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Interactive comment on "Biomass burning fuel consumption dynamics in the (sub)tropics assessed from satellite" *by* N. Andela et al.

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Review of "Biomass burning fuel consumption dynamics in the (sub)tropics assessed from satellite" by Andela et al.

General comments

The paper presents an approach to estimate fuel consumption by combining satellite data with field data and analyzes the derived spatial patterns of fuel consumption. Burned area data from MODIS is combined with fire radiative power (FRP) data from SEVIRI and MODIS to estimate fuel consumption. This approach requires a factor to convert fire radiative energy (FRE) to burned dry matter. The authors used a standard factor reported in the literature based on laboratory measurements (e). As an alternative, the conversion factor was estimated from field data by fitting a regression between

MODIS FRE and field measurements of fuel consumption. By using the standard conversion factor, the derived conversion factor and by using MODIS or SEVIRI FRP data, the authors find similar spatial patterns of fuel consumption but large differences in absolute numbers. Relations between fuel consumption, NPP and fire return intervals remarkably differ between continents.

I very much appreciate the approach of combining these different datasets. Such estimates are certainly valuable to better understand and model vegetation-fire-carbon cycle interactions. The paper is very well written.

Specific comments

One conclusion of the authors is "Moreover, satellite-derived fuel consumption estimates could be used as a reference for biogeochemical models, while providing improved insights in the underlying processes." (p. 22, l. 16-17). Although I completely agree that satellite-derived data can help to improve process-representations in biogeochemical models, I disagree with this conclusion. The authors present large differences in fuel consumption between the MODIS- and SEVIRI-based estimates and additional large differences in the lab-based and the field-based FRE-to-DM conversion factor. These two issues indicate large uncertainties in fuel consumption estimates. Thus, I'm not convinced that these estimates can be used as a reference for models unless the uncertainties in fuel consumption are quantified. In my view, a major uncertainty originates from the fitted regression between MODIS FRE and field measurements of fuel consumption because only a limited set of field data is available with a limited representativeness for MODIS pixels. I think it is necessary to quantify the uncertainty of the regression (i.e. of the conversion factor) for example by bootstrapping the set of measurement point that goes into the computation of this regression. The bootstrapped distribution of conversion factors (or for example the 0.025, 0.5, and 0.975 quantiles of this distribution) can be then propagated into the computation of fuel consumption to provide spatial fields of upper and lower uncertainty estimates. The distribution of conversion factors can be also used to test if the lab-based factor

of 0.368 really differs from the derived factor or if this is a sampling issue. Such an uncertainty would make the estimate of fuel consumption much more valuable and I would accept it for benchmarking and testing biogeochemical models.

Minor remarks

p. 21, l. 31-32: I don't understand the connection of this sentence with the previous sentences. Can you please clarify it and improve the text.

- Figure 2 a, b and c: It seems that the two maps fit pretty well. I only noticed the biases after the second reading when I saw the labels of the color legend and the different axis ranges in (b). Can you please make the same color legend ranges for both maps and the same ranges for the axes in (b)?

- Figure 5 and corresponding analysis: Can you really treat fire return period as the independent variable? I assume fire return period and fuel consumption are highly inter-related. Maybe you can explain this better or you could use a different predictor variable. Additionally, it is strange that the high NPP values are at the bottom of the axis. The plot would be easier if NPP increases from bottom to top.

- Table 1: Can you add the references as additional column to improve readability?

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