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The Comparison of Wading Measurement Discharge between ADC and FP111 in Shallow Flow

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During the low water period, the water depth of streams in Taiwan is very shallow and the velocity is too slow; the discharge in the streams is relatively small. At this time, larger velocity measurement equipments such as Price Type AA cannot be completely submerged in water so that they are unable to be applied to measure the velocity. Discharge measurements using conventional methods, including Price Type AA suspended in the water from bridge, are therefore unusable. The discharge records during the low water period can provide required information for monitoring ecological reference flow and various related applications of water intake engineering design. Therefore, it is necessary to choose an appropriate equipment to measure the discharge in shallow water flow in order to continuously carry out the monitoring and recording the discharge. This study is conducted in Linbian river basin, selecting Laiyi Bridge in Linbian Township Pingtung County as the gauging station. The research uses Acoustic Digital Current Meter (ADC) and Digital water velocity meter (FP111 Global Flow Probe) to measure the discharge of river during the low water period in order to explore the applicability and deviation of the two equipments which have different features and measurement principles.

There are 11 discharges conducted in this study. The method of calculating the discharge is to get the sum of the measured discharge of sub-section in each measurement. Furthermore, based on velocity-area principle in Mean-Section Method, the total discharge can be estimated from the velocity data obtained by using velocity equipment. The result of the study indicates that both equipments can be applied to measure the discharge on the condition that the measurement probe should be completely submerged in water. However, ADC is more applicable than FP111 to measure discharge in shallow water flow because the precision of ADC is 7.96% higher than that of FP111. Also, through the independent sample T-test in statistical analysis, the result of difference of means test analysis shows that there is no significant difference in the measured data using the two different equipments. Due to its higher precision, ADC is relatively capable to obtain the flow velocity in small flow. When the velocity is very small (i.e. flow velocity is 0.01 m/s), ADC is still able to measure the velocity, but its price is relatively more expensive. If the precision of measured data is taken into account, it is recommended to use ADC to measure the discharge. If the expensive equipment is unattainable because of funding issue, FP111 can be used to conduct the measurement in order to obtain the required flow field of the study area.

Keywords: Acoustic Digital Current Meter; Measurement Discharge; Mean-Section Method; Shallow Flow.