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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Simultaneous state-parameter estimation of rainfall-induced landslide displacement using data assimilation" *by* Jing Wang et al.

Anonymous Referee #2

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The manuscript describes a method for predicting landslide displacement using simultaneous state-parameter estimation (SSPE) with data assimilation and shows application of the method to a landslide in Sichuan, China. The paper is concise and well organized. References are mostly adequate and current. The English is mostly adequate, but the paper would benefit from editing to improve clarity and grammar.

I have two main criticisms of this paper: (1) The polynomial trend line alone (Fig. 6) seems to be a better predictor of the net displacement than the full method (SSPE accumulation prediction + polynomial trend line, Fig. 9). (2) The authors have not shown conclusively that their proposed method works in a situation that is critical for

hazard management, namely, predicting when landslide displacements will accelerate to rapid, dangerous movement.

Regarding point 1, above, visual comparison of the different plots in Figures 6, 7, 8, and 9 is complicated by different vertical scales and lengths of the time series shown. Please show dates rather than time steps and use the same starting and ending dates for each of the plots in Figs. 6,7,8, and 9. Inconsistencies between amplitudes of observed periodic displacements in Fig. 7 (+/-10 mm) and Fig. 8 (+/-30 mm) cast doubt on results of the SSPE assimilation prediction in Figs. 8 and 9. Nevertheless, the overall displacement pattern (Fig. 6 and 9) is relatively steady (gradually changing) and the periodic component of displacement appears to account for only a tiny fraction of the net displacement. At the five-day time step used, the additional complication of predicting the periodic displacement component seems unnecessary for the data from stations GPS03 and GPS04.

Regarding point 2 above, relatively steady movement like that observed at stations GPS03 and GPS04 is relatively easy to predict and does not require a very sophisticated model to predict the displacement pattern, as discussed above. It is important that any method of predicting landslide displacement perform well in predicting relatively steady or gradually accelerating and decelerating movement and the time series from stations GPS03 and GS04 are well suited for such a test. An additional displacement time series that shows quick acceleration from slow movement to very rapid movement would provide an important practical test of the method. Displacement predictions in such a case would require shorter time steps (perhaps variable time steps that get shorter as displacement rate increases). How would that affect model performance (accuracy and computational speed?

Additional comments: Show an outline of the landslide boundaries on Fig. 3. Page 1, line 22, A more general reference about landslide danger to life and property is needed here. Page 2, lines 18 and 19, check citations against reference list.

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