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Comment on nhess-2021-345

Paul Santi (Referee)

Referee comment on "Augmentation of WRF-Hydro to simulate overland-flow- and streamflow-generated debris flow susceptibility in burn scars" by Chuxuan Li et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-345-RC1, 2022

General Comments

The paper is very well written and easy to follow, and it is a nice integration of modern modeling techniques and data for use in debris flow analysis.

I think a slight change in the declared focus of the paper will better highlight its value. Allow me to explain. At many points in the paper, the authors have gone to a lot of trouble to set up, run, and calibrate models that basically demonstrate the same things that have been said (and quantified) in other papers using much simpler analyses: debris flow volume and discharge increase multifold in burned areas, the hazard is concentrated in stream channels, and there is a lag between rainfall peaks and flow events, for example. However, the authors' analyses provide some information that has not been clearly shown before. Importantly, they are able to create calibrated time graphs of streamflow and discharge. Also, they are able to compare their models with the USGS post-wildfire assessments to show differences (they refer to this in lines 652-656, but don't give details of the analysis).

I think the paper would be stronger if they acknowledge early on that other research has demonstrated (and quantified) changes in volume, discharge, and lag. Then they could focus on the advantages offered by a more sophisticated, calibrated model. I think the discussion should also include a section on applying the model elsewhere. Is it realistic to do this for other sites, or is it too dependent on specific calibration parameters? How could a practitioner do this type of analysis? What does it offer a scientist that they do not already know? The discussion could also compare there model to the USGS model, using a modification to Figure 9, for example, to demonstrate and explain the important differences.

Specific Comments

Section 5.4 - I don't feel that this is a strong section. It concludes that the hazards are greater in the burned area, and mostly in the channels, and that streamflow is elevated downstream in burned areas, which are not unique findings. Likewise, Figure 11 doesn't come across as strongly as previous figures. I suggest dropping this section,.

line 489 ff - an interesting note, your modeled discharge increases by 3 or 4 fold matches field measured changes published in Brunkal and Santi for large drainage basins (I could not find the area for your drainage basins, since you include normalized values, but I assume they are more than 5 km^2) (Brunkal, H. and Santi, P., 2017, "Consideration of the Validity of Debris-Flow Bulking Factors," Environmental and Engineering Geoscience, DOI: 10.2113/EEG-1774). See Figure 3 of this paper.

Technical Corrections

Figures 1, 7. and 9 could benefit from a bar scale.

Figure 9 - the legend is hard to understand. I assume the first bar is volume and the second is normalized volume?