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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Debris flow run-out simulation and analysis using a dynamic model" *by* Raquel Melo et al.

Anonymous Referee #1

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general comments The manuscript titled "Debris flow run-out simulation and analysis using a dynamic model", by Melo et al., concerns an interesting topic related to df scenarios and potential damage in a study basin of Central Portugal. Taking into account the topic of the special issue, some comments on possible applications in a warning system should be included. The employed model is not new. The manuscript describes an example of application of the model to map zones susceptible to debris flows originated from hydraulic erosion. Unfortunately, only scarce information seems to be available on the real cases selected for calibration/validation. Therefore, limited chances of true calibration/validation exist, and obtained scenarios seem to have a limited practical significance. Nevertheless, the manuscript could be considered for publication after moderate/major revisions. More details on application of the model to simulate real

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cases during calibration and validation phases should be given to better understand input data, assumptions and model initialization, and adopted criteria of evaluation of the results - from sites of initiation to travel paths to deposition zones. Further discussion would be important on the following issues: significance of rain data with respect to sites of debris flow development, and of adopted excess rain values, erosion coefficient and rheological parameters; available information on initiation-track-deposition zones of real cases, on depth of erosion due to entrainment, on thickness of deposits, on velocities attained. References should be extended by mentioning other types of modelling approaches.

detailed comments page 2 line 2: perhaps, it would be better to generalize “without past or historical occurrences” into “without past known occurrences”. lines 8-23: actually, there are also other types of models, suitable to medium and small scale applications, based on a discretized viewpoint (e.g. cellular automata) of the considered slopes, and on either empirical or semi-empirical approaches. Initial soil slip and successive entrainment of further material along the path of the flow are considered therein by a combination of elementary processes, acting within the cells of the computational domain. Despite adopting simplified approaches (e.g. the equivalent fluid), the rheological issues are also taken into account in some of these models through energy-dissipation options. Authors may here add some reference to some of such papers available in literature. Moreover, some comments should be included on techniques commonly adopted in literature to overcome difficulties in model calibration and validation. The need of quantitative, automated and exhaustive evaluations and sensitivity analyses (e.g. based on genetic algorithms) should also be stressed.

page 3 section 2 (Study area) Based on types of phenomena mainly considered in the paper (cf. shallow landsliding and erosion), some information on weathering conditions of the outcropping terranes would be useful. lines 20-21: please improve the sentence (“generated 20 dead people” sounds quite bad..).

page 4 line 22: some considerations should be included on all assumptions made on

all model parameters (e.g. here, critical height for erosion) and other considered factors (rainfall, soil thickness, etc.).

page 5 line 5: please check and improve the sentence “The routing of solids and water are separately, obeying”. lines 12-13: please check and improve the sentence “These two debris flows were selected based on its size and volume of the mobilized material, as well as the conservation of deposits at the time of field surveying.”. line 15: it is not clear whether the overlap between simulated and real case was considered or not for calibration and validation purposes (cf. criteria a-c, lines 15-19). Such type of evaluations should be performed, whenever feasible, in a quantitative way by employing a suitable fitness function (as commonly seen in literature). lines 22-23: the sentence “It is also known that rainfall hourly data are more important than rainfall cumulative daily data.” is correct if restricted to shallow landslides and hydraulic processes on the slopes. lines 30-31 (and following): the lack of information on amounts of rainfall and on characteristics of the soils in the study area seems a limiting issue for proper model applications. Authors should extend the discussion of such limitations and of solutions adopted.

page 8 lines 16-17: “We found out that excess rain values lower than 28 mm h-1 do not generate debris flows. Thus, the calibration was performed using an amplitude of 1 mm h-1.” it is not clear how such threshold was determined. Please, add some more details and explain better the connection between the two sentences. lines 17-22: again, please give more details on how mentioned thresholds were determined.

page 9 line 6: “..related with the run-out..” perhaps “related to”?

page 10: lines 8-9: “..according to the models performed, it is possible to determine that the stages of initiation, transport and deposition of DF #1 had a total duration of 53 minutes, whereas DF#2 occurred over a period lasting 77 minutes.” I’d rather say that these durations result from model applications. A description of what actually occurred in the field is not so immediate.. line 16: “In a first analysis, the values obtained for

scenarios A and B appear to be realistic..” how was performed such evaluation? did you use an objective criterion to decide when they are not realistic? (even considering limitations on field data) lines 18- end of section 4: before commenting presence of buildings in areas affected by the simulated flows, you should discuss (in quantitative way) the ability of the model to simulate known real cases (by comparing simulated vs. real affected areas, as said above). Moreover, once calibrated against real cases, the model should be validated (again, in a quantitative way) against further real cases (not employed for calibration). It is not clear whether/how calibration and validation was performed in this study. section 5 (concluding remarks) To be updated after revisions to the other sections.

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