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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Brief communication: Using punctual soil moisture estimates to improve the performances of a regional scale landslide early warning system" *by* Samuele Segoni et al.

Anonymous Referee #2

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General comments

The paper briefly communicates the improvement of a previous version of a landslide early warning decision tree (SIGMA) by adding soil moisture information. Two separate methodologies are presented. The first consists in cutting-off the application of SIGMA if mean daily soil moisture (MSM) averaged on the given Territorial Unit (TU) is below a threshold value. The second uses the time series of soil moisture measured at a point within the decision tree of SIGMA. The topic fits within the scope of NHESS. The paper is globally well-written, though language is improvable. However, I have some concerns about the real improvement obtained by using soil moisture information, and I think that

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the authors should prove the improvement by more in-depth tests. In particular, the authors should address the following points:

- As far as I understand, MSM is available from TOPKAPI for all (or most of) the 25 TUs. Why the authors apply it only to 7 selected TUs? This could be an ad hoc choice to make the methodology work well
- Soil moisture measured at an arbitrary point (where are the punctual measurements located?), may be totally unrelated to soil moisture at landslide locations. Hence the improvement showed by the authors may be just a case. For a more robust testing, the authors should apply some sort of "jack-knife" validation test

Another point is that I do not see the rationale of considering the standard deviation of a random variate as an indication of its magnitude. The standard deviation is a measure of dispersion. The magnitude could be rather expressed by comparing the difference between the value and the mean with the standard deviation.

For the reasons above I think that this brief communication should undergo **major revisions** before its publication.

Specific comments

P3 from L18. "A back analysis. . .". Why only 7 TUs are used for the test?

P3 L19 "from 320 to 231" these numbers differ from those in table 1. That's okay because, as far as I understand, the number of TUs considered is different in the two cases. Maybe the authors should explain better this point

P4 L3: I understand that the SIGMA model has already been published by the authors, but the rationale of using standard deviation is not clear. The authors should possibly explain better this point. (See general comments)

P4 from L14 "The results of the back-analysis clearly show an overall improvement. . ." The authors should apply a more in-depth test for assessing that the performances

truly improve, by applying a “jack-knife”/”leave one out” validation test. This consists in the following: a) calibrate the decision tree based on all rainfall events except one (left-out); b) test the performance of the calibrated decision tree on the rainfall event left-out; c) repeat steps a) and b) until all rainfall events are covered as left-outs, d) summarize the results (e.g. by ROC indices) of all the left-outs. This may be done for all TUs. Other similar validation tests may be applied (See e.g. Haykin, 1997)

Haykin, S., 1999. Neural Networks: A Comprehensive Foundation. Prentice Hall, Upper Saddle River, New Jersey.

P1 L17 Possibly update references on landslide triggering thresholds by adding, e.g.: Peruccacci et al, 2017; Peres and Cancelliere, 2016; Leonarduzzi et al., 2017.

Leonarduzzi, E., Molnar, P. and Mcardell, B. W.: Predictive performance of rainfall thresholds for shallow landslides in Switzerland from gridded daily data, doi:10.1002/2017WR021044, 2017.

Peres, D. J. and Cancelliere, A.: Estimating return period of landslide triggering by Monte Carlo simulation, J. Hydrol., doi:10.1016/j.jhydrol.2016.03.036, 2016.

Peruccacci, S., Brunetti, M. T., Gariano, S. L., Melillo, M., Rossi, M. and Guzzetti, F.: Rainfall thresholds for possible landslide occurrence in Italy, Geomorphology, 290, 39–57, doi:10.1016/j.geomorph.2017.03.031, 2017.

Perhaps the introduction may take into account that the importance of including soil moisture information in landslide triggering thresholds has been stressed by a recent NHESS invited perspective by Bogaard and Greco, 2017.

Bogaard, T. and Greco, R.: Invited perspectives. A hydrological look to precipitation intensity duration thresholds for landslide initiation: proposing hydro-meteorological thresholds, Nat. Hazards Earth Syst. Sci. Discuss., 1–17,doi:10.5194/nhess-2017-241, 2017.

Tab. 1: also the number of landslides and true positives and negatives should be

shown, and commented in the text

Technical corrections

P1 L12 maybe replace “were” with “are”

P1 L22 “thresholds” instead of “threshold”

P1 L23 “landslide occurrence” instead of “the landslide occurrence”

P1 L25 “as a proxy” instead of “a proxy”

P2 L2 “landslide” instead of “the landslide”

P2 L29 here introduce the acronym MSM

P2 L27 “rainfall-runoff” instead of “inflow-outflow”

P4 L14 “importantly” instead of “important”

P4 L29 “is by large” maybe can be improved

Fig. 1: Where soil punctual measurements were taken?

Fig. 2: on the upper-left: there must be a mistake in the orientation of the arrows

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