

Interactive comment on “Three-dimensional model study of the arctic ozone loss in 2002/2003 and comparison with 1999/2000 and 2003/2004” by W. Feng et al.

Anonymous Referee #2

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General Comments

This paper describes the recent improvements which have been implemented in the well known and already well documented SLIMCAT 3D CTM in order to better reproduce the polar chemical ozone loss. The model is now extending to the ground and is tested with two different spatial resolution and two different radiation scheme. The results are compared to ozone and tracer observations obtained during three winters in which the temperature and vortex conditions are different. The authors conclude that in its updated version, using sigma-theta vertical coordinates, a high resolution ($2.8^\circ \times 2.8^\circ$) and the NCAR-CCM radiation scheme, SLIMCAT is better simulating transport and mixing and that the polar ozone loss is now better reproduced.

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The paper is well written. After an enhancement of the paper concerning the comments, it can be recommended for publication in ACP.

Specific Comments

I have two comments on the pictures:

First one - figure 3, 7 and 8 The top plot is at 425K, middle one at 460K and bottom one at 495K, why not showing the high altitude plot on top and the lowest one in the bottom.

Second one - figure 2, 3, 4, 6, 7, 8, 9 and 10 It is very difficult to understand the various plots, reading at the figure caption. Simultaneously, you need to look at table 1. I suggest to add, in the figure caption, the conditions of the various SLIMCAT runs instead of the colour. The information on the colour is already provided on the graph.

Figure 2: I suggest to add in the figure caption: from SLIMCAT runs C, D1 and E1 (CCM, high resolution) as a function of time

Figure 3: I suggest to add: for SLIMCAT runs A (MIDRAD, low resolution), B (CCM, low resolution) and C (CCM, high resolution).

Figure 4 and figure 7: I suggest to add: runs D1 (CCM, high resolution) and D2 (MIDRAD, high resolution).

Figure 8: I suggest to add: runs E1 (CCM, high resolution) and E2 (MIDRAD, high resolution). Etc..

Introduction: line 6 "Models still fail to reproduce many aspects of polar chemistry and transport" can you be more specific and suggest these "many" aspects?

Line 15: "In the past, many models have tended " again, can you be more specific and suggest which models?

Section 3 line 14: Observed O3 minihole around Scandinavia - do you have a refer-

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ence?

Section 4.2: the title is wrong: Comparison of data for two winters 2002/2003 and 1999/2000

Section 4.2: lines 12 to 20 and figure 4: Comparison between Slimcat and balloon measurements. It seems to me that D1 (CCM) is better reproducing the balloon N₂O profile than D2 (MIDRAD) and this leads to a better simulation of the O₃ profile. However, I do not see such a good agreement for CH₄, it is even better with D2 than with D1. Can you comment? What does it mean? CH₄ cannot be used to test transport in the models?

Section 4.3 line 25: In order to help the reader looking simultaneously at the text and figure 7, I suggest to add the day of year in the text : " the observed sudden change in ozone around mid February (day 45) and mid March (day 75).

Minor comments

Section 3 line 24: Figure 1 (right) also shows the difference Remove "also" in the text.

Figure 10: the NO_y plot run C should be on top right and NO_y plot run B should be in the middle right.

Figure 12: Title of figure (a) is Polar O₃ chemical loss at "456K" I suppose that it is wrong. Should be "465 K" as it is written 465K in the figure caption. However, in the text, page 5056 line 25 it is also written 456K so what is correct? 456 or 465?

Section 4.3 line 20: Remove the "." just before "after 13 years"

Section 4.5 line 8: A significant changes in ozone were observed.. should be corrected to Significant changes in ozone were observed.

Section 5 line 16: The different shemes and resolution used in the model "results" in different should be corrected to The different shemes and resolution used in the model "result" in different

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