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Comment on hess-2020-668

Anonymous Referee #2

Referee comment on "Technical Note: Sequential ensemble data assimilation in convergent and divergent systems" by Hannes Helmut Bauser et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-668-RC2>, 2021

General comments: The technical note titled "Sequential ensemble data assimilation in convergent and divergent systems" written by Hannes Helmut Bauser et al. investigated the performance of data assimilation in convergent and divergent systems. Although the manuscript showed how a sequential data assimilation method (EnKF) works in two convergent and divergent systems, at the current version, manuscript only showed the results of different case studies without detailed explanation why we observed those results, which is crucial for technical studies. In addition, the manuscripts did not provide suggestions to improve the performance of data assimilation in convergent and divergent systems. In my opinion, it is better if the manuscript considers scenarios that use one or two techniques to maintain ensemble spread or to avoid convergence to wrong states in convergent systems as stated in the introduction section. Examples presented in the manuscript is ideal. Authors may consider examples that are nearer to the realistic cases.

Specific comments:

- Introduction: Evidences on why we need to assess the performance of data assimilation in convergent and divergent system should be more clearly stated (why we need to do this study). How convergent/divergent system impacts on the effectiveness of data assimilation? What is the disadvantage of divergent systems (slowly converge to the truth state?) ? Provide more examples of convergent/divergent systems in hydrology and geosciences.

- Section 3 and 4: Provide more technical explanation of the obtained results and show the quantitative criteria (NSE, relative error, correlation coefficient, etc.) that compare results obtained with data assimilation and with forecast (open loop), especially explain the changes of ensemble variance with time. Why the initial condition for data assimilation was not set to be different from the true one? What is the observation values used for assimilation and their corresponding errors?

- Section 4: Which method was used for joint state and parameter estimation?

- Figure 1: Show the results corresponding with forecast in figures 1a,b,d for comparison. Explain what is and .

- Figure 2: results obtained with the forward run without data assimilation should present in figures b,c,d for comparison.