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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Three-dimensional hydrodynamic lake simulations of avalanche-generated impulse wave dynamics for potential GLOF scenarios at Lake Palcacocha, Peru" *by* Rachel E. Chisolm and Daene C. McKinney

W. Schwanghart (Referee)

w.schwanghart@geo.uni-potsdam.de

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The manuscript has many overlaps with the HESS paper by Somos-Valenzuela et al. (2016). Yet, there is sufficient novelty and originality that warrant publication of this manuscript for which NHESS is a suitable outlet. This added value, however, should be addressed more rigourously before the manuscript is ready for publication.

The main strength of the paper lies in the sensitivity analysis of numerical models

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of displacement wave generation, propagation, run-up and overtopping. A revised manuscript should accentuate this issue, both in the title and overall focus. So far, the paper emphasizes the GLOF hazard of Lake Palcacocha and conveys a case study rather than a more general treatment of the problem. I am sure that this would help to demarcate the paper against the paper by Somos-Valenzuela et al. (2016).

A stronger focus on sensitivity analysis would entail to shorten several of the general issues raised in the introduction but rather extend on the issues in section 1.2. A clearer distinction should also be made between the sensitivity assessment and the scenarios. So far, uncertainties that arise from the avalanche simulation process are mixed with the assumptions about the size of the avalanches or the scenarios, in general.

Sensitivity analysis is closely related to the analysis of uncertainties and how they propagate to measures relevant for decision makers. The crisp values listed in Table 2 and 3, and classification of scenarios into "safe" and "not safe" appear at odds with a probabilistic assessment but should rather incorporate uncertainty characterization which could either be quantitative (Table 2,3) or qualitative (Table 4) and derived from the sensitivity analysis.

I think that my concerns about the current manuscript can be adressed but need substantial rewriting or restructuring. Moreover, additional analysis may be required. I thus recommend major revisions.

Specific comments:

1, 11: risk in the risk literature is defined as average loss per year. I'd replace the term risk with probability.

2, 2: perhaps rephrase: "..., and Schwanghart et al. (2016) showed that more than 68% of Himalayan hydropower projects are located on potential GLOF tracks".

2, 10: It is unclear what the 40% refer to. 40% more lakes than before 1986?

2, 19: Can you briefly explain, why this is so? Is there something special about the

moraines in the Cordillera Blanca? Or is the statement more general, i.e., that moraine-dammed lakes are more susceptible than bedrock or ice-dammed lakes?

2, 29: any reference to back the statement that lake dynamics remain one of the most problematic processes?

3, 6: The abbreviation SWE (shallow water equations?) has not been introduced before.

3, 18: specify "this area"

4, 5: Please provide more quantitative information on the moraines here.

4, 33: I'd avoid the term "complex" here, in particular since you continue with "To complicate matters further...". Complex is not complicated.

6, 10f: I am not an expert in computational fluid dynamics, and have problems understanding this part. To avoid that readers get lost here, please try to use plain language to explain the issues with the turbulence model. Otherwise, this part is extremely technical when compared to the preceding part of the paper.

6, 18: Here scenarios are mentioned, but are later explained in 2.4. Consider rearranging the headings.

7, 1f: What is the source of the elevation and bathymetry data?

7, 10: I think this should be interpolation, not extrapolation.

7, 16: not easy to solve: avoid subjective statements

8, 20: provide reference to empirical methods

8, 27f: This point has been mentioned before. I'd delete this part.

10, 8: Avoid interpretation here

10, 6: It is a bit unsatisfactory that there is a baseline level of error due to the extrap-

olation of the initional conditions to a coarser grid. Any chances to overcome these issues? Otherwise, it is difficult to separate the sensitivity to initial conditions and sensitivity to grid size.

12, 27: I would avoid the term tsunami in this context. Rather call it a displacement wave.

14, 19f: The first paragraph should rather be placed in the introduction or removed.

16, 14: remove somewhat

Figure 1: Consider using hillshading to better visualize topography (see Fig. 1 in Somos-Valenzuela et al. 2016). In addition, adding glaciated areas would be helpful.

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