

## ***Interactive comment on “Determination of Heavy Rain Damage-Triggering Rainfall Criteria Based on Data Mining” by Jongsung Kim et al.***

**Jongsung Kim et al.**

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Comment : The manuscript deals with a methodology to determine rainfall thresholds associated with damage-triggering in Korea. The topic is relevant, and the objectives are clearly explained at the beginning.

Comment : However, in my opinion the manuscript presents important problems regarding both its form and content. For example, the structure of the manuscript does not help the reader to get a clear idea of the methodology proposed, it seems more a technical report, for internal use, than a scientific paper, intended for global dissemination.

Reply : The objective of this study is to propose a new methodology to determine

rainfall criteria or threshold of heavy rain damage which is different from the existing methodologies. For the reader, we explained a new methodology in detail which proposed in this study and also rewrote the abstract. As the reviewer mentioned, the paper can be understand as technical report or internal use, so we rewrote and rearranged the content of the manuscript. The general explanations were removed and more technically rewritten. Korea is publishing damage data every year and we used this damage data to suggest a new methodology. If other countries also have damage data (maybe the damage data can be obtained from EM-DAT), the proposed methodology can be used for the determination of criteria or threshold of heavy rain damage.

Comment : While some aspects are presented in detail others are omitted or not discussed. For example it is not clear to this reviewer if maximum rainfall for the different time periods are considered with local references (for example from local IDF series) or to some other framework, as described for rain gauge point measurements by [1] or gridded two dimensional radar derived precipitation field, as described by [2].

Reply : We rearranged the contents of a manuscript to make the balance of explanations and discussions in each section. The reference [1] studied for the characteristics of extreme rainfall events which are measured at stations using ID curve and [2] studied the cluster analysis for the examination of the rainfall similarity of regions using the gridded radar rainfall data. However, this study obtained point rainfalls and point rainfalls are transferred to mean aerial precipitations (MAP) or rainfalls which is used as independent variable to determine the criteria of heavy rain damage. Therefore, the references [1] and [2] are not directly related with this study.

Comment : English language should be reviewed in depth as current problems hamper following authors descriptions. Besides there are additional issues, that should be carefully reviewed by authors. I do not intend at this stage to provide a list of specific comments,

Reply : A native speaker corrected the manuscript for English and we reviewed the

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manuscript very carefully.

Comment : the abstract does not provide an overview, it seems part of the introduction, presenting too many details;

Reply : We rewrote the abstract. Heavy rainfall occurs over the Korean Peninsula mainly via typhoons and localized storm events, leading to severe flooding and landslide risks. The Korean Meteorological Administration (KMA) has established equal criteria for issuing a heavy rain advisory over the peninsula, even though each region or local government has different disaster prevention conditions and rainfall and heavy rain damage characteristics. Therefore, the purpose of this study is to propose a methodology for the determination of heavy rain damage-triggering rainfall criteria (HD-TRC) that can be utilized in individual regions according to their rainfall and damage characteristics to improve a heavy rain advisory. The study regions included 66 administrative districts in Gyeonggi Province, Seoul, and Incheon, Korea. The HD-TRC were determined based on rainfall and heavy rain damage data. Therefore, data were obtained from 2005 to 2018, and the data for the flood/rainy season, which occurs from June to September, were extracted for each year. The rainfall data were obtained from the KMA, and the data for heavy rain damage that occurred during disaster periods were obtained from the Statistical Yearbook of Natural Disaster published by the Ministry of Interior and Safety. Maximum rainfall in 1- to 24-h durations and 1- to 7-d antecedent rainfall were obtained and utilized as independent variables. A principal component analysis was performed utilizing the training set, and the rain index was defined as the sum of the principal components of the independent variables. The best HD-TRC were then determined through classification performance evaluations. This study incorporated abnormal days in the analysis, which are defined as days during a disaster period with no rainfall or an insufficient amount of rainfall to cause damage. A Monte Carlo simulation was performed to consider abnormal days stochastically, and the result was defined as the advanced HD-TRC. Finally, the resultant criteria of the HD-TRC, advanced HD-TRC, and heavy rain advisory were compared based on perfor-



Interactive  
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mance evaluations utilizing the test set, which concluded that the advanced HD-TRC exhibited the best performance. Thus, its methodology could be utilized for regional heavy rain damage warnings.

Comment : lines 37 and 38 present inconsistent information (3.4 trillion KRW correspond to different USD amounts in each line);

Reply : We corrected it.

Comment : in line 62 authors enumerate list methods considering “statistical, empirical, and satellite” which does not make any sense;

Reply : We rewrote the introduction, and deleted the corresponding contents.

Comment : the introduction of Monte Carlo methods (line 174-175) is not done properly;

Reply : We just wrote the general MCM and how to use MCM in this study.

Comment : Figure 15 is mentioned in line 419 but is missing, etc.

Reply : Figure 15 is a typo and we corrected it.

Comment : Perhaps part of the problems can be solved by improving the English issues, but I think the manuscript cannot be reviewed properly in its current form.

Reply : A native speaker corrected the manuscript for English and we reviewed the manuscript very carefully.

Comment : For all the above I recommend authors to reconsider what do they want to explain, to select carefully the examples and describe in a concise way their proposal of new methodology and finally to check in depth the English version before submitting a new version of the manuscript.

Reply : We revised the manuscript carefully for writing and explaining a methodology in concise way and also a native speaker checked English. Thank you very much for

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very valuable comments of the reviewer.

NHESSD

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2020-295>, 2020.

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