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Accuracy of the river discharge measurement

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Discharge values recorded for water conservancy and hydrological analysis is a very important work. Flood control projects, watershed remediation and river environmental planning projects quite need the discharge measurement data. In Taiwan, we have 129 rivers, in accordance with the watershed situation, economic development and other factors, divided into 24 major rivers, 29 minor rivers and 79 ordinary rivers. If each river needs to measure and record these discharge values, it will be enormous work. In addition, the characteristics of Taiwan's rivers contain steep slope, flow rapidly and sediment concentration higher, so it really encounters some difficulties in high flow measurement. When the flood hazards come, to seek a solution for reducing the time, manpower and material resources in river discharge measurement is very important.
In this study, the river discharge measurement accuracy is used to determine the tolerance percentage to reduce the number of vertical velocity measurements, thereby reducing the time, manpower and material resources in the river discharge measurement. The velocity data sources used in this study form Yang (1998). Yang (1998) used the Fiber-optic Laser Doppler Velocimetery (FLDV) to obtain different velocity data under different experimental conditions. In this study, we use these data to calculate the mean velocity of each vertical line by three different velocity profile formula (that is, the law of the wall, Chiu's theory, Hu's theory), and then multiplied by each sub-area to obtain the discharge measurement values and compared with the true values (obtained by the direct integration mode) to obtain the accuracy of discharge.
The research results show that the discharge measurement values obtained by Chiu's theory are closer to the true value, while the maximum error is the law of the wall. The main reason is that the law of the wall can't describe the maximum velocity occurred in underwater. In addition, the results also show that the cross-section is divided more sub-sections, discharge values closer to the true values, however, the cost and time will spend higher. Thus, for a variety of discharge measurement conditions, we need to consider the accuracy of the measurement that can accept, and thus to determine the method of discharge measurement (i.e. the number of sub-sectional). The results of this study will be used to determine the number of the vertical velocity in flow discharge measurement.

Keywords: Accuracy, discharge, Chiu's theory, velocity profile.