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Hydrology and Earth System Sciences Discussions

Interactive comment on "Performance and reliability of multimodel hydrological ensemble simulations based on seventeen lumped models and a thousand catchments" *by* J. A. Velázquez et al.

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We deeply thank Dr. Zappa his objective review and important comments. Our answers follow:

1."It would be nice if the authors would spend some words on the climatology of these 10 years as compared to long-term time series".

The following sentence was added (Page 4028, Line 2):

This period includes a wide range of conditions (e.g. with large floods in 1999 and 2001 and severe drought in 2003), but not much different from what can be observed on these catchments on the long term.

2.“The selected catchments include basins with different characteristics and located in different climate regions. I wonder if all basins are headwaters (with areas between 10 and over 32000 km2) or if the biggest basins are combining the results from subbasins. The referred work of LeMoine et al. (WRR, 2007) does not answer this doubt either. LeMoine et al. used less basins and the biggest one is smaller than 10000 km2”.

The following sentence was added (page 4027, line 25):

Some of these catchments are headwater catchments while others are medium to large size catchments.

3.“So here splits my comment: a) If sub-basins are used, then I wish the authors would indicate if routing has been adopted to combine small headwaters to large river basins and that they spend some words on the way they dealt calibration of nested sub-basins. b) If all basins are headwaters, then how do the 17 different model deal with the routing? Do some of the parameters (e.g. storage coefficients) indirectly assume values that allow accounting for internal flow times for the larger river basins? I assume that most of the used lumped models have been originally developed for mesoscale catchments with areas not exceeding 200 to 3000 km2). I ask the authors to explain their strategy since it is a real challenge to combine nested basins for obtaining ensemble hydrographs for large river basins (e.g. Jaun et al., 2008).”

Indeed all the model used are lumped as already mentioned in the text, i.e. they do not split the catchment into sub-catchments and therefore do not include channel routing. However, like all lumped models, the model structures include routing functions that account for the travel time and different pathways of water at the catchment scale. Although the lumped approach is often thought to limit model performance on large catchments, this is not systematically the case: catchment response on large catch-

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ments is often more smoothed than on small ones, with responses easier to model with a lumped approach. In this respect, the work by Merz et al. (2009) shows that lumped models even tend to provide more satisfactory results on large catchments than on small ones on average!

The text was modified as follows to clarify the approach (Page 4028, Lines 12-17):

All model structures were applied in a lumped mode, which means that catchments were not split into sub-catchments or grids but considered as a single unit. Although some of the test catchments are quite large, this does not seem to be a real limitation for the application of lumped models, as shown by the results by Merz et al. (2009). Obviously, some specific conditions or events may be better modelled using semi-distributed or fully distributed spatial schemes (see e.g. Jaun et al., 2008), but the modelling scheme proposed here can be applied with other model types. Further discussion on the impact of the spatial scheme on model performance can be found in Andréassian et al. (2004) or Smith et al. (2004).

These lumped models correspond to various conceptualizations of the rainfall-runoff transformation at the catchment scale. They all include a soil moisture accounting procedure but with various formulations (linear or non linear, possibly with several soil layers). They also include transfer functions to account for the travel time and different pathways of water at the catchment scale. These functions includes from 1 to 5 linear or non linear stores, and unit hydrographs or pure time delays.

4.“Figure 12: The authors state that their findings "supports the finding of Viney et al. (2009) that the best ensembles are not necessarily those containing the best individual models, but it seems that the inclusion of some good models is essential". My experience with ensemble verification is that it is important, that the selected ensemble members present an adequate spread. An example of rank histograms with catchments sub-sets would allow to verify if the spread of the subset ist higher than the one of C0, C1 and C2”.

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The following text will be added (Page 4038 Line 20):

Figure c. shows an example of rank histograms of one catchment for different ensembles of models (C0, C1, C2 and the optimized subset Coptim). It can be noted the improvement of the spread after the optimization procedure.

References:

Andréassian, V., Oddos, A., Michel, C., Anctil, F., Perrin, C. and Loumagne, C.: Impact of spatial aggregation of inputs and parameters on the efficiency of rainfall-runoff models: A theoretical study using chimera watersheds, Water Resour. Res., 40(5): W05209, doi:10.1029/2003WR002854, 2004.

Jaun, S., Ahrens, B., Walser, A., Ewen, T., and Schär, C.: A probabilistic view on the August 2005 floods in the upper Rhine catchment, Nat. Hazards Earth Syst. Sci., 8, 281–291, 2008.

Merz, R., Parajka, J. and Bloschl, G.: Scale effects in conceptual hydrological modeling, Water Resour. Res., 45 (W09405), 2009.

Smith, M.B., Seo, D.J., Koren, V.I., Reed, S.M., Zhang, Z., Duan, Q., Moreda, F. and Cong, S.:The distributed model intercomparison project (DMIP): motivation and experiment design, J. Hydrology, 298(1-4), 4-26, 2004.

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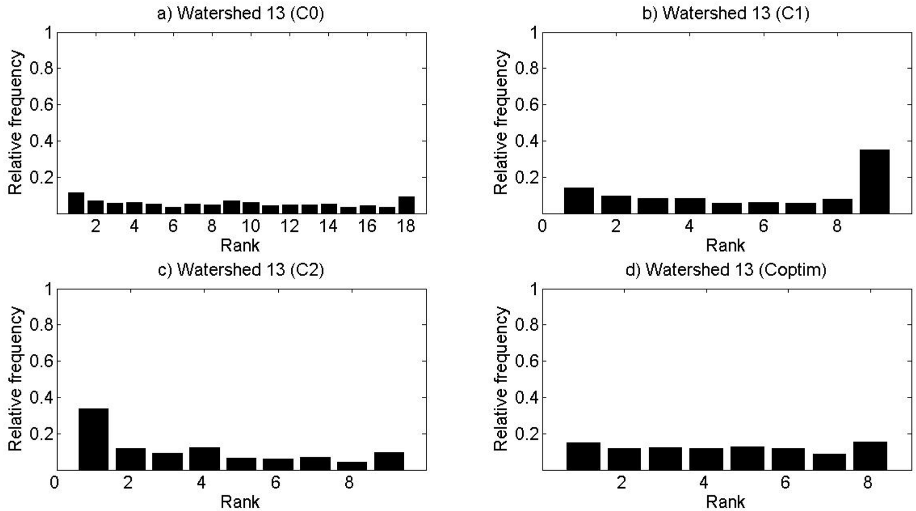

Fig. 1. (Figure c). Examples of rank histograms for a given catchment with ensembles C0, C1, C2 and the optimized subset Coptim.