

We thank the reviewer for insightful and constructive comments and provide answers to the comments below. The reviewer comments are in normal font, our replies are in bold font.

Summary

This study addressed a very interesting topic since it presents an operational river discharge forecasting system. This system employs meteorological forcing data from a weather forecast model (NOAA-GFS) and uses a data assimilation technique to update river discharge in real time. Although the runoff routing scheme (i.e., the Muskingum routing) and the data assimilation approach (i.e., the Kalman filter) are very simple, this study made a good attempt to combine weather forecasting output and data assimilation for flood forecasting. This operational river discharge forecasting system is successfully applied in the Kavango River, and shows the potential to assimilate remotely sensed observations. However, the manuscript may need more detailed description about forecasting experiment setups and parameter estimation. Therefore, I suggest this paper could be published after a few minor revisions.

Thank you, we will address your comments as explained below.

Comments

(1) The authors reported results for the open-loop run without assimilation, the assimilation run, and the 1–7 day ahead forecasts. I think these scenarios use different meteorological forcing data. Please correct if I miss some information. In the scenarios of 1–7 day ahead forecasts, Are the discharge observations from Rundu assimilated in real time in the forecasting system? Is the simulated discharge at the outlets of all 12 subbasins updated in the data assimilation?

Yes, the meteorological forcing is different. The open-loop, assimilation and 1-day ahead forecasting runs use 1-day ahead forecasted precipitation and temperature. The 2-day ahead forecasting run uses 1-day ahead forecasted precip and temp up to real time and then the 2-day ahead forecast. The same is done for the 3-7day forecasts. Rundu discharge measurements are assimilated in real time, or as they become available (typically a real-time delay of a few hours). And yes, the Kalman filter updates the simulated discharge at all basin outlets. This will be explained in more detail in the revised manuscript.

(2) Table 4 shows performance indicators of the forecasting system. Did you set the other scenarios of removing some observations in the data assimilation? I invite the authors present some more information about these scenarios.

Yes, in the forecasting runs, observations closer in time than the forecasting horizon have been removed. So, for instance, the 4-day ahead forecasting run only assimilates observations up to t - 4 days. Does this answer the question? We will provide more detail in the revised version.

(3) Real-time discharge observations are assimilated into the Muskingum routing scheme, and Kalman filter is used in the data assimilation. Certainly, this is very simple and efficiency. But the authors also state that the TIGER-NET project has the plan of using satellite earth observations (e.g., soil moisture), not only the in-situ observations, so the routing scheme and the Kalman filter may not meet such a big plan.

This is entirely correct and also discussed in the manuscript (see page 11090, lines 8-20). We will expand this discussion to highlight limitations of the present approach.

(4) There are three parameters in the Muskingum scheme (MAK_X, MSK_CO1 and MSK_CO2, see the routing process in SWAT). They should be prescribed or estimated before simulations,

because they may be influential to runoff routing in data assimilation. But the manuscript does not give any information about their estimates in Table 1.

These parameters were set automatically by MWSWAT when the first version of the SWAT model was parameterized. Subsequently they were subject to sensitivity analysis and manual calibration to find optimal parameter values. They were not included in the automatic calibration because of their relatively lower sensitivity compared to other parameters. This information will be added to the revised manuscript.

(5) The original meteorological forcing data from NOAA-GFS are six hourly, but the SWAT model is run at a daily time step. Did you integrate the six hourly data to daily?

Yes this is what we did. We did not run with sub-daily precipitation input. This information will be added to the revised manuscript.

(6) I found the computation of persistence index (PI) in Eq. (6) is different from the expression in Bennett et al., 2013). Please check it. What is the latest available observation (Qlast) ?

Equation 6 in our paper is equivalent to equation 6.6 given in table 6 of Bennett et al, 2013. Qlast corresponds to \hat{y}_{i-1} in the Bennett paper. We believe there is a typo in Bennett's notation as this should be \hat{y}_{i-1} , i.e. the hat is missing. The idea in the PI is to use the last available observation as the reference, i.e. \hat{y}_{i-1} and not the average of all observations as in the NSE. Qlast is today's observation of river discharge. In the 1-day ahead forecast, there is a lag of 1 day between Qlast and the forecast, in the 7-day ahead forecast, this lag is 7 days. We will explain this better in the revised manuscript.

(7) I suggest all figures, especially Figures 5, 6, 7, 8 and 9, should be redrawn before submission. The size of the text in figures looks too small.

Yes, we agree and will fix this in the revision.