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THE PINGER

News from the Marine Team at Quester Tangent

Acoustic classification of the entire Strait of Georgia

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Quester Tangent™ Making Data Intelligent™

The Canadian Hydrographic Service (CHS), Sidney, Canada, wanted to assemble a chart of seabed types over the entire Georgia basin, B.C., Canada, almost 300 km long and as wide as 30 km, based on thousands of grab samples and billions of pixels of multibeam backscatter. The challenge, to use ground-truth information to label QTC MULTIVIEW acoustic classes, was made more taxing by the data volumes and their disparate histories and sources.

QTC MULTIVIEW makes maps of acoustic similarity. Its classes encompass seabed regions that are reasonably homogeneous and distinct from the other regions, in terms of the character of their acoustic backscatter. Labels are assigned to these classes by correlation with ground truth.

From 2002-2008 CHS surveyed almost all the Strait of Georgia with a Simrad EM1002 multibeam sonar system. The system collected bathymetry and backscatter images of all the surveyed areas. The bathymetric data are used to compensate backscatter amplitudes for grazing angle at the seabed, and then backscatter amplitudes and texture

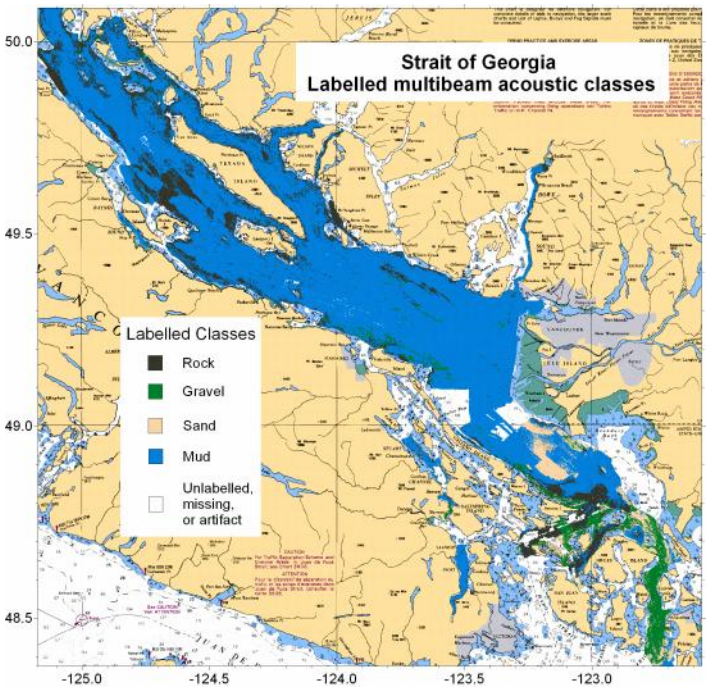


***Figure 1**: Acoustic classes for the entire Strait of Georgia, excluding water depths less than 20 m. The areas covered by each class are: mud 4369 km^2, sand 257 km^2, gravel, 334 km^2, and rock 1023 km^2*

Next tutorial
The next Seabed Classification tutorial is scheduled for the Oceans Conference in September 2010, Seattle, WA, USA

***Quester Tangent does the Combo……*QTC SWATHVIEW**

Our new QTC SWATHVIEW means that you no longer need two separate products to process multibeam and sidescan data. The new software combines all the capabilities and familiar features in our proven QTC MULTIVIEW and QTC SIDEVIEW products into a single package, and also includes processing of interferometric swath data.

QTC SWATHVIEW already supports classification of data from 72 different swath sonar platforms and 17 different vendors across a wide variety of formats!

Visit our web site or contact us to:

⇒ see if your system is already supported, or if not, to see how support can be added.

⇒ arrange a trial of QTC SWATHVIEW or to arrange for some of your data to be processed as a demonstration.

are used for classification. Over these years some 53 billion pixel amplitudes were collected in water deeper than 20 m and divided into 23 million sub-images which were assigned to up to 12 classes in 11 separate classification processes. There was one process for each mode (shallow, medium, or deep) for each quarter of the Georgia basin, and labels were needed for all these acoustic classes. The various modes cannot be classified together because each has its own pulse length, and pulse length is a major determinant of the backscatter texture and amplitude.

The Strait of Georgia has been surveyed by CHS starting many years ago, and before that back to Captain Vancouver. More than 7000 samples of surficial sediment have been collected, using everything from wax in a sounding weight to grab samplers with a video camera mounted just above them. It is a testament to the skills of the pre-GPS surveyors that there was no need to reject any of their data for inconsistent positions. Figure 2 shows their data mingled with modern information.

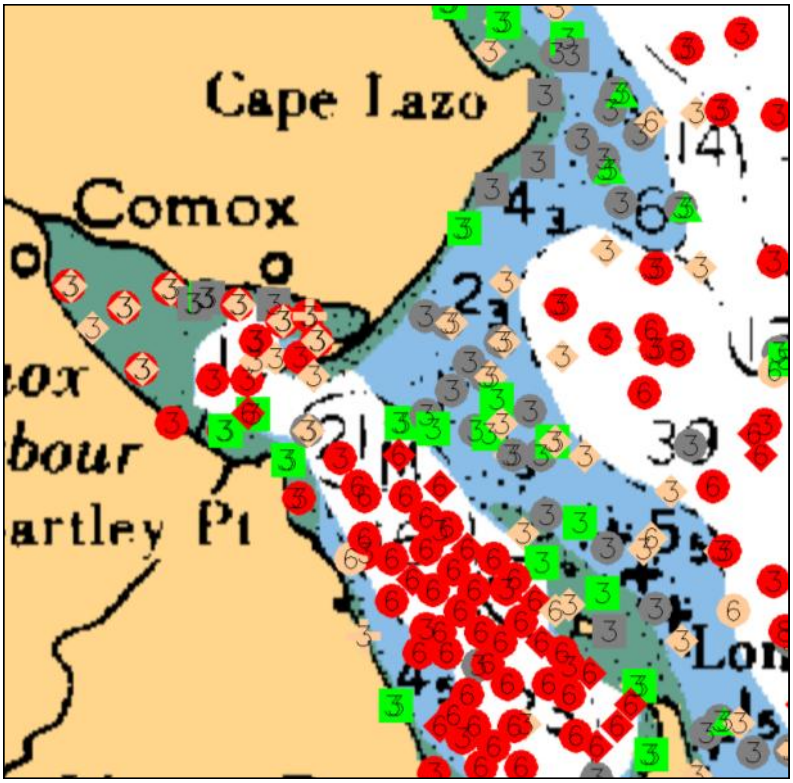


Figure 2: *Grab samples from Comox Harbour and its approaches are sand (sand colour) and mud (red), and the Comox Bar is rock (grey) and gravel (green) with some sand. Grab source 3 is CHS, namely the data used to put bottom symbols on the current charts, and source 6 is from geological surveys by a different government department.*

Because of the frequency of the EM1002, the acoustic seabed classes are determined by only the top few decimetres of sediment over hard ground. Volume scattering from up to 2 m into the seabed can influence the backscatter from fine-grained sediments. These sampling techniques emphasise the surficial sediments, and thus sample the sediments that are the primary, but not the only, determinant of the nature of the acoustic backscatter.

The first step in correlating acoustic and grab data was to determine the acoustic class at the site of each grab. Most grab sites are surrounded by points with an acoustic class assigned to each one. If the assigned classes are all the same, then the acoustic class at the grab site would obviously be that class. Often, though, the surrounding points have a variety of assignments and categorical interpolation is needed. An in-house variant of QTC CLAMS, which performs categorical interpolation, was used because the points to which classes were assigned were the grab sites, which are not arranged in a regular grid.

Confusion matrices contain the number of times that a site is in both a particular acoustic class and a particular ground-truth class. Each column is for an acoustic class and each row for a ground-truth class. Ideally, the entries in a row are predominantly in just one column. When this occurs, that acoustic class can be labeled with the ground-truth descriptor of that row. If there are more ground-truth than acoustic classes, one acoustic class can get the common label of several ground-truth classes, perhaps mud, sandy mud, and sandy mud with shells being grouped as mud. Good correspondences like these were not always found, due to different data sources and methodologies. The confusion was resolved with a semi-quantitative approach.

For each mode and each quarter of the area, the confusion matrix and the chart were considered together. This allowed artifact classes to be put aside mentally (this particular EM1002 did not give consistent amplitudes), while homogeneous regions were given an emphasis in labeling. It was helpful to group the ground-truth data into major types: mud, sand, gravel, and rock. Figure 1 (first page) is the resulting map of labeled acoustic classes. It faithfully shows that sediments in most of the deep (300 – 400 m) parts of the Strait are mud, while the major reefs are rock. Rock and gravel are common in the tidal passes through the Gulf Islands and San Juan Islands and sand occurs only south of the Fraser delta.

Tony's Tips

Tony Tipple steps in to answer your questions about our products and technology.

Question: *I am processing multibeam and sidescan data. What rectangle size should I use?*

Tony:

There is no right or wrong rectangle size, but there are some guidelines to consider when making your choice:

Resolution: The resolution of seabed types tends to have a scale of metres. Consider the scale of the seabed types you are interested in and try to match rectangle size to it.

Aspect ratio: Try to make rectangles approximately square in geographic space in order to reduce anisotropy (direction bias) in the classification. The software includes a rectangle size calculator which provides an estimation of rectangle size in geographic space.

Width: Classifications are based on survey lines, not mosaics. Therefore rectangle widths are restrained by the width of a survey line. Using multiple rectangles on a side will increase confidence that the classification is based on the sediment type rather than the survey geometry. Consider between 2 and 8 rectangles on a side.

Length: Some multibeam sonar systems that are not beam steered will have uneven coverage due to ship motion. Rectangles that are short in the along-track dimension may be able to fit into these uneven regions and significantly increase the coverage of your seabed classification.

Processing time: The smaller the rectangle, the greater the number and the more computer time needed for processing.

International Partner…….Focus on:

Andy Williamson, founder of Undersea Sense

I came into the industry over twenty years ago with an engineering degree and started working in the production of pingers, acoustic relocation, and wired and wireless diver communications equipment in Helle Engineering's new factory in Aberdeen. After a steep learning curve and exposure to the workings of a small company, I moved to another small Aberdeen based company involved in the manufacture of ROVs, sonars, cameras and acoustic systems. Over the course of these ten years, I had become increasingly involved in both the financial management and sales sides of businesses, learning greatly from the experience. Since then I have been involved in a number of businesses in the UK and overseas as director and shareholder producing and supplying products and offering service and training. This involved lots of international travel for exhibitions, customer training and demonstrations, during which I met a large number of customers and distributors, many of whom have become friends.

In 2009, having been the managing director of ***Sonavision***, suppliers of sonar, acoustic seabed classification, cameras and communications systems for more than a decade, I left to form ***Undersea Sense***. Its mission is to supply high quality products and services into the UK Oil and Gas, Environmental Monitoring, Defence and Hydrographic Survey markets.

In my spare time I can be found at my local golf club in Ellon, working to bring down the handicap or spending time with my wife Susan and eight year old daughter Caitlin.

This article was contributed by Andy, our new partner for the UK—we are excited to have him on board as a member of our international team!

Proud Owners

As always we have too many new owners of our products to provide a full listing, so if you are interested to know who is using our technology in your area, contact us for an introduction. Quester Tangent's technology is now used in well over 40 countries.

This edition of our newsletter announces the release of our new product, QTC SWATHVIEW …….and we have already delivered the first license, which went to ***GEMS Survey*** in the UK!

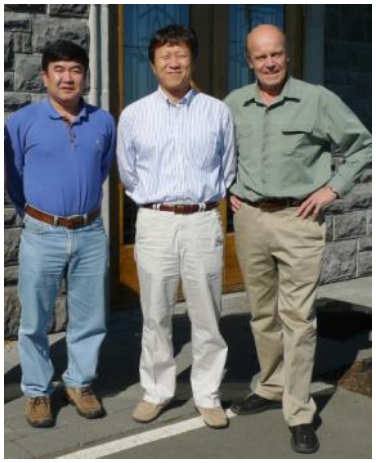
Other new owners are ***AP Marine Environmental Consultancy***, Cyprus, ***CINESTAV,*** Mexico and ***Dial Cordy & Associates,*** USA, who received licenses of QTC SIDEVIEW for sidescan classification. The ***University of Miami,*** Florida, took delivery of a QTC VIEW, to bring their total to three units in active use. The QTC5.5 is our new upgraded acquisition hardware which is available with QTRT software for accurate real-time classification.

Visit us at Booth 412/414, Oceans 2010 - Seattle

Training Update…….

New from Quester Tangent is ***TVI—Training Via the Internet*.** Students participate from anywhere they want to, as long as they have an Internet connection. Training is interactive with a live professional trainer from QTC, and takes place over a number of relatively short sessions during the course of a few days. TVI is available for all our data processing products

TVI has only recently been introduced and is already proving very popular, but we still offer the more traditional training courses, either in our clients' offices or at our premises in Canada. Recent training in Canada has seen visitors from the ***Korea Institute for Geoscience and Mineral Resources*** (KIGAM), from Mexico's ***Unidad Mérida del Centro de Investigación y de Estudios Avanzados*** and from ***B.C. Hydro***.



Dr. Gee-Soo Kong & Dr Jin Ho Kim of KIGAM, with QTC's Tony Tipple during training in Canada.

Workshop Alert

The next Seabed Classification workshop will be coordinated by our partners, Harvey-Lynch, and held in August in the Gulf Coast, USA.
Contact us if you would like to participate.

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Introducing you to…….

Tony Christney
Software Developer

Quester Tangent welcomes Tony back into the fold, to help us move forward with continuous product development and improvement!

Raised on the wet west coast of Vancouver Island, Tony has spent most of his life near the sea. His early years in Bamfield, BC (home to a significant fishery as well as a world class marine research facility) exposed him to both the commercial and scientific importance of the world's oceans. Hired as a co-op student in 1997, Tony worked for Quester Tangent for 8 years in the Marine Research department under Jon Preston. In 2005 Tony left Quester Tangent to care for his young children, and has now returned as a developer working on Quester Tangent's marine software.

Tony is a father of three and enjoys taking the whole family camping in the summer and skiing in the winter. An active member of the Victoria ***ultimate*** community (a team sport played with a Frisbee), Tony has competed at national tournaments in the college, mixed and masters divisions. He also is an avid recreational cyclist and woodworker.

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*Do you have any articles of interest you would like to contribute to **The Pinger**?*

Please contact Chris Elliott