

Hydrol. Earth Syst. Sci. Discuss., author comment AC3
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Reply on RC3

Amilcare Porporato

Author comment on "Hydrology without dimensions" by Amilcare Porporato, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-442-AC3>, 2021

Thank you, Demetris, for the very nice words and for the insightful review!

Indeed, the paper tries to be didactic and in the revised version I will pay particular attention to make it more accessible and readable since it examines cases from diverse fields.

Regarding the section "2.3 Augmented and directional dimensional analysis" and its Appendix, I have tried to make this part more precise (besides correcting a few errors). I've thus discussed in more detail why, in normal conditions, the last Pi group can be neglected in (A3). This is related to a self-similar behavior of the first type, which is supported by experience. As correctly stated in the review, this is not a mathematical necessity, but merely a fact of experience. I've improved the presentation of these concepts in the revised version.

I also added the example of the wave and diffusion, as suggested. This is a simple, but illustrative example, which I also used in the medal lecture, which is worth reproducing in the revised version of this paper. Thank you for the suggestion.

I also agree with the need to improve the introduction of Eq. (7), where the power law (self-similarity) may seem to be introduced 'out of the blue'. It is also important to better explain that, in agreement with the review here and the references by the reviewer (Koutsoyiannis, 2014; Koutsoyiannis et al., 2018), expressions like equation (7) only hold asymptotically. This is at the heart of the very concept of (asymptotic) self-similarity.

Regarding the comment that 'scaling, self-similarity and fractal behaviour look to be overemphasized or overpraised in the paper', as in Figure 4, I should mention that this is not necessarily related to fractal behavior. Moreover fractal behavior can be, but does not need to be linked to stochastic behavior. Like in the Moody diagram in the fully rough regime, the scaling is simply a power law relation among variables (of course it results from some asymptotic behavior of turbulence which in this regime has specific statistical properties).

Of course, stochastic behavior is to be expected along with measurements and model errors. This is emphasized in the revised version of the manuscript. Indeed, the rainfall partitioning model is a stochastic model with random rainfall inputs. This is now emphasized and better explained.

Finally, regarding citations: Kolmogorov is now cited; Theodoratos et al. (2018) is also interesting and now cited – note however that here the authors use the wrong variable, the contributing area, A , instead of specific area, and this is explained in the revised text; and finally, the quote by Strahler is made more precise.

Thank you again for the insightful and useful recommendations.