

Interactive comment on “Real-time prediction of rain-triggered lahars: incorporating seasonality and catchment recovery” by Robbie Jones et al.

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Attempts to use rainfall intensity/duration thresholds to effectively predict debris-flow occurrence in non-volcanic terrains and lahar occurrence in volcanic landscapes have been ongoing for decades. This paper, utilizing a rich data set from Montserrat and innovative statistical treatments of the data, makes an important contribution to the discussion. The paper is clearly and concisely written and the figures are quite good. Overall, I would like to see a bit more clarification of the methods used, more explanation (in plain English) of what the statistical treatments are attempting to show, and a broader discussion of the significance of the results in the context of other research.

What makes this paper an important contribution is the authors' consideration of (1)

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catchment stability (measured as total cumulative rainfall since the last significant eruptive activity); and (2) the “false positives problem”, i.e., when the occurrence of rainfall intensities above a threshold can, in some cases, trigger lahars but which in other cases do not. While the conclusions reached on both of these topics are a valuable contribution, more discussion of the significance of these findings in the context of previous studies would be extremely helpful.

There are several places in the paper where more attention is needed to clarify the research itself and its significance: 1) It would be helpful if there were a Methods section that summarized all of the approaches and assumptions used in the study. Explanations of these are currently scattered throughout the paper. 2) The sentence in lines 52–56 is overly complex and confusing. In fact, a word seems to be missing. 3) In line 64 it would be good to say a bit more about what is meant by “temporal catchment development.” 4) In lines 81 and 84 there is inconsistent capitalization of “Vulcanian.” 5) At the beginning of section 4, please explain why data sets from different rain gauges are used for different time intervals. Different catch efficiencies can bias results between gauges, and local convective rainstorms can deliver different RF amounts to different gauges. 6) More explanation is needed for how the peak rainfall intensity (PRI) of 1 hour was chosen for the analyses, and some discussion of PRIs used by other researchers is warranted. 7) What are the time lags between the PRIs and lahar initiations? 8) Decline in lahar frequency and magnitude following catchment disturbance is a commonly reported phenomenon. Discussion is needed on how the results of this study specifically compare to the results of other studies. 9) Sentence in lines 187–189 is unclear. Is there a word missing? 10) In lines 193–194, the AUC produced by Eq. 2 is given for the analysis of all RF events. What is it for Eq. 3? 11) Discussion is needed for why the antecedent moisture index of 3-day previous rainfall was chosen. What indices have been used by other researchers? 12) In lines 225–226, it would seem that the longer durations of the synoptic rainstorms are critical for providing the antecedent moisture during the wet season. It would be good to emphasize that here for the main reason that lahars are harder to trigger in the dry season. 13) In line 227,

a reference for inefficient bulking in dry channels is in order. 14) Toward the end of the discussion section, a better explanation of the meaning and significance of the ROC analysis is needed. From what you have written, I assume (not being familiar with this analysis) that (1) $AUC = 0.5$ means the number of true positives equals the number of false positives, and that (2) $AUC = 1.0$ means the number of true positives is 100%. Is this the case? 15) How far above the PRI thresholds are the false-positive rainfall intensities? For example, if you set a PRI threshold of 25 mm/hr, how large a PRI can occur that does not trigger a lahar? 16) Figure 2 caption: Please explain the vertical dashed lines.

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