Implementing a reference backscatter calibration technique on a multi-sector multibeam echosounder

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Increasingly, national hydrographic agencies are committing to routine acquisition of seabed backscatter estimates from multibeam echosounders (MBES) as part of national programs for seabed characterization. As part of their bathymetric survey mandate, these agencies have a long history of sounding quality control utilizing absolute and relative calibration (reference surfaces and crossover comparisons). Equivalent quality control is, however, not yet in place for managing seabed backscatter measurements.

This presentation builds on two previously-reported approaches that A: extracted relative beam pattern estimates from multi-sector data (Hiroji, 2016), and B: obtained broadband absolute seabed backscatter measurements (Guimarães, 2020). The next logical step is to combine these over a common location to shift the relative measurements to the absolute reference. Doing so, however, is fraught with both algorithmic and operational complications.

Previous efforts to implement this cross-calibration only considered a simplified vertically referenced ensonification geometry, ignoring the dynamic variations due to vessel rotations. As a result, neither the rotation of the beam pattern with respect to the vertical reference nor the compensation due to active beam stabilization were accounted for. Furthermore, modern MBES have multiple transmit sectors over multiple swaths and the associated changes in frequency and signal modulation. In addition to the algorithmic complications due to geometry, the field acquisition of MBES backscatter over a reference site provides further operational considerations including the homogeneity of the reference surface and the amount of vessel motion and resulting active stabilization. This work explicitly addresses these additional geometric and operational complications.

To test the proposed technique, broadband reference backscatter (45-450 kHz) from areas with different seafloor types, derived from data obtained with a calibrated split-beam echosounder Simrad EK80, is used to adjust the received acoustic intensities acquired from the same areas with the Kongsberg multi-sector MBES EM710 and EM2040P, thus allowing to obtain calibrated backscatter.

Hiroji, A. (2016). *Extracting sonar relative beam patterns for multi-sector multibeam sonar* [PhD thesis, University of New Brunswick]. https://unbscholar.lib.unb.ca/islandora/object/unbscholar%3A7757

Guimarães, I. B. (2020). *Obtaining a reference for calibrating broadband multibeam seabed backscatter* [Master's Thesis, University of New Hampshire]. https://scholars.unh.edu/thesis/1466/