Bathymetric Map of Missisquoi Bay

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Figure 1. Middlebury College's Research vessel **RV Folger.**

Introduction

Missisquoi Bay is to be bathymertically remapped over a period of 3 years (2013-2015). This work reports on the higher -resolution multibeam data collected during the summer field seasons of 2013 and 2014. Data were collected on Middlebury College's research vessel **RV Folger** (Figure 1) using the Reson 7125 (512 beam dual frequency) multibeam system with Applanix 320 MV Inertial Motion Unit (IMU). The multibeam transducer transmits an acoustic 'fan' of individual beams (Figure 2). For each of the 512 acoustic beams in this fan, the travel time, angle of the beam away from nadir, motion of the ship (heave, pitch, roll and yaw) and precise positional location of the ship are required to calculate its exact location and depth. Multibeam swath (fan) data were then processed using CARIS HIPS and SIPS.

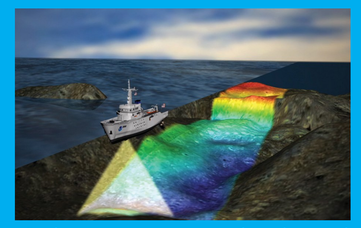


Figure 2. shows a cartoon a vessel, and acoustic fan or swath mapping of the sub-bottom topography.

Data

Shiptracks for the RV Folger were planned every 60m in 2013 and every 120m in 2014 (Figure s3 and 4). In 2013, 407 lines and 104 GB of data were collected (Figure 3). In 2014, 194 lines and 350 GB were collected (Figure 3). Two multibeam control lines allowed 2013 and 2014 data to be merged into a single map. These control lines create an "X" shape, and intersect every track line from 2013 and 2014 data collection (Figure 4).

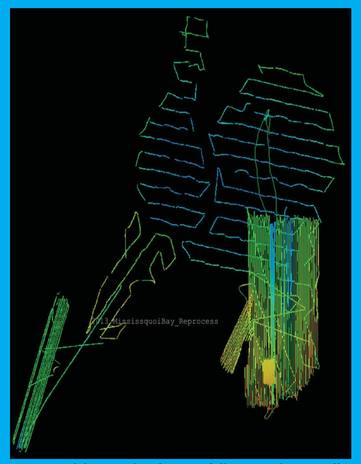


Figure 3. Ship tracks for multibeam data collected in 2013.

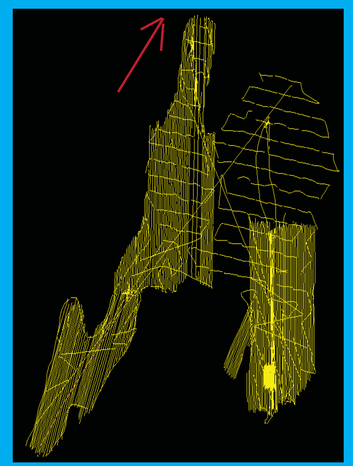


Figure 4. Ship tracks for multibeam data collected in 2013 and 2014. There are two control lines, which are the two longest lines that create an "X" shape through Missisquoi Bay. The red arrow points to Venice Bay, Canada.

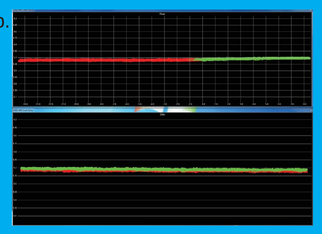
Processing

Data processing included:

1. Reformatting and editing sound velocity data
2. Editing swath data (Figures 5a, 5b, 5c)
3. Creating & loading the tide (lake level) data
4. Computing Total Propogated Uncertainty (TPU)
5. Comparing depth differences between control and other track lines using delta draft (Figures 6a and 6b)
6. Creating and editing a CUBE (bathymetric) surface

5a.

5b.



5c.

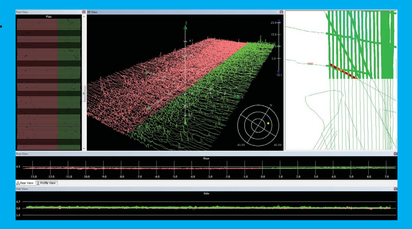
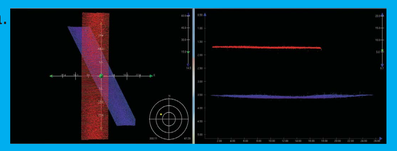


Figure 5 (a) Swath data prior to editing using rear and side view, (b) the same swath data after editing. (c) the 3D multibeam editor window with 10x vertical exaggeration.

6a.



6b.

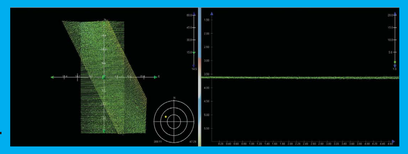


Figure 6a. shows the multibeam control lines (purple) and the data line (red) before editing, and Figure 6b. shows the data after the delta

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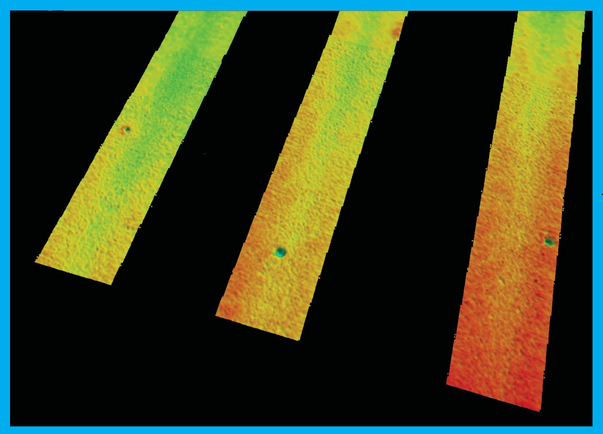
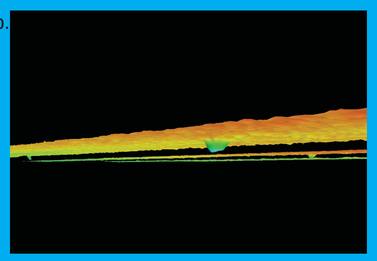
New Findings

Pock Marks were discovered in Missisquoi Bay (Figures 7a, 7b, 7c). The pock marks found typically indicate the presence of a ground water seepage from deeper regions below the sediment. A shoal was also discovered in Venisse Bay (Figure 8).



7a

7b.



7c.

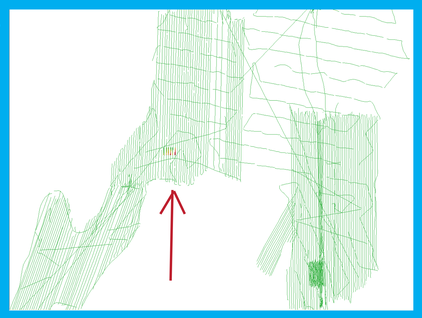


Figure 7. (a) 3D image of the pock marks using a 10x vertical exaggeration. The diameter of the center pock marks is 2.7m and 0.2m deep. (b) 3D image of the center pock mark from below (also 10x exaggeration). (c) Shiptracks of multibeam data collected in Missisquoi Bay. The red arrow indicates the area (in red) in which the above mentioned pockmarks were found.

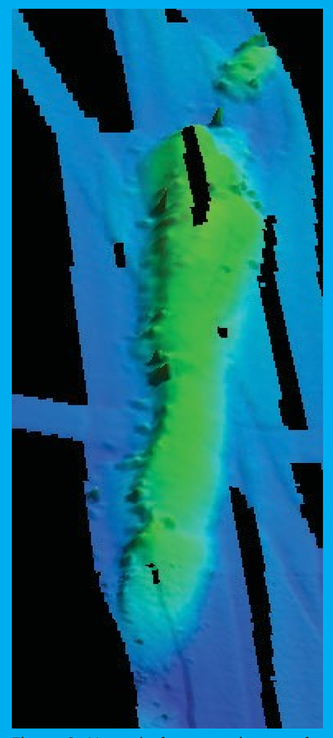


Figure 8. Never before seen image of a shoal found in Venice Bay (20x exaggeration). The red arrow in Figure 4 points to venice Bay.

Final Product

The 2nd generation bathymetric map of Missisquoi Bay is shown in Figure 9. This map incorporates 457 GB of multibeam data and only one-third of the initially planned ship tracks were obtained. There is a lack of data collected in the northeastern corner of Missisquoi Bay (seen in Figure 4) will be acquired during 2015 field season.

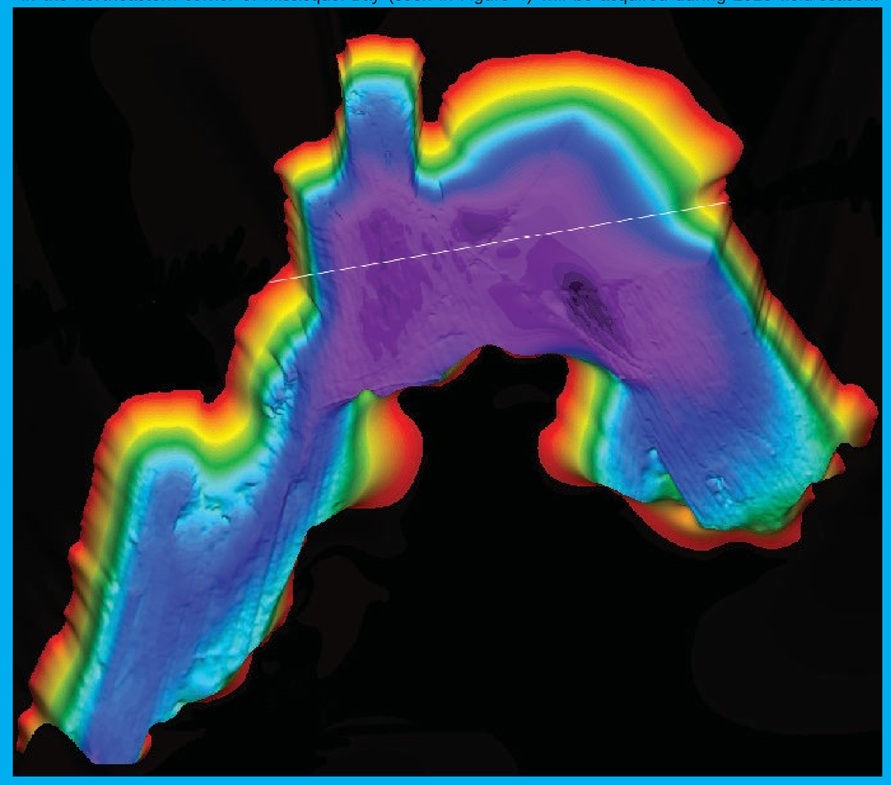


Figure 9. The 2nd generation, high-resolution bathymetric map of Missisquoi Bay.