

Interactive comment on “Hydrological hysteresis in catchments and its value for assessing process consistency in conceptual models” by O. Fovet et al.

Anonymous Referee #2

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In the submitted manuscript Fovet et al. present a study that uses hydrological hysteresis to understand the hydrological behavior of a catchment in Western France. Hysteresis between discharge and unsaturated / saturated zone storages at the hill slope and the riparian zone are expressed by a hysteresis index that reflects the strength and the direction of hysteresis by one number. Further on, the hysteresis index is used to evaluate four lumped simulation models. That way the authors can distinguish models with better process representation from less realistic models.

Most parts of the manuscript are well written and structured. Its scientific contribution will fit well into Hydrology and Earth System Sciences after some revision have been

C2296

performed. Apart from some more elaborations about the Hysteresis Index and some necessary shortening of subsection 3.1 I have two major comments:

1. Already in the methodology the authors refer to another study (Hrachowicz et al., 2014, in revision at WRR) that is not available for the reader. In particular the reference to hydrological signatures that are not explained in the text or shown in the figures through the entire text made some of the interpretations and conclusions hardly understandable.

2. In the description of the models and their parameters (which is partly referring to the above-mentioned study) the authors choose one final parameter set for each of the four models based on a weighted performance measure that only uses discharge observations. However, many preceding studies showed that models with more than 4-6 parameters face problems of over-parameterization when they only use discharge for calibration (Jakeman and Hornberger, 1993; Wheater et al., 1986). The low spread of weighted efficiencies/Euclidean distances in Fig3 in the manuscript might disprove that but the distributions shown there are re-shaped (with an exponent of 10) and might appear much more uniform in their original distribution. Since the model simulations are a substantial part of the interpretations and second part of the manuscript the authors need to provide some more information about the reliability of their models and the chosen parameters.

Please see the uploaded pdf for more detailed comments.

References

Jakeman, A. J. and Hornberger, G. M.: How much complexity is warranted in a rainfall-runoff model?, *Water Resour. Res.*, 29, 2637–2649, 1993. Wheater, H. S., Bishop, K. H. and Beck, M. B.: The identification of conceptual hydrological models for surface water acidification, *Hydrol. Process.*, 1(1), 89–109, doi:10.1002/hyp.3360010109, 1986.

C2297

Please also note the supplement to this comment:
<http://www.hydrol-earth-syst-sci-discuss.net/11/C2296/2014/hessd-11-C2296-2014-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 5663, 2014.

C2298