We thank the reviewer for his/her comments. Please see our point-to-point reply below in blue.

General comments:

This study uses the NASA GEOS Earth System Model framework to investigate the impact of biomass burning aerosols and cloud cover on the Amazon region ecosystem productivity. This is a very interesting topic and the paper is clearly structured and generally well written.

However, while this work could certainly bring an important contribution to existing published studies on this topic, I think in its current form it still needs major revisions. I really hope this is something the authors can and will address in a revised manuscript.

Major comments:

1. A key question that needs to be addressed is whether the simulated response of GPP to changes in diffuse radiation fraction is realistic. More specifically, does the model accurately simulate observed GPP response to changes in diffuse, direct, and total surface radiation? And how does this simulated GPP response compare with other existing model estimates?

Answer: We strengthened the model evaluation with new Figures 5-6, 8, and S7-8 and discussions in lines 481-488. Following the evaluation approach in Malavelle et al. (2019), we evaluate our model's ability to simulate GPP on the global scale against FluxCom and FluxSat. As mentioned in section 2.2, FluxCom GPP is derived from surface measurements of carbon fluxes whereas FluxSat GPP is derived from satellite data. The comparison of global distribution of multiyear average GPP (Figure 5) and zonal mean multiyear average GPP (Figure 6) show that GEOS captures the GPP global distribution seen in the observations, with a GPP peak in tropics. The model does show a second peak in middle latitudes of the Southern Hemisphere but misses the observed peak in the Northern Hemisphere subtropics.

Malavelle et al., (2019) also conducted a similar evaluation for NPP. However, the MODIS NPP yearly data is currently unavailable due to unexpected errors in the input data related to persistent cloud cover (https://lpdaac.usgs.gov/products/mod17a3hv006/).

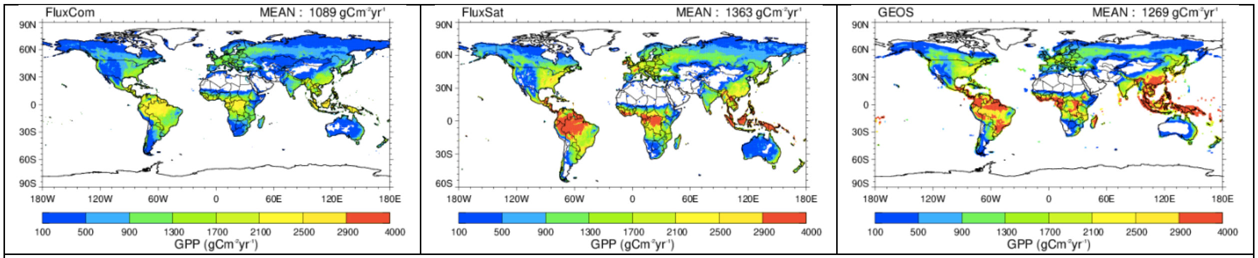

Figure 5. 2010-2015 multiyear average GPP from FluxCom, FluxSat, and GEOS.

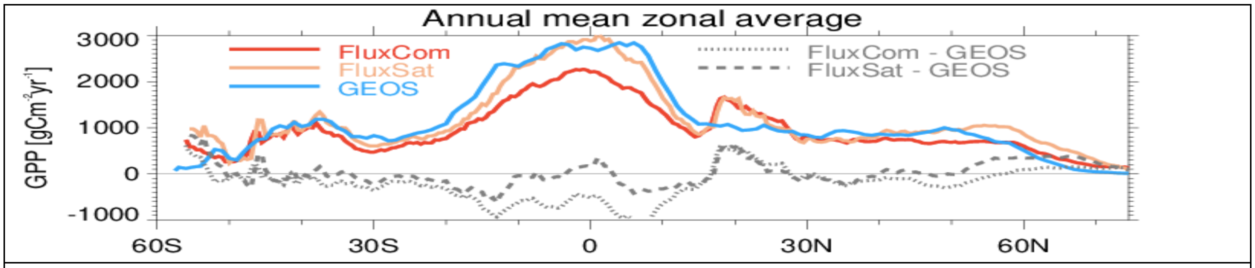

Figure 6. zonal mean of multiyear (2010-2015) average GPP from FluxCom, FluxSat, and GEOS.

The regional multiyear GPP comparison among the three datasets was given and discussed already in the original submission (Figure 7). Although the above evaluations of global and regional multiyear average GPP in Figures 5-7 are needed for the examination of the model's fundamental mechanisms including photosynthesis, a more direct evaluation to address the model's accuracy in simulating observed GPP response to changes in diffuse and direct surface radiation is also needed and shown in Figure 8. Following the evaluation approach of Rap et al., (2015), we compared the GPP response to direct and diffuse light at two Amazon sites, Tapajos and Guyaflux. The figure clearly demonstrates that in the model, as in observations, diffuse light is more efficient in stimulating GPP (see lines 512-518).

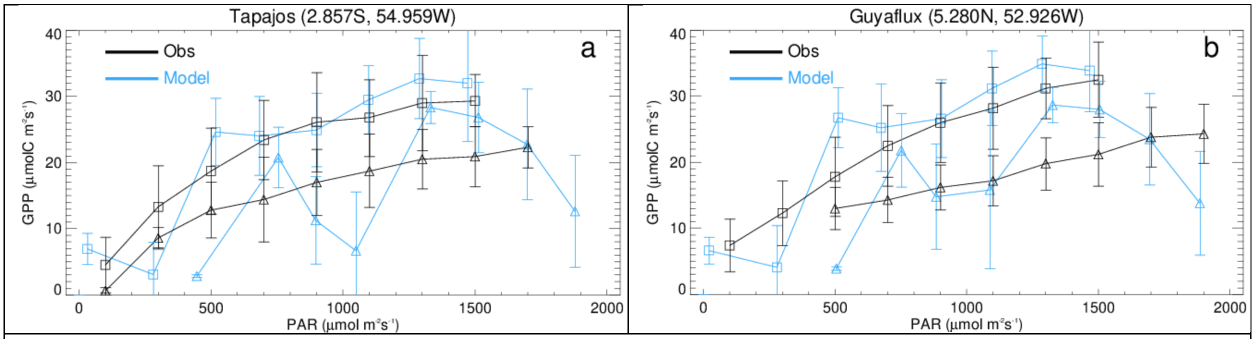

Figure 8. Observed (black) and GEOS modeled (blue) light response of GPP to direct (triangles) and diffuse (squares) photosynthetically active radiation (PAR) averaged over bins of 200 μmol quanta m^{2} s^{1} at (a) Tapajos and (b) Guyaflux. Error bars show 1 standard deviation of all values within a bin. The

observation data are cited from Figure 2 of Rap et al. (2015) and the data period is 2002-2005 for Tapajos and 2006-2007 for Guyaflux, while model period is 2010-2016 for both sites.

To answer how this simulated GPP response compare with other existing model estimates, we summarized all relevant studies in Table 2 and added discussions correspondingly in lines 635-645.

Table 2: Summary of model estimation of GPP increase in response to biomass burning aerosol over Amazon Basin

Study	This work	Malavelle2019	Moreira2017	Rap2015	Strada2016
GPP	1.0% (dir+dif)		27% (dir+dif)	0.7% (dir+dif)	3.4% (dir+dif+clm))
NPP	1.5% (dir+dif)	1.9 to 2.7% (dif+dir+clm) 1.5 to 2.6% (dif) -1.2 to -2.5% (dir) 1.6 to 2.4% (clm)	52% (dir+dif)	1.4% (dir+dif)	
Period	Annual average over 2010-2016	Annual average over 30 model years, 2000 climate,	Sept., 2010 under cloud-free condition	Annual average over 1998-2007	Annual average over 30 model years, 2000 climate
Atmospheric Model	GEOS ESM	HadGEM2-ES	BRAMS		ModelE2 ESM
Running mode	replay	freeGCM	Regional model with ICBC from NCEP	offline	freeGCM
Vegetation model	Catchment-CN (using LSM4 for photosynthesis)	JULES	JULES	JULES	YiBs
Radiation model	RRTMG_SW	SOCRATES	CARMA	A two-stream radiative transfer model (Edwards and Slingo, 1996)	k-distribution approach with various updates (Schmidt et al., 2014)
Cloud model	Cloud microphysics model (Barahona et al., 2014)			Monthly mean clouds from ISCCP-D2	a mass flux cumulus parameterization (Del Genio and Yao, 1993)
Aerosol model	GOCART	CLASSIC	CCATT	GLOMAP	OMA
BB emission	GFED4s	GFEDv2 1997-2006 average	3BEM	GFED3	IPCC AR5

dir, dif, and clm represent for direct radiation, diffuse radiation, and climate adjustment, respectively
3BEM: the Brazilian Biomass Burning Emission
BRAMS: Brazilian developments on the Regional Atmospheric Modeling System
CARMA: the Com-munity Aerosol and Radiation Model for Atmospheres
CCATT: a Eulerian transport model suitable to simulate trace gases and aerosols
CLASSIC: the Coupled Large-scale Aerosol Simulator for Studies In Climate
GLOMAP: The 3-D GLObal Model of Aerosol Processes Model
HadGEM2-ES: The Hadley Centre Global Environment *Model*, version 2-Earth System
IPCC AR5: The Intergovernmental Panel on Climate Change Fifth Assessment Report
ISCCP-D2: the International Satellite Cloud Climatology Project
JULES: the Joint UK Land Environment Sim-ulator v3.0
OMA: One-Moment Aerosol,
SOCRATES: Suite Of Community RAdiative Transfer codes based on Edwards and Slingo
YIBs: The Yale Interactive Terrestrial Biosphere model

2. Why is the role of other climatic feedbacks associated with biomass burning aerosol emissions (e.g. reduction in leaf temperature) completely ignored, despite the fact that an ESM is used? While, the authors do acknowledge at the end of the paper (lines 716-719) that the aerosol induced changes in meteorological fields can also affect plant

growth, this seems to be a huge missed opportunity here. Malavelle et al. (2019) showed that the overall impact of biomass burning aerosols on NPP is the net result of multiple competing effects and it would be interesting to see if similar responses are simulated with the NASA GEOS ESM system.

As the reviewer pointed out, aerosols impact the ecosystem via various pathways: 1) adjusting radiation fluxes into the ecosystem, 2) changing atmospheric environment via its direct radiation effect, and 3) changing atmospheric environment via its semi- and indirect effect on cloud. In addition, biomass burning emission results not only in an increase of atmospheric aerosols, but also in the change of chemical gas components such as CO_2 and O_3. These gas tracers also have direct and indirect impact on the ecosystem. We would like to investigate these impacts in an incremental approach. In this study, we not only examine specifically the ecosystem response to the change of into-ecosystem radiation flux owing to biomass burning aerosols using NASA GEOS ESM, but also try to explain such impact from fundamental mechanism. We also investigate the role of the Amazon background cloud fields in tempering such impact. The importance of the latter study is explained in our following response to the C#3a-d of reviewer 2. We conducted our study using Replay mode so that we can exclude the compounding influence of aerosol-climate adjustments on atmospheric fields as we explained in text lines 309-317 and our response to reviewer 1's C#6 and reviewer 2's C#3d. To study the impact of aerosol-climate adjustments in the future, we need to switch the simulation configuration to freeGCM mode to let the model forecast meteorological fields by its governing equations all through its simulation period.

3. The second research objective (and the way it is addressed) is a bit unclear and it should be formulated and addressed much more clearly.

- 3a. It is evident that clouds have a substantial impact on the efficiency of the aerosol diffuse radiation effect, as they have a strong effect on diffuse radiation fraction. In a similar way it can be said that the aerosols have an impact on the efficiency of the diffuse radiation effect caused by clouds. So this in itself is not necessarily a research question.

  There are two distinctive features in clouds and aerosols that require us to treat them differently in their impact on the radiation flux to the ecosystem. First, like our distinction of natural and anthropogenic aerosols in their impact on air quality and climate, the cloud is a more natural phenomenon, while biomass burning aerosols (BBaer) can be, at least partially, controlled by humans. Second, clouds are much more efficient in controlling both direct and diffuse radiation fields than aerosols, see modified Figure 9 that added a thin-cloud mechanism. Based on the stronger efficiency of clouds in adjusting radiation fields, it is worthwhile to investigate whether the same amount of BBaer could result in a very different impact on radiation fields under different background cloud conditions. As shown in Figure 14, under extreme environments, a unit increase of biomass burning AOD results in GPP increase by ~30 $kgm^{-2}s^{-1}$ in clear sky while GPP decrease by ~6 $kgm^{-2}s^{-1}$ in all cloud condition. Of course, the atmosphere of Amazon burning season could never be cloud free or completely clouded all the time in the real world. What is the potential range of the variation of Amazon clouds in burning seasons when the Amazon experiences environments of La Niña, normal years, and El Niño? To what extent does this range of cloud variation adjust the efficiency of "diffuse radiation fertilization effect" under the same emission strategy? These questions were not addressed clearly in previous studies, and we have tried to answer these questions in this study. We have added above discussion in lines 675-685.

- 3b. Is there a difference in the model between the simulated GPP response to changes in diffuse radiation fraction caused by aerosol changes and those caused by cloud cover changes?

No. The GPP response to direct and diffuse radiations are calculated by integrating both aerosol and cloud fields. The point of the second research objective is that background cloud amount can adjust the impact of released biomass burning aerosol on direct and diffuse radiation, and consequently the biomass burning aerosol radiative diffusion fertilize effect.

- 3c. The fact that during the investigated period (lines 649-654), the interannual variation in regional cloudiness is small and therefore plays only a secondary role on the diffuse radiation fertilisation effect (compared to the dominant role played by the variation in biomass burning aerosol) is not surprising and does not really address the second research objective.

The atmospheric radiation transfer theory tells us clouds dominate the atmospheric direct and diffuse radiation fields. It is worthwhile to investigate whether the emitted biomass burning emission could have a similar impact on surface radiation (and thereby similar impact on the ecosystem) under different atmospheric background environments. How sensitive is BBaer diffuse radiative fertilization effect to the different Amazon atmospheric conditions and to the potential bias in model cloud simulation? This is useful information for policy makers in controlling biomass burning emission.

Figure 14 indicates that dGPP can vary from 18.5 to 15.5 (kgm-2s-1) with a unit AOD of burning particles released to the atmosphere under the range of Amazon interannual cloud variation in dry season, which is 0.35 to 0.44 in our study period. In other words, there is ~20% dGPP uncertainty adjusted by background Amazon cloud in our studied period. Our work demonstrates quantitively the role of clouds in tempering aerosol diffuse radiation fertilization effect. We added the above discussion in lines 747-752.

- 3d. Lines 657-682: The cause for the difference between the 2013 and 2015 lines in Figure 11 is suggested to be the difference in cloud cover between the two years. I wonder whether this is indeed the case, since the results illustrated in Figure 11 are in fact for binned cloud fractions anyway? I would speculate they are in fact caused by the difference in (i) biomass burning emissions (they do matter in your calculated ddX/dBBAOD, which is defined in terms of both Pair1 and Pair2) and (ii) temperature and precipitation. This needs to be investigated and clarified.

First, following the suggestion of reviewer1 (S#41), we replotted this Figure by adding a ± one standard deviation representing potential variation. We can see much more variability in ddGPP/dAOD at low cloud cover (CF) than at high CF. The number of the occurrence frequency (%) in bins shown in the figure indicates that 2015 has more chances falling to low value CLDFRC bins than 2013.

Second, the impact from the potential variation of meteorologic fields in the four sensitivity runs is small. As we show in Figure S3 &4, the important relevant meteorologic fields of cloud fraction, surface T, and soil moisture over the studied area among the four simulations are very close. This phenomenon stems from the model feature we adopted in this study. In order to focus strictly on the ecosystem response to the into-ecosystem light perturbed by biomass burning aerosols, we use a Replay mode configuration in simulations. In Replay mode, every six hours, the model dynamic state (winds, pressure, temperature, and humidity) is set to the balanced state provided by the Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA2) and then a six-hour forecast is performed until the next analysis is available. MERRA2 is the assimilation system that enables assimilation of modern hyperspectral radiance and microwave observations, ozone profiles observations, along with GPS-Radio Occultation datasets. Simulation with Replay is important in this study for two advantages: 1. Nudges GEOS dynamic fields to MERRA2 reanalysis ensuring atmospheric conditions of the four simulations are close to each other, therefore, resulting in more focus on the study of into-ecosystem radiative impact (also see answer to C#7 of reviewer 1), 2. Ensures the observational-constrained meteorological fields used in our study.

It is worth pointing out that previous studies listed in Table 2 were performed in a free running General Circulation Model (freeGCM) mode. In freeGCM mode, the model forecasts meteorological fields by its governing equations throughout its simulation period. Its dynamic system is self-consistent, which lets it be an ideal mode to be used for the study of aerosol-climate feedback. However, the meteorologic fields simulated with this approach may drift away for a long simulation period with a small uncertainty in initial conditions.

Specific comments:

1. Terminology: Why is the term “aerosol light fertilizer effect“ being used instead of other already established terminology, e.g. diffuse radiation fertilization effect, Mercado et al (2009). I suggest the use of existing terminology to better integrate the work with other studies, but if the authors feel strongly about introducing this new terminology, a clear rationale for this should be provided.

   Our original thought focused more on the GPP response to the net effect of the radiation perturbed by biomass burning aerosol. We have changed the terminology to “diffuse radiation fertilization effect” to be consistent with previous studies such as Rap et al., (2015) and Mercado et al., (2019).

2. Why was the this particular period (i.e. 2010-2016) chosen? Can this be extended?

   Please refer to our answer to C#1 of reviewer 1.

3. Lines 100-101 and 140-142: It is not quite true that Malavelle et al (2019) did not consider the effect of clouds altering the diffuse radiation fertilisation effect. They do in fact discuss this and mention in their paper that “despite cloudiness affecting how much aerosols can interact with radiation, we notice that NPP is enhanced in the central part of the Amazon when BBA emissions are increased (Fig. 5).” So this needs to be reformulated and clarified in this paper to avoid confusions. This points also relates to my major comment 3, i.e. the need to better define and address the second research objective.

   Malavelle et al., (2019) gave a general direction that clouds affect the aerosol-radiation interaction. As we pointed out in our response to C#3a &3c, since clouds typically dominate atmospheric radiation fields, we need to know how sensitive BBaer diffuse radiative fertilization effect is to the potential interannual variation of Amazon burning season clouds. Could the same amount of BBaer result in a very different impact on radiation fields under different background cloud conditions? To what extent does uncertainty in model cloud simulation affect our conclusion of BBaer diffuse radiative fertilization effect? We carried out investigations to address these questions specifically. We have modified the sentence in lines 100-103 as "Their study takes into account the dynamic feedback of short lifetime cloud fields. However, the authors have not explicitly quantified the impact of Amazon background clouds and their interannual changes in tempering the aerosol diffuse radiation fertilization effect (DRFE)."

4. Lines 140-142: The authors seem to have missed other relevant studies on this topic, such as Strada and Unger (2016) and Unger et al. (2017). Results presented in this work should also be compared and integrated with those from these other studies.

   Thanks for introducing these two works. We have cited them (line 789). The GPP response to overall aerosol influence over the Amazon by Strada and Unger (2016) has been summarized in Table 2 as well.

5. Lines 403-406: It would be good to investigate a bit more the cause of the difference in observed and simulated SSA in August at Alta Floresta. What about other periods and other sites?

   Following the reviewer' suggestion, we extended the SSA comparison to the whole year. This is also consistent with the whole year comparison for aerosol and gas tracer between GoAmazon campaign and GEOS model (Figure 1) and AOD among AERONET, MODIS, and GEOS (Figures 2).

   The seasonality of the model SSA generally follows the pattern shown in AERONET observation with ~5% higher in its annual mean value. Certainly, there is room for the model to improve its optical property simulation, particularly for biomass burning aerosols. We have an on-going NASA funded project that aims specifically to study the impact of biomass burning aerosols and their chemical aging on optical properties and radiative forcing. The model reported relatively high SSA (Figure 2b) and high OC (Figure 1a) during the first half of August compared to the observations. Due to a high heterogeneity in aerosol distribution, it is challenging to capture aerosol plume in its exact time and location. There was a surge of biomass burning pollution surrounding this station at the time shown in the CO observation (Figure 1b). Traditionally, CO is a good tracer for biomass burning study and its spatial distribution is relatively homogenous due to its longer lifetime.

We have gone through the AERONET observational data. There are only two AERONET stations that reported aerosol AOD measurements within the Amazon area and the study period, see Figure R2. However, station Arica is located at the bend of South America's western coast, which is influenced mainly by marine aerosol and local anthropogenic pollution. Only station Alta_Floresta, which is located at the center of the Amazon basin and had large biomass burning pollution, provides meaningful information for this study.

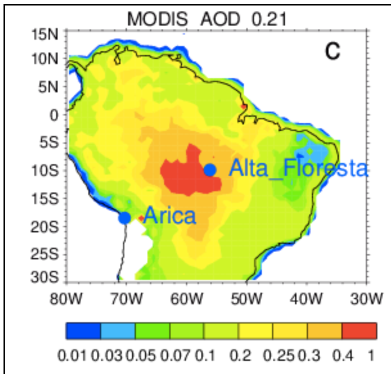

Figure R2: two AERONET sites that located in the Amazon region and have observations in the studied period.

6. Lines 458-461: Only comparing averages over Aug-Oct 2010-2016 for simulated SW radiation and CERES measurements can potentially mask important differences. Please include an assessment and discussion of model vs measurements agreement for the full time series (e.g. 2010-2016 time series of monthly means).

Yes. The model-CERES SW radiation comparison for 2010-2016 time series of monthly mean over the Amazon region is now shown in Figure S6 (lines 476-477). Apparently, the GEOS model has a good Rsfc simulation for the full time series in its seasonality under both clear and all sky conditions. The multiyear annual average of Rsfc is about 2.8% and 3.6% higher in the GEOS simulation in clear sky and all sky conditions, respectively.

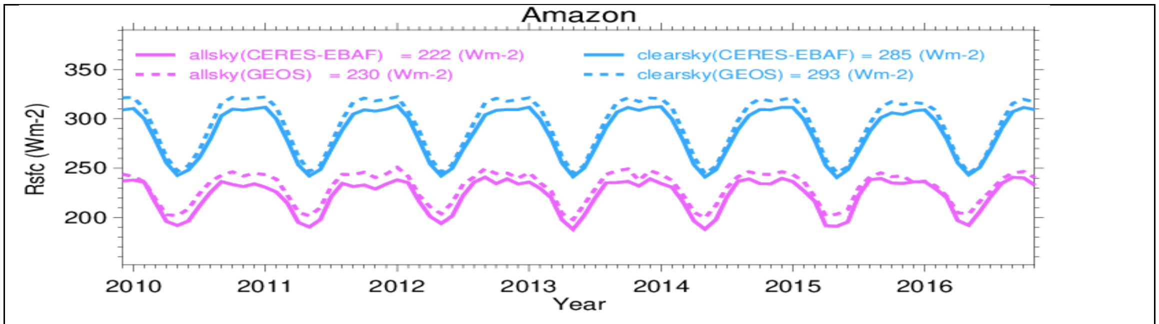

Figure S6. The model-CERES shortwave surface downward radiation (Rsfc, Wm^{-2}) comparison for 2010-2016 monthly mean time series over the Amazon region. The values given in legend are the multiyear average Rsfcs from the model and observation for all-sky and clear-sky conditions.

7. Lines 470-477: Similarly to the evaluation of SW radiation, the evaluation of simulated GPP should be investigated in more detail, i.e. time series rather than just averages.

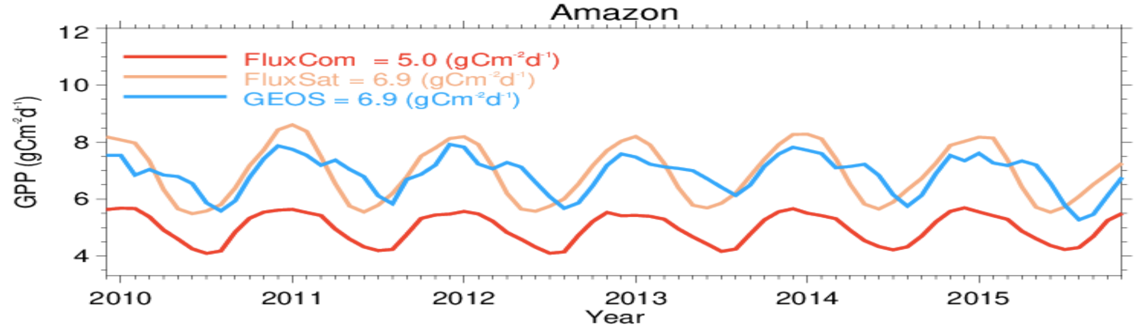

Figure S8. The GPP comparison for 2010-2015 monthly mean time series over the Amazon region among FluxCom, FluxSat, and GEOS. The multiyear average GPP ($gCm^{-2}d^{-1}$) are given in legend.

Comparison of GPP timeseries over the Amazon region among FluxCom, FluxSat, and GEOS has been added (Figure S8). The seasonality of the three datasets is similar, which is high in boreal winter season and low in boreal summer season. However, the month with minimum GPP is shifted 1 to 2 months among the datasets (e.g., ~June for FluxSat, ~July for FluxCom, and ~August for GEOS). GEOS multiyear annual average GPP is close to the value of FluxSat but higher than that of FluxCom. Although there are few of observational sites available in FLUXNET 2015 Tier 1, Joiner et al. (2018) (hereafter J18) evaluated FluxSat GPP performance around Amazonia using monthly data at 0.05◦ resolution for the tropical BR-Sa3 site (Figure 18a in J18). The evaluation showed that the high GPP values for this site produced by FluxSat (Figures 16 & 17 in J18) were supported by the flux tower values. The above discussion has been added in lines 501-509.

8. Figure 6: I would suggest the add another line corresponding to total radiation (i.e. the sum of the blue and red lines). This should help the discussion and better illustrate the point.

   Done.

9. Lines 479-516: This simulated response of total and diffuse surface radiation to different aerosol concentrations and cloud conditions needs to be evaluated against some observations. This is a key process to get right for this study and is not currently addressed in the paper. This relates to my major comment 1.

   In this section, we discussed the principal theory of how surface direct and diffuse light fluxes respond to the presence of aerosols and clouds using the photolysis model Fast-JX (Wild et al., 2000; Bian and Prather, 2002). FastJX solves the 8-stream multiple scattering in atmospheric solar radiation transfer for direct and diffuse beams, using the exact scattering phase function and optical depths of atmospheric molecules, aerosols, and clouds, and provides photolytic intensities accurate typically to better than 3%, with worst case errors of no more 10% over a wide range of atmospheric conditions (Wild et al., 2000) (also see our response to S#26 of reviewer 1). The model has served as a main core module for simulating atmospheric actinic fluxes and photochemistry in several global (e.g. GEOSCCM, GEOS-Chem, GFDL-AM4, MetUM) and regional (e.g. CMAQ, WRF-Chem) models.

   The model has also been evaluated against various other models that participated in an international multi-model comparison for solar fluxes and photolysis calculation organized by SPARC CCMVal2 (PhotoChem-2008 in Chipperfield et al., 2010). The primary goal is to improve model performance due to better calibration against laboratory and atmospheric measurements since some of the photochem-2008 models (e.g. TUV and NIWA) had been involved in previous campaigns, such as IPMMI and POLARIS. Recently, the model has been evaluated against the measurements from actinic flux spectroradiometers on board the NASA DC-8 during the Atmospheric Tomography (ATom) mission (Hair et al., 2018), which provided an extensive set of statistics on how clouds alter photolysis rates. In the aforementioned evaluations, the fast-JX model is among the models with good performance. We have added above discussion in lines 524-534.

Chipperfield, M., Kinnison, D., Bekki, S., Bian, H., Brühl, C., Canty, T., et al. (2010). Stratospheric Chemistry (Chapter 6). In V. Eyring, T. G. Shepherd, & D. W. Waugh (Eds.), SPARC Report on the Evaluation of Chemistry-Climate Models. WCRP-132, WMO/TD No. 1526, SPARC Report No. 5 (pp. 191-252). Toronto: SPARC.

Hall, S. R., Ullmann, K., Prather, M. J., Flynn, C. M., Murray, L. T., Fiore, A. M., Correa, G., Strode, S. A., Steenrod, S. D., Lamarque, J.-F., Guth, J., Josse, B., Flemming, J., Huijnen, V., Abraham, N. L., and Archibald, A. T.: Cloud impacts on photochemistry: building a climatology of photolysis rates from the Atmospheric Tomography mission, Atmos. Chem. Phys., 18, 16809–16828, https://doi.org/10.5194/acp-18-16809-2018, 2018.

10. Figure 8 and lines 580-586: An Amazon regional average GPP increase of +9.9% resulting from an increase in DFPAR of 10% is substantially larger than other existing estimates, e.g. Rap et al. (2015), Malavelle et al. (2019). However, the corresponding percentage change in NPP (lines 597-601) seems closer to estimates from other studies. It is important to investigate this further and include a discussion on why this is the case (e.g. to what extent the GPP change is driven by changes in respiration and NPP, respectively). This point also relates to my major comment 1, regarding the need to validate the simulated GPP response to changes in diffuse/total radiation against observations and/or other existing model estimates.

    Figure 8 (now Figure 11) shows the results in August 2010 when biomass burning emission was the maximum during the whole study period (see Figure S2a and Table S1a). On the 7-year burning seasons, the increase of Amazonian GPP estimated by our study was by 2.6% via a 3.8% increase in diffuse PAR (DFPAR) despite a 5.4% decrease in direct PAR (DRPAR) as we stated in our abstract and conclusion sections. The 7-year annual averaged GPP is only increased by 0.99% (Table 2), which is much lower than the value in burning seasons. We have compared our results with those from other model works in Table 2.

11. Lines 605-611: The comparison with Rap et al. (2015) is incorrect and misleading. Firstly, it is incorrect because the 0.5-4.2% range of NPP change in this study is an interannual range, while the 1.4-2.8% range from Rap et al. (2015) is an uncertainty range for the 1998-2007 average due to biomass burning emissions

uncertainty. The actual interannual range from Rap et al. (2015) can be inferred from their Fig. 4 and Fig. S5. Secondly, it is misleading as the two periods are different (2010-2016 vs 1998-2007), so any comparison of interannual ranges should also include a discussion on the interannual variability in biomass burning emissions during 1998-2016.

Thanks for pointing this out. The NPP should increase ~1.4% with 1BBA emissions over 1998-2007 in Rap et al. (2015). We have corrected the number in the revised text (line 641). We also indicated the different simulation periods in the two studies (see Table 2) and showed the potential variation of BBaer emission over the period of 1998-2007 and 2010-2016 in Figure S2a.

12. Lines 702-703: "The cloud fraction at which BB aerosol switches from stimulating to inhibiting plant growth occurs at ~0.8." I think this is a potentially confusing statement as it only applies to the biomass burning aerosol loadings recorded during the period investigated here. In reality, as both cloud cover and aerosol concentrations affect the diffuse radiation fraction, this threshold does also depend on the aerosol loading. A more useful threshold would be one defined in terms of diffuse radiation fraction.

This conclusion is made under the Amazon region within our study period. To avoid any potential confusion, we changed the sentence (lines 773-775) to "Over the Amazon region within our study period, the cloud fraction at which a unit AOD switches from stimulating to inhibiting plant growth occurs at ~0.8."

Technical corrections:

1. Line 32: "call here" should be "called here".

Done.

2. Line 124: missing supporting citation for the 40% value.

Li, W., R. Fu, and R. E. Dickinson (2006), Rainfall and its seasonality over the Amazon in the 21st century as assessed by the coupled models for the IPCC AR4, J. Geophys. Res., 111, D02111, doi:10.1029/2005JD006355.

3. Line 354: typo "metrological"

Corrected.

4. Lines 625-631: Description of figure is best included in the figure caption, with manuscript text dedicated to discussion of results.

   These lines have been deleted.

5. Lines 641-643: Please reformulate to avoid using “presumably” which is a bit too vague. A more precise statement would read much better.

   Change “presumably” to be “simply”.

6. Lines 666-673: Why is a different font used in this paragraph?

   Font has been changed.

7. Lines 701-702: “Curiously, BB aerosols stimulate plant growth under clear-sky conditions but suppress it under full cloudiness conditions”. I suggest removing the word “curiously”? This is in fact to be expected.

   Done.

References:

Strada, S. and Unger, N.: Potential sensitivity of photosynthesis and isoprene emission to direct radiative effects of atmospheric aerosol pollution, Atmos. Chem. Phys., 16, 4213–4234, https://doi.org/10.5194/acp-16-4213-2016, 2016.

Unger, N., Yue, X., and Harper, K. L.: Aerosol climate change effects on land ecosystem services, Faraday Discuss., 200, 121–142, https://doi.org/10.1039/c7fd00033b, 2017.