

Interactive comment on “Global fatal landslide occurrence 2004 to 2016” by Melanie J. Froude and David N. Petley

Anonymous Referee #2

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GENERAL COMMENT

The article “Global fatal landslide occurrence 2004 to 2016” presents a spatio-temporal analysis of a global dataset included in a continuously updated database. Several information are provided, also focusing on some hot spots and on some specific events. The description of the dataset is very detailed, while the description of the structure of the database could be improved. The theoretical background and the methodological approach are sufficiently explained. Figures are clear and explanatory, in particular the maps. The discussion regarding the connections among human actions and landslide fatalities is interesting.

The paper is quite long, especially in the sections 3.2 (Medium term trend in landslide occurrence) and 3.3 (Complex triggers). However, it is well written, in a good English

language. It is clear and easy to follow, except for the above mentioned sections that could be shortened. I suggest shortening the paper of about 10-15%.

The manuscript is interesting and the subject is within the topic of special issue of NHSS journal, definitely. If data had been made available to the public, it would have been an excellent strength of the work.

Overall, the manuscript is worth to be published. In my opinion, it needs minor/moderate revisions before being accepted.

In the following, I list some specific comments, concerning the terminology used in the paper and other issues. In addition, I have some comments on tables and figures, and I propose some other technical corrections.

SPECIFIC COMMENTS

First, I have several comments regarding the terminology used in the paper, which I believe should be ameliorated.

TERMINOLOGY:

In several places in the text, starting from the abstract (line 16), Authors write about “landslide events”, without defining them. Given that in the literature several definitions of landslide events are proposed, I suggest introducing their definition at the beginning of the manuscript (e.g., in the introduction) and then use it consistently.

Moreover, in few parts of the manuscript, Authors use “databases” and “inventories” (e.g., line 40). Since they are not synonymous, I would suggest defining them and specifying the differences among them.

Further on in the text (line 51), Authors refer to “landslides and mass movements”. Also in this case, I suggest specifying the differences, in any in the definition adopted.

At line 147, Authors define as “complex landslides” the landslides having a known trigger different from rainfall. Actually, “complex landslides” are one of the classes

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defined by the most known and cited landslide classification (Varnes, 1978; Cruden and Varnes, 1996). For this reason, in order to avoid misunderstandings, I suggest choosing another definition.

In some places in the manuscript, precipitation and rainfall are used as synonymous. Actually, this is not exactly true, given that precipitation can include also snow or hail-storm. If the authors have precise information regarding rainfall and/or precipitation triggering of the landslides, an explanation would be interesting.

OTHER COMMENTS:

Line 27: regarding climate-landslides interactions, I suggest considering the recent work by Gariano and Guzzetti (2016), in which there are also several mentions to the feedbacks among climate, environmental, and human triggers (or disturbances, or impacts) on landslides that can be useful for the discussion at lines 442-452.

Line 60: please note that Dowling and Santi (2014) compiled a global catalogue of 213 debris flows that have resulted in 77,779 fatalities, in the period 1950–2011, recorded from academic publications, newspapers, and personal correspondence. The authors analysed spatial, temporal, and physical characteristics of the phenomena, and concluded stating that landslide mortality is higher in developing countries.

Moreover, the NatCat service and the Natural Hazards Assessment Network (NATHAN) prepared by Munich Re should be mentioned, even if they were designed for insurance purposes. Finally, I believe that some citations to national landslide catalogues and databases could be added in this section.

Lines 63-65: I suggest rewording the sentence at lines 63-65 to make it clearer.

Line 68: I suggest adding more information on the structure of the database, also from a technical point of view (e.g., used software(s), amount of data, data management).

Line 69: I suggest introducing an acronym for the “Global Fatal Landslide Database”.

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Lines 98-107: it seems to me that, in the database, some fields cataloguing the precision in the temporal definition and in the spatial localization of the landslides are missing. These would be very useful for data analysis, e.g., the analysis of the precision and the quality of the database, and also to support the statements at lines 106-107. An explanation is needed.

Line 111: I suggest adding a subsection title.

Line 140: I suggest rewriting the sentence to make it clearer. Sections 3.2 and 3.3 are very long. In some parts, they are very difficult to follow. I suggest a significant shortening of both subsections.

Line 428: In the final discussion, it should be acknowledged that such global database, as all global databases and catalogues, focuses primarily on major catastrophic events that typically have impacted large areas. For this reason, the number of the listed landslides is known to be largely underestimated, in particular regarding on low to medium intensity events, and on local events. The incompleteness of the global databases hampers their use for quantitative risk assessment studies, as reported in the mentioned article by Van Den Eeckhaut and Hervàs (2012).

Lines 442-447: I report in the following some statements extracted from the IPCC special report “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation”, in particular from Chapter 3 (Seneviratne et al., 2012), which could be useful for discussion:

- "Many weather and climate extremes are the result of natural climate variability (including phenomena such as El Niño), and natural decadal or multi-decadal variations in the climate provide the backdrop for anthropogenic climate changes. Even if there were no anthropogenic changes in climate, a wide variety of natural weather and climate extremes would still occur".

- "There is evidence that some extremes have changed as a result of anthropogenic

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influences, including increases in atmospheric concentrations of greenhouse gases.”.

- “There is low confidence in projections of an anthropogenic effect on phenomena such as shallow landslides in temperate and tropical regions, because these are strongly influenced by human activities such as poor land use practices, deforestation, and overgrazing”.

TABLES

Table 1

The definition of landslide trigger for “precipitation” (Rainfall raises pore-pressure in slope materials triggering failure) is correct for deep-seated failures but could be slightly different for shallow phenomena as debris slides, debris avalanches, and debris flows. I suggest adding an explanation, following e.g., Sidle and Ochiai (2006).

Regarding “garbage collapse”, I am somewhat doubtful about including this class in the analysis, given that these collapses do not pertain to natural slopes and consequently, given the different materials, the failure mechanisms are different. An explanation would be useful to the understanding.

FIGURES:

Figure 1: Just a comment, I find Figure 1 very interesting and explicative. The comparison among the distribution of fatal landslides per Country and the location of most populated and richest areas in the globe is remarkable.

Figure 2: I would suggest adding the label “Year” for x-axis as done for Fig. 3. I would suggest adding tick marks also on left y-axis and on x-axis in correspondence to odd years (perhaps external to the graph).

Figure 3. I would suggest adding tick marks on x-axis in correspondence to odd years (maybe external to the graphs).

Figure 5. I would suggest using “J F M A M ...” instead of numbers for identifying

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months. For a rapid understanding of the figure, labels “Mean daily rainfall (mm)” could be coloured in the same colours of the bars. Finally, why not using the same scale for all y-axes?

Figure 6. I would suggest adding tick marks on x-axis also in correspondence to odd years, to all panels.

Figure 7. The percentage for mining is missing. Moreover, in the please add total percentage instead of ≤ 1 to collect all other classes.

Figure 8. I would suggest adding tick marks on x-axis also in correspondence to odd years, to all panels.

Figure 9. I would add “construction”, “mining”, “illegal mining”, and “hill-cutting” in the four panels, above the legend, for a rapid understanding of the figure.

TECHNICAL CORRECTIONS

Line 19: “ENSO” should be defined for readers not expert in climate, meteorology and atmospheric sciences. Otherwise, I suggest deleting it from the abstract.

Line 29: please add “that” after “demonstrates”.

Lines 62-62: please change “Kirschbaum et al., 2012; Kirschbaum et al., 2015” into “Kirschbaum et al., 2012; 2015”.

Line 138: Hallegatte et al., 2018 is cited ad 2016 in the list.

Line 196: Magaña et al., 1999 is reported as 2003 in the reference list.

Line 238: Allen et al., 2015 is not in the reference list. In the list the paper is reported with the year 2016.

Line 240: replace “Fig. 7c” with “Fig. 6c”. There are other wrong citation to Fig. 7 that should be corrected in Fig. 6 at lines 242, 244, 247, and 251.

Line 301: replace “Chan 1985; Chan 2000” with “Chan, 1985; 2000”.

Line 324: Trenberth and Shea, 2005 is cited as “2006” in the reference list.

Line 371: replace “Yu and Li, 2011” with “Yu et al., 2011”.

Line 421: Kumar and Pushplata, 2014 is cited as 2015 in the reference list.

Line 470: Kumar et al., 2018 is not in the reference list.

Line 482: please specify (a) or (b) at (World Bank, 2018).

Line 485: include “of” before “73”.

Line 498: “Xie et al., 2013” is not in the reference list. There is a “Xie et al., 2003”.

Line 499: “GPCC, 2018” is not in the reference list.

Lines 753-756: I have not found this reference cited in the text

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