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Earth Surface Dynamics Discussions

Interactive comment on "The role of hydrological transience in peatland pattern formation" *by* P. J. Morris et al.

Anonymous Referee #2

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This manuscript describes a numerical model that simulates peatland pattern formation in bogs. This is a good study that clearly furthers our understanding of the mechanisms that underlie pattern formation in peatbogs. This paper is of obvious interest for peatland scientists, but also for ecosystem ecologists and modelers and I recommend it for publication. I enjoyed reading the manuscript, as it is well written, the model parameters are well explained, and the results are clearly presented and discussed in light of previously published findings.

In this paper, the authors increase the realism of previously published models by getting rid of 3 simplifying assumptions related to hydrological parameters, permeability of deep peat layers, and peatland surface hydrology transience. However, despite the degree of sophistication of this new model, results presented here are not very differ-

ent than those from the original and simpler models. For example, pattern formation is still very sensitive to initial values of peat hydraulic conductivity and transmissivity, suggesting that (1) the new model might still be lacking some important negative feedbacks, and (2) the original model results were real, and not mathematical artifacts (as previously proposed in the literature). The authors acknowledge this fact and suggest a series of improvements for future models (e.g., routines that describe litter production and decomposition, and continuous changes in peat hydraulic conductivity). In addition to this list, I suggest that a short section (a few sentences at most) discussing the effects of different plant functional types should be added.

My only concern with this study relates to the (very short) time is takes for the model to generate patterning. The authors indicates that "...equilibration times required by the hydrological submodel to attain the level of transience necessary for patterning are of the order of hours to days: these timescales are largely meaningless in terms of vegetation dynamics." I agree with them and would like them to further address this concern: what does it mean for real-life ecosystems? how to compare these findings to empirical studies?

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