Review of « A process-based Sphagnum plant-functional-type model for implementation in the TRIFFID Dynamic Global Vegetation Model », by R. Coppell et al., submitted to *Geoscientific Model Development.*

This study by Copper et al. presents a new *Sphagnum* plant functional type model designed for implementation in the TRIFFID dynamic vegetation model. As far as I can judge, such a study is novel and is worth being published. The main novelty is the extension of photosynthesis/growth model to non vascular plants. The text is relatively clear and well written. However, there are a certain number of points that must be considered before publication, including some mistakes in the equations that must be corrected.

Major points:

(1) The β factor in Table 2 and equation A.1 multiplies the assimilation rates. This assumes that photosynthesis responds directly to soil water stress. Personally I think that, at least for vascular plants, this response should be indirect, i.e., it is a response to the progressive closure of stomata, which themselves react to decreasing soil water. So, for vascular plants, it is the stomatal conductance g_s that should be affected by the β factor. The authors refer to Cox et al. (1998) to justify this multiplication of the assimilation rate by β. Cox et al (1998) indeed used a β factor (very similar, although slightly different mathematically), but this factor was applied to the stomatal conductance (Jarvis model), not to the assimilation rate. The authors should justify their procedure. It implies that when soil water decreases to the wilting point θ_w, the α parameter grows to infinity, whereas it would tends towards zero in the case the β factor multiplies g_s. So, the mathematical solution may be impacted. For non vascular plants, g_s may be considered as independent of soil water (as the authors assume), although Williams and Flanagan (1998) reported a dependence on water table depth (as mentioned by the authors in appendix 2). Also, what is the critical soil water θ_c? Does it correspond to the field capacity, as in Cox et al. (1998)? It is reasonable to assume that stomatal conductance is progressively lowered (at least for vascular plants) when soil water decreases below field capacity. But it is not really reasonable to assume that plant desiccation will start at field capacity. For vascular plants, this normally starts at θ_w. So, why multiply assimilation by the β factor? For non-vascular plants, it may be different, desiccation may start earlier, but a justification of the procedure used here is needed and it should be based on an explanation of the processes (or at least on process-based hypotheses).

(2) There are mistakes in equations A.12, A.13 and A.16 and A.17. These equations are not dimensionally correct. In these equations, R_d should be divided by V_m (eq. A.12 and A.16) or by γ (eq. A.13 and A.17). Moreover, the last term of eq. A.13 is also wrong: it cannot contain K that comes from eq. A.1, since A.13 does not correspond to the Rubisco limitation case. Please, correct these equations. If these equations are also incorrect in the code, then the code should be modified and rerun. But possibly it is just a problem of the manuscript. Please check.

(3) Your validation in Figure 1 is not convincing. With respect to Strack et al. (2009) you have modified the respiration curve. Indeed Strack et al. report ecosystem respiration (ER) and net ecosystem exchange (NEE), but you need Sphagnum autotrophic respiration (R_p) and net primary productivity (NPP), because your model does not contain soil respiration (i.e., peat decomposition) and vascular plant respiration. For that reason, you are making a correction to the respiration curve of Strack et al. (2009), that you take as constant, as explained on page 18. This explanation is not convincing. For instance, you just discuss vascular plant respiration, but not heterotrophic respiration, which may vary strongly with water table depth. I would recommend removing the R_p and NPP curves in figure 1, and thus validating only GPP from these data.

Minor points:

- p. 12, definition of g_s: it should be specified that this conductance is for water vapour
- p. 13, definitions of N_l, N_r and N_s: units should be mol N m^{-2}, not mol CO_2 m^{-2} s^{-1}
- p. 15, table 3: description and references should appear in different columns for clarity. Also description may be slightly expanded (some of the parameters are very specific to TRIFFID)
- p. 18, lines 16-19: you should provide somewhere in the paper the climatic inputs you used in the model, since these are fixed. We need to know more about your model inputs.
- Figure 1, p 19: use more contrasting colours than dark blue and black
- Figure 2, p 21: the difference between model and data is sometimes quite important. May need more comments.
- P. 25, line 13: notation capital Θ should be replaced by lower case θ
- p. 25, line 20: f_T and ω both occur twice
- both V_{max} and V_m are used for Vc,max. Is there a difference? Should be harmonized.
- p. 30 line 18: "dependent" instead of "dependant"
- p. 31 line 27: "…that different desiccation stress functions are required…" instead of "…that a different desiccation stress function is required…"