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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of anthropogenic chlorine, stratospheric ozone change and chemical feedbacks on stratospheric water" *by* T. Röckmann et al.

Anonymous Referee #2

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This paper addresses the influence of a changing stratospheric chemical composition with respect to 1) the increasing chlorine burden, 2) the thinning of the ozone column, and 3) increasing water vapour (H2O) levels on the oxidation of methane (CH4) and the production of H2O in the stratosphere. The investigations have been mainly performed with a 0-D chemical box model and the main conclusions have been corroborated by using a 2-D model.

General Comment:

To investigate the three chemical mechanism considered in this paper, which are highly coupled, a careful choice of the model being used is needed as this model have to take into account the coupling mechanisms. The authors decided to use a 0-D chemical box

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model for these studies. From my point of view there exist major concerns against this choice. The increase of the chlorine levels in the stratosphere is leading to a decrease of ozone accompanied by an enhancement or the actinic flux in the stratosphere resulting in changes of the stratospheric chemical composition. The 0-D box model used in this study does not consider this interaction as the calculation of the actinic flux in the radiative transfer model is independent of the calculated ozone field and depends on a prescribed ozone profile only. In addition, changes in the stratospheric circulation during the considered time periods or the tape recorder effect both affecting the stratospheric composition (and H2O itself) cannot be modelled by a 0-D box model.

As the authors are able to perform 2-D model runs I would recommend that the authors use the 2-D model to investigate three scenarios: 1) a "full coupled" run (run A) with changing CH4 and CFC's levels resulting in ozone changes being considered in the radiative transfer calculations, 2) a "full coupled" run (run B) but with no changes in the CFC's (constant values at the lower model boundary representing 1980) to investigate with respect to run A the influence of the changing chlorine levels on the strength of the CH4 oxidation, and 3) a "non-coupled" run as run A but with no interactive calculation of the actinic flux to investigate with respect to run A the influence of a decreasing ozone column on the CH4 oxidation and H2O production. These studies would extend the earlier work of Considine et al. (J. Geophys. Res., 106, 27711-27729, 2001) who also use a 2-D model to calculate the influence of changing chlorine on CH4 and H2O and would be an interesting and publishable investigation of the possible reasons of the postulated enhanced oxidation of CH4 in the stratosphere.

Technical Correction:

Figure 1: If this figure will be published in the resubmitted paper again, please add which observational data from Randel et al. (1999) are shown as grey-shaded area for comparison (H2O or CH4) ?

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 833, 2004.