How to Improve the Quality and the Reproducibility for Acoustic Seafloor Characterization

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Current commercial solutions for processing acoustic data with the aim of seafloor characterization does not take full advantage of the wide spectra of information collected by modern sonars (e.g., water column data, multiple sectors). In addition, those solutions tend to act as a 'magic black-box' with only a few user-defined parameters. This can be seen as an advantage (it makes these technologies available to a large community), but it also engenders a lack of data reproducibility. Currently, it is a real challenge to 'properly' merge backscatter-based products from different vendors (and even from the same vendor given the lack of metadata).

In order to mitigate both issues, we developed a different approach. The proposed workflow is organized into two main phases: the first part focuses on artifact identification and reduction, while the second part is product-oriented. The artifact-oriented phase applies a (growing) set of algorithms to facilitate the identification of corrupted data so that they can then be ignored or, if required by the user, reconstructed using several different techniques. This approach also provides a metric that can then be used to identify which ping should be excluded during seafloor characterization.

The first phase is cleanly separated from the product creation. At the end of it, corrected data in the sonar's native format are generated together with an (optional) 'difference' file (containing only the data that has been modified) and a human-readable and computer-interpretable textual description of all the applied processes. This 'native-format' solution is better than converting the data to a hybrid generic data format which may not adequately preserve all of the important information from the file. The 'difference' files reduce the amount of data storage since they contain only the changes, rather than doubling the storage requirement. An additional advantage is modularity. For instance, based on the kind of survey different strategies combining the identification and reduction methods can be built. Once the valid, corrected data files are created, they can be mosaicked or analyzed for seafloor characterization by the user-preferred application.

The proposed approach is demonstrated with real-world data by first using a set of bubble washdown detection algorithms, then improving the quality of the generated outputs. Specifically, the mosaic is created after the reconstruction of the corrupted samples with a weighted randomization schema, while the seafloor characterization is improved by ignoring the corrupted data.

A possible future development of this approach is to carry all the line-based descriptions of the applied processes together with the products. To make this possible in a robust way, we propose the creation of an open, community-driven product data format mimicking what has been done for bathymetric data by the Open Navigation Surface Working Group (BAG format).