Sediment transport measurements with a multi-component ultrasonic profiler

S. Fischer[1] and M. Burckbuchler[2]

Measuring velocity profiles in turbulent flows has always been of great theoretical and practical interest. It allows the statistical characterisation of turbulence and better understanding of processes such as sediment motion, closely related to the flow turbulence. A full agreement on how turbulent flows are affected by presence of particles is yet to be reached. An example is the modification of the well-known law of the wall, which has been the subject of analysis by several authors[1]. Over the past two decades, the development of increasingly sophisticated measuring systems has enabled flow parameters to be obtained from acoustic technology. For example ADCPs (Acoustic Doppler Current Profilers) or UVPs (Ultrasonic Velocity Profilers) are based on multiple diverging monostatic configuration. These profilers are capable of reasonable to high temporal and spatial resolutions and have been increasingly used in the fields of research and environmental engineering. Yet, none of these devices allow to resolve sufficiently fine flow scales, preventing a proper characterization of turbulence statistics and turbulent processes. To overcome these limitations, ADVPs (Acoustic Doppler Velocity Profilers) were developed[2] to provide quasi-instantaneous co-located two- (2C) to three- (3C) component velocity profiles along the transmitter beam axis, using a multi-bistatic configuration. These devices were shown to resolve up to the Taylor microscale.

In 2019, Ubertone developed a commercial version of the ADVP, the UB-Lab 2C, as part of the ANR ASTRID project MESURE (Métrologie mES hydroacoUstiques opéRationnElles).

In the present paper, datasets of time-resolved two-component velocity profile measurements under different flow conditions will be presented.

This paper will remind the already shown capabilities of this measurement technique ADVP, such as its good performance for sediment flux profiling. And we will present new results and new potential and developments around these instruments, such as a commercial 3C-ADVP deployed for oceanographic studies[3] with extended acquisition frequency over long periods.

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[1] UBERTONE, 8a rue principale, Schiltigheim, France.

[2] UBERTONE, 8a rue principale, Schiltigheim, France.

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