



Interactive comment on “Correction of upstream flow and hydraulic state with data assimilation in the context of flood forecasting” by S. Ricci et al.

Anonymous Referee #1

Received and published: 24 February 2011

This paper describes a two-step approach to assimilating water level observations into a hydraulics model to improve water level and discharge predictions. The manuscript would constitute a useful scientific contribution to the literature if the overall presentation could be thoroughly improved. In its current form, the paper is poorly organized with confusing sentences/phrases throughout, making it painful to read. Please see detailed comments below.

1. In Section 2.2 (description of the BLUE method), Equations (2)–(4) and (6) are re-defined on the next page with a time index (Eq. 7–10). This repetition can be safely omitted by keeping only one set of equations (e.g., that with a time index). I am not sure why it is stated (near the end of this section) that in the BLUE method, $M(i-1, i)$ is

assumed to be an identity matrix. Does this mean the model is kept unchanged over time? Please clarify.

2.Since the correction of upstream flows is the first step of the two-step approach, it makes sense to describe this step first (instead of the correction of the states).

3.Equation (16): it would be desirable to briefly describe the physical meanings of the three parameters a , b , and c . If this equation was based on some previous work, the related reference(s) should be provided here.

4.Section 3: Modeling of background error covariance B . This is potentially an important section since in the BLUE approach B is kept constant instead of evolving with time. However, the organization/presentation of this section is particularly poor, making it very difficult to follow. First of all, while it is important to do so, the purpose of the model simplification and that of applying KF and BLUE to the 1-D advection-diffusion model are never explicitly stated. Although one could get the idea after reading this section and the next section a couple of times, the purpose of Section 3 should be explicitly stated upfront. Also, the description in 3.2 and 3.3 is pretty much fragmented with the results and interpretations from these experiments (including figs 5&6) presented in the appendix. The revised paper should focus on a better coordination between Sections 3.2 -3.3 and the appendix so that a complete story (short or in relevant detail) is provided in the body text.

5.The description of the two catchments in Section 4.1 can be improved and consolidated. For example, currently some location names mentioned in the text cannot be found on the schematic diagrams (Fig. 7&8). Another example is the second paragraph on page 9088, which is somewhat too wordy.

6.The first paragraph of Section 4.2 seems to be out of place since this section should be focus on “data assimilation set up”. This paragraph can be removed.

7.Section 4.3 is more about illustration of data assimilation “results” instead of method.

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Hence the section title should be rephrased.

8.It is mentioned on page 9091 (Line 21-22) that similar performance was observed for shorter and longer range forecasts (as compared to six-hour forecasts). I am curious to see whether this is really true as normally one would expect to see forecast skill decreases with lead time (especially when the forecast is persistence based). As a recommendation, the authors could evaluate the skill as a function of time within both the analysis and forecast periods, i.e., evaluating the skill at every hour from the beginning of the assimilation window to the end of the forecast window (as oppose to only examining the performance at -24 hr and +6 hr). This would provide a more complete investigation/evaluation of the gain from data assimilation and how it changes with lead time.

9.As a suggestion, the authors could compare the DA results to another baseline scenario where the most recent water level observation is used to directly initialize the model to make a forecast, in addition to a free run starting from several days earlier in the past, not using recent observations that are already available. One would argue that such a baseline is expected to perform better than the free run defined in the paper, making it more difficult to demonstrate the value of data assimilation.

10.Currently the paper focuses on the results from the Adour basin only, while it is desirable to also provide results from the other basin with proper interpretations. For example, Table 1 and 2 can be extended to include some statistics for the Marne Val-lage basin.

11.Other minor issues/typos (note this is not a complete list; a thorough proofreading is necessary)

P9068, L23: strenuous -> strenuous?

P9068, L24: lateral additional discharge -> additional lateral discharge

P9069, L11: data assimilation combines model simulations (not “numerical”) and ob-

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servational information

P9069, L20: remove approaches

P9069, L30: Full name and reference should be provided for “BLUE” since it appears here for the first time.

P9070, L21: mode → modes; properties → performance

P9072, L1: better to use another word (such as “include”) than “stand for” here.

P9076, L21: data approach → data assimilation approach

P9077, L10: three linear transformations → a three-parameter linear transformation

P9077, L 21: remove “in the composition”

P9078, L9: the control j-th variable → the j-th control variable

P9080, L15-17: The justification of this approach is made with a simple advection-diffusion model on top of which it was achievable to implement a Kalman Filter. This sentence should be rephrased or simplified.

P9080, L19: Appendix 3.3 → Appendix A?

P9080, L22: remove “data assimilation”

P9082, L6: please rephrase “data assimilation twin experiment”. Typically this is referred to as “identical-twin experiment” in the literature.

P9083, L22: please rephrase “a non symmetric B matrix erroneous setting “

P9084, L8: explicitly → explicitly

P9084, L15: twin-obs → identical twin

P9084, L23-28: please rephrase/consolidate these sentences.

P9086, L7: applied on → applied to

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P9086, L24: the catchment area is limited by three thresholds → please clarify

P9088, L9: characterised → characterized

P9088, L21: correlation → relationship

P9090, L4: then → than

P9090, L6: questionned → questioned

P9090, L14-16: please clarify “a threshold is applied on the misfit between the observation and the simulated water level to eliminate inconsistent observations”. P9090, L24: there is no purple curve in the figure.

P9092, L14: “perfectible” → please consider using another word. No calibration can be perfectible.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 9067, 2010.

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