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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Benchmarking hydrological models for low-flow simulation and forecasting on French catchments" *by* P. Nicolle et al.

P. Nicolle et al.

pierre.nicolle@irstea.fr

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Reply to the Anonymous Reviewer 3

We thank Reviewer 3 for his careful reading and evaluation of our manuscript and his detailed suggestions, which will help improving the manuscript. In the following, we explain how we will account for his comments. Each time, the comment is repeated and our reply is given.

Reviewer's comment (RC): The manuscript compares the performances of 5 different hydrological models used to forecast low flows of 21 French watersheds

based on a large variety of criteria. The text is well written and structured, clear, referring to the recent literature on low flow forecasting and will certainly be of interest for the readers of HESS. The work could nevertheless benefit from a more in-depth analysis of the obtained low-flow forecasts and their limits. The whole approach remains a little too empirical and descriptive at this stage with no clear conclusion or open perspectives for future improvements. Important questions, some mentioned in the manuscript, could be discussed in more detail:

Authors' reply (AR): We thank the Reviewer for his constructive comments and will account for his suggestions as detailed below.

RC: 1) Most of the tested models have not been specifically developed for the purpose of simulating low-flows. Have their calibration procedures been adapted to better simulate the low-flow periods? Some information on the calibration procedures of the model, the possible influence on their parameter values, recession dynamics, would be useful here as well as some suggestions.

AR: The calibration method adopted by each modeller was indeed adapted to better simulate low flows: the objective functions used are generally specifically adapted to low-flow simulation (e.g. Nash-Sutcliffe Criteria calculated with Q0.2 for PRESAGES, or mean of the Kling-Gupta criteria calculated both on Q and 1/Q for Mordor and GR6J). The calibration method and criteria are described in Table 3. We will better explain these aspects in the text.

RC: 2) Beyond the quantitative criteria, the analysis of the simulated discharge series could be a little more developed. Are for instance the forecasts in fig. 11 realistic? Is it really likely that the discharge increases within a few days to exceed the Q80 during a marked low-flow period in mid-August for a significant number of rainfall scenarios as suggested by some tested models? I have some doubts. Most of the tested models seem too sensitive to rainfall during low flows for the Meuse river.

AR: The models were tested using an ensemble of likely rainfall scenarios, some of which are quite wet, explaining the sudden reaction of models. Actually, the spaghetti representation visually emphasizes outlier scenarios, while the 80

RC: 3) It appears that the discharge lies significantly under the average inter-annual discharge already in May for the 3 selected severe low-flow periods and the 2 selected watersheds in figures 10 to 12. This leads to a question: what is the relative importance of the initial conditions and of the summer rainfall scenarios in the determination of the discharge evolution during low-flows? Is this relative weight the same in the observed and simulated series? In other words, are the models representing the correct low-flow dynamics? This is a tricky question that cannot be answered based on aggregated criteria only. By the way, the selected NVQ benchmark could have been improved: distribution of available streamflows in the other years for the considered day, but selecting only the years where the baseflow at the date of the forecast lie in similar ranges as in the considered year. This would probably be less in favor of the tested models. Could the authors test this?

AR: We thank the Reviewer for this interesting suggestion. We agree that using more demanding benchmarks helps better emphasizing the limits of the tested models. We will investigate the added value of such a benchmark to better analyse the behaviour of the tested models.

RC: 4) The differences between simulation and forecasting performances deserve some more explanation.

AR: We agree that this is a key aspect that deserves clear explanation. We will better explain the differences by introducing a schematic diagram.

RC: 5) Beyond the relative performances of the models, could the authors comment on the absolute values obtained for the various tested criteria? Are the performances of the models really sufficient for decision making (what decisions)

on the tested rivers?

AR: Given the feedbacks from operational forecasters on the use of such models, we think they are indeed useful, even though some of their performance criteria remain modest compared to the benchmarks. There is clearly a significant margin of progress. This will be better commented in the results and conclusion section.

RC: 6) The figures and tables could also be improved. I am not convinced that the rankings are the most useful peace of information. I would prefer to see the average values of the criterions in tables 6 and 7. Comments on the ranks in the text are sufficient.

AR: The objective of the ranking was to give some index of relative reliability of the tested models. However, we acknowledge the limitations of ranks and will provide an integrated criterion based on the mean of the non-dimensional criteria we used.

RC: 7) Many figures and legends are too small. Figures 4 and 8 are for instance attractive, but difficult to read and interpret. They have moreover little added value if compared to tables 6 and 7 (with values of criteria) and figures 14 to 16. Fig 10 is impossible to read because the contrast between the different curves is not sufficiently marked. Colours but also line types should be varied.

AR: We agree that some figures should be improved. We will account for reviewer's suggestions and provide more readable versions of these illustrations.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 13979, 2013.