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Hydrology and Earth System Sciences Discussions

Interactive comment on "Similarity between runoff coefficient and perennial stream density in the Budyko framework" *by* D. Wang and L. Wu

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The results presented by Wang and Wu are encouraging.

However, I have several questions for the authors, in the hope that it will lead to an interesting discussion.

1. They refer to the work of Melton and then Madduma Bandara, which led Abrahams to combine the results of these earlier studies and present a U-shaped relationship between Drainage Density and the P-E Index of Thornthwaite. The interesting aspect of this relationship is that in both very arid and humid conditions the drainage density is high, and somewhere in the middle it goes though a minimum. Abrahams explains

the minimum in terms of the armoring provided by vegetation. How do the authors reconcile their result with that of Abrahams? Especially, why is not the drainage density high as Melton found? I suspect that this has something to do with the definition of perennial drainage density. Is this correct?

2. I see a breakdown in the symmetry between the Budyko relationship and the drainage density relationship that authors have proposed. In Budyko, all variables are local, i.e., P, Ep, E, and Q, and so E/P, Q/P and Ep/P are estimated locally for each catchment. From what I can understand, in the authors' work Dp/Dp* is no longer local, because Dp* is not local, but estimated as the maximum out of all 157 catchments. This creates a serious problem for the generality of the established relationship, unless they rationalize that they estimate the local maximum from the global maximum. This is problematic, to say the least.

3. Where is the role of geology? I would have thought that one of the factors that keep river flowing perennially is subsurface or groundwater flow (which will reflect the geology), and wouldn't that be a better variable to relate to perennial drainage density, whereas maximum drainage density will be governed by more extreme flows, and if one were to map the extent of drainage network during high flows you might get at the Dp*. I am bit surprised that both geology and floods are not explanatory variables in the estimated relationship.

4. Overall, more questions are raised as you discuss the results of the paper. It is surprising, and yet confounding, and I would expect the authors to rationalize their results better, especially in respect of the previous work of Abrahams (1984).

5. It is a fairly simple paper, yet I found an unsmooth presentation – many statements were repeated. I would expect them to give a more polisher presentation. I can understand the amount of work that would have gone into the analysis, but it will also be nice to present some real catchments to contrast the drainage densities found and a schematic figure to illustrate the difference between Dp and Dp* (in the same catch-

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ment).

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