

## ***Interactive comment on “The influence of biomass burning on tropospheric composition over the tropical Atlantic Ocean and Equatorial Africa during the West African monsoon in 2006” by J. E. Williams et al.***

**Anonymous Referee #1**

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### I. General impression

I think it is an interesting paper, where one tries to explain certain impacts of biomass burning. One also tries to investigate how well the CTM TM4\_AMMA can simulate BB impacts, and which factors influence this description. The main points of this study are therefore for me : (i) BB contributes strongly to atmospheric composition in equatorial Africa (I presume this is not a new result); (ii) Maximum BB impacts in this model appears between 0-5S which is more southerly than satellite observations (I presume this is not new) ; (iii) Different factors possibly influencing the description of this impact are

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investigated; (iv) The updated meteorological data set gives significant different results for tracer transport and distributions. I think the paper reasonable well situates the research into a wider context, and refers extensively to other peoples work. However, in this paper, a lot of work has to be done by the reader. For example, it is sometimes hard to find in the figures what is meant, and some figures are not very easy to read. Also, there are too many figures and the information is not enough syntetised. The paper is rather heterogeneous : it does not always clearly mentions the aims, places conclusions on different places of the text, uses different types of models, and uses approaches which are maybe not always perfectly suited. Because there are conclusions widely spread over the text, it is sometimes difficult to retain the important message of the paper. To some extent, the paper is rather descriptive and not very quantitative (too few quantitative results).

### II. General comments

- The use of the trajectory model feels a bit as a different part, which is not very well integrated in the paper. I have the impression that the trajectory analysis does not really fit in the paper; the model is also not described in the experimental setup. Shouldn't it have been better to test this new meteorological forcing in the CTM, rather than introducing a different tool (a trajectory model)?

- In addition, the use of the trajectory model is not an "independent way" for me.

- I have the impressions that you used a lot of things which were available (from other studies, in the model, ...), but maybe are not optimal for this study : (i) two different types of models (ii) you used as base simulation FULL while the HIGH\_ANTH simulation as base simulations would have been better (iii) part of the reasoning is based on results which are not present : the impact of temporal resolution of the meteorological forcings and horizontal resolution (just by mentioning personal communications of TM5 results); trajectory calculations showing more transport to the equator are mentioned but not shown or proven (iv) emissions budgets and burdens in regions like "34N-34S"

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and over all longitudes are not very meaningful for this study (v) sampling at 650 hPa, at 670 hPa, ... : why not sampling all the time at the same altitude?

- Sometimes new topics arise in the middle of the text : p7516, line 20-22 : weather 6-hourly data is sufficient

- It would be nice to have a horizontal map where you indicate the different regions you study : the transect region (6W-3E)x(40N-20S), the SAFR region (40S-0N)x(20W-40E), the GUIN region (0N-10N)x(20W-40E), the regions you study in Fig4 (4-6S)x(3W-6E) and (6-8N)x(3W-6E), the locations of Cotonou, Nairobi and Windhoek

- Figures 3, 4a and 4b are analysed simultaneously, which makes it sometimes hard to follow the text, or to find out in which figure one has to search a signal

- Figures 3, 4a and 4b : they are small, with too much details, and therefore ask a lot of energy to recognise what is described in the text; the mentioning of colour codes in the caption instead of on the plot is not good

- Conclusions are not always very well funded, are spread all over the text, and are sometimes too strong

- I do not find the titles of the sections very well chosen (see later)

- I should not talk about "sensitivity studies" in the abstract (that is too technical too appear in the abstract)

- The trajectory figures always show different parts of Africa, which does not increase the readers comfort.

- LANGUAGE : (i) I would not stress so much this "co-located" : isn't this assumed automatically?; (ii) I would replace "(e.g.)" should be ", e.g.,"; (iii) I would replace "(e.g. REFERENCE)" by "(e.g., REFERENCE)"; (iv) In the dates, I should skip the "the"; (v) I think "temporal distribution" should be "temporal resolution"; (vi) [CO], [O3] : brackets usually refer to concentrations, while here in the paper you describe in fact mixing

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ratios.

### III. General comments on each section

#### Comments on the abstract

The abstract contains quite strong conclusions, which are maybe not very well funded. It is also a bit heterogeneous.

#### Comments on the introduction

- Again, the introduction is quite heterogeneous.

- There is a quite good beginning of the introduction : importance, variability, difficulties.

- Then some partial results from others are mentioned.

- Then shortly an inter-comparison exercise is mentioned, with mentioning all the factors that might contribute to modelling errors ...

- Then finally a quite long extension about the injection heights (which is not in equilibrium with its importance in the paper elsewhere).

- The aim of the present study is not very clear, and should be stated more clearly. You mention something general in p7510, line 16-20, but it is not clear if the present study is supposed to answer this question. Also in p7512, line 1-4, you say something about the present study. However, the emission height impact finally appears only to be a small part of the study.

#### Comments on Section 2

- The structure of this section is ok.

- The naming of the section is not good : it should be like "2. Model and experiments".

- The naming of the subsections could be : "2.1 Model description" and "2.2 Experimental setup".

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- To make the paper more coherent and logical, I should describe the trajectory model in this section; now it really feels as if the trajectory-model results have been added in a rush, placing the model description on the same place as the results.

#### Comments on Section 3

- Isn't the title of the section a bit long?
- Subsection title "Monthly comparisons" : I would skip the word "comparisons", and replace it by something else.
- Subsection title "Daily mean variation " : I would say "variations of the daily mean".
- In this section, it is not always unclear which figures are discussed.
- The differences in some of the figures are rather small and hard to see
- Some of the colour coding is wrong : magenta.

#### Comments on Section 4

- The title of this section is not very nice.
- Why is there "regional" in the title of the first subsection and not the second?

#### Comments on Section 5

- The improvements due to the use of the new meteorological data set are not as significant as one would expect from reading the abstract.
- The fact that the plots always use different limits, makes it not so easy to compare them.

#### Comments on the naming of the sections

I would rename some of sections and subsections

2. "Model description and experimental setup"

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2.1 "Model description"

2.2 "Experimental setup"

3. I would not put this "3°W-6°E" in the title; because the fact that you study 40S-20N is maybe even more important

4. "Comparison of model results with measurements"

4.1 Why "regional" in this title?

#### IV Detailed comments on the text

Below follows a detailed list of comments, suggestions and typos.

#### PAGE 7508

- as you use accents in "Midi-Pyrénées", you are supposed to use them also in "Aérolologie" and "Aéronomie"

- I think you should write "Laboratoire" instead of "Laboratory"

- only one address contains a postal code; try to be consistent

#### PAGE 7509

- p7509, line 2 : "3-D" should be "3-dimensional" or "three-dimensional" the first time you use it

- p7509, line 4 : "has" instead of "have"

- p7509, line 5 : "sensitivity studies" is maybe too technical to be mentioned in the abstract

- p7509, line 7 : "around" is rather vague, maybe you just mention that it confirms that there is a considerable contribution around 850 from the SAFR region

- p7509, line 9 : "temporal distribution" - isn't "temporal resolution" better?

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- p7509, line 10 : "much more important" : isn't this a bit too strong?
- p7509, line 16 : "burning region" : is not very nice
- p7509, line 17 : "extreme" is some term for some specific phenomenon described in other papers; therefore, I would just write "very high"
- p7509, line 18 : is this "analysis" meant to be singular or plural? This determines the "show" or "shows".
- p7509, line 18 : this "6-hourly" is not relevant (which you show later), so I should not mention this detail
- p7509, line 20 : this " $\sim 6^{\circ}\text{N}$ " comes a bit abrupt; before (p7509, line 8) it is as if the region up to  $10^{\circ}\text{N}$  is affected
- p7509, line 22 : what is meant by "African region"? Africa, Central Africa, ...
- p7509, line 22-23 : "show" instead of "shows" and "reveal" instead of "reveals" because "simulations" is plural
- p7509, line 24 : "drives" should be "drive" because "data" is plural

PAGE 7510

- p7510, line 2-9 : I miss a reason why it is worth studying these fires: is it a health or a climate impact? Which species?
- p7510, line 5 : "sparsely populated regions" : also the level of industrialisation counts, and shouldn't this be refined by "tropical"?
- p7510, line 11 : "inter-annual"; shouldn't it be "inter-annual"?
- p7510, line 14-15 : "such events" is too vague : are as well the BB as the natural wildfires assumed to increase?
- p7510, line 24 : "around" is vague : is meant "in" Africa or "off-shore" Africa?

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- p7510, line 25 : "lower atmosphere" is vague (w.r.t. the 4-5 km, mentioned a bit further); what is equatorial Africa?
- p7510, line 26 : shouldn't you mention that NO<sub>x</sub> is a catalyst?

PAGE 7511

- p7511, line 6 : "As part of AMMA" : not very nice
- p7511, line 12 : "the 3-8 August 2006" : I would skip "the"
- p7511, line 15 : "difficulties" instead of "difficulty"
- p7511, line 16 : "WAM" : although it has been defined in the abstract, you also have to define it in the main text
- p7511, line 18 : this "such pollutants" is a bit strange, because in the sentence before you talk only about ozone
- p7511, line 18-21 : this sentence is bizarre. You say that the "transport" (which is a very specific process) is dependant on many processes ... Therefore, I would replace this "transport" by something more general (evolution, distribution, ...), or add "long range"
- p7511, line 21 : I would skip "used to introduce such events"
- p7511, line 22 : is "lofting" correct?
- p7511, line 23 : this sentence is a combination of a description of the physical mechanism, combined with more modelling terms like "injection heights". To make this distinction clearer (that injection height is not something physical but a modelling strategy), I would say "effective injection heights".
- p7511, line 28 : I would replace "place more emphasis" by "put more emphasis"
- p7511, line 29 : "employed"

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PAGE 7512

- p7512; line 1 : in the former sentence you say there is a debate about the impact of the injection height. In this sentence you start by saying that you contribute but in the part of the sentence that follows the "by", there is no reference to injection height but only very general aims.

- p7512, line 1 : "to" instead of "towards"?

- p7512, line 8-9 : what is meant by "differences in the monthly variability"? That the mean in one month is very different of the mean in another month? Should "variability" not just be "distribution"?

- p7512, line 9 : "concentrations" should be "mixing ratios"

- p7512, line 9-10 : "[CO]" and "[O3]" are symbols for concentrations

- p7512, line 8-12 : are you not saying twice the same in this sentence (highlighting the differences between the different sensitivity studies examining the effects of altering model parameters)?

- p7512, line 12 : add "emissions" after "BB"

- p7513, line 13 : "host" : not neutral enough

- p7512, line 15 : "influence" : on what?

- p7512, line 16 : "Sect. 6" instead of "Sect 6"

## 2. MODEL DESCRIPTION

### 2.1 EXPERIMENTAL SETUP

- p7512, line 21 : I would skip "vertical"

- p7512, line 22 : Forecasting should be "Forecasts"

- p7512, line 23 : shouldn't you give some short information on the model: chemi-  
C1536

cal scheme (stratospheric/tropospheric chemistry), wet and dry removal parameterisations, convection, turbulence?

- p7512, line 25 : "heterogeneous rate data" : not nice; maybe this "data" are coefficients; be a bit more specific (maybe you mean uptake parameters)

- p7512, line 25 : "used for accounting for" : maybe replace by "to account for"?

PAGE 7513

- p7513, line 5 : it is not necessary to mention "grid cells"; everything you do in a CTM is discretised; so just say "where ..."

- p7513, line 5, 6, 10 : both "cross sectional" as "cross-sectional" appear

- p7513, line 3-6 : "which provides" : because "provides" is singular it refers to "the parameterization"; however, the "which", could also refer to the "cirrus particles"; therefore, I suggest to replace the "which" by "and"

- p7513, line 7 : "using a scaling ratio of 10" : do you mean that you use values which are 10 times stronger than in the parameterisation of "Heymsfield and McFarquar"?; or do you convert this two physical quantities with different units one into the other just by multiplying?

- p7513, line 15-16 : I would skip "for these particles"

- p7513, line 16 : "surface", maybe plural?

- p7513, line 17 : I would replace "improvement" by "modification" or "more detailed description"

- p7513, line 18 : I would skip "available"

- p7513, line 19-20 : I would skip "compared ... TM4\_AMMA" because this applies only to 1 of the 2 modifications mentioned in the first part of the sentence

- p7513, line 23-26 : does this data set also contains emission data for 2006, or only

C1537

up to 2000?

PAGE 7514

## 2.2 DEFINITION OF SENSITIVITY STUDIES

- p7514, line 17-10 : 4 times the use of "e.g." should be corrected
- p7514, line 12-13 : sensitivity - purpose - quantifying - importance : with all these words, the meaning becomes very vague
- p7514, line 14 : "we also assess" : shouldn't this be "in order to assess"; it is also not clear what makes that this second sentence is added in the introduction
- p7514, line 14 : "moreover" and "also"; a bit synonyms
- p7514, line 14 : the "here" from the former sentences, forces us to believe that the "assessment" is done in this paragraph, which is not true; therefore maybe you can write : "Moreover to assess the influence of the vertical ..., we adopted different ..."
- p7514, line 15 : I would say "temporal resolution" instead of "temporal distribution"
- p7514, line 18 : replace "included" by "used" or "performed for"
- p7514, line 21 : don't you have a better word for "sequentially"? Sequentially refers too much to time. Maybe "respectively".
- p7514, line 26 : add something between "low" and "therefore" : ";," or "and"
- p7514, line 28 : "subsequently" : I would skip this

PAGE 7515

- p7515, line 5-9 : how can the coarsening be responsible for this? I don't understand how the interpolation process (which is linear) and for both data-sets (GFED monthly and GFED8-daily) should behave differently. "Cumulative sum" is not nice, it is saying twice the same.

C1538

- p7515, line 6 : the word "between" asks for a word like "difference" before ...
- p7515, line 8 : add "grid" or "data" after  $1^{\circ} \times 1^{\circ}$
- p7515, line 10 : I would inverse the order of "in-situ O3 formation" and "long range transport"; the long range transport does not only refer to O3 but also CO I presume
- p7515, line 14-15 : skip "the" before 2-3km and 3-4 km.
- p7515, line 21 : "product" is not a very nice word, I would skip it
- p7515, line 20 : "methodology" : a bit vague (I think you mean by which instrument, how frequent sampling, wavelengths, etc ...)
- p7515, line 24 : by increasing the emission, to first order you don't change the lifetime, you only change the burden. So correct this.
- p7515, line 26-30 : the reason why you do this, is not well explained. I think you use the emissions for the year 2000 from RETRO (which you don't mention, but which I presume) and want to correct them for the assumed increase. The increase rate is not very well known, and you use an increase rate from one city (because nothing better is available). The aim of your paper is studying BB, not the background anthropogenic emissions. I understand that you want the best possible background, but choose than 1 of the 2. This sensitivity study is a bit out of the scope of this paper.
- p7515, line 29 : you are saying a bit twice the same in the sentence "The annual growth rate in anthropogenic emissions is highly uncertain due to the lack of accurate emission data."
- p7515, line 29 : Maybe start new sentence with "therefore"

## 3 THE INFLUENCE OF REGIONAL BIOMASS BURNING ...

PAGE 7516

- p7516, line 6 and line 9 : "2-D" and "2D"

C1539

- p7516, line 9 : "cross section" while in caption of Fig.1 "cross-section"
- p7516, line 12 : rough jump; maybe some introduction saying that you start talking about model results
- p7516, line 14-16 : I would say "or the background, "
- p7516, line 18 : maybe remention which "regions" : SAFR and GUIN
- p7516, line 20-22 : does this analysis allows you to decide whether 6 hourly analysis are sufficient? I suggest that you have to correlate observations with model results to say whether this frequency is enough. Here, one gets the impressions that comparing O3 with tracer distributions undergo the same forcing can explain
- p7516, line 21- 22 : "whether using 6-hourly updates of the meteorological fields is sufficient" : a new topic arises; this should be mentioned in the introduction

PAGE 7517

- p7517, line 1 : I would skip this "respectively"
- p7517, line 8 : I would skip "for this year"
- p7517, line 10 : for analyzing the emissions, in principle one does not need a model simulation. I would skip this "analysis of the emissions budget" : just write "the emission"
- p7517, line 11 : why 34N-34S (due to your analysis method)? why looking at all longitudes? even looking at all the longitudes, it is not a closed system. So therefore I would suggest studying just a part of the Africa continent+part of the Atlantic ocean, or just the "cross section". By looking to all longitudes and expressing the results in percentage, these number don't tell a lot. Another option is to discuss absolute differences.
- p7517, line 15-17 : I don't know why has to be mentioned "where the longer atmo-

C1540

spheric lifetime of CO means there us in effect from proceeding months". Imagine we look only to the impact of NOSAFR, than we see that an emission reduction of 17.5\% in CO leads to a burden change of 7.5\% in CO, and an emission change of 5.8\% in NOx to a 3.2\% burden change in O3; if you look at 3 months period, with a CO lifetime of 30 days, than the impact from the preceeding months cannot explain this more than factor two difference between CO and O<sub>3</sub> effect. I think it is not the impact by the lifetime of the former months which causes this.

- p7517, line 16 : "proceeding" should be "preceding"
- p7517, line 16 : this "means" is not very nice
- p7517, line 17-19 : I don't know in what sense this is clarifying
- p7517, line 18-19 : [NO2], [PAN] : skip the brackets
- p7517, line 20 : "occur" should be "occurs"
- p7517, line 21-24 : if I read this sentence, I interpret it as : From looking at the figure, one should see that the BB extends (1) far inland reach 15°N, and (2) well into the SAHEL (10-20N). Are you not saying twice the same?
- p7517, line 23 : the ozone impact is not really going up to 15N
- p7517, line 29 : why are FULL and FULL\_8day so different? Why giving numbers for 34N-34S and 0-34S, and not 0-34N and 0-34S?
- p7517, line 28-29: shouldn't you expect that the monthly and 8 daily data sets should be coherent? How can one otherwise say that an impact is caused by the time resolution (while it may also be caused by different emission totals)?. Please explain this more.

PAGE 7518

- p7518, line 1-3 : you have to compare impacts

C1541

- p7518, line 3 : change throughout JJA : this is not nicely expressed
- p7518, line 5 : "details"? shouldn't this be "analysis"
- p7518, line 8-9 : "which corresponds ..." : specify whether you mean that at this altitude you have the largest variability, or in this 20N-20S interval
- p7518, line 13-18 : One has the impressions that both reasons (i and ii) are valid for both places, while in fact (i) is the reason for the South and (ii) is the reason for the north. Maybe formulate it clearer.
- p7518, line 19 : "extreme [O3]" maybe explain better what is meant; this "extreme" has not been explained yet; maybe skip the "the" - makes it more natural
- p7518, line 21 : not a nice second part of the sentence
- p7518, line 25 : "(e.g)" should be ", e.g.,"
- p7518, line 26 : I should skip "variability"
- p7518, line 27 : can't you quantify this correlation
- p7518, line 27 : "pulsing effect" is not a nice expression
- p7518, line 27 : why not "SAFR" instead of "S\_Afr" for naming the tracer (then one sees the link with the naming of the domain)
- p7518, line 28 : explain "break" period : in which figure do I have to look (I presume Fig. 3)?

PAGE 7519

- p7519, line 1-2 : "3-8 august" is 6 days long, while "215-222" is 8 days long
- p7519, line 2 : last part of the sentence "as well other periods during July" is not very nicely coupled to the rest of the sentence
- p7519, line 2-4 : is the "NOGUIN AUG" correct : finding such differences for a source

C1542

region where there is normally almost no emission?

- p7519, line 3-4 : it is not clear to which figure you suggest us to look : at Fig3, Fig 4a?
- p7519, line 9-10 : "where higher (lower) concentrations are seen in the FULL run" : (I don't see this)
- p7519, line 8-10 : this conclusion is much too strong
- p7519, line 13-15 : from Figure 3, I cannot see that
- p7519, line 14 : "much larger effect" is exaggerated
- p7519, line 16 : tropical tropospheric budget : up to which altitude? up to which latitude, 34S-34N or 23S-23N?
- p7519, line 16-18 : which are you comparing? Probably HIGH\_IH, but mention this explicitly.
- p7519, line 18 : "non-negligible" : these numbers are hard to appreciate because you average over all longitudes
- p7519, line 20 : "should be considered a maximal effect" is not a nice sentence; maybe you can replace "a maximal effect" by "as an upper limit"
- p7519, line 25 : temporal resolution

PAGE 7520

- p7520, line 6 : which Figure?
- p7520, line 6 : replace "would" by "may" or "can"
- p7520, line 11 : "corresponding decreases"?
- p7520, line 11-12 : why is O3 so much lower in 4-6S around 850 hPa (w.r.t. reference simulation)?

C1543



- p7520, line 13 : "Measurements against model results" : not very nice
- #### 4 MEASUREMENTS AGAINST MODEL RESULTS
- p7520, line 13 : title of this section is not very nice
  - p7520, line 14 : "co-located", "host" is not nice
  - p7520, line 15 : I should skip "representative"
  - p7520, line 15 : is it only the LT? you show profiles up to 300hPa (next page); earlier discussions treated as well MT as LT
  - p7520, line 16-19 : strange sentences
  - p7520, line 19-20 : this is a vague sentence

#### 4.1 REGIONAL COMPARISONS IN SOUTHERN AFRICA

- p7520, line 25 : mention that you are here in the source region of BB emissions

PAGE 7521

- p7521, line 1 : "imposed" is bizarre : "imposed" suggest that your are describing your model choices, while your are just describing how reality is; I would replace "imposed on" by "of"
- p7521, line 2 : "diurnal variations" by "the diurnal variation"
- p7521, line 2-4 : skip comparisons and between
- p7521, line 4 : "relate to"?
- p7521, line 6 : 1-sigma variability "standard deviation" (as used in the figure caption)
- p7521, line 6 : associated with "from"
- p7521, line 8 : "underprediction" instead of "under prediction"

C1544

- p7521, line 10 : I would skip "season"
- p7521, line 10-12 : isn't the BB burning emission going down in SON, and shouldn't therefore be a smaller variability? In your introduction you say JJAS is the main BB period, so I would expect larger variability in JJA than in SON.
- p7521, line 13-16 : this sentence is gramatically not correct as the 3 arguments are not treated in the same way; moreover argument 1 and 2 partially overlap (seasonal w.r.t. temporal). Why can't the chemistry be a source of the problem?
- p7521, line 12-16 : can't you be more specific; there are a lot of possibilities left over ...
- p7521, line 14-15 : "not being optimal" is a bit vague
- p7521, line 16-19 : "we have shown ..." : maybe you should first describe what you see in this figure - this has not been discussed before
- p7521, line 17 : why do you say it improves only in July? (on page 7522, line 1 : it is for all months)
- p7521, line 21 : maybe remind that in the HIGH\_CO experiment, only the emissions south of the equator were increased
- p7521, line 25-27 : it is true, but hard to see because both curves are in different graphs, with only having the green as a reference in both figures (but which is far away)
- p7521, line 25-27 : comparing the FULL\_8day simulation with what? with the FULL?

PAGE 7522

- p7522, line 1-2 : why "different profiles" : to conclude this, don't you just have to look at 2 profiles, i.e., HIGH\_CO and FULL\_8day?
- p7522, line 4 : "ran" should be "run"

C1545

- p7522, line 6 : it is not just the inventory that is coarser, it is also the model; I would say : "higher horizontal and temporal resolution do not play a role"
- p7522, line 9-11 : mention that you talk about the inventory. Do you conclude that only the BB emissions are too low?
- p7522, line 11 : I would replace "from" by "in"
- p7522, line 14 : "under-predicts"
- p7522, line 15 : is lower atmosphere LT + MT?
- p7522, line 15-16 : people want to know how much "a few ppb" is, to be able to compare it with the "5 ppb" mentioned before. One wants to know if the observations are closer to the NOSAFR run or to the FULL run.
- p7522, line 21 : "this year" : maybe say "fro the year 2006"
- p7522, line 21 : replace "with CO" by "for CO"
- p7522, line 24 : "are" should be "is", because number is singular
- p7522, line 26-27 : "which were not operated" : not a nice sentence
- p7522, line 29 : would skip "the" before "continuation"
- p7522, line 29 : all the "(e.g.)" should be ", e.g.,"

#### 4.2 Comparisons in Equatorial Africa

- p7523, line 2 : "dominant" : be more specific
- p7523, line 7 : Say why you choose these stations
- p7523, line 10 : skip "Moreover"
- p7523, line 14 : "over estimating"
- p7523, line 15 : I should put "observed" before "increase"

C1546

- p7523, line 16 : I should skip the "between" or the "~"
- p7523, line 16 : skip "altitude levels"
- p7523, line 16 : "under predictions"
- p7523, line 18 : you can skip the "+/-" before "5-10"
- p7523, line 18 : replace "plus/minus" by "tilde" (to be coherent with rest of the text)
- p7523, line 21 : no [] needed for O3
- p7523, line 21-22 : the first observation by what?
- p7523, line 27 : replace "(i.e.)" by ",i.e "
- p7523, line 19 - p7524, line 5 : what is new in this? your are only mentioning existing literature
- p7523, line 26 : "authours" while "authors" in acknowledgements
- p7523, line 27-28 : "although ..., ... also exhibit ..." : this is not a contradiction, it is even logical (if something is irregular, than one expects to have also on larger time scales significant differences); according to me, there is also an important difference between "sporadic" and "not continuous"
- p7523, line 26 - p7524, line 2 : hard to read sentence, e.g. : I would add "that" after suggesting; the part "... measurements ... have observed increases" : this is not correct

PAGE 7524

- p7524, line 8 : mention the Julian day if you refer to Fig. 3 (if you suggest to look at Fig. 3) : give the Julian day number corresponding with 13-14 August
- p7524, line 11 : skip "there is"
- p7524, line 14-15 : "extreme days" : not very scientific

C1547

- p7524, line 21 : shouldn't resolution be mentioned too?
- p7524, line 22 : Explain why you take Nairobi? Far from the region of interest studied until now (3E-6W, 20S-40N)?
- p7524, line 24-25 : I would not use "in spite". Having less comparisons, just weakens your conclusions.
- p7524, line 25 : what do you mean by "variability in the monthly mean profile" : differences between monthly mean profiles, or standard deviation of the population of 1 month
- p7524, line 25-27 : this is only true for the LT and MT
- p7524, line 26-27 : "magnitude of the 1-sigma variability of the means" : "standard deviation"

PAGE 7525

- p7525, line 4 : "insignificant" (there are however differences between blue and black)?
- p7525, line 5 : the "This" refers to the sentence before or to more ...
- p7525, line 7-13 : and for Nairobi , any suggestions why?
- p7525, line 11 : why is this HIGH\_ANTH not in the Table?
- p7525, line 17 : try to mention that the colour scale indicates the concentrations
- p7525, line 18 : replace "in each respective trace gas" by "for both trace gases"
- p7525, line 20 : mention what you mean with "very high" : the peak of 450 ppb for CO or the 300 ppbv for CO? And also for O3?
- p7525, line 23 : mention eventually Fig 6 upper right panel after "sondes"
- p7525, line 23 : "source" is not the correct word for this; maybe "origin"

C1548

- p7525, line 24-25 : "where the photochemical production has formed over previous days" : bad sentence; therefore replace by "photochemical production of O3 has formed" or "photochemical production has formed O3" or ...
- p7525, line 27 - page 7526, line 2 : any explanation?

PAGE 7526

- p7526, line 1-2: I agree, except for the peaks observed around 7h50 and 10h40
- p7526, line 11-13 : I don't understand this; for me it is just that CO is mainly governed by regional sources, while this is not especially true for O3
- p7526, line 19 : I would add "which is much smaller" after "latitudinal range covered"
- p7526, line 20 : similar to ? (the former day)
- p7526, line 24 : "reproduce much of the large scale variability" : isn't it rather the vertical gradient which it represents (it is not large variability, it is because the aircraft changes altitude). I have the impression that the NOSAFR vertical gradient is closest to the observed vertical gradient (see Cotonou profiles in Fig. 6), although there remains still a very large bias. And the gradient is maybe right, but the bias remains very large.
- p7526, line 26 : I would add "that" after "either"; replace "maybe" by " may be"
- p7526, line 28 : "not optimal" : vague

PAGE 7527

- p7527, line 4 : add blanc between "50" and "ppbv"

## 5. TRAJECTORY CALCULATIONS

- p7527, line 6 : mention the date of these events
- p7527, line 10 : these values of 2-4°N have not appeared earlier in the manuscript, so it is a bit strange that they appear here after a "we have shown"

C1549

- p7527, line 13 : is it independent? it is just a Lagrangian model with no chemistry ... Couldn't you have used these new meteorological analysis in the CTM?
- p7427, line 15 : back trajectories or forward trajectories?
- p7527, line 16 : "as to what" : a bit difficult to read
- p7527, line 18 : replace "and" by "or"
- p7527, line 16-19 : (a) assumes forward trajectories, and (b) and (c) backward trajectories; you should mention this - otherwise too unclear
- p7527, line 22 : does this trajectory model includes vertical diffusion and convection?
- p7527, line 23 : why haven't you shown this BB emission plot earlier?

PAGE 7528

- p7528, line 5 : add "in the august profile of Fig6"
- p7528, line 6 : Fig.4 does not show profiles (even if it shows the evolution at 2 different levels); maybe you just mention that it confirms that there is a considerable contribution around 850 from the SAFR region
- p7528, line 7 : be clearer about this "towards"
- p7528, line 10-11 : why do you conclude this : first, because fig9a keeps it pretty low? and second because fig 9b needs convection?
- p7528, line 13-15: this "elevated" gives the impression that you talk about both days, while next you say that it was high in August the 14th but not on August 3rd
- p7528, line 20-23 : the reasoning is in two steps; In reality air is first transported from the BB emission regions towards the ocean; in a second step from the ocean to the continent. If I understand it well, you believe that your model well describes the second step, but not the first step, and thus causing the bad correspondence with the measurements

C1550

- p7527, line 27 : "large [CO]" is not correct, should be "high CO concentrations"
- p7528, line 25 : remove "the" before 9; replace "9h" by 9a.m. or 9h00; add "(during the peaks)"

PAGE 7529

- p7529, line 5 : I should replace "rising" by "rises"
- p7529, line 13 : "performed the trajectories" is not correct
- p7529, line 14 : "have" should be "has" because "set" is singular
- p7529, line 15 : I would replace the first "on" by "of"
- p7529, line 16-17 : "trajectory results" is not nice
- p7529, line 20 : I should write / "Figure 12 shows the backward trajectories corresponding with those ..."
- p7529, line 22-25 : I would say that Fig.12a is not too different from Fig.10a. Only two trajectories have their origin over the southern Africa continent
- p7529, line 25-27 : even if these trajectories pass a certain moment nearer the regions where the BB plumes are transported inland, if you follow the trajectories longer they come from over the ocean (similar to Fig 10b).
- p7529, line 27-page 7530, line 1 : this is very interesting, why don't you show it

PAGE 7530

- p7530, line 3-4: why this conclusion about the limitation of trajectorie studies?

## 6. CONCLUSIONS

- p7530, line 17 : shouldn't "2009a" be "2010"?
- p7530, line 20 : "temporal resolution" instead of "temporal variability"

C1551

- p7530, line 18-26 : the evidence for this is very poor
- p7530, line 26 : I don't know if you have shown that for modelling well the seasonal composition you need the high temporal resolution of the emissions
- p7530, line 27 : "tropospheric CO comparisons of co-located model output against MOZAIC measurements" : not very nice

PAGE 7531

- p7531, line 4 : "over-estimate"
- p7531, line 10 : temporal resolution instead of distribution
- p7531, line 12 : "under sampling"
- p7531, line 18 : "under-estimation"
- p7531, line 19 : "over estimates"
- p7531, line 25 : "around the region" is too vague

V Detailed comments on the table and figures

Find below comments on the table and the figures.

Table 1 :

- The caption : in the text is mentioned that the table contains information about all experiments (what about HIGH\_ANTH)?
- The caption : it contains general information about the aim of these simulations. That should not be mentioned. Skip "used to examine ... ."

Figure 1 :

- [CO] : the brackets shouldn't be there
- "cross section" is not written as in the main text

C1552

- Why do the differences in CO become important above 100 hPa?
- "calculated as" instead of "calculated for"

Figure 3 :

- these figures are very small
- replace "for [CO] (top) and [O3] (bottom)" by "CO (top) and O3 (bottom) mixing ratio"
- skip the word "season"
- skip the word "vertical"

Figure 4a :

- replace "Daily mean values of [CO] (top), [O3] (middle)" by "Daily mean mixing ratio of CO (top), O3 (middle)"
- The colour which is supposed to be magenta is not magenta
- For the list of colour codings, inverse the order of colour and simulation (to be coherent with Figs. 5, 6, 7 ...), i.e. : "FULL (green), NOGUIN (blue), ..."
- Can't you make some colour legend in the figure. This limits that someones eyes have to move from the caption to the figure and back.
- replace ";" by ":"

- Lower right panel : if this plot represents values over the 6-8N region, averaged 3W-6E, the mixing ration for the Guinea tracer should be maybe closer to 100 ppt.

Figure 5 :

- skip "season" and "during"
- replace "The bottom row shows: simulations using emissions with 8-daily variability. FULL\_8day .." by "The bottom row shows simulations using emissions with 8-daily

C1553

variability: FULL\_8day .."

- replace "The error bars represent 1-sigma deviation from the mean values" by "The horizontal bars represent the standard deviation."
- can't you add the color coding in the Figure, to increase the readability?

Figure 6 :

- skip "month"
- replace "are" by "is" because number is singular
- replace "The error bars represent 1-sigma deviation from the mean values" by "The horizontal bars represent the standard deviation."

Figure 7 :

- These figures are very small.
- The sensitivity plots are hard to distinguish
- Information about the lower panels is given during the information of the top panel (about the starting point), this shouldn't be the case. Mention this when you describe the bottom panels.
- Mention also in which sense the aircraft flies : clockwise or counterclockwise
- here you write "for the 13 ... " while in Fig. 8 you write "on the 14 ..."

Figure 8 :

- add left and right (as in Fig. 7)

Figure 9 :

- in the text is mentioned "a,b,c", so in the Figure a,b and c should also be indicated (not only in the caption).

C1554

Figure 10 :

- add a) and b) in the plots

Figure 11 :

- add a) and b) in the plots
- I don't see "The numbers indicate the pressures at which the air starts and ends (in parenthesis)."
- you need an extra blanc between "." and "The pressure"
- 10am should be "10 a.m."

Figure 12 :

- add a) and b) in the plots
- you need an extra blanc between "." and "The pressure"

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 7507, 2010.

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