Underwater acoustic localization of pulsed sources with an array of three hydrophones

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ABSTRACT
In connection with the development of an acoustic observatory for sperm whales off south Crete an array of three moored hydrophones is considered. It is known that range, depth and bearing of a pulsed source can be estimated using a pair of hydrophones by exploiting the time differences between direct and surface-reflected arrivals. However, that approach suffers from left-right ambiguity, as well as from increased range/depth and azimuth uncertainty for source locations close to the broadside and the endfire of the two hydrophones, respectively. The addition of a third hydrophone, not aligned with the other two, removes the left-right ambiguity and can also lead to reduced uncertainties in range, depth and bearing estimation by increasing the spatial diversity, associated with the different orientation of each hydrophone pair. Furthermore, this configuration allows for range approximation by combining simple bearing estimates based on time differences of direct arrivals at the different hydrophone pairs, e.g. in cases where surface-reflected arrivals cannot be resolved. The presentation will focus on the benefits from the use of the three-hydrophone configuration compared to localization with a pair of hydrophones. [Work partially supported by the Stavros Niarchos Foundation / ARCHERS project].

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