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Interactive comment on "Generation and analysis of a new global burned area product based on MODIS 250 m reflectance bands and thermal anomalies" *by* Emilio Chuvieco et al.

Anonymous Referee #1

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General Comments

Chuvieco et al. describe a a new 250m MODIS burned area product ("Fire_cci v5.0") produced under the auspices of ESA's Climate Change Initiative programme, which the authors note provides the highest spatial resolution among existing burned area (BA) data sets. The authors stated goal in generating this product is to "complement existing BA products generated from the 500m MODIS bands", which consist of NASA's current 500m MODIS MCD64A1 and previous MODIS MCD45A1 BA products, "as well as to improve detection rate of smaller burn patches." In stating this goal I suggest the

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authors recast the first objective as a means of attaining the second, for merely "complementing" existing operational remote sensing data sets without providing a material improvement is not a very useful undertaking in itself.

An aspect of this new data set that is both interesting and concerning is that it is being made at a higher spatial resolution using a less-capable combination of bands (red + NIR) than are used in the existing 500m MCD64A1 and MCD45A1 global BA products. The authors claim that the better spatial resolution makes "this product theoretically more suitable to analyze spatial properties of burned patches than other existing global BA datasets", but in my opinion the authors have not given sufficient attention to the implications/cost of attaining this improved resolution. A source of confusion for me, and I imagine other readers as well, is that the current Collection 6 MODIS BA product seems to map significantly more burned area (11%) than this new product, with the added benefit of having a lower omission error ratio (0.622 versus 0.708) and a much lower commission error ratio (0.353 versus 0.512).

Overall I believe the authors do not provide adequate guidance to the community of modelers they seek to serve. With a reported global user's accuracy of just 49%, modelers should be cautioned that less than half of the 250m pixels classified as burned in this data set actually burned according to the authors' own reference data. It would be immensely helpful if the authors could quantify this accuracy as a function of patch size. How else are modelers to know if the claimed improvement in the information provided about small patches is legitimate?

The fire patch analysis is interesting, for here is where a 250m BA product would have something new to offer, but as the manuscript currently stands those results are interpreted exclusively as if the new product is detecting small genuine burned patches as opposed to detecting noise. To properly interpret this analysis the authors must also assess the accuracy of the Fire_cci v5.0 product specifically in this small-patch regime. Without this information it is unclear if the patch results reflect real fire behavior or are instead driven by commission errors in the product.

Specific Comments

I believe a description of the algorithm used to make the Fire_cci v5.0 product is the one published in *Remote Sensing* last year (Ramo and Chuvieco, 2017), but this source is oddly not cited.

P4 L25: It isn't clear how the 5×5 window is related to the 16 250m pixels within each 1000m hotspot.

P4 L25: 1000m is the size of a MODIS hotspot at nadir. Is the larger size of the non-nadir hotspots taken into consideration?

P6 L2: Imagery from which Landsat platforms were used over the 2003–2014 validation period?

P6 L4: Which semi-automatic classification algorithm was used to map burned patches in the Landsat scenes?

P6 L7: GFED was used to guide the BA stratification, but this seems problematic because GFED BA was made from the Collection 5.1 MCD64A1 product, which the authors report is highly correlated with the Collection 6 product (Table 2). Is it reasonable to stratify validation reference data using the data that are to be validated? This is essentially what the authors have done. It seems this could open a door for considerable bias. What if, for example, GFED does not detect any of the true burning in a particular region?

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P6 L16: Change “that” to “than”.

P7 L14: The rationale for and applicability of the seemingly arbitrary 107 hectare threshold is unclear. On what basis was this threshold selected?

P7 L15: Why “at equator for the MCD64A1 product”? The pixels of the MCD64A1 product have the same area at all latitudes.

P8 section 3.3: It is essential to show a confusion matrix for each product as part of the product validation results.

P8 L24: For consistency delete “significantly” since the DC difference between the Fire_cci v5.0 and both other products is comparable (0.117 versus 0.113).

P8 L23-32: The many accuracy metrics reported here could be much more clearly presented in a table.

P8 L23-32: I think it is worth reminding the reader that in comparing the various accuracy metrics here the Fire_cci c4.1 was only validated for the years 2005–2011 whereas the other other products were validated for the years 2003–2014 (i.e. five additional years).

P8 L31: “From this point of view the MODIS Fire_cci c5.0 product is better equilibrated than the other BA products.” This claim seems very weak because 1) the difference in relative bias among all three products is statistically insignificant and 2) the lower

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bias is the result of having better matched but *comparatively high* commission and omission error ratios. A product having a matched commission and omission error ratio of 0.99 would by this standard be perfectly "equilibrated".

P9 L1-7: This additional validation, which is not described in the methods section, and from which the authors suggest that their validation using 1200 Landsat reference scenes "may be considered a pessimistic estimation of accuracy", requires much more detail. The text cites Chuvieco et al. (2016) in reference to the national fire perimeters, but that source pre-dates the Fire_cci c5.0 product and I am wondering if Ramo and Chuvieco (2017) is perhaps more relevant. This more recent source describes an assessment using national fire perimeters in North Australia, Canada, and California for the years 2006–2008, presumably using the same reference data referred to here. (It is not clear why here the additional assessment is for 2008 only.) In any case, based on the Ramo and Chuvieco (2017) results, I believe the commission error of 0.23 quoted here, which the authors describe as "much lower", is misleading because this value is biased toward North Australia, where BA algorithms typically perform relatively well. In fact, Ramo and Chuvieco (2017) report significantly higher commission errors in Canada and California (0.32 and 0.41, respectively, for 2008) using what appears to be the same RF NIR model used to make the Fire_cci c5.0 product. Moreover, the commission errors were higher still (0.38 to 0.56) in both regions for the years 2006 and 2007.

P9 section 3.4: Did the comparison with Sentinel-2 BA reference data account for the presence of commission errors in the MODIS BA data sets? In addition, is there a reference for the Sentinel-2 BA data used in this analysis, or is this the first time those data have been used?

P10 L10: Is this shape index the same as that described at P7 L7?

Figure 4: Please make color scheme for the different products consistent with Figure 3. Please also plot the 1:1 regression line for comparison.

Figure 5: Should note in caption or text why the number of points differs so greatly between the three plots.

Figure 7: It would be very helpful to also show the commission error ratio in this figure.

Figure 8: The pattern shown in the bottom map, whereby the 500m MODIS product seems to detect more burned patches in many areas, particularly outside the zones of very high fire activity, is surprising. One would think the higher resolution 250m product would more or less consistently map a larger number/density of burned patches.

It would be helpful to include a full resolution figure corresponding to one of the reference scenes that shows an example of the small burns detected in the Fire_cci v5.0 product that are missed in the MCD64A1 product.

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