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Climate of the Past Discussions

Interactive comment on "A reconstruction of radiocarbon production and total solar irradiance from the Holocene ^{14}C and CO_2 records: implications of data and model uncertainties" *by* R. Roth and F. Joos

Anonymous Referee #2

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The manuscript by Roth and Joos is a mature paper focused on the uncertainties in reconstruction of radiocarbon production and total solar irradiance during the Holocene. The manuscript is rather long, perhaps too long for one paper, as analysis for the Holocene and for the last millennium (including temperature response to changes in total solar irradiance) could be split into two papers. However, the current paper format is also acceptable. I found the manuscript well written and have only minor comments listed below.

General comments

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.

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.

Technical comments

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

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".

p. 1173, l. 10: 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? Perhaps, naming the model

as “Bern-LPJ model” would be more appropriate for the given paper.

p.1176: l.6-7: “the biological cycling of carbon” – add “in the ocean” to specify that you do not consider land C cycle

p. 1178. l. 7: typo: “out” should be “our”

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

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

p. 1216, Table 2: units in the left column: shouldn’t they be the flux units (mol/yr?)

p. 1217, Fig.1: I miss arrows with C fluxes on this figure

Reference

Broecker, W., and Barker, S., 2007. A 190‰ drop in atmosphere’s Δ14C during the “Mystery Interval” (17.5 to 14.5 kyr), Earth and Planetary Science Letters, 256, 90–99.

Interactive comment on Clim. Past Discuss., 9, 1165, 2013.