Interactive comment on "Understanding Hydrologic Variability across Europe through Catchment Classification" *by* Anna Kuentz et al.

M.C. Westhoff (Referee)

m.c.westhoff@vu.nl

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This paper aims to classify a large set of European catchments using a few different regression, and clustering techniques. The results are analyzed by looking at spatial patterns while the main drivers are characterized for each class.

Although I personally have no record in catchment classification methods, I judge this paper as potentially publishable. But before that, I think the paper can and have to be improved.

The first point I was triggered about was the sentence "So far we have not yet found a widely accepted classification system" (P2, L8), which made me expect that this paper would (or at least aimed) to finalize this issue. However, this is not the case, while I think you can make this attempt by reserving a part of the available dataset

for validation. The used dataset is large enough and I think the results would benefit from a "calibration-validation cycle" in which the dataset is split in two randomly chosen sets, of which one is used for calibration and the other for validation. This can be done several times for different randomly chosen subsets. This exercise may tell you more about number of catchments needed in a class and how robust the chosen signatures are.

A second aspect was that I had problems understanding what was done and in which order. If I am not mistaken, I think you can roughly summarize it by: 1) With a regression analysis catchment descriptors (CD) are correlated with flow signatures (FS). 2) Classes have been derived using 3 different clustering methods: one using CD, one using FS and one using a CART analysis. 3) For each class, correlations between CD and FS are derived and compared with the correlations derived in step 1. If this is indeed the case, I suggest to add e.g. a flow chart and to turn paragraph 2.2 and 2.3 around.

I very much agree with paragraph 3.4 in which it is suggested that the finding can be used for ungauged basins or to parameterize large scale models. But to really benefit from the results of this paper I would encourage the authors to also publish the regression constants. This would make it possible for others to indeed parameterize large scale models, while other future classification studies can better compare (quantitatively) their results with those of this study.

Minor comments: Be consistent in using either the term "Catchment Descriptors" or "physiographic control"

P3,L32: Give also the range of the catchment sizes

P6,L5: explain what E-HYPE is

On P3,L11-12 it is stated that "No study so far, to our knowledge, has applied the results from comparative hydrology at the continental scale, also including large rivers

with human alteration and ungauged basins", suggesting that this study will include basin subject to human alteration. Now on P6,L12 it is stated that stations with strong flow regulations were eliminated.

P12,L15: It is unclear to me to which method is referred here. Please clarify

P12,L8: You mean actual evaporation, right? Also add this at P13,L15 and potential other locations.

P14,L9: Is it possible to quantify the strong relationship?

C3