generation of 3D model on the coast of Samejima,the sea of Enshu and detection of coastline by drones

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1. Background・Purpose

It is clear from the past study of Iwata Minami High School area department that the coastal erosion on the coast of Samejima, the sea of Enshu(fig.1) is in progress. In order to study the coastal erosion, we perform leveling with auto level and hand level. However, leveling by human work requires much time and effort. So we focused on the drone we had on the headquarters club(fig.2). We thought, "Can we do surveying efficiently by using this drone", we decided to work on research activities with the goal of increasing the efficiency of surveying with drone.

2. 3-D point clouds

Last year ago, we conducted a 3-D reconstruction method using drone.

First, I captured videos of the coast of Samejima with a drone. After that, the image is extracted from the captured videos. 3-D point sets are generated from an image acquired using 3-D point set reconstruction processing software(fig.3). This makes it possible to create a reconstruction point group of the coast. However, the scale of the reconstruction point cloud is different from the actual coast. Therefore, based on the size of the actual blue sheet used for shooting, the blue sheet in the point cloud is subjected to enlargement and contraction processing. This allows the entire point cloud to be scaled to the actual scale.

We also performed leveling with auto level and hand level to check how accurate the acquired data are.

3. Detecting the coastline

This year, we detected coastlines from 3D point clouds(fig.5). First, the point cloud on the coast is divided into strips elongated in the y direction. Subsequently, each strip is divided in the z direction at regular intervals by processing by the program. Furthermore, for the cut ones, the variance is calculated in each range.

Finally, determine the threshold and record where the variance value exceeds the threshold. Then draw. As a result, the shoreline was successfully detected, and it was possible to identify the coast and the sea.

4. Discussions

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This time, we succeeded in 3-D reconstruction of Samejima coast and detection of the coastline. First, comparisons were made using data of elevations measured using a surveying instrument and data of point clouds at the same points surveyed(fig.4). In addition, when performing comparison, it was based on the data acquired using a surveying instrument. When the two data were put together on the graph, it was possible to confirm the part where they coincide and the part where a large error occurred.

These errors were larger at the measurement start point and at the part near the shoreline.

Then, the coastline was also detected using the acquired 3-D point clouds. Since the threshold was artificially determined, it was possible to detect the coastline closer to the actual coast by freely changing the threshold. However, in the method performed this time, human work was very much.

Therefore, it is not completely applied to "to conduct surveying efficiently" which is the main purpose of this study.

5. Conclusion・Future outlook

In this study, we captured videos of a beach using a drone and succeeded in 3-D reconstruction on the coast of Samejima, the sea of Enshu. However, when comparing the data obtained from leveling and point cloud, a part where a large error occurs in the elevation was confirmed. Improvement is expected by improving the accuracy of reconstruction using a laser scanner. The operation of a drone equipped with a laser scanner also requires safety considerations.

We also succeeded in detecting the coastline from the acquired 3-D point clouds. As a result, it was possible to identify the beach and the sea. However, the method of coastline detection conducted this time has many artificial parts. Therefore, it is necessary to repeat the discovery of improvement points, the proposal of new methods, and the execution for the purpose of study “efficiency of surveying”.

Keywords: drone, the coast of Samejima, 3-D point clouds

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図1　鮫島海岸の位置

図2　撮影に用いたドローン
（DJI　PHANTOM3 STANDARD）

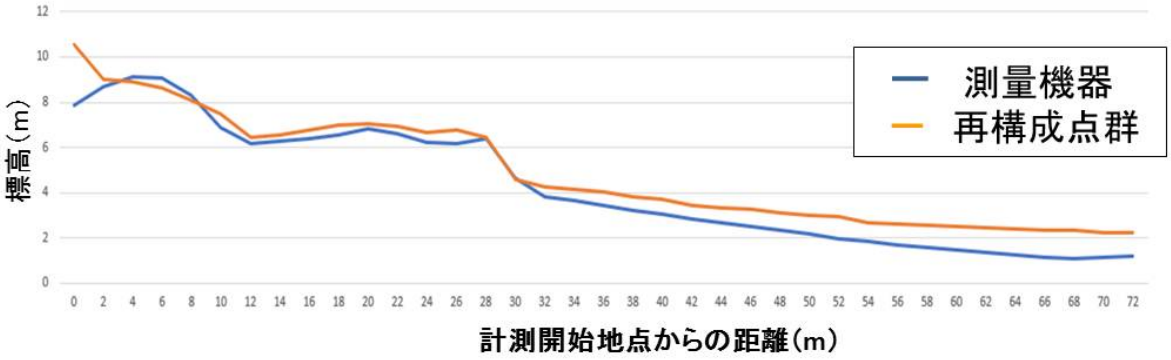

図4　測量結果の比較

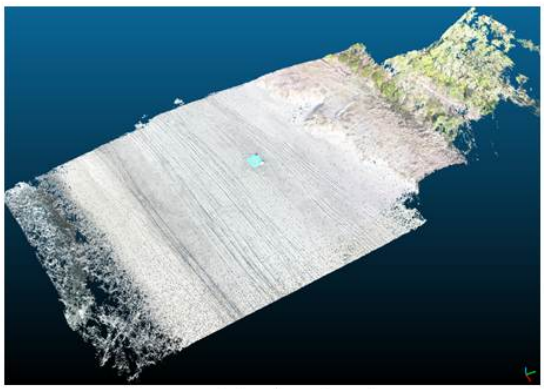

図3　鮫島海岸の
三次元点群画像

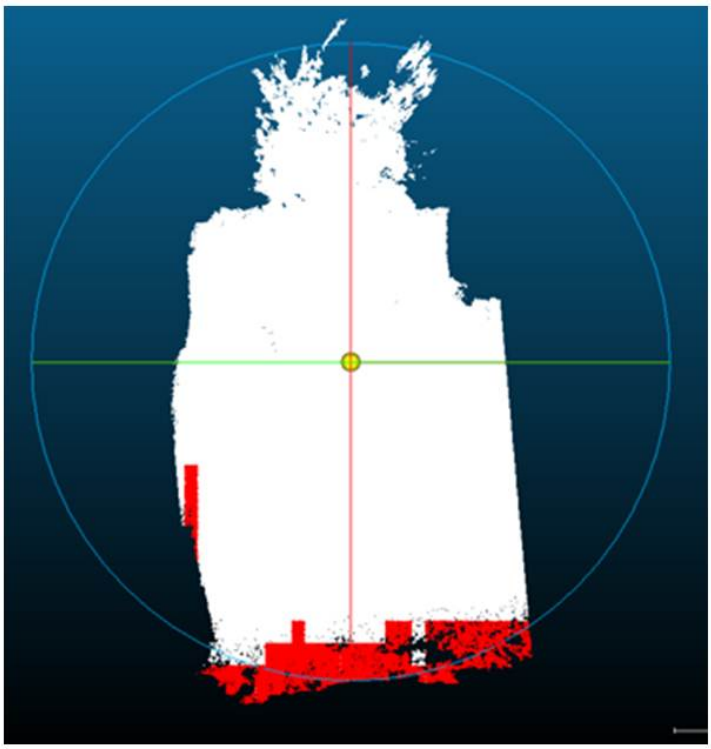

図5　海岸線が検出された海岸
海（赤色）　　陸（白色）

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