Bathymetric and Reflectivity-derived Data Fusion for Preliminary Seafloor Segmentation and Strategic Bottom Sampling

G. Masetti[1], L.A. Mayer[1], L.G. Ward[1], D. Sowers[2]

1. Center for Coastal and Ocean Mapping, University of New Hampshire, USA
2. NOAA Office of Ocean Exploration and Research, USA

Modern multibeam sonars and processing software typically produce geo-located bathymetry and backscatter mosaic products, thus offering the opportunity to treat both data sets together to support seafloor characterization. However, there are few studies that have offered general methods for using machine-focused (automated) approaches for seafloor segmentation that combine and use the information found in co-located bathymetric digital elevation models (DEMs) and acoustic reflectivity mosaics.

We explore a methodology to combine both bathymetry and backscatter data to automatically segment the seafloor. The proposed method attempts to mimic the approach taken by a skilled analyst assuming that, when called upon to manually segment a seafloor area, the analyst initially evaluates the context surrounding the area and attempts to take full advantage of both bathymetric and reflectivity products rather than focusing on small-scale geomorphometric variability (e.g., local rugosity). The result is a bathymetry- and reflectivity-based estimator for seafloor segmentation that mimics the positive aspects of the segmentation process as performed by a skilled analyst (e.g., the use of context and multiple inputs) but avoids the inherent deficiencies (subjectivity, processing time, lack of reproducibility).

The algorithm starts by adopting principles of topographic openness, pattern recognition, and texture classification to identify geomorphic elements of the seafloor or “area kernels”, and then derives the final seafloor segmentation by merging or splitting the kernels based on the principles of similarity and multi-modality.

The output is a collection of preliminary, homogeneous, non-overlapping seafloor segments of consistent morphology and acoustic backscatter texture. Each labeled segment is enriched by a list of derived, physically-meaningful attributes that can be used for subsequent task-specific analysis. In this work, the resulting segments have been evaluated as possible inputs to identify a strategic seafloor sampling (ground-truthing) plan aimed at advancing characterization results while optimizing operational field efforts.