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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "A two-phase model for numerical simulation of debris flows" *by* S. He et al.

Anonymous Referee #2

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General Comments:

The paper sets out a depth averaged two phase debris flow model and then shows some 1d simulation results. There is a little of any originality in the paper and the bulk of it is completely standard manipulations of standard equations.

Specific Comments:

On page 2153 the authors write " Following the pioneering work of Savage and Hutter (1989), in the past few decades, great achievements have been made in the numerical simulating of debris flows by means of depth-integrated theory. In Savage–Hutter (S–B) model (1989), the flow- ing layer on one-dimensional slope is assumed to be an incompressible material and depicted by the Mohr–Coulomb behavior." This was an

important paper but is has nothing to do with Debris flows. It is concerned with dry granular flows which behave very differently.

In the discussion of two-phase models the authors should mention the recent work of Kowalski (J. Fluid Mech. 714 pp. 434–462, doi:10.1017/jfm.2012.489 which accounts for the relative motion of the solid and fluid phases. The Iverson model with a pore fluid equation also accounts for this to some extent.

Developing separate momentum equations for each phase has several drawbacks. A great many more closures are necessary for one. Relationships such as (3) and (5) are only approximate and miss many other important coupling terms.

In Section of 4 they average normal to the bed which they call the z direction. They implicitly assume that the bed is flat

The model also contains some very poor assumptions. Such as equation (18) where they assume that the pressure in the fluid is given only by the fluid density. This means that their models ignores all suspension effects and always has an excess poer pressure of zero. Correctly modelling this is key to an accurate debris flow model and is completely ignored here. Any model must at least also include the force f from equation (3) in calculating the fluid pressure.

Technical Corrections

There are far t omany technical correction to list. I stoppped after the first page

p.2152 "and depth-average integration" -> "and depth-averaged integration"

p.2152 "validated by using one-dimensional dam-break problem" -> "validated with a one-dimensional dam-break problem"

p.2152 "The influences of" -> "The influence of"

p.2152 "motion of debris flow are discussed" -> "motion of debris flows is discussed"

p.2152 "and comparison between" -> "and a comparison between"

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 2151, 2014.