

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Comment on hess-2022-57

Anonymous Referee #2

Referee comment on "Quantitative effects of antecedent effective rainfall on *ID* threshold for debris flow" by Shaojie Zhang et al., Hydrol. Earth Syst. Sci. Discuss.,
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The manuscript aims at determining thresholds for debris flow initiation accounting for the current and the antecedent precipitation conditions using a physically based and a statistically based approach. The topic is relevant and has been previously addressed by several authors. However, I am not sure what is the novelty contribution of the work and I have several concerns:

- The structure of the manuscript, the clarity of the text, tables, and figure captions need to be significantly improved. Currently, the ideas are very difficult to follow throughout the manuscript.
- I think there is a confusion between antecedent precipitation (AEP) and antecedent soil moisture conditions (line 31- 35 and 168-169). Antecedent precipitation is the rainfall that falls over a catchment during a given amount of time before the triggering rainfall event happens. AEP is only a proxy for soil moisture conditions and does not always correspond well with the measured soil moisture at the sites which depends on soil properties.

Additionally, the definition of antecedent precipitation (AEP) and triggering rainfall event is not clear. The manuscript does not state for how long the antecedent precipitation is accumulated and the minimum time between two consecutive rainfall events is not specified. This information is essential as the aim of the manuscript is to find rainfall I-D thresholds for different AEP values.

- The data used to fit the thresholds shows almost no variation. This is surprising as usually there is a larger variation in the recorded rainfall conditions that have triggered landslides and debris flows (e.g. Marra et al 2017, Brunetti et al 2010, Guzzetti et al. 2008). Which data has been used to obtain the R-squared values?
- Another of my main concerns is in the validation of the obtained thresholds. The authors base their validation on the comparison between the two types of thresholds they have obtained. However, 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.

- Finally, one of the main conclusions of the manuscript is that antecedent precipitation plays an important role in debris flow initiation and less intense rainfall is required to trigger a debris flow when the antecedent precipitation is significant. This conclusion has been reached by several authors in the past and I agree. However, the results presented in section 4.3 contradict this conclusion. Table 5, figure 8 and figure 9 show that for a given duration of 1 h the intensity required to trigger a landslide event is higher when AEP is equal to 60 mm than when AEP is equal to 20 mm.

For the above-stated reasons, I do not recommend the current manuscript for publication in HESS.

Additional comments:

Line 42: Are you sure? If I recall well Marra et al. (2017) uses rainfall depth and rainfall duration.

Fig4: What do the blue and red points represent? Are those points the debris flows used to fit the thresholds?

Fig 5. Rainfall intensity depends on rainfall duration and should be expressed in [mm/h]. I think that you are not plotting the intensity but the rainfall accumulation.

Table 4: Why is the duration interval for which the thresholds are defined different for all the considered antecedent precipitation values and the two debris flow densities?

Fig 6: I could not find any reference to this figure in the text.

Fig 7: What do the dots represent?

Fig 8: What are the black points? What is P?

Line 437: Units are missing "when D is larger than 3."

Line 458-459: It is stated that debris flow events are plotted in figure 12 however they

are not.

References:

Brunetti, M., Peruccacci, S., Rossi, M., Luciani, S., Valigi, D., & Guzzetti, Fausto. (2010). Rainfall thresholds for the possible occurrence of landslides in Italy. *Natural Hazards and Earth System Sciences*, 10(3), 447–458. <https://doi.org/10.5194/nhess-10-447-2010>

Guzzetti, F., Peruccacci, S., Rossi, M., & Stark, C. P. (2008). The rainfall intensity–duration control of shallow landslides and debris flows: an update. *Landslides*, 5(1), 3–17. <https://doi.org/10.1007/s10346-007-0112-1>

Marra, F., Destro, E., Nikolopoulos, E. I., Zocatelli, D., Creutin, J. D., Guzzetti, F., & Borga, M. (2017). Impact of rainfall spatial aggregation on the identification of debris flow occurrence thresholds. *Hydrology and Earth System Sciences*, 21(9), 4525–4532. <https://doi.org/10.5194/hess-21-4525-2017>