Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-172-RC2, 2020

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Multilayer-HySEA model validation for landslide generated tsunamis. Part II Granular slides" *by* Jorge Macías et al.

Anonymous Referee #2

Received and published: 16 October 2020

In this manuscript, the authors validate their new wave-slide model Multilayer-HySEA against to three granular landslide benchmarks from US National Tsunami Hazard and Mitigation Program (NTHMP). Their work focuses on presenting the deformable Savage-Hutter type landslide module additional to the wave model framework. The subject of the manuscript is important to both research of wave modeling and landslide tsunami hazard. The model has certain innovation by allowing the slide model and the overlying wave model to be run in the same Cartesian coordinate system. Their simulation results show that the model can capture landslide-generated waves well with a deformable granular slide and the simulations are quite efficient with the GPU-parallel computing technique. However, I find the paper to be somewhat lacking substance on its own. Some questions are necessary to be answered in the manuscript before it is

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Discussion paper

published:

1. Are the governing equations of deformable landslide derived in local coordinate or Cartesian coordinate? In most of landslide cases, steep slopes are involved in the bathymetry. If the landslide governing equations are derived in Cartesian coordinate, the assumption in regular shallow-water-type equations that the pressure gradient in vertical momentum equation is balanced by gravity force is not valid anymore. It needs non-hydrostatic pressure to represent the vertical acceleration of the landslide. If the landslide governing equations are derived in local coordinate and then transformed into Cartesian coordinate, the problem will not be there. The vertical acceleration perpendicular to the local bed is negligible.

2. What is the physical connection of the parameters in the landslide model to the material properties? How sensible is the change of these parameters to the landslide motion and induced tsunamis? In all three benchmarks, the internal friction angles and basal friction angles were. In the present model, another set of characteristic angles were used. The author should provide the relation between the angles used in the simulations and the real material properties. The parameter denoting the buoyancy effect r is just a tuning parameter if the author cannot link it to the status of real landslide. What is the model user to set up this parameter If the user does not know any field or experimental observations ahead of time?

Minor suggestions: 1. I am not sure if the authors' use of the term 'two-phase model' is correct or not. Most of the time only the model solving both the fluid phase and solid phase of the landslide is called 'two-phase model'. 2. In Line 54 the authors mention 'particular difficulty' of the BP6 simulations. If they do not say somewhere what the difficulty is, they can simply delete the words in the brackets. 3. Both BP5 and BP6 provide the slide shape at different time in the experiments. I would recommend the authors to compare the slide shape of simulation results to the observations in Figure 4 and Figure 8. 4. The symbol r is used twice. It both denotes the slide liquefication and the wave gauge locations in Table 1. 5. Some typos: 2020a in line 17; duplicate

sentences from line 276 to 280.

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