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Atmospheric Chemistry and Physics Discussions

Interactive comment on "What would have happened to the ozone layer if chlorofluorocarbons (CFCs) had not been regulated?" *by* P. A. Newman et al.

N. Harris (Referee)

Neil.Harris@ozone-sec.ch.cam.ac.uk

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General Comments:

This paper investigates the (fortunately) hypothetical effects that a continued CFC emissions.would have had. The two models used in the study both show that truly dramatic changes in stratospheric chemistry and dynamics and in surface UV would have occurred in the absence of the relatively strict adherence to the Montreal Protocol process and its provisions. I was very surprised to learn that this is only the third such study following on from Prather et al. (1996) and Morgenstern et al. (2008). The paper addresses a number of highly relevant questions in a clear, well supported and rigor-

ous manner and reaches substantial conclusions. I recommend publication following minor revisions.

Specific Comments:

I hope that the authors will consider the following points when revising the paper.

1. Ozone loss.

The authors use the term ozone loss in a somewhat vague way. Loss has come to mean chemical loss, but it is not clear that that is how they mean it here. If they cannot diagnose chemical loss, then they probably need to be more careful in their language, with at least a definition of terms earlyish in the discussion. This is worth clarifying, because a perfectly valid argument could be made that it does not matter whether the loss is chemical or dynamical in origin because it results from the presence of such high levels of CFCs. If that is the authors' position they should state it.

2. Separation of chemistry and dynamics.

I raise the first point partly because section 6 on dynamics and transport is presented in a somewhat linear way (less ozone -> more/less heating -> different gradients, etc) without much mention of how these processes are feeding back on ozone as well as each other. If surface UV radiation is the only end product, this does not matter much, but this seemed one place where the generally clear presentation probably glossed over some interesting science and became somewhat 'lite'.

3. Model dimension.

The statements about the 2D and 3D models were interesting (as Drew Shindell has also noted). If the conclusions about similarity of 2D/3D models are robust, then it implies that much greater use could be made of 2D models in UNEP/WMO assessments at least for the quantities (ozone, chemistry and UV) which are the main subjects of this paper. I imagine that 3D stratospheric modellers would have much strong views about this prospect, but I think this aspect could usefully be investigated more here (or I

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guess another piece of work). Such a conclusion is feasible as much of the discussion in the text is about altitudinal and latitudinal gradients rather than longitudinal ones.

4. Figures.

The plots in general are clear and well thought through. However, I doubt that they will be clear (particularly the inserts) when printed in the final size. The authors do therefore need to reconsider how they are presented in the published paper. However, for most readers, it would be good if the current versions could also be made available as they are the best for use in talks or lectures.

It is not clear to me whether figures 8 and 9 are strictly necessary. The main points are that active chlorine becomes negligible in the Arctic (at least in March) by 2040; and that active chlorine suddenly becomes important after 2050 in the tropics. This is said clearly in the text. The authors should at least consider whether full speciation is needed for the chemical species.

I also struggle abit with Figures 10-12 which seem far more complex than the associated discussion (see my comments in 1 and 2).

Technical Corrections.

20566, 5: ...and modelling studies. This research led...

20569, 27: must? The actual success of the MP is best measured against.....

20575, 1: precipitously over 90 years? Dramatically?

20583, 19/20: End this sentence end after 'globe'? Personal exposure is not greatest in cities and I would hope that most people know where Washington is.

20588,1: Newman, P.A.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 20565, 2008.

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Interactive Comment