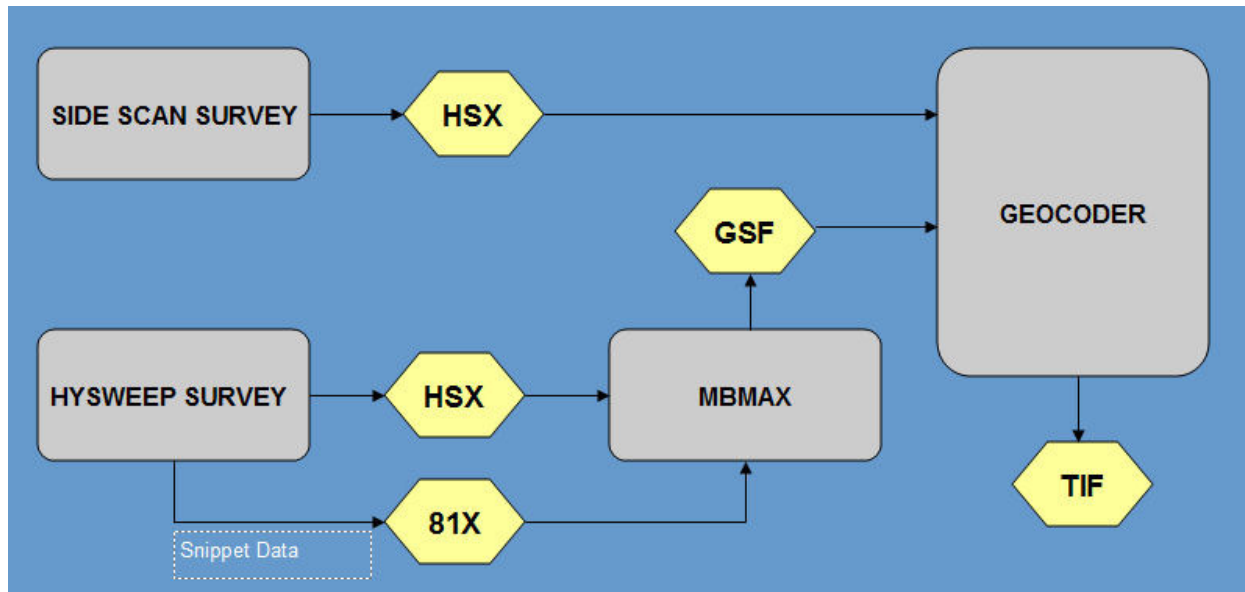


HYPACK Improves Its GEOCODER Integration

By Pat Sanders

HYPACK 2008 marked our initial integration of the GEOCODER program, developed by Dr. Luciano Fonseca of UNH-CCOM (Center for Coastal and Ocean Mapping). GEOCODER contains advanced routines for mosaicing data from side scan, average backscatter data from multibeam and snippet data from multibeam. Our initial work on GEOCODER centered around getting our HSX files with side scan data to load into the program and to figure out save and load average back scatter and snippet data. Mike Kalmbach designed a method to save snippet data, writing the info to 81X files. Dave then modified MBMAX (Multibeam Editor) to write the Average Backscatter and Snippet data to GSF format (Generic Sensor Format). The GSF files could then be loaded directly into GEOCODER.



Side Scan and HYSWEEP Interaction with Geocoder

If you are logging the pseudo-side scan from multibeam, you can bring the HSX file from HYSWEEP SURVEY into GEOCODER.

Putting GEOCODER into our hands was similar to handing a 15-year old the keys to the Lamborghini. There were so many options and processing enhancements available in GEOCODER that we were just happy to get a mosaic (TIF) out the far end. Over the last months, we have received some guidance and assistance from Luciano Fonseca and become more comfortable with many of the routines in GEOCODER. Dave Maddock has set to work modifying the user-interface to make it a little easier for our users to navigate, while trying to keep the advanced features of GEOCODER available.

One of the complaints from our users regarding our initial integration was that mosaics generated from Average BackScatter (ABS) and Snippets was fuzzy. We were quick to admit that we weren't very impressed and turned to Luciano for some help. In July, Luciano visited us for a week and he helped us get to the root of the problem. By

making some changes to computation of the geometry in the GSF file and making adjustments to the bottom detection values, the mosaics from the ABS and Snippets have greatly improved.



Figure 1: Mosaic of a wreck

The sample mosaic (left) shows three short multibeam lines over a wreck. Using our previous routines, the wreck was almost indistinguishable from the surrounding background. In our updated version, the features and bottom are very prominent.

In order to show some of the things we have learned while working with GEOCODER, I'd like to use the following example. I have read in 3 GSF files of short lines over the same wreck.

One of my first lessons from Luciano was to extract the Transmit (TX) Beam Pattern for the multibeam sonar. Every sonar has its own particular TX Beam Pattern. Although there is a lot of similarity between similar systems (e.g.: most Reson 8101 transducer exhibit very similar beam patterns), you can extract the beam pattern for your sonar by selecting a flat, featureless area of one of your input lines.

I've clicked on the trackline of the westernmost line then selected the Extract Beam Pattern menu item. I can now specify which ping numbers of the line I wish to use when extracting the Beam Pattern.

In my example, I have modified the dB level so that the selected area stands out in darker color. I have also selected my pings in a flat, boring area. Once you press the Remosaic button, GEOCODER analyzes the data and extracts the Transmit beam pattern for the sonar. That information is displayed for the Port and Starboard beams (red and green) in the beam pattern analysis graphic (Fig 3). Ninety degrees is the nadir beam. It is stored in memory and will be used (if you elect

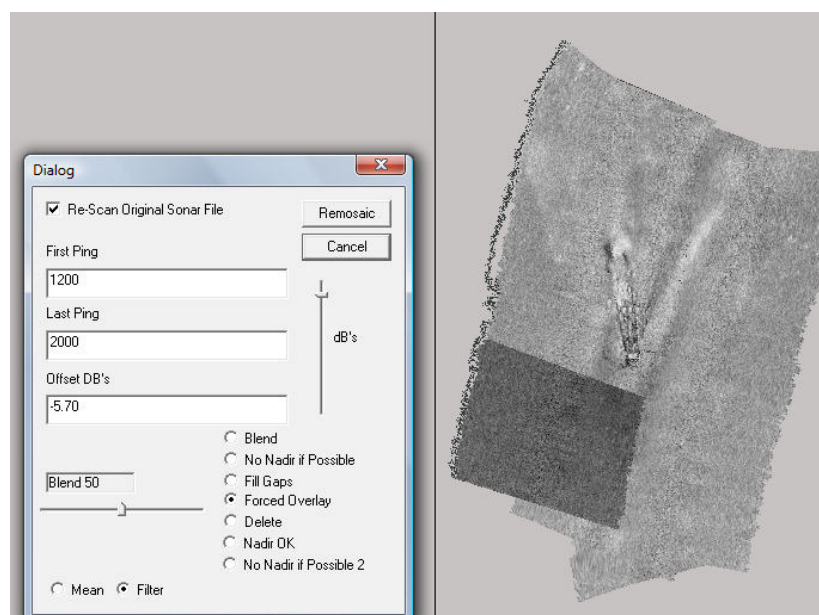


Figure 2: Extracting the Beam Pattern

to apply the TX Beam Pattern) when generating any mosaics during this session. You can also save the Beam Pattern Angular Response to a file that you can read into GEOCODER in future sessions.

I can now go ahead and re-generate the mosaic. I first enable the 'Apply TX Beam Pattern' option and then just click the 'Assemble' menu item.

Although it is difficult to pick out difference at this level, the original mosaic (left) and the mosaic created with the TX Beam Pattern applied (right) are shown side-by-side below.

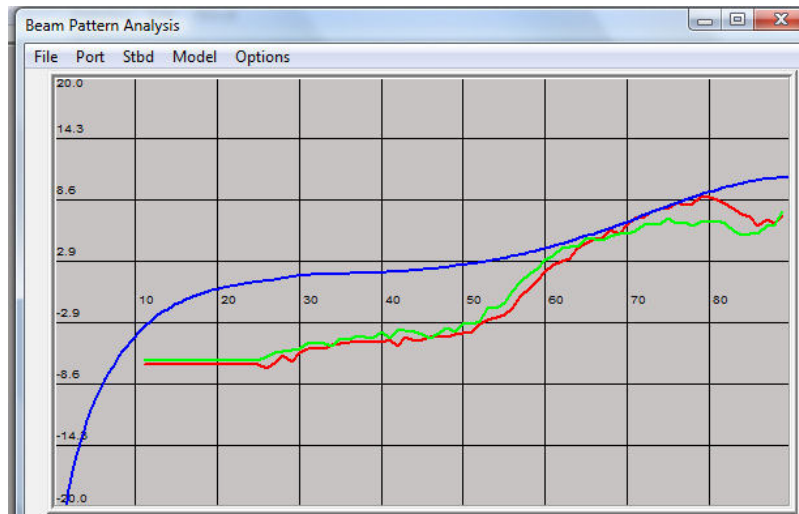
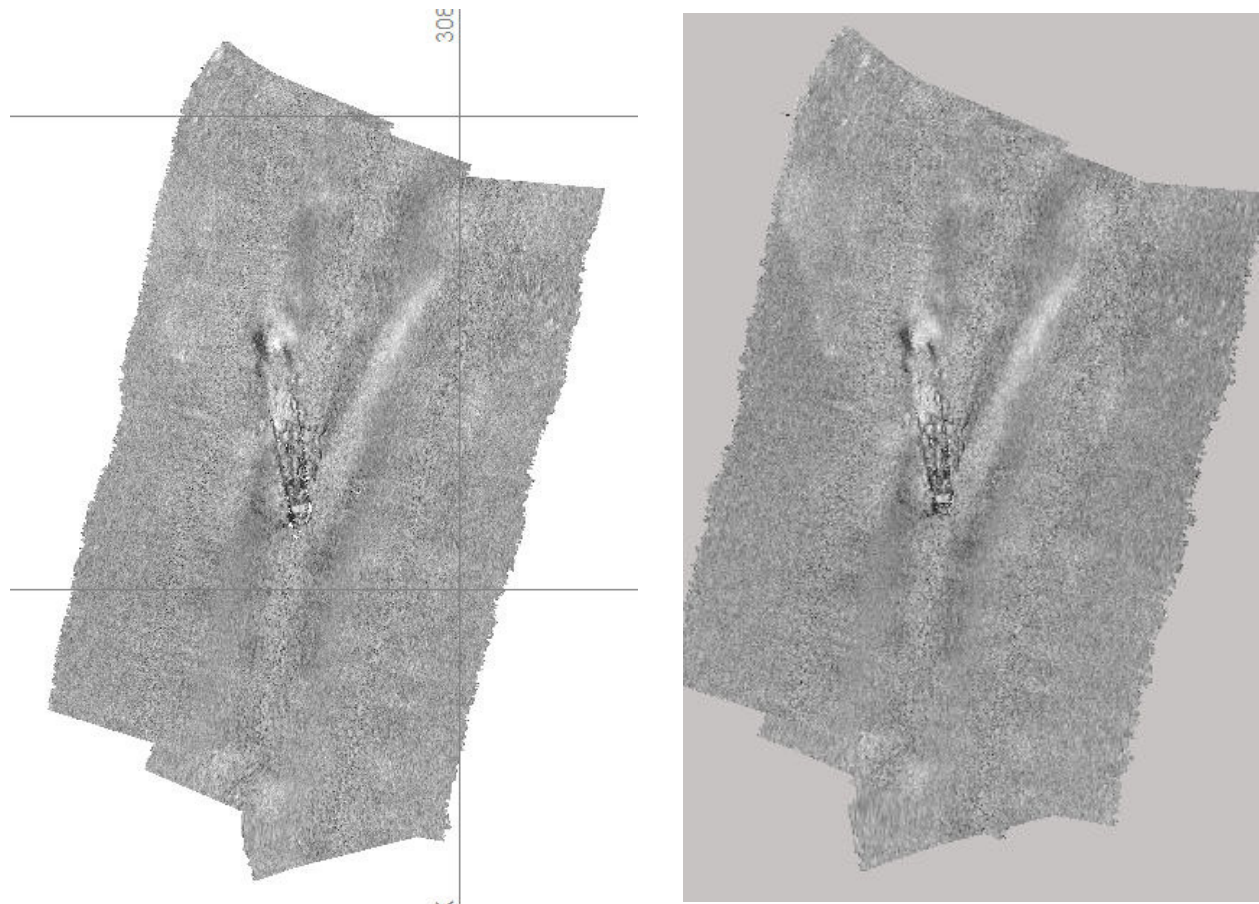


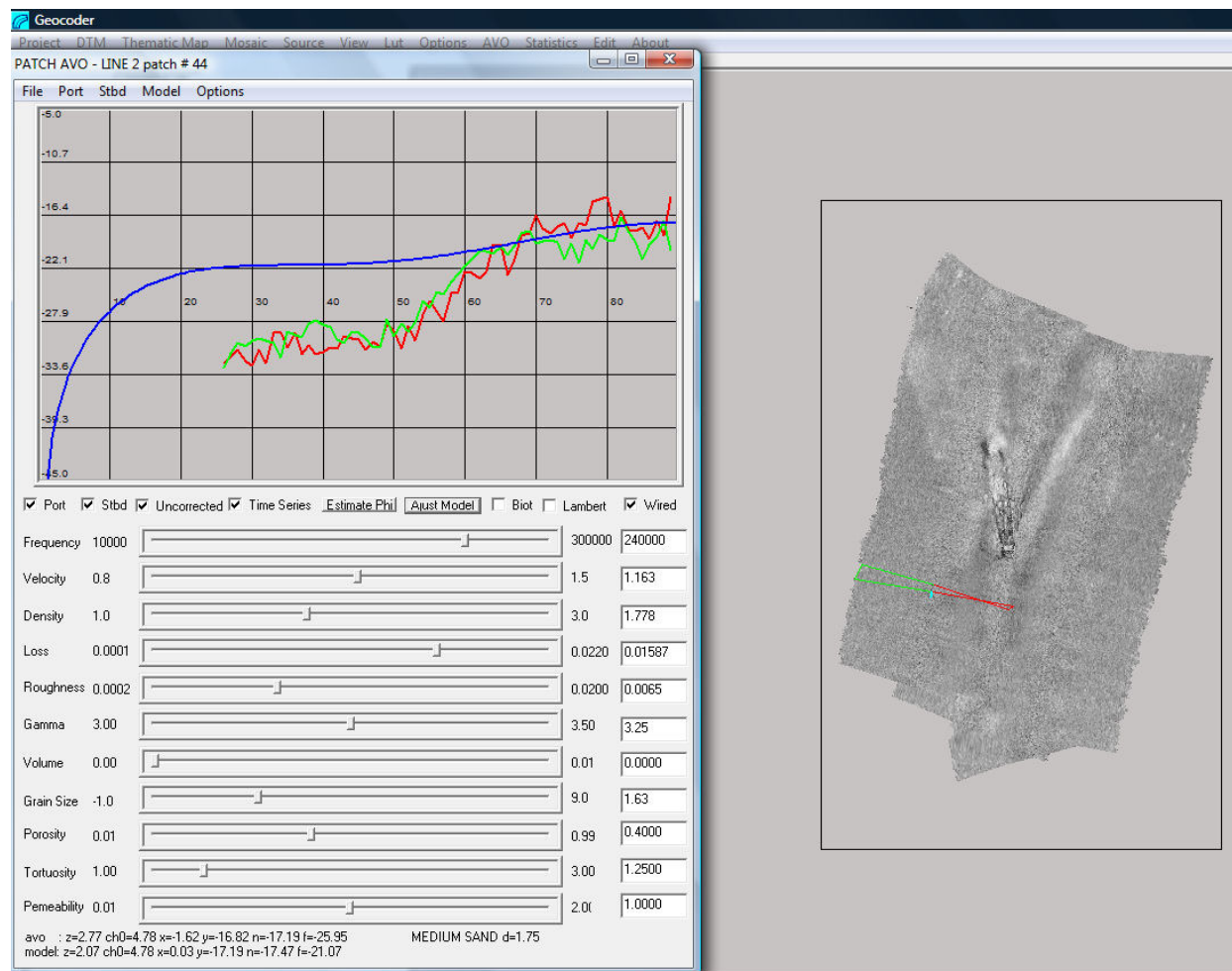
Figure 3: Beam Pattern Analysis



Some of the variation in the bottom material are better delineated in the mosaic where the beam pattern has been extracted and applied.

One of the more interesting features of GEOCODER is the ability to make determinations of the bottom type based on the angular response. Called AVO (Angle versus Offset) or ARA (Angular Response Analysis), the routine analyzes the port and starboard beam patterns to determine the slope of the angular response for the near-nadir and off-nadir beams. Based on the computed slopes, GEOCODER searches an internal database to generate a classification for the material.

1. Click the AVO – Calculate menu item and regenerate the mosaic.
2. Click View - Patch AVO. By clicking on a track-line, GEOCODER loads the angular response for several beams at that location into the Beam Analysis window.
3. Click the 'Adjust Model' button and GEOCODER makes a determination on the bottom surface type.

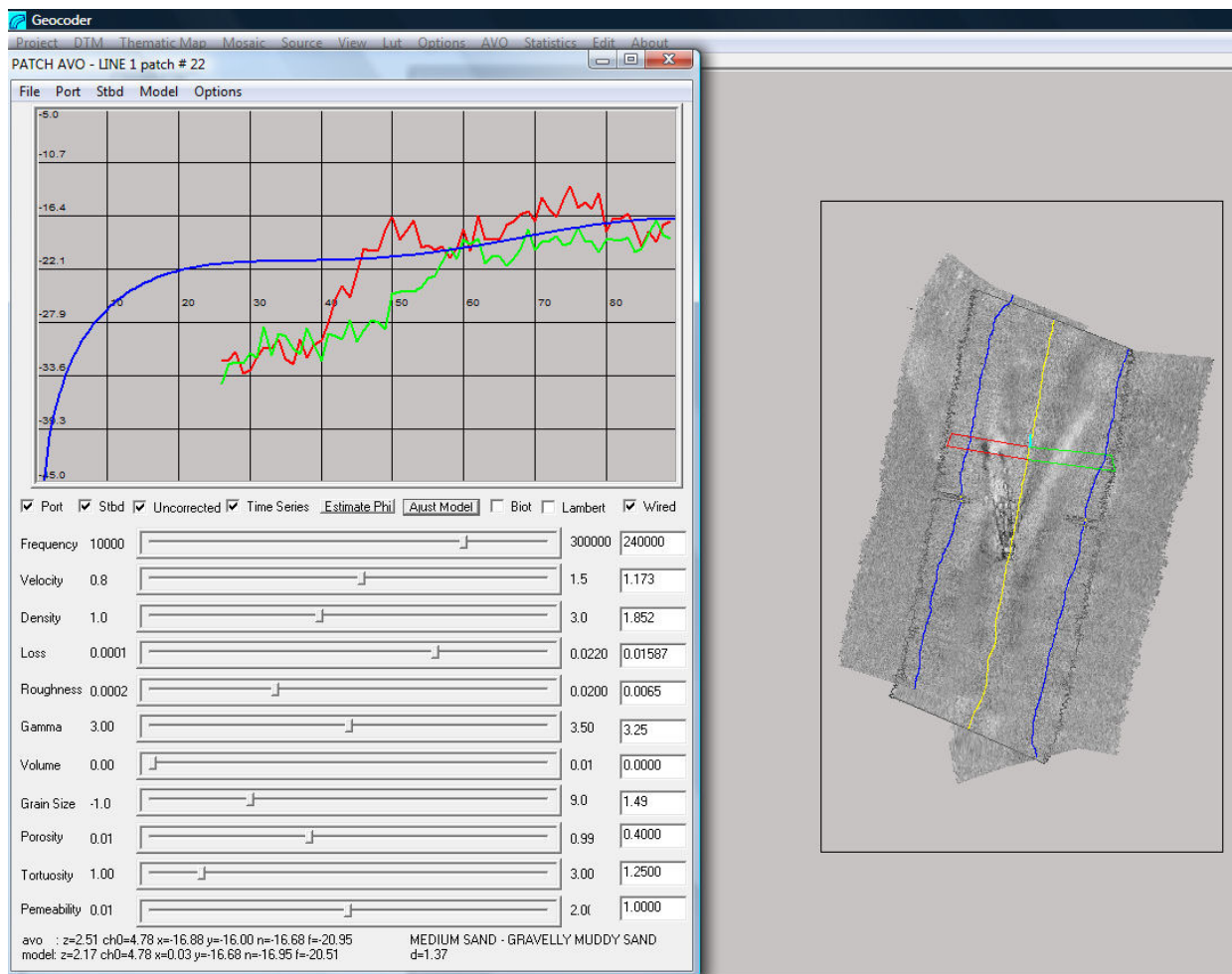


The window above shows the mosaic on the right with the area used for the computation in the green and red polygons.

Note: GEOCODER performs the bottom analysis over the entire swath of the multibeam and cannot be used to pinpoint a material at a spot location.

The window on the left shows the model (blue line) after the 'Adjust Model' button has been pressed. The red and green lines represent the Angular Response of the sonar.

GEOCODER then alters the Grain Size, Roughness and other parameters to generate the 'best fit' between the model and the data. The bottom type is then listed on the bottom right as 'Medium Sand'.



In the same example, we select an area just north of the wreck. In this case, it has determined the bottom type as 'MEDIUM SAND – GRAVELLY MUDDY SAND'.

You should always take bottom samples to confirm the GEOCODER analysis. I have found minor differences in the resultant bottom types, based on whether or not I extracted the beam pattern or not.

Dave is in the final stages of making modifications to the user interface of GEOCODER. The work that you see will be reflected in an upcoming release of HYPACK 2009.