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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Extrapolating future Arctic ozone losses" *by* B. M. Knudsen et al.

J. Austin

john.austin@noaa.gov

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I tend to agree with the overall conclusion of Gianni that CCMs with all their faults are better than extrapolating observations. Knudsen et al. have barely touched on the impact of water vapour and ozone trends and their impacts on the temperature trends, as indicated in my voluminous but necessary responses. I agree that the relationship between, say, ozone depletion and PSC amounts will likely remain the same as in the past, after allowing for halogen changes. The problems with the Knudsen et al. paper stem from two sources: the lack of a full range of scenarios reflecting all the observational errors and the process of extrapolating trends into the future.

Regarding the former, we are frequently advised against using trends or other products derived from assimilation fields over multi-decadal timescales because of the change in instrumentation and small scale circulations introduced by the data insertion technique. For example, in the recent SPARC General Assembly it was shown that peak age of

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air from assimilation fields is only of order 3 years compared with 5 years for a typical CCM and at least 6 years from tracer observations. Given these uncertainties, data assimilation fields give a range of past temperature trends which may be a significant fraction of the range given by CCMs for temperature trends. Also, there is the chaos issue on which the authors have not provided an explanation of their stance or change of stance since WMO (2003).

Regarding extrapolations, I think Gianni has offered some clear explanations as to why a simple extrapolation of the past is inappropriate. The fact that the authors make a few comments about it being 'dangerous' is not good enough. This is a point I have also made independently in several of my previous comments. One could interpret the recent data as indicating that temperatures have stabilised in the polar regions. If this recent behaviour were maintained it would be consistent with the importance of ozone in controlling temperature. To this end, CCMs are entirely consistent, if erratic, and certainly doubts remain concerning the attribution of trends in CCMs. However, the extrapolations of Knudsen et al. have a logical and fatal inconsistency. That is, the extrapolation of past temperature trends requires an implicit extrapolation of the ozone trend to satisfy the physics. Yet when this is done, the conclusion would be that ozone won't decrease further. It is this inconsistency which means that I support Gianni's arguments and why I go further in giving the Knudsen et al. paper little benefit of doubt in anything like its current form.

I have now exhausted my official limit of 5 SCs and 2 discussion threads. I look forward to reading comments from Referee 2.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 3227, 2004.

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