

Interactive comment on “The global carbon budget 1959–2011” by C. Le Quéré et al.

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Received and published: 5 December 2012

In this study, the CO₂ emissions resulting from deliberate human activities on land (including land use, land-use change and forestry) was labeled as ELUC, and defined as including “CO₂ fluxes from afforestation, deforestation, logging (forest degradation and harvest activity), shifting cultivation. . .” (page 1119).

Further on page 1122, the authors state that “Tropical deforestation is the largest and most variable single contributor to ELUC . . . We used annual estimates from the Global Fire Emissions Database (GFED3), available from [http:// www.globalfiredata.org](http://www.globalfiredata.org). Burned area from Giglio et al. (2010) is merged with active fire retrievals to mimic more sophisticated assessments of deforestation rates in the pan-tropics (van der Werf et al., 2010). This information is used as input data in a modified version of the satellite-driven CASA biogeochemical model to estimate carbon emissions, keeping track of what frac-

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tion was due to deforestation (van der Werf et al., 2010) . . . In this paper, we only use emissions based on deforestation fires to quantify the interannual variability in ELUC”

This raises a number of questions about the GFED “Fire-Based Method” for deforestation-only ELUC carbon emissions that the authors should address in this ESSDD interactive discussion:

1. How did the GFED methodology restrict the annual ELUC flux estimates of CO₂ to (de)forested areas only? In van der Werf et al. (2010), the authors reported that “sub-grid cell information on the partitioning of burned area according to land cover type and fraction tree cover bin was used to better estimate the contribution of different sources, and to partition total burned area within the 0.5 grid cell into herbaceous and woody burned area”. Was that the same method adopted in this ESSDD study to eliminate non-forest fire CO₂ emissions from the original GFED3 gridded output of all biomass burning emissions worldwide? If so, were extensive areas of (savanna) burning in Africa and Australia excluded from the global CO₂ ELUC totals reported on page 1133: “Global CO₂ emissions from Land-Use Change activities were 0.9 ± 0.5 PgC in 2011 . . . estimate(d) based on satellite detected fire activity.” This is presumably from GFED ELUC results, since that is the only method cited that uses satellite-detected fire activity.

2. If it is the case that extensive areas of biomass burning in Africa and Australia were not accurately excluded from the global CO₂ ELUC totals reported on page 1133, then this was likely to result in an overestimate of annual CO₂ emissions resulting from all deliberate human activities on land (including land use, land-use change and forestry). Unlike deforestation CO₂ emissions, savanna fire emissions are comprised of a large fraction of plant biomass produced by (herbaceous) NPP over the past year of growth, rather than from decades of tropical forest wood accumulation. This fraction of savanna NPP biomass would have decomposed on the soil naturally within a year (regardless of the presence of fire), and therefore should not be included as ELUC emissions resulting from deliberate human activities on land. The exclusion of wildfire

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emission contributions to ELUC from countries like Angola, Australia, DRC Congo, Mozambique, Sudan, Tanzania, and Zambia is supported by FAO reporting that has not placed any of these countries into the top 10 nations for annual deforestation losses globally (as summarized by Potter et al., 2012, International Journal of Geosciences; www.scirp.org/journal/PaperInformation.aspx?paperID=21214)

Interactive comment on Earth Syst. Sci. Data Discuss., 5, 1107, 2012.

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