

Interactive comment on “Cross-hemispheric transport of central African biomass burning pollutants: implications for downwind ozone production” by E. Real et al.

Anonymous Referee #2

Received and published: 4 October 2009

This paper interprets observations of biomass burning plumes made during the AMMA campaign in 2006. The authors use both meso-scale tracer simulations and a trajectory chemistry model to interpret the observations.

Although there appears to have been plenty of effort undertaken here there are few conclusions of note and nothing which really aids us in our understanding the composition of the region. There is much comparison with the available previous work but I have problems working out what new has been found from these studies.

I would suggest that the authors attempt to synthesis their results into a more coherent document especially with emphasis on how these results address the Atlantic ozone

C5578

anomaly. Often information is provided with no sense of whether this result is novel or confirms our understanding of the atmospheric system. It is hard to sense whether any of these results matter.

There is a significant amount of citation of papers which are not yet in press or submitted. Whilst I acknowledge that there is some need for this in the cases of large campaign such as this, it should be kept to a minimum. There are reference made to unpublished papers which are not essential to the scientific case being made and these should be removed.

The document contains many typographic issues: Brackets around references are often inappropriately placed. Subscripts on chemicals are often missing., colons in appropriately used. There should be a choice between using Fig. or Figure but not change half way through a sentence etc

The document is also littered with acronyms. These are to be avoided where possible, especially when they are not are infrequently used again in the document.

Often the data analysis is simplistic. Values are quoted without mention of whether they represent means or medians, and are not quoted with indications of variability (standard deviations or standard errors).

This will require a significant re-writing of the document and the editors should bare this in mind when making their decision. I have considered rejecting the document, but believe that given sufficient work it can be of publishable quality.

Specific comments:

P1 L1 Levels is ambiguous. Concentrations is more specific as to what is meant here

L10 ‘due to the fact that transport occurred from a region nearer or even over the fire region’ I don’t understand what is mean by this. For the tracer to be emitted into an air mass the air mass needs to have been at the surface. Advection, convection and diffusion can then mix the air mass but the air mass needs to see the surface to have

C5579

emissions put into it. Otherwise the concept of airmass doesn't work.

L19 What is an 'O3 production potential'? This is a term used often in the document but it is not explained.

Introduction L1 Amounts is not a good word. Mass would be more quantitative

L7 'Largest' compared to what? Is this on a per continent basis?

L15 The authors should check their capitalization. Capitals should be useful for proper nouns not locations. Central African Republic but central Africa.

L22 'shows higher concentrations.' Higher compared to what?

L24 'These air masses' Which airmasses are we referring to here.

Page 17389 L5 'The relative importance of mid-level versus upper level transport of BB emissions from Central Africa requires further quantification together with the O3 production potential of these air masses over West Africa and downwind over the southern Atlantic Ocean and their contribution to observed O3 maxima.' This sentence is confusing.

Page 17390 L12 You can't reference figures in papers that don't exist. You could draw out a similar figure to this yourself or not mention the figure.

Page 17391 Line 17 Figure doesn't appear to show any aerosol. Why is the vertical axis figure 3a and 3b different. It makes it impossible to compare them. What is in the advantage of not showing them all on the same primary coordinate time?

P 17392 L4 I don't understand the units used here. Is this the particle number density? Is this at STP? I've never seen this unit used before to describe an aerosol concentration. $1e4$ is not conventional notation to represent number scientifically and is different to the rest of the text.

L6 What does the $n=$ mean? Is this the diameter or radius of the particle?

C5580

P 17395 :L28 Is there a substantive difference in the plot if a longer period (30 days) or a shorter (10 days) is chosen?

17396 L 6 I don't see any 'significant' periodicity in the plot, Can the authors be more explicit in where they see this.

L10 'The one between 3–11 August 2006 corresponds reasonably well with the break phase of the AEJ-S described by Mari et al. (2008) when pollutants build up over the continent even if the model has higher concentrations for longer over this region.' I don't understand what this sentence is trying to say. Higher than what? For longer than what?

P 17397 L 10. The average time since emission have been calculated. Could a value for the variability of this also be calculated? Is what is seen the emission from one day or is it a mixture of many days?

L 14 How have the mean wind speeds been used to calculate the transit time? Is it the same method as Sauvage? Would be expect the numbers to be the same?

P 17397 L 23 It is not obvious to all of us where the Central African Republic is? Could instead the lat / lon be given.

L 28 'The MT tracer is also much closer to the BB emission region or even coincident with it (see Fig. 8, upper left panel) compared to the UT tracer which has to be transported to the north-east before being uplifted by deep convection.' I'm not sure what is being implied here. The MT BB tracer has to at some point be in the boundary layer over the bb region otherwise it would never get into the air. What are the authors trying to infer here about their dataset?

P 17400 L 26 Why is there the change from O3 production to O3 destruction?

P 17401 L 1 The authors make an important point here. Despite the impact of the aerosol on the photolysis and chemistry over all it makes little difference to the O3 production. Why is this? They slow down the production but the total production is the

C5581

same? This has significant impact of the OPE of NO_x emitted by BB.

L12 Some of these sentences are very unclear. It is difficult to reconcile O₃ production, destruction and net tendency but the authors should attempt to write in a clearer manner.

P 17401 L18 The authors claim that PAN and HNO₃ are both responsible for 80% of the NPO₃. On some level this doesn't make sense as the numbers add up to 160%. Can the authors explain what is going on?

L15 The authors appear to have two different mechanisms occurring here. The first is the release of NO₂ from PAN decomposition and HNO₃ photolysis which then photolysis and releases O which makes O₃, the second is the release of NO_x from PAN decomposition and HNO₃ photolysis which goes on to photochemically produce O₃ through the NO + HO₂ / RO₂ reaction. It is not clear which they are referring to.

L30 Over what time period is the mean [OH] calculated

P17401 L1 Why do you need a background concentration to make this calculation? Does it make a difference that you have calculated this in a plume rather than in the background atmosphere.

L6 You have gone to a lot of effort to find VOC concentrations for your plumes yet there is no discussion of the impact of them on photochemistry of the plume. Do they matter?

P17403 L20 I'm confused as to how the VOC concentration in the UT have been arrived at. This should be explained with more clarity. There is a lot of uncertainty in the initial concentrations used in these UT studies. There should be some sense of the impact of these uncertainties on the simulations and thus on the conclusions.

Conclusions The conclusions are weak and reiterate the basic evaluation of the model simulations and don't provide any real insight into the Atlantic Ozone Anomaly other than a vague support of it being driven by biomass burning.

C5582

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 17385, 2009.

C5583