Real-time Uncertainty Output for MBES Systems

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Since the introduction of CUBE as a new paradigm in MBES bathymetry processing, the need for better understanding of sensor measurement uncertainty has been exacerbated. Generic models of this uncertainty have been published by the Canadian Hydrographic Service and IFREMER. The former model addresses the complete set of sensors and computations involved in bathymetry processing. It is widely used today for MBES as it does not depend on in-depth knowledge of the internal working of the sensor and it can be computed with only *a priori* knowledge. IFREMER model deals specifically with uncertainty pertaining to MBES and the various forms of bottom detection process. It is considered more accurate, but it requires access to implementation information that is not publicly available.

This paper presents an implementation of the IFREMER model adapted to the specifics of the RESON systems. Starting from the generic model, a more accurate one is designed to fit the characteristics of the systems. Array shading, beamforming techniques and bottom detection algorithms are taken into account to compute the final uncertainty measure. The process outputs - in real-time - the estimated uncertainty associated with each beam of each ping. This information is broadcasted to the survey management software package. It is also recorded in a sonar datagram.

The proposed model takes into account the actual survey conditions that can be readily measured by the sensor. An online measure of the sonar output Signal to Noise Ratio (SNR) is factored in the computation. Options to deal with additional parameters affecting the sensor accuracy, such as sea bed slope and bottom roughness, are still being investigated.

It should be noted that this model is part of the larger scheme of Total Propagated Uncertainty. It deals only with the accuracy of the MBES system consisting of a sonar and bottom detection algorithm. Sound speed values, ray bending and depth reduction accuracies are considered outside the scope of the present process.

The quality of the model is validated statistically using Monte Carlo simulations and with experimental data collected by a full system in a controlled environment. This validation is performed using a SeaBat 7125. Once proven on this system, the model will be expanded to the other RESON systems of the latest generation.