Geophysical Research Abstracts
Vol. 19, EGU2017-4728, 2017
EGU General Assembly 2017

Turbulence locality and granular-like fluid shear viscosity in collisional suspensions

Diego Berzi (1) and Luigi Fraccarollo (2)

(1) Politecnico di Milano, Civil and Environmental engineering, Milano, Italy (diego.berzi@polimi.it), (2) Università di Trento, Trento, Italy

We re-analyse previous experimental measurements of solid volume fraction, mean velocity and velocity fluctuations in collisional suspensions of plastic cylinders and water flowing over inclined, erodible beds. We show that the particle pressure scales with the granular temperature as predicted by kinetic theory of granular gases. Assuming that also the particle shear stress is well predicted by kinetic theory permits the determination of the fluid shear stress and the effective fluid viscosity from the experiments. We suggest that the effective fluid viscosity in collisional suspensions has two components: one associated with the turbulence generated near the surface of the particles and one associated with the transfer of momentum of the fluid mass in conjugate motion with the fluctuating particles. We model the first contribution using a mixing length approach, and show that the mixing length is local, as it does not scale with distances from boundaries. The mixing length is less than one diameter and decreases with increase in the solid volume fraction. We introduce a granular-like viscosity to model the second contribution to the effective fluid viscosity, by replacing the particle mass density with the density of the added mass of the fluid in the expression of the granular viscosity of the particles of kinetic theory. Finally, we also show how the granular temperature scales in the turbulent and granular limits of the effective fluid viscosity.