

"How the extreme 2019–2020 Australian wildfires affected global circulation and adjustments"

by Senf, F. et al.

Author's Response to the Editor and Reviewers of the manuscript

Dear Editor and Reviewers,

we thank the Editor and the Reviewers for their comments on our manuscript. Based on your very valuable comments, we implemented changes for the 2nd and hopefully final revision.

In order to separate the reviewer's comments and the author's response we have used the following color coding and formatting. The reviewer's comments are printed in black, the authors responses are printed in blue and text parts taken from the updated manuscript are printed in green.

For the reviewer's convenience, we provide two tracked-changes versions of our manuscript: First, the 1st part of *diff-combined.pdf* file contains the added and removed parts. The second part of this PDF file only contains the added content. The PDF file is compiled with degraded figure quality with *latexdiff* (unfortunately some artifacts remain) for fast difference checking.

Sincerely, on behalf of the authors,

Fabian Senf

senf@tropos.de

Response to Editor:

from the letter:

There are some small issues left that should be taken care of before publication. Additionally, I would like to ask you to consider the corrections given in the attached pdf file. In general, I think you should carefully check your manuscript for the language. It is in many occasions not clearly written (feels always like something small but important is missing in the sentence) and the language itself is a bit too much slang (like discussing with your colleagues during coffee break or in a meeting, but not as it is supposed to be in a written document).

We would like to emphasize that we are concerned that our scientific presentation is taken as casual language. We have therefore thoroughly read and reviewed the manuscript.

However, it is also important to us that complex problems are presented as simple as possible. Figurative language can be helpful and ensure a better understanding of the context, especially for people who are not familiar with the subject or for non-native speakers. For us, simplicity is the highest premise and we are guided by the Einstein quote: *"Everything must be made as simple as possible. But not simpler."*

from the public justification document - Editor comments ACP-2023-113:

Title: What do you mean with adjustments? I would suggest to rephrase the title.

With regard to the term "adjustments":

Since AR5, the effects resulting from the aerosol-radiation interactions and the aerosol-cloud interactions are no longer divided into direct, semi-direct, and indirect effects. A change in nomenclature lead to the newly introduced re-partition into instantaneous effects and adjustments (see AR5, Fig. 7.3). This change in basic nomenclature in AR5/6 is certainly a call for the scientific community to adopt these terminologies accurately. A good introduction to the term "adjustments" is also provided in the paper by Sherwood et al, (2015, <https://doi.org/10.1175/BAMS-D-13-00167.1>).

Honestly, therefore, we cannot see why the term "adjustment" should be ambiguous and do not want to choose a different designation in either the title or the text body.

We added the following link at the end of our 1st introduction paragraph:

In general, the atmospheric adjustment concept considers a combination of all atmospheric responses to forcings that are not mediated by the global-mean temperature (Sherwood et al., 2015)

P1, L18: ".....downward coupling mechanism in the model". Please rephrase. This sentence is misleading and sounds like that the model is affecting the atmosphere.

Thank you for the hint! The misleading part was removed and the sentences was

shortened.

P1, L22: I am not sure if cycling is here the correct wording. Do you mean "exchange"?

We changed the word to "budgets".

P3, L61: To just write "adjustment" is not enough. You should write "according" adjustment and in general make clear that you mean with adjustment the adaption of the atmosphere to the new conditions.

We modified the part as follows:

... resulting tropospheric and stratospheric adjustments ...

P3, L87: Same here. Do you mean adjustments to the mode? Adjustments to the atmosphere?

The term "adjustments" is interpreted by us following Sherwood et al., (2015). We don't think this designation is unclear here.

P4, L94: add "as" -> as already detailed

done!

P4, L09: input -> taken

We use "input" as verb here. We don't think that our version is wrong.

P4, L114: What do you exactly mean with "optics" ? Optical properties? Please rephrase.

done!

P5, L133: replace comma by semicolon? Better to rewrite the sentence so that it is better readable.

We rephrased the sentence.

P5, L148: add "the" -> the so-called

done!

P5, L149: "were input as external data" -> please rephrase. Better to just write "were used"?

The verb "input" says exactly what we mean here, i.e. that we input the data as external data. We propose to keep it as is.

P7, L189: as reviewed by -> better to write "as found" or "as discussed in the review by ..."

done!

P8, L224: computed -> simulated

done!

P8, L225: I would suggest to be more clear and to write instead of "during the 3 months"

“during the 3 month period considered”.

done!

P9, L251: nudged -> nudged model+

done!

P9, L282: I would suggest to write “In total”. I think “In the net” is not correct English. It would be rather “In net”.

We choose "in total" here and also at a later occurrence.

P10, L269: singular or plural? Thus, either has “a” maximum amplitude or has maximum amplitudes.

done!

P11, Figure 3 caption: add “forcing”

We rather added "contributions" here.

P12, L294: It is still not clear what is meant with “adjustment”. Further, I would suggest to rephrase the sentence or move “there” behind “show”.

Please find our statement above for clarification of the term "adjustments".

We also suggest to leave the statement on longwave adjustments as is because it reflects our intended message.

P12, L295: At first glance -> At “a” first glance

done!

P15, Figure 6 caption: Move “starts at 300 hPa” at the end of the sentence or write “ pressure range between 300 and 10 hPa”.

done!

P18, L380: “Adjustment” to what?

Again, it is hard for us to see what is unclear. We propose to rephrase the sentence as follows:

... tropospheric adjustments due to the Australian wildfire smoke are considered.

P19, Figure 10 caption: plotted -> shown

done!

P20,L412: low -> lower

done!

P20, L412: make a listing instead of writing and twice? Thus, add comma after temperature and delete "and".

done!

P20, L414: Downward impact of what? Do you mean with downward the circulation?

We rephrased it as follows:

... downward influence on the troposphere ...

P20-21, L420-421: "downwelling of longwave radiation" sounds wrong.

This is a standard term in the radiative transfer community.

P21, L427: Once again it is not clear what you mean with adjustments.

Please find our statement above for clarification of the term "adjustments".

P22, L442: Impacts on what. Please clarify and rephrase sentence.

done!

P24, L519: add "clouds" -> cirrus clouds

done!

P24, L524: add "the" -> at the top

done!

P24, L525: reported clear sky values -> where these negative? Please write clearly if negative or positive.

We added "negative" here.

References: No consistent style used. Check ACP style and correct reference list accordingly.

We are using the official ACP template `copernicus.bst', version 1.4 (March 2022) for rendering our bibtex entries.

We carefully updated the journal names which had some inconsistencies.

Response to Reviewer #2:

The authors have taken my comments into account, and I am generally satisfied with the adjustments made to the paper. However, I do have a few additional minor suggestions:

Lines 123-125 (version with tracked changes): It should be explicitly mentioned that the perturbations in other gaseous compounds, such as ozone, carbon monoxide, etc., are not included, in addition to water vapor. Please note that the water vapor injection was detected by several spaceborne instruments.

We updated the sentence according to your suggestion.

Line 170: You might consider adding a few references regarding the spurious impact that nudging may have on the representation of the large-scale atmospheric circulation (e.g., Davis et al., 2021 and references therein).

Great reference! We added the following:

For example, in Davis et al. (2022), nudging was shown to introduce biases into the representation of residual circulation and, consequently, tracer transport.

Figure 8: I would recommend replacing the term 'adiabatic heating' with 'advective potential temperature tendency' for clarity.

We changed the caption of Fig. 8 as follows:

Similar to Fig. 7, but for the average perturbations in the tendencies of potential temperature due vertical advection which we interpret as adiabatic heating due to circulation changes.

However, we like to keep the term "adiabatic heating" in the figure title because it is much clearer linked to the interpretation of the underlying mathematical term and it is also much shorter than "negative tendency of potential temperature due vertical advection".

References

Davis, N. A., Callaghan, P., Simpson, I. R., and Tilmes, S.: Specified dynamics scheme impacts on wave-mean flow dynamics, convection, and tracer transport in CESM2 (WACCM6), Atmos. Chem. Phys., 22, 197–214, <https://doi.org/10.5194/acp-22-197-2022>, 2022