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Interactive comment on "Relationships between burned area, forest cover loss and land use change in the Brazilian Amazon based on satellite data" *by* T. Fanin and G. R. van der Werf

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We appreciate the comments on our draft. Please find a detailed response below with the reviewer's comments in italics.

Regards,

Thierry Fanin

1 Minor comments

1. *On Fig 1, I would suggest replace the word "provinces" by the word "states".*

   Corrected, thanks

2. *Page 8239 / lines 5-10: Consider that, on the other hand, active fires may be easier to identify because there is potentially less confusion for detecting the thermal signal from active fires than the appearance of burn scars.*

   When doing our analyses we initially used both active fires and burned area. Both datasets have advantages and disadvantages and we agree with the reviewer that active fires are easier to identify. However, the reason we used burned area is that it is to some degree a more quantitative proxy for the extent of fires; to be detected more or less the whole grid cell has to burn (Giglio et al., 2009). Active fires on the other hand may originate both from a small fire burning in part of the grid cell or from a large fire that burned the whole grid cell. In addition, the active fire data has a coarser resolution.

   We had mentioned this trade off in the discussion before but have modified it to address the reviewer's concern: "One key uncertainty we have not addressed here is the use of burned area to study fire extent. The burned area algorithms are often geared towards detecting relatively large fires and not all fires in deforestation zones may be flagged as burned by them. In addition, it is not well known how reliable the burned area data is in deforestation regions. The use of active fires and ancillary data may mitigate some of these issues (Randerson et al., 2012) but the footprint of active fire detection is four times larger than that of burned area and active fires have their own limitations related to overpass times

and cloud cover. In the future, higher resolution observations from for example VIIRS (Schroeder et al., 2014) may enable simultaneous use of burned area and active fires in native resolution applications like ours."

3. *Page 8250 / line 21: Replace the name "Assunçã" by "Assunção".*

   Corrected, thanks

2 Major comments

1. *8242 / 22-30 through 8243 / 1-3: According to text in these lines, the methodology applies a 5 years period after deforestation for evaluating the evolution of the burned area. Why the authors used this specific number of years? Also, could the results be different applying a different value for this period?*

   We have tested how sensitive our results are to the length of the time window under consideration. As expected, it slowly and regularly increases over time, from 37% for 3 years to 49% for 6 years. To some degree, our choice of 5 years is somewhat arbitrary but it is based on the balance between having a short enough window so we could compare different years (in our case 2002-2007) and having a long enough time window to make sure the post-deforestation land use is relatively stable.

   To address the reviewer's comment, we modified the text as follow: "This 5 years time period was chosen to balance the number of years we had for analysis (which decreases when we lengthen our time period) and the time required

   for conversion. The 5 year time window was also used by Lima et al. (2012), who showed that 15% of the fires in their study area in 2005 occurred in land deforested in 2000. Shorter time periods lowers this number somewhat (e.g., 3 years yields 37%) while longer time periods make a marginal difference"

2. *8248 / 21-24 through 8249 / 1-2: In relation to the regulation of the concentration of CO2 in the atmosphere, the authors should also account for the density of the vegetation biomass. The study presented accounts only for the area affected by fires.*

   We agree, and have modified this sentence to be more complete to: "Our study shows that, at least for the Brazilian Amazon, degradation and fire dynamics outside the tropical forest domain may be equally important in regulating atmospheric CO2 concentrations. The exact impact of these processes requires taking into account the biomass density (e.g., Baccini et al. (2012)) , which will be the subject of a follow-up study."

3. *8249 / 3-11: The authors should also explain that may be harder to detect burned area than active fires, because there is potentially less confusion in detecting the strong thermal signal from active fires than the scars from burned surfaces, which may be confounded by shades or humid surfaces.*

   Please see the related comment above

4. *8249 / 25-28: The following sentence can be misleading and should be restated: "This indicates that droughts not only enhance burned area, but also increase forest cover loss in areas not monitored by PRODES and call for including*

woodland dynamics in carbon cycle studies." First, PRODES monitors the entire study region. The type of change in forest cover reported by PRODES may be different than the type of change in forest cover reported by GFC, but the areas monitored by both methods are the same. Also, woodland dynamics are already taken into account in carbon cycle studies. That is the case, for example, in models of the land surface participating in the last IPCC report to calculate the spatial distribution of vegetation biomass.

We appreciate the comment and realize we could have been more precise. Our main point is that PRODES does not consider areas that have been deforested in the past. In other words, if a grid cell was deforested at some point and abandoned, removal of secondary forest would not be captured. In addition, we would like to draw attention to estimates of deforestation CO2 emissions in global carbon studies, which often focus solely on the humid tropical (Le Quéré et al., 2015).

To avoid further confusion we have modified our sentence to : "This indicates that droughts not only enhance burned area, but also increase forest cover loss in for example secondary forests. These are not necessarily monitored by PRODES, which excludes grid cells that have been deforested before, and not always included in large scale carbon cycle studies such as those from the Global Carbon Project (Le Quéré et al., 2015)."

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