

Interactive comment on “Impact of biomass burning on pollutants surface concentrations in megacities of the Gulf of Guinea” by Laurent Menut et al.

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Menut et al. present a comprehensive evaluation of the influence of biomass burning emissions in central Africa on atmospheric composition and air quality in cities around the Gulf of Guinea. They clearly show that their model represents the atmospheric state in good agreement with different observational datasets. Their evaluation of the model sensitivity to parameters related to the injection height of biomass burning emissions is very welcome and clearly explained. I recommend publication of this work in Atmospheric Chemistry and Physics subject to addressing the following comments.

General comments

C1

I recommend that the authors check through the manuscript for the consistent use of some expressions. In particular they exchange “Gulf of Guinea” with “Guinean Gulf” quite regularly and it would read more clearly if they chose one and use that. Also the terminology of the different experiments (e.g., NoFIRE and FIRES) is a bit mixed up through the manuscript after it has already been defined – they can use the experiment names without having to describe them again.

The manuscript touches on a couple of key issues in biomass burning and atmospheric composition on which some further comments or recommendations would be useful. Firstly, some concluding comment on injection heights for biomass burning emissions would be of interest, particularly on whether it improves the estimation or not. Secondly, the CHIMERE model underestimates column CO compared with observations which is commonly seen across different models – can the authors make some comment on why this is the case with CHIMERE? In particular the injection height of the fire emissions doesn't seem to make up the difference, could the OH field in the model be playing a role? I don't expect them to answer these questions fully but some comments in the context of the presented work would be a welcome addition.

Specific comments

Page 1, line 7-8: replace “to be” with “being”.

Page 2, line 2: replace “have evidenced” with “show”.

Page 2, line 27: “groud” should be “ground”.

Page 2, line 28: replace “Satellites data provide” with “Satellite data provides”.

Page 2, line 32: define the AERONET acronym – it is given in the caption for Table 1 but should be included in the text and removed from the Table caption.

Page 4, line 1: the authors mix up use of “modelled” and “modeled” – please check consistency throughout the manuscript (ideally using “modelled”).

C2

Page 5, line 19: “consist in” should be “consist of”. Also check rest of manuscript.

Page 5, line 27: it isn't clear what is meant by “monthly databases”.

Page 5, line 32: the last sentence isn't very clear – are Abidjan and Lagos the only megacities? Or are there more?

Page 6, Figure 2 caption: check the units are consistent with those given in the main text.

Page 6, line 15: replace “were done” with “have been made”.

Page 6, line 29: replaces “source” with “sources”.

Page 7, line 10: “area burned” should be “burned area”, “daily estimated” should be “estimated daily”.

Page 7, line 11: clarify that daily refers to the daily emission.

Page 7, line 12: “CO for the month”.

Page 7, line 14: clarify if “South-Africa” refers to SWA.

Page 8, line 16: “numerically cost consuming”.

Page 9, line 11: “fires” should be “fire”.

Page 9, line 32: clarify if “vegetation emissions fluxes” refers to biogenic emissions or fire emissions.

Page 9, line 34: use “concentrations” rather than “content”.

Page 10, first paragraph: the explanation of the different experiments has already been given in the previous pages – I found the explanation clearer on this page and it would benefit the reader to use just this one, linking to the TRC and FIRES experiments as already described.

Page 10, line 11: “information is”. The details of the plots in Figure 1 are not necessary

C3

in the text and should be removed.

Page 10, lines 15 and 17: use “south” rather than “bottom”?

Page 11, Figure 5 caption: not necessary to specify BADC as the source of observations – this is clear in the text.

Page 11, line 10: “fire emissions”?

Page 12, line 1: “dry convection in the lower troposphere”.

Page 15, line 1: replace “concentrations” with smoke or pollution?

Page 15, line 2: replace “caught” with “caught”.

Page 15, line 11: “continental Central Africa”.

Page 15, Section 5.3: it isn't clear that this section is all that necessary as much of the summary of results has already been made in the preceding points.

Page 16, line 1: “MODIS AOD product at wavelength of 500nm” – use of the symbol λ is unnecessary, also using ϕ for latitude later in the manuscript.

Page 16, Figure 9 caption: should “CHIMERE without fires” be NoFIRE and “CHIMERE with vegetation fire emissions” be FIRES? Also it would be of great benefit to have each plot of the figure labelled so that a clearer explanation can be given in the caption – this also applies to the other figures.

Page 16, line 11: “fires emissions” should be “fire emissions” – please also change this throughout the manuscript.

Page 16, line 13: “shows that the model”.

Page 16, lines 13 and 14: please quantify the terms “underestimated” and “overestimated” – it isn't easy to tell from the Figure, and the addition of difference plots would be useful.

C4

Page 17, line 8: “BADC stations” – please clarify the source of the measurements (Met Office MIDAS land surface stations?) and not the data centre where they were obtained from.

Page 17, line 10: change “this” to “it”, and “not modelled enough correctly” to “not modelled correctly”.

Page 17, line 14: “biomass burning” (use either fire or biomass burning consistently).

Page 17, line 20: what is meant by “not well retrieved”? does this refer to the satellite observations? Or how the model represents the atmospheric concentrations? “the Central Africa” should be “Central Africa”, and “AODs” should be “AOD” (please change this throughout the manuscripts as well).

Page 17, lines 35 and 38: “FIRES” should be “FIRES” or “FIRE” – also throughout the rest of the manuscript.

Page 17, line 37: a comment on how difficult it is to reproduce the long-range transport over the ocean due to errors in the model transport would be useful.

Page 18, line 8: replace “retrieved” with “represented”?

Page 18, line 14-15: suggest changing to “the hypothesis that the optical properties of the modelled aerosols, and the estimation of the extinction”.

Page 19, Figure 10 caption: clarify which column is which – in the text it is described but should also be here in the caption. Labelling the plots will be helpful.

Page 19, line 6: “expressed” should be “expresses”.

Page 19, line 8: “while high values”.

Page 19, line 11: change “finest particules” to “finer particles”.

Page 20, Figure 11 caption: “carbon monoxide”, no need to redefine the different experiments (i.e., remove “without” and “and with biomass burning”).

C5

Page 20, line 6: “consists of three-day averaged”.

Page 21, line 4-5: the description of the three model simulation types is not necessary.

Page 21, line 8: clarify that these are CO columns rather than concentrations.

Page 20, line 13: change “where are located the studied cities” to “where the studied cities are located”.

Page 20, line 14: “has” should be “have”.

Page 20, section 6.4, line 6: “colocated” should be “collocated”.

Page 20, section 6.4, line 16: remove “correctly” – as described in the manuscript, the model does not 100% correspond to the observations.

Page 21, line 1: the first sentence isn’t very clear – is the author referring to modelling the vertical aerosol profile for comparison against CALIOP? If this is the case it can be stated more simply.

Page 23, line 1: “thresholds of optical characteristics”?

Page 23, line 4: “not being modelled”.

Page 24, line 24: change “retrieved” to “reproduced”.

Page 24, line 27: “bit” should be “but”.

Page 25, line 11: “enables us to have”.

Page 25, line 15: “For the fire emissions”.

Page 25, line 25: “tree” should be “three”; change “both produced by” to “produced by both”.

Page 25, section 7.1, line 6: “no pollution peaks”.

Page 26, line 1: “a pollution alert”?

C6

Page 26, Figure 14: it would be useful, in the context of pollution alerts to relate the reported CO, O₃ and PM₁₀ results to the WHO and/or EU recommended exposure thresholds. Add plot labels.

Section 7.2: This section would be of great interest if there were any corroborating observations, which does not seem to have been the case here, or if the authors could provide references to where aerosol composition from the model has been compared against observations. In its current form this section seems to be a bit of an unnecessary addition and distracts from the main message of the rest of the manuscript and could be removed.

Page 28, line 12: change “pollutants surface concentrations” to “surface concentrations of pollutants”.

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