



Testing of criterion for local turbulent support of grains in sheet flow layer

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In steady uniform turbulent sheet flow, bed load grains are transported through a layer adjacent to the eroded mobile bed. The grains are non-uniformly distributed throughout the transport layer with the local concentration being zero at the top of the layer and tending to the bed concentration at the bottom of the layer. Interparticle collision is the dominating support mechanism for the conveyed sediment grains, particularly in the lower part of the layer where the local concentration is high. A certain threshold value of the ratio of the grain settling velocity and the local fluid shear velocity, v_t/u_*^f , is often used as a criterion for turbulent support for individual grains in flow. Different flow conditions at different heights within the transport layer lead to different local values of the fluid shear velocity (and perhaps also of the grain settling velocity) and give rise to a question whether or not the turbulent suspension of the grains is effective locally in the layer (particularly in its upper part).

We use our experimental results obtained for sheet flows carrying lightweight model sediments (various fractions) in a laboratory tilting flume to analyze distributions of the criterion velocity ratio across a transport layer for different flow conditions given by a broad range of values of the bed Shields parameter. In order to identify local values of u_*^f within the transport layer, experimental information is combined with results of modelling of granular stresses using principles of kinetic theory of granular flow and/or principles of dense granular flow rheology.