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Sound-speed estimation from RAFOS transmissions

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Acoustic navigation of Lagrangian (moving) floats is carried out by measuring travel times from a number of fixed stations/moorings. A minimum of two fixed stations are needed for location estimation in the horizontal, whereas an additional fixed station is commonly used to remove left-right ambiguity. The signals (RAFOS) and sampling schemes used in ocean acoustic navigation are characterized by limited time resolution (order of 200 msec), much smaller than the resolution used in travel-time tomography (order of 1-10 msec). The possibility of combining navigation signals (travel times) from three fixed stations to multiple moving floats for simultaneous sound-speed estimation and float localization is examined here. The redundant travel-time information in this case offers a significant advantage and makes the accurate estimation of the speed of sound feasible. It is shown that the estimation error for the sound speed decreases with the number of floats, and thus the estimation accuracy improves as the set of floats grows larger. This procedure also leads to improved location estimates for the individual floats. A number of numerical experiments are used to demonstrate the performance of the method. [Work supported by EU/FP6 Damocles project.]