

Interactive comment on “Group decision-making approach for flood vulnerability identification using the fuzzy VIKOR method” by G. Lee et al.

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The authors suggested the procedure for assessment of flood vulnerability using fuzzy based VIKOR method on group decision making (GDM).

The selected topic in this article is sound and meaningful because the complex problem caused by different stakeholders in flood management should be resolved by a proper procedure or method.

Especially they try to reduce the uncertainty caused by subjective judgment from disagreements on this issue using the scientific procedure such as fuzzy based VIKOR in GDM.

The method in this study effectively improved the procedure for assessment of flood

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vulnerability and meaningfully overcame the limitation of the classical vote based GDM procedure. Therefore, the problems tackled with this study are of relevance to NHESD Journal. Also, the format of this article and language are appropriate.

Finally I recommend that this article can be accepted because of sound scientific suggestion and its originality. However, I have a few questions for the improvement of this article.

1. In my knowledge, there were so many different types of fuzzy membership functions such as triangular, trapezoidal, Gaussian, Generalized bell, sigmoid etc. The author should explain clearly why they use only triangular fuzzy membership function.

We thank the reviewer for your valuable and very scrupulous comments.
We added the reason why we choose triangular fuzzy number.

"2.3 Data fuzzification

The real values of natural flood hazard data cannot be expressed and then obtained with ease. In addition, the technique of measurement and count have some uncertainty due to the investigation time and value averaging process. Therefore, this study applied fuzzy logic to construct data matrix for estimating flood vulnerability.

All collected data can be transformed into fuzzy membership functions using their distribution forms. Fuzzy membership functions are triangular, trapezoidal, Gaussian, Generalized bell etc. From all collected data, it can be concluded that triangular type reflect well as shown in Figure 2 and be simply calculated. Thus, each data was transformed to triangular fuzzy numbers (TFNs) in this study.

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The weight sets are determined from the Delphi survey which uses fuzzy linguistic variables. Linguistic logic is useful to define the opinion of each decision maker. Table 2 presents the fuzzy linguistic variables and TFNs for the weighting. Seven linguistic variables—very low, low, medium low, medium, medium high, high, and very high—were introduced."

2. In spite of sound suggestion of fuzzy based VIKOR, it is necessary that some limitations of this method or procedure should be explained clearly. I recommend that the authors will add the future study for improvement of that limitations in conclusion chapter.

We studied the approach of flood vulnerability assessment in previous research, Lee et al. (2013). During the study we found that the weights set determined by averaged opinions of decision makers can be distorted. Thus we had an idea that can be reduce the difference using numerical way. It led to this study, the robust approach can apply opinions of decision makers. This study is part of a process of making a credible assessment result for flood vulnerability management. We have been studying composing the proper factors related regional characteristics in next research. It can provide an approach that are useful for flood vulnerability management planning.

we added the above at conclusion.

"In the next study, the focus will be put on composition of factors to assess flood vulnerability with regional capability and characteristics. Furthermore, the relationship between the flood vulnerability developed in this study and real flood damages should be investigated in the future. Then the future

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flood damage can be approached by flood vulnerability coupling with climate change scenarios."

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