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Hydrology and Earth System Sciences Discussions

Interactive comment on "Towards the sequential assimilation of SAR-derived water stages into hydraulic models using the Particle Filter: proof of concept" *by* P. Matgen et al.

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The manuscript by Matgen et al introduces the application of particle filtering data assimilation procedure to improve flood inundation forecasting by the coupled hydrologic-hydraulic modeling. In a synthetic framework, they assimilated the SAR-derived water stages into the model to test the usefulness of the particle filtering. I enjoyed reading the paper and I am glad to have the opportunity to provide some comments for better clarity and contribution of the work. Paper is well written with good syntax aside from minor grammatical errors that can easily be corrected in the revised version. I had the chance of seeing the constructive comments provided by other referees, therefore, I

will highlight some other outstanding issues in the paper as follows:

Specific Comments:

1. It appears that the authors have used the CLM as the hydrologic model to provide the hydrograph as the input to the hydraulic model. Given the great amount of complexity of such a land surface model that considers both energy and water balances in its conceptual framework, it is not clear to me why the authors have picked such a model knowing that they have set-up a synthetic case study. Minimal illustration was provided for the hydrologic model (CLM) used considering that it could be a main source of uncertainty water stage estimation. If the importance of the hydrologic model is minimal in the study why they have not chosen a simple conceptual model for this which could be sufficient for a proof of concept?

2. Section 2.1 "Experimental Design", It is mentioned that the adopted experimental design depicted in figure 1, is similar to the presentation by Andreadis et al. (2007), however, it appears that Figure 1, is very similar to the schematic framework presented by Moradkhani (2008) in figure 2 of his paper. It would be more clarifying if the authors explain about this in the paper.

3. Minimal and simplistic illustration has been provided for the data assimilation (Particle filtering) in section 2.2 presuming that this is the major portion of the current paper contribution. I think after reading the paper, still many ambiguities remain about the particle filter implementation for water stage estimation. Therefore, section 2.2 needs to be elaborated further and explained more clearly that a reader interested to the subject can duplicate the work without reading many other articles to understand this.

4. Page 1794, L 5-13, it is not clear to me if the authors have applied the SIR particle filter or they just mention the features of SIR algorithm. Further illustration would clarify the issue.

5. I would call the HEC-RAS model as a hydraulic model rather than a hydrodynamic

model that the authors used throughout the paper.

6. Page 1796, L1-10, authors mention that they perturbed the forcings, parameters and the initial condition by adding a Gaussian random number to their deterministic values. Knowing that the forcing data (in particular the precipitation) to hydrologic models have the multiplicative nature, the forcings need to be perturbed lognormally instead, to be more realistic.

7. The procedure for generating a meaningful ensemble in hydrologic modeling and data assimilation as explained through equations 5-9 was also explained by Moradkhani et al., (2005). This is meant to provide more historical background on the subject.

8. Page 1797, L13-15, " ..., an artificial positive bias of 25% was introduced to the simulated upstream boundary discharge ... to simulate the bias that is inherent in most model realizations, even after calibration". I am not sure if this is a true statement that after calibration we observe positive bias in models. If there is such a huge bias in the calibrated model, most likely the model calibration is ineffective or the hydrologic model has structural deficiency.

References:

Moradkhani, H., Sorooshian S., Gupta, H.V., Houser, P.: "Dual State-Parameter Estimation of Hydrological Models using Ensemble Kalman Filter", Advances in Water Resources, 28, 2,135-147, 2005.

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