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Comment on hess-2022-237

Anonymous Referee #2

Referee comment on "Power-Law between the Apparent Drainage Density and the Pruning Area" by Soohyun Yang et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-237-RC2, 2022

General comment

The authors investigated on the relationship between the pruning area of a river basin (A_p) and the apparent drainage density (ρ_a) presenting two analytical derivations demonstrating that the exponent η of the pruning area is equal to the exponent ε of the power-law exceedance probability distribution of drainage area. The authors tested the derivation on four US river basins and, subsequently tested the relationship of the exponent η with the fractal dimension of the river basins considering two literature expressions and proposing a new expression.

The work has a scientific value, but I have two main concerns related to the analysis.

- The hypothesis behind the two derivations of the exponent η. Section 2.1.1. The Derivation 1 is developed in the hypothesis that $A_p = A_{ð□□□}$ (Page 5, line 123). However, eq (14) is derived in the hypothesis that $A_p << A_\Omega$. The authors should discuss on this assumption. Does it mean that the expression could be scale relevant and not appliable if ω is close to â□¦? The same assumption ($A_p = A_{ð□□□}$) is done in Section 2.2.2 (Derivation 2), but then the equation (16) is generalized regardless the scale of the basin. Is equation (16) still valid if $A_p << A_{ð□□□}$?

- It seems that the authors proposed a new expression (eq. 25) of η as function of the fractal dimension D_b just "observing the real river network" and finding a support of this choice considering that quarter-power scaling laws are widely found in biological systems. However, the proposed equation, even if it performs better in the four case studies as respect to the literature expressions, seems to always underestimate the η value. Why fixing an "a priori" coefficient? Even if the sample size is very low, why not

deriving the coefficient, minimizing the error between observed and estimated values and proposing, as future development, a testing of the new expression with a wider sample size?

Minor comments

Page 5, line 134. "… the overland flow length W…" Do the authors mean flow width?

Page 11, line 259-260. What does "satisfactory results" mean? Did they calculate any performance indicator? The sample seems quite small (4 basins). Can the analysis be considered robust?