

## ***Interactive comment on “Global carbon budget 2013” by C. Le Quéré et al.***

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The authors present an update of the global carbon budget based on a revised synthesis of existing datasets of fossil fuel CO<sub>2</sub> emissions, emissions from changes in land use, atmospheric CO<sub>2</sub> increase, ocean CO<sub>2</sub> uptake and changes in the net budget of land carbon inferred from the global budget equation as a residual. The applied methodology is essentially the same as in the previous assessment published in 2013. The main difference is the addition of the new estimates for the year 2012 and somewhat revised numbers of the CO<sub>2</sub> emissions from changes in land use, primarily after 1982. The manuscript includes a new section providing a brief discussion of non-CO<sub>2</sub> carbon emissions (primarily CH<sub>4</sub> and CO) which are deemed small in the global context, as well as a brief description of the carbon transfers from land to ocean and atmosphere through the hydrological cycle. However, these new elements are not

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considered to affect the global budget numbers; primarily because they are small and thus within the uncertainties of the budget terms. Furthermore, new observation based global estimates of the ocean sink are included, as well as the results from a new crop of dynamic global vegetation models. This auxiliary information is included as a plausibility check on the global annual budget and its temporal variability, but it is not used to correct the global budget numbers determined with the base methodology.

Major comments:

(1) As in my review to the previous paper (Le Quere et al., 2013), I am not happy with the nomenclature. The text refers to the “anthropogenic budget”, even though climate related natural variability clearly is also reflected in the presented budget numbers; especially on shorter time scales. In some places climate and other changes are added as a qualifier, but the text would gain by being more precise here. A case in point: take Table 7 labelled “Anthropogenic CO<sub>2</sub> budget” which clearly includes these other terms. Why is the decadal land sink maximal in the 1990’s? This is clearly not an “anthropogenic” effect. Why not consistently throughout the text simply refer to the “global carbon budget” and use the term “anthropogenic” only where appropriate (e.g. for the FF and the LU terms)?

(2) The dataset associated with this manuscript only contains estimates for the period 1959–2012. However, at several locations in the text and e.g. Figure 2, as well as the reported cumulative emissions since 1750 refer to data that are not available in the excel spreadsheet. E.g. the LU emissions prior to 1959 are discussed in the text; they appear to have changed, however, they are not included in the dataset and the given reference is a manuscript that is not yet been published. Either the budget estimates prior to 1959 should be included, or the referring text bits removed.

(3) The main group of authors of this manuscript have published in the framework of the Global Carbon Project each year an updated version of the global carbon budget. These previous updates are referenced in the text, as well as in the data excel spread-

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sheet. However, it would be very useful for the uninitiated reader if the major changes in methodology of each update were summarised, perhaps in a Table. E.g. earlier versions of the budget included the additive bias correction of the ocean sink trend as compared to the multiplicative method in this and the previous version. The difference in the reported ocean sink in the 1960's is substantial but difficult for the non-specialist to pull out of the various publications in different journals.

(4) The present document contains a completely different group of DGVMs as auxiliary information for the plausibility check on the terrestrial sink as compared to the variant reported in 2013. Why did the authors now choose different models? Are the model results of last year no longer valid? This new choice of models needs to be explained, and why the models of last year are now no longer considered state-of-the-art.

Additional more specific comments

(5) Uncertainties of FF emissions: Guan et al., 2012 come up with a systematic uncertainty for the Chinese emissions alone of 0.4 PgC/yr. Does this not imply somewhat less optimistic uncertainties for the FF emissions than reported here (1sigma on global emissions = 0.4 PgC/yr).

(6) p. 694: the proper reference to the ppm to PgC conversion number is Prather et al., 2012; Joos et al only cite it. This needs to be changed also in Table 1.

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