

Pulsed-Source 3D localization with a 3-hydrophone array

Passive acoustic monitoring of marine mammals involves the use of hydrophones to localize vocalizing animals by merely listening to them. Sperm whales produce trains of pulsed sounds, so called clicks, during their long dives. These sounds serve for communication and foraging (biosonar) and if they are picked up by a hydrophone array they can be used for animal localization, which apart from monitoring, can help the design of mitigation protocols to protect endangered populations from human activities. An enhanced 3-hydrophone 3D localization method addressing the pitfalls of 2-hydrophone localization will be presented, taking into account refraction of acoustic paths using ray theory. A Bayesian framework is adopted allowing for the estimation of localization uncertainties. Three different array topologies will be studied and the obtained uncertainty estimates through analytic predictions and simulations, will be compared against those of the 2-hydrophone topology and against 2D localization uncertainties based on direct arrivals. The improvements obtained by the 3-hydrophone localization approach, in terms of removal of left- right ambiguity in bearing estimation and reduction of the range/ depth and bearing estimation uncertainties, will be highlighted. Preliminary results of real experiments in the Mediterranean Sea, south of Crete, will also be presented.