

## ***Interactive comment on “Competing roles of rising CO<sub>2</sub> and climate change in the contemporary European carbon balance” by R. Harrison and C. Jones***

**R. Harrison and C. Jones**

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We are now ready to resubmit or version of the manuscript 'Competing roles of rising CO<sub>2</sub> and climate change in the contemporary European carbon balance', which has benefited by consideration of the reviewer's comments we received. The manuscript has been much improved, and we thank the reviewers for their thoughtful comments. To receive 4 such positive reviews was very encouraging. We have also received considerable help with both the paper revisions and extra analysis and also in some new simulations from John Hughes, and so his name has been added to the author list.

Our responses to your comments are as described below (reviewer's comments in

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italics). The changes are often very minor, but where we have made a significant change we have described what we have added.

*Abstract: I suggest deleting the second paragraph of the abstract. It is duplicated at the end of the conclusions and in my opinion is more appropriate for the conclusions than the abstract.*

We agree and have updated as suggested, although have kept the final sentence of the second paragraph.

*Links to Vetter et al paper: I think there are times when more reference could be made to relevant information in the Vetter et al paper, but there are also occasions where it would be useful to repeat the information here rather than rely on the reference. For example, I suggest that when the JULES model is introduced (p2388-2389) it be noted that more model information is given in Table 1 of Vetter et al.*

OK. We have extended the model description section, added reference to the Vetter et al paper, and also a reference to the JULES website.

*An example of when I think the Vetter et al reference is insufficient is for the definition of the four European sub-regions (North, West, Central, East) (p2389). I think these need to be shown in this paper, so that the work presented here can be correctly interpreted. This will require adding another figure, or adding region dividing lines to Fig 2. It would also be useful to explain the Eastern boundary of the figures: Vetter et al. indicate that the simulation was for 15W-60E and 30-75N but was the simulation not performed for the SE portion of the region?*

OK. We have added a figure to show this. The SE corner is missing as we are constrained by the availability of driving data and hence we must use the model domain of the REMO climate simulations.

*Sec 3.1.1 and Figure 1: In the main text you are clear about what the sign of NEP means for the CO<sub>2</sub> flux to the atmosphere, but in the figure you reverse the axis which*

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*I suspect could easily be missed. You need to note this for the reader, definitely in the figure caption but probably in the main text as well. I wonder too whether the figure would be more meaningful for readers if it was presented as an integrated number for Europe in TgC/y. It would make comparisons with the summer 2003 values given in the second paragraph of this section more meaningful. At the moment this second paragraph seems too discursive and had no direct link to the results in Fig 1, in fact Fig 1 does not show 2003 as unusual. If you want to keep this information here, then you need to make the appropriate links to your results - my understanding from the Vetter et al paper is that JULES gives a 2003 anomaly for Western Europe but not Europe as a whole - if this is the case, you need to explain that this is the reason that 2003 does not stand out in Fig 1. I also think that the Pinatubo paragraph in sec 3.1.2 (p2392, line 18-25) might fit better in this section.*

The 2003 anomaly was centred over Western Europe (as discussed in some detail in Vetter et al), and to some extent was countered by an opposite anomaly in the East, leading to a smaller signal at a Europe-wide level. The Vetter et al paper also discusses that JULES is less sensitive to the anomaly than other models. Why this is remains unknown, but is actively being researched. This is now explained.

*Sec 3.1.2 and Figure 3: The decadal changes shown in figure 3 appear to be quite small - how do they compare with interannual variations in these fluxes?*

We have revised how this figure is plotted in order to show data more clearly and also improved the clarity of the relevant text.

*Sec 3.2: I didn't find this section very clear. You might consider moving the second paragraph to earlier in the paper when Fig 2 is previously discussed. Ok*

*The third paragraph seems to be too general to fit here - perhaps it would fit better at the beginning of the discussion section? Paragraphs 4 and 5 might be easier to follow if you describe what is seen in the Figure first (the latitudinal gradient of increased uptake) and then explain it by changes in water use efficiency. We have moved the first*

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sentence.

*Discussion: It took me a while to work out that each of the paragraphs in this section were all related to the first sentence of the discussion - the different components of climate. This needs to be clearer, otherwise the discussion seems to lack focus. You might also like to think about whether any of this can be linked back to the simulations that you present here so that the connection with this work is maintained. We have made this clearer*

*Technical corrections*

*p2387, line 24: small n for nitrogen done*

*p2387, line 25: should the first Ciais reference in this line also be 2005b? Yes - done*

*p2389, line 7: 'does' not 'dos' Done*

*p2389, line 12: 'changes' not 'change' Done*

*p2389, line 15: comma (,) after 'climate' Done*

*p2389, line 17-18: move close double quotes from end of line 17 to after 'CO2' on line18 Done*

*p2389, line 15 and line 18: labelling the second simulation 'climate only' rather than just 'climate' may be a little clearer, although you don't actually make much use of these labels through the paper so perhaps you don't need them at all? We have improved the text along these lines*

*p2390, line 8: suggest replace 'below' with 'in sec 3.2' Done*

*p2390, line 20: change 'and reducing of uncertainty' to 'and to reducing uncertainty' Done*

*p2391, line 5: suggest removing the paragraph break and adding 'Clearly' before 'The climate impact' and 'For example' before 'Where ecosystems ...' Done*

**BGD**

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*p2391, line 9: add 'the' before '1980s'* Done

*p2393, line 1: the subscript 2 in CO<sub>2</sub> appears to have dropped out of the section heading and onto the next line* OK

*p2393, line 5: add 'the' before 'observed CO<sub>2</sub>'* Done

*p2393, line 15: are the two Janssens numbers supposed to indicate a range. If so then write as 'around 135-205', otherwise please explain why there are two numbers. Yes this is a range, now corrected*

*p2393, line 23: remove 'increased' before 'carbon storage'* Done

*p2395, line 5: hydrological misspelled* Corrected

*p2396, line 7: suggest adding 'in stored carbon' after 'net increase'* Done

*p2396, line 14: Shouldn't 'increased' be 'decreased'?* Done

*p2396, line 24: subscript 2 in CO<sub>2</sub>* Done

*p2396, acknowledgements: these appear to end mid-sentence* Acknowledgements are complete, end of sentence overleaf looks new because of capital E.

*p2398, line 30: should it be 'at' not 'as'?* Done. we are impressed by the referee so thoroughly checking the reference list!!

*p2399, line 6: missing initials for Jenkinson* Done

*p2399, line 32: missing accents on Le Quéré* Can type setter do this please?

*p2403: the colours given in the figure caption disagree with what is shown in the figure key. Also no units are given.* Corrected

*p2405: delete 'in' from second line of caption* Done

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Interactive comment on Biogeosciences Discuss., 4, 2385, 2007.