We would like to thank Referee #2 for the important comments given in order to enhance our manuscript.

**MAJOR COMMENTS**

**COMMENT 1**

**R:** *The experimental setup and analysis of the results contain a major flaw. While the EnKF and PF both perform poorly, the PF with parameter resampling is suggested to overcome the problems of the EnKF and PF. This may be true but it is necessary to allow for parameter estimation in the EnKF as well to provide an objective analysis. As it stands, the manuscript overlooks the recent work by many authors to use the EnKF and also PF for state and parameter estimation. I would suggest adding a state-parameter estimation experiment with the EnKF, and providing a literature review on the works done on state-parameter estimation that have performed similar studies recently, to give a balanced analysis of the techniques and advancement made.*

**A:** We agree on the fact that in the manuscript we have not focused on state-parameter estimation using the EnKF. As suggested by the Reviewer, we will add the following references to the manuscript and modify the introduction section to cite these references:

Dechant C, Moradkhani H. (2010) Radiance data assimilation for operational snow and streamflow forecasting. Advances in Water Resources DOI 10.1016/j.advwatres.2010.12.009.

Franssen HJH, Kinzelbach W. (2008) Real-time groundwater flow modeling with the Ensemble Kalman Filter: Joint estimation of states and parameters and the filter inbreeding problem. Water Resources Research 44: W09408.

Leisenring M, Moradkhani, H. (2010) Snow Water Equivalent Estimation using Bayesian Data Assimilation Methods. Stochastic Environmental Research and Risk Assessment, : 1–18 DOI 10.1007/s00477-010-0445-5.

Montzka, C., Moradkhani, H., Weihermuller, L., Canty, M., Hendricks Franssen, H.J.,Vereecken, H., "Hydraulic Parameter Estimation by Remotely-sensed top Soil MoistureObservations with the Particle Filter", Journal of Hydrology, 399 (3-4), 410-421, 2011.

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, 2005a.

Moradkhani, H., Hsu, K., Gupta, H. V., and Sorooshian, S.: "Uncertainty Assessment of Hydrologic Model States and Parameters: Sequential Data Assimilation Using Particle Filter", Water Resources Research, 41, W05012, doi:10.1029/2004WR003604, 2005b.

Wang D, Chen Y, Cai X (2009) State and parameter estimation of hydrologic models using the constrained ensemble Kalman filter. Water Resources Research 45: W11416.

However, we consider that our study is focused on the application of the particle filter and the possibility to improve baseflow predictions without the need of estimating all the parameters related to the different biophysical processes represented in the CLM. In this sense, we think that a comparison between the proposed methodology and the state-parameter EnKF is unnecessary since the main contribution of this paper is to highlight the potential of using the particle filter under the example-study conditions.

**COMMENT 2**

**R:** *Another key issue is the setup of the synthetic experiment. While using a different parameter set to create the synthetic truth than for state estimation experiments, a bias is created, which is often the case in real experiments, but it is difficult to say how realistic these errors are. This is especially important in looking at the somewhat conceptual parameters, such as the number of layers contributing to baseflow and surface runoff. By changing these parameters, the physics in the model may be altered to a point where soil moisture assimilation would not be expected to improve baseflow prediction. This is especially likely since the different parameter sets partition flow differently between surface runoff and baseflow (specifically parameter set 1 and 2).*

**A:** This is a very important comment and we have to clarify the following in the content of the paper.

First, for the generation of the synthetic truth, parameters NwRb (baseflow parameter) and NwRs (runoff parameter) are set to values of 5 and 4, respectively. These values are identical to parameter set 2 and different from set 1 and 3. We agree with the comment given above related to these two parameters, and this fact is corroborated when cheking the baseflow RMSE indices for the different parameter sets in Table 3. The improvement in the modelled baseflow without assimilation and using the SIR+PR is of around 13% for set 1, 67% for set 2, and 22% for set 3, with the best performance for set 2 due to the use of identical values for NwRb and NwRs. We think that we obtained an improvement in the baseflow predictions with parameter set 1 and 3 because the values do not differ much from those in set 2.

Second, we have to specify in the paper that parameters NwRb and NwRs are not being resampled. Although we identified the optimal values through the calibration, these parameters are not taken into account in the resampling step.

**R:** *I suggest that there be more justification that the assimilation of soil moisture from the synthetic observation should improve the baseflow characterization in the model based on different parameterization. This is necessary to highlight the importance of parameter resampling as suggested by the title.*

**A:** We think that it is possible to justify the improvement obtained based on different parametrization by explaining in the paper that the three parameter sets represent three local minimas in the parameter space since these sets are obtained through calibration with discharge observations, and the idea of the resampling is to assign consistent paremeter values with specific moisture conditions, but always playing within a parameter value range wich is in the vicinity of the local minima. The latter can be proven by the small additive noise used in the perturbation of the resampled parameters.

Moreover, we consider the idea given in the previous paragraph as a new contribution to solve the discharge-prediction problem, and we assume it to be different from other approaches. The synthetic nature of the study is justified by the fact that real data sets contain inaccuracies which are difficult to assess, making it very difficult to demonstrate our approach.

**MINOR COMMENTS:**

1) *Page 5853, Lines 16-18: The description of model setup to use individual "patches" as ensemble members could use further expansion. It is difficult from this explanation to understand exactly what the author means.*

**A:** The description of the use patches as ensemble members will be expanded in the manuscript.

2) *Page 5855, Lines 1-2: "Depending on the algorithm, either an ensemble of synthetic observations is generated (for the EnKF) or only a single realization (for the PF)." While it is correct to perform this way (though an ensemble of observation can be used in the PF as well), this description is a little misleading and can give the reader the impression that the PF and EnKF must be treated entirely differently or are not applicable to the same situation. I suggest revising this sentence.*

**A:** The sentence will be revisited.

3) *Page 5856, Line 6: I am unclear of what is meant by "optimal disturbance fraction". I assume this is the relative error associated with the magnitude of the given value but an equation would help. Also, it seems that 0.01 for forcing data is quite low. Can you provide justification for this?*

**A:** This will be clarified and the number will be justified.

4) *Page 5862, Line 28: "Residual resampling is an improved version of the SIR method" is not proven. Though it has been suggested, the literature does not support this statement. Also, if this was proven, by opting for SIR over residual resampling without justification degrades the quality of the paper. I suggest removing this comment or describing residual resampling as an alternate to SIR.*

**A:** Thanks for the suggestion, it will be taken into account.

5) *Page 5864, Line 5-10: These lines state that MCMC steps can "handle" particle degeneracy problems. Though this has been suggested in the literature, it is not a proven methodology in hydrologic modeling.*

**A:** These lines will be modified according to the comment.