

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC2  
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## Comment on nhess-2022-184

Anonymous Referee #2

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Referee comment on "Antecedent rainfall as a critical factor for the triggering of debris flows in arid regions" by Shalev Siman-Tov and Francesco Marra, Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2022-184-RC2>, 2022

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This manuscript aims at analysing the rainfall conditions leading to debris flows in an arid area in the Dead Sea region. To do so, Lidar-based DSM and media posts are used to gather a debris flow inventory. Rain-gage and radar data are employed to characterise the rainfall conditions leading to debris flow initiation. Generally, I appreciate the work. The manuscript is interesting and fits well with the journal topics. I feel, however, that the manuscript needs some major improvement for its publication.

- The definition of antecedent rainfall and triggering rainfall should be clarified in the manuscript. In the current version of the manuscript, two different definitions of antecedent rainfall are given. The first definition is provided in Lines 255-256, where antecedent rainfall is defined as "the time passed between the beginning of the storm and the time defined as the offset of the triggering convective cell". The second is given in lines 293-294, where antecedent rainfall is defined as "the rain accumulated on the deposit pixel during the period starting on a 24 h break in rain until the specific measured intensity". This is rather confusing. Usually, the term antecedent rainfall refers to the rainfall that falls in an area during a given period of time before the beginning of the triggering rainfall episode. From the two definitions provided in the manuscript, it is not clear which is the distinction between triggering rainfall and antecedent rainfall.
- I suggest modifying the structure of the manuscript. As it is now, the results of the analysis of the triggering rainfall conditions are only presented very briefly in section 4.3 (only one paragraph is used). The results of the analysis of the antecedent rainfall are scattered throughout the manuscript. Part of them are given in section 4.3, where the triggering rain should be characterised. Some others are presented as part of the discussion (section 5.1). This is surprising given the title. I think that including a results section explaining both the analysis of the triggering rainfall and the antecedent rainfall conditions before the discussion would help make your point clearer.
- In the discussion, the fact that not all intense rainfall events can trigger debris flows is solely attributed to the role of antecedent precipitation. However, other factors such as sediment availability also play an essential role in debris flow initiation. This fact has not been considered. It should be at least mentioned in the discussion and the abstract.
- [Section 2.1: Geography and geological settings] The authors provide an extensive

description of the geological setting of the studied area in which the debris flows occur. However, more relevant information to understand the materials involved in the debris flows is to be provided. Which is the granulometry of the materials involved in the debris flows? Is the availability of sediment homogeneous over the study area? These two factors are relevant as the soil properties might influence the velocity at which pore pressures are dissipated. Sediment availability plays an important role in debris flow initiation.

### **Specific comments:**

- [Section 3: Debris flow detection and characterisation] The occurrence of past debris flows is mapped mainly using Lidar-derived DSM. However, due to the relatively low frequency in which lidar surveys have been conducted, this product does not allow determining the triggering times. Media reports are useful but tend to include only events close to urban areas that impact the population. Perhaps the use of satellite images can improve the debris flow inventory in terms of the number of events and determination of the triggering time. Has this possibility been considered?
- [Section 4: Rainfall data] From the text in section 4.1 it seems that rain-gage measurements are only used to adjust the radar rainfall estimates. However, line 199, states that rain gages are used to fill in the gaps in the rainfall time series at the locations of debris flows. In such cases, the rainfall accumulations at the rain-gage sites could be very different from the rainfall falling at the catchments where debris flows are triggered. Have you adjusted the rainfall measurements in some way?
- [Line 11]: The term short-lived debris flow is not widely used. It might be a good idea to provide the definition earlier in the text. Currently, the term is not defined until line 119.
- [Lines 201-206] How do you define antecedent rainfall? What criteria are used here to distinguish between antecedent rainfall and triggering rainfall?
- Fig 5, line 265: typo: red triangles.
- Fig 6 The caption should be improved. What do the black dots represent?
- [Section 4.3: Characterisation of the triggering rainfall] Reading the sub-section title, I expect to find an extensive description of the triggering rainfall events. However, this topic is addressed only in the first paragraph. Lines 253-261 focus on the antecedent rainfall.
- Line 316-327 I wonder which is the sediment availability in the different catchments where debris flows have been reported. Assuming that you had a complete inventory, it could be the case that some rainstorms did not trigger any debris flow simply because there was not enough prepared sediment in the catchments (see: Bovis, M. J., & Jakob, M. (1999). The role of debris supply conditions in predicting debris flow activity. *Earth Surface Processes and Landforms*, 24, 1039–1054).