**Atmospheric
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Discussions**

Interactive comment on "Past and future simulations of NO$_2$ from a coupled chemistry-climate model in comparison with observations" by H. Struthers et al.

Anonymous Referee #2

Received and published: 1 October 2004

Title: Past and future simulations of NO2 from a coupled chemistry-climate model in comparison with observations

Authors: H. Struthers, K. Kreher, G. Bodeker, P. Johnston, H. Shiona, A. Thomas, J. Austin, and R. Schofield

General Comments:

This is a much improved draft compared to the first version originally submitted to ACPD earlier this year. It addresses the interesting and important question of the mismatch between N2O and NO2 trends in observations and tries to investigate this question by using a coupled chemistry-climate model. After some further clarifications

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and improvements the paper could be published in ACP. I still have some concerns regarding the offline calculation of NO2 and the inconsistent use of the trend model.

Specific Comments:

I've identified three major points of concern to me:

1) If I understand correctly, a column model is used offline to calculate NO2 (including the diurnal cycle of NO2 with an "improved" temporal resolution). Earlier the paper describes the data as being stored every 5 days instantaneously. What are the errors in NO2 associated with this approach? Temperature and pressure are changing during the day as well (and the chemistry is using this information in the partitioning of the family for every timestep, I presume). Question: How different is the NO2 modelled with the column model to the NO2 the model derives in a self-consistent way during the integration (given that the diurnal cycle of T and p is not represented in the column model)?

2) Reading the manuscript I got the impression that the trend model is not using the QBO signal for the trend analysis of the model data. I understand that the model has some kind of QBO, where the phase might be different to the observed QBO. Given this, one would expect the trend model to use the QBO signal from the model to be comparable, but instead the trend model is not using any QBO proxy. Please justify and explain.

3) Another point regarding the used trend model. If I understand correctly different trend models are used for Lauder and Arrival Heights. The trend model for Arrival Heights seems to include a 20hPa temperature term which is not included in the trend model for Lauder. Why? Wouldn't it be better to compare like with like?

Technical Corrections:

The explanation of Figure 7 is too sloppy (text and caption). Please specify which plot is which more accurately.

I feel the summary should also have a (final) overall summary in addition to the separate summaries for Lauder and Arrival Heights results.

In line three of the abstract I would include the word "modelled": the trends -> the modelled trends

On page 4550: equvalent -> equivalent

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 4545, 2004.

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