Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2017-354-RC2, 2017

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Hydrological control of large hurricane-induced lahars: evidences from rainfall, seismic and video monitoring" *by* Lucia Capra et al.

Anonymous Referee #2

Received and published: 15 November 2017

Summary

The role of rainfall characteristics (e.g. distribution, duration, volume and intensity) and catchment properties (e.g. size, shape) in determining lahar initiation and the downstream arrival of lahar pulses is an area of important study, particularly at tropical volcanoes. In this manuscript *Capra et al.* study rain-triggered lahars at Colima Volcano in two catchments to (in total) four different rainfall events. The two catchments are the *Montegrade* watershed, a long catchment with limited width and, the *La Lumbre* watershed, a large, semi-spherical catchment north-north-west of Colima. Using rainfall, geophone, and image records collected during Hurricanes Jova, Manuel, Patricia

and an extreme rain event (in June 2013). Geophone records, correlated with imagery, for the Montegrade catchment identified the arrival of lahar pulses. In all cases (Jova, Manuel and 11 June), the largest peak occurred last and coincided with the arrival of a block-rich lahar front. Similar behaviour was observed in the La Lumbre watershed during Hurricane Patricia.

These observations were augmented by 'rainfall simulations' of the event in Montegrade and La Lumbre catchments. My main critique of this work surrounds the use of these simulations, model assumptions and conclusions drawn from this model that may not be fully justified. Despite this, the authors present some interesting analysis and conclusions to the problem of rainfall-induced lahar occurrence which, subject to the following modifications, is well suited to this journal.

Main issues

As mentioned above, the rainfall simulations used in this work need to be clarified and care needs to be taken when analysing and drawing conclusions from the simulation results. In particular:

1. **What are the assumptions of the SCS curve model and how may it affect results?**

   The SCS approach is a simplified method for estimating rainfall runoff. Lower curve numbers result in less runoff for the same amount of rainfall. However, as stated on lines 229-231, this model simplifies the complex relationship between rainfall and overland flow into a single number. A weakness of this approach is that the curve number does not consider the effects of single storm properties (e.g. rainfall intensity) on infiltration.

2. **How was rainfall applied over the simulation domain?**

The authors state that the rainfall 10 minute intervals were applied to the simulation (lines 249-50). However, there is no indication if this varied spatially. If a spatially homogeneous rainfall input was used, the authors need to indicate this and, in discussion, consider the effect of this assumption on results and implication for the migratory, long duration rainfall scenarios.

3. Related to point 1, in Fig. 8, simulated discharge shows better correlation to identified lahar pulses during Hurricanes Jova, Manuel and Patricia. In these events, rainfall intensity is much lower and cumulative rainfall is more linear than the 11 June event. This highlights a potential limitation of the runoff erosion model that needs to be identified and discussed.

4. Although correlation between observed lahar pulses and simulated discharge indicate a level of agreement between simulation and reality, the models have not been calibrated to real world (i.e. measured discharge) data. In effect, the model can then only *indicate* differences in watershed response between the Montegrade and La Lumbre catchments.

Based on these issues, elements of the discussion and conclusion may need modification:

Line 338: pulses better match *simulated* watershed discharge. This is a crucial distinction, as without calibration we cannot estimate the potential error in the discharge rate.

Line 338-340: "Nevertheless ...", in Fig. 8c, only one of the four observed pulses coincide with the simulated discharge - this correlation could be (in my opinion likely is) pure coincidence for this event - you need to account for this. I would recommend removing this sentence entirely, as it is largely repeated in lines 357-359.

Line 368-371: "This is a well documented mechanism ..." it is hard to interpret what is being said here. What is the difference between discharge rate and watershed dis-

charge? How does one control the other? Rainfall intensity and watershed shape seem to control the arrival of main pulses more than discharge.

Overall, I suggest to the authors that the strength of this manuscript is in the correlations of multiple streams of data (rainfall intensity, cumulative rain, geophone records) to examine the relationship between rainfall and lahar pulses. Since the rainfall simulations are uncalibrated, they add some context to the discussion, but simulation results (in their current form) cannot be used to draw conclusions about the relationship. I believe the manuscript would be greatly improved by a rewording of the discussion, reducing the emphasis on rainfall simulations and instead focusing on the relationship between rainfall characteristics and lahar pulses.

Technical and minor issues

Please see the attached .pdf for corrections to English style and grammar.

Line 38, 160, 219: What is a 'stormwater'? This is unclear terminology

Line 58: Ruapehu is not in a tropical region.

Line 161, 165, 170/Figure 1: "MgMS" do you mean MSMg?

Line 163/Figure 1: "LMS" do you mean MSL?

Line 193/194: Change to "Volcán de Colima"

Line 202/203: "Sierra Madre Occidental high relieves" perhaps just Sierra Madre Occidntal range?

Line 225: Reference is O'Brien et al.

Line 317-318 and 320: See above discussion, I think it is important to state the pulses match with peak *simulated* discharge.

Line 322-324: Given model assumptions and disparities when compared to the other events, there is a high chance this correlation is coincidental. If you want to note the correlation here, you should also highlight the disparity.

Line 333-335: Reword sentence to fix grammar... Seismic and visual data from events analysed here provide evidence to key factors...

Line 338-380 and 357-359: See above, these two sentences are almost exactly the same. Recommend removing the first instance.

Line 398-399: "Based on the deigned storm obtained..." meaning is unclear, be specific on the requirements to anticipate start time and arrival of lahar pulses.

Fig. 1 caption: "...locations of the monitoring stations are indicated by triangles"

Fig. 1: Is station MSMg_2015 identified in the manuscript? If not, remove.

Fig. 3b/c: As a normalised plot, there is no need for the 'y' (norm) axis to be greater than one. Adjust to be between 0 and 1.

Fig. 5c is unnecessary, remove.

Fig. 8 needs to be improved, suggest the following:

- In the caption, rain intensity is a gray line, but in the figure it is gold/yellow.
- Fig. 8b - "Rain" and "Rain intensity" legend entries are switched
- Left axis (%norm) should only be between 0 and 1 (see above)
- Arrows in Fig. 8c do not seem to indicate anything - should "first stream flows" text be placed nearby?
- Color and line choice makes it hard to discriminate between rain intensity and discharge. Try adjust colors or line thicknesses.

Table 1: The manuscript suggested 'Jova' had seismic records for Montegrade ravine?

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2017-354/nhess-2017-354-RC2-supplement.pdf

---

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2017-354, 2017.