Hydrology and Earth System Sciences Discussions

Interactive comment on "Snow Accumulation-Melting Model (SAMM) for integrated use in regional scale landslide early warning systems" *by* G. Martelloni et al.

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We would like to thank Anonymous Referee # 1 for his constructive comments. In his review, the referee identifies 4 criticalities, which are addressed below.

1

Remark: However, the claim that SAMM is an intermediate approach between physically based models and empirical temperature index models is overstated. To model snow storage/melt the author employ a rather ad hoc density description combined with the mass balance equation. To describe snow storage/melt they use a highly

parameterized (13 empirical parameters) approach.

Answer: We removed from the abstract and from the introduction the sentence "SAMM follows an intermediate approach between physically based models and empirical temperature index models", which evidently leads to misunderstandings. In the conclusion, we better explained our point of view, trying to avoid overstatements: "In this regard, SAMM could be considered an intermediate approach between temperature index- and physically based models: from an operational point of view it simply uses air temperature as an index to take into account snow melting and accumulation, but the value of the threshold temperature (as well as all other parameters involved in the equations) is defined by means of a semi-physical approach, which starts from a conservation of mass equation but uses empirical approximations and calibrations to overcome the unavailability of dynamic data for an operational employ of the model at regional scale". If this sentence is still found inappropriate, we are ready to modify or remove it.

2

Remark: Their description of the model is ambiguous. It is not always clear which parameters are used from which time steps.

Answer: From an operative point of view, temperature and rainfall are the only parameters provided in real-time by the sensors network, therefore they are the only dynamic parameters used by the model. All other empirical parameters are constants, which are actually used to better calibrate the response of the model: the simplex flexible algorithm tune their values to find the optimal configuration which minimizes snowpack thickness errors in the calibration dataset. We revised the text (at the end of 2.2.2 and in the conclusions) making explicit mention to these features of the model. Moreover, each step of the model explanation has been more clearly explained following the detailed comments of the Editor.

3

Remark: The author claim that their approach improved the landslide early warning. At this point I would have liked to see some kind of performance matrix or a bit more statistical evaluation as it is profided. * Observed and predicted landslides * probability of detection (POD) * probability of non detection (PON) * hit rate (HR) etc.

Answer: As suggested by all Referees and Editor, to fully highlight that the performance of the SAMM+SIGMA system is better than the performance of SIGMA alone, we presented the results of this comparison in deeper detail. A table is provided to show the confusion matrix (true positives, false positives, true negatives, false negatives) and a series of indexes commonly used to evaluate the performance of similar models (e.g. sensitivity, specificity, likelihood ratio, ecc...). The table is accompanied by a new text that describes and discusses these outcomes.

4

Remark: The paper is reasonably well written, but it could gain if revised by a native english speaker.

Answer: According also to Referee #3, we contacted a professional English reviewer for the revision of the final version of the manuscript.

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