Determination Of The Turbulence Scale Using Particle Image Velocimetry

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Abstract:

The study of the turbulence-sediment interaction shows the importance of turbulence scales in sediment transport. These spatial and temporal scales, strongly affect the sediment particle displacement. They are also important in numerical modelling as well as in the calibration of the limit of the measurement instrumentation.

Experimentally, turbulence length scales are determined using a two-point velocity measurement. Different methods could be used for this purpose, however, a good spatial resolution of the measurements could be achieve only by the visualization techniques. In order to find the evolution of turbulence scales in the complex condition such as accelerated *flow,* we used the Particle Image Velocimetry (PIV) technique.

A permanent free surface water flow was established in a rectangular canal with 12 m length, 0.5 m width and 0.6 m depth .Grid-generated turbulence was produce by using a biplane square-mesh, grid fixed at 3.70 m of canal entrance. By passing over a large two-dimensional dune, flow was accelerated and decelerated respectively. The instantaneous velocity field at downstream of the grid was measured by a complete set of LaVision PIV instruments.

Our results show:

*The efficiency of PIV technique to determine the velocity field (Figure 1);

*The efficiency of PIV technique to determine turbulence length scale at low velocity conditions; and

*The high evolutions of the turbulence length scale in accelerated and decelerated flow (Figure 2).

The velocity profiles in accelerated (and decelerated) flow change are related to a plain bed which may be a result of the evolution of turbulence scale in accelerated flow.

Therefore, this evolution should be considered in accelerated flow.