

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

Anonymous Referee #3

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I have read the comments from the other two reviewers, and I generally agree with their suggestions about this paper. However, I would like to add an additional comment or two.

My most significant concern about this paper is the dataset that is used to derive the drainage density for the perennial streams. The authors use the National Hydrography Dataset to identify the extent of the perennial network. All of the results rely on this dataset accurately reflecting the actual extent (and lengths) of perennial stream networks. However, among geomorphologists this dataset is widely regarded as a very poor representation of channel network extents and perhaps sinuosity (even perennial stream networks) because it is ultimately derived from blue lines on old contour maps,

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and the criteria that were used to derive blue lines on maps were not necessarily scientific or consistent between different regions of the country. It might be appropriate for many purposes, but it may not be appropriate for identification of true drainage densities.

The authors make no direct tests of the validity of this dataset for this purpose in the paper. Instead, they support its use only with a citation to Simley (2003). Unfortunately, this is only a newsletter and not peer reviewed literature. In addition, the weblink in the citation takes one to a list of newsletters, and none of the newsletters date from 2003 at that provided site. Thus, there is no evidence that this dataset can be reliably used for the purposes at hand.

In addition, even if the dataset reliably represents "perennial" streams, we don't know the definition of perennial that was used to define those streams. The authors discuss various definitions of perennial streams, but they do not identify the definition that was used to delineate these stream networks or demonstrate that it was consistently applied through all regions. I believe the appropriateness of this dataset needs to be strongly documented and/or directly tested before we can have any confidence in the results. It would be much more convincing if the drainage densities were checked for a few stream networks with different aridity indices or runoff coefficients.

Second, and not as important, it is peculiar to me that the hydrologic data that are used in the analysis are from 1971-2003. The authors justify this selection by saying they hope to "minimize the non-stationary signals of water balance." I don't see how any choice of time period could avoid that issue completely. However, isn't it more appropriate to choose the hydrologic data so that it coincides with the time period when the channel extents were mainly calculated? When were these calculated? It would be important to know. Given the origin of this data, I would guess that much of the data pre-dates 1971. In addition, even if the dates are unknown, all drainage densities would have experienced the older period of hydrologic data, while only perhaps some would have experienced the more recent period of flows.

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Third, the authors acknowledge that many other factors (geology, topography, etc.) might affect the perennial drainage density, and they suggest that these factors should be investigated in the future. It might be worth considering whether any of these variables are correlated with the variables that are studied and thus might be lurking variables. In particular, I'm curious whether the relief of the watersheds (as a proxy for watershed slope, which will affect erosion and thus channel formation) is related to the aridity index in the dataset. It might be relatively easy to check and might strengthen the support for a direct relationship between the hydrologic variables and the drainage density.

Finally, I think the conclusions need to be more carefully written. For example, they state that the perennial stream density is "strongly correlated" with the mean annual runoff coefficient. However, I don't think any correlations are actually given in the paper (perhaps I missed them).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 7571, 2012.

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