

## 1. Specific Comments

<b>Question 1</b>	Does the paper address relevant scientific and/or technical questions within the scope of NHESS?
<b>Comment</b>	Yes.
<b>Question 2</b>	Does the paper present new data and/or novel concepts, ideas, tools, methods or results?
<b>Comment</b>	Yes.
<b>Question 3</b>	Are these up to international standards?
<b>Comment</b>	Yes.
<b>Question 4</b>	Are the scientific methods and assumptions valid and outlined clearly?
<b>Comment (1)</b>	I suggest the authors should specifically introduce the operation of the use of flow routing module. For example, how the authors define the beginning points (cells) of debris flows: do the authors use every landslide points as debris-flow initiations? Suggesting by Griswold et al. (2008) and Chiang et al. (2012), not every landslide initiation will deliver debris flows.
<b>Answer and Modification</b>	<p><b>[Answer]</b></p> <p>Thank you for your suggestion to improve the module for landslide induced debris flow analysis. We introduced the use of flow runoff module in mainly two approaches.</p> <p>First, the module can detect debris flow susceptibility region. Although this method classifies all landslide areas as debris flow susceptible region, it is useful for preliminary assessment of the study area to determine likelihood of landslide induced debris flow. In this paper, the study area shows high potential to landslide induced debris flow based on the AMI (Approximate Mobility Index), and thus we can expect most of landslides to be mobilized into debris flow.</p> <p>Second, it can be used for runoff generated debris flow. Debris flows, also, are able to initiate by mobilization of a channel bed due to surface water flow. In this regard, initiation of debris flow is influenced by topographic and geotechnical parameters such as slope angle, curvature, grain size, unit weight of soil, water supply and so on. Some researchers suggested a critical value of runoff required to generate debris flow. Using TRIGRS runoff module, one can calculate the discharge rate in each cell thus identifying the critical areas for debris flow generation potential based on the runoff threshold.</p> <p><b>[Modification]</b></p> <p>We added the explanation in the page 17, line 9 – page 19, line 11 in Section 6.3.</p>
<b>Comment (2)</b>	The study area looks like to be constrained in hillslope area, not extending to flooding area. Hence, the debris flow prediction does not include the affected/ inundation area over communities. Can the routing module extend to the low land area?
<b>Answer and</b>	<p><b>[Answer]</b></p> <p>Thank you for your suggestion. Unfortunately, as of now the runoff route is unable to</p>

<b>Modification</b>	<p>be extended to the low land areas. Improvement of TRIGRS runoff module by addition of parameters related to rheology or flow travel angle, we can calculate spreading area affected by debris flow. However, this would make the model more complex, thus defeating the purpose of this research which is to perform a quick, simple landslide and debris flow susceptibility assessment.</p> <p>Also, one of the key themes of the paper being susceptibility does not require detailed analysis in the form of area inundated which is usually covered in hazard analysis.</p> <p><b>[Modification]</b></p> <p>We added the suggestion as your commendation in the page 20, line 13 – 14 in Section 6.3.</p>
<b>Question 5</b>	Are the results sufficient to support the interpretations and the conclusions?
<b>Comment</b>	The proposed LRclass is a quantitative index used to evaluate the prediction of landslide location. I agree with the authors' idea, suggesting it's useful to avoid overestimation. However, to me, this index mainly highlights the "effectiveness" of model prediction, instead of "accuracy". The study only obtained 49/147 (33.3%).
<b>Answer and Modification</b>	<p><b>[Answer]</b></p> <p>"Accuracy" of the index was used in the context of being effective in avoiding overestimation. However, we see that it can bring about some confusion, and hence we will accept the suggested change to "effectiveness".</p> <p><b>[Modification]</b></p> <p>We changed the word in the page 1, line 23 in Abstract, and page 15, line 28 in Section 6.2.</p>
<b>Question 6</b>	Does the author reach substantial conclusions?
<b>Comment</b>	I suggest the authors put their analysis of "landslide and debris flow susceptibility zonation" in the study, as mentioned above, and then they may modify/add more results in current conclusion.
<b>Answer and Modification</b>	<p><b>[Modification]</b></p> <p>We added the description in the page 20, line 28 – 30 in Section 7.</p>
<b>Question 7</b>	Is the description of the data used, the methods used, the experiments and calculations made, and the results obtained sufficiently complete and accurate to allow their reproduction by fellow scientists (traceability of results)?
<b>Comment (1)</b>	The authors need to explain how they estimate the soil depth. And please provide the source of observed landslide timing (interviewing people?/from news?/from government report?)
<b>Answer and Modification</b>	<p><b>[Answer]</b></p> <p>Soil depth is one of the most important input factors in the physical based model like TRIGRS. The soil depth has been obtained from the detailed site investigation report by the Korean Geotechnical Society in the aftermath of the Mt. Woonmyun debris flow disaster.</p> <p>The source of the observed landslide timing was collected from the news, and then verified with a government report.</p> <p><b>[Modification]</b></p>

	We added the explanation for the estimation of soil depth with ground water table in the page 13, line 12 – 17 in Section 5.2. Also, we added the sentence which gives source of observed landslide timing in the page 6, line 27 – 29 in Section 3.
<b>Comment (2)</b>	In addition, as mention above, the authors should explain the operation of the use of flow routing module. It's important to fellow scientists who really want to reproduce the work.
<b>Answer and Modification</b>	<b>[Answer]</b> Recommended change has been incorporated. <b>[Modification]</b> We added the description in the page 17, line 9 – page 19, line 11 in Section 6.3.
<b>Question 8</b>	Does the title clearly and unambiguously reflect the contents of the paper?
<b>Comment</b>	As mention above, the authors should consider to add their analysis of “landslide and debris flow susceptibility zonation” in the study.
<b>Answer and Modification</b>	<b>[Answer]</b> We have done the recommended changes as mentioned above.
<b>Question 9</b>	Does the abstract provide a concise, complete and unambiguous summary of the work done and the results obtained?
<b>Comment</b>	Yes.
<b>Question 10</b>	Are the title and the abstract pertinent, and easy to understand to a wide and diversified audience?
<b>Comment</b>	Yes.
<b>Question 11</b>	Are mathematical formulae, symbols, abbreviations and units correctly defined and used? If the formulae, symbols or abbreviations are numerous, are there tables or appendixes listing them?
<b>Comment</b>	Please go to the “technique corrections”
<b>Question 12</b>	Is the size, quality and readability of each figure adequate to the type and quantity of data presented?
<b>Comment</b>	Yes.
<b>Question 13</b>	Does the author give proper credit to previous and/or related work, and does he/she indicate clearly his/her own contribution?
<b>Comment</b>	The authors pay more attentions to literatures of landslide modeling. To combine a landslide model and a debris-flow model, however, is not new. Several articles have proposed their own ideas for various application purposes. The authors should review more works related to landslide-debris flow modeling, such as: Chiang, S.H., Chan, K.T., Mondini, A.C., Tsai, B.W., Chen, C.Y., 2012. Simulation of event-based landslides and debris flows at watershed level. <i>Geomorphology</i> 138, 306-618.
<b>Answer and Modification</b>	<b>[Modification]</b> We have added the literature review for landslide induced debris flow coupled models in the page 5, line 1 – 25, in Section 1.
<b>Question 14</b>	Are the number and quality of the references appropriate?

<b>Comment</b>	As mentioned above, the authors should add their references regarding landslide – debris flow model.
<b>Answer and Modification</b>	<b>[Modification]</b> We added the reference.
<b>Question 15</b>	Are the references accessible by fellow scientists?
<b>Comment</b>	Yes.
<b>Question 16</b>	Is the overall presentation well structured, clear and easy to understand by a wide and general audience?
<b>Comment</b>	Yes.
<b>Question 17</b>	Is the length of the paper adequate, too long or too short?
<b>Comment</b>	The length of the paper is adequate.
<b>Question 18</b>	Is there any part of the paper (title, abstract, main text, formulae, symbols, figures and their captions, tables, list of references, appendixes) that needs to be clarified, reduced, added, combined, or eliminated?
<b>Comment</b>	Please check the “technique corrections”.
<b>Question 19</b>	Is the technical language precise and understandable by fellow scientists?
<b>Comment (1)</b>	Page 2548, line 4: In Abstract, the “catchment” (the contributing area of upstream flows) is not adequate for the study area. Please consider using another term to describe.
<b>Answer and Modification</b>	<b>[Modification]</b> We changed “catchment” to “region” in the page 1, line 11 in Abstract.
<b>Comment (2)</b>	Page 2550, line 19: Regarding the introduction of SHALSTAB: “This model correctly predicts the observed tendency for soils to be thick...”. “This model” indicates the process-based model for soil depth estimation, which is not a part of SHALSTAB. It’s a particular case and application, along with SHALSTAB, in Dietrich et al. (1995), and many others, after Dietrich et al. (1995).
<b>Answer and Modification</b>	<b>[Answer]</b> Thank you very much for pointing out the discrepancy. Our intention was to inform the readers in brief about the inclusion of process based soil depth estimation model into SHALSTAB.  <b>[Modification]</b> We have made the revision in the page 3, line 18 – 20 in Section 1.
<b>Comment (3)</b>	Page 2559, line 14: Consider to use “rainfall distribution” to replace “climate”, or rewrite the sentence: please change the term “climate”, because the climate is used to indicate a long-term statistical meteorological property for a given region. Same in

	line 15.
<b>Answer and Modification</b>	<b>[Modification]</b> Thank you for your advice. We changed “climate” to “rainfall distribution” in the page 11, line 24 in Section 5.1 and “precipitation” in the page 11, line 25 in Section 5.1, respectively.
<b>Question 20</b>	Is the English language of good quality, fluent, simple and easy to read and understand by a wide and diversified audience?
<b>Comment</b>	Yes.
<b>Question 21</b>	Is the amount and quality of supplementary material (if any) appropriate?
<b>Comment</b>	No supplementary materials for the manuscript.

## 2. Technique Corrections

<b>Question</b> 1	Page 2552, line 1: “Some research has” → “Some researchers have”
<b>Answer and Modification</b>	<b>[Modification]</b> We modified the expression in the page 4, line 22 in Section 1.
<b>Question</b> 2	Page 2555: notation of eq (2) should be deleted.
<b>Answer and Modification</b>	<b>[Modification]</b> We deleted the expression.
<b>Question</b> 3	Page 2556: eq. (3) should be changed as eq. (2); please consider that to use FS to replace Fs to make all nations in the manuscript being consistent (same in line 9).
<b>Answer and Modification</b>	<b>[Modification]</b> We modified the expression.
<b>Question</b> 4	Page 2556: add eq. (3) for equation in line 20.
<b>Answer and Modification</b>	<b>[Modification]</b> We added the expression.
<b>Question</b> 5	Page 2557: add eq. (4) for equation in line 2.
<b>Answer and Modification</b>	<b>[Modification]</b> We added the expression.
<b>Question</b> 6	Page 2558: eq. (4) should be changed as eq. (5).
<b>Answer and Modification</b>	<b>[Modification]</b> We modified the expression.
<b>Question</b> 7	Page 2562, line 7: “was” → “is”
<b>Answer and Modification</b>	<b>[Modification]</b> We modified the expression in the page 14, line 25 in Section 6.2.
<b>Question</b> 8	Page 2563, line 13: “factors” → “indices”
<b>Answer and Modification</b>	<b>[Modification]</b> We modified the expression in the page 15, line 28 in Section 6.2.
<b>Question</b> 9	Page 2563: add eq. (6) for equation in line 25.
<b>Answer and Modification</b>	<b>[Modification]</b> We added the expression.

<b>Question 10</b>	Page 2564, line 9-11: consider to rewrite the sentence: double-use of “in other words”.
<b>Answer and Modification</b>	<b>[Modification]</b> We delete on of the expression.
<b>Question 11</b>	Page 2566, line 12: “factor” → “index”
<b>Answer and Modification</b>	<b>[Modification]</b> We modified the expression in the page 20, line 20 in Section 7.
<b>Question 12</b>	Table 2: the horizontal line below “parameter (unit)” is missing, but I can find it in the original text.
<b>Answer and Modification</b>	<b>[Answer]</b> We added the horizontal line. In the original manuscript is no problem.
<b>Question 13</b>	Some technique problems may occur during pdf format converting. Similar problems can be found: In figure 11, the later part of figure caption ((a)...(b)...(c)...) should move to figure 12; and so dose figure 12: the later part of figure caption ((a)...(b)...) should move to figure 13.
<b>Answer and Modification</b>	<b>[Modification]</b> We modified the expression. In the original manuscript is no problem.
<b>Question 14</b>	I suggest put the boundary of study area in Figure 2.
<b>Answer and Modification</b>	<b>[Modification]</b> We added the hill-shade imagery to stress study area.