

## ***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.***

**Anonymous Referee #5**

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This study describes a identical twin data assimilation experiment, where synthetic SAR-derived observations of water stage are assimilated into an offline-coupled hydrologic/hydraulic model (CLM and HEC-RAS) over a 19 km river reach, using a Particle filter. The manuscript is well written, and the topic is appropriate for the Hydrology and Earth System Sciences journal. There are a couple of issues that need to be addressed, particularly pertaining to the generation of the synthetic observations, therefore I recommend publication after minor revisions.

p. 1787, line 6: reference for use of optical imagery.

p. 1789, line 29: why doesn't the Hostache et al. approach seem to be a valid approach

C875

for operational situations?

p. 1791: What are the characteristics of the SAR observations and how do they relate to the synthetic observation generation (e.g. spatial and temporal resolution)? This is quite important as the synthetic experiment needs to be made as realistic as possible, in order to provide insights for a future real-data application.

p. 1795, lines 1-3: this sentence creates more questions than answers. How is the model structure transparent and optimized? I suggest re-wording or removing the sentence altogether.

Fig. 2: it might be worth showing the deterministic CLM simulation along with the generated ensemble.

p. 1798, line 18: the standard deviation of 2 m is missing from the text.

p. 1803, line 16: I would be a little careful about the sentence “synthetic observations that are realistic in terms of accuracy for remote sensing-derived water levels”. Perhaps rephrase?

p. 1803, lines 17-20: the authors state “We advocate the use of a particle filter as part of the proposed assimilation scheme because it provides flexibility regarding the form of the probability densities of both model simulations and remote sensing observations”, but this wasn't really shown in the results. If the authors do want to explore this, very interesting, question they could perform the same analysis using an ensemble Kalman filter for example.

p. 1804, lines 8-11: “The error forecast model regresses the future error value against the current value”; I believe this is slightly misleading, because the error model essentially uses a constant value between update times from what I understand. Using this error model in an ungauged basin, could be necessary due to lack of alternatives, but it would likely be quite inaccurate.

p. 1804, line 12: change “add to model error” to “added to model errors”.

C876

