

Interactive comment on “A theoretical framework for the net land-to-atmosphere CO₂ flux and its implications in the definition of “emissions from land-use change”” by T. Gasser and P. Ciais

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The analysis by Gasser and Ciais sets out a framework for thinking about the components of the perturbation flux of carbon between land and atmosphere. There are fluxes driven by environmental change (e.g., CO₂, climate, N), and there are fluxes driven by land use and land-cover change (LULCC). If there were no interaction between these two components, life would be easy. But there are interactions: the environment affects the carbon balance of managed lands, and management changes the effect the environment would have if the lands had not been managed (think degraded pasture vs. natural forest). Thus, there are four components to consider. The authors go on

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to consider three possible definitions of the LULCC flux. They show the implications of the definitions for past, current, and future fluxes, using the results from a model for illustration and giving examples of the different definitions used in the literature. The authors not only suggest which definition usually works best; they also show that the differences can account for as much as 20% of the variability among estimates, and may account for some of the residual terrestrial sink as well.

This paper is an excellent blend of mathematical precision and narrative clarity. It is not light reading, but it contains a number of explicit cautions and a few “ah-haaahs” for those who persevere.

Specific comments:

Page 200, line 29: I don't see why the authors say def. 2 “is even superior to” def. 3 in some instances. What criterion are they using?

Page 188, line 19: “than” should be “as”.

Page 191, line 16: “keep” should be “keeps”.

Page 196, line 20: “others” should be “other”.

Page 199, line 19: “less” should be “least”.

Page 201, line 21: “implies to run” should be “would require running”.

Page 203, line 6: delete “up”.

Page 203, line 8: replace “results which definition” with “results in which the definition”.

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