

## Response to Reviewer #2

*We would like to thank the reviewer for reading and commenting on our revised manuscript. We regarded all comments and incorporated them into our manuscript. Our reply is given below in italic.*

### **Comment on Revised manuscript “TransClim (v1.0): A chemistry-climate response model for assessing the effect of mitigation strategies for road traffic on ozone”**

The authors have made substantial efforts to thoroughly revise the manuscript taking into account the comments from both the reviewers. In particular, substantial effort has been made to amend the content and structure of the methods section, which improves the manuscript’s readability. Furthermore additional evaluation of TransClim has been conducted on different source regions and for different emission scalings, which help document the performance of the model. I have made a few additional minor comments below for consideration by the authors (with line numbers relating to those in the revised non-track changed manuscript). Once these have been considered I am happy for the revised manuscript to be accepted for publication.

Throughout the revised manuscript I did a few sentences referring to TransClim assessing the climate effect of changes in road traffic emissions (section 2.1) and in other parts (e.g. section 2.3) specifically mentioning that TransClim assesses the impact on tropospheric O<sub>3</sub> and on climate via radiative forcing. For clarity it would be good to check throughout the manuscript and make consistent reference as to how TransClim assesses the impact on climate (i.e. via changes in tropospheric O<sub>3</sub> and stratosphere-adjusted radiative flux change at top of the atmosphere). For example can the link be made on Lines 98-100.

*Thank you very much for this comment. We checked the manuscript and specified the wording in the sections 2.1, 2.3 and 4.*

On Section 2.3 I am still wearing of calling them requirements. It is stated in the revised manuscript that the requirements were set out in Rieger (2018) where further testing of the algorithms took place. Also the sentence before the bullet points states “Here, we summarize the resulting key points for the final algorithm of TransClim”. Therefore it seems to me that section 2.3 is more like objectives of TransClim or even processes included within the model.

*As suggested by the reviewer, we changed the name “requirements” into “objectives” to better present the content of section 2.3.*

In figure captions use schematic instead of sketch.

*Thank you, we changed the word sketch into schematic.*

Line 167 - change end of sentence to “enables quantification of the climate response to a small perturbation.”

*We changed the sentence as suggested by the reviewer.*

Line 179 to 183 – In both bullet point 2 the calculation is referred to as “the stratosphere-adjusted radiative fluxes of the perturbed O<sub>3</sub> field”. Is point 2 stating the total O<sub>3</sub> change from emission perturbations and point 3 is the difference between the total O<sub>3</sub> and the O<sub>3</sub> from traffic only. Can you just make clear what point 2 is (total O<sub>3</sub> from all road emission perturbations?)

*Thank you. Point 2 refers to the O<sub>3</sub> concentration which is modified by the model chemistry. It includes changes in road traffic emissions. We adapted point 2 and point 3 to make this point clearer to the reader.*

Line 209 – change fix to “fixed”

*Thank you, we have changed the text accordingly.*

Line 230-231 – Consider revising to “Rieger, (2018) tested several different algorithms and the one that produced the best results is used in TransClim and described here”.

*Thank you for suggesting revising the sentence. We modified the sentence.*

Line 279-280 – “... the change of the variable x towards the EMAC reference simulation.”. Should this be rephrased to say “... the change of the variable x with respect to the EMAC reference simulation.”?

*Thank you, we changed the sentence as suggested.*

Line 283 – 284 – Similar to above. Change “... at top of the atmosphere of the emission scenario towards the control scenario ...” to “... at top of the atmosphere for the emission scenario with respect to the control scenario ...”

*Thank you for this hint; we have modified the sentence.*

On Fig 4 and in section 2.6 it is mentioned that the algorithm is applied in each grid box (b) for each emission region (i). Would it be better to mention that the algorithm is applied on grid box in section 2.5 as well so that there is consistency between the sections?

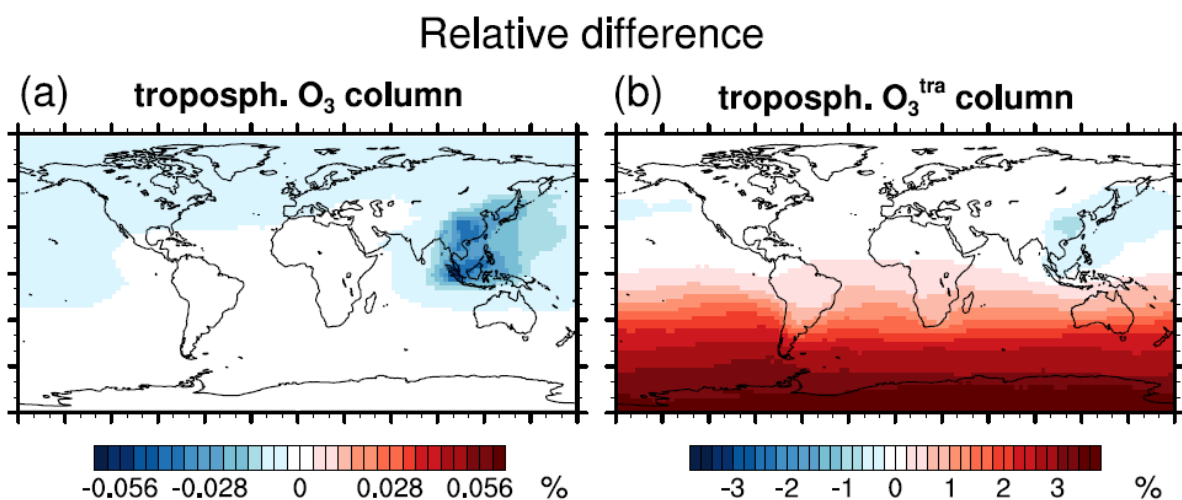
*Thank you for this hint. To be consistent, we mentioned the application of the algorithm on the grid box as well in section 2.5.*

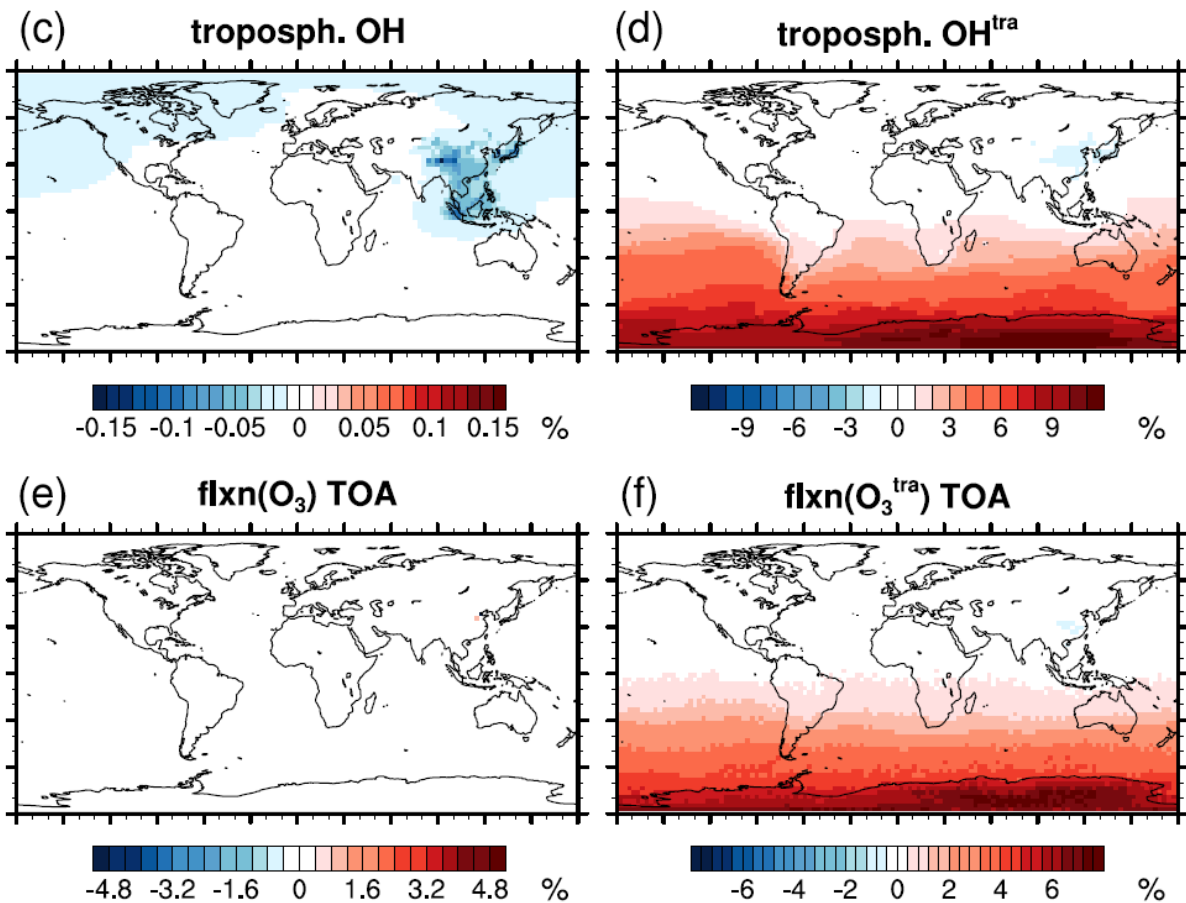
Line 315 – don’t need “regarded”

*We omitted the word “regarded”.*

Line 332-330 – so similar problem as presented in Fig 5 but positive bias now?

*Exactly, in this case TransClim overestimates the contributions  $O_3^{tra}$ ,  $OH^{tra}$  and  $flxn(O_3^{tra})$  only in the Southern Hemisphere (see figure below). This is again caused by the small values in the Southern Hemisphere. To compute the relative differences, the absolute differences are divided by these small values which generate this noise.*





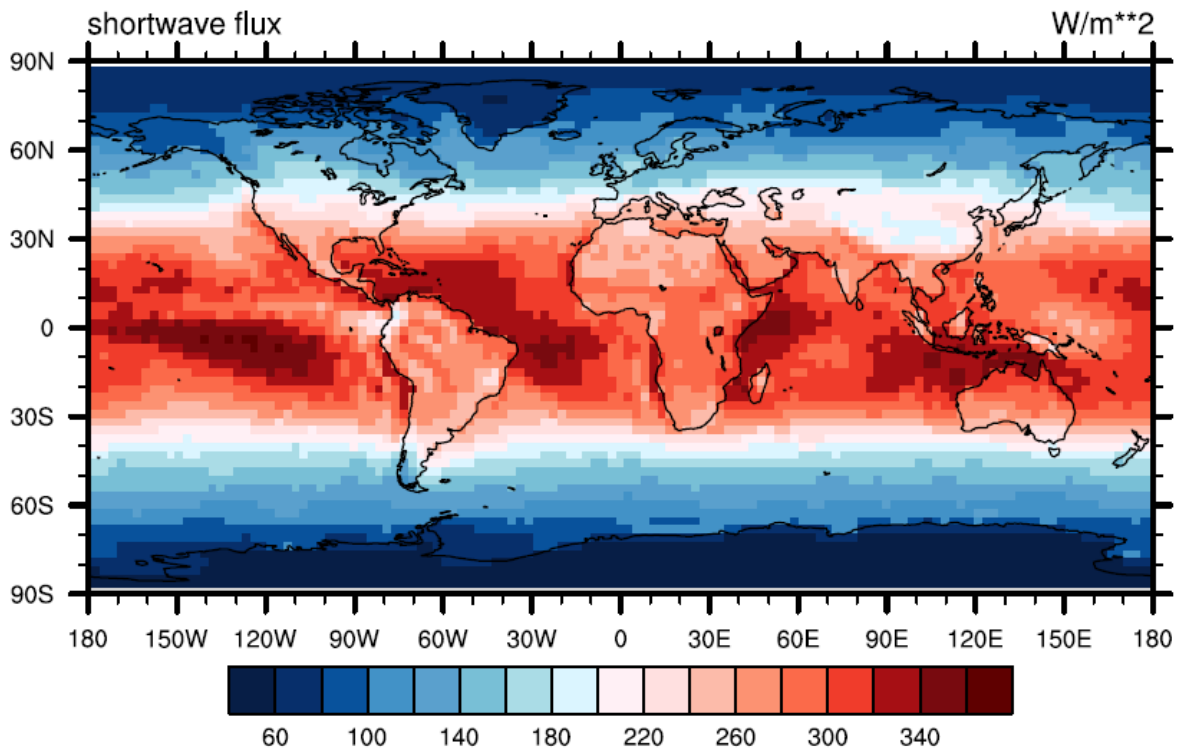
Line 512-513 – Should this mention that the TransClim O3 response is based on simultaneous emission changes from all three precursors (NO<sub>x</sub>, CO and VOCs)?

*Yes, TransClim is based on simultaneous emission changes. We reworded the sentence to make this point clearer.*

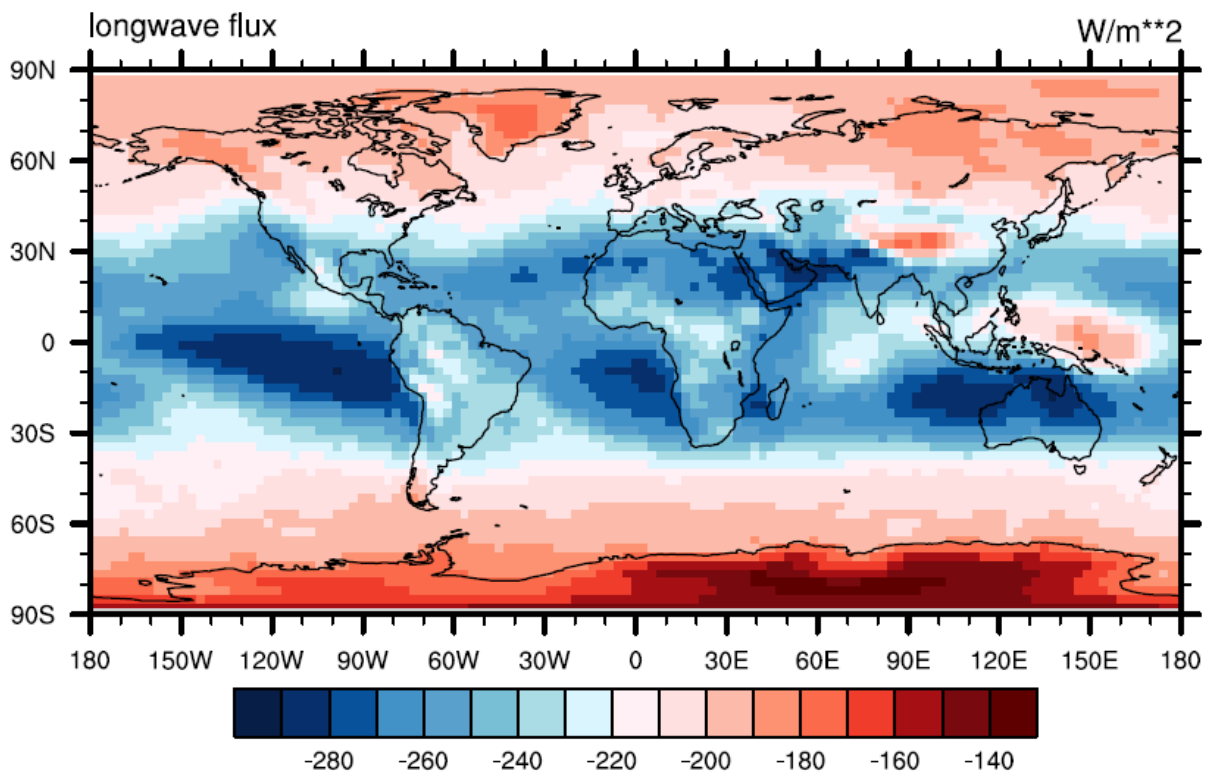
Fig A1 – It is correct that there are negative values for Flxn(O<sub>3</sub>) at TOA? Is this including stratospheric O<sub>3</sub> too?

*The plot shows the net radiative fluxes due to ozone at TOA. It includes the tropospheric and stratospheric ozone. The net radiative fluxes are computed by adding the shortwave and longwave radiative fluxes (shown below) resulting into positive and negative radiative fluxes for ozone.*

## shortwave flux at TOA



## longwave flux at TOA



### **List of relevant changes**

- Specification of how TransClim assesses the climate effect in sect. 2.1, 2.3 and 4
- Change of term “requirements” to “objectives” in sect. 2.3 and sect. 4
- Extension of equation (5) in sect. 2.5: the fundamental equation of the algorithm also depends on the grid box  $b$