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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Landslides Data Assimilation Using TRIGRS Based on Particle Filtering" *by* Changhu Xue et al.

Anonymous Referee #1

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General comments: The paper is an interesting application of data assimilation to time-series modeling of a slow landslide using TRIGRS. The use of TRIGRS in this respect is novel to my knowledge. The paper is well-organized, however I believe the discussion is lacking sufficient detail and explanation which would aid the understanding of the reader and enhance the impact. In particular, the ultimate added value of this procedure is not well-defined. If calibrated model inputs are desired, it makes sense to discuss the various other interdependent input parameters of TRIGRS. If corrected model outputs are desired, then more discussion of how the corrected TRIGRS outputs compare to observations and to uncorrected outputs is needed. The figures have a lot of data on this subject but discussion of the figures is too brief in my opinion.

Specific comments:

1. pg2 line 4, the word "background" is used throughout the manuscript and is clearly used in reference to the TRIGRS model, but the meaning isn't quite clear to me. If this is a term more common to DA literature it would help to more explicitly define it here.

2. pg 2 line 10, another recent DA application to natural hazards is Brezzi et al. (2016). "A new data assimilation procedure to develop a debris flow run-out model" Landslides. October 2016, Volume 13, Issue 5, pp 1083–1096 https://doi.org/10.1007/s10346-015-0625-y

3. pg 2 line 30, "It is at the east of the Tibetan Plateau,..." This sentence is awkward and should be reworded.

4. pg 3 line 25, the projected GPS and InSAR tend to agree, but in the DA procedure, which is used for comparing FS values? InSAR only? Is the GPS essentially a check on the InSAR?

5. pg 4 line 3, "Other parameters are fixed." Please mention how other parameters are determined, especially rainfall intensity, and if their sensitivity affects friction angle. Conductivity and other hydraulic parameters will have a significant effect on the time-evolution of output FS and directly relate to the pressure head output. Why was friction angle chosen? Please explain this choice and the choice of other parameters. If the purpose of DA is to correct model outputs as opposed to back-calculating "true" model inputs, then I can see why it wouldn't be as important to calibrate all the input parameters. If that is the case, I think a bit more discussion is needed highlighting the improvement and emphasizing the utility of the corrected outputs.

6. pg 4 line 7, is the sensitivity analysis performed at the first time step? Please clarify.

7. pg 5 line 5, "change of internal friction angle is mainly affected by soil water and deviation of other initial parameters." I'm not clear on what is meant by this. I'm guessing it means that changing friction angle is effectively correcting for inaccuracies in the hydraulic parameters. But the pressure head output is independent of friction angle,

so I'm having trouble understanding the added value of DA with regard to the pressure head outputs. Regardless, I think this sentence should be elaborated on.

Regarding Figures 9 and 12: If TRIGRS FS continues to decrease while the observed velocity stays constant, then would friction angle continue increasing arbitrarily until it would eventually reach unrealistic values?

8. pg 5 line 6, how does the calculated average deformation rate compare to the observed?

9. pg 5 line 9, "It can provide a reference for slope analysis." Again, I think it would be good to expand on how the corrected outputs are useful and explain why others might find utility in replicating this procedure.

Grammar and figures: The English of this paper is good, however there are many instances of slightly awkward wording, a few misspellings, and inconsistent capitalization.

Figures 1, 2, and 3 should be improved. Text size should be increased and some sort of contrast should be added to make it more readable against the dark background. The inset map on Figure 1 needs to better identify the study area location (the red box is too small to see clearly). All maps require a scale bar and north arrow.

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