We would like to thank the reviewer for his/her constructive and thoughtful comments, which have provided valuable suggestions to improve this manuscript. Below we respond to all the concerns and/or suggestions of the reviewer and highlight the changes made to improve the manuscript. In our response we refer to the line numbers of the revised manuscript which we will post in a separate comment.

Reviewer # 2

The manuscript by Andela et al. (2015) investigates different methods for characterising the diurnal fire cycle using FRP measurements from the SEVIRI geostationary instrument but using the temporal sampling opportunities available to low Earth orbit satellite instruments such as MODIS. Characterising the diurnal fire cycle is necessary for deriving FRE estimates and for parameterising emissions in atmospheric transport models in near real time. Three different methods for characterising diurnal fire activity are assessed at high spatial and temporal resolution. The work builds on previous studies in this area and proposes a new approach for modelling the diurnal fire cycle using polar orbiter data which facilitates the development of emissions inventories using FRP datasets.

This manuscript is suitable for publication in ACP. Detailed below are some minor comments.

Comments (# line number)

Comment #179
It would be useful to include the range of the number of SEVIRI pixels that fall within a 0.1 degree grid cells over the study region as later sections discuss issues related to fire size\spread etc. within a grid cell.

Response #179
In equatorial West Africa, close to the sub-satellite point a 0.1° grid cell is around 120 km^2 and the SEVIRI footprint is around 9 km^2 (3 x 3), resulting in approximately 13 SEVIRI pixels per grid cell. Moving away from the sub satellite point this is eventually (e.g., Madagascar or north Portugal) reduced to around 6 SEVIRI pixels per 0.1° grid cell. There SEVIRI pixels have a footprint of around 15 km^2.

We have added this information to the data section (lines 187 - 190):
"A single 0.1° grid cell comprises over 13 SEVIRI pixels close to the sub-satellite point (equatorial West Africa) and this reduces to around 6 SEVIRI pixels at greater of nadir angles (e.g., Portugal and Madagascar)."

Comment #218
The mean fire size is derived using MODIS burned area data between 2001-2013 whilst the SEVIRI FRP data cover a three year period (2010-2013). What was basis for using datasets covering different length time periods and does it impact the results shown in figure 3c (i.e. is the average fire size and its spatial distribution similar when 2010-2012 MODIS burned area data are used)?

Response #218

We had assumed that the fire size is relatively constant. However, we agree that there is likely some year to year variation in the fire size due to inter-annual variation in climate conditions. To be more consistent we have updated the figure and now show the 2010-2012 mean value.

Comment #408:

The overall (2010-2012) FRP correlations are discussed but a brief comment on how these vary spatially and temporally would be useful. For example, is the uncertainty greatest during periods or in regions of low fire activity and least during periods of peak fire activity? Figure 6 indicates the approach generally works well in estimating FRE during the peak fire season when emissions are greatest.

Response #408

Correlation is generally highest for the larger and more intense fires (high ρ_{peak}, ρ_{base} and σ). Higher FRP fires (e.g., large fire front or high fuel consumption rates) are in general best observed by the SEVIRI instrument, and the diurnal cycle is therefore more likely to have a proper Gaussian like shape (small fires likely contain gaps). Besides the quality of the SEVIRI data, these larger and more intense fires have typically long duration over the day and are therefore more often detected at MODIS overpasses. Therefore, the percentage of FRE emitted on days that no active fires were observed at MODIS overpasses (i.e., Fig. 4a) was typically low in regions of larger more intense fires with higher correlation as a consequence. For the same reason highest correlations will occur during optimal burning conditions (typically at the end of the dry season).

We have updated the discussion to better address these issues (lines 695 - 710):

"Correlation between the modelled and SEVIRI time-series improved considerably when moving from hourly to daily resolution, showing that the models were better able to estimate daily budgets than the distribution of fire activity over the day. These differences may be explained by the inability of the models to correctly estimate the hour of peak fire activity, a fire diurnal cycle that is not well represented by a Gaussian function, or in the case of small fires the fire diurnal cycle may not be fully detected by the SEVIRI instrument. Because of the large day-to-day variation in the fire diurnal cycle and the FRP measurements limited to the time of the MODIS overpasses, the individual FRP observations have a low precision (i.e., large random error) and omission (i.e., non detection) of fires is frequent (Figs. 1 and 4), resulting in low correlation at high spatiotemporal scales (Table 3). Because fires rarely occur on their own and generally form part of a regional pattern (Bella et al., 2006), the correlation increased considerably when accumulating results to a 1° spatial scale. For the same reason model performance was found to be best in savannas and woody savannas, where the highest number of fires occur and the sample size is thus largest, or in areas of large fire size where omission was relatively low. Model performance was therefore best when optimal burning conditions were reached, often coinciding with the peak of the burning season."

Comment #497-499

The discussion of the fraction of FRE omitted at MODIS sampling intervals is interesting. How do regions of the greatest FRE percentage omissions relate to the total annual FRE (fig 3a) and how significant are these omissions with respect to the continental FRE estimate?

Response #497-499

The areas with highest annual FRE and relatively intense fires (high ρ_{peak}, ρ_{base} and σ) are characterized by having relatively low omission. Largest omission is typically found in areas of small fires and in regions of reduced detection opportunities during the burning season caused by limited number of overpasses and cloud cover. Therefore, the effect of omission on total FRE estimates on the continental scale will be limited, but regional FRE estimates may be strongly affected by the effect (see Figs. 5).

We added two phrases to the results section, to address this issue (lines 513 - 517):

"The most important biomass burning regions were typically characterized by relatively long fire duration over the day (Fig. 2c) and the effect of omission of active fires on continental scale FRE estimates was therefore relatively low (cf. Fig. 3a, 4a and 5). However, frequent omission of relatively small fires of short duration may strongly affect FRE estimates for some regions (Fig. 5)."

Technical Comments (# : line number)

#19: replace 'like' with 'such as'
#27 : 'comprised of'
#34 : replace 'done' with 'implemented'
#65 : delete 'becoming'
#83-85 : replace 'earth' with 'Earth'
#100 : replace 'measurement' with 'estimation'
#122 : replace 'using' with 'used'
#180, #198 : it is not clear what '(fsg3)' etc.
#191 : replace 'Because' with 'As'
#318 : include parenthesis ' (i.e. persistence)'
#366 : 'the ratio'
#394 : include 'FRE' – e.g. 'regional aggregated FRE time series' ?
#396 : replace 'Because' with 'Since'
#426 : delete 'or all of these lower FRP' ?
#446 : replace 'was' with 'is'

Response to technical comments:

We have made all the suggested changes. In #180 and #198 we have removed these internal product codes for clarity.

Comment Figure 1d: x-axis - replace 'sum' with 'local time (hours)'.

Response: done

Comment Figure 5: The colour scaling on this figure highlights the improvements made using the climatological approach but makes it more difficult to discern the grid cell values of the other two methods. Inclusion of histograms of the %FRE difference in the lower left corner of each map would help illustrate the distribution of grid cell values.

Response: Done, we have also added an additional phrase to the Results section (lines 529 - 531): "Moreover, the more narrow distribution of modelled FRE as a fraction of SEVIRI FRE by the climatological approach as opposed to the persistent approach suggests that results are not only more accurate but also more precise (Fig. 5)."

Comment Figure 6c : c) 'Democratic Republic of Congo'
Response: done

Comment Table 1: It would be useful to include the standard deviation for each parameter and land cover type as some parameters appear comparatively stable per land cover type whilst others more variable (figure 2).

Response: Done, we have also added the following sentence to the results (lines 489 - 491): "For σ, ρ_{peak} and ρ_{base} SD was typically about half of the average value, while SD of h_{peak} was largest for temperate forests, shrublands and grasslands."