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 thank the Referee for the positive evaluation of our manuscript and for the helpful suggestions. All of them are carefully addressed in the revised manuscript. Below we describe our point-to-point responses to the referee's comments.

Referee's comment: ... I have highlighted a few specific issues that need to be addressed, but certainly not all of them. I suggest that the authors use the identified issues (including typos and grammatical errors) as only examples of things to look out for, as they very carefully read the manuscript to find and correct similar occurrences of such issues or others wherever they exist in the manuscript.

We are sorry for any grammatical errors and typos that we did not notice before submission of the reviewed manuscript. We have followed the referee's suggestion and carefully re-read the manuscript. Corresponding corrections are made in the revised manuscript.

Referee's comment: The authors state (Page 19, Lines 1-3) that: "the analysis presented in Fig. 5 clearly indicates that the VBS scheme enables more adequate representation of BB aerosol dynamics than the standard scheme at the first (growing) stage of BB aerosol aging." However, only STN simulations are shown in Figure 4. It would be good to include (later in the manuscript) a figure showing the spatial visualization (similar to Figure 4) of simulations comparing the results of incorporating the aging process in the model against those that do not consider aging. Such visuals would more readily demonstrate the benefit of this work.

Our decision not to include a figure showing the AOD spatial distribution according to the VBS simulation in the reviewed manuscript was made by taking into account that it was similar to that depicted in Sect. 4d (as noted in Sect. 3.1). However, the referee's comment indicates that the omission of this figure was not sufficiently justifiable. Accordingly, the missing distribution has been included in the revised manuscript. To do it in the optimal way, we have split the original Fig. 4 into two figures, one of which (Fig. 4) shows only CO columns, while another demonstrates AOD distributions. Furthermore, we have provided additional plots showing the results of the VBS simulation for the two selected days (21 and 22 July, 2012) in the Supplementary material (see Fig. S3). The extension of Fig. S3 allowed us to visualize some improvement in the agreement between the spatial distributions of the measured and simulated AOD values due to the use of the VBS scheme instead of the standard one.

The fact that a direct comparison of the AOD simulations and observations (when they are averaged temporally or spatially) did not allow us to tell which of the model configurations is more adequate (as it is explained in Sect. 3.1) emphasizes the benefits of the method introduced in our paper. Indeed, in contrast to a conventional comparative anal-

ysis, our statistical consideration of the AOD enhancement ratio as a function of the BB aerosol photochemical age demonstrated quite clearly that the VBS scheme enables more adequate representation of BB aerosol dynamics than the standard scheme at the first (growing) stage of BB aerosol aging. This result allows us to believe that our method provides a convenient tool to visualize the effects of BB aerosol aging in the simulated data (as noted at the end of Sect. 4).

Referee's comment: At various points in the article, the authors raise an important issue that needs to be investigated, but immediately state that it is "beyond the scope of this study" (e.g. Page 8 - Line 6, Page 15 - Line 13, Page 18 - Line 5, Page 18 - Line 29). Given that the scope of a study is not set in stone anywhere, but typically determined by the authors themselves, it is unnecessary to identify an essential aspect of an investigation and turn around to say that it is beyond the scope of your study. There is no rule preventing the authors from conducting such analyses in this study. Therefore, I suggest that the authors find a better way to express why they cannot conduct such relevant analyses, make a suggestion on how to effectively approach each of such issues, or avoid raising them in the first place.

Indeed, we mentioned several points which, in our opinion, deserve careful consideration in the framework of dedicated studies, and we agree that it was unnecessary. Accordingly, following the reviewer's suggestion, we have tried to avoid raising such points. We believe that the corresponding stylistic changes did not affect the overall quality of the scientific discussion.

Referee's comment: Page 4, Line 6: change "doubled" to "increased". You have "by a factor of 2" later in the sentence, which makes the use of "doubled" repetitive.

The sentence is corrected in the revised manuscript as suggested by the referee.

Referee's comment: Page 5, Line 21: delete "and" from "algorithm and is".

The misprint is corrected in the revised manuscript.

Referee's comments: Page 6, Line 21-22: delete one "type" from "a given type of land cover type".

The corresponding sentence is re-phrased to avoid the repetitive use of the words "land cover types".

Referee's comments: Page 8, Line 22: It is not clear what is meant by: "as it is follows from ours simulations".

We meant that the indicated mean value of the OH concentration in BB plumes was obtained from our model results. In the revised manuscript, instead of referring to our simulations (which are described only after the sentence in question), we provided a reference to relevant experimental results.

Referee's comments: Page 11, Lines 1-2: Unconventional sentence construct: "Only those grid cells and days were considered to be representative of background conditions, where the contribution of the fires to the simulated values of both CO columns and AOD did not exceed 10 percent.

The sentence criticized by the referee has been rephrased as follows: "A given grid cell and day was assumed to be representative of background conditions only if the BB fractions in the simulated values (based on the STN and BGR model runs) of both CO columns and AOD did not exceed 10 percent."

Referee's comments: Page 12, Line 9: insert "to" after "corresponding". Page 15, Line 5: delete "of" before "parameters".

The suggested correction is inserted in the revised manuscript.

Referee's comments: Page 17, Line 17: replace "adequate" with "reasonable". Since the differences between measured and modeled values are still apparently significant, these results should not be described by the term "adequate".

The suggested change is made in the revised manuscript.

Referee's comments: Page 21, Line 31: There are no "green crosses" in Figure 7b. The crosses are black.

The mistake is corrected in the revised manuscript: the word "green" is replaced with the word "black".

Referee's comments: Page 24, Line 2: It is not clear how "absorption" can increase the surface area of aerosol particles. Please explain the physical mechanism implied here. I think you probably mean "hygroscopicity" (which involves the absorption of moisture that may cause aerosol particle to swell). However, "absorption" is not the technical term used to describe that process. "Absorption" is mostly used to refer to light absorption (as opposed to "scattering").

We meant that liquid or amorphous aerosol particles can grow as a result of absorption (uptake) of both organic and inorganic compounds from the gas phase (according to the partitioning equilibrium theory). However, we agree that the term "absorption" is mostly used to refer to optical properties of aerosol. Accordingly, in the revised manuscript, we replaced it with a more general (and more conventional) term "condensation".

Referee's comments: Page 26, Line 23: change "then unity" to "than unity".

The suggested correction is made in the revised manuscript.