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Natural Hazards and Earth System Sciences
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Discussions

Interactive comment on "Potential Impact of Climate Change and Extreme Events on Slope Land Hazard – A Case Study of Xindian Watershed in Taiwan" *by* Shih-Chao Wei et al.

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Reviewer 1: Anonymous

General comments: This manuscript proposed the scenario approach coupled with landslide simulation, debris flow simulation and loss assessment. The reviewer believes that the approach to link the landslide simulation with debris flow simulation as well as loss assessment was unique and interesting but the manuscript should be improved to be published.

Authors response: We are grateful for the helpful specific comments. These comments

should substantially improve the manuscript. Please see our response to the specific suggestions below.

Reviewer 1: In line 7 of page 2, the authors mentioned that "some potential effects of landslides have been investigated by studying the differences between current and future scenarios". However, any detailed explanation about the potential effects was not provided, so the reviewer cannot understand the explanation.

Authors: We will provide and explain the potential effects observed from past researches.

Reviewer 1: In line 14 – 15 of page 2, the authors explained that the accumulated rainfall over a period of 3, 6, 12 hours exceeded the 200 year record. However, the authors did not provide exact rainfall amounts. To understand the climate condition of Taipei area, total amount of rainfall accumulations for 3, 6, 12 hour periods should be provided.

Authors: The maximum 3, 6, 12, and 72-hour rainfall during Typhoon Soudelor in Fushan meteorological station are 253mm, 442mm, 655mm, and 792mm respectively.

Reviewer 1: In line 13 of page 4, "The TRIGRS is an inventory of shallow landslide simulation programs developed : : :.". But the TRIGRAS is not an inventory. Inventory means that the collection of past landslide features in a certain area for a certain period.

Authors: Thank you for your correction. We will rephrase the misused word "inventory" as "susceptibility."

Reviewer 1: Does the subtitle "Landslide Inventory Simulation" mean that the location of past landslides (That is, landslide inventory) were simulated and matched by TRIGRS? However, it does not seem that the analysis results of TRIGRS are matched to the location of past landslides in this manuscript. In this case, the term "landslide inventory simulation" should be revised.

Authors: Yes, this is what we mean. We will rephrase "inventory" as "susceptibility" to avoid misunderstanding.

Reviewer 1: In Fig. 3, the authors provided historical landslide area. The reviewer recommends to provide more detailed information about how the inventory was constructed and the landslide locations were obtained.

Authors: The historical landslide area (landslide inventory) were delineated by aerial photo by Central Geological Survey in Taiwan annually.

Reviewer 1: In 3.3, the soil parameters such as cohesion, friction angle, unit weight, hydraulic conductivity, and diffusivity were used as input values in landslide analysis using TRIGRS. However, any values for the soil parameters were not provided. Since the input parameters in TRIGRS are important, the values of the input parameters should be provided. In addition, since the soil thickness is also an important parameter affecting the simulation results, the detailed procedure to evaluate the soil thickness using slope-depth relationship should be explained.

Authors: The calibrated parameters of TRIGRS are provided in the supplementary document, as shown in Table S1. The relationship of slope and landslide depth is based on the survey data in Taiwan (Chen et al, 2010), as shown in Table S2. We will provide the references and descriptions in the next version.

Reviewer 1: The explanations in line 11 – 14 of page 13 is not clear. The reviewer cannot understand why and how calibration zones were reduced from 90 to 56. Please rewrite

Authors: There are 18 geologic settings and we set the landslide rate in 5 classes. Because zero landslide rate occurred in some geologic settings, only 56 zones were obtained for parameters calibration. We will rephrase our description.

Reviewer 1: In line 7 – 8 of page 14, “Based on the landslide simulation results and soil thickness in each grid, the landslide inventory map were drawn, as depicted in Fig. 8, : : :”. In reviewer’s opinion, Fig. 8 is not landslide inventory but landslide analysis

results. In addition, the author should provide clear explanation that the procedure that the authors performed and the results in Fig. 8 that the authors obtained. Since the most analysis results using TRIGRS show the distribution of factor of safety, the reviewer cannot understand the reason that Fig. 8 shows the soil depth as the results of analysis. Were the soil depths in Fig. 8 used in debris flow simulation? In the manuscript, any explanations were not provided.

Authors: Yes, the Fig. 8 is the TRIGRS simulation results. The soil thickness is one of the inputs for TRIGRS, and it was used for calculating the initial debris-flow volumes in Debris-2D input. So we drew the TRIGRS simulation results with soil thickness in Fig. 8. We will add the description in the next version.

Reviewer 1: In line 7 – 11 of page 15, the reason that the concentration was presumed to be high and a maxima was used for the practical estimations should be explained. In addition, the meaning of the sentence “the beginning of debris flow was assumed to be the same as the starting time.” is not clear.

Authors: We will add some description to explain the calculation procedure.

1. The equilibrium concentration of debris flow can be estimated by an empirical formula purposed by Takahashi (1981) in Eq. (7) and the maximum value cannot exceed 0.603 (Liu & Huang, 2003) which is occurred when the slope larger than 20.6âĹŸ. Due to the slope of our most study basin even more than 20.6âĹŸ, thus this paper direct take 0.603 for the concentration value of debris flow to estimate debris-flow volumes in Eq. (6).

2. In reality, the landslide triggered debris flows in different locations could be occurred in different time. However, it is difficult to predict the debris flow occurred time after landslide, and in this paper what we concern is the final volume and influence area caused by debris flows. Therefore, the assumption of all the debris flows be the same starting time would not affect the final results.

Reviewer 1: In 4.2, the authors provides the calculation results of the possible economic losses using the quantified method in Table 1. However, the authors did not provide any values used in the calculations and the calculation procedures that the authors performed. The detailed information should be provided.

Authors: The calculation procedures of economic losses could be divided into three parts. First, we need to identify the impact area and depth of disaster which were got from the simulation results of debris flow. Then, the debris flow coverage area will be intersected with land-use map for identifying the loss of different use (e.g. household use, agriculture use, forest use etc.). Finally, the losses could be evaluated by loss functions and the corresponding parameters established in the database according to the uses. The total losses is the summation of the individual losses in different uses. The debris flow coverage area for different land use are provided in the supplementary document, as shown in Table S3.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-125/nhess-2018-125-AC1-supplement.pdf

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