Response to referee #2 document for NHESS manuscript 2021-345 by Li et al.

The manuscript deals with assessment of the debris flow hazard in burned areas through simulations that used high-resolution weather radar-derived precipitation. The manuscript has several interesting points, and overall is well written. It is certainly worth to be considered for publication, but I have a couple of points which need to be clarified.

Response: We thank referee #2 for providing valuable comments for the improvement of the manuscript. We plan to make specific changes in response to each of these comments, and believe that the manuscript will be significantly improved as a result of these changes.

The first (and main) one regards the terminology used. I am afraid that, throughout the article, the term hazard is not used correctly. In my opinion, Authors are rather talking about susceptibility, and not hazard, the difference being that hazard should depict the probability of occurrence of a certain phenomenon not only spatially but also temporally. This latter issue (time) is not considered in the study. I suggest go back to the original definition by Varnes (1984) and UNESCO, and in later works as well, to clarify the meaning of susceptibility and hazard, and to change accordingly the terms in the manuscript.

Response: We thank the referee for highlighting the issue of our loose use of terminology, and we agree with the referee's assessment that our manuscript and methodology are primarily focused on susceptibility, rather than probabilistic hazard assessment. In our revision, we will adhere to the definition of terms summarized in Section 2.1 of Reichenback et al (2018), *A review of statistically-based landslide susceptibility models*, Earth-Science Reviews. Accordingly, we plan to change the word "hazard" to "susceptibility" throughout the manuscript and in the title. In addition, we will add a paragraph to the discussion section which discusses methods by which WRF-Hydro could move beyond "susceptibility" assessments to probabilistic "hazard" quantification. Methods for probabilistic advancement include systemic investigation of parameter uncertainties, use of ensemble-based precipitation data, and quantification of precipitation return intervals with intensity-duration-frequency (IDF) curves.

Another point which needs more details is the description of the debris flows. Authors talk about several debris flows that occurred, and start to cite them in section 2.1. However, a clear description of the events, in terms of geology, morphology, morphometry, volumes is never properly given. This should be done the first time debris flows are mentioned (possibly in section 2.1) to let the reader understand the main characters of the events. For instance, were these debris flows individual phenomena, or did they start from multiple source areas? Further, were they channelized or openslope? More geomorphological info would be useful to understand the conditions under which the debris flows initiated and developed. Only at page 18 some info are provided, but these should appear much before than that, and be well organized, rather than distributed in different parts of the manuscript.

Response: We sympathize with the referee's desire for more data on the debris flows highlighted in our manuscript. However, at present, there have been no systematic studies of these debris flows, so while we are quite confident that debris flows occurred at these locations based on field observations of the deposits and our remote sensing analyses, information about source areas (which are in extremely inaccessible locations) and volumes are not well constrained. We do know that David Cavagnaro et al. (https://agu.confex.com/agu/fm21/meetingapp.cgi/Paper/921613) have undertaken a huge effort to map debris flows in the Dolan Fire burn scar. I suspect this forthcoming work will be able to answer some of the referee's concerns in greater detail.

In our revised manuscript we plan to move the descriptions on the debris flows in section 5.2 to section 2.1, and use Google Earth to estimate the number of source regions and morphology to the best of our ability.

In addition, we will provide more information on the geological setting of debris flows using the USGS geologic map (https://mrdata.usgs.gov/geology/state/state.php?state=CA).

Other issues:

Figure 1 definitely needs a location map, showing where we are in California, and in USA. Authors give for granted that anybody knows the site, but for an international journal a location map is always necessary.

Response: In our revision we will add a location map of the USA which depicts the locations of California and the burn scar/debris flow region.

Throughout the manuscript, references should be listed in chronological order when more than two references are cited. Some incomplete or wrong references are present in the list. Please check at this regard the attached file. Eventually, some minor issues are indicated in the accompanying file.

Response: In our revision we will reorder the in-text citations chronologically and correct the references. We thank referee #2 for their very careful examination of references. We have checked the attached file and will address those minor issues accordingly.

Overall, I evaluate positively the manuscript, which however needs to clarify the points outlined above, and recommend minor revisions.

We thank referee #2 again for their careful review and positive comments.

References:

Cavagnaro D et al. (2021) Variability in hydrologic response to rainfall across a burn scar: observations from the Dolan Fire, California. AGU abstract. https://agu.confex.com/agu/fm21/meetingapp.cgi/Paper/921613

Reichenbach P, Rossi M, Malamud BD, Mihir M, Guzzetti F (2018) A review of statistically-based landslide susceptibility models. Earth-Science Reviews. 180:60-91 doi:https://doi.org/10.1016/j.earscirev.2018.03.001