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Regional rainfall thresholds for landslide occurrence using a centenary database, by Teresa Vaz, José Luís Zêzere, Susana Pereira, Sérgio C. Oliveira, Ricardo A. C. Garcia, and Ivânia Quaresma

Reply to Anonymous Referee #2

We appreciate the comments given by the reviewer #2. Detailed answers to the reviewer comments are presented next, item by item. The reviewer comments are presented in black, followed by our answer in blue.

1. The paper by Vaz et al. deals with the identification of landslides triggering thresholds. The paper is well written, even if the topic is highly studied and some drawbacks are found. The most critical issue is due to the fact that landslides are not classified in terms of mechanism, material or volume (3.1 paragraph, line 23). I don't know if the authors could provide at least one these, but I think that an effort in at least one of them could affect the final results. In fact, antecedent rainfalls are very important for landslides affecting soils, but they could be less relevant for rockfalls...
   Most of the adopted landslides are located in urban area, where the fall of walls and some artificial cut could have been termed landslides.
   Several other landslides are located close to the sea, affecting the sea cliff, are the authors sure that they were not triggered by waves?

   We appreciate the comments given by the reviewer #2. We will improve the description of the database (subsection "3.1 Identification of landslide events") addressing the points raised by the reviewer. An amended version of the section 3.1 is presented below:

   "Additionally, using the same newspaper sources, landslides that did not caused any human damage during the same time period were identified and included in the database that supported this study. It should be pointed out, that fall of walls and instabilities directly resulting from engineering works were rejected. Similarly, the landslides in active coastal cliffs were not included in the database. The database structure is divided in two sections: landslide features and landslide damages. The first section includes information of landslide type; temporal and spatial location; triggering factor; and newspaper metadata. The second section refers to human consequences of landslides (fatalities, injuries, missing people, evacuated and homeless people), and direct and indirect damage in buildings, structures, roads and railroad.
   Our analysis is focused on the date of landslide occurrences. So, the newspapers are a reliable data source, despite the existing uncertainty concerning the spatial location of many reported landslide events and their type. Only landslides with at least 1 day of accuracy were included in the database. The spatial accuracy of landslides cases was classified, following Zêzere et al. (2014), in 5 classes: (i) location with exact coordinates (accuracy associated with scale 1:1 000); (ii) location based on local toponymy (accuracy associated with scale 1:10 000); (iii) location based on local geomorphology (accuracy associated with scale 1: 25 000 scale); (iv) location in the centroid of the parish; and (v) location in the centroid of the council. A total of 400 landslide cases were inventoried being the majority (83%) located with accuracy corresponding to classes (i) to (iii). These landslides affected clay (40.24%), sandstone and conglomerate (22.52%), limestone (16.52%), volcanic (11.11%), marly and marly limestone (9.01%) and

granite (0.60%). The landslide type was classified following the Cruden and Varnes (1996) classification scheme. The slides are the dominant landslide type in the database (53.8%), followed by falls (14.4%). Flows and complex slope movements are less representative (2.4% and 1.5%, respectively). The landslide type is frequently unknown (27.9%). In this study the analysis was performed for all landslide types, following the approach of similar studies (e.g. Brunetti et al., 2010; Rosi et al., 2012; Peruccacci et al., 2017)."

2. I understand the attempt to find a filtering criterion in Page 6 lines 15 -19, but as the authors say it is arbitrary and it is in contrast with the analysis they perform within 10 km, where most of them could be anthropic-induced (pag. 8 lines 23-25). Maybe, thresholds could be evaluated in the range 5 - 10 km, excluding urban landslides. All the performed analyses and the considerations carried out are reasonable and well described, but main drawbacks are the input data.

   We appreciate the suggestion of the reviewer to perform the threshold in the range 5 - 10 km. To answer this topic we will include in the subsection "5.3 Identification of landslide rainfall-triggered events" the follow paragraph:

   "An alternative method, to the 3-year return period criterion could be the calculation of the thresholds in the range 5 - 10 km, thus excluding the current urban area. However, the landslide database used in this analysis covers a very large time period (145 years) and the urban area extension did change considerably. For example, at the end of the 19th century the rural zones were present within the 5 km buffer. Moreover, this option would reduce the number of landslide events considered in the analysis from 96 to 37, which would reduce the reliability of the obtained rainfall thresholds."

3. minor issues:
   pag 2 line 8 change depth with height
   pag 3 line 6 change quantity with quantify
   pag 4 line 3 remove brackets for April etc
   pag 4 line 24 change along with In
   pag 9 line 13 most rainy
   pag 9 line 27 change detaches with identifies
   Fig 1 it is better to categorize the elevation
   Fig 3 some labels are wrong , i.e. Dez

   We acknowledge the reviewer corrections, which will be integrated in the new version of the manuscript.