

Interactive comment on “Modelling short-term variability in carbon and water exchange in a temperate Scots pine forest” by M. H. Vermeulen et al.

Anonymous Referee #2

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General comments: The paper studies vegetation – atmosphere carbon and water exchange using multiple years of Eddy Covariance data from Loobos, a Dutch Scots pine forest and LPJ-GUESS, a process based ecosystem model. Specifically, the paper looks at multiple timescales (daily, monthly and yearly), and shows that interannual variability in carbon and water exchange (IAV_{cw}) is not well captured by models. Next, different model versions are used in order to explain and minimize the IAV_{cw}.

Overall, I think the paper is well written, and interesting. The extension of the model with carbon uptake up to -10 degrees Celcius is interesting, even though it is not improving IAV_{cw} much. Also, the different water uptake routines show interesting results.

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I would recommend this paper for publication, with minor revisions. Please see comments below.

Specific comments: Page 275, eq 1. What is $p_{stemhigh}$ and $p_{stemlow}$? This is not clear from the next, nor from figure 1. Also, I would recommend not just explaining the abbreviation in the figure caption, but also in the text.

Page 278, section 2.3.2. In this section, the authors show some results for the alternative temperature response function, also referring to the supplementary information, and in section 3.2.1 (page 281) more about the temperature response is shown. I would suggest to move large parts of section 2.3.2 to section 3.2.1 so the paper is better structured.

Page 283, line 20-22. Figure S3, the authors state that the soil moisture patterns are captured reasonably well compared to observations, but I see quite a distinct difference in the years 2000 and 2005-2008, with the model showing much more dynamics than the data. 2003, on the other hand, is captured much better where the data show much more rewetting in the beginning and the end of the year, which the model also simulates for the other years. However, the data don't follow this rewetting patterns. Could the authors please comment?

Page 284, line 1-5. In figure 8, modeled transpiration versus observed sap flow is shown. In the text, the authors stress the good correlation in these figures. However, I would like to ask them to comment on the difference between S1 and S2-S3. The latter two have much less modeled transpiration (ranging from 0-1.5) than the observed sapflow (ranging from 0-3). However, S1 has a similar range in modeled and observed transpiration (except for 2009, where sapflow had a smaller range, up to 1.5 rather than 3 mm/day as in the other years). In the manuscript, the authors indicate the conservative water uptake by S3 (as is also shown in figure S1). Could they explain why we also see a smaller range in simulated values for transpiration for S2? Also, S2 indeed increases the r (table 3), but increases the RMSE at the same time.. How do

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these changes affect figure 2?

Page 284, line 19-21: and to a lesser extend S2?

Page 288, line 25-26: Could the authors explain further? Because of drainage below the rootzone? Water that is not intercepted will enter the soil, correct? And then be available for AET? Unless it is drained?

Page 289, line 26: the onset of drought, rather than drought? In figure S3, the 2003 drought seems to be captured well in general..

Technical corrections: Finally, some minor grammatical and style suggestions:

Page 272, line 21-22: Reichstein instead of Re-ichstein Page 275, line 6: change into 'The scalar c1 is. . .' and remove c1 from the end of the sentence? Page 275, line 17: change) to be after Vm instead of after temperature Page 275, line 21: add comma after kinetics Page 278, line 13: change into: 'than, but in a similar range as, observed..' Page 280, line 24: add (2.4 and 1.6 respectively) after observed Page 284, line 6: add (S2) after 'species specific uptake' Page 284, line 7: add (table 3) after 'coefficient'

Figure 6: add 'winter' in the beginning of caption, rather than at the end Figure 9: add 2003 and 2005 in the figure itself (e.g. above the different figures, 2003 on the left and 2005 on the right)

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