IDENTIFYING PORITES FROM BATHYMETRIC LIDAR POINT CLOUD AND AERIAL IMAGE

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KEY WORDS: Green Lidar, Seafloor Substrate, Atoll

Abstract: Coral reef presents quite unique geomorphologic characteristics. The change of terrain is very drastic, which frequently generates navigation threats. With airborne bathymetric Lidar, area with coral reef systems could be surveyed for the seafloor topography. In 2010, a mission was carried out to map Dongsha atoll with an AHAB Hawkeye II system. Besides the laser waveforms, RGB images are also collected with a digital camera operated together with the lidar. These images provide useful information for data editing. During the editing process, those points identified as not on the seafloor are tagged as non-floor and not included in the interpolation process. After reviewing the final edited dataset, it is found that some sounding points identified as non-floor were the top of Porites, one type of coral. This study reports the finding of Porites from the soundings and the aerial image. Both the geomorphological and image characteristics of Porties are investigated.

INTRODUCTION

Airborne Bathymetric Lidar (ABL) utilizes laser beams in the green channel for scanning the surface beneath water. This technology provides a useful means for surveying the area characterized with high navigation risk, such as shallow water area, and places full of shoals. Coral reef is a typical type terrain of this kind. In 2010, a survey of Dongsha Atoll was conducted with an ABL system, AHAB Hawkeye II (Shih, et al., 2011).

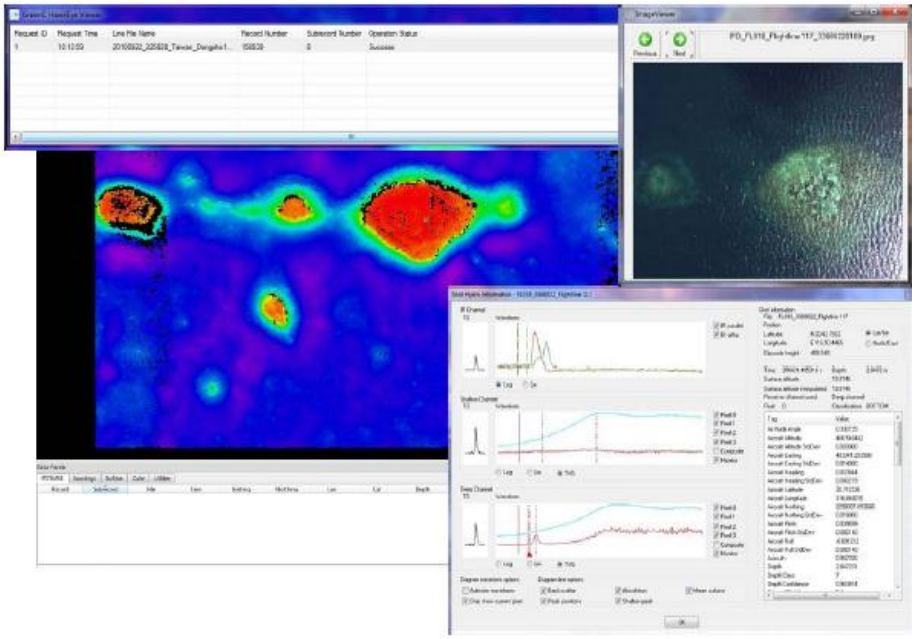

Figure 1: The editing environment

With AHAB Hawkeye II system, full waveforms are recorded. After the data processing with AHAB CSS software, each waveform is geo-referenced and point clouds are generated. Then the manual editing process is required for cleaning up the noises and non-bathymetric points. In the 2010 mission, GreenC (GDS, 2010)

together with Fledermaus (IVS, 2010) provided the environment for editing. As shown in Figure 1, the waveforms from IR, Raman, Shallow Green, and Deep Green, channels, together with the bathymetric view and the digital image acquired with a mid-format camera accompanied Hawkeye II, are linked and displayed for the operator. The other option is displaying the points in a three dimensional view interactively, as shown in Figure 2.

SAMPLES OBSERVED

During the editing, for those scattered points which is significantly higher than the surrounding floor points. Would be identified as noise and removed. Therefore, the points shown in red, which is about 1.8 m higher than the surrounding, would be identified as noise and flagged as non-bathymetric points.

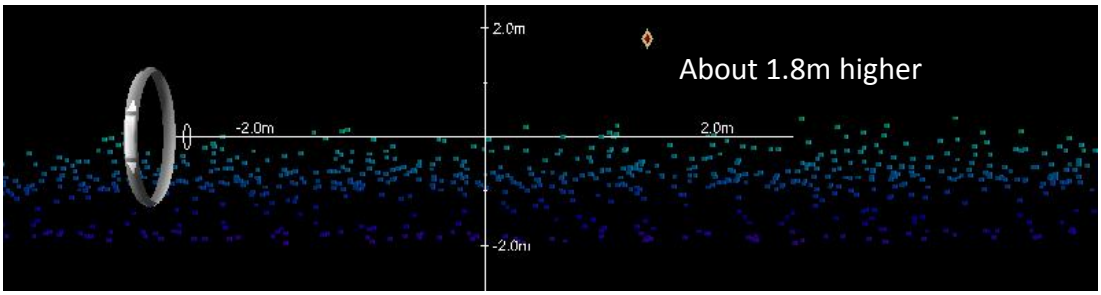

Figure 2: Vertical profile

Figure 3: Image showing Porties

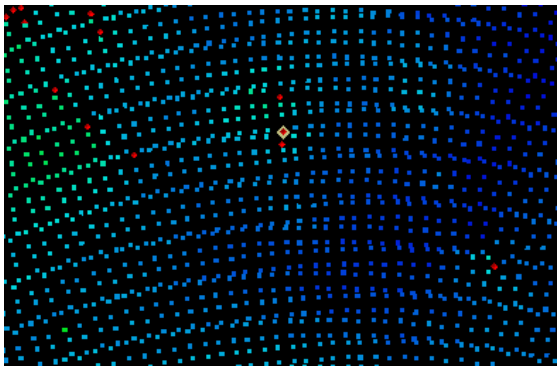

Figure 4: The horizontal view of the points

Unfortunately, this particular point is located on a Porites, a type of coral which could grow into column shape. This is supported from evidence in the image, and also confirmed with divers who are familiar with the area. After finding a sample, larger area of the measured bathymetric lidar points are searched in the Fledermaus/GreenC environment. A number of possible Porites lidar points are identified.

SCHEME PROPOSED

For the bathymetric mapping of coral reef area, the disturbance from drastic floor feature, such as Porites, to the data editing is observed and confirmed in the Dongsha Atoll 2010 mission. Because the Porites does present potential navigation hazard, it should be better to be identified and mapped. In the current working environment, one has to identify all Porites manually. The procedure is to check the points which were removed in the previous editing process, and select the points which close to the water surface and above the surrounding. Then, one has to check the geo-referenced images from the accompanying camera for the features which could identify Porites. On the selection based on the point location and its surrounding, automated procedure could be developed. On the image analysis side, a suitable image enhancement scheme, even feature extraction scheme could be developed. But, further research and experiments are required.

ACKNOWLEGEMENT

The authors wish to thank Mr. Dushan Arumugam from Geomatics Data Solutions for his generous help. The financial support from National Science Council, Taiwan, under the grant number NSC 101-2625-M-009 -011 is gratefully acknowledged.

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