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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Three-dimensional numerical simulation of mud flow from a tailings dam failure across complex terrain" *by* Dayu Yu et al.

Dayu Yu et al.

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Dear Referee, thank a lot for your valuable and helpful comments concerning our manuscript. Please note that the revised manuscript has been attached in supplement file. The main corrections in the manuscript and the point-by-point responses to your comments are as following:

Comment 1: Three-dimension (3D) technology can benefit to the simulation of the real world. And in this paper, it is used for the simulation of mud flow. However, this paper seems not giving a satisfying overview on the use of 3D technology in the related fields of tailings dam accident.

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Discussion paper

Answer: It is a novel method to predict the flow range of tailings fluid on real 3-D terrain using 3-D CFD approach. Most prediction of flow range of tailings fluid was implemented using 2-D models. In the introduction, we revised the overview and supplemented the 3-D method for the study of debris flow or landslides on page 2 in lines 60-106.

Comment 2: The author used much text to introduce the numerical models used in this paper, however, the improvement of these models for dealing with tailings dam accident doesn't seem to be described clearly.

Answer: We have made the corresponding revision according to your comments on page 6, lines 193-196. Since the rheological properties of mudslide fluids and tailings fluids are similar we used a series of CFD models or methods to solve run-out problem for predicting the inundation area of tailings fluid after tailings pond dam failure. To make it possible for the tailings-flow simulation, we integrated the Bingham-Papanastasiou model into the original code of OpenFOAM.

Comment 3: During the simulation for the A'xi tailings dam, the author used two different DEMs with 0.5m $\times$ 0.5m and 12.5m $\times$ 12.5m resolutions. Will the boundary inconsistency of two areas with different DEMs cause the low accuracy of simulation? How did the author address the inconsistency while reconstructing the 3D terrain?

Answer: Just as your keen-insight comment, there is an inconsistency problem that is common in the mosaic process of different resolution DEM. We have done some processing on the original DEMs, and after processing, the inconsistency problem is greatly alleviated. The process is as follows: First, the two DEMs with different resolutions were georeferenced to ensure a geographical match. Then we compared the elevation values of many identical feature points of the two DEM, and found that the elevation values of UAV DEM are generally about 40 m higher than those of ALOS. All pixel values of the UAV DEM are resampled by 40 meters to reduce the elevation difference of the two DEM at the boundary line. Finally, two DEMs are mosaiced together in

the geographic information system, such as ArcGIS and QGIS. This is not the perfect way to deal with the inconsistency of the boundary, and there is still some error at the joint, but we think that this local error will not significantly affect the simulation results, which is acceptable.

Comment 4: The parameters of models is usually important. In this paper, how did the authors obtain the parameters for the simulations of different tailings dams?

Answer: In fact, for the rheological parameters of tailings, we selected a group of rheological test data (Section 3.3) of tailings similar to that of simulated tailings in a series of rheological tests conducted by Liao et al.

Comment 5: How to evaluate the simulation results, is there some quantitative methods was used for result evaluation?

Answer: For the evaluation of the simulation results, we first simulated an analytical verification test and a laboratory validation test to illustrate that this method was used to simulate tailings fluids by some quantitative comparison. Then, we simulate a real case of tailings dam break ïijĹFeijiao tailings dam in BrizialïijĽ, and the simulated routing and destroyed range coincided well with satellite images obtained after the Feijiao DamâĚăcollapse, which recorded destroyed downstream area, but there is lack of other field data or observations in evaluating the simulation results of real case because the occurrence of tailings dam break is uncontrollable and some quantitative information in the process of dam break is difficult to collect.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-298/nhess-2019-298-AC2-supplement.pdf

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