Dear authors,

many thanks for your revised version. I can see that the manuscript has been improved. However, I think that still a range of minor clarifications are required before this manuscript can be published.

Thank you, we have revised the manuscript following your comments, as detailed below.

My comments:
P3 L5 remove this sentence

Eq 3: The integral still does not seem be correct. I assume that what you are wanting to express is that for any grid cell you calculate the term within integral for each subfraction occupied by a particular land cover type and then sum this up to the gridcell by i) multiplying with the cover fraction and ii) then making a sum? This would be more correctly then represented as a sum over the land cover types. In any case, the integral borders LU=0 and LU=LUtot are not meaningful, because LU is not an index of any of the terms within the integral

The anthropogenic ignition equation considers only one type of the HESFIRE land cover inputs, which is the gridded landuse (LU_{tot}, crops+urban). As it was, the equation was confusing because LU was not apparently an index of the terms within the integral, but in fact it was though LU_n, which is a function of LU (formerly Eq 4.).

We've rewritten Eq3 and 4 into a single equation. The computation of LU_n was simplified. We removed $LU_{range[1]}$, the fraction of landuse from which we start counting ignitions, which is zero, and renamed $LU_{range[2]}$, the fraction at which ignitions saturate, as LU_{thresh}. Below is a copy of the former Eq3 & 4 and of the new Eq 3.

$$ANTHROP_{ign} = (1 - GDP_n)^{GDP_{exp}} \times \int_{LU=0}^{LU=LU_{tot}} LU_{ign} \times (1 - LU_n)^{LU_{exp}} \qquad \text{Eq. 3}$$

with LU_n as normalized land use fraction, e.g.:

If $LU \leq LU_{range[1]}$ $LU_n = 0$

If $LU \geq LU_{range[2]}$ $LU_n = 1$ Eq. 4

Else $LU_n = \dfrac{LU - LU_{range[1]}}{LU_{range[2]} - LU_{range[1]}}$

Replaced by

$$ANTHROP_{ign} = (1 - GDP_n)^{GDP_{exp}} \times LU_{ign}$$
$$\times \int_{LU=0}^{LU=LU_{tot}} \left(\frac{LU_{thresh} - min[LU, LU_{thresh}]}{LU_{thresh}} \right)^{LU_{exp}}$$

We adapted the description of the equation to include the change in parameter name: "LU_{thresh} is the fractional land use value beyond which additional land use does not contribute any more ignitions. LU_{thresh} was initially set to 1, but the exponent parameter LU_{exp} was systematically optimized at very high values. LU_{thresh} was thus progressively decreased to a final value of 0.1, pointing to a rapid saturation of human ignitions with land use."

Eq 4: This seems to be a fairly complicated way to say that LUn is constrained to solutions between 0 and 1. Consider rewriting to LUn= max(min(fraction_of_Else,1),0)

This equation was edited, and included into equation 3 (see previous comment). We used your formatting in Equation 5 to describe the normalization of RH.

Eq 11: Please explain how these thresholds were derived, or clearly indicated that these values are based on heuristic reasoning. Also, now that I understand what this does - is this really fragmentation? In my book, fragmentation refer to how homogenous a landscape is, whereas you seem to mostly discount for certain land-use types, irrespective of whether they occupy the gridcell in one block or fragmented into several small pieces.

We weren't sure what thresholds you are referring to. Equation 11 (now Eq 10) is the fire termination equation with the relative humidity, soil moisture and temperature thresholds. Fragmentation was in Eq 13 (now Eq 12).

Regarding the weather thresholds ("Weather-related termination occurs when fire spread rate decreases to zero, that is when RH is 80% or above, soil moisture is 35% or above, or when the temperature drops below freezing."), these are derived and explained earlier in the manuscript, for their impact on fire spread. Termination occurs when fire spread is zero. We now refer to the section in the manuscript where those thresholds are defined: p.10, l.15 "Weather-related termination occurs when fire spread rate decreases to zero, that is when RH is 80% or above, soil moisture is 35% or above, or when the temperature drops below freezing (see Sect. 2.2.2)."

Regarding fragmentation, the index we use is indeed a basic one. Fragmentation can be expressed through a number of different indices: number of patches, edge density, connectivity, etc. including the one we use (Jaeger, 2000, Schumaker, 1996). It is certainly not ideal, but we think the term fragmentation is appropriate here, and clearly identifies what it is about to readers who are used to this term in fire sciences. We had a short discussion specific to the fragmentation index in the discussion version of the manuscript, and we re-included it now. P.12, l.1 "Note that

this is a simple fragmentation index, more advanced approaches can include aspects of connectivity, edge density and more (Jaeger, 2000; Schumaker, 1996)."

P11 L8: Please clarify that this constraint is only needed because you do not simulate fuel loading explicitly?

We now mention in the referred sentence that fuel load is not explicitly represented: P.11, l.13 "Areas that cannot sustain natural vegetation fires include croplands, urban areas, water bodies and deserts. Because HESFIRE does not explicitly represent fuel loads, areas that burned up to 8 months prior to the day being considered also contribute to fragmentation, to avoid repeated burns within the same fire season, but allowing fires in the following fire season if enough precipitation occurs (e.g. in sub-Saharan Africa)."

P12 L4. Isn't it trivial that 100% correspond to a fraction of 1?

We removed these details, now the sentence reads: P.11, l.12 "where $Frag_n$ is the fraction of the grid-cell that cannot sustain a fire."

P22 L20ff. Please reword (Figure 6 in this paper) compared to model X (Figure X in Author#1) etc. Also it should be added that this comparison is at at best of qualitative nature.

We have rewritten the sentence: p.22, l.12 "The comparison to results reported by other models – mostly fire incidence – suggests HESFIRE generally achieves strong performances with respect to spatial patterns: Figure 6 in this paper compared to figure 3c in Thonicke et al., 2010 (SPITFIRE model), figure 2 in Prentice et al., 2011 (LPX model), figure 1 in Kloster et al., 2010 (CLM model)."

We feel that the sentence p.22, l.18 "Note however that these results are not fully comparable as they are produced from fire-modules embedded within dynamic vegetation models, with potential bias originating from other parts of the model (e.g. PFT distribution, fuel load)." conveys the fact that these models are different, and explains why comparing their projections does not provide the whole story.

P22 L20 and 21. Check english: strong performance on? not "with respect to"?

Corrected in the previous comment.

P23L13: "This issue has been reported before?" Really? I thought HESFIRE was a new model...?

It hasn't been reported in HESFIRE, but in another fire modeling experiment. We reworded the sentence: p.23, l.8 "This issue has been reported before in another fire model (Rupp et al., 2007),…"

P24 L 16: No reference to conclusion needed here.

It was removed

P26 L 13 remove notes on removed paragraphs

Removed

P26 L16: Please be more specific in that you briefly mention/respeat the main improvements of HESFIRE compared to other models, as well as the main limitations here

We weren't sure what you meant in this comment. We present specific conclusions drawn from the results and discussion, suggesting potential applications and identifying steps to support fire research in more advanced coupled frameworks. I'll be happy to edit the conclusion though if you point to particular issues.

Figure 3: remove "(which happened...)".
Removed

Figure 4: Please reformat Y-axis to match the parameters as they are listed in Table 1 (in particular with respect to subscripts)

Sorry about that, we updated the figure.

Page 38: What is this text at the top of the page referring to?

This text was part of Figure 5, and indicated the value and range of the lightning strike ignition probability. It is now removed, similar to the next comment.

Figure 5: What are the numbers at the top of each panel. I don't think it's necessary to state these values assuming they correspond to those of Table 1

We've removed the numbers, and only indicate the parameter name now.

Figure 7: Please provide Y axis for all plots. Please prepare this graphic such that it fits onto the journal pages (break into parts if needed).Please separate the map from the rest of the figure. I am not sure what "significance of the IAV correlation means" Please elaborate. Please clarify in the legend, which number belongs to GFED and HESFIRE.

We added the Y-axes for all plots. As with the preparation of the manuscript for discussion, we will provide the figure split in sub-figures so that it fits the journal pages. The map was separated and is now figure 7. We've also renamed "IAV correlation" as "inter-annual correlation (IAC)" and indicated in the legend which number belongs to GFED and HESFIRE.