Hydrol. Earth Syst. Sci. Discuss., 7, C4750–C4755, 2011
www.hydrol-earth-syst-sci-discuss.net/7/C4750/2011/

Hydrology and Earth System Sciences Discussions

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

S. Patil and M. Stieglitz

sopan.patil@gatech.edu

Received and published: 20 January 2011

We thank Anonymous Referee #1 for a thoughtful and insightful review. Below, we address some of his/her specific concerns:

RC 1: Nested sites in individual basins: Among your sites, only the catchments in the Upper Delaware are completely non-nested. There are a few nested sites in the Lower Susquehanna and the Allegheny but extensive nesting in the Lower Chesapeake. (See attached figure.) Non-nested streamgages might be more useful because nested sites have only partially independent basins and, therefore, would be similar. In addition, streamflow from an upstream nested site is flowing into the downstream nested site.

Answer: This is a good point raised by Referee #1. If we had access to large amount of non-nested catchment data that fit our selection criteria, we would certainly use it. While it might be the case that the nesting of catchments has an effect on the spatial variability of Q, our current data does not support the notion. For example, in both Allegheny (2 catchments nested) and Upper Delaware (completely non-nested catchments) basins, similar patterns of CV-Q percentile relationship are observed (Fig. 3).

RC 2: I expect that the geology of a catchment has an important effect on groundwater discharge to streams and that baseflow is the primary source of low flows. It would be useful to have more discussion of how differences in catchment geology and soils would be affecting low flows.

Answer: We agree with Referee #1 that the geology of catchments has an important effect on the variability at low flows. However, an examination of the catchment geologic data of all the 25 catchments showed that there is a large variability of soil types within each catchment. We also examined the related metrics of soil properties such as permeability, % organic matter, % clay content, etc. but no distinct differences were observed in the soil types between the catchments from which we could have been able to draw some conclusions. In the revised manuscript, we will add a more detailed description of the geology and soils within each river basin in the Study Sites section and also make additions to the discussion that reflects the above observation.

RC 3: What do you think is the effect of basin size on the coefficient of variation (CV) of different percentiles of streamflow? In general, does the CV decrease as catchment size increases?

Answer: We examined the relationship between inter-annual CV and drainage area using data of all the 25 catchments for 50th and 90th percentile Q (to represent different flow conditions, see Figure 1 at the bottom of this document). This relationship has considerable scatter and does not show any particular trend (even for other streamflow percentiles). Therefore, based on our data, we do not observe any effect of basin size on the CV of different percentiles of streamflow. In the revised manuscript, we will include a sentence that reflects this observation.

RC 4: Do catchments with higher BFI values have lower CV values?

Answer: The 25 catchments in our study have BFI values roughly in the range of 0.6 to 0.7. This range is too narrow to study the effect of BFI values on the CV of catchment flows at different percentiles. We examined BFI vs. inter-annual CV of all the 25 catchments for 50th and 90th percentile Q (Figure 2 below in this document). This relationship has considerable scatter not only at the 50th and 90th percentiles but also at other Q percentiles. In the revised manuscript, we will include a sentence that reflects this observation.

RC 5: Figure 4 shows that, typically, the CV decreases as the Q percentile increases. You should comment on whether this pattern is due to changes in the standard deviation or the average value.

Answer: For low to intermediate percentiles, changes in CV are due to an increase in the average value. For percentiles greater than approximately 90%, changes in CV are due to greater increase in standard deviation compared to the increase in average. In the revised manuscript, we will add a sentence mentioning these causes of change in CV.

RC 6: Figure 7 might be more informative if you showed the percentage of streamflow estimated to be from baseflow, as opposed to the "raw" baseflow value. In general, baseflow from groundwater discharge is the primary source of streamflow during low flow periods. "Common wisdom" would suggest that the percentage of streamflow derived from baseflow is high in the warm months when flow is low.

Answer: Referee #1 is right that if baseflow in Figure 7 is plotted as a percentage of total flow, the highest values will be obtained during the dry summer season. In the

original version of the manuscript, we used Figure 7 in our discussion to show that the absolute values of baseflow increase during the wet season and suggest that at high flows an increase in subsurface hydrologic connectivity occurs between different hillslope regions of the catchment. In the revised manuscript, we will eliminate Figure 7 and provide a better verbal argument for our discussion. We think this elimination will reduce the confusion and misinterpretation of the argument we wish to put across to the reader.

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

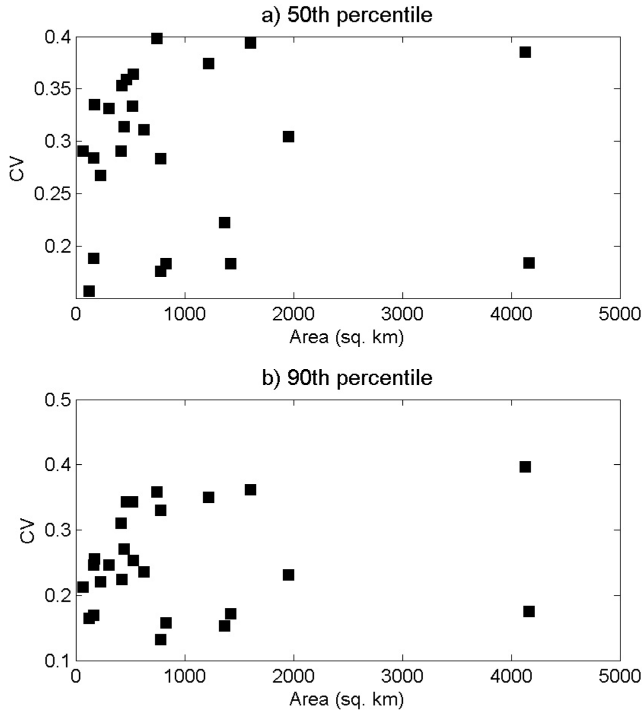

Fig. 1. Relationship between CV and drainage area for a) 50th percentile, and b) 90th percentile

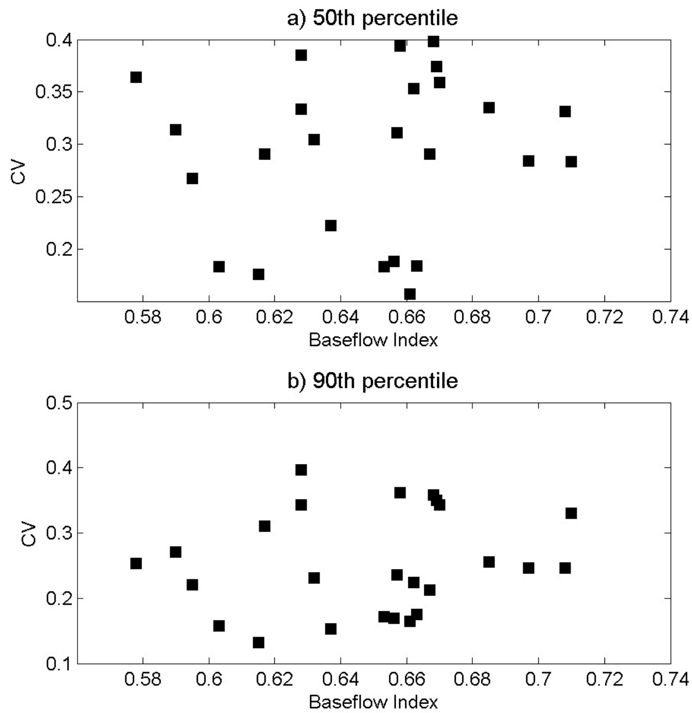

Fig. 2. Relationship between CV and baseflow index for a) 50th percentile, and b) 90th percentile