UNDERWATER SOUND MAPPING: STATISTICS AND UNCERTAINTY

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The aim of the Joint Monitoring Programme for Ambient Noise in the North Sea (EU Interreg North Region Programme 'JOMOPANS' (https://northsearegion.eu/jomopans/) is to develop a framework for operational monitoring, based on a combination of acoustic modelling and measurements. Output will be the management tools necessary to incorporate the effects of ambient noise in assessment of the environmental status of the North Sea, and to evaluate measures to improve the environment.

JOMOPANS has specified frequency spectra in the 10 Hz to 20 kHz one-third octave (base-10) bands of the monthly percentiles of the distribution of one second snapshots of the depth-averaged sound pressure level (SPL), as acoustic metrics for continuous noise in the North Sea. The main objective of the acoustic modelling is to develop and demonstrate verified and validated modelling methods applicable for generating North Sea maps of this acoustic metric. All partners in the JOMOPANS acoustic modelling work package have prior experience with underwater sound mapping (see e.g. Erbe et al, 2012; Colin et al, 2015; Sertlek et al, 2019). To counter the current lack of standardization in underwater sound measurement and modelling, the partners are comparing results and exchanging lessons learned, with the aim to draw conclusions about the validity and effectiveness of the various models and sources of model input data.

The initial focus in JOMOPANS is on modelling underwater sound from ships and wind. Semi-empirical source models for ships and wind are combined with propagation models to calculate the geographical distribution of the acoustic metrics in the North Sea. Direct numerical calculation of the SPL for all 1 s snapshots in each month for a receiver grid covering the complete North Sea area is not feasible in practice. Moreover, the calculations are subject to several uncertainties associated with the selected modelling approach and available input data. A probabilistic modelling approach reduces the computing efforts and includes modelling uncertainties in maps of sound level percentiles.

An inventory is made of the various uncertainties in the acoustic modelling and input data. Uncertainties in the propagation loss models are quantified by comparison of the results of various models for well-defined benchmark scenarios. The uncertainty in the ship source level model is quantified through comparison with data sets from the ECHO (https://www.portvancouver.com/environment/water-land-wildlife/echo-program/) and SHEBA (https://www.sheba-project.eu/) projects. Preparations are being made for validation of the modelling against data from JOMOPANS North Sea monitoring stations.

References

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