

## ***Interactive comment on “Terminology as a key uncertainty in net land use flux estimates” by J. Pongratz et al.***

**C.D. Jones (Referee)**

chris.d.jones@metoffice.gov.uk

Received and published: 16 September 2013

Review of Pongratz et al., "Terminology as a key uncertainty in net land use flux estimates"

This paper is a much needed and detailed exposition of the multitude of ways of defining "land use" carbon emissions. It has long been known that land-use emissions of carbon are hard to either measure in reality or diagnose from model studies. It is becoming recognised that results of attempts to do so are actually quantifying different quantities and that these should not be compared side-by-side. For example Arora et al have previously presented results from several experiments and discussed different definitions of land-use flux.

C406

But there has been lacking a comprehensive review of the very many aspects of this discussion, and their implications. This paper provides that and hence offers a road to some clarity on the issue. The bad news is that the issue is extremely complex! But that simply makes this paper more important. This paper will become a good reference text for anyone designing an experiment - it is crucial to define up front exactly what you want to quantify. Secondly it will provide a good "best practice" guide for how to present results. Given the complexity, it was useful therefore for the authors to explicitly pick out 3 key aspects which they saw as most important.

I think it is beyond the remit of this paper (or any paper) to recommend a specific single definition of "land use flux" and the authors wisely stop short of this. Instead it is likely that we are stuck with multiple definitions of land-use emission - but at least removing misinterpretation of different published values is achievable.

I particularly liked the comparison of published studies as a way to demonstrate the use of the framework. Up to the end of section 2 the discussion is in times quite abstract and hard to follow. The text, table and figures together do a good job at explaining things, but the concept is sufficiently complex and subtle that it is impossible to follow at first reading. Some "worked examples" therefore are very useful.

My biggest request would be to extend the analysis to include the IAMs which produced the RCP scenarios. "land use emissions" are provided as an output from these (e.g. follow links from here: <http://cmip-pcmdi.llnl.gov/cmip5/forcing.html>) - can you use your framework to elucidate the exact definition of what they mean? Two important questions: a) the land-use emissions (as used to drive ESMs in CMIP5 for example) have been harmonised to merge smoothly with Houghton et al at year 2005. (e.g. see Jones et al., 2011, GMD documentation of HadGEM2-ES experiments). Is this a sensible thing to do? or have we wrongly harmonised timeseries of inconsistent things? b) there are 4 RCPs from 4 IAMs - are they even using the same definition of "land use emission" between them?

C407

I think an addition of this would be very valuable, after which I recommend this paper be published with minor revisions. A few specific comments and suggestions follow.

Chris Jones

- p. 683 - either the authors or the typesetters need to be very careful here that "l" in equation 2 does not look identical to "I" on line 27. There's already enough scope for confusion without two symbols looking the same!

- I found the definition of "p" (potential natural veg on managed land) hard to follow early on and wondered how it differed from "recovering areas". It became clear later that it is a hypothetical (what would have been there) state. But this doesn't come through clearly at first definition.

- in figure 1b what drives your choice of sign for each arrow? the fact some are up versus down implies you have determined the sign of each, but it's not clear why - e.g. many of these could be either + or - couldn't they? e.g. environmental changes due to fossil fuel burning might have created a source or sink depending on local climate changes.

- sec. 4.4 - nice discussion around what is observable. But even if we can't observe a total or net flux, can you comment on any constraints we can get on components of the problem? e.g. ESMs (and I assume DGVMs too) vary hugely in their biomass (more than factor 2-4 between CMIP5 EMSs - see Anav et al., 2013, J. Clim). So presumably observational constraints on biomass will to some extent reduce the part of land-use emissions to do with removal of biomass. Are there any other observations which can help?

---

Interactive comment on Earth Syst. Dynam. Discuss., 4, 677, 2013.