

## ***Interactive comment on “Transient simulations of the carbon and nitrogen dynamics in northern peatlands: from the Last Glacial Maximum to the 21st century” by R. Spahni et al.***

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This paper reports the development of a new aspect of the LPJ/LPX DGVM to incorporate N dynamics in the peatland part of the model and develop an aspect related to the transfer of C from upper to lower layers in the peat. The model is used to simulate peat growth since the LGM and output is compared to temporal and spatial patterns from peat core and soil map data. The final part of the analysis is to simulate future changes in peat C accumulation to 2100. The model development is a further advance in the progress of LPX and the simulations suggest that this approach has much promise. This is a major contribution to the science and I have only minor suggestions

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for change and a few questions and comments.

5638, L25. This implies that acrotelm thickness is varied and if so how is it defined – by water table position alone? Is this the average or maximum WT depth in the year? Later it is suggested that the acrotelm is fixed at 0.3m. Acrotelm definitions and variability are a bit unclear especially in relation to the discussion of water table variability in 2.2.1.

5642, L15-25. It is always easy to criticise the simplifications necessary in modelling studies such as this but the use of interpolation between 1000 yr timeslices of the climate model data needs further comment. We know that there have been very significant (sub)millennial scale changes in hydrology (and temperature) through the Holocene in many northern peatland regions. It would be interesting to know what the potential impact of these short term events might be on peatland C cycling. I am not suggesting that these analyses are done here but it would be good to see some comment on this. P5649 mentions this variability, but how big is the estimated influence of these factors?

P5645. Section 3.2.2. Does this mean that the model data are not being used to determine the timing of peat initiation at all, as they are set by basal peat age?

P5648. 4.2.2. Tuning using peat accumulation as the target. Does the use of the total C accumulation for each time step limit the tuning? It is clear from the plots of simulated C compared to observed C (Fig A1) that the patterns of change over time are very different even if the total C accumulated might be similar. Is the model right for the wrong reasons?

P5649. L15-20. The comparison between data and model for the Scottish sites is interesting because it shows that the data are more variable than the model. The Glen Torridon site shows an early Holocene peak – does this imply that perhaps local autogenic factors are at play – perhaps plant community influences? In general, the model underestimates the variability and often the temporal trends in peat accumula-

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tion shown by the data.

Fig 4 P5677. Are these the mean annual T and P or seasonal?

Fig 5 and P5650, L12-13.: Is this correlation only for 5 points? It looks as if the Siberian site drives this almost completely. Without Siberia there looks to be no relationship because only a very small part of the gradient has data.

P5653 L4. Why is there such a high frequency of near zero acrotelm-catotelm transfer rates? Perhaps I missed this but this needs some comment and explanation.

P5656. Section 5.4.4. I am not clear why scenario T09 LGM was run. The data on peat initiation are pretty unequivocal so it is not surprising that in this section the modelling suggests that the WSL could not be older than the data – if the model had showed it was possible, I would have doubted the model, not the data!

P5658. Section 5.5. Can you comment on the limitation posed by the different timescale for future response? All the model testing is over 1000 year timesteps and the model is good at multi-millennial totals but less good a temporal variability over shorter periods. How good is the model likely to be at simulating 100 years in the future? I guess that because the climate changes are large by comparison with the past this may not matter too much but can you comment?

The fonts on many of the figures are illegible or very difficult to read. Please check these are all OK in the final pdf file.

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