Geophysical Research Abstracts
Vol. 19, EGU2017-3995, 2017
EGU General Assembly 2017

The rheology of non-suspended sediment transport mediated by a Newtonian fluid

Thomas Pähtz (1) and Orencio Durán (2)

(1) Institute of Port, Coastal and Offshore Engineering, Ocean College, Zhejiang University, Hangzhou, China (tpaehtz@gmail.com), (2) Department of Physical Sciences, Virginia Institute of Marine Sciences, College of William and Mary, Williamsburg, USA (odvinent@vims.edu)

Using a coupled DEM/RANS numerical model of non-suspended sediment transport in a Newtonian fluid (Durán et al., POF 103306, 2012), we find that the gas-like part of the granular transport flow can be described by a universal condition that constrains the average geometry of interparticle collisions. We show that this condition corresponds to a constant sliding friction coefficient μ at an appropriately defined bed surface, thus explaining the success of Bagnold's old idea to describe the sediment transport in analogy to sliding friction. We are currently exploring whether this rheology applies to gas-like granular flows in general. We further find a transition of the gas-like flow to either a solid-like flow (solid-to-gas transition), which is typical for aeolian sediment transport ('saltation'), or a liquid-like flow (liquid-to-gas transition), which is typical for subaqueous sediment transport ('bedload'). The transition occurs at about the location of maximal particle collision frequency. If there is a liquid-like flow below the transition, we find that it can be described by a $\mu(I)$ rheology, where I is the visco-intertial number, an appropriately defined average of the viscous and intertial number.