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Hydrology and Earth System Sciences Discussions

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 #2

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1. General Comments

- The authors have applied a two-step data assimilation scheme to correct the hydraulic state variables at the observation point and the upstream region to improve short-term flood forecasting. A Kalman filtering technique described as BLUE is applied to correct water levels of a hydraulic model and accordingly to correct background prediction errors in discharge. The proposed scheme is applied to two catchments, the Adour and the Marne Vallage, in France. The authors conclude that the two-step data assimilation scheme led to a significant improvement of the water level and discharge in the analysis and the forecast modes.

- The topic of the research is highly relevant to the scientific scope of HESS and the

idea of assimilating stream level into hydraulic model is quite new in the discipline even though it is not a novel idea. The manuscript is however very poorly structured and written: it was very difficult for this reviewer to read through the manuscript to the end. Also, the manuscript is not carefully written as the numerous typos (listed below) in the text suggest. This reviewer strongly recommends the authors to carefully revise the writing of the text.

- From Eq. 2 and Eq. 11, there are many redundant mathematical expressions. BLUE is basically a special case of the Kalman filter and thus this reviewer does not see any clear reason why the authors use the specific term 'BLUE' to describe the methodology. There are redundant descriptions of the hydraulic model used in the work. Overall, chapters 2 and 3 can be restructured more concisely to describe the model and KF.

- Observation error R and error covariance terms are not described in detail even though they form the essence of the Kalman-filter based data assimilation. Please add quantitative descriptions of the terms used in the simulations.

- In the formula for Hsel on page 9074 (not numbered), are the locations of 1's chosen just randomly for illustration? I wonder what the columns of all zeros (first and last) represent.

- Equations 14 and 15 need a sound justification. What is the relationship between the Z vs. Q in the manuscript and the conventional rating curves linking Z to Q?

- Justification for the asymmetric error correlation is made based on the simulation of a simple model. Is the 1-to-10 asymmetric ratio made integrating the correlation function on either side of Xobs or just chosen arbitrarily by trial and error. It is not clear from the manuscript.

- In the last paragraph of page 9093, the numerical problem described is very hard to understand. Please elaborate on it.

- In Fig. 14, the assimilated runs look worse than the free runs. Are the descriptions in

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the legend incorrect?

- In the results summarized in the figures 12 and 13, the assim runs merges to the free runs at the end of the recessions. Does this originate from the increase impact of the baseflow in the recession period?

- Much of the performance evaluation is based on somewhat qualitative descriptions, such as “significant” and “impressive”. Please provide quantitative measures to avoid the confusions in interpreting the results. In fact, it is hard to agree that the forecasting capability of the assim runs are significantly improved based on the results in Table 1. The described approach needs to be applied to more cases, preferably separately to groups of similar rainfall-runoff events to be more convincing.

2. Specific Comments

There are several acronyms that are used without explanations (e.g., MASCARET, BLUE, EDF). Please explain them when they first appear in the manuscript. Some of the errors in words and expressions are listed below. This is only a part of it, so please revise the manuscript thoroughly.

P9068, L19: ressources → resources

P9068, L22: strenuous → strenuous, Major uncertainties come from → Major uncertainties come not only from

P9068, L23: simplified and then discretized → simplified and discretized

P9069, L12: a better description of it → a better estimate of it

P9070, L6 and hereafter: gaussian → Gaussian

P9071, L12: lineic → linear?

P9071, L14∼L15: on → of

P9071, L22: x is the control... → Suppose x is the control...

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P9072, L1: “discharge” is not a state variable.

P9074, L6: dynamic correcting the water level → dynamic correction of the water level or dynamically correcting the water level

P9076, L17: tide influence → tidal influence or the influence of the tide

P9077, L2: Please explain what ‘free extremities’ mean.

P9078, L2: composed with → composed of

P9078, L4: as follow → as follows:

P9078, L23: flows is → flow is

P9079, L4: refered → referred

P9080, L6: as and easy → as easy

P9081, L22: on the each → on each

P9085, L12: downstream the → downstream of the

P9086, L11: france → France

P9086, L12-13: rewrite the sentence

P9091, L2: egal → equal?

P9092, L12: satysfing → satisfying

P9092, L17: degradate → degrade

P9094, L1: adour → Adour

P9094, L2: details → detail

P9097, L7: less impressive → change this to a technical expression

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