Interactions between turbulence and mobile-bed in shear-driven flows

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Abstract

During this presentation, I will present experimental results of intense sediment transport obtained in a free-surface uniform flow using an acoustic device (ACVP) to measure co-located velocity and concentration over a vertical profile (z). I will particularly deal with the interactions between the turbulent boundary layer and the sediment bed. Two main insights are highlighted. First, it is shown that the strong bed-level dynamic observed in the experiment results in an increased co-variance rate between wall-normal (w) and streamwise (u) velocity fluctuations in the near-bed region. This feature is interpreted as an additional shear-stress mechanism induced by the coupling between the large-scale coherent structures and the bed-dynamic. Second, the statistical analysis of the turbulent velocity fluctuations shows that the increased Turbulent Kinetic Energy observed in the suspension region present a lower correlation rate which can be explained by the increased contribution of interactions (i.e. u'w'>0, corresponding to quadrants I and III in the u'w' plane). This feature might explain the low value of the von Karman and Schmidt number observed in the sediment transport literature since a few decades.