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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of resolution on ship plume simulations with NO_x chemistry" *by* C. L. Charlton-Perez et al.

Anonymous Referee #2

Received and published: 26 May 2009

This paper studies the effect of spacial resolution on simulations of the chemical evolution of a ship plume in the tropical MBL with a CTM with a simplified chemistry scheme. Of particular interest is Fig. 3 which shows that highest OH concentrations are located in a halo at the edge of the plume. Further, the dependence of mean OH, NOx lifetime and mean ozone production (OPE) in the domain are shown be linearly dependent on the logarithm of the grid box volume (Fig. 5-7). This study can be of help in developing some parameterization for plume processes.

I find that this contribution deserves to be published in ACP subject to some minor revisions. In particular, the quantitative information in Fig. 5-7 should be accompanied by the actual absolute mean NOx and ozone values - it is the mixing ratios that can be compared to observations. Also, the table with the chemical reactions is likely to

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require some corrections and the the main simplifications made should be included also in the abstract and the conclusions. Finally, the recent Franke et al (2007) Met Z study also represents a step towards a parameterization of ship plume effects and should be included in the discussion.

List of specific points

Abstract

1) P 8588 L 1 - 2 Please specify that the study refers to (sub)tropical conditions and include a brief description of the simplifications adopted in the chemistry scheme, e.g. what about NMVOCs?

2) P 8588 L 8 It would be interesting to know what happens to NOx and ozone concentration.

3) P 8588 L 12 What about mentioning here the OH halo effect?

4) P 8588 L 13-15 This sentence should be rephrased and clarified.

5) P 8588 L 17-18 Some work on parameterizations has already been published (Franke et al. 2007 Met Z)

Introduction

Overall, I found the introduction a hard read. I missed a clear structure and would recommend the authors to try summarise each paragraph in one sentence while improving it. The scope of the paper is addressed in several distinct paragraphs and I would recommend putting these bits together into the final paragraph.

6) P 8588 L 4-6 Please rephrase and be careful. Possibly, add a sentence on the Eyring et al (2007) ACP study.

7) P 8589 L 4-12 Please consider moving this paragraph or at least L 9-12 to the end of the introduction.

ACPD

9, C1241–C1247, 2009

8) P 8591 L 16 There seems to be a mismatch between resolutions and spectral truncations.

9) P 8591 L 21-23 Please consider moving this sentence to the end of the introduction.

10) P 8592 L 2-4 Please rephrase and clarify.

Section 2

The authors could consider merging sections 2 and 3 into one section which describes the methodology employed in the study.

11) P 8592 L 10-11 This sentence could go into the final paragraph of the introduction - and could mention that the paper focusses on a tropical case.

12) P 8592 L 21-23 Please rephrase and clarify your choice.

Section 3

13) P 8594 L 17-18 Please add to this sentence or else comment on the large-scale subsidence described in P 8595 L 21-23.

14) P 8594 L 21 Is it a "reaching the domain boundary" what the authors meant with "exiting the box"?

15) P 8595 L 2-3 The statement in the round brackets seems to say that this dependance goes beyond the scope of this study.

16) P 8595 L 7 Is the hyphenation needed here?

17) P 8595 L 11 Please consider comparing here the LES model domain to the domain used in the CTM or referring to P 8596 L 7.

18) P 8595 L 17-19 Please comment on this possible caveat or consider moving the sentence in P 8596 L 11-13 into this paragraph.

19) P 8596 L 21-23 Please consider adding a citation to this statement - if you have

ACPD

9, C1241–C1247, 2009

done these tests yourself please clarify.

20) P 8596 L 23-25 Please consider adding a comment about the time step(s) over which the interpolation takes place.

21) P 8597 L 21-24 Please consider moving these sentences into the previous paragraph.

22) P 8598 L 10 Please comment on your choice to exlude important NMVOCs from the chemical scheme.

Section 4

Please consider merging section 4 and section 5 into a single results section.

23) P 8598 L 18-19 Please consider moving this sentence to the previous section.

24) P 8598 L 21-27 Please consider adding that Fig. 1-2 refer to the C1 simulation.

Section 5

25) P 8599 L 4-8 There seems to be more in this section than what is described in this paragraph - is it really necessary?

26) P 8599 L 20-25 Please consider merging this paragraph with the previous one.

27) P 8600 L 10-11 I highly suggest that the authors include mean absolute values of NOx and O3 as they do for Oh in Fig. 5. The concentration of NOx and O3 is the quantity that can be easily compared to measurements.

28) P 8600 L 13 Please define NOx lifetime here rather than in P 8601 L 13-15.

29) P 8601 L 2 Is the first round bracket at the right place? Please check also other citations.

30) P 8601 L 20 Please add e.g. "each time the resolution is halved" at the end of the sentence.

ACPD

9, C1241–C1247, 2009

31) P 8601 L 25 Is this a caveat of your model or a conclusion from your interpretation of the model results? What is chicken and what is egg?

32) P 8602 L 12 Why do you use the present tense here? What about "suggested"?

33) P 8602 L 16 The verb, "are", is missing.

34) P 8602 L 29 Please consider starting a new paragraph with "When the ship emission".

35) P 8603 L 1-5 This point is fairly interesting and deserves some more attention. I found it surprising to see the OPE dependence on resolution increase when the emissions are halved. I would appreciate if the authors would comment more on this and suggest some mechanism.

36) P 8603 L 91 This comparison seems to refer to the experiment with full emissions - please state this explicitly.

37) P 8603 L 7-11 Please consider moving this paragraph to P 8602, before the paragraph with the halved emission rate.

Section 6

38) P 8603 L 13 Please specify "tropical" or "subtropical" before MBL.

39) P 8603 L 16 Please consider starting a new paragraph here.

40) P 8603 L 22-24 Please consider rephrasing taking into account possible model limitations (chicken and egg issue).

41) P 8604 L 2-6 These seem to be potential improvements to the study which as such go beyond the scope of the study. Please clarify on this.

42) P 8604 L 12 This is likely a good point for the authors to speculate on how the results might change under extratropical conditions.

43) P 8604 L 16 What about the implications for e.g. aircraft plumes?

ACPD

9, C1241–C1247, 2009

44) P 8604 L 17-20 I think the authors should be more careful at this stage. The recent Franke et al. (2007) Met Z study could be mentioned too. If the authors wish to make a plea for a particular approach, then they should motivate this.

Appendix A

Why not give a name to this interesting appendix?

45) P 8604 L 22 If Eq. (A1) is the same as Eq. (1), why not simply refer to Eq. (1)?

46) P 8604 L 24 I understand that the authors are referring to a "concentration flux" and I would recommend them to be more specific.

47) P 8605 L 17 Please consider substituting "Another method" with "The method employed in this study".

48) P 8606 L 10 Actually, all the lines seem to be solid, please clarify.

49) P 8606 L 12-16 Please specify that you are comparing the high resolution with the C8 case.

Table 1

Please double check the contents of Table 1. In particular, some equations are missing either the right or the left hand side.

Fig. 1

The gray between 316 and 1000 is a bit too light. The upper and lower boundary of the color bar could be triangles (as for Fig. 2 and 3).

Why not invert the labelling of the x axis with 0 either in the centre or at the right boundary of the grid cell with the ship emissions? Please consider this also for Fig. 2, 3, and 8.

Fig. 2

ACPD

9, C1241–C1247, 2009

Should the label of the horizontal axis not be "y"?

Fig. 5

The last sentence in the caption could go into the main text.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 8587, 2009.