Open Backscatter Toolchain (OpenBST)

A community-vetted workflow for backscatter processing

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***Abstract*— Seafloor acoustic backscatter collected by multibeam echosounders (MBES) is routinely used to generate products such as backscatter mosaics and angular response curves. However, the usability of backscatter products has been hindered by a lack of consistent outputs that may be the result of differences in sonar calibration, data collection and processing. The Open BackScatter Toolchain (OpenBST) project aims to mitigate discrepancies that arise from existing processing workflows by providing open-source, community-vetted processing algorithms for backscatter data. In this work, an example of the OpenBST approach was applied to the backscatter processing workflow for a popular multibeam echosounder, using a reference dataset recently collected in Portsmouth Harbor, NH. At each processing step, intermediate outputs are produced (and compared) using commonly adopted methodologies. Finally, an analysis of the relative relevance of selecting those methodologies at the various intermediate steps is presented.**

Keywords—Multibeam Echosounders; Seafloor Backscatter, Data Processing/QC; Remote Seafloor Characterization; OpenBST

I. INTRODUCTION

Recent advances in multibeam echosounder (MBES) technology and data storage has facilitated and increased the collection of seafloor backscatter. Because the strength of backscatter is linked to physical properties of the seafloor, backscatter may be a useful tool for characterizing the sea bottom. Backscatter data products, such as mosaics and angular response curves, have proved useful to a variety of fields outside of hydrography, including habitat mapping, dredging, and geological surveys.

The standards and best practices for collecting bathymetric data are well defined and often regulated by international and state regulatory boards. In contrast, backscatter data are not held to similar standards. Data collection approaches and representation is varied among hardware manufacturers. Further, there is no agreed upon methodology for processing of backscatter, resulting in products from the same input dataset varying significantly between software manufacturers.

II. THE PROCESSING ISSUE AND OPENBST

To date, the majority of efforts towards backscatter standardization has been focused on hardware calibration. However, an effort lead by the Backscatter Inter-comparison Project (BSIP), found that backscatter products generated from the same dataset by various popular processing packages varied significantly throughout the processing workflow. Even at the first processing stage of these packages (i.e. reading the raw data and converting them to a representative value per beam), the median backscatter levels were found to vary by over 3dB, pointing to differences in adopted methodologies among software packages. If the goal is to be able to use backscatter data in a quantitative manner, the lack of a coherent collection and processing methodology presents a significant impediment to the utility of backscatter data and products since it limits end-user's ability to quantitatively use the data.

The Open Backscatter Toolchain, or OpenBST, project aims to address and mitigate the discrepancies encountered in the BSIP results. OpenBST is collaborative in nature and designed to be a virtual meeting ground where the software vendors, researchers, and end users can discuss the merits of various backscatter processing approaches and toolchains. (https://www.hydroffice.org/openbst).

III. OPENBST – A COLLABORATIVE VIRTUAL ENVIRONMENT

A. Overview

OpenBST operates as a publically available, open and community-vetted set of processing algorithms. All algorithms are implemented in Python and presented in interactive Jupyter Notebooks. Each Notebook is representative of a particular sonar system and its suggested processing chain. At each step of the processing workflow, the algorithms are used to generate intermediate products, and the different methodologies are then compared visually and statistically. The code is hosted on Github (https://github.com/hydroffice/hyo2_openbst), where the community can participate in active discussions intended to highlight the best processing methodologies/algorithms based on the current state-of knowledge.

B. Example Notebook

Finally, presented here is an example of one of the OpenBST Jupyter notebooks. The notebook is based on data from a Reson T50-P MBES collected in Portsmouth Harbor, NH. The values of intermediate products for different processing stages are contrasted. Analysis of the products is used to highlight the relative merits of different methods and to point out discrepancies in current knowledge.

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