

## ***Interactive comment on “TITAN2F: a pseudo-3-D model of 2-phase debris flows” by G. Córdoba et al.***

### **Anonymous Referee #3**

Received and published: 23 September 2015

This paper deals with an important topic in natural hazards and natural hazards mitigation: the modeling of debris flows. Therefore the paper is certainly suitable for the journal.

However, the paper contains many minor mistakes, including spelling mistakes that the authors should find and correct by themselves. A particularly frustrating problem is the inconsistent use of sub- and superscripts. At the beginning of the paper the phase component and direction are used as super and subscripts, respectively. But by the end of the paper, the subscripts disappear, making the paper difficult to read.

Content:

The major problem I have with this paper is that I miss the physics. The authors present

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equations without strong physical arguments, or at least linking the mathematics to some observations or real case studies. They transform Hutter's equations in a form tractable for computers. This is hard work, but, to be honest, rather uninteresting. It would be nice to have some geophysical arguments; it appears the authors have done very little practical mitigation work. I believe this is necessary for a journal like NHESS.

A good example of this failing is on p.10, l. 15, defining active-passive state (push-pull). Here they should explain what happens physically. Does the height of the avalanche increase (decrease) or is it a change in density, or even, does the height as well as the density change simultaneously? This is a long-standing problem in debris flow mechanics and the authors miss the opportunity to make an interesting statement. Writing down the active-passive equations, simply because everybody does it, will not help the community move forward. I believe that exactly two-phase models might help improve our physical understanding of active-passive flow states and therefore the advantages/disadvantages of the proposed model should be discussed with reference to practical mitigation planning.

Debris flow mechanics is strongly linked to several principles of soil mechanics, including cohesion, effective stresses, excess pore pressures and the physical properties of the interstitial fluid. These themes are all missing in the paper.

My conclusions:

1. The paper should be carefully corrected for the "minor" mistakes
2. Whether the paper then may be published, depends on the philosophy of the editors. Since there is no new physical aspect in the paper, I would say, reject the paper, since it is not of interest for the readers (lack of physics). But if you address just readers interested in how to transform a bunch of differential equations into tractable form for computers, you may publish it.