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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effect of atmospheric aerosol particles and clouds on Net Ecosystem Exchange in Amazonia" *by* G. G. Cirino et al.

Anonymous Referee #1

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Title: The effect of atmospheric aerosol particles and clouds on Net Ecosystem Exchange in Amazonia

General comments:

The authors report on the effect of aerosol particles and clouds on the net ecosystem CO2 exchange at two sites in the Amazon. These sites are located where the Amazon forest experiences either a short or a lengthy dry season, in combination with either more or less influence of biomass burning. Although this type of research was already performed in Amazonia, there is a novelty in trying to validate remote sensed AOD derived from MODIS products against AERONET data, which I think the authors failed in highlight. There was a massive work performed by the authors to reach the results pre-

sented here, even though I sense that it was not fully exploited (e.g., 10 years of AOD and NEE may allow to draw some conclusions about interannual variability). However, the manuscript has many flaws that are not acceptable for the standard of ACP. For example, there are several moments that I sense that I know what the authors meant, but I am not sure. In addition, I have the impression that some sections were written in a rush, e.g. the results and discussion, and the authors either ended up them abruptly or introduced sentences out of blue that are not self-standing. The objectives of the work are not stated clearly, and leave the reader without a clue whether this research was to assess the influence of clouds and aerosol particles on NEE or to test and validate the AOD derived from MODIS in Amazonia. Finally, I missed any discussion or reference to soil water availability in the dry season. The authors mentioned the biotic factor (i.e. forest canopy and stomatal conductance) as it only responds to radiation loads (either direct or diffuse).

According to my point of view, the results are interesting and sounding, but not self-standing. The authors themselves acknowledge that to observe only the aerosol effect on the solar irradiance flux and consequently on the NEE measurements, the aerosol effect has to be isolated from the cloud effect. I therefore only recommend the publication of this manuscript after major revisions.

Specific comments: P1L18-19: when, during all year round or in dry season only? P1L27: Eddy covariance technique rather than eddy correlation techniques P2L2: "...AOD ranged from 0.10 to1.5." - Also at 550 nm? P2L6: "...approaches 0." - Change to "approaches zero." P2L18-19: "...modify CO2 exchanges in the biosphere-atmosphere interface." – How? P2L29: "vonRandow et al., 2004)..." – Change to "von Randow et al., 2004)...' P3L4: "Long-term studies coordinated by the LBA experiment..." - In 2000 the LBA project was at its infancy, and there were no data to support this sentence (i.e. long-term studies) P3L12-13: "...recent numbers indicate a kind of balance in uptake/emissions." - Please, add a reference to support this sentence P4L1-2: "...Central Amazon, which suffer smaller impacts from biomass burning

emissions." - I sense that this is the objective of your work. That is, to investigate and compare the impacts of aerosol loads on NEE on forests close to and far from burning emissions. Why not to make it clear to the reader? P4L10-11: "...but these were made from relatively short data time series..." - Are you going to present a study with a longer data set? Why not explore that you are going to perform analysis with a data set that is longer than previous studies have used? P4L11-12: "...two regions of the Amazon: Rondonia-RO and Santarem-PA..." – Suggest to rather write "wet and seasonally dry forest of Amazonia"; in addition, are you going to present data from any other region of the Amazon? Manaus is located in the same latitude of Santarem and therefore still wet forest; these two sites differ in the length of the dry season... P4L14-17: Are you not saying the same thing, but with different words in these two sentences? P4L19-22: What is the objective of this work? It is not clear whether the authors want to assess the influence of clouds and aerosol particles on NEE or to test and validate the AOD derived from MODIS in Amazonia... P5L1: "...-18 and -8 kgCha-1day-1..." - Suggest to remove the operator to not confound the reader that is not used to the convention used by micrometeorology P6L8: "...of 23.5 0C and 31.0 0C, respectively" – Typos P6L15: "2.2.2 Meteorological and flux measurements of CO2" - Suggest reviewing this section as there are many inconsistencies regarding instrumentation and data acquisition systems. In addition, it is recommended to separate the meteorological from turbulent measurements P6L24: "...wet and dry bulb thermometers ($\pm$ 0.1 °C),.." - Do the thermohygrometers from Vaisala have dry and wet bulbs? P6L24-25: "...anemometers with a minimum wind speed of 0.3 to 0.4 ms-1 and..." - I sense that this information is not relevant here as wind speed is not the focus of this research and are not mentioned in Table 1; furthermore, these minimum wind speeds values are not correct (please, refer to the manuals to check them) P6L25: "...rain gauge with accuracy of $\pm$ 0.2 mm." - This is not right; this is the resolution of the rain gauge P6L28: "...eddy covariance system similar..." - Now you are using the correct term. Note that most of the time you have been using the term eddy correlation that is not correct, to describe the technique that has been used to measure and calculate the fluxes you are using for your analysis

P6L29: "...sonic anemometer ($\sim$ 10.4Hz)..." - This is not right. Sonic anemometers usually operate at 20 Hz, but in most cases about 1/2 of data is collected because the turbulent signal is still present within this sampling frequency P6L31-32: Please, review this table as it contains several information that are either not correct or not updated P7L14-15: Are these periods correct for every site? P8L10: "CO2 turbulent flow" – Did you mean CO2 turbulent flux? P8L10: "...the eddy correlation system..." - Please, review the use of eddy correlation and eddy covariance throughout the text. It is confusing. P8L11: "...CO2 concentration..." – CO2 (there are many other typos like this throughout the manuscript) P8L12: "...profile at discrete levels zi of Δzi thickness..." - If you mention the discrete levels, than you should have written them mathematically in the equation 1... P8L12: "...the soil surface..." - Looking at Table 1, the nearest level to the soil surface is 5.6 m; may it be considered soil surface? P8L16: "...following Albinet et al. (2001)..." – "...following Aubinet et al. (2001)..." (there are some typos like this throughout the manuscript, please review other citations too) P8L19: "...C is the..." – Typos, lower case P8L19: "...the [CO2] (μmolmol-1)..." - Have you introduced this term before? If you are going to use it to represent CO2 concentration, please be consistent with the symbols you are using throughout the text P8L21-15: You are anticipating the results and discussion here, in a section that is dedicated to show the methods; suggest moving this paragraph to the right position in the text... P8L27: "...atmosphere (respiration greater than photosynthesis)." - There is no photosynthesis at night... P9L19: "...the words "cloud" or "cloudiness" was..." – Did you mean "...the words "cloud" or "cloudiness" were..."? P11L29: "...find kt*: First, it was plotted values of kt against time of the day." - I sense that I know what you mean, but you need to rephrase this sentence P12L1-2: "Finally, the values of kt found along 1 the mornings and afternoons clear-sky selected were..." - This sentence is quite confusing consider rephrasing it... P12L9: "...solar zenith angle calculated Gates (1980)..." - Is this sentence right? P12L26-27: "...carbon flux (%NEE) by way of the following relationship..." - Confuse, reorganize the wordiness P13L1: "...given condition sky..." – Did you mean sky condition? P13L5-6: "...parameter f, it was initially analyzed and

grouped data at intervals of solar zenithal angle between 10-20° and 20-35°." - I sense that I know what you mean, but this sentence is confusing... P13L9: "Therefore, a 10 to 35° elevation angle were chosen..." – Suggestion "Therefore, an elevation angle ranging from 10 to 35o was chosen..." P13L14: "...are satisfactory in view of the measurement sample size..." - Rephrase this sentence, I know what you mean, but it is not grammatically correct P13L15: "The coefficient of determination R^2..." - This is text book knowledge; there is no need to explain what R2 stands for... P13L18-19: Do the coefficients for RBJ obtained in this study differ from that published by Oliveira et al. (2007) for the same site and almost for the same time period reported here? Why you refer only to Tapajos National Forest? Please, explain P13L23-27: This is redundancy. Remove this paragraph from the text as you will discuss them in the next section... P14l2: "...radiation PARf..." – Delete PARf as it is going to be introduced after the Equation 9 P14L5: "...and q = (Sf / Se) /kt..." – You should write this as Equation 10, rather than writing it when explaining the terms of Equation 9; in addition, how have you measured the diffuse radiation and what the term Se stands for? P14L7: "...Earth's surface ..." - This is not scientific writing... P14L7-9: Suggest reorganizing this sentence. As it is, confuses the reader as out of blue you introduce the terms LUE and Df P14L12: "As there are no direct measurements of skin temperature of the canopy at either study sites..." - Have you checked whether surface temperature measured by infrared thermometers are not available? P14L13: "...around 15-20m high inside the canopy on..." - Are you sure you meant high inside canopy here? Rather, you meant "height above the canopy..."? P14L14: "...long wave radiation from the surface (LâĘŚ)..." - This is not what is written in Equation 11... P14L23: "This section presents and discusses the main results of this study." - Remove it from the text P14L23-24, P15L1: "The first task was to validate MODIS AOD estimations with the AOD measurements from the AERONET sun-photometer network." - Are we finally talking about the objectives of this work? This should have been made clear before (at introduction)... P15L4-5: "...parameter (f), during the biomass burning season at both sites." – "Only now you are giving the reader a chance to know that you will concentrate

your analysis during the burning season; this should have been warned anywhere, for instance either in the introduction or section 2.2... P15L24-25: "...show values around 5-10% higher than AERONET measurements, are considered acceptable 24 (Chu et al., 2002)." - Revise the wordiness of this sentence; it is confusing... P15L28-30: It seems like you are anticipating the conclusions... P16L3: "In the present study, the impact of..." – Change to "The impact of..." P16L4: "...budget is assessed..." – Change to "...budget was assessed..." P16L9: "...with a R^2, $\sim$0.22 (K34)..." – Change to "...with a R^2 of about 0.22 (K34)..." P18L15: "For each ZSA..." – Change to "For each Zenithal Solar Angle (ZSA)..." P20L8: "...the canopy forest and..." – Change to "...the forest canopy and..." P20L20: "...produced an increase in VPD of..." – Is this right, an increase in VPD? Did you mean a decrease in VPD? P21L1: "...satisfactorily quantity the reduction..." – You meant "...satisfactorily quantify the reduction..."? P21L7-8: "Aerosols from biomass burning produced up to a 50% reduction in the amount of total incident solar radiation and..." - How did you take aerosol and cloudiness apart? Did I miss this in the text? P21L17-19: Figure 11 does not support what is being said here; you have not discussed leaf or canopy respiration in the results and discussion section and out of blue adds this speculation about reduced rate of respiration. P21L21: "...on CO2 fluxes difficult." – You meant "..... .on CO2 fluxes is difficult."?

Equations Equations 4 to 9 do not seem to have been written with a formula editor...

Tables Table 1: Vertical profile of [CO2] and water vapour [H2O]: Correct the lower case for CO2 and H2O; IRGA PP Systems CIRAS SC - Are you sure that this was the only IRGA used at these towers during the time period you have used the data set? Measurement height at K34 - These are not correct; Relative humidity: Vaisala thermohygrometer (HMP35A) and (HMP45AC) /PT100 resistors - Are you sure PT100 are used to measure relative humidity? u, v e w (wind vector): Measurement height at K34 – Are you sure that these heights are correct? *Height above the canopy top ($\sim$35m) - This is somewhat confusing. What is the height of the canopy top at K34 flux tower site? Table 2: Suggest removing it, as it was barely used in the manuscript

Table 3: Afternnon – Typos (afternoon) Table 4: Suggest deleting it, as regression coefficients may be plotted together with Figure 5

Figures Figure 3: “Scatter plots and regressions between clear-sky clearness index and the cosine of solar zenithal angle...” - This is not what is shown as Y-axis label. Instead, it is shown NEE... In general, I suggest reviewing the number of figures to reduce them to a number of 6-7 at most.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/13/C11029/2014/acpd-13-C11029-2014-supplement.pdf

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