Atmos. Chem. Phys. Discuss., 14, C9997–C10000, 2014
www.atmos-chem-phys-discuss.net/14/C9997/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Variability of Antarctic ozone loss in the last decade (2004–2013): high resolution simulations compared to Aura MLS observations" *by* J. Kuttippurath et al.

Anonymous Referee #1

Received and published: 10 December 2014

The authors have done ten years model simulations with 1x1 degree horizontal resolution using a well known chemical transport model (Minosa-Chim) to investigate the variability of Antarctic ozone loss. They also used MLS measurements to check how good the model performance for the stratosphere by comparing the transport tracer N2O, chemical species ClO, HCl for chlorine activation process, and HNO3 for denitrification as well as estimated ozone loss using model and observations. First they derived the climatological ozone loss at different equivalent latitudes, and diagnosed the contribution of various catalytic cycles to stratospheric chemical ozone loss. Then they have shown the time series of vortex averaged ClO and diagnosed ozone loss

from model and MLS. They also compared the ozone loss/production rates for these ten years. The paper is well organised and written and easy to follow. Some of the results are useful but most of the results and conclusions are expected and not new for the community. It does not make a significant contribution in improving and advancing our understanding the stratospheric dynamics and chemistry research area. It would be good if the authors can add a few sentences to say the advantage of high resolution simulation and if possible also compare the model results with the low resolution siumlations from in the model. The paper can be published in ACP but it requires some clarification. Specific comments can be found below:

Specific comments:

1) Chlorine activation. The model has too low ClO compared with MLS data. It is not convicing to conclude "largely due to the slower vertical descent in the model during spring". Why are there two layers of the modelled HCl in Figure 4 (almost constant HCl values 0.7-1.2 ppbv around 500 K)?

2) Ozone loss. How good is the modelled ozone compared with MLS for Antarctic winters 2004-2013? This should be the first step to check the model and it is important to understand the ozone loss difference between model and MLS. Form Figure 1, it looks like that the ozone loss between 65-67S equivalent latitude (EqL) is much larger than the value inside the polar vortex in September and October. Why is it? Can you explain why the diagnosed ozone loss for October from MLS has similar distribution and value in Figure 1? I think the air mass should be different for each EqL region.

3) It is not clear which ECMWF analyses data used to force the model. Is it operational data or ERA-Interim reanalyses? If ECMWF operational analyses are used, it needs to mention that the ECMWF vertical levels has been changed to 91 levels from Feb 2006 and to 137 levels from June 2013.

4) Initialisation. It reads weird that the chemical fields in the model are initialized from a different CTM (REPROBUS). Does this mean that the Mimosa-Chim needs ten years

initialisation of chemical fields from REPROBUS simulations? Not sure how good the intialisation compared with available MLS data on 1 May. Is it possible to get the initialisation from even a low or standard Mimosa-Chim simulations?

5) Why have not they sampled the model output at MLS locations and time? These should be easily done by doing the interpolation during the model simulations.

6) It would be good if the author can add one section to describe the meteorological conditions for these ten years (e.g., temperature, vortex area, PSC surface area).

Minor comments:

1) Abstract, lines 3-4, why "high frequency polar vortex observations"?

2) Abstract, line 7, maybe change "69" to "67" which will be consistent with the text in Page 28208 Line 2 etc.

3) Introduction, Page 28205 Line 27, add a reference for UARS MLS there.

4)Page 28206 Line 3, add a reference for Mimosa-Chim model.

5) Page 28209 Line 9, change "is" to "are".

6) Page 28208, Line 24, "see later anayses", do you mean sections 3.2 and 3.3.4?

7)Page 28209 Line 1, Can you explain why the modelled and measured O3 is so large in September?

8) Page 28209 Line 15, In Figure 2, it is clearly seen the value is over 0.3 ppbv/sh from BrO-ClO, why is this cycle "hardly exceeds 0.3 ppbv/sh for August and September.

9) page 28211 Line 13, why the model overestimates the denification?

10) Page 28211 Line 19, add a reference for SLIMCAT.

11)Page 28211 Lines 28-29, it seems this is the problem in Minosa-Chim CTM, but why is "still a critical issue" in "most CTMs"?

12)Page 28213 Line 10, add a reference for SCIMACHY.

13) Page 28213 Line 22, change "consistent with" to "depending on"

14) Page 28214 Line 25, is it "around 550 K"?But from Figure 5, the peak loss altitude is below 500 K.

15) Page 28215 Line 14, define the vortex core.

16) Error bar for MLS in Table 2 should be estimated.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 28203, 2014.