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Discussions

Interactive comment on "The carbon balance of South America: status, decadal trends and main determinants" *by* M. Gloor et al.

Anonymous Referee #2

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Manuscript entitled "The carbon balance of South America: status, decadal trends and main determinants", written by M.Gloor et al. (bg-2011-460) The authors present a manuscript which aims to review current scientific knowledge in natural and socioeconomic processes, which have an influence on the carbon cycle. The authors describe current knowledge in climate, biome changes, deforestation, carbon content estimations stored in forests and soils and the resulting loss due to deforestation. They continue to present estimations of fossil fuel emissions and fluxes from renewable energy and contrast them by carbon source-sink distribution, which they estimate from inversion modeling and application of dynamic global vegetation models. In the synthesis the authors conclude that South America has been a net carbon source in the 1980ies and close to neutral in the 1990ies. The idea of the manuscript is well developed and the figures are detailed and present a good quality. However, the manuscript does not

cover all relevant processes in a sufficient way or for the entire South American continent as the authors state in their objectives. I will outline in the following: Major issues: 1. The review is incomplete as it does not cover all mentioned processes for all countries our biomes of entire South America: The manuscript concentrates on compiling knowledge on tropical South America with emphasis on the Brazilian Amazon. In order to publish this review either the title has to be changed accordingly or more studies need to get included that reflect the changes in the carbon balance from Columbia down to the Tierra del Fuego. This includes

1.1 Unfortunately, the authors ignore a large part of the scientific literature that deals with the influence of fire in various ecosystems of South America, its human modification, of which the use in the deforestation process is widely discussed and estimates of related carbon emissions are available. The compilation of knowledge on this topic must be added before this manuscript can finally be published.

1.2 There is a growing literature on the carbon balance in rivers and VOC, which should be considered and the interactions that could occur need to be formulated better. This is a point where the authors stop compiling scientific evidence and put vague statements.

1.3 The section on deforestation is insufficient if the authors aim to reflect recent knowledge on deforestation areas. More description on deforestation in, e.g., the Chaco region of South America, is needed and must be added.

1.4 The section on agriculture production and exports is very short and more information is available through FAO statistics on agricultural production and exports to cover the process of "carbon lost" from the study region.

1.5 To cover the influence on the carbon balance and changes in source-sink distributions the authors need to add a section on timber extraction as this is an important cause for deforestation and is also a carbon extraction from the system. There is information available on quantities and project interactions that the authors need to include

in their review. Additionally, this needs to be taken into account in the carbon balance estimation using the book-keeping approach.

2. In the presentation of the carbon balance for the study region, be it either tropical South America or the entire South-American continent, the authors must state which processes are included in the book-keeping approach and discuss the missing processes as well as uncertainties associated to the single processes as well as the entire outcome of the carbon balance.

3. It is not well formulated in the manuscript, why future projections from dynamic global vegetation models where first attempted to get included in the manuscript, where this was not really an objective of the manuscript. Why did the authors expect a homogenous response of the vegetation models and why do they think this is a pre-condition to regard the results from the intercomparison to be regarded as publishable results?

Minor issues: 1. Section 2.3, last paragraph: It is not clear to me how an upward trend in water vapour outflow published in 1996 can support the hypothesis of changes in the water balance published in 2005. Please provide more evidence or explain in more detail how the findings of the mentioned studies complement.

2. Section 2.4: Rammig et al 2010 NewPhyt and Jupp et al. 2010 NewPhyt. investigated the uncertainty of climate projections and the role of the CO2 fertilization effect under future climate conditions. Conditions of shifts in between savannah and tropical forest where investigated by Hirota et al. This literature is missing in this section.

3. Section 3.2: There are articles published dealing with carbon release from deforestation and related pyrogenic emissions, e.g. van der Werf. This needs to be considered when describing the state of the art. Also there is a rich literature discussing the non-linear relation between fire and deforestation in the Amazon, which is missing and needs to be considered.

4. Section 3.4 Please describe how measurements from the ATTO tower can contribute

to improve the situation on monitoring CO2 fluxes over the Amazon.

5. Section 3.5: Please consider in the explanation of the model results, which carbon-relevant processes are captured by the models to explain the difference in the simulated responses. It is required to explain the quality measures that are needed from the DGVMs in order to get included in the carbon balance analysis! Are these uncertainties really larger than the uncertainties from fossil fuel emissions? This must be explained and quantified.

6. Section 3.6 needs fundamental revision as outlined in the section on major issues.

7. Section 4: Explain why TRMM or NCEP data are not sufficient to measure changes in precipitation pattern, why is the uncertainty lower when considering river discharge. Again, only talking about the Amazon basin in this respect is not enough in a review about processes influencing the carbon balance of a continent.

8. Fig. 4 Explain how the meat export was converted to make it comparable to other carbon-related fluxes. Again statistics from Brazil are not sufficient to give an overview about South America.

9. Fig. 10 Please provide a definition of NBP, is fire included in the balance?

Interactive comment on Biogeosciences Discuss., 9, 627, 2012.