

## ***Interactive comment on “Evolutionary geomorphology: thresholds and nonlinearity in landform response to environmental change” by J. D. Phillips***

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First of all, I really enjoyed reading this paper. It provides a neat philosophical perspective on thresholds and nonlinearities, which is the subject matter of this special issue. The paper has elicited one formal review and two informal reviews which arrived too late, and are appended below. The reviewers are also very enthusiastic about the paper.

While I am in philosophical agreement with the author on most points, I tried to interpret the ideas in a hydrological context. I very much like the comment that "generalization is enhanced by reducing rather than increasing the number of factors considered." This can easily apply to hydrologic systems as well. In spite of this, I am somewhat at a loss

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as to how to go about dealing with thresholds and nonlinearities that are ubiquitous in hydrology - how do I go about monitoring, modeling and predicting hydrologic systems and subsystems - hydrology is replete with approaches that treat the earth system as a continuum, continuous in space and time. Given that there are thresholds, given that they are important, how does one go about changing the way we analyze and incorporate these in our models etc which is different from the current reductionist paradigm? I did not get a clear answer to this question from the paper, although I learned how geomorphologists approach things.

The other aspect that got missed out is "pattern dynamics" - the tell tale signs that threshold triggering leaves behind either in the time record or in the spatial record. It will be great to get the author's insights into this aspect, even from a geomorphologic perspective.

Finally, I have attached the comments of two reviews which arrived late - both are very supportive and constructive and I would like the author to consider and incorporate these in the final version that will be submitted for publication in HESS.

Provided these done, I am in favour of publication of the paper in HESS. I look forward to receiving the final version for approval and forwarding to HESS.

M. Sivapalan

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#### Reviewer #2

Comments on Phillips: Evolutionary geomorphology; thresholds and nonlinearity in landform response to environmental change.

For this special issue this is an excellent review and introduction to nonlinearity in geomorphology. In particular it demonstrates the reality and real consequences of non-linearity and points to how progress can be made through recognition of nonlinearity rather than avoiding it or throwing up our hands. And the paper is well written. There

are some points for improvement.

First, while the meta-explanation claims of some theory are rightly, in my opinion, off-putting, some degree of generality among systems is worth investigation and the author would better serve the readers to point out where self-organization or emergence may be useful concepts to compare among systems. But rather than considering any and all uses of the term “self-organization” discussion should be limited to where it is a strict consequence of nonlinearity wherein a system of many dimensions is reducible.

Following on this, given that this paper will open up a literature for many readers, there is an untapped discussion that is important to geographers, if not others, that could be brought in. Starting with: Massey, D. 1999. Space-time, 'science' and the relationship between physical geography and human geography. Transactions of the Institute of British Geographers 24:261-276 [already cited by the author in 2001]. one can see that there has been a discussion in Britain on the relationships between history and geography that touches directly on the points raised by the author in section 4. She and others who respond directly address evolutionary geomorphology. And while this paper is a good introduction to the author's own work, which is as good as any entry into the field, the points made in

Phillips, J.D. 1999. Spatial analysis in physical geography and the challenge of deterministic uncertainty. Geographical Analysis 31:359-372. - not cited here - are also complementary to section 4 and should be added.

And given that this is a review of sorts, the addition of another reference or two would not hurt. Where the text reads:

Notwithstanding the comments above, nonlinear dynamics and complexity have been widely discussed in geography, geology, and geomorphology with an emphasis on abstractions of theory rather than concrete aspects of surface forms and processes, and on imported rather than home-grown methods and terminology.

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it would be appropriate to cite (saying discussed, point to) the work of Malanson, which uses this broad brush, and perhaps Turcotte; for example:

Malanson, G.P., Butler, D.R. and Georgakakos, K.P. 1992. Nonequilibrium geomorphic processes and deterministic chaos. *Geomorphology* 5: 311-322. Turcotte, D.L. 1990. Implications of chaos, scale-invariance, and fractal statistics in geology. *Global Planetary Change* 89:301-308. Additionally, unless the topic is being addressed elsewhere in the special issue, the role of nonlinearity in ecohydrology should be cited, as in the work of Rodriguez-Iturbe and students: Manzoni S, Porporato A, D’Odorico P, Laio F, Rodriguez-Iturbe I Soil nutrient cycles as a nonlinear dynamical system *NONLINEAR PROCESSES IN GEOPHYSICS* 11 (5-6): 589-598 2004 Guswa AJ, Celia MA, Rodriguez-Iturbe I Models of soil moisture dynamics in ecohydrology: A comparative study *WATER RESOURCES RESEARCH* 38 (9): Art. No. 1166 SEP 2002

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### Reviewer #3

I have noted a couple typographic errors in the manuscript. The typos I noted are in section 4, paragraph 3 (“generalizations”) section 5, paragraph 3 (“we make seek”).

Otherwise the paper is excellent and I would like to recommend acceptance

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 365, 2006.

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