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Hydrology and Earth System Sciences
Discussions

Interactive comment on "iCRESTRIGRS: A coupled modeling system for cascading flood-landslide disaster forecasting" *by* K. Zhang et al.

Anonymous Referee #1

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General Comments: This paper represents a significant conceptual advancement in the modeling of flash flooding and shallow, rainfall-induced landslides. Combining CREST and TRIGRS appears to provide a fairly complete solution for modeling the surface water, shallow subsurface hydrology related to runoff and flooding as well as the initial hydrologic conditions, transient pressure head, and slope stability processes related to landslide initiation. The paper is generally well written and provides a general framework for modeling the hazards resulting from heavy or prolonged rainfall. The paper could be improved by stating more of the modeling assumptions (see specific comments) used in the case study and making a number of technical corrections.

Specific Comments:

1. P. 1, lines 19-20 and p. 2, line 9: The phrase "leading to losses that are significantly greater than the sum of the losses from the individual hazards" seems a little nonsensical. I understand that the authors are trying to convey the synergistic effects of flooding and landslides, but the effect of combined versus separate action of the hazards needs to be expressed more clearly. Consider "losses resulting from the combined hazards are significantly greater than the sum of losses from the hazards if acting separately"

2. P.1 line 23. It is confusing to refer to this combined modeling system as an "early warning system." A modeling system is part of many early warning systems, but warning systems consist of much more than computer models. Change "coupled flash flood and landslide disaster early warning system" to "coupled flash flood and landslide initiation modeling system"

3. P. 2, lines 27 – 32. These two sentences seem somewhat contradictory. The emotional effects of the recent devastating tornado seems to have been more critical in determining public behavior than the source of the warnings. Either rephrase to clarify that different sources of the flash flood and storm forecasts had a lesser role or explain how this contributed to the fact that the public's attention was drawn to the tornado warnings.

4. P. 4, line 12. Is there a reference for the "multi-linear reservoir" concept?

5. P. 4, lines 30 – 31. Delete reference to Iverson (2000) in line 31. The "pressure-diffusion solutions for pressure changes below the water table," though somewhat similar to the pressure-diffusion solution presented by Iverson (2000) for specified flux at the ground surface use different boundary conditions.

6. P. 6, line 6. Are the parameters a and b in equation 3 determined theoretically or empirically?

7. P. 8, lines 10 – 20. A few more details are needed regarding modeling assumptions: What assumptions were made regarding soil depth (constant or spatially varying? if

so, how?)? Did you check the factor of safety for prestorm initial conditions to confirm that no (or very few) grid cells had a factor of safety less than 1? For the pressure head computations used to compute factor of safety, did TRIGRS and iCRESTRIGRS use the unsaturated infiltration model as described at the bottom of p. 4? If so, why does table 1 not contain columns for the alpha (inverse height of capillary fringe) and residual moisture content values used in computing pressure head?

8. P. 12, lines 6 – 8. A new MPI version of TRIGRS is available that could help with the large area and finer grid assessments suggested here. The citation is Alvioli, M., and Baum, R.L., 2016, Parallelization of the TRIGRS model for rainfall-induced landslides using the message passing interface: Environmental Modelling & Software, Vol. 81, July, p. 122 - 135. doi:10.1016/j.envsoft.2016.04.002

9. Figure 6. Please label key factor of safety values (0.9, 1.0, 1.1) along the ROC curve.

Technical Corrections:

P. 2, lines 16 – 17. Change "damaging infrastructure based on the work of Wooten et al. (2008) and the following geological surveys." to "damaging infrastructure (Wooten et al. 2008; Bauer et al. 2012)."

P. 2, line 27. Change "marking" to "making"

P. 2, line 28. Change "largely" to "partly"

P. 2, line 29. Change "(Uccellini et al., 2014); the public's attention" to "(Uccellini et al., 2014). Moreover, the public's attention"

P. 6, line 21. Change "model realistically compute" to "model to realistically compute"

P. 7, line 34. Insert "dataset" after "(STATSGO)"

P. 8, line 2. Change "Land Cover Database (NLDC) 2011 land cover database (Homer et al., 2015)." to "Land Cover Database (NLDC) 2011 (Homer et al., 2015)."

P. 8, lines 4 – 6. Change "15-minute streamflow observations from four USGS streamflow gauges (#03503000 at Little Tennessee River, # 03513000 at Tuckasegee River, # 03460795 at Pigeon River, and # 03453500 at French Broad River) were aggregated to hourly resolution and serve as streamflow validation data for the model." to "Streamflow observations from four USGS streamflow gauges (#03503000 at Little Tennessee River, # 03513000 at Tuckasegee River, # 03460795 at Pigeon River, and # 03453500 at French Broad River) were aggregated from 15-minute to hourly resolution and serve as streamflow validation data for the model."

P. 9, line 11. Insert "indicator" after "global statistical accuracy"

P. 9, lines 19 – 20. Change "Apparently, the storm was rapid and intense." to "The storm was rapid and intense."

P. 9, line 29. Change "the land surface's slope is predicted to fail" to "the regolith that covers the sloping ground surface is predicted to fail"

P. 10, line 7. Change "way how infiltration" to "way that infiltration"

P. 11, line 34. Change "It is worth to note that there is still a large room for improving" to "It is worth noting that there is still much room for improving"

P. 13, line 1. Change "and Anders, C. F.:" to "and Anderson, G. F.:"

Table 1. If the unsaturated infiltration option was used in TRIGRS and iCRESTRIGRS, then add columns for the inverse height of capillary rise (alpha) and residual moisture content (theta-sub-r).

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