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An acoustic barrier based on amplitude variations of the ray paths and double beamforming

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The objective of this work is to build an acoustic barrier to detect and localize a target between two vertical arrays of sensors. To perform this detection/localisation, we record the signal between each source (of the source array) and each reveiver (of the receiver array). Using these data, we extract the different ray paths between sources and receivers thanks to a new signal processing method: double beamforming. Then, we show that ray paths and their arrival times are not affected by a target in the medium but that ray amplitudes change. As a result, it is possible to use amplitude variation of the rays to find the target localisation.
To validate these methods we perform ultrasonic experiments in a tank. These experiments are often used in underwater acoustics as they emulate shallow water waveguides: indeed, by multiplying the frequency by a factor x, distances are divided by the same factor. As acoustic and elastic propagation properties are not affected by this scaling down, it is possible to achieve "oceanic experiments" in a simple tank. Results of double beamforming and target detection are shown.