

Interactive comment on “Modelling the impacts of climate change on tropospheric ozone over three centuries” by G. B. Hedegaard et al.

Anonymous Referee #1

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General:

The authors present the results of simulations done with a hemispheric chemistry transport model using fixed anthropogenic emissions. The simulations are forced with ECHAM5/MPI-OM meteorology and cover four 10-year time slices representing the 1890s, 1990s, 2090s, and the 2190s. The meteorological data are based on the greenhouse gas emission scenario A1B.

Several similar modelling studies have been published in the last years, either using regional, hemispheric or global models. Even the authors themselves have previously published a similar investigation, differing from the current study only by another choice of meteorological data (ECHAM4 with A2) and a different selection the of time slices. Although no simulation results have been published so far for exactly this particular

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combination of GHG emission scenario and time slices, many of the principal results shown here can also be found in previous studies. To justify a publication, it would be necessary to concentrate on the few new outcomes, which has not yet been done consequently. Therefore, I recommend revising the manuscript in order to highlight and analyze those results that have so far not discussed in previous publications.

With respect to the presentations of the results itself, the paper leaves the impression that the authors put generally only little effort into this. Thus, it is absolutely necessary to improve them. Particularly the quality of the figures is very poor and uninspired. There are too many stamp-size figures where almost nothing can be recognized. It should be possible to distinguish the relevant features on a printout of the paper and not only when the figures are enlarged to 200 or 300 %! Therefore, the general concept of the figures should be revised. I can imagine that the quality could be increased by testing different colour schemes (maybe rainbow would show more features for mean fields), a smaller number of colour shades, and avoiding the empty space on the right to get larger pictures. The authors should also present some results in a different kind of figure (e.g. line plots, bars showing differences for single grid points or regions, etc.).

The paper should only be accepted after a substantial revision. This revision should also include some changes in the general setup of the paper. One option might be the reduction or even omission of discussion parts that only confirm the results of previous studies –in favour of extensions with respect of points which are not or only briefly addressed so far. Another option might be putting this study into a larger context by a more thorough reflection of previous work (e.g. by discussion differences between the 1990s/2090s results of the current and the author's previous simulations.).

Furthermore the paper contains several lapses in English (for example, the correct use of 'has' and 'have' in connection with singular and plural should be checked).

Specific remarks:

The results for the 1890s are almost nowhere discussed and are not very relevant

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anyway, maybe they can be omitted.

Johnson et al. (2001): Missing reference

P. 6814: Did the authors perform the ECHAM5 simulations themselves? Otherwise, data source should be acknowledged.

Fig. 9 is mentioned only once in the context with NO_x on page 6118. Fig. 9, however, shows NO_2 . The authors should either discuss NO_x chemistry or skip the figure.

P. 6919-6821: There are a lot of commonplace remarks on chemistry or isoprene emissions which do not always appear closely relevant to the presentation of the results.

P. 6825: Does this mean that there are still significant concentrations of isoprene at a height of almost 5 km?

P. 6826: *Today most atmospheric climate models have very simplified descriptions of atmospheric chemistry including ozone chemistry and therefore account poorly for the feedback from atmospheric chemistry to the climate system.* This sentence is not exactly true anymore nowadays.

Figure 6: Maybe t-values are not useful to analyse changes in isoprene as significant changes are shown over the oceans.

Language (errors in heavy print, no complete list):

Four decades in different centuries **has** been simulated

Since the atmospheric chemistry of most chemical compounds **are** highly dependent on temperature . . .

the **dessert** of Sahara

The **Arctic Ocean differs from the above pattern** . . .

There are therefore a close correlation between

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This study indicates that a given change in ozone concentration in the future **depend on** . . .

can have **NO_x ious** effects

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 6805, 2011.

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