Application for Water Environmental Engineering with UAV

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1. Introduction

UAV is applied for various fields including measurement recently. In this study, the authors studied application for water environmental engineering with UAV: water quality estimate in the Isahaya bay and water depth estimate in the Kohnoura river in Nagasaki prefecture. Moreover, application for further water environmental engineering was the purpose in this study.

2. Methods

Softwares used were Phantom4 (UAV), ArcGIS (Esri Japan), PhotoScan (Agisoft), and PhotoShop (CS6). 3D models was made of photos with Geo Tag (GPS) by UAV. Geo Tag is coordinates: longitudes, latitudes, and heights. All photo format was JPEG. Next, photo synthesis could be completed by PhotoScan. With synthesized photos, DEM (Digital Elevation Model) and orthogonal photos were constructed. For water quality estimate, both DEM and DSM (by Ministry of Land, Infrastructure and Transport) were the main data of this study. Fig. 1 shows the method for water quality estimate, while Fig. 2 shows the method for water depth estimate.

3. Results

Fig. 3 shows the result of correlation analysis for water quality and RGB digital values each pixel in photos in the Isahaya Bay. From multivariable analysis, both chlorophyll-a and turbidity estimates indicated so high correlation with RGB values. Next, Fig. 4 shows the distribution of chlorophyll-a estimate in the Isahaya Bay. The amount of chlorophyll-a became higher depending on the distance from the sea. Fig. 5 shows relationship between water depth estimate and distance from the sea in the Kohnoura river. The farther from the sea, the shallower the water depth is in the Kohnoura river.

4. Discussion

4.1 3D analysis

For water environmental measurement, the authors performed 3D analysis with photo synthesis by UAV. With PhotoScan, the 3D model was completed in short time. Moreover, DSM and orthogonal photos were made by UAV easily with high resolution.

4.2 Expectation on water environmental engineering

The authors certificated that many fields of water environmental measurements would be improved in the future. Low-cost and quick solution can be realized by UAV.

Reference

1) Hirohumi Chikatsu, Akihiko Kodaka, Shuji Yanagi, Masaru Yokoyama: Performance assessment of 3D modeling software in UAV photogrammetry measurement, Journal of the Japan Society of Photogrammetry and Remote Sensing, pp117-127, 2016.

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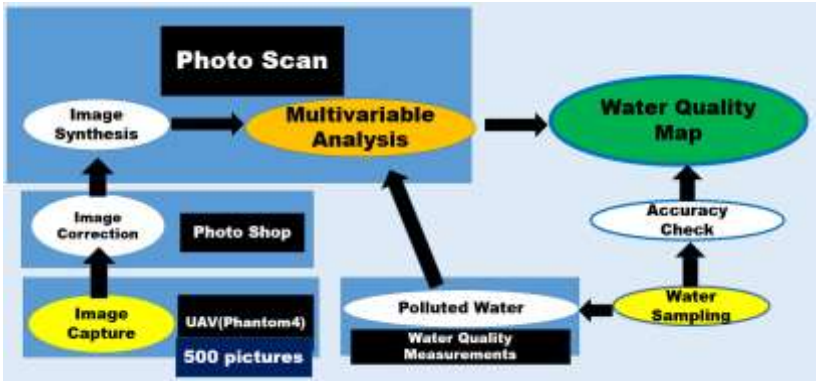

Fig. 1 Method of water quality Estimate in the Isahaya Bay

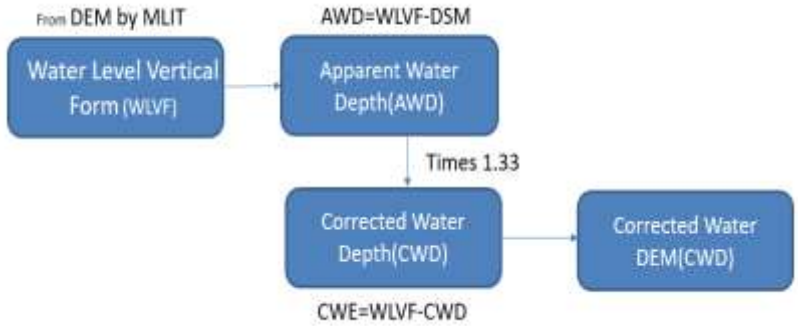

Fig. 2 Method of water depth estimate in the Kohnoura River

Water Quality Indices	Deterministic Coefficient	Evaluation
Chlorophyll-a	R^2 =0.974	Very good
Conductivity	R^2 =0.736	Good
Turbidity	R^2 =0.997	Very Good
pH	R^2 =0.809	Good
Salt Content	R^2 =0.863	Good

Fig. 3 Correlation of water quality in the Isahaya Bay

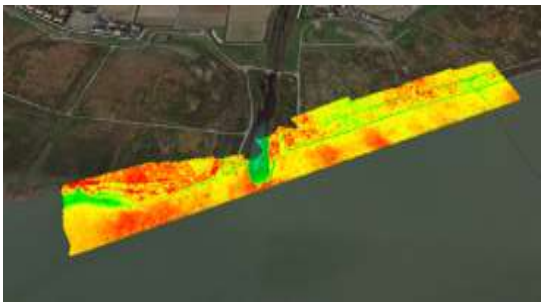

Fig. 4 Chlorophyll-a distribution in the Isahaya Bay

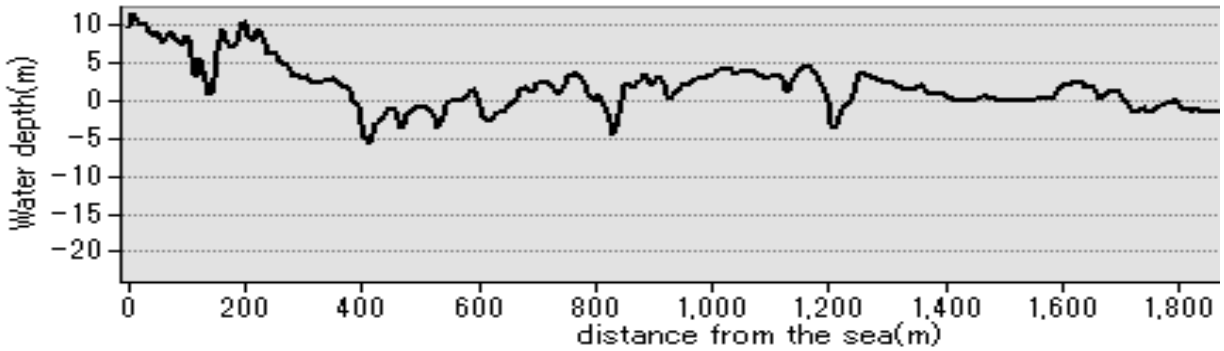

Fig. 5 Profile of water depths from the sea in the Kohnoura River