Reviewer #2

Original comments are given in normal fonts, the reply is set in bold. New revised text in red.

The paper setup is a bit confusing as the forcings are provided (and simulations are performed) for the last 21 kyr (Figs. 2, 3) so that the reader would expect to see the results for the whole 21 kyr period. However, the CO2 fluxes and temperature changes are given only for the last 19 kyr (Fig. 6), the oceanic 14C budget is given for the period from 13 ka to 4 ka (Fig. 9), and 14C production rate is shown only for the last 10 kyr (Fig. 10). This difference between simulated and analyzed periods is not reflected in the last paragraph of the introduction where the outline of the paper is described. A brief explanation of a rationale of focusing on different intervals in different sections of the text would be helpful.

The following sentence is added on page 1174, line 21:

"The transient simulations are started at 21 ka BP well before the analysis period for the production (10 to 0 ka BP) to account for memory effects associated with the long life time of radiocarbon (8267 years) and the millennial time scales of ocean-sediment interactions."

The reconstruction of radiocarbon production during the last glacial termination is outside the scope of this paper. Such a reconstruction would require an earlier start of the transient simulations. The marine radiocarbon budget is shown in Fig. 9 to illustrate how different assumptions on the processes governing the carbon cycle changes over the last termination affect the Holocene production reconstruction. We have selected the period from 13 to 4 ka BP to illustrate the differences between the different setups. Fig 6 has been revised as suggested and the forcings are now shown over the period from 21 to 0 ka BP in the revised manuscript.

What I missed in the manuscript is a discussion of how good are the two model runs, CIRC and BIO, in reproducing 14C dynamics during the so-called "Mystery Interval" from ca. 17 to 14 kyr BP (Broecker and Barker, 2007). I understand that this paper is about the Holocene dynamics and it is already long. However, it would make sense at least to mention Broecker and Barker's study in the introduction as one of motivations to simulate the atmospheric 14C dynamics during last 21 kyr using a coupled climate carbon cycle model.

A detailed discussion of the glacial termination and the Mystery Interval is outside the scope of this paper. We prescribe atmospheric $\Delta^{14}C$ and the 190‰ decrease during the Mystery Interval in our simulations. Thus, we are not in a position to assess how well the model would be able to represent the $\Delta^{14}C$ evolution during the Mystery Interval. CIRC and BIO represent schematic, idealized bounding scenarios to test how uncertainties in our understanding of the carbon cycle during the glacial termination affect the reconstruction of radiocarbon production during the Holocene. We will include a reference to Broecker and

Barker in the revised manuscript in the discussion in section 3.2.1.

p. 1166, l. 16: "our record.." - is it a record (usually geological record) or a simulation?

Changed "our record" to "our reconstruction" in the entire manuscript.

p. 1167, l. 4-5: surfaces atmospheric temperature (SAT) - SAT should be a name of characteristic in the model, but its more correct naming in the manuscript should be something like "global mean annual surface air temperature".

SAT is a commonly used abbreviation and not specific to our model. SAT is introduced now as:

"...changes in global mean surface air temperature (SAT)"

to make its meaning clear.

I am confused which terrestrial model is used in the study: is it LPJ or LPX? The first-order difference between these two models should be in the fire subroutine as LPX utilizes more advanced SPITFIRE model, but it could be some other differences as well. If the LPJ is involved, isn't it misleading to call it Bern-LPX as the LPX performance would be different from the LPJ results?

LPX is the name for the Bern-version of LPJ which includes various extensions (peatland, N_2O, CH_4, nitrogen cycle) compared to the original LPJ model. As the version used here is close to the model commonly known as LPJ, we changed "LPX" to "LPJ" in the manuscript.

p. 1181, eq. 4: What are n and T in this equation?

nT stands for nano Tesla. The typesetting of the equation has been adjusted to make this clear:

$$TSI = (1364.64 \pm 0.40) Wm^{-2} + B_r \cdot (0.38 \pm 0.17) Wm^{-2} nT^{-1} \quad (1)$$

and the units are explicitly mentioned p 1181, line 10): " This model of converting Br (here in units of nanotesla) into TSI is.. "

Table 2: units in the left column: shouldn't they be the flux units (mol/yr?)

Correct, this was a mistake

p. 1183: comparing land NPP and air-to-sea C fluxes is not fully correct; you need to compare air-to-sea C fluxes with land GPP.

We do not agree. Only NPP is affecting the inferred radiocarbon production. The fraction of GPP that is not associated with NPP is returned to the atmosphere within hours and days, time scales much shorter than those of radioactive decay

and the multi-annual to multi-centennial time scales considered in this study. Thus the flux (GPP-NPP) does not affect inferred radiocarbon production.

Fig.1: I miss arrows with C fluxes on this figure.

We revised figure 1 including the addition of arrows for C fluxes

Minor corrections/typos

Minor details were corrected as suggested by the referee.

References:

Broecker, W., Barker, S.: A 190 ‰ drop in atmosphere's 14C during the “Mystery Interval” (17.5 to 14.5 kyr). Earth Planet. Sci. Lett. 256 (12), 9099, doi:10.1016/j.epsl.2007.01.015, 2007.