

# A study on the Development of Flow Measurement Method using Drones

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This study aimed to develop flow measurement method using drone in flood season. Measuring flow in all branches is difficult to conduct annually due to budget and labor shortage, safety and river works. Especially when heavy rain like storm comes, changes in stage-discharge relationship should be reviewed; however, it is usually impeded by the aforementioned issues. To solve the problem, it developed a simple measuring method with a minimum of labor and time. A numeric map and numeric orthophoto coordinate of South Korea are mostly based on Transversal Mercator Projection (TM) in accordance with rectangular coordinate system and use World Geodetic Reference System 1980 (GRS80) oval figure for conversion. Applying a concept of aerial photogrammetry, it located four visible Ground Control Points (GCP) near the river and measured the coordinates using RTX-VRS. Hovering at a same level, drones took orthodiagraphic pictures of water surface at an interval of 3 seconds. It defined the pictures with GRS80 TM coordinate system, a rectangular coordinate system and then conducted an orthometric correction using GCP coordinates. According to X and Y coordinate analysis, it estimated the distance between the floating positions at 3 seconds-intervals and calculated the flow through discharge area according to the flow path. The experiment target were Uijeongbu-si(Singok Bridge) located in upstream of Jungrang River and Yeongdong-gun(Youngdong 2nd Bridge) located in upstream of Yeongdong River. As a result of comparing the calculated flow rate and stage-discharge relationship curve at each point, errors of about 1.58% and 4.64% occurred. This study attested applicability of the flow measurement method using drone in real river by applying the rectangular coordinate system based on the concept of aerial photogrammetry. While measurements in nighttime, windy weather and rain can be limited due to drone's mechanical limitations, further technological development of drone can enhance the measurement.

**Keywords** : Drone, Flow Measurement, Aerial Photogrammetry, Ground Control Point, Rectangular Coordinate System, TM Coordinate System