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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Implicationsof constant CFC-11 concentrationsfor the future ozone layer" *by* M. Dameris et al.

Anonymous Referee #1

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General comments:

The paper by Dameris and colleagues investigates the potential impact of enhanced CFC-11 concentrations on future ozone by means of a coupled chemistry-climate model. A recent publication by Montzka et al. showed that atmospheric CFC-11 concentrations have not declined as expected from the Montreal Protocol. Motivated by this finding Dameris et al. conducted a sensitivity simulation with the CCM EMAC for the first half of the 21st century assuming constant CFC-11 levels after the year 2002. This simulation has been compared to a reference in which atmospheric CFC-11 develops in compliance with the Montreal Protocol.

Although I like the idea of estimating the implications of increasing CFC-11 emissions on future ozone, I have major concerns related to the set-up of the performed sensi-

tivity simulation. I totally agree with the authors that the future evolution of CFC-11 is not know, and that therefore a simplified modelling approach may be justified, but assuming constant year 2002 concentrations was in my view the most unfortunate choice. We know from observations that atmospheric CFC-11 has further decreased since 2002, namely from about 258 ppt to about 230 ppt in 2017. That means that the sensitivity simulation assumes too high atmospheric CFC-11 for the time period 2002-2017. Thanks to its long lifetime this additional CFC-11 stays for a while in the atmosphere and makes a quantitative estimate of the recently discovered increased CFC-11 emissions for future ozone meaningless. I would have understood a sensitivity experiment that follows the observations until 2017 and assumes constant CFC-11 values afterwards.

In my opinion this study requires additional efforts before becoming acceptable for publication in ACP. Either the authors perform a new sensitivity study with a more meaningful set-up (not necessarily the one outlined above, if there are better ideas), or they have at least to provide an estimate of the overestimated increase in stratospheric chlorine loading due to fixed CFC-11 levels between 2002 and 2017 and the subsequent ozone loss in their current sensitivity run.

Specific comments:

- No matter which constant CFC-11 value the authors assume for their sensitivity, it would be interesting to estimate the emissions required to achieve or maintain these CFC-11 values. This would help to put the made assumptions into perspective, also with historic CFC-11 emissions, and to get an idea of how likely the chosen scenario is.

- In general I would appreciate to see some information on the statistical significance of the displayed differences between both model simulations.

- As this study is based on one CCM only, it would be interesting to see a short discussion about the sensitivity of ozone recovery and return dates in EMAC to stratospheric

chlorine compared to other CCMs, following the Dhomse et al. paper.

- Fig. 4, 5, and 6 show Antarctic ozone chemistry for September. Usually October is shown for Antarctic ozone. I assume the authors chose September because Fig. 2 shows the largest difference between both model simulations in September. Some explanation would be helpful.

- p4, l15-17: What is the percentage increase of ClOx in the LS?

- p6, l21-26: Do you attribute the discussed additional cooling in SEN-C2-fCFC11 to the additional CFC-11 or the changes in stratospheric ozone or both?

Technical corrections:

- p2, l9: Dohmse -> Dhomse

- p8, l15: Dohmse -> Dhomse

- Fig. 1, 3, 4, 5: I think one running mean, either 3 or 5 years, would be enough. Especially in Fig. 3 (top) the many different lines are rather confusing than helpful.

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