Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2017-425-AC1, 2018

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Regional physically based landslide early warning modelling: soil parameterisation and validation of the results" *by* Teresa Salvatici et al.

Teresa Salvatici et al.

michele.dambrosio@unifi.it

Received and published: 13 February 2018

RC:I think this manuscript presents the application of the HIRESS code to forecast shallow landslides at the regional scale. Especially the geotechnical and hydrological input data were measured in 12 sites and then the spatial distribution of measured data was estimated by Monte Carlo simulation. Through the application of HIRESS code, it is possible to forecast the shallow landslide using rainfall data in the special area with regional scale. So I think it deserves to be published in NHESS after some minor problems are solved clearly. Some minor problems are as follows; AC: We thank the referee with his/her revision and fruitful comments.

RC: Firstly, I wonder how to consider the unsaturated soil parameters such as bubbling pressure in the HIRESS code. I think the unsaturated soil parameters were not considered in this manuscript. As you know the shallow landslide is induced by the rain infiltration into the ground and saturation of the surface soil layer. To analyse this phenomenon, the relationship between matric suction and water contents in the surface soil layer was considered in a view of unsaturated soil mechanism. AC: We thank the referee for the comment but we are not sure to have properly understood the comment. In particular we are not sure if the comment wants to highlight that the unsaturated parameters were not considered in the analysis. If this is the key point we want to stress that the HIRESSS model considers the effect of matric suction in unsaturated soils, taking into account the increase in strength and cohesion. The variation of matric suction based on volumetric water content, defined trough the hydrological model, is modelled taking into account the parameters of the soil characteristic curves (the bubbling pressure, the pore size index distribution and the residual water content). Unfortunately we have not defined the soil characteristic curve experimentally but the soil characteristic curves parameters were derived from literature values (Rawls et al., 1982) based on the soil types measured through laboratory analysis. We will revise the text providing a more clear and in-depth explanation on how the parameters of unsaturated soils have been taken into account in the analysis.

RC: Second, to make Thiessen's polygons for the rainfall data in a certain area, the rainfall data in study area as well as out of the study area especially around the study area should be used. But, in this study, the rainfall data in the only study area were used to make Thiessen's polygons. Also, the modification method of Thiessen's polygons should be verified. AC: To properly run the HIRESSS model we need spatially distributed rainfall data; the most obvious approach could be the use of a geostatistical model to interpolate rainfall data (e.g. IDW or Kriging), but these approaches are not suitable for the study area, because of the morphology of the territory (small valleys surrounded by high mountains), that is not considered in these models. So, we have decided to define a sort of "relevance area" of each rain gauge and the same rainfall

value (for each hourly time step) has been assigned inside each area. We used only rain gauges of the study area because we did not have other stations to be used in the definition of the Thiessen's polygons. The modification of polygons has been carried out to take into account the morphology of the area and to avoid that data of some rain gauges could be considered in different river basins.

RC: Finally, in this manuscript, the final aim is to set-up the early warning system for shallow landslide with regional scale. But this manuscript focused on the application of the HIRESS code to the special area to forecast shallow landslide. Therefore, this part should be corrected and complemented to match up with the overall contents of the manuscript. AC: As discussed also in the introduction of the manuscript, warning systems for landslides can be designed and employed at different reference scales. In particular local systems for single slopes and regional systems. Usually the term regional refers to an area bigger than the single slope. Here below a list of selected references that report regional application of physically based models:

Baum, R., Savage, W., Godt, J., 2002. Trigrs: A FORTRAN program for transient rainfall infiltration and grid-based regional slope- stability 322 analysis, Open-file Report, US Geol. Survey. Baum, R.L., Godt, J.W., Savage, W.Z., 2010. Estimating the timing and location of shallow rainfall-induced landslides using a model for transient unsaturated infiltration. J Geophys Res 115:F03013. Chen, H.X., Zhang, L.M., 2014. A physically-based distributed cell model for predicting regional rainfall-induced shallow slope failures. Engineering Geology doi:10.1016/j.enggeo.2014.04.011 Dietrich, W., Montgomery, D., 1998. Shalstab: a digital terrain model for mapping shallow landslide potential. NCASI (National Council for Air and Stream Improvement) Technical Report, February, 1998. Rossi, G., Catani, F., Leoni, L., Segoni, S., Tofani, V., 2013. HIRESSS: a physically based slope stability simulator for HPC applications. Nat. Hazards Earth Syst. Sci., 13, pp. 151–166. Salciarini, D., Fanelli, G., Tamagnini, C., 2017. A probabilistic model for rainfall-induced shallow landslide prediction at the regional scale, 386 Landslides, 14(5),1731–1746.

We think that the term regional is appropriate and it can be left in the manuscript.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2017-425, 2018.