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Hydrology and Earth System Sciences Discussions

Interactive comment on "Hydrologic similarity among catchments under variable flow conditions" *by* S. Patil and M. Stieglitz

Anonymous Referee #2

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The paper analyses the spatio-temporal variability of flow duration curves of catchments belonging to the same river system and whose long-term annual rainfall and streamflow are similar. It shows that the between catchment (spatial) variability of low flow conditions is higher than for moderate to high flow conditions. The authors motivate this by arguing that low flows are more controlled by local processes (e.g., soil moisture influenced by local terrain) and high flows by meteorological forcing, which are more coherent in space. In conclusion, spatial proximity alone should be used with care when transferring information on low flows to ungauged catchments. The subject is of interest and suitable for the publication on HESS. The paper is synthetic, well organised and well written. Therefore I recommend the publication of it after considering the following concerns.

Page 8613, line 8-21:
in fig. 2 the low flows appear more divergent (in space) than other flow quantiles. However the y-axis of figure 2 is logarithmic, meaning that differences are emphasized for small values. Analogously, the coefficient of variation is selected as indicator of spatial variability across flow percentiles and shown in fig. 3. The CV is a measure of variability relative to the mean and, to me, some of the features of fig. 3 could be explained by looking at the mean (which can be guessed by looking at fig. 2). This relates to point 5 of reviewer 1. I would suggest the authors to add a sentence to explain why it is better/necessary to use this variability measure (the CV) when assessing the similarity among catchments across flow conditions.

Page 8615, line 20:
In Fig. 6 I would suggest to show the monthly flows of all catchments in each basin, provided that the variability of precipitation and PET is low among them. This would add information on the spatial variability of regimes and motivate the second part of the sentence at line 20 of page 8615, i.e., "an increase in ET demand during the summer period decreases the flow magnitudes and increases the spatial variability of streamflow".

Page 8616, line 1:
what does "isolated nature" mean?

Page 8616, line 16:
"Therefore, during high flow conditions, the contribution from faster flow paths, viz., surface flow and shallow subsurface flow, becomes increasingly important. This phenomenon has been observed in several experimental studies, ...". How does this relate to the spatial variability of high flows?

Page 8616, lines 22-24:
to me, the high spatial CVs for high percentiles is very interesting. Does it mean that the floods are of local type (driven by local storms) while more common high flows

HESSD
7, C4273–C4275, 2010

happen in wet periods (frontal precipitation events)? This could be checked looking at the seasonality of the maximum annual peaks. Do they happen in summer?

Page 8616, lines 26-29:
how does the relation between peak floods vs. catchment area affect the spatial variability shown in fig. 3? Is the CV higher where the variability of catchments sizes is higher? Please add a sentence to relate this statement to the cases shown in the paper.

Page 8617, lines 1-3:
"During the high flood events, the hydraulic properties of stream channels of individual catchments assume an increasingly important role in controlling the streamflow within these basins, and therefore, might be causing an increase in regional variability". This is true, to me, for big catchments much more than for small ones. Is then the spatial variability, again, due to the difference of catchment size?

Just a suggestion: the spatial CV could be labelled CV_S (in Fig. 3 and in the text) and the temporal CV_T (Fig. 4) in order to avoid confusion.

Figs. 2, 3 and 4 would be clearer if the same x-axis would be used.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 8607, 2010.