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Experimental measurements of sediment incipient velocity by using B-scan ultrasound imaging device in the water channel

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Abstract: Sediment incipient velocity (SIV) is an important parameter for the rule of sediment movement and fluvial processes in the river sediment engineering. The field measurement of the SIV during the process of sediment incipient motion near the riverbed is a difficult problem. For this problem, this paper puts forward a novel method of measuring SIV by using B-scan ultrasound imaging device and current meter in the water channel of river model experiment. In this method, we use a B-scan ultrasound imaging device to get the ultrasonic images of moving particles and riverbed under the water, and use a current meter to obtain the flow velocities of observed points near the bed at the same time. By statistical analysis of the images, relationships between the imaging spot number/area of particles and the water flow velocity are obtained, which have shown the whole process of sediment incipient motion clearly. Results show there are some suddenly changed positions in these relationships. These suddenly changed positions correspond to the states of incipient motion, which can be used to analyse and measure the SIV. After kinds of model experiments, the measured SIV is within an acceptable range and can be verified by the change of riverbed boundary lines. This method is very suitable for river model experiments, especially for water channel test under muddy water or sediment-laden flow. This paper provides a new approach to the research and analysis of sediment movement with the advantages of direct observation and real-time research.

Key words: Incipient motion; river model experiment; sediment incipient velocity; ultrasound imaging measurement; water channel

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