APPLICATION OF THREE-DIMENSIONAL POINT CLOUDS TO RIVER MANAGEMANT USING DRONE SURVEYING

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In recent years, due to the effects of global warming, record-breaking rainfall has been increasing causing extensive damage in many parts of Japan. However, in the current river management system, this is only determined by the results of visual inspections on foot or periodic longitudinal and cross-sectional surveys every 200 m. Therefore, measurement methods that can acquire data efficiently and quantitatively are required. Thus, we consider the use of three-dimensional (3D) laser point clouds acquired using information and communication technology devices in river management recently. The 3D data obtained using laser point clouds can visualize the topography as a continuous “surface”, thus improving the efficiency and sophistication of river management. Measurement methods that can acquire data efficiently and quantitatively are required. Including this advantage, the use of 3D point cloud data with ICT equipment leads to more efficient and advanced river management.

Therefore, the purpose of this study was to investigate the application of 3D laser point clouds to river management using a drone survey equipped with a green laser scanner that can penetrate water. In this research, we equipped a UAV with a real-time kinematic Global Navigation Satellite System (GNSS) to perform the survey without adjustment points. RTK-GNSS is a self-positioning system that combines the GSI’s (Geospatial Information Authority of Japan) nationwide electronic reference points and satellites.

As a result, we observed that the surveying with an accuracy of 5 cm could be performed not using the adjustment points for measuring the height of river levees to identify overtopping hazard areas, which requires an accuracy of about 50 mm. Therefore, it has been demonstrated that RTK-GNSS can provide the desired accuracy even in times of disaster or at locations where it is not possible to set up a coordination point. In addition, we quantified transparency in terms of turbidity and examined the measured depths. It can be applied to topographic surveying of shallow rivers with a depth of 2.0 m or less when the FTU (Formazin Turbidity Unit) turbidity is 1.0 or less. Moreover, we verified the extraction of the variants of the two-period data. ICP is a technique for matching the first period point cloud to the second period point cloud by repeatedly rotating and translating the second period point cloud. We were able to quantitatively represent the location of the occurrence of the variants through the application of the ICP technique. Therefore, it is possible to identify localized deformation locations in a river in real time, which is expected to improve efficiency.

In the future, we need to verify the accuracy in water areas. In addition, we need to investigate a new 3D point cloud measurement method that can measure from the ground surface.

Keywords: Three-dimensional Point Clouds, River management, Drone, Green Laser, ICP