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An Inter-frequency attenuation model for estimation of click distance

In the last 10 years, the knowledge of marine mammals behaviour, their trajectory and density estimation has been enhanced by using passive acoustics techniques. Whale detection and precise localization is often achieved by expensive and heavy hardware such as hydrophone arrays and bottom mounted hydrophones. However, the frequent use of light and single hydrophone devices, which are quick to deploy, requires methods of analysis. In the past, the first steps in the realization of an estimator of the propagation distance between the acoustic source and the receiver were proposed. In this paper, the theoretical expression of this propagation distance estimation is presented with the necessary simplifying assumptions in the case of odontocete wideband signals.

It is called Inter-Frequency Attenuation (IFA) model as it is based on the inter-band signal's attenuation laws. This model is evaluated on sperm whale range estimation on recordings of 25 min on four hydrophones. The range prediction is compared to a precise ground truth available from previous studies. The mean relative absolute range error of the direct theoretical IFA model is 15 %, but a statistical IFA regression yields to 6 %. We also discuss the dependencies between IFA and the source orientation.”

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