.”)

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