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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Probing into the aging dynamics of biomass burning aerosol by using satellite measurements of aerosol optical depth and carbon monoxide" *by* Igor B. Konovalov et al.

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We are very grateful to the Referee for the positive evaluation of our manuscript and for the useful comments which are carefully addressed in the revised manuscript. Below we describe our point-to-point responses to the referee's comments.

Referee's comment: *P4 lines 11-14: The sentence starting with "Konovalov et al. (2014) optimized BB emissions..." and till the end of the paragraph is very difficult to read. I had trouble understanding if the values of the factors 2.2 and 2.9 refer to emissions or to ratios of optimal BB emissions. Please rephrase.*

The values of the factors 2.2 and 2.9 refer to ratios of the optimal BB emissions. We

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Discussion paper

understand that the sentence indicated by the referee was difficult to read. It has been rephrased in the revised manuscript.

Referee's comment: P9 lines 10-24: I understood from this section (specifically P9 lines16-17: "... we zeroed emissions of other types of aerosol and disabled secondary aerosol formation from anthropogenic and biogenic precursors.") that model runs including BB emissions (VBS and STN) only include BB aerosols without the other background aerosol. Does this mean that to obtain total AOD for, say, VBS run you add VBS_AOD and BGR_AOD? If so, then I can't see where this is stated explicitly (or this is what P10 lines 30-34 mean?). Please clarify.

Indeed, to obtain total AOD, we added AOD from the BGR run and AOD from the STN (or VBS) run. It was not explained explicitly, and we are sorry for this omission. The corresponding explanation is introduced at the end of the first paragraph in Sect. 2.2.2.

Referee's comment: P11 lines 14-15: Should T_1 read T_0? From the definition of trace species on P8 line 20, it looks like T_0 is the only chemically passive species, the concentration of which will stay constant over time in the presence of OH. If I am mistaken and you insist that there should be T_1 please elaborate (on P11 line 14, after the words "would be constant") on why this is so.

Yes, T_1 should read T_0, while T_2 should read T_i. We are sorry for the confusion. The corresponding typos are corrected in the revised manuscript.

Referee's comment: P12 line 23: what is BB part of the observed AOD? Is this total MODIS AOD less the background AOD? In which case, is this observed background AOD value obtained by averaging the most background-like values as described in P10 line 27 - P11 line 2?

Indeed, the BB part of the observed AOD is, by definition, the total MODIS AOD less the background AOD. And yes, the background AOD value can be estimated by averaging the most background-like values selected in the same way as described in P10 line

27 - P 11 line 2 in the reviewed manuscript. To avoid possible misunderstanding, we have slightly modified the corresponding text. Specifically, we removed the words " the BB part" and indicated that the background part of AOD was evaluated by using both the measurement and simulation AOD data as explained in the same section below (specifically, the corresponding explanation is provided in the second paragraph after Eq. 9).

Referee's comment: Also, from here on in the text, only one kind of background values are referenced. These are all the variables with subscript b. It is not very clear to me if these background values are all from the model, or there are separate backgrounds for model and observations (e.g. in Eq. 9 are the same values subtracted from the first (obs) and the second (model) parts of the terms in the parentheses?), or it is some combined value applicable to both model and observation? I see that this is explained somewhat afterwards (P13 line 25 till the end of the section), but this still does not answer the question of using the same or different backgrounds for model and observation in the same equation.

In our analysis, the background values are not available directly from observations but can be evaluated only by using a model for selection of the grid cells and days corresponding to the background-like conditions. On the other hand, the modeled background values can be affected by biases that are corrected by using the observational data as explained in Sect. 2.2.2. Thus, it was not feasible to evaluate the background values for the modeled and observed AOD separately. Rather, we used the combined values (obtained in the two different ways as explained in the second paragraph after Eq. 9) applicable to both measurements and observations. In the revised manuscript, we clarify (by means of a statement following after Eq. 9) that the background values, ν_b and τ_b, of the CO columns and AOD are the same for the corresponding observations and simulations Eq. (9).

Referee's comments: Suggested technical changes:

P5 line 9: "ageing" should be "aging". I noticed this instance, but please check the rest of the manuscript for consistency.

P5 line 21: remove "and" between "algorithm" and "is".

P8 line 23: remove either 'is' or 'it is' between the words 'as' and 'follows'.

P16 line 9: remove "and" between "comparison" and "of the measurement".

Fig. 2b: Y-axis label contains subscript bm, which is not used anywhere else in the paper. Please make consistent or explain.

Fig.5 in the headers of the figures: dt is nowhere defined. From the text in section 3.2, I deducted that this is probably the bin width, but could be helpful of the notation was also mentioned.

We thank the referee for the suggested technical changes, all of which are introduced in the revised manuscript. Note that owing to the referee's comment, we noticed some inconsistency in the notations. Specifically, while the width of the photochemical age bin was originally denoted as d_a, in some instances (including the headers of several figures), the same value was mistakenly referred to as d_t. Both the text and figures are corrected accordingly in the revised manuscript.

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