Clim. Past Discuss., 7, C855–C858, 2011
www.clim-past-discuss.net/7/C855/2011/

Climate of the Past Discussions

Interactive comment on "Systematic study of the fresh water fluxes impact on the carbon cycle" *by* N. Bouttes et al.

Anonymous Referee #2

Received and published: 16 June 2011

Unfortunately, I share the concerns raised by reviewer 1 and by Menviel and Timmermann There is a lack of analysis of results, the paper is not written very carefully, key references are missing, and other studies are not referenced carefully. The sum of these shortcomings makes it indeed very hard to recommend this paper for publication. I suggest that the authors withdraw their manuscript, perform the necessary additional analyses, and rewrite a new paper.

1) The analysis of the simulated CLIMBER 2 results remains very superficial. There is no quantitative spatio-temporal attribution of change to mechanisms/processes neither for the ocean nor for the land. This is what I would expect given the examples provided by previous work. Considering only global and hemispheric changes is simply not enough.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

2) Basic questions remain unanswered. A) What are the physical changes simulated by CLIMBER 2? B) How do the temperature and precipitation fields change? C) Are there shifts in the ITCZ? D) Are there changes in light availability for photosynthesis? E) Are there changes in wind speed or is this not taken into account by the statistical atmosphere? F) Are changes in NADW and AABW the only circulation changes or are there changes in Indo-Pacific overturning? G) What about convection? H) How is the heat within the ocean redistributed and how does this affect solubility related DIC changes? I) Are there changes in intermediate water mass formation in the different basins? K) Are there changes in seasonality of T, Precip etc that affect land and ocean carbon cycling?

3) A) How are changes in ocean carbon storage related to changes in SSS, SST, alkalinity, nutrients, organic matter, calcite, opal, iron, export productivity, dissolved organic material? B) How do the cycles of organic matter and calcite change in response to freshwater input? C) Are there changes in wind speed and air-sea gas exchange rates? D) What is the role of ocean-sediment fluxes? E) Are the changes in DIC restricted to the Atlantic or are there also changes in the SO, Pacific or Indian Ocean? F) Are there changes in oxygen concentrations?

4) A) How do NPP, soil respiration rate, heterotrophic respiration, and the distribution of plant functional type change in different regions and how are these changes related to underlying drivers such as air and soil temperature, precipitation and soil moisture, or available radiation. B) How do negative and positive influences on total carbon storage balance in different regions? C) Köhler et al., find substantial changes in total carbon storage in northern mid-latitudes, whereas Bozbiyik et al., find largest total changes in the tropics. How does the response of VECODE compare to these results?

5) Why are there no factorial experiments to disentangle different drivers or to distinguish between land and ocean changes?

6) Why are results only discussed in comparison to Menviel et al. and Schmittner and

CPD

7, C855–C858, 2011

Galbraith? This focus on two studies only appears very odd. A) There is a fair number of additional paleo studies that warrant comparable attention (examples are: Köhler et al., 2005; Obata et al., 2006, Bozbiyik et al., 2011, Marchal et al., Climate Dynamics, 1999, Marchal et al., Paleoc., 1998). B) In addition, there are also publications that deal with CO2 and AMOC changes in the context of IPCC-type emission scenarios (E.g. Maier-Reimer et al., Climate Dynamics, 1994; Sarmiento and LeQuere, Sci, 1996, Joos et al., Sci, 1999, Plattner et al., Tellus, 2001, and the more recent literature on scenarios)

7) Shortcomings are general features of models. a) I miss a discussion on potential limitations and shortcomings of this study and CLIMBER 2. b) The authors should place their model in the available model hierarchy and highlight deficiencies that are potentially relevant for the current study. A discussion on how the choice of CLIMBER 2 could affect conclusions should be provided. For example, more sophisticated model studies and proxy data reveal a shift in the ITCZ in response to an AMOC shutdown. How is this represented in the statistical atmosphere of CLIMBER 2. The 2-d ocean of CLIMBER 2 has been developed about 20 years ago. Changes in AMOC can be related to shifts in convection pattern and the 3-dimensional structure of ocean circulation could affect results. VECODE features a very limited set of plant functional types, e.g. in comparison to the LPJ model used by Köhler et al., 2005. How those CLIMBER 2 compare to models applied in other studies. What are strengths and weaknesses? How could the inclusion of a peat module affect results?

8) The suggestion on page 1374, line 23 ff that the CO2 amplitude and the duration of the AMOC shut-down can be used as a proxy for the initial 'rate of AMOC' appears not realistic given the wide range of responses found in different studies. This claim should be deleted.

9) 1377, conclusion: The conclusion that the model results support the crucial roles of brines (as parameterized in CLIMBER 2) appears hard to defend given the small differences between simulations with and without brine parameterization (Fig 5,6, 8)

CPD

7, C855–C858, 2011

and the large uncertainties surrounding the terrestrial and oceanic responses. This claim should be deleted.

Specific comments: Abstract: line 1 to 3 This first sentence does not portray the paleo record and the statements are wrong. CO2 changes roughly in parallel with the Antarctic temperature.

Line 12 to 15: These are not new findings and have been highlighted before

Line 1, line 15: What means “rapid”

Line 17/18: This sentence is unclear.

Line 20 to 23: I do not believe that this statement is accurate and entirely true. What about sensitivities of different carbon cycle models to the same changes in physical drivers?

Page 1365, line5: does CO2 really decrease to its initial level? The ice core records shows it differently.

1365, line 27: there are more than two modeling studies available.

1368, figure 1 etc. The freshwater fluxes should be described by their form, rectangular and triangular, as done in earlier studies. Calling them Schmittner and Menviel scenarios is too much of a personal call and is not accurate as these types of freshwater release have been used much earlier.

1370, line 24: “waters are less soluble” – language

1370, line 24: A quantitative and regional analysis is required that includes also the other driving forces.

1373, line 19 to 21: So what is the insight here? Fig 3 and fig. 7 could be easily combined.

Interactive comment on Clim. Past Discuss., 7, 1363, 2011.