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Geoscientific Model Development Discussions

Interactive comment on "Improving predictive power of physically based rainfall-induced shallow landslide models: a probabilistic approach" *by* S. Raia et al.

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1. In this paper, we assume a well-defined, deterministic model for slope stability. The model takes as input a variety of quantities, among which topographic data (i.e., a DEM of the area), rainfall intensity and duration, and geotechnical and hydrological parameters. Once the input data are determined, the outcome of the model is purely deterministic and we do not question here the performance of the model itself. Instead, we focus on the uncertainty associated to the geotechnical and hydrological parameters. The answer to the Referee's question is given by the practical impossibility of determining the exact numerical values of such parameters with the accuracy required

by the model i.e. on a cell-by-cell basis. It is simply unfeasible to know the required values everywhere, given their large variability. This, in turn, means that it is impossible to use the model with confidence on a large area. We propose to overcome the limitations posed by this uncertainty implementing a random sampling of the parameters values. In our study areas, use of the uniform distribution was dictated by the lack of accurate information on soil characteristics. Indeed, the use of a Gaussian distribution would imply knowing the central value and the standard deviation of the distribution for the different parameters. We suggest that this can be viewed as a new way to use the adopted stability model, since the outcome of many run initiated with different, random values of the input parameters, can be interpreted in a probabilistic way. The fact that the probabilistic approach performs better that the deterministic one is evidence of the increased predicting power of the probabilistic approach. Moreover, when exact parameter values are known, the probabilistic implementation reduces to the original deterministic model.

2. In this paper we adopt typical rainfall time series measured in the study areas. The investigation of the effects of different rainfall histories is not within the scope of the paper. A discussion of such effects can be found in Alvioli et al. (2013), where storms of different intensities and durations are systematically considered. We have added this paper to the list of references.

Alvioli, M., Guzzetti, F., Rossi, M., (2013). Scaling Properties of rainfall-induced landslides predicted by a physically based model. Accepted in Geomorphology; DOI 10.1016/j.geomorph.2013.12.039 Available at http://arxiv.org/abs/1306.1529 [physics.geo-ph]

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