

# ***Interactive comment on “Multi-decadal Records of Stratospheric Composition and their Relationship to Stratospheric Circulation Change” by Anne R. Douglass et al.***

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Reply to Referee (Eric Ray)

Thank you for reading our paper and your positive assessment.

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We have addressed all of your comments

Pg. 1, line 17: The beginning of the AURA data record is stated as 2015 but I think you mean 2005. Yes we meant 2005, thank you for catching that. (fixed in the text)

Pg. 4, line 1: extra “the” done

Pg. 5, line 9: remove “data” before “column”, “from” is misspelled Done

Pg. 15, line 30: remove one “consistent” from the sentence The sentence is rewritten: The underestimate of simulated HNO<sub>3</sub> and HCl in the 1990s seen in Figure 6 is consistent with fewer elements in the age spectrum experiencing altitudes high enough for rapid destruction of source gases.

Pg. 22, line 4: should be “red dashed” This caption has been rewritten: Figure 1: The GMI CTM differences from the 1980 – 2015 mean for mean age (black), N<sub>2</sub>O (blue) and CH<sub>4</sub> (blue dashed) at 72 hPa for (a) 46°N and (b) 46°S. The GEOSCCM differences from the 1980 – 2015 mean for mean age (black), N<sub>2</sub>O (red) and CH<sub>4</sub> (red dashed) at 72 hPa for (c) 46°N and (d) 46°S. Trends calculated for successive 10 year periods at 72 hPa are shown for N<sub>2</sub>O (blue, GMI CTM; red GEOSCCM) and CH<sub>4</sub> (blue dashed, GMI CTM; red dashed GEOSCCM) at (e) 46°N and (f) 46°S. Tropical trends at 100 hPa (green, N<sub>2</sub>O; green dashed CH<sub>4</sub>) are shown in panel e). They are the same for both simulations and reflect the boundary conditions.

Figures 3 and 4: It took me a while to figure out why the mean ages between these figures look different. You should mention somewhere in the text and in the figure caption that the time interval of the plots is different and why.

In the discussion of Figure 3, the text includes “Prior to ~2000, growth of the HCl column and the HCl lower stratospheric mixing ratio was controlled by the rapid growth of the source gases.” and then goes on to discuss the next 15 years. A sentence has been added to the figure caption: The time interval begins in 2000 when the chlorine containing source gases have stopped increasing or begun to decline. The phrase

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“starting in 1993, about 18 months after the eruption of Mt. Pinatubo in reference to Figure 4 was added to the text.

A sentence has been added to the figure caption: The time interval begins in 1993, about 18 months after eruption of Mt. Pinatubo.

Just as a side note, I saw better agreement between the NH average mean ages from the tropical pipe model driven by observations vs. MERRA only after 2000 compared to before 2000, as shown in Figure 7 of the Ray et al., 2014 JGR paper. It’s nice to see consistency in that result to what is shown in this paper.

We also are happy to see this consistency. (no specific changes)

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