

General comments for Garisoain et al.

The research entitled “Sphagnum and Herbaceous Net Ecosystem Exchanges in a Pyrenean Peatland: A Long-Term Study Using the ISBA Model” provides, in my view, valuable contributions to the peatland modelling field, and should be published provided minor changes are made.

The inclusion of a *Sphagnum* PFT to account for crucial peatland feedbacks was shown to make a considerable difference to the land surface model ISBA. The paper is long but thorough, and usefully presents the implementation of this model development to a calibrated simulation.

There should be more care taken, however, to explain how the model is being validated against a different model of in-situ data rather than the site data in its rawest form. This often cannot be helped, but it warrants more discussion after presenting the model validation results to ensure readers are not misled.

Formatting figures should be checked for colour-blindness suitability. If any of your figures were in black & white, they would be very difficult to read – especially in Figure 3, where the mean and maximum air temperatures are only differentiated by the axis label colours, and Figure 5, where line thickness and colour intensity are similar such that they cannot be distinguished in black and white.

Line-by-line comments

Lines to expand:

43: another citation here would be useful, unless you are citing Turunen (2003) consistently throughout the paragraph – in that case, present that work more formally to better indicate that it informs multiple lines in the paragraph.

68: specify that ‘average depth’ refers to peat deposits.

73: it would be useful to have some indication about the positioning of the piezometers within the site – nearby specific vegetation types? Placed randomly? Placed in a grid?

76: the ‘Couserans massif’ phrase is unclear to those not familiar with French geography and may be worth introducing in section 2.1.

78-79: the sentence “The vertical resolution ... carefully considered” does not make sense. Reword.

79: by ‘this’, are you referring to the model, the model’s resolution, or something else? Be more specific.

81: the ‘see also’ phrase should be expanded to a full sentence to claim how the vegetation is portrayed in your 2023 paper’s figure.

123: you have inconsistencies with naming equations compared to page 4. This continues throughout the paper.

167: explain more. Vertical distribution? Is this constant throughout the simulation or an initial condition? You get into it more by line 205, but it would be better to make it clearer here too.

225: cite the CENTURY model for thoroughness.

332: R^2 values below 0.5 warrants more explanation for their inclusion. Also, in the referenced Figure A4, you do not define subfigures (e) and (f).

364: it would be useful to re-state that reported values are coming from ISBA in this section even if it seems redundant. This recurs in line 413 when discussing the dryness index – it may be useful to re-state that this is/isn’t an ISBA output as it’s not easy to keep track.

367-369: you present the results qualitatively. It could be useful to put a number to the acceleration in NEE decline by comparing simple linear regressions for the two periods you describe. The same could be said for year-to-year variability; you could compare average change year-to-year for the two periods. This may not be statistically significant, but will make the point more concrete.

375: How did you pick the time ‘several time periods’ displayed in the figure? You kind of explain in line 386, but it is unclear if this selection was intentional to show this point, or if the finding occurred organically from blocking out the three periods of time blindly.

411: ‘or contribution of 48% Figure 6’ in the parentheses does not make sense. Do you mean to use the previous figure to contribute to the point that summer NEE ‘drives’ cumulative NEE? If so, give it its own sentence.

510-511: the sentence ‘Over the long term ... carbon sources’ deserves a citation, or more notes on where you’ve seen this in your data. If van der Woude et al. (2023) is the citation, you can connect the previous phrase with this one using a semicolon to make this abundantly clear.

Table A1: The inclusion of the value for SWI_c is confusing if not given more context. Does this mean SWI for C3 herbaceous plants? This is specified in the main body of the paper. Where did you get this value?

More nitpicky formatting notes:

Note that before the text begins, you need to capitalise the second name of the Correspondence Author.

20: change ‘most’ to ‘more’ to avoid superlatives.

27-32: consider abbreviations for the models you describe, especially those you repeat later. The phrase “developed as offline tools ... framework” is awkward and could be rephrased.

40-41: I do not believe “Average” should be capitalised, and you should capitalise the components of LORCA contributing to its acronym.

49: abbreviate ‘continental surface models’ to CSMs in tandem with changes from lines 27-32.

58: do not separate objective with full stops. Rather, use semicolons.

80: italicise all Genus and species names for plants.

95: fix citations - Goudriaan (1986) and Jacobs (1994).

96: it’s a bit confusing to introduce eq 2 before eq 1. It makes sense for (1) to be first, so restructure the sentence to match this order.

100: ‘That’s to say’ is a clunky phrase; use ‘meaning’ instead. I think it would read better for C_i and CO_2 to have separate units despite being the same.

104: you have ‘et’ instead of ‘and’. You need an ‘is’ after I_a .

106: add R_d in the beginning of the phrase like you do for the previous eqs.

107: ‘type of PFT (plant type)’ is clunky. Reword – maybe ‘PFT parameters’?

117: instead of a comma, connect your two references (Shi et al and Walker et al) with an ‘and’.

121: ‘Although they are not the same physical quality’ is either incomplete, or should be connected to the prior statement with a comma. Maybe restate the year (1994) rather than just saying ‘Jacobs’ as it’s on a new page from the original citation.

124: fix citation – Gong et al. (2020).

128: you do not define ω_{opt} .

132-133: italicise *Sphagnum*.

136: rather than ‘a day’, say ‘one day’ or ‘a timestep of one day’.

142: 'SLA (constants e and f)' is ambiguous.

156: change 'grass/herbaceous' to 'grass/herbaceous PFTs'.

158: change 'plant functional type (PFT)' to simply 'PFT' or 'the selected PFT'.

162: 'B' is missing formatting. Add a comma after *B_{brown}*.

174-178: make this more concise; it does not flow well.

193: the line would read better as: 'Below a threshold value, as the *Sphagnum* mosses dry out, the resistance of the *Sphagnum* increases linearly, allowing the retention of a minimal threshold of water in the mosses. As such, we define:' Omit space before colon.

198: define SWI_{sp} on line 195. You replace 'Water' with 'Wetness' on page 8 – make consistent.

206-208: Move the sentence 'Beyond 10 cm ... $SWI_{sp}=0$ ' after the sentence following.

212: no need for a new line here in my opinion.

228: no need for 'see', you can just cite using (Gibelin et al., 2008).

233: the word 'set' is unclear. Reword more explicitly. Is this an initial condition? Default?

243: missing subscript for O₂.

256: italicise *i* and *j*.

258: fix citation - (Morel et al., 2019).

259: remove contraction.

262: 'potentially *a* limiting reaction'.

265: rather than saying gas transport by plants, you could say plant-mediated transport, which explains the abbreviation better.

267: rather than saying vegetation type, you should say PFT to stay consistent.

277: no need for period after 'summation'.

281: fix citation – Garisoain et al. (2024).

283: add 'the' between 'use' and 'daily'. Put a period after $dif(t)$.

287: no need for period after 'A3'.

289: I do not believe you define the dryness index as DI explicitly anywhere. Equations 18 and 19 seem not to be well explained, even if they are simple.

295: you begin to introduce unnecessary extra spaces here.

308-309: omit sentence 'In other words ... are introduced'. You are clear enough in this paragraph without over-explaining.

320-321: capitalise Section.

323: two full stops here by accident.

326: capitalise Carbon. In the Figure 1 below, put y-axis units in parentheses.

332 & 344: missing a comma before 'Figure'.

Figure 5: using 'minus' to mean negative sounds clunky – I would simply say 'gross primary productivity' and explain it is negative to visually demonstrate it in balance with ER to create NEE. You should omit the space between 'periods' and the colon.

386: omit 'the'.

Figure 7: omit 'the' and 'one' on either side of 'annual'.

411: comma after R^2 before figure A7.

444: make singular – 'the black curve represents...'

455: the opening phrase is clunky and could likely be said in fewer words.

494-495: restructure the sentence as so – 'Despite some differences in seasonal representation, both ISBA and the statistical model by Garisoain et al. (2024) agree that ...'

520-521: italicise *Sphagnum*.

Figure A6: 'Hourly' misspelled.

Table A1: 'functional' misspelled in title. No need for a space between Notes 1 and 2. Semicolon would be better after $D^x_{max} = 0.4$. You haven't properly formatted g_m or D_{max} . Page number for p. 38 is the wrong font.