

Manuscript reference number: hess-2017-308 - Response to Anonymous referee #3

We would like to thank the referee for his review. We provide here a response to his comments together with our proposed edits to the manuscript. The referee's comments are reported in black and denoted as RXY where X is the reviewer number and Y is the corresponding comment number whereas our response is in blue.

The manuscript of Marra et al. seems to me as a very good and interesting piece of research on the rainfall trigger conditions for debris flows. The paper is well-written, the structure is appropriate.

We would like to thank the referee for his review.

R3C1

P3, L11: maybe clarify how the end of the rainfall event was defined. Is it the time of DF initiation or end of rainfall? Was the definition of the rainfall event for the rain gauge station data always unambiguous?

This is a good question. Unfortunately, the temporal information on the DF occurrence in the catalog is often as high as the day of occurrence, so that no information is available on the time of occurrence. Consequently, the rainfall events are identified until the end of the rainfall. The definition was not ambiguous since each DF was associated to a single rain gauge (nearest neighbor approach), thus providing single rainfall data series.

We propose to update this part of the text to make this aspect clearer to the readers adding: "*Since no information is available on the exact time of occurrence of the debris flows, the events were extended until the end of the rainfall.*"

R3C2

P4, L1: should be Figure 2b.

Thanks for noticing. The figure reference will be updated.

R3C3

P5, L4: I agree with referee1 that a few more details on the method for generating the synthetic rainfall fields would be useful.

Thank you for the question. As reported in the response to referee #1: the method is generating rain gauge networks (i.e. coordinates of hypothetical rain gauges) rather than rainfall fields. The synthetic rain gauge estimates are defined as the radar measurements on the corresponding pixels (i.e. the pixels containing the location of the rain gauge). The approach of using the radar rainfall fields as the 'true' rainfall fields follows exactly what was done for the analysis of spatial aggregation. The triggering rainfall is then defined by the measurement of the rain gauge closest to each debris flow (nearest neighbor 'interpolation' method). This approach strictly follows what previously used by Nikolopoulos et al. (2015) and Destro et al. (2017). We propose to update this portion of the manuscript to improve its clarity: "*Synthetic rain gauge networks were produced using the procedure proposed by Nikolopoulos et al. (2015a) and Destro et al. (2017). The location of the rain gauges was randomly generated to obtain densities of $1/A$, with A set to 10, 20, 50, and 100 km². To avoid clustering of the rain gauges, a minimum distance between two synthetic stations was set to $0.5\sqrt{A}$. Rainfall estimates of the synthetic rain gauges were defined as the value of the radar rainfall fields for the pixels corresponding to the simulated gauge locations. The rain gauge estimation of triggering rainfall was then defined as the value reported by the rain gauge closest to the triggering location.*"