



Turbulent Flows over a train of gentle Hills: An extended Experimental Investigation

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Gentle topographic variations can lead to profound influence on the climate near the ground surface, and thereby on exchange rates of momentum and scalar transfer between the biosphere and the atmosphere. This recognition is now motivating fundamental understanding of how a wavy surface impacts the flow dynamics near the ground for high bulk Reynolds numbers (Re_h). Using detailed flume experiments conducted for high Re_h and moderate roughness Reynolds number (Re_k) on a train of gentle hills, we demonstrated that classical analytical theories developed for isolated hills can be extended to a train of hills, at least for the longitudinal velocity component, if the back ground velocity is appropriately defined. We also showed that these theories can reproduce the essential 2-D structure of the Reynolds stresses, but dramatically fail to reproduce the mean vertical velocity distribution within the inner layer. The reasons for this failure is discussed.