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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "3-D-numerical approach to simulate an avalanche impact into a reservoir" *by* R. Gabl et al.

Anonymous Referee #1

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The authors present a pragmatic approach to numerically model avalanche impact into reservoirs and the subsequent overtopping of a retaining structure using the commercial software FLOW 3D. The approach is demonstrated using prototype reservoir data. The approach is compared to results of generally applicable equations provided in literature. Unfortunately reliable prototype field data for impulse wave events are not available. General comments: The topic is of great interest for the community since easily applicable numerical models are not yet present. However the data presentation in the current form is too much a black box. Although the numerically obtained overtopping volumes agree almost perfect to the results obtained using the literature equations, this might be due to compensating uncertainties for the specific set of parameters. The slide induced generation process is specified with an accuracy of ïĆś30%, whereas the

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wave run-up and overtopping process is specified with an accuracy of ïĆś60%. Therefore a more detailed systematic sensitivity analysis would be necessary to understand the model approach. The first step would be to compare the generated wave characteristics to observations in physical models. To some extend such data are available in literature (Fuchs et. al is already cited by the authors). Additional test data best matching the current model parameters may be requested from VAW. I further assume the reduced slide width of the 'water avalanche' compared to a snow avalanche will change the wave generation process. Besides the slide velocity, as the governing initial slide parameter (compare Eq. 1) the slide thickness still has a significant effect. As a second step, wave run-up and dam overtopping should be investigated, thereby varying the relevant parameters wave height H, wave length L and freeboard. The paper is a bit lengthy which could be improved be rewriting/shortening/removing of repetitions. Specific comments: In its present form the title '3-D-numerical approach to simulate avalanche induced wave-overtopping in a reservoir' would better match the content. I still recommend to include a more detailed wave height analysis/comparison. page 4123, lines 5-8: this is hard to understand, please rewrite to increase clearity lines 17-20: 'accumulation' is the wrong word in this context. 'run-up' or 'overtopping volume' or 'cumulated overtopping' would be a better expression please change in the entire main text lines 18-20: a sentence starting with 'if' does not make sense in combination with 'usually' line 25: 'is used by experts' is a very charming but unscientific expression. Please rewrite. page 4125, line 11: 'unseparated and separated flow' please explain in which case which flow separates line 20: 'Zweifel (2004) focuses. . .' there is a mixture of past and present tenses. Past tense should be used for literature review and test results, whereas present tense is useful to describe generally valid expressions. Please check main text for uniformity. lines 27-30: 'slip density' is the wrong expression, please replace by 'slide' in the entire manuscript Page 4126, lines 1-3: Heller (2008) did not investigate all seven parameters, he extended the existing parameter space and finally analysed the wave generation process accounting for all the basic parameters mentioned. line 9: Müller (1995) did not conduct experiments in the VAW

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impulse wave channel which was constructed around 1999 by H. Fritz Line 20: 'outflow volume' is not the correct expression for coastal engineers, 'overtopping volumes' would fit much better from that point of view, I guess outflow is used particularly for dam break scenarios Line 21: The volume is not 'THE' main parameter but 'one of the main parameters', since velocity and run-up height are also important Page 4127, lines 14: 'the overflow height R' this statement is not true. The run-up on a linearly inclined slope does not correspond to the overtopping flow depth in case of shore or dam overtopping. Page 4128, lines 7: 'carried out by means of with. . .' I assume that is a doubling? Lines 11-17: a small statement on different equations for the 3D case would be good Page 4129, line 2: 'plan surfaces' did you mean 'plain surface'? Page 4130, lines 21: predefined trajectories for underwater slide motion are a difficult field. There is a paper by Fuchs et al. (2013) on that topic. [Fuchs H, Winz E, Hager WH (2013). Underwater landslide characteristics from 2D laboratory modeling. Journal of Waterway, Port, Coastal, and Ocean Engineering 139(6):480-488] Page 4131, line 23: 'the water is heavier than snow' given the volume is adjusted according to the density it has the same weight Page 4131, line 25 to page 4132 line 5: Please rewrite this section for clarity. Page 4133, lines 4-6: I don't understand the effect of the melting of the avalanche, please explain better and rewrite Page 4135, line 13: the z-coordinate is missing Line 26: was the cell size varied? Please add proof (some numbers or a chart) that it can be neglected. Page 4137, line 18: 'The water particles move only horizontally. . .' this is not true. Particle motion also incorporates vertical movement. Page 4138, line 1: what is the dangerous velocity? Please explain better and rewrite. Page 4138, line 14: How large is the variation in front velocity? Lines 17-26: Please explain better and rewrite for clearness. Page 4139, line 7-12: The overtopping caused by reflected waves are interesting and might be significant, but strongly depend on the reservoir shape, which is differing in prototype. Please add a comment on that. Page 4139, line 25: 'still water height' do you mean 'still water depth'? Page 4140, lines 15-22: In shallow water different wave-types may be generated contributing to the observed deviations. Therefore a comparison of generated wave profiles would be

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useful.

In general: please provide a table comparing the results (Wave height, overtopping volumes, . . .) of the numerical tests with the results based on literature equations. Fig1: Please increase Figure legend, indicate time steps in caption and indicate subfigures (a) to (c). Fig2: Please increase font size. Fig3: Please increase font size and indicate subfigures (a) to (h) Fig4: Please indicate subfigures (a) to (d) and add legend Fig6: Please increase font size and symbol size Fig7: Please increase font size Fig8: Please increase font size and symbol size, please connect symbols by lines

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