Nonlinear Processes
in Geophysics
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Discussions

Interactive comment on "Horton laws for Hydraulic-Geometric variables and their scaling exponents in self-similar river networks" *by* V. K. Gupta and O. J. Mesa

Anonymous Referee #1

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Referee report on

Horton Laws for hydraulic geometric variables and their exponents in self similar river networks

by

Gupta and Mesa

Gupta and coworkers derive H-S type scaling laws for hydraulic variables based on simple hydraulic relations, self similarity and mass conservation. The paper presents new results which may have significant impact for comparisons of field studies with

optimal channel networks and scaling relations of stream networks.

However the paper can be considerably improve in language and structure. The authors should try focusing on the main messages and provide a more stringent presentation avoiding lengthy explanations and repetitions.

a) First state what is the problem

b) Explain why the problem is important

c) Then discuss how the problem is solved

The paper is very technical. Thus it needs a very clear structure stating the assumptions, explaining what the predicted parameters are and showing what is compared with real systems.

The authors should invest more effort in improving the writing of the manuscript. I'll provide specific comments for the authors below.

The following general questions/comments the authors may consider:

1) The authors have to improve their explanation of the underlying physical reasoning for their result as many different processes can lead to the same scaling behavior.

2) Please elaborate in more details the "advantages/disadvantages" of the presented theory compared to the OCN theory. e.g. compare the different assumptions in the different models and discuss their significance.

3) The fact that slope defines a critical point is interesting. please elaborate how this fact can be interpreted in the context of scaling and critical phenomena. Is there a phase transition at the critical point?

4) style: simply say what has to be sad. references to explanations in subsequent chapters are unnecessary and sometimes even confusing

Specific comments and questions on the text are: line 1: three hydraulic variables,

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namely stream discharge... line 7: exponents for width... line 9: corresponding scaling laws for the H-G variables can be derived. line10: ... but do not agree with field observations obtained for three different sites. line 12: ... as the network order increases. However it.... line 14: What are self similar solutions of type 2 line 15: ... which allows us to...

abstract: The terminology SS-1 and SS-2 is used without explanation what it means. Please revise the abstract such that it is self explanatory. line 22: Horton discovered scaling laws when analyzing maps of river networks. line 23: His original motivation was... Generally the authors should explicitly state what Horton laws are: scaling laws for some quantity with Horton-Strahler branch numbering? line 25: Strahler modified the ordering Horton introduced. The Horton ordering was never introduced and it was never explained what the modification is. Either explain what Strahler modified or leave the statement out. line 39: What is the stream number? Did the authors mean "number of streams"? line 46: better say: Horton-Strahler type scaling laws seem to be universal and can be found in many natural networks such as plant growth.... give citations when making statements like this. line 50: ...recent research has shown that Horton like scaling relations naturally arise in self similar networks. Also citations are needed here. Reference to sec.2 unnecessary. line 64ff:Simply say: In a classical paper Leopold and Miller showed that also H-G variables follow H-S scaling laws in stream networks line 68: Here we develop ....

The introduction starts with a literature review, then switches to the main achievement "we develop...." and then switches back to the description of the structuring of the text. Section 2 repeats almost the same sentence and content as the introduction. Please avoid repetitions and structure the paper accordingly.

A clear definition of the (artificial) networks used in this study is needed: Define self similar Tokunaga networks. This is the basis of the analysis and important to understand the text. line 178: "we assume.... to solve this equation" Which equation is meant by this sentence and where is it solved. Is it related to sec4 100 lines later? Please

clarify.

line 164: Please justify assumption of constant length. line 170: network theory gives a topological description. For geometry however a length scale definition is missing. Please explain better how geometric properties are obtained from RSN line 420: ... without imposing Horton's law for the H-G ... Please state that ss-1 follows from OCN if so. language: In our model however ss-1 does not hold. line 565: "field experiment" may be better field study. The word experiment may imply some control on the process, which is not the case for measurements in a natural system. line 602: typo in $R\_Q\hat{}0$ plot Fig.3: caption describing what is shown in the plot. Larger dots, identify the slope. plot Fig.4: same as above. Fig.5 is how a plot should look like.

All together I would suggest the authors to revise the text and work on the improvement of the structure of the manuscript to communicate their thoughts more clearly, especially as the paper contains some interesting results. In a clear form I believe the manuscript will be an interesting contribution contribution for the NPG community.

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