

Comment on hess-2021-479

Anonymous Referee #2

Referee comment on "Morphological controls on surface runoff: an interpretation of steady-state energy patterns, maximum power states and dissipation regimes within a thermodynamic framework" by Samuel Schroers et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-479-RC4>, 2021

In this study, the authors investigated how the hillslope topography controls the overland flow, using thermodynamics metrics. It is a very interesting approach. The manuscript is overall well-written: in particular, the introduction is almost in a complete shape.

Nevertheless, I have a couple of main concerns. I wish the manuscript to be more focused. This is a very theoretical study... and it would not be easy for readers to follow. Clarifying focus would be helpful. I would suggest clarification in two points mainly.

1. If I understand correctly, one of the major motivations is the existence of the peak in the total energy distribution over hillslope shown in Fig 3. Yes, this could be an interesting subject to be investigated. The authors did detailed work in the following section. But after all, I don't really follow why this work and the contents are related to the maximum entropy production principle. Maybe I am misunderstood but I believe readers would be very confused.

2. I feel the contents in sections 3 and 4 are unrelated, and this makes me further confused about the focus of this study.

Below I list minor suggestions.

Title: I don't know whether the word 'Hortonian' here is necessary. This paper does not consider the runoff generation mechanism. The contents here are applicable for any overland flow, and whether the flow is generated through saturation excess or infiltration excess is irrelevant.

L 37: Typo (Dary-> Darcy)

Eq(1): Do you ever use this eq. in this study?

Eq(5) and others: The notation * to express 'multiplication' may be confused with the convolution symbol?

L219: I understand that in Fig3, the volumetric energy and its gradient decrease downstream, but I don't know whether they minimize? How do I know they reach the minimum?

L253: Authors use geopotential to express topography while most works simply use surface elevation profile. This is an interesting approach but I would really wonder what are benefits or reasons?

L352: I don't well understand why authors do this modeling.

Section 4.1: It would be very helpful if the study area is shown as a figure.