EGUsphere, author comment AC2
https://doi.org/10.5194/egusphere-2022-596-AC2, 2022

Reply on RC2

Judith Uwihirwe et al.

Author comment on "Potential of satellite-derived hydro-meteorological information for landslide initiation thresholds in Rwanda" by Judith Uwihirwe et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-596-AC2, 2022

Dear Referee,

Thank you for your feedback on our manuscript. The raised comments and suggestions are of great value for the improvement of the manuscript. We have considered all as follow:

Comment: The title contains the term "landslide hazard", which is misleading if referred to the manuscript contents. Hazard is generally intended to be an "off line" property of a territory, which is a function of susceptibility, temporal and magnitude (size) probability.

Response: The word "Hazard assessment " will be removed from the title to fit with the manuscript content as suggested. The Title will be "Potential of satellite-derived hydro-meteorological information for landslide initiation thresholds in Rwanda".

Comment: Regarding the discussion of threshold results, in my experience, false negatives (i.e., missed alarms) are more important than false positives (i.e., false alarms), because the consequences of missed alarms (e.g. deaths and injuries) are certainly more severe than those caused by false alarms (e.g., the unnecessary evacuation of a school). Therefore, looking at the number of missed alarms in Fig. 8b and 8e, I would not rely too heavily on these thresholds in a LEWS (Landslide Early Warning System). I suggest you to review the Discussion and Conclusions.

Response: We agree that the consequences of offering false alarms (FPR) are less harmful on the short-term than missed alarms (FNR) which implies that the best threshold should maximize the rate of true positives TPR (true alarms) while minimizing the FNR. However, the thresholds in Fig. 8b and 8e are classical thresholds ED relying exclusively on rainfall (Trigger), leading to the high rate of missed alarms and thus less important for a robust LEWS development. Similar to this study, previous studies (Bogaard and Greco, 2018; Peres et al., 2018, Marino et al., 2020; Thomas et al., 2020; Zhuo et al., 2019, Mirus et al., 2018a; Thomas et al., 2019; Uwihirwe et al., 2020, 2021) indicated that the consideration of the prior subsurface hydrological conditions reduce the number of missed alarms FNR as well as the number of false alarms FPR relative to the exclusive use of rainfall-only thresholds. In Figure 8a, 8c and 8d, 9a, 9b and 9c, we integrated the hydrological information (i.e. antecedent soil moisture) in landslide thresholds to improve the rate of TPR and reduce the rate of FNR and FPR. The main goal of hydro-meteorological thresholds (Cause-trigger) is to maximize the rate of true positives TPR

(true alarms) i.e. minimize the FNR but at the same time reducing the rate of false positives FPR (False alarms). The used statistical metrics (TSS and RAD) are also in line with this concept aiming at maximizing the rate of true positives TPR while minimizing the rate of false positives FPR. Once TPR is maximized, the FNR is also minimized though difficult and or impossible to have a perfect threshold model with zero FNR and FPR. We will add a discussion point about this information in Section 4.2.4 and in conclusion part. We will also correct the number of false negative (FNR) in Figure 8f and 9d.

Minor revisions

Comment: Figs. 1, 2, 3, and 4 are similar and repetitive, and the 5-km buffers locally obscure the information from high-granularity maps in Figs. 1 and 2. For a better readability, my suggestion is to merge Figures (perhaps Fig. 1 with Fig. 3, and Fig. 2 with Fig.4) selecting two maps (perhaps elevation and geomorphology), and grouping sensor and landslide information, in Fig.2-4. By the way, I think that the year of occurrence in not that important for this analysis given the relatively low number of failures. Other information on the landslide sites (mean terrain slope in ROIs, aquifer type) could be provided in a Table with the list of failures.

Response: We will merge Fig.1&2 containing quite similar information and keep Fig. 3&4 showing different extent of our study area (ROIs) to keep the flow of the methodology. The mean terrain slope (Map) will only be kept in text and be removed in Fig 2.

Comment: I suggest using "cumulated event rainfall" for E, "event duration" for D, and "rainfall mean intensity" for I.

Response: We will replace " rainfall event volume E" by "cumulated event rainfall E" ; and "event intensity E/D" by "rainfall mean intensity E/D" as Suggested. The "event duration" for D is same as suggested and will be kept.

Comment: Tables 4 and 5 are a bit confusing. If I understand correctly, the first group of 5 columns refers to the whole landslide area, while the second group only refers to the modeled catchments. If so, please amend the tables accordingly.

Response: We will amend the Tables' captions accordingly even though same explanation have been provided in the footnotes of Table 4 and Table 5.

Comment: In Section 4.2.3 on hydro-meteorological thresholds, I would suggest to calculate also classical ED thresholds, which could provide competitive skill scores.

Response: In Figure 8b, 8e and 8f the classical ED thresholds are presented despite the weak prediction capability (TPR=50%) and weak skill score.

Comment: Figs. 8 and 9. You should improve the quality, especially that of 8d and 9d. Please, also avoid too small characters in the legend a, and instead use the caption to explain symbols and colours.

Response: We will improve the quality of Figure 8 and 9 by increasing the font size of the legend and explaining some of symbols in the Figures' captions.