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Hydrology and Earth System Sciences Discussions

Interactive comment on "A past discharges assimilation system for ensemble streamflow forecasts over France – Part 1: Description and validation of the assimilation system" *by* G. Thirel et al.

G. Thirel et al.

guillaume.thirel@jrc.ec.europa.eu

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The authors would like to thank Benjamin Zaitchik for his review and the fruitful comments. Each point of his review will be answered, and is named by the number of the ramarks in the review.

1. The bias between the open loop and the assimilation experiments is low (10% of the discharge in mean and at the maximum, 6% for the best experiment, tab. 3),

and is mainly present during low flows (summer period). Moreover, the increments given by the BLUE were naturally limited by the background and observation errors that we defined. The authors agree that the development of this assimilation system is a good opportunity to improve the model parameterization, however it is beyond the scope of this paper. Actually, very few optimisations where done in the Safran-Isba-Modcou chain. The most important ones are the introduction of a subgrid drainage term by Habets et al. (2008) for a better description of low flow and an exponential profile for the saturated hydraulic conductivity for a better shape of the flood peaks (Quintana Seguí et al., 2008). The referee points deficiencies in reproducing the low flows. We are currently extending the simulated aquifer domain in order to have a better estimation of the low flow. For the area where an explicit simulation of the aquifer is not available, we plan to use very simple, conceptual, reservoir-based, aquifer. An interesting work (not published) suggests that a better restitution of low flows might be obtained using such a simple model. This option will be tested in the future. Habets F., A. Boone, J.L Champeaux, P. Etchevers, L. Franchistéguy, E.Leblois, E. Ledoux, P. Le Moigne, E. Martin, S. Morel, J. Noilhan, P.Quintana Segui F. Rousset-Regimbeau, P. Viennot (2008)) : The SAFRAN-ISBA-MODCOU hydrometeorol-ogical model applied over France, Journal of Geophysical Research D: Atmospheres 113, D06113 (2008) 18 Quintana Seguí, P., Martin, E., Habets, F., and Noilhan, J.: Improvement, calibration and validation of a distributed hydrological model over France, Hydrol. Earth Syst. Sci. 13, 163–181, 2009

2. To use the knowledge of the distributed hydrologic response in order to distribute the increment across the time window and the area could indeed be an interesting way to avoid big increments of the initial time step. However, increasing the time window would decrease the reactivity of the assimilation system. See also answer to point 3.

3. The referee raises the question of time and space scales of the assimilation. Concerning discharges, only daily values were available. Concerning the time-window, the BLUE system allows to change the time windows length. But in this case we don't

average the discharge observation. Discharges of day D-1, D-2,... D-N are assimilated separately. However, it is important to use each observation in the assimilation only once : the periodicity of the assimilation must be equal or greater than the assimilation time window.

Concerning the choice of the variable state, the variability inside a basin or sub-basin would be definitely better used. However, in our case, 34 perturbed runs are needed because this is the number of sub-basins in the biggest basin, the river Loire basin. When considering all the grid points of this basin separately, the number of perturbed runs needed would be of several thousands. This is unrealistic at this stage to implement it as well for tests purposes as for an operational approach, as it would require too much CPU time.

4. We fully agree with this comment. Work is planned on this subject.

5. Unfortunately, no other states or fluxes were kept, because of the huge CPU time and storage costs that would have been needed. However, this is a good question that will be investigated in the future.

6. We agree, that this comment must be investigated. A current limitation of the approach comes from the fact that the error correlations between the two soil reservoirs have been neglected (i.e. the B matrix was taken diagonal).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2413, 2010.