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# Reply on RC2

Shaojie Zhang et al.

Author comment on "Quantitative effects of antecedent effective rainfall on *ID* threshold for debris flow" by Shaojie Zhang et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-57-AC2, 2022

Dear Reviewer 2:

The author is very grateful to your careful review of this manuscript. The authors believe that the comments made by the reviewers will be useful in improving the manuscript. The author answers several major questions raised by reviewer 2 one by one.

The first concerns□The reviewer is not sure what is the novelty contribution of the work and suggested that structure of the manuscript, the clarity of the text, tables, and figure captions need to be significantly improved. It may be because of writing problems that the reviewer 2's understanding of innovation is biased. This manuscript is not intended to repeat the qualitative description of the influence of AEP on the ID threshold curve. The author found that a higher AEP can provide favorable hydrological conditions for runoff generation and solid material resource recharge in JJG, but it do not always mean that the ID threshold condition for triggering debris flow is decreased. As for JJG, only after AEP>40 mm, the AEP and ID threshold condition for triggering debris flow will be completely negatively correlated; when 15 mm≤AEP≤40 mm, the solid material supply is rapidly increased by the AEP, a stronger hydrodynamic condition is required to transform them into debris flow in JJG meaning that the ID threshold condition for triggering debris flow is enhanced, and this positive correlation between them persists until the two ID threshold curves intersect in the I-D coordinate system. AEP will significantly change the position of the threshold curve in the I-D coordinate system, and the change law of the position of the ID threshold curve can be described by the functions of α~AEP and β~AEP, α and β are the two parameters of the ID threshold equation. Due to the two functions, the ID threshold curve can regularly move in the I-D coordinate system rather than a conventional threshold curve stay the same regardless of AEP variation, it is beneficial to improve the prediction capacity of the ID threshold. Therefore, the function of AEP and these two parameters can quantitatively describe the influence of AEP on the ID threshold curve. However, no scholars have conducted relevant research on how to construct the functional relationship between AEP~alpha and AEP~beta.

The second concern is about the confusion between antecedent precipitation (AEP) and antecedent soil moisture conditions. The authors believe that AEP can reflect the level of water content in the topsoil within a watershed. However, the authors do not intend to stress that AEP is equivalent to soil water content. There is definitely a big difference between these two physical parameters. In particular, the empirical decay formula for

calculating AEP is subjective, so it is difficult to have a regular correspondence with the measured soil water content. The authors will revise the relating sentences in order to avoid this misleading.

The third concern is about the data used to fit the thresholds shows almost no variation. In our current manuscript, two types of data are used for getting the ID threshold curves. The first data groups are obtained from our numerical model, and the second first data group is from the field observation data. Large different of ID curves under different AEP between our study and the others e.g., Marra et al 2017, Brunetti et al 2010, Guzzetti et al. 2008. The authors guess that the main reason is due to the different methods for dealing rainfall data. In the references, they used one same debris flow event but the rainfall events standard is different, different recognition of rainfall process can cause big difference in the I and D, so the ID curves from the references have big difference. However, our study set the same recognition standard. We guess this is the main cause.

The fourth concern is the performance of neither of the thresholds has been evaluated using independent inventory data. Additionally, the thresholds have not been compared with similar thresholds that have already been obtained in literature. Actually, the performance of the thresholds has been evaluated using debris flow inventory data. This work had been published in another Journal, e.g., Geomorphology (A physics-based model to derive rainfall intensity-duration threshold for debris flow) and Journal of Hydrology (A hydrology-process based method for correlating debris flow density to rainfall parameters and its application on debris flow prediction). And also, we compared with similar thresholds that have already been obtained in literature, please also check the published paper "A physics-based model to derive rainfall intensity-duration threshold for debris flow". The main focus of the current manuscript is to use the database constructed by numerical model to quantify effects of antecedent effective rainfall on ID threshold for debris flow, especially on how to construct the functions of AEP~alpha and AEP~beta, in order to describe the change law of the position of the ID threshold curve in the I-D coordinate system.

The fifth concern is the results in figure 4 is contrast with the conclusions. The authors agreed this point, and after careful consideration, we think the current conclusion is not suitable. As mentioned in the "first concern", the author found that a higher AEP can provide favorable hydrological conditions for runoff generation and solid material resource recharge in JJG, but it do not always mean that the ID threshold condition for triggering debris flow is decreased. As for JJG, only after AEP>40 mm, the AEP and ID threshold condition for triggering debris flow will be completely negatively correlated; when 15 mm≤AEP≤40 mm, the solid material supply is rapidly increased by the AEP, a stronger hydrodynamic condition is required to transform them into debris flow in JJG meaning that the ID threshold condition for triggering debris flow is enhanced, and this positive correlation between them persists until the two ID threshold curves intersect in the I-D coordinate system.

As for other detailed comments, the authors will amend them according to your suggestions. Thanks again!

Best regards!