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Noise maps complexity in regards of environmental properties

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Maps of underwater noise generated by shipping activity became a useful tool to support international regulations on marine environments. They are used to infer the risk of impact on biodiversity. Maps are performed by 1) computing the emitted noise levels from ships, 2) propagating the acoustic signal in the environment and 3) using localized measurements to validate the results. Because of mismatches in environmental data and a limited number of measurements, noise maps remain highly uncertain.

In this work, the uncertainty of the noise maps is investigated through the potential complexity of soundscape. The acoustic signal at each receiving cell is computed from the convolution of the source of the ships by the transmission losses of the environment. Complexity is mapped by computing Shannon's entropy of the transmission losses for each receiver. High entropy areas only reflect high shipping densities and favorable acoustic propagation properties of the local environment. Low entropy areas reflect: low shipping density and/or poor acoustic propagation properties. An area with high shipping densities and poor acoustic propagation properties will still have low entropy values.

Entropy maps allow classifying areas depending on their environmental features. Thus, scenarios of uncertainty are defined. Results highlight the necessity to consider the diversity of the environmental properties in support of the production of noise maps. The methodology could help in optimizing spatial and temporal resolution of map computations, as well as optimizing acoustic monitoring strategies.