Ground Filtering and 3D Visualization Method for Underwater Objects

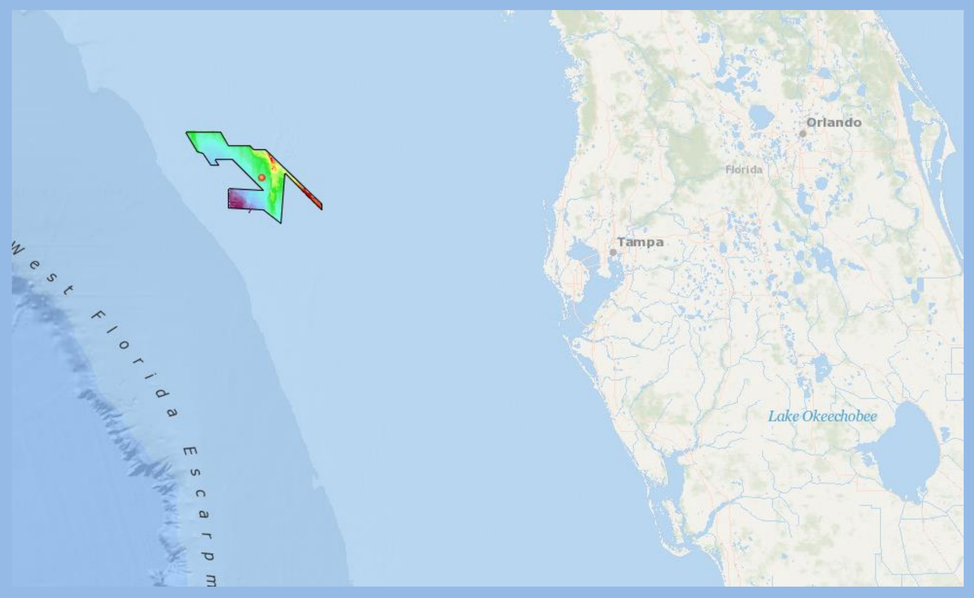
Sean Munson and Jennifer Kist

Department of Geology and Environmental Geosciences, College of Charleston

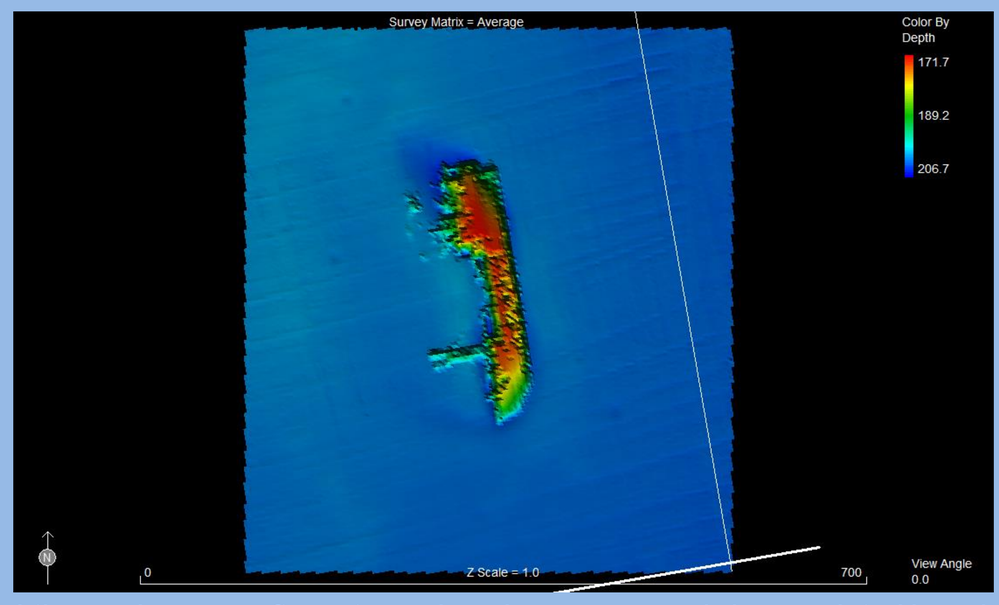
COLLEGE of CHARLESTON
DEPARTMENT OF GEOLOGY AND ENVIRONMENTAL GEOSCIENCES
BEAMS

munsonsr@g.cofc.edu

Bathymetric sonar surveys are an excellent tool for locating underwater objects whether they pose a danger to ship navigation, are part of ongoing construction, or for periodic inspection. While bathymetric data processing suites offer 3D visualization options, the size of data which includes the seafloor is large and may include a substantial amount of data that is not useful to a specific application of sonar survey. Additionally, more accessible visualization options may be desired separate from the confines of the proprietary software. A method is presented here for ground filtering of foreign objects using an open-source Cloth Simulation Filter and a 3D visualization method that is easily accessible on a variety of platforms.

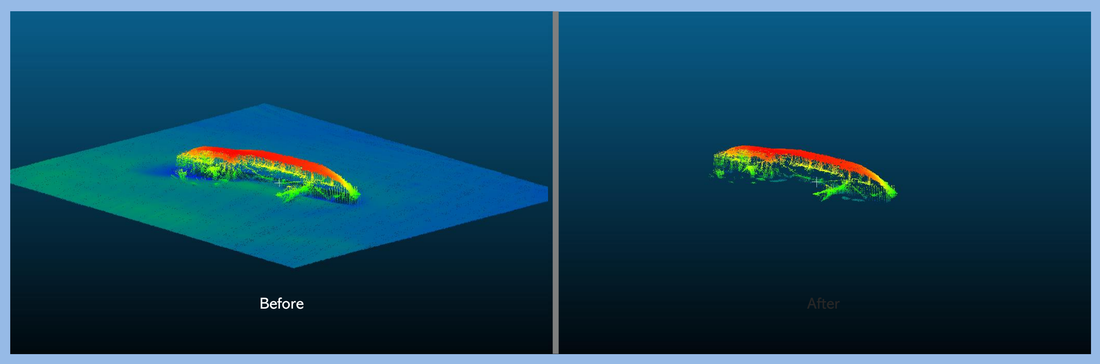


The M/V *Holstein* sank in a storm off the Florida Gulf Coast in October 1992. It was mapped by the University of Southern Florida Continental Shelf Characterization, Assessment, and Mapping Project in July 2016 during a survey of the Southwest Florida Middle Grounds. Multibeam sonar data was collected with a SeaBat 7125 at 400 kHz, frequency modulated.[1]



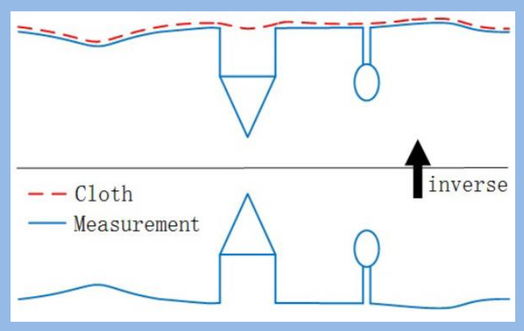
Multibeam data were first trimmed to the area around the wreck in Hypack to expedite processing time for ground filtering.

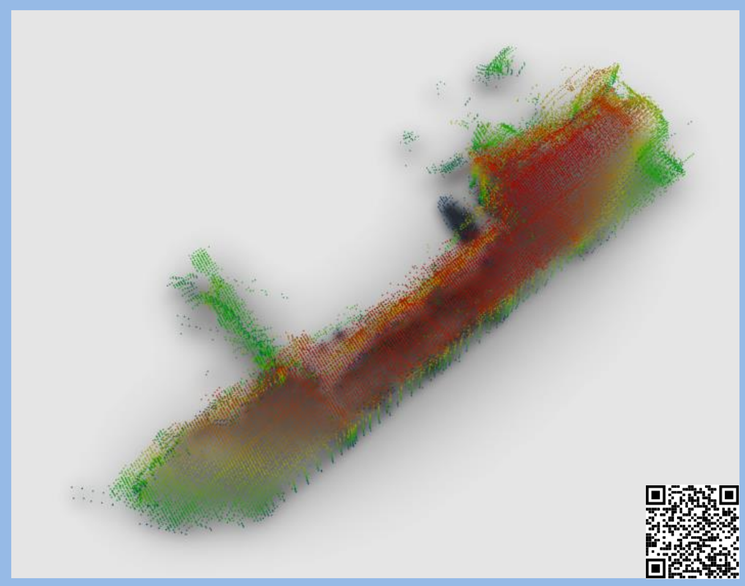
The edited Hypack data files were re-processed in "elevation mode" to invert the data. This step was necessary prior to importing the point cloud into CloudCompare for ground filtering.



In CloudCompare, a Cloth Simulation Filter (CSF) was used to filter the shipwreck and the ground. Originally, the CSF was developed for LiDAR data as a method of generating a digital terrain model.[2]

The CSF inverts the data point cloud and lays a simulated cloth along the underside of the data, then identifies nodes in the simulated cloth that interact with the point cloud and nodes that do not, identifying them respectively as "ground" and "non-ground" points.





The resulting point cloud was exported to SketchFab as an example of an easily accessible visualization tool. No 3D mesh has been applied, but the point cloud provides a simple visualization of the remains of the M/V Holstein.

Scan the QR code to try the 3D visualization on your own device.

REFERENCES

1. Murawski, S., Lembke C., Gray, J, Brizzolara, J., and Hommeyer, M. The Southwest Florida Middle Grounds. Data collected 2016-2018. 4×4-m grid. "Southwest and West Florida Middle Grounds Data Products." Last updated June 2018. Retrieved from: http://www.marine.usf.edu/scamp/data-products/swfmg. Funding provided by the National Fish and Wildlife Foundation (NFWF): GEBF Grant #45892.

2. Zhang, Wuming & Qi, Jianbo & Peng, Wan & Wang, Hongtao & Xie, Donghui & Wang, Xiaoyan & Yan, Guangjian. (2016). An Easy-to-Use Airborne LiDAR Data Filtering Method Based on Cloth Simulation. Remote Sensing. 8. 501. 10.3390/rs8060501.

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