Answers to Anonymous Referee #1 "Combining fire radiative power observations with the fire weather index improves the estimation of fire emissions"
By Francesca Di Giuseppe et al.

Overall, the manuscript was well written and concise. The figures and equations were explained well within the manuscript. The importance of the study was also adequately addressed. In general, the results support the conclusions; however, further information is needed (see specific comments) specifically related to the use of this model over various land cover types and in regions impacted by cloud cover.

We would like to thank the reviewer for the positive comments.

Specific Comments:
* There is no mention of testing the model over different land cover/use types. Have the authors run any comparative tests? There was a brief mention of results over Africa that were not included. Could you include some additional results in the appendix - if the manuscript length is an issue?

This is a very good point. The FWI was specifically designed to work for the boreal forecast of Canada and, despite it is used worldwide, its accuracy might be different under different ecosystems. This implies that modelling changes in FRP using changes in FWI might be more or less successful in different parts of the globe. We have tried to address this aspect using a land cover mask to divide among different ecosystems. For consistency we use the land cover mask that is implemented in GFAS to attribute the dry matter combustion rate to each grid point.

This land cover type is based on land cover classes which are derived from the dominant burning land cover type in GFED3.1 and additional organic soil and peat maps, (full details are given in Heil et al. 2010 which describes GFAS settings).

By using this land cover mask we have estimated the error between FRP and persistence and between FRP and the FWI model for all the points for which a valid FRP was observed. The 2d error density plots shown highlights that the FWI is very effective in reducing the errors when there is a overestimation of fire activity and works equally well in different land covers.

We have added the plot to the paper and and explanatory paragraph which reads

In the new approach changes in FWI are used to predict changes in FRP. The accuracy of this assumption depends on how a good predictor is FWI of fire evolution. The FWI was developed to describe fire danger and behavior for the boreal forests of Canada and its accuracy might be smaller for different vegetations. To understand the expected reduction of error in different ecosystems figure \ref{fig:land_cover_class} partitions the results shown in figure \ref{fig:obs_comparison1} by land cover using GFAS classification. In GFAS the land cover classes are derived from the dominant burning land cover type in GFED3.1 and additional organic soil and peat maps, (full details are given in \citet{heil:10}). The density plots show a substantial reduction of the overestimation errors for all land cover types. One interesting aspect is that *positive biases are reduced more than negative ones. This behavior can be explained noticing that the distribution of FWI, by using FWI values only when fire events are observed, is conditionally sampled towards high values \citep{digiuseppe:17}. At extreme value, the FWI flattens out and increases in its value are limited. Instead an increase in precipitation and humidity can produce a sudden FWI decrease, which translate to large negative value for the modulation factor. Negative FWI increments are therefore larger than positive ones. This asymmetric behavior means that errors are mostly corrected for overestimation of FRP on missing observation locations.*

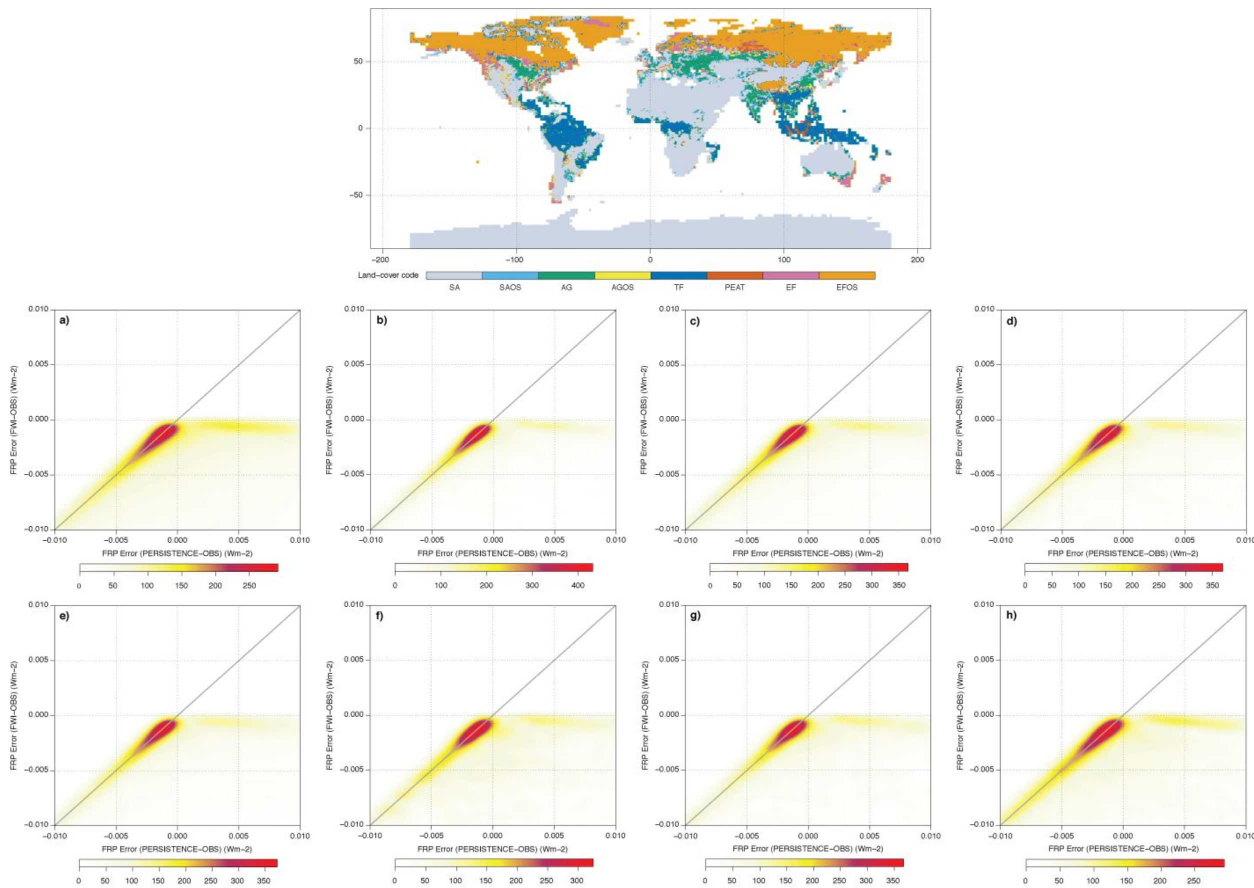


Figure caption

Upper panel: Land cover class map based on dominant fire type in GFEDv3.1 and organic soil and peat maps. Gaps in land areas have been filled (see Kaiser et all (2012) for details). Lowe panels: 2-dimensional probability density functions (PDFs) of the observed FRP departure of MODIS compared to the two observation operator models relaying on the assumption of persistence and on the FWI. The PDF refers to different land covers a) Savanna (SA), b) Savanna with Organic Soil (SAOS),c) Agriculture (AG),d) Agriculture with Organic Soil (AGOS), e) Tropical Forest (TF), f) Peat (PEAT), g) Extra-Tropical Forest (EF), h) Extra-Tropical Forest with organic Soil (EFOS)

* Page 2 Lines 11 – 20: Please include the nadir pixel resolutions for the SEVIRI and MODIS products for comparison.

We have added this information

"*SEVIRI has lower spatial resolution then MODIS; the observing pixel size at nadir is 3000m against the 1000m of MODIS for the channels that are used in the FRP calculations*."

The authors mention the advantage of increasing the temporal frequency of observations using SEVIRI; however, this will lead to much coarser spatial resolutions, which will have implications on small fire mapping.

Agree and we have added this information in the text

"This broad spatial resolution makes small fire mappings challenging with the exclusive use of SEVIRI. Nevertheless, the high sampling frequency means fire observations can occur during brief cloud-free spells in otherwise mostly cloudy regions."

* Page 2 line 21 – The authors should state that they are using MODIS FRP observa- tions - for clarity after the SEVIRI paragraph.

Corrected

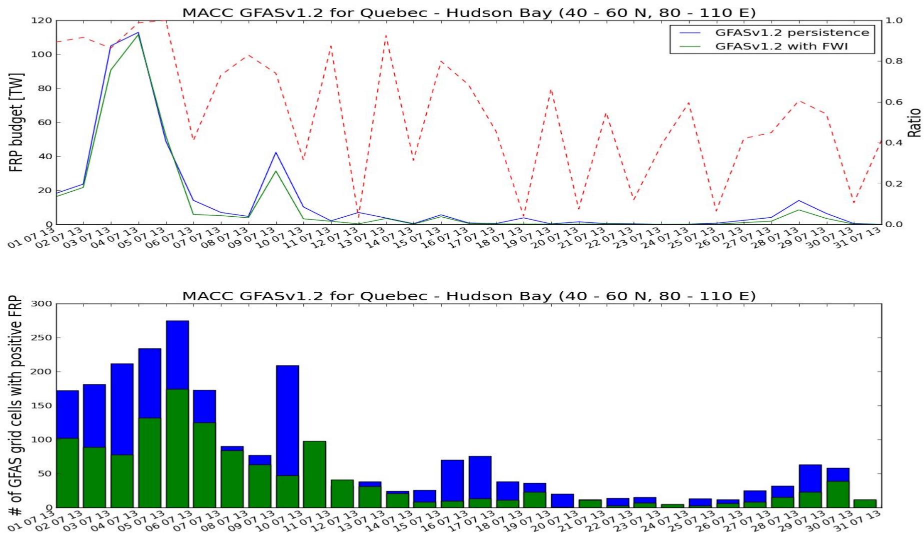
* Page 7 line 6 – Define extreme fire.
We agree - The use of "extreme" was therefore not appropriate and we have rewritten the sentence Usually fires are classified as extreme (or mega-fire) if they are widely spread and rage out of control (scientific literature suggests that fires with an areal extent > 10 000 ha, are ecological disasters because they burn vast areas of land and are characterized by high intensities that are seemingly outside of observed historical ranges). However there is not a rigorous definition. n this sentence we did not refer to mega fires but describe a properties of the two fire cases considered. Moreover we want to showcase the capability of the new way of modelling FRP for average cases more than for extreme situation.

To understand the impact of the new operator on the emissions we concentrate on the prediction of two fire events with different characteristics

* Page 7 Line 12 – "Using FWI.....up to 80%...." – could you include the average and std values too?
The mean is 0.54 and the standard deviation is 0.30. We have added this information in the text

* Page 9 line 13 – Have the authors tested their model during months when cloud cover is an issue?

The model is tested globally and for locations where observations are missing due to cloud cover issues. So for example in figure 3 (Which is copied here for convenience), the green bars show the number of points where FRP observations were classified as missing in the MODIS dataset. The FRP predicted in these locations are different depending on the model applied. If persistence is applied than the total FRP budget is expressed as the blue line (top plot). Otherwise, if the FWI model is used the total FRP budget is expressed as the green line. Only missing FRP observations (mostly due to cloud cover) contribute to the differences between these two lines (red line).



Technical Comments

* Page 2 line 28 – Change (Di Giuseppe et al., 2016) to Di Giuseppe et al. (2016).

Corrected

* Page 5 line 1 – Should “is still large” read “ is still larger”?

Corrected

* Page 7 line 9 – Should 4 June read 4 July?

Yes thanks for pointing this out

* Page 7 line 8 – Change “on 2-6 July” to “between 2-6 July”.

Changed

* Page 7 line 14 – Change “i.e..” to i.e.

Corrected

* Page 9 line 4 – Change ”from Quebec on reached Europe the ” to “ from Quebec reached Europe on the”

Changed

* Page 9 line 24 – “Holben et al., 1998” should read (Holben et al., 1998)
Changed

* Page 10 line 6 – change “ in case ” to in cases
Changed