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

Anonymous Referee #1

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General comments

This study is mostly a review paper with an attempt to produce a synthesis of combined estimates of carbon fluxes (by putting together different datasets). The authors collected the most recent published datasets related to carbon emissions and removals in South America. The study includes the adaptation of two existing simple models (one model of emissions from Land use changes and another of carbon removals from forest growth) to published datasets on deforestation and forest censuses for producing new estimates of emissions from deforestation and sinks from intact forests. The most detailed, interesting and original part of the study relates to carbon fluxes from vegetation, due to land-use changes or ‘natural’ removals.

This analysis should be of interest to scientists dealing with the issue of carbon fluxes

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Discussion Paper



to the atmosphere. The paper is easy to understand but there are some missing details for the specialist to follow, which are detailed in sections “specific comments” and “technical corrections”.

Specific comments:

I would recommend the title to better reflect the fact that the paper is based on the review /collection of existing datasets (“We attempt to summarize the carbon budget of South America …”) and that the most detailed and scientifically interesting part of the paper is about carbon fluxes from vegetation.

The carbon emissions from deforestation reported by the study for two last decades (0.5 PgCyr-1) should be compared (with related discussion) to previous estimates, in particular from Achard et al (GBC, 2004) at 0.54 PgCyr-1 for 1990s and from Pan et al (Science, 2011) at 1.51 and 1.37 PgCyr-1 for 1990s and 2000s (fig1 in Pan et al). Note that although Pan et al estimate seems very high and Pan et al paper contains little details on the method, this paper can not be omitted as published in Science.

In pages 642-643 of section 3.2 (Deforestation): “Main uncertainties of the approach arise because of uncertainties in forest biomass density (i.e. forest tree biomass per area (t ha⁻¹)). Our estimates indicate a flux to the atmosphere on the order of 0.5 PgCyr-1 due to deforestation and land use change in South America over the last two decades or so (Figs. 7 and 8).” The beginning of section 3.2 paper describes the datasets on deforestation which have been collected and used, but it is not clear to me from the main text to which dataset on biomass they are combined and through which method (spatially explicit model, bookkeeping model by country, sub-administrative unit, other method?). It is also not explained in appendix.

The study reports carbon exports related to “Agricultural production and exports” (section 3.6) but the conclusions refer only to carbon fluxes to the atmosphere (“we find that South America had been a net source to the atmosphere during the 1980s (0.3–0.4 PgCyr–1) and close to neutral in the 1990s with carbon uptake in old-growth forests

Interactive
Comment

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Interactive Discussion

Discussion Paper



Interactive
Comment

nearly compensating carbon losses due to fossil fuel burning and deforestation." I have difficulties to understand how carbon export related to fluxes to the atmosphere. Indeed these results does not seem to be considered n final estimates of C fluxes.

Technical corrections

Consider Baccini et al, Nature CC, 2012 in complement to Saatchi et al, 2011 when referring to biomass maps.

Consider Gibbs et al, PNAS, 2011, when referring to agriculture as driver of deforestation.

In section 2.2. p 635, the spatial resolution of Landsat data is c. 30m x 30m instead of 100m x 100m

When referring to the simple version of the book-keeping model and to the issue of lagged fluxes it might be useful to consider also Ramankutty et al, GCB, 2007.

In section 3.3. page 644 "(i.e. approx 0.5% forest area lost per year, estimated from INPE deforestation numbers based on PRODES)". This 0.5% rate is applied from year 1970 when INPE data starts from year 1988. At least a short explanation / discussion about validity of this rate for 1970s should be given.

Data in Appendix are difficult or impossible to read (e.g. in section A.4). They should be reformatted as Tables with same units.

Problem of figures numbering: In the figures are quoted in following order: figure 8, figure 11, figure 9, ...

Mayaux et al, 2005 appears in the text but not in reference list. The list of references should be checked (any other missing or not referred in the text?).

In table 1, the estimate of flux for "Old-growth forest" refers to year 2005 only but is displayed in column "2005-2009" which is quite confusing. Also the related jump from year 2004 to year 2005 in Figure 11 is also misleading because there are no available

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estimates for further years (it looks at a future trend and not as a specific drop during a single year)..

Use consistent wording through the text for “old-growth forest” (e.g. suppress “intact forests”).

Why displaying MODIS land cover map in Figure 1 when text is using estimates from GLC-2000 map (Eva et al, 2004)?

Figure 7 should be enlarged as period 1970-2010 is difficult to read in present version.

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