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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Further analyses of the decadal-scale responses and trends in middle and upper stratospheric ozone from SAGE II and HALOE" *by* E. E. Remsberg

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1 Summary

This paper reports on a multivariate linear regression on SAGE II and HALOE ozone profile data. This work is an extension to an earlier work by the same author (Remsberg and Lingenfelser, ACP 2010). In the earlier paper, the focus was on the HALOE observation period (1991-2005) and on the solar cycle response on ozone derived from both HALOE and SAGE II data. In this paper the study is extended to the early SAGE II period (1984-1998). Also an update (due to some binning modification since the

Remsberg and Lingenfelser paper) on the results for the HALOE observation period is given and compared to.

One of the major results is that the solar response of about 2-4% in the upper stratosphere is very similar in both observation periods. This result does not change when using linear trends or an EESC proxy in the regression, the latter better describing the trend change in the stratospheric halogen load. Larger differences are seen in the lower stratosphere that is likely due to differences in atmospheric dynamics and variability between the different periods considered here.

The methods used are well explained, however, the results from this paper are not particularly new (being only a slight modification from the earlier paper) and, in my opinion, some important issues are not sufficiently addressed as discussed below:

2 Regression model

In the regression model no proxy terms are used and most terms are periodic terms with frequencies corresponding to QBO, solar cycle, and seasonal changes and a linear trend term. The authors state that they had some difficulties in fitting the years around 1990 where a strong ENSO event occurred and the QBO phase lasted longer than usual. The use of fixed periodic terms for the QBO is in this case a disadvantage. The authors left the answer open if the use of a QBO and, possibly, an ENSO proxy term would have helped to improve the consistencies of their results in particular with the solar cycle estimates in the lowermost stratosphere (see Figure 11).

3 Role of stratospheric aerosols

As discussed to some extent in the paper by Dhomse et al. (2011) and discussions in ACP, the Pinatubo and El Chichon volcanic event to some extent impact the solar cycle signal. Furthermore, the different sensitivities of SAGE II and HALOE measurements to stratospheric aerosols (SAGE II being more affected) may also in part explain the different solar cycle responses seen for instance in Fig. 11 (different periods and different satellites). This should be more thoroughly discussed and analyzed in this paper.

4 Comparison to a 2D model (Fig. 11)

There have been many other model comparisons (3D and 2D models) and I do not understand why only the old Brasseur model from 1993 is shown. This is too selective and it would be important to relate the results from this paper to the recent WMO assessments (e.g. in 2006) where the solar cycle dependency (in models and observations) is well summarized.

5 HALOE and SAGE long-term trends (Fig. 12)

In this figure trends from SAGE II (number density) and HALOE (vmr) are compared, which is clearly not appropriate here since it is like comparing apples with pears. It would be very important to know if the long-term trends agree between both satellites when one data set is converted from one unit to the other. This can be easily done. Temperature information are provided in both SAGE II (mainly from a met analysis) and HALOE (retrieved directly and taken from met analyses dependent on altitude)

data sets. This would indeed prove that the temperature trend is responsible for the differences in vmr and number density trends.

6 Minor issues

Abstract: "periodic 11-term" –> "periodic 11-yr term"

Introduction: "max minus min of order 2 to 4%", better "from two to four percent" (generally to much use of "order of" in the text to indicate variations of a few units, I prefer "from/to" or "about" and reserve "order of" for magnitude of order changes)

p. 25017, l. 6: "Figure 7 is the distribution" –> "Figure 7 shows the ..."

p. 25017, l. 14: "As an example, Fig. 8 is the ozone time series" –> "... depicts the ozone time series"

Acknowledgment: correct "Radiationand" and "servingas"

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