

Interactive comment on “Global analysis of radiative forcing from fire-induced shortwave albedo change” by G. López-Saldaña et al.

Anonymous Referee #2

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This paper by G. López-Saldaña et al. aims to quantify the “instantaneous” albedo change after fire and the associated radiative forcing over the area burned at a continental and global scale from 2002-2012. They combined the MODIS 500m burned area product, the coarser resolution MODIS BRDF/albedo (0.05 deg) and NCEP incoming solar radiation for analysis. Although a couple of studies have used remote sensing data to address the similar problem in savanna (instantaneous) and boreal regions (both instantaneous and longer term impact), this study is the first attempt to study the larger area, and thus definitely advanced our understanding of the large scale impacts of fire on the energy balance.

General comments: _____

In general I found that it would be much easier for the audience to absorb the main findings if the results and discussions were better organized. Right now as it is presented, a few results seem to be shown randomly and jump from one point to another point. I'd suggest the author to present the results around some main points: for example, one paragraph for spatial distribution (e.g., a global map of 11 year long term mean would be very valuable), one for interannual variation and extreme fire impacts, one for land cover differences, and etc.

My main concern is the potential implication of the much different spatial resolution of MODIS BRDF/albedo (0.05 deg) and burned area (500m) that were used in this study. First it needs to be mentioned why the 500m MODIS BRDF/albedo, which will produce the most meaningful results, was not used. Secondly, and most importantly, when aggregating the MODIS 500m burned area to the CMG 0.05 deg grid, did the authors apply any threshold to identify the CMG grids, burned or not burned? For example, if only 10% of 500m pixels within each CMG ~5km grid were burned, but the albedo change was calculated at ~5km resolution, which would include many unburned 500m pixels, and thus would lead to low bias of albedo change and forcing estimates. It wasn't clear whether and how this fractional burned area at the CMG resolution was considered. It would also be interesting to stratify the data according to the fractional area burned within CMG grids and plot the relationship between albedo change and fractional area burned. In fact, I suspect this is the reason for the largest albedo change coincident with the year having the highest area burned (assuming this is the area summed over the 500m burned area).

Other specific comments: _____

1. In both the title and “Abstract”, please make it clear the albedo change and forcing presented in this paper were indeed “instantaneous”. This is critical for understanding the numbers, as both quantities change significant as vegetation recovers after fire.
2. In the “Introduction”, page 7777, Line 11, “The radiative forcing caused by CO₂”, did you mean by CO₂ change? 3. In page 7777, Line 18-24, again, when referring to

other studies, please clearly state the time periods of the albedo change and forcing, e.g., did Govaerts et al. and Jin and Roy report the “instantaneous” change? Since this manuscript was for global analysis, please also cite some studies in other regions, such as in boreal regions.

4. In Page 7777, Lines 26 to 27, state clearly the uniqueness of “the main goal”, e.g., continental and global estimate. Also I didn’t get that it is for instantaneous estimate instead of longer term impact until I read the method and results?

5. In Page 7779, Lines 6-13, with regards to linear temporal interpolation, any special considerations for the abrupt albedo change after fire, both for adjacent pre-fire and post-fire periods ? It makes sense to include only snow-free albedo after knowing that this study was to look at the instantaneous change after fire.

6. In Page 7779, Lines 20-22, when aggregating MCD64A1 500m burned area to CMG 0.05 degree resolution, did you record and keep track of the fraction of burned area? See the main comment on this. When the estimate was presented over the area burned, did you mean only over the areas burned identified by the 500m burned area product, or over the areas burned at the 0.05 deg resolution?

7. In Page 7781, Line 16: change near-infra-red to near-infrared

8. In Page 7783, Line 25-29, it would be interesting to present numbers for global LAND area only.

9. Page 7784, Line 10: change from “In here, we ...” to “We here ...”

10. For “Results” and “Discussions”, see general comments on the organizations.

11. Table 1, not necessary, a reference is good enough.

12. In “Results”, Page 7782, Line 19-23, are all linear trends presented significant (Figure 2)? For the statement of “The mean albedo changes, considering the change between post-fire shortwave albedo minus the pre-fire value, have the opposite trend

C4846

of the total annual area burnt.”, is the magnitude of post-fire albedo reduction also decreasing, consistent with the trends of burned area and forcing?

13. In Figure 4, it would be easier to compare if all y-axis were in the same range; In Figure 5: please label image panels A to D; and refer each in the legend.

14. It would be more interesting to show a global map of mean albedo change and forcing averaged over the 11 years.

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