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The effect of bed roughness on the free surface of an open channel flow and implications for remotely monitoring river discharge ERIKA JOHNSON, EDWIN COWEN, Cornell University — The effect of increased bed roughness on the free surface turbulence signature of an open channel flow is investigated with the goal of incorporating the findings into a methodology to remotely monitor volumetric flow rates. Half of a wide (B=2 m) open channel bed is covered with a 3 cm thick layer of loose gravel (D_{50} =0.6 cm). Surface PIV (particle image velocimetry) experiments are conducted for a range of flow depths (B/H=10-30) and Reynolds numbers (Re_H =10,000-60,000). It is well established that bed roughness in wall-bounded flows enhances the vertical velocity fluctuations (e.g. Krogstad et al. 1992). When the vertical velocity fluctuations approach the free surface they are redistributed (e.g. Cowen et al. 1995) to the surface parallel component directions. It is anticipated and confirmed that the interaction of these two phenomena result in enhanced turbulence at the free surface. The effect of the rough bed on the integral length scales and the second order velocity structure functions calculated at the free surface are investigated. These findings have important implications for developing new technologies in stream gaging.

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