In this study, the authors present a Data Assimilation (DA)-hydrodynamic modeling framework where multiple gauge observations are integrated into the LISFLOOD-FP model to improve the performance of flood inundation mapping. The results indicate that the multivariate assimilation of point-source observations into hydrodynamic models can improve the accuracy and reliability of probabilistic flood inundation mapping by 5-7% while it also provides the basis for sequential updating and real-time flood inundation mapping. This paper is well written, well-organized and has practical meaning for inundation mapping, risk analysis and decision making. I have some minor comments for the authors to improve their paper.

Response: We thank the reviewer for the positive evaluation of our work.

Line 168: Xu et al., 2017 is used as a reference. However, this paper is not listed in the bibliography.

Response: This reference will be added to the bibliography.

The text (e.g. names of counties and states) in Figure 1 is blurred. Please improve it

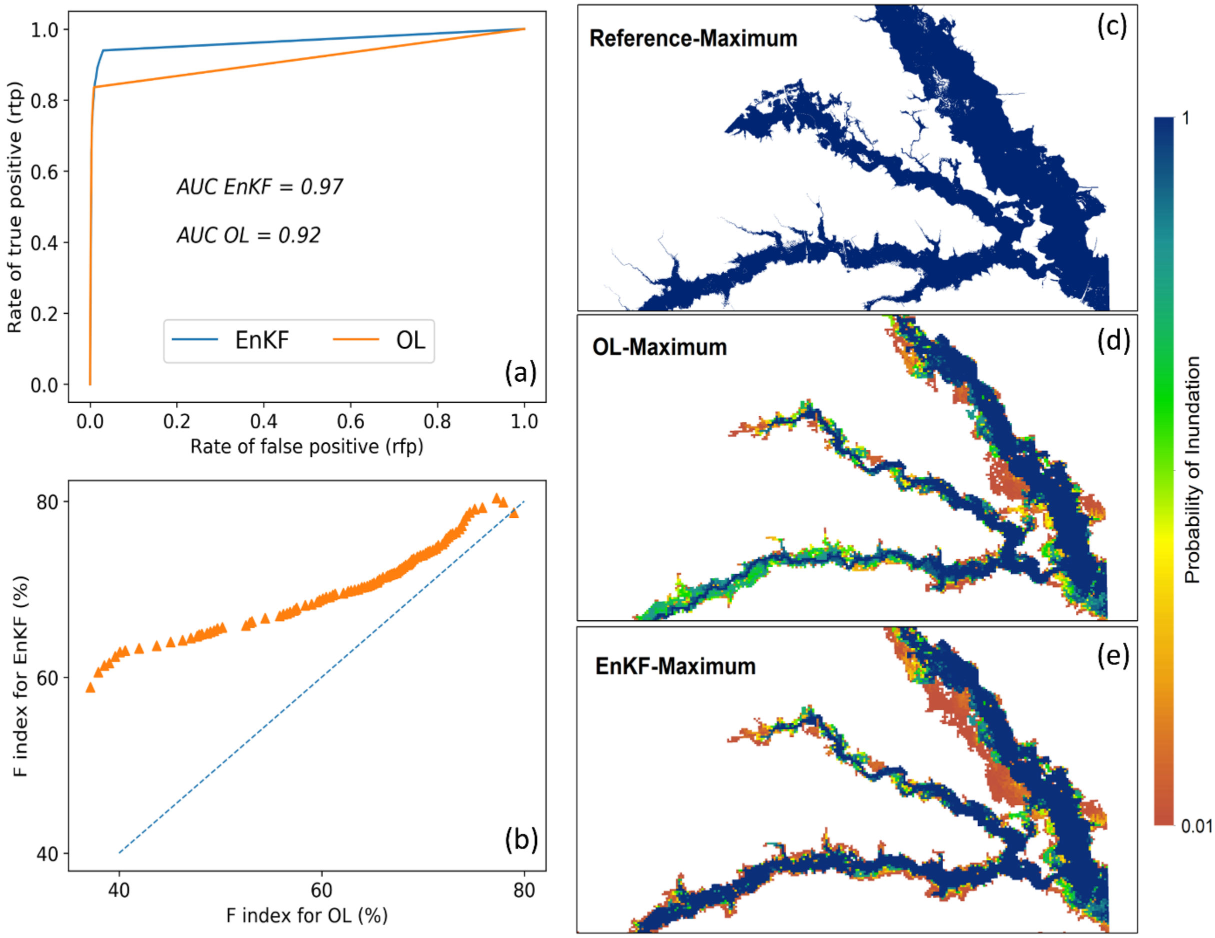
Response: The quality of figure will be improved in the revised version of the manuscript.

In addition, the water discharge at gauge 1 and 2 as well as water stage at gauge 2 (n=3) are assimilated. The authors could also assimilate the water discharge and the water stage at gauge 1, 2 and 3 to further improve the performance. Is the data available?

Response: Thank you for the comment. The water stage at gauge 2 is not available for the peak of Harvey. We used all available data for two internal gauges. In this research we explain the DA-hydrodynamic modeling framework in a generic format where n number of point source observations can be assimilated into a hydrodynamic model. This helps the potential users to follow this approach and apply it for different number of observations in future studies.

Figures 6 & 7: the two figures presented the comparison between OL and EnKF. It would be better to add the real inundation map in the third column of the figures.

Response: The reference flood inundation map we use in this study is representative of maximum flood maps during all days (The union of daily flood maps). We don’t have daily real inundation maps to compare with simulated maps at daily scale. However, we provided these two figures to explore the differences of OL and EnKF approach for generating probabilistic inundation maps. In order to validate these two methods, we first evaluate the temporal behavior of these two approaches by comparing the simulated time series with observations at gauges (Figure 4) and then test the spatial behavior by taking the union of all simulated daily maps and comparing with the reference map in Figure 8. Although we don’t have daily real maps to update Figures 6 and 7, we improved Figure 8 by adding three subplots that display the comparison of maximum OL and ENKF with reference map. Please see the updated figure below:

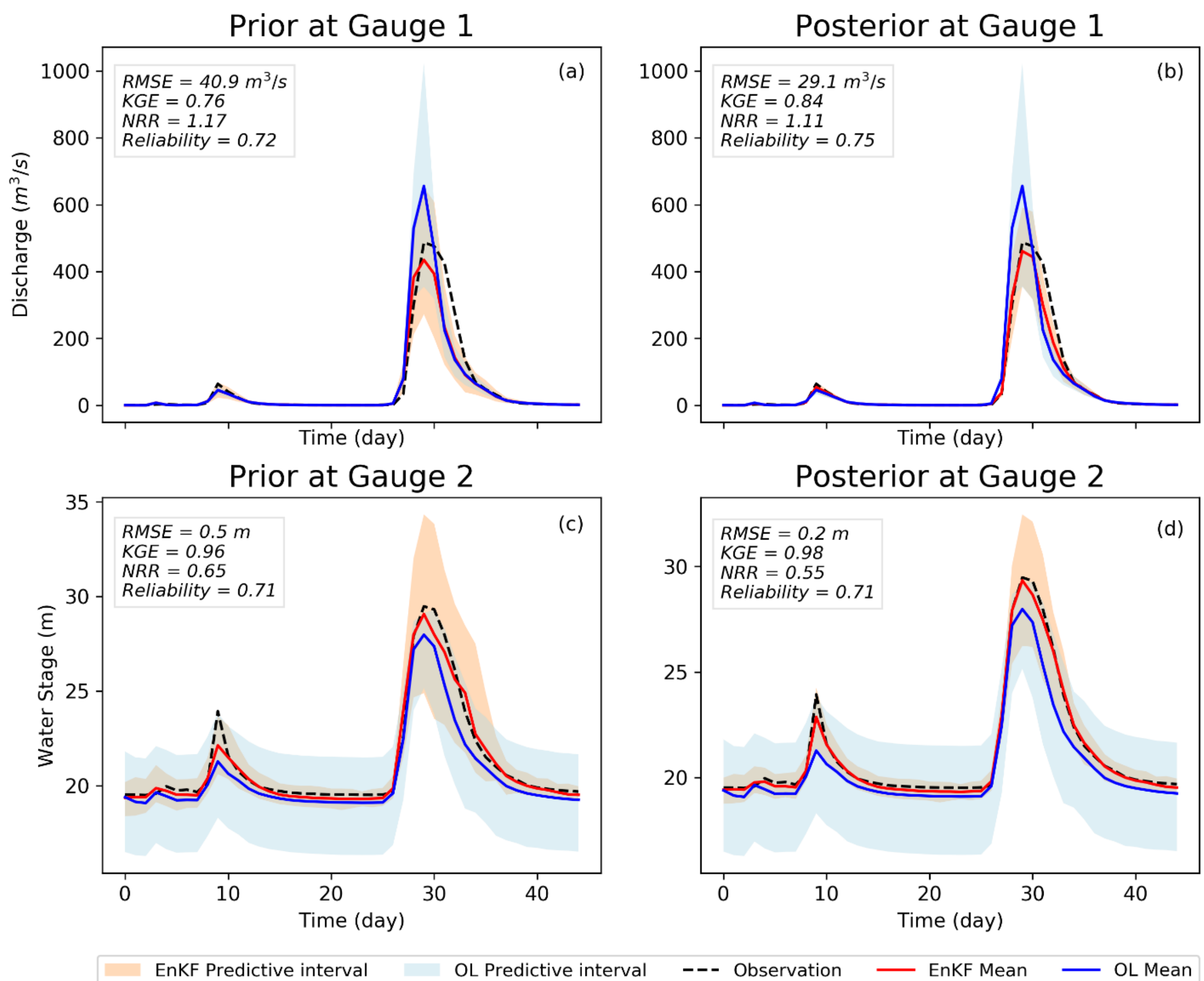


Line 542-545: Here, we used the EnKF data assimilation method in conjunction with a hydrodynamic model to account for different sources of uncertainties involved in different layers of model simulations, including the boundary conditions, model parameters, and initial condition, and generate real-time probabilistic flood inundation maps. It is nice to consider different sources of uncertainty here. How the uncertainty fluctuates with ensemble size and error settings?

Response: Analyzing the sensitivity of DA-hydrodynamic modeling results, to the error settings and ensemble size, is an interesting topic of research. However, to accurately address these two points, a multitude of DA-hydrodynamic models should be simulated within a sensitivity analysis framework which is not within the scope of this study. Here, we aimed to demonstrate the effectiveness of assimilating multi-source data into hydrodynamic models for improving inundation mapping skill. According to several past studies that explored the sensitivity of EnKF to the ensemble size, the model performance is highly sensitive to small ensemble sizes less than 50 but the sensitivity will be reduced by moving to larger numbers around 100 (e.g. see Figure 4 in Moradkhani et al., 2005 and Figure 2 in Gillijns et al., 2006). With access to sufficient number of computing cores at the University of Alabama High Performance Computing cluster, we were able to use a relatively large number of 100 ensemble members (It is larger than most of studies that used EnKF method). This ensures that our results will provide reasonable range of uncertainties. Regarding the error settings, the synthetic experiment is typically used to tune the perturbation parameters. The synthetic experiment results together with the recommendations of past studies, are the basis for designing the error settings in a DA framework.

Figure 4: it would be better to add the predictive interval of open loop

Response: Thanks for the great suggestion. Figure 4 was updated and the open loop interval was added. Please see the updated Figure below:



Line 112: the following paper may be a good reference for the SMAP soil moisture data assimilation. Xu et al. Continental drought monitoring using satellite soil moisture, data assimilation and an integrated drought index. Remote Sensing of Environment, 2020, 250:112028.

Response: The reference will be added to the manuscript.