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Turbulent structures in smooth and rough open channel flows

VESSELINA ROUSSINOVA, Research Associate, Department of Civil and Environmental Engineering, University of Windsor, RAM BALACHANDAR, Professor, Faculty of Engineering, University of Windsor — Turbulent flow in open channels is unique because it is bounded by the free surface and the flow is entirely dominated by the bed turbulence. Both experiments and simulations agree that the large-scale near-wall structures interact with the free surface without significant reduction of their strength. Still the link between bed and free-surface turbulence is not well understood and it is of a particular importance for the processes occurring at the surface in shallow geophysical flows. In this paper, high resolution particle image velocimetry (PIV) measurements in an open channel flow are presented. Velocity measurements were obtained in the streamwise - wall normal (x-y) plane and streamwise-spanwise (x-z) plane. Streamwise-spanwise (x-z) planes were acquired at various vertical locations. The focus of this study is to investigate the streamwise oriented vortices along the flow depth as documented through the analysis of swirling strength, conditional averaging and vortex statistics. Turbulence measurements in rough open channel flow are also presented and compared with those on the smooth wall.

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