

Review of

Estimation of flow velocity for a debris flow via the two phase fluid model

By s. Guo, P. Xu, Z. Zheng and Y. Gao

The authors present a 1D binary mixture model reduced to steady processes subject to gravity forces, interaction forces between the phases and pressure according to Bagnold. The paper

- (1) Addresses a worthwhile problem with restricted but useful results,
- (2) It will – after revision – likely reach an international standard.
- (3) The presentation is concise but requires some qualification.
- (4) It puts the results into the context of other relevant papers
- (5) It is mostly correct and shows the results/applications with adequate tables and figure

The Abstract expresses clearly the aims and scopes of the paper and so does the Introduction, except that it does not become clear whether the distribution of the grains and that of the fluid (=slurry) are basically uniform and build a single layer. In Section 2 “Velocity estimation...” the model equations are presented but it does not become clear whether the interaction force for the mixture as a whole vanishes or not; see eqs. (3), (4) which, when added together the only force of the mixture as a whole should be $b_s + b_f$. Is it so, I doubt? The text between eq. (13) and (17+) must be rewritten. It does not become clear what the authors mean by the ‘outside control volume’. Beyond eq. (17), it does not become clear why/how two different expressions for P_o and T_o are presented. The remainder of the text and sections 3 and 4 are clearly written and understandable.

Small points

- Introduction: In the second § it does not become clear whether a two layer system (slurry and dense fluid-solid mixture) is looked at.
The three stated assumptions are extremely restricting:
 - (1) No geometric deformation of the moving mass is possible
 - (2) What is meant by that ‘no external materials are involved’ [do you mean erosion and deposition] and there are ‘no transformations between the solid and the liquid phases’ [Do you mean that no phase changes occur?]
 - (3) Steadiness. This is almost never the case.
- For the presentation of eqs. (1)-(4) it should be said that the two phases are density preserving and the mixture is saturated.
- Equations (5), (6): I do not understand the term ‘surface forces’ I would interpret f_s and f_f as interaction forces between the phases, and $f_s + f_f = 0$ would be required. Is this satisfied?
- Equation (7): Is v the barycentric velocity? Is there any literature reference for the value of k , given after eq. (8)?
It is not clear in this context what a ‘viscous debris flow’ is against a ‘thin debris flow’. Please be precise.
- Equation (11): Is v_{bar} in this equation the same as v ?
- Text and equations between eqs. (13)-(18): This text needs to be revised. It does not become clear what ‘outside control volumes’ etc. mean. Perhaps the authors mean the volume of the pore space or the ‘grain area wetted by the fluid’.
In the text from (13)-(18) twelve articles ‘the’ are missing and after eq. (15) ‘the pressure difference’ is NOT ‘generated’ but ‘is acting’. Moreover, it is not clear, how the two choices of P_o and T_o in the un-numbered equations are connected. No hints or references are given.
- What is a ‘framoid’? (top on page 5) Please also explain the meaning of l . Is it the boundary layer thickness around the grains?

- It is stated on top of page 6 down to eq. (23) that ‘the turbulence parameter η and the velocity profile parameters a , b , c must be determined experimentally determined. But how is this done? Please explain, the formulas ought to be useful.
- Text between eqs. (23) and (24). Here all of a sudden ‘the velocity of the solid phase in the y-direction and the effect of the turbulence in the slurry are ignored’. Everything from eqs. (24)-(35) is then restricted to this simplification. Can we then simply forget the text between eq. (20) and eq. (23)?
- Can you explain in a few words how eq.(32) is solved to obtain eq. (33)?
- 3. Results and discussion: Can you explain how eqs. (38),(39) are derived (from (36), (37)) and how the un-numbered equations for the squared velocities of the solid and fluid are deduced.

Introduction line 14: brush → bush

3 lines before ‘4 Conclusions’: locale → location