Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2021-476-RC2, 2021

Comment on acp-2021-476

Anonymous Referee #2

Referee comment on "Recent ozone trends in the Chinese free troposphere: role of the local emission reductions and meteorology" by Gaëlle Dufour et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-476-RC2, 2021

This paper reports ozone trends in the free troposphere over China using the IASI satellite instrument and interprets them using an atmospheric transport model. I have a few comments that the authors should consider when they revise their manuscript. One major comment is associated with the authors not using averaging kernels when they compare their model to the IASI data.

Second paragraph: this area of the world is attracting a lot of attention. Already since this paper was submitted there are a few more papers that need citing in the introduction, e.g. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL092816?af=R

Page 4, Line 17: Three different a priori and constraints….ambiguous.

American spelling: use of centre for ECMWF and elsewhere. Vapor instead of vapour.

Section 2.3. There is little in the way of data description for the surface measurements. What is this website? How are the measurements collected? Uncertainties? What are criteria pollutants?

Page 5, Line 16: ...the larger the amplitude of the diurnal ozone cycle… This is not immediately obvious to me. Surely the boundary layer diurnal variation has a large role to play? This reviewer would have used a short-lived gas or particulate that would be relevant to the distance from anthropogenic activity.

Section 3.1. Here, I would focus on providing the validation that is pertinent to your study. A more detailed validation is always available in another paper.

Minor point: page 7, line 9: shorter than +/- 6 hours.

Page 9, line 2: We select IAGOS profiles with top measurements not lower than 500 hPa? This statement is unclear.

Page 9, line 7: most sensitive to what?

Page 9, line 12: why does the column degrade re correlation? It is reverting to the prior?

Page 9, line 15: last sentence is unclear.

Page 9, line 21. Model has a positive bias of 12% compared with the surface stations over China?

Page 11, line 11. Here and elsewhere I strongly disagree with the absence of averaging kernels when the model is compared to the satellite data. It seems as though the default for this study is to ignore them and place the comparisons that do use them in an appendix. It should be the other way around, if anything. You cannot legitimately compare the model with IASI without taking into account the vertical sensitivity of IASI to changes in ozone.

Page 13, line 11: confirm this corresponds to two sigma. Explain to the readers why you've opted for that measure.

Page 16, line 16: typo.

Page 17, line 2: typo or at least I think so!

Table 4: the sensitivity calculations appear to be a progressive (cumulative) degradation of the reference case. In that case, won't the sensitivity calculations become more non-linearly different from the reference case?

Page 18: while discussing the impact of various sensitivity calculations it would be useful to link them back to the model and observed comparisons. For instance, the influence of the biomass burning in the export region looks impressive in the model (Figure 6) but the model doesn't look particularly favourable against the data in Figure 5. BTW, Figure 5 appears to be cropped.

Section 5.2 was interesting but I think it would benefit from being more accurate in describing differences between TOAR and this study, even if the authors run the risk of repeating themselves, e.g. differences in time period.

Page 19: length of period. Sensitivity to perturbations can be removed by using, for example, the Theil-Sen estimator. Using that approach may also reduce the sensitivity of your results to end points.

Page 21: impact of sampling. To check consistency would it be useful for the authors to sample the model coincident with IASI and then again with IAGOS and compare the trends using the two sets of sampled data?

For Table 6, I suggest also include the number of points in each calculation since this value will change a lot for the rows and columns.