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Geoscientific Model Development Discussions



# *Interactive comment on* "eSCAPE: Regional to Global Scale Landscape Evolution Model v2.0" *by* Tristan Salles

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This manuscript presents "eSCAPE", which is a model developed to explore landscape erosion and deposition both above and below sea-level. The model is relatively well described and uses a nice range of techniques to model many of the sub-processes involved. I would like to hear how the author defends criticism that this model is not novel. eSCAPE v1 was published in the Journal of Open Source Software, how does v2 differ? What makes it require a whole new publication? Furthermore, and I ask this out of naivety, how does eSCAPE differ from Badlands? Is the difference significant? Overall this is my only major concern, and it is one that is potentially wrong. Otherwise in general the manuscript is well written (except for a few grammatical errors with verb conjugation).



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Discussion paper

Minor comments in the order in which the come in the text:

The introduction way oversells the model. Yes, it can model global erosion and deposition using a set of rules, however the model cannot capture lateral movement of the surface due to faulting. In fact there is no faulting, which is arguably the major process that connects mantle convection to surface processes. This is a very challenging problem, and not one the author seeks to solve. However, much text is wasted on describing a vision of a global coupled model. This should be saved for a research proposal and not used here. Explain what the advance is in this model, how it advances on v1, and Badlands. What is eSCAPE v2 for?

Line 15: What was the reason for cherry picking these citations, none of which date from the 80's?

Line 28: What is the purpose of this paragraph? As it is, it is far too short to encompass how global mantle flow is expressed at the earth's surface.

Line 70: I thought the approach of Jean Braun was O(N) efficient, always? Is the author saying otherwise?

Equation 2: The first line does not make sense. q_1 = b_1, not q_i = b_i

Line 127: "calibration" is out of place here.

Line 128: "evidence" should not get an "s", likewise "behaviour". There are other minor grammatical errors which I am sure will be corrected when copy edited.

Equations 7 and 8: Here it is hard coded that n=1 and m=0.5. This is stated later in the manuscript, but this is potentially a major limitation of the model, as the recent study by Kwang & Parker (2017) suggests that "the choice mâĹŢnâĂĽ=0.5 yields a curiously unrealistic result: the predicted landscape is invariant to horizontal stretching".

[ Kwang, J. S. and Parker, G.: Landscape evolution models using the stream power incision model show unrealistic behavior when mâĂĽâĹŢâĂĽn equals 0.5, Earth Surf.





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Dynam., 5, 807-820, https://doi.org/10.5194/esurf-5-807-2017, 2017. ]

Line 159: In this equation the non-suspended sediment gets left behind, right? But the stream power law assumes instantaneous sediment transport. Therefore the two are incompatible? I am missing something here. Perhaps some additional explanation of how the model goes from erosion to deposition would help.

Section 2.3: The “priority-flood” algorithm is non-physical, right? I wonder if it should not be done after the hillslope processes (diffusion), as this would smooth depressions and potentially fill them. Then the subsequent filling by fluvial deposition should occur?

Section 2.5: Does marine deposition use a constant diffusion coefficient? Some marine deposition models vary this diffusion coefficient with water depth, to simulate wave and tide effects. I assume that this is not the case within eSCAPE?

Table 3: I think the marine parameters are missing from the table.

Summary:

I think eSCAPE is a very nice model but I think this manuscript could explain the model a little bit better. My only major criticism is the lack of clarity on how v2 of this model differs from v1, and why that difference warrants another publication.

Reproducibility:

The code is available and I have successfully installed it. I have come across minor issues in running the code, due to my install of python and petsc, but this will be fixed before publication I am sure.

I hope these comments help

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