Responses to the comments of anonymous referee #1.

(Referee's comments are shown with italic fonts and our responses are shown with normal font.)

Authors have compared measured black carbon (BC) measurements conducted at a site in Southern India with model simulations that use three different emission inventories. A key finding is that these inventories tend to underestimate BC fluxes from biomass burning. The manuscript is well written and gives new insights into the sources of BC in the atmosphere.

I recommend the manuscript for publication in Atmospheric Chemistry and Physics after the authors have addressed the following two minor comments.

We thank referee for evaluating our manuscript, providing suggestion to improve it and recommending as suitable for publication in ACP. In following part, we provide point by point responses to the referee's comments.

(1) *The authors define one key quantity, potential emission sensitivity (PES), at the end of the first paragraph of the section 3.2 as follows: "When the PES field is multiplied by emission fluxes, the volume integral of this product gives the simulated concentration at the receptor point. " This is a rather indirect and vague way to define PES, I'd propose that the authors define it in more straightforward fashion using an equation (if needed) to make the definition more concise.*

We thank referee for this suggestion. In the revised manuscript, we are going to provide description of PES and our methodology to calculate BC concentration as following.

Potential emission sensitivity (PES) fields or the source-receptor (s-r) relationship describe sensitivity of receptors $\boldsymbol{y}$ to sources $\boldsymbol{x}$. A detailed description about FLEXPART based s-r relationship can be found in Seibert and Frank (2004). In the present case, the receptors are 24 hour average black carbon concentrations at measurement location and sources are area averaged black carbon emissions in different grid boxes at different time intervals. In case of FLEXPART based s-r relationship, it is a matrix $\boldsymbol{M}$ whose elements m_{il} are defined by $m_{il}=\frac{y_l}{x_i}$ (i=1,.., I for the sources and l=1,.., L for the receptors ; Seibert and Frank, 2004). Once, the matrix $\boldsymbol{M}$ is known, for a given source vector (emission inventory), receptor values (BC concentrations at measurement site) can be obtained by a simple matrix-vector multiplication.

(2) *A second key quantity, fire radiative power (FRP), is not explicitly defined, but the authors only provide references where this can be found (second paragraph of Section 2). I'd propose that the authors include a explicit definition of FRP in the manuscript.*

Since, we have not used FRP values quantitatively, we did not include all the details. However, as suggested by referee, we will be including definition of

FRP and other related details in the revised manuscript.

References

Seibert, P. and Frank, A.: Source-receptor matrix calculation with a Lagrangian particle dispersion model in backward mode, Atmos. Chem. Phys., 4, 51-63, 2004.