

Interactive comment on “The Australian terrestrial carbon budget” by V. Haverd et al.

Anonymous Referee #1

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Harverd and co-authors used a fine-spatial-resolution model (BIOS2) to estimate the full C-CO₂ model for Australia. The result is comprehensive in that it includes what could be expected to be the major contributors to the carbon budget. The results and discussion are well crafted and original in places i.e. figures 6 and 7 are refreshing. I recommend this paper for publication following technical comments and suggestions on the presentation.

General comment As I understood it, the RECAPP protocol suggests to use bottom-up measurements to estimate the regional carbon budget, in the absence of such measurements it was suggested to use a DGVM. Although it seems that some ground observations are available, this study made use of BIOS2 to estimate the carbon budget. Is BIOS2 a classic DGVM (parameterized and validated against ground observations) or is it rather a data assimilation tool (using observed LAI instead of calculating it or using soil C-inventories instead of a spin-up)? The current manuscript has only 4 lines

(pages 12262-12263) on this issues. A table (or figure) showing more details is needed for the reader to assess the strengths and weaknesses of this approach. The current manuscript refers to Harverd et al 2012, this approach is acceptable to learn more about the details but essential information should be repeated in the manuscript under review.

The same table or figure could be used to put forward that BIOS2 was used to estimate NPP and NEP but that these estimates were completed by making use of other data products and observations. The complexity of BIOS2 in terms of processes should be better described. On page 12268 climate and CO2 are put forward as the main drivers of changes in the biospheric carbon accumulation. Which processes were included in this analysis (those shown in fig 2?) and more importantly, which were not included in the analysis but could potentially have an effect in Australia or regions thereof i.e. diffuse/direct light, ozone, UV-damage, nitrogen, phosphorous and sulphur cycling, land management (ploughing, grazing, extinction of large predators, ...)?

Add a paragraph/section describing which information went into the error bars. IAV is clear but it is not clear whether the error on the mean is a real uncertainty (model, parameter, driver uncertainty) or mainly reflects spatial heterogeneity.

Suggestions - Providing some basic statistics on Australia may be useful to many readers i.e. surface area of Australia (the conversion is given in Table 1 but not the absolute numbers), surface areas of the different biomes/land covers, productivity of the different biomes/land covers etc. Rather than having one field for 'Biosphere' in table 1, I suggest to distinguish some relevant biomes or land cover types i.e. forest, savannah, cropland, grassland, desert, etc. - The fields in Table 3 (i.e. the COSCAT region numbers) are not very useful. The information in Table 3 could be plotted (as a bar graphs?) on Figure 13. This would reduce the number of display items. - Consider drawing the boundaries of Fig. 5 on Fig. 4. This would increase the information content of Fig.4 and Fig.5 and reduce the number of display items. - Fig 10 adds little to the topic of the manuscript i.e. the Australian carbon budget. The text is sufficient. This would reduce

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the number of display items. - Figure 11 nicely shows how the fire season moves from the W to the East. However, most of the figure is white. May be a zoom over Northern Australia would make for a better figure. - Check the manuscript for (trivial) acronyms i.e. NT and WA appear to be provinces of Australia but this was not made explicit. SH is introduced but only used a couple of times (write in full as it is much easier to read and won't make the manuscript substantially longer). Same with the wind directions especially when combined with province codes i.e. page 12274 line 11 '...the arid interior to NW WA is ...'.

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