Sedimentation of fluid-solid suspensions

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Résumé

We carried out novel experiments of the dam-break flow of particulate suspensions made with glass beads and water at different concentrations. When released, the mixture travels down the flume by sedimenting progressively, at a constant velocity, until motion ceases. From experiments, we show that the dynamics of such flows involves two uncoupled phenomena (1). On the one hand, the settling of the particles develops at low Reynolds number, similarly to that developed in static suspensions, so that the mass flux of the settling particles can be related to the suspension properties (2). On the other hand, the flow of the mixture is similar to that of an equivalent fluid of constant density and viscosity. In gas-solid suspensions, the momentum lost by the flowing mixture is equal to the product of the deposited mass flux and the longitudinal velocity.
Assuming that (1) the time duration of the flow is the time taken by the particles to settle; and (2) the slope of the final deposit corresponds to the ratio between the growth rate of the deposit height and the frontal velocity of the flow (1), allows us to extract the sedimentation velocity from such rapid short-lived flows, which turns out to be of the same order of magnitude than that measured in similar static suspensions of same concentration (2), but slightly inferior due to particles agitation.

References

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Mots-Clés: fluid, solid suspensions, dam, break flow, sedimentation, scaling laws

*Intervenant