

## ***Interactive comment on “Chemical ozone loss in the Arctic winter 1991–1992” by S. Tilmes et al.***

### **Anonymous Referee #1**

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This paper derives chemical ozone loss in the Arctic winter 1991/92 from HALOE observations and other measurements, using the well established tracer-tracer correlation technique. This paper thus expands on earlier studies by the authors. In particular Tilmes et al., ACP, 2004, have calculated Arctic ozone loss from HALOE data for the winters from 1991/92 to 2002/03.

The winter 1991/92 is of particular interest as it was strongly influenced by enhanced aerosol loading following the eruption of Mt. Pinatubo in June 1991, leading to unusually enhanced ozone loss. At the same time the enhanced aerosol loading potentially affects the quality of the HALOE measurements. In the present paper the authors therefore compare ozone loss estimated from HALOE with estimates from other in situ data, not affected by the enhanced aerosol.

Overall the paper is well written and I recommend publication in ACP providing that my

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comments below are adequately taken into account.

General comments:

The main result of this study is the finding that the ozone loss derived from HALOE observations agrees well with results using in-situ airborne and balloon-borne observations. This gives confidence that the calculated ozone loss (in particular at lower altitudes) is robust and not an artefact of the observations during periods of enhanced aerosol loading. However, the statement "we conclude the influence of large aerosol loadings on HALOE measurements is small ..." (p.10113, l.17) and similar statements earlier in the text is not well supported and should be better quantified if the authors want to make this rather general and important claim. Alternatively it may be better to resort to the statement that ozone loss calculated from HALOE measurements agrees within error bounds with results from in situ observations. Anyway, a more rigorous estimate of the errors for the calculated ozone loss would be appropriate to better support the main conclusions.

Specific comments:

p.10101, l.20: This is only true for the lower stratosphere in winter where photochemical lifetimes are long.

p.10103, l.7: Please give details which HALOE version was used.

p.10104, l.18: Can you give a few details how/why enhanced aerosol loading enhances the potential for chlorine activation?

p.10104, l.21: "major warming resulted in weaker, westerly zonal winds": for which altitude is this statement?

p.10106, l.1: (a) define PVU in terms of SI units. (b) Do you mean  $PI=29PVU$ , or  $P=29PVU$  at 475K?

p.10108, l.16: "It is shown that HALOE O<sub>3</sub> and CH<sub>4</sub> observations are reliable between

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350 and 700K." This seems to be a central point of this study. Can this statement be quantified?

p.10111, l.13: I found the description of how Cly and active chlorine is calculated a bit confusing. If I understand this correctly, first Cly is calculated from the correlation with CH<sub>4</sub> after Grooss et al. (2002) (taking into account the increase in Cly between 1992 and 2000.) and then the difference between this Cly (some people may call this Cly\*) and measured ClONO<sub>2</sub>+HCl is attributed to active chlorine. If this is correct, the first sentence (l.13-15) is wrong.

More fundamentally, as this is a rather indirect technique to estimate chlorine activation, this raises the question to what extent the MIPAS and LPMA observations are potentially affected by aerosols. Can you comment on this?

p.10112, l.9: "could lead to rapid ozone loss": I would say it "will" lead to rapid ozone loss.

p.10127-10129: I suggest to combine Figs. 9 to 11 into a single figure. Cly and active chlorine from Figs. 10 and 11 can be drawn into a single figure and by including a CH<sub>4</sub> scale as a second y-axis on the right hand side of the plot (in addition to potential temperature) Fig. 9 is redundant.

Technical corrections:

p.10098, l.7: insert "1991" after "December"

p.10099, l.26: change "PFP value that indicates" to "PFP value corresponding to"

p.10108, l.5: change "As for January, February observations" to "As for January, observations during February" if this is what you mean.

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