**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Catchment classification: hydrological analysis of catchment behavior through process-based modeling along a climate gradient" *by* G. Carrillo et al.

Anonymous Referee #3

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The authors did a nice job in setting up the modeling and the similarity frameworks, paying attention in defining a reasonably minimal parameterization compatible with accurate process description. I believe this is a very valuable step toward the goal of functional catchment classification.

I would raise only very few points, trying to contribute to the clarification of the proposed approach.

The first point attains the concept of 'data'. The authors use hydrological signatures as catchment features that can be used to assess model performances. Two of the

used signatures contain values that can unambiguously determined from observations, such as the runoff coefficient and the slope of the FDC. The third one, the Baseflow Index, is indeed an index that arises after filtering the streamflow data with a baseflow separation model. Even though much literature has been devoted to the identification of the baseflow index, I would suggest to treat this quantity as a model-dependent variable, using caution in definitely considering it a 'catchment feature'. A similar point has been treated by the authors in their statement of P4614 L9 ff, with reference tp the characteristic time scales suggested in this paper. A correct distinction between actual data and 'filtered' data would imply a slight rephrasing of some parts of the paper in which the BI is implicitly treated as 'data'.

Again with respect to the baseflow a more specific comment is in order. It looks not very clear how the authors calibrate the coefficient ε mentioned in eq. (33). I suppose calibration would depend on an overall fitting between observed and modeled streamflow components (the time series or the Flow Duration Curves). Indeed, the role of ε is very significant, in that it determines the baseflow series from which the aquifer parameters are estimated (if I have correctly understood the procedure). If the technique for estimation of ε is based on a fitting of the FDC this would provide an additional explanation of the very good relation existing between the time scale of the deep aquifer and the slope of the FDC (P4612 L2 ff).

I find interesting the use the authors do of databases available for the catchments in the US. Of particular interest is the availability of soil information and of the parameter concerning vegetation height H. As this kind of data is not easily available in other geographic areas, it would be useful -in future work- to check the performance of methods that indirectly estimate H, which is a parameter of some relevance for the canopy losses. Incidentally, the same symbol, H, was already used for the sensible heat.

Finally, additional detail (e.g. a reference) would be appreciated as regards the University of Maryland vegetation classification system, that provides the fractional spatial coverage of vegetation type.