Reviewer #2:

General comments

This paper presents an innovative application of a hybrid data assimilation algorithm, EnKF-OI (Optimal Interpolation), for streamflow and flood prediction. The hybrid algorithm, developed by El Gharamti et al. (2021), offers novel advancements in hydrologic prediction. It enhances the ensemble spread of EnKF through two key mechanisms: (1) incorporation of time-invariant climatological error covariance into the prior ensemble covariance matrix, and (2) integration of along-the-stream localization. The study conducts a comprehensive evaluation of the hybrid algorithm using two case studies: flash floods in West Virginia and long-term flooding in Florida. Results are analyzed across four main dimensions: (1) weighting between dynamic and static covariances, (2) dynamic ensemble size, (3) adaptive weight adjustment, and (4) short-term streamflow forecasts. The hybrid data assimilation algorithm shows promising performance in two applications.

The paper fits the scope of the HESS. The innovation of this research is clear to me. The experiment design, result analysis, and the presentation of this paper are of good quality. It is a pleasure of reading this research. I suggest a minor revision.

We would like to thank the reviewer for their positive and constructive review. All reviewer's comments have been addressed. Please find our response below.

Minor comments to the authors

1. Line 6: Consider adding a reference to "El Gharamti et al." in the abstract.

   We have checked the HESS guidelines for adding citations to the abstract and found out that it's not allowed, so we remove the reference.

2. Line 44: Ensure consistency in abbreviating "United States" (USA or US).

   We decided to stick to the US and be consistent as suggested by the reviewer.

3. Line 85: Clarify the difference/relationship/innovation between the existing HydroDART system and the EnKF-OI algorithm employed in this study. Is the EnKF-OI algorithm newly developed or already in the HydroDART system? This clarification would highlight any methodological innovation in the paper.

   We would like to thank the reviewer for pointing this out. Indeed, for this work we have implemented the adaptive hybrid EnKF-OI scheme in DART from scratch. This marks the inaugural implementation of hybrid ensemble-variational filters in DART. It's also the first realistic large-scale application of the adaptive hybrid scheme. The added text reads as follows:

"The implementation of the hybrid ensemble-variational scheme is the first of its kind within DART and features several flavors for updating the hybrid weighting coefficients including: constant weights, time-varying homogeneous weights in addition to the more comprehensive temporally and spatially varying weights (as in this work)."

4. Line 118: Provide a brief explanation of "nudging."

Thank you for pointing out the need to expand, in response this sentence has been added.

"Streamflow nudging is the current data assimilation methodology in NWM operationally. "Nudging" also known as direct insertion refers to moving the modeled flow towards the observed discharge at each time step of the routing model."

5. Lines 125-127: Consider rephrasing this sentence for clarity or conduct a grammar check.

Thanks for the suggestion! This section has been restructured based on the input from both reviewers.

6. Line 202: Confirm if the sentence "The notation… is equivalent to the trace of matrix A" is used in the preceding equation.

The equation has been corrected to reflect the variables in the preceding equation.

7. Line 206: Check the format of the reference "El Gharamti (2021)."

Done.

8. Lines 397-398: Clarify if this sentence refers to the last subplot of Figure 7.

We added text clarifying that the discussion is referring to the bottom panels of Fig. 7.

9. Is it possible to shorten this paper by moving some results (e.g., 2nd case study relevant content) to the supplementary? The current manuscript is relatively long.

We understand the reviewer's concern, however, the choice to test the adaptive hybrid EnKF-OI scheme in two different domains was intentional. We wanted to validate and test the robustness of the scheme in varying hydrological conditions; in this case (i) quick flash flooding and (ii) long lasting inland flooding due to hurricanes. We also tried to present a detailed verification process in order to cover all aspects of the algorithms and uncover its characteristics under several conditions: e.g., low flow, high flow, bias, reliability, accuracy, etc. We strongly believe that having both test cases in the manuscript is important to support our conclusions.