The authors are grateful to the reviewers for their constructive comments. We'll endeavor to respond appropriately below.

Comments from 1st Reviewer

[*The manuscript includes many figures (27) and possibly some of then can be further combined and or excluded or also improved (screenshots by themselves are not very informative). I think that legend is important in the figures showing the erosion and deposition cells.*]

Combined or removed figures as warranted. Added figures to explain some of the questions from the reviews. Net reduction in figures (to 24). Legends were added to some figures, but screenshots remain and some figures have descriptions in captions instead.

[*Authors state that the software will be freely available for to no-profit groups. I wonder why not to release the code under an open source license (GPL as an example) in order to facilitate the re-usage and improvement, of this interesting tool, by the scientific community. I also wonder if the tool will be provided as a binary code for multiple OS (Win, MacOS, GNU/Linux)*]

Currently, we are not intending to release the code under an open source license. We are extremely interested in working with the larger scientific community and will freely provide the software for non-commercial use. The tool was written for the Windows platform and will not be provide as a binary code for multiple OS.

[*Among the different papers dealing with regional modeling of debris flow runout cited in the introduction I would suggest to introduce these other two papers that are exactly dealing with the topic:*]

Thank you for the references, we included them in our update. The papers by Mergili and others take a decidedly different (though innovative) approach to landslide runout. We expect, based on our review, that they require additional software (UNIX, GRASS GIS) that are less common outside of academia, as well as calibration of the break criteria. While LABS also expects calibration by an expert, the methods are, in our opinion, more accessible to the user.

[*In the description of the program it is said that the software uses 5m resolution DEM. Is it not possible to run the tool on a grid having different size? If not I think that some comments on the memory requirement for running the tool on a given portion of the territory should be provided since this can hamper to use of the tool, on normal laptop or workstation, for modeling large areas.*]

The program is optimized for a 5 m DEM. Smaller or larger DEMs are likely to produce incorrect results. Comments about computer power and memory are almost certain to be obsolete at time of (or shortly after) publication. We are currently running the program on a variety of laptops and limiting processing time by breaking down the DEM to reasonable sizes (currently several hundred km^2). For slower computers there is a Region of Interest function within the program that allows the user to define an limited area for analysis.

[*Description of the program is rather short and not very detailed. As the tool is proposed to the scientific community I suggest to enlarge the description of the algorithm. As an example section 2.4 about spread is not very clear to me and the 3D Gaussian surface of figure 2 is not very informative.*]

Agreed. We replaced Figure 2 with a more detailed explanation of the spread mechanism.

[*I also suggest to clear if the model, after the run, alter the DEM, carving or uplifting it in correspondence of erosion and deposition areas. This would be an important tool since, when a an agent passes through* *a given cell, it could find the the DEM altered by an antecedent agent coming from another source and this could have an effect on the propagation of the second one. It seems the DEM is modified, from what we can read at lines 10-11 at page 6, but probably it should be made more clear.*]

You are correct, the model alters the DEM as it propagates and this in turn affects subsequent landslides. However, once the run is reset, the DEM is reverted to it's imported (original) form. This ensures that multiple runs are not affected by previous runs.

[*Some concepts are repeated. As an example page 5/6 lines 26-27/1-2 or page 7 lines 10-11*]

We have endeavored to remove unnecessary repetition.

[*I suggest to add information to the background for the first case study. As an example it is relevant to know the size of the study area, which DEM was used and if the DEM is pre- or post-event.*]

Done.

[*Section 3.2.2 is about calibration. However it is not clear how the model is calibrated. I would have expected that some of the parameters used by the model would have been changed to make the model match with the observed data but it seems to me that there is not such type of action. Why didn't the authors tried to tailor the model results to the ground truth? This has also to do with the model sensitivity. I really suggest to better discuss this point.*]

Clarified in manuscript.

[*In section 3.2.3 it is said that random source location are placed based on a susceptibility map. It is relevant to describe how this susceptibility map was generated. Authors also mention existing terrain polygons but, if I'm not wrong, they were not mentioned before and I don't know what they are. It is not clear to me what they are. In the same section lines from 1 to 8 are not very clear to me. Probably experiment settings should be better explained. Again, in the same section, at line 10, authors say "once the historical event were calibrated.." but calibration phase was in section 3.2.2 and I'm not sure they are talking of that part of the manuscript but rather about the six storms.*]

Clarified in manuscript.

[*At lines 14-16 of page 9 authors discuss a sort of susceptibility map. The citation is Palmer (2018) but the reference is "Palmer: Lake Cowichan and Youbou Slope Hazard Assessment, 2018." that I wasn't able to find.*]

The report is publicly available here: Natural Hazard Risk Assessments | Cowichan Valley Regional District (cvrd.ca)

[*At line 20 of page 9 authors say "The model was calibrated by simulating landslides within the study area, comparing the results to mapped and expected landslide behavior..". I think they can improve the description of what they intend with "mapped and expected landslide behavior".*]

Clarified in manuscript.

[*At line 24 of page 9 authors say "magnitude frequency curves that are similar to other coastal BC data sets (Figure 18) with a similar rollover and distributions" but, taken the same area value, the model data differ till 1 order of magnitude of cumulated probability with the other curves. It seems, as a consequence,* *that area distribution is underestimated. Why non to try to better calibrate the model parameters to improve the matching of the model outputs with the frequency size distribution of the real inventories?*]

Updated and clarified section.

[*In section 3.3.2 manuscript declares that "Landslide initiation locations were created by importing randomly distributed points, a uniform distribution of points, and manually in the GIS tool within LABS". However there is no discussion about the effect of these different methods used to define the landslides initiation locations on the performance of the models. There is only a rapid comment on section 3.3.3. On section 3.3.3 authors start with: "Once tested..". Are they meaning "Once calibrated.."?*]

Clarified in manuscript.

[*At line 9 on page 10 there is the following text: "(both random and manually selected)" . But just a paragraph above authors state: "A user-based initiation-point selection method was used for the final model runs as this method generally resulted in landslide generation somewhat more frequently than randomly or uniformly generated points that would sometimes occur on a flatter portion of the slope". Sorry but I don't understand which is the method used, at the end.*]

Clarified in manuscript.

[*Comment on lines 12-14 of page 10 are interesting but I wonder if they can be considered conservative given the fact that the magnitude frequency curve of the modeled landslides resulted in smaller landslides respect to those observed in other similar zones*.]

Updated discussion in manuscript and provided M-F curve for mapped vs. modeled landslides of same slope.

[*In section 4.3 there is a discussion about DEM resolution, that is fixed to 5m. As I said, I think that this should go together with an analysis of the memory requirement for running the tool. Having a fixed value for the resolution there are probably limitations (memory) about the maximum size of the area that can be studied using a computer*.]

Such a discussion will probably be outdated by the time this goes to press. Certainly by the following year. Computational demand is affected by the size of the area being processed at a single time; however, LABS has a ROI button that allows the user to focus analysis on smaller portions of the DEM if required.

[*Page 8, line 29: "700 mm" and "6000 mm" I suppose.. Is the -1 an error? Page 10, line 29: are authors meaning Figure 24 and 25? page 12 line 6: please remove "is"*]

Done.

Comments from the 2nd reviewer:

[*In general, there is serious issue with respect to quantitative assessment of reliability of the modeling results in terms of calculated landslide volumes, depths and their run-out limits. All of these parameters are very useful and can be applied for practical hazard assessment, but the user needs to know how reliable the model outputs are. This is so far characterized mostly by qualitative, general statements.*]

We acknowledge that model reliability includes a high degree of expert judgement, however, we think that a landslide professional will have a relatively easy time calibrating the model. We’ve added clarity around calibration of the model in the manuscript.

[*Please add reference which would provide definition of "debris floods" as this would significantly contribute to better understanding of the topic*.]

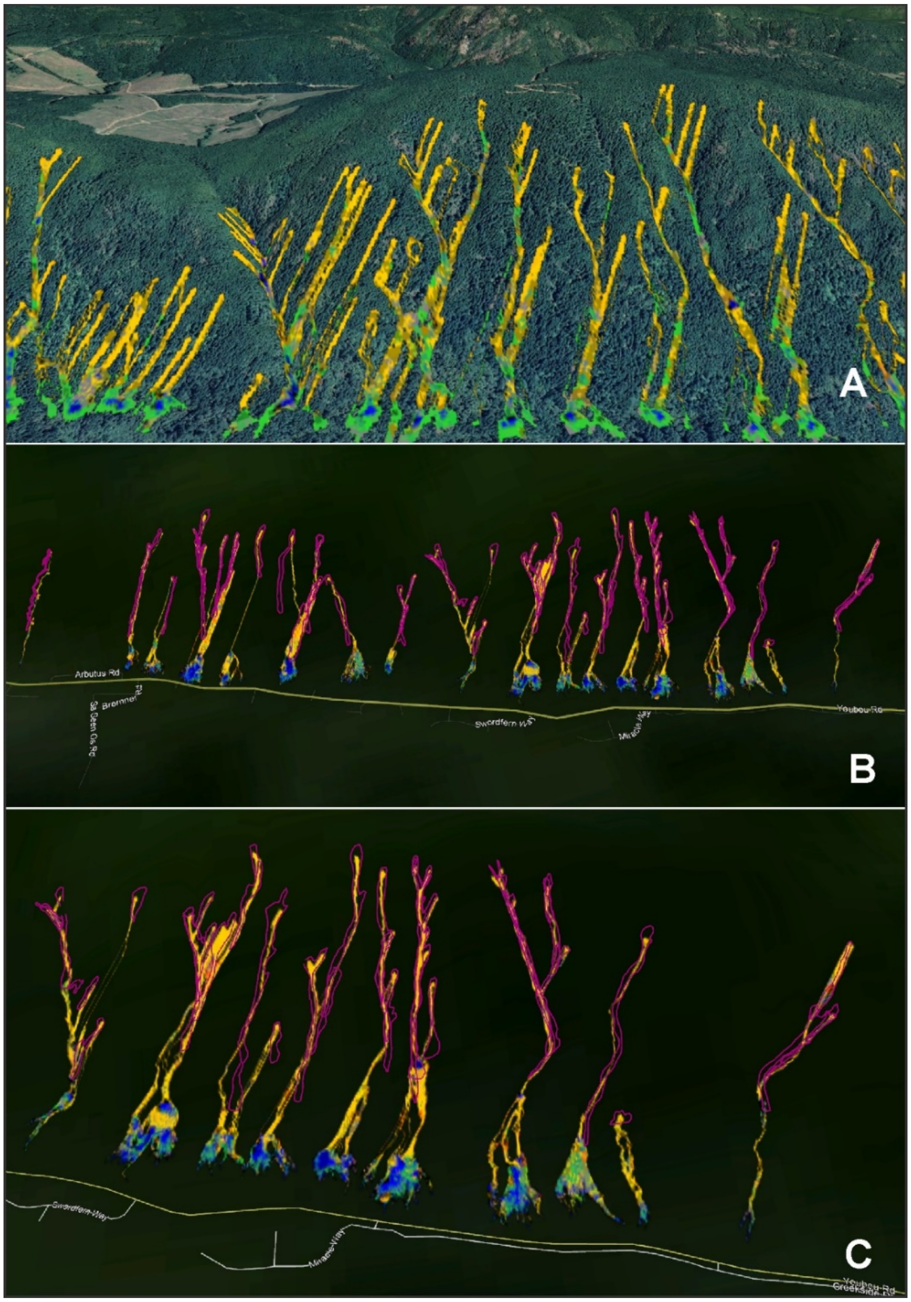
Done

[*This fact* [that distal margins of landslides tend to be inundated less frequently than the main landslide body] *along with characteristics mentioned in the preceding paragraph can be serious limitation of the model if we would search and answer where it is safe to build houses with respect to the expected run-out. Could you quantify or describe in more quantitative manner the uncertainty related to the margins of the modeled run-out?*]

We consider this to be a strength of the program. The fact that we can run a simulation multiple times and get what we believe is credible variation between runs allows the user to better estimate the potential footprint as in the following example. LABS allows you to show both the overall footprint and the most likely footprint for a specified topography (the current DEM).

[*Please explain … narrow shape of the transportation paths. It seems that some problems with DEM could be involved! Please, check it.*]

The narrow shape of the transport paths is typical for debris flows in many areas of the world. It’s not a limitation of the model but a reflection of the topography. That said, there is some potential for DEM error that is considered in the paper. It is almost certainly a limitation at the DEM scale, however, it is also consistent with the actual mapped landslides. (Figure attached).



Strong linear orientation of modeled landslides on the North Shore when hundreds of landslides are viewed at once (A). The results look more reasonable (though still linear) when compared to just the mapped landslides (B) and (C). Google Earth image in the background of (A).

[*I think that* [the runout] *probability also largely depends on the initial volume of the material. Please consider this in your conclusions. It would be also nice if you may show calculations where the initial volume of landslide mass was larger*.]

Runout does indeed depend on the initial volume, as well as the difference in available entrainment along the landslide path. The professional landslide specialist needs to consider these criteria when calibrating the model. The latest version of the model can increase or decrease the initial volumes, and the scour and deposition to match the geomorphologically interpreted criteria.