

Acoustic Rapid Environmental Assessment: the AOB concept[†]

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Abstract

Rapidly assessing the environmental conditions of a given coastal area with the capability of being able to predict its evolution in the next 24 or 48 hours has been the goal of many initiatives since the end of the cold war and the shift of strategic regions to shallow areas. Most efforts were carried out by oceanographic teams feeding data of various nature (currents, SST, temperature, altimetry, wave height, etc...) into small scale circulation models (such as mini HOPS and NCOM). Testing has been going on for several years on the validation of such models in various scenarios. Among others, the goal of this testing is to decrease the error variance of various environmental parameter predictions at 1, 2 or 3 days with a minimal model initialization. For tactical purposes it was implicitly assumed that a decrease of the error variance on the environmental parameter predictions would necessarily imply a reduction of the mean square error of the acoustic detection probability prediction. This can be accepted as a general trend but can not be guaranteed since the relation between the temperature profile and the acoustic output is non linear. With the appearance of Matched Field Tomography (MFT) in the late 80's and its application in shallow water scenarios in the early 90's, a new era on the usage of acoustics for environmental purposes was opened. A large number of experimental results obtained by various teams using MFT in shallow water regions have shown the influence of internal tides and internal waves, the strong influence of bottom properties on signal propagation and the crucial role of source receiver geometry and bathymetry on the inversion process. Since even the most sophisticated propagation model existing today (and presumably in the years to come) can not take into account all real world details, in many situations the outcome of the inversion process that most closely matches the acoustic signal is an environment often "slightly shifted" from the actual measured environment, thus the concept of *equivalent acoustic model*. At this point an acceptable goal would be to use the present equivalent acoustic model together with the oceanographic model predictions to obtain more accurate prediction of the acoustical field at future times. As a matter of fact the problem is not so simple since the environmental shift of the inverted data may not be solely due to acoustic modeling issues but is also due to errors in the inversion process and noise, which are effects often difficult to separate. Using the acoustic and environmental data gathered during the MREA'03 sea trial, this paper intends to put in evidence the differences between the inverted and the measured environmental quantities - mainly water column temperature profiles - and the usage of the Acoustic Oceanographic Buoy (AOB) as a promising tool for operational environmental assessment of small coastal areas.

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