

## Applications of Sonar Detection Uncertainty for Survey Quality Control and Data Processing

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An objective measurement of the bathymetric uncertainty introduced by sonar bottom detection has been proposed (Lurton and Augustin, 2009) to overcome the sonar-specific heuristic solutions proposed by constructors. This approach pairs each sounding with an estimation of sonar detection uncertainty (SDU) based on the width of the signal envelope (amplitude detection) or the noise level of the phase ramp (phase detection), thus capturing the intrinsic quality of the received signal and any applied signal-processing step.

Along with the environment characterization and the motion sensor accuracy, the SDU represents a major contributor to the total vertical uncertainty (TVU). As such, the monitoring of the SDU statistics by detection types, acquisition modes, and transmission sectors (when available) provides an effective way to alert the surveyor about ongoing issues in the data collection. It also has potential application in the evaluation of the health status of the sonar - for example, by comparing SDU-derived performance of repeated surveys on the same seafloor area and estimating the uncertainty contributions from environment and motion. Finally, the SDU may be integrated in multiple stages of the data processing workflow, from data pre-filtering to hydrographic uncertainty modeling, up to more advanced applications like hypotheses disambiguation in statistical gridding algorithms (e.g., CUBE).

Based on such considerations, we conducted a study to explore possible applications of the estimated SDU values for survey quality control and data processing. The results of the analysis applied to real data – collected using multibeam echosounders from manufacturers who are early adopters of this metric (i.e., Kongsberg Maritime and Teledyne Reson) – provide evidence that SDU is a useful tool for survey monitoring.

### Bio

Giuseppe Masetti received a M.S. degree in Ocean Engineering (Ocean Mapping option) from the University of New Hampshire in 2012, and a Master in Marine Geomatics (with honors) and a Ph.D. degrees in System Monitoring and Environmental Risk Management from the University of Genoa, Italy, in 2008 and 2013, respectively. After having served with the Italian Navy – as Operation Officer aboard the hydrographic vessels ITN Aretusa and ITN Magnaghi –, in 2013 he joined, as a Tyco Post-Doctoral Fellow, the Center for Coastal and Ocean Mapping where he is currently working as a research faculty. His current areas of interest include methods to improve survey data acquisition and processing, with a focus on acoustic seafloor characterization. He is the lead developer of the HydrOffice framework.