Response to Eric Ray

We thank the reviewer for the thorough read of our manuscript and careful consideration of our study. We particularly appreciate the point the reviewer makes on comparison of our new dataset with N_2O and SF_6 datasets in the prior literature, and after consideration, have added a comparison figure for the supplemental of our manuscript (see comment below). We also appreciate the technical corrections and believe this review has strengthened the manuscript, overall.

Here we detail changes made in our revised manuscript in order to address particular points for reviewer #1.

Pg. 1, line 25: I think you mean 0.04 ppt rather than ppb.

We have revised the manuscript to correct this typographic error.

Pg. 3, line 19-20: There are two more recent studies on the lifetime of SF_6 that should be included here since they both significantly reduce the estimated lifetime, Ray et al., JGR, 2016 and Kovacs et al., ACP, 2017.

We have revised the manuscript to use updated estimates of the SF_6 lifetime from Kovacs et al (2017) and Ray et al. (2017) addressing this comment and that of reviewer #1.

Pg. 6, line 12: Change 'provides' to 'provide'.

We have revised the manuscript to correct this typographic error.

Pg. 7, line 21: Even though it's apparent from the values of the concentration you should add 'N_2O of' before '301.5' since the figure includes both N_2O and SF_6.

We have revised the manuscript to change language to "N_2O mixing ratio of…".

Section 3.1: You mention comparable measurements and their locations in the text of this section but it would be easier to see this information in a figure. What would be useful is a plot of concentration vs. latitude at two different times, one at the beginning of your measurement time series and one at the end. By including all available surface measurements, it will be easy to see how many other measurements exist for each time and how it changed. Since the concentrations changed enough over the period of your measurements you could just color the two different times differently and they will fit on the same plot. The lack of measurements in the 1970s should be readily apparent from a plot of this type.

While we find adding raw data from prior studies makes Fig. 5 unnecessarily busy and detracts from this new contribution of Cape Meares data to the atmospheric community, we can see that a visual comparison of our results with prior work is useful in addition to the discussion we already have in the manuscript. Additionally, we note that much of the raw data for SF_6 previously published is not available through open access WDCGG (or other platforms). To address this, we have included a supplemental figure which compares regressed fits through the Cape Meares dataset with fits from other comparator sites in the literature. We hope this will help reader assess how this new dataset fits within historical published trends in N_2O and SF_6.

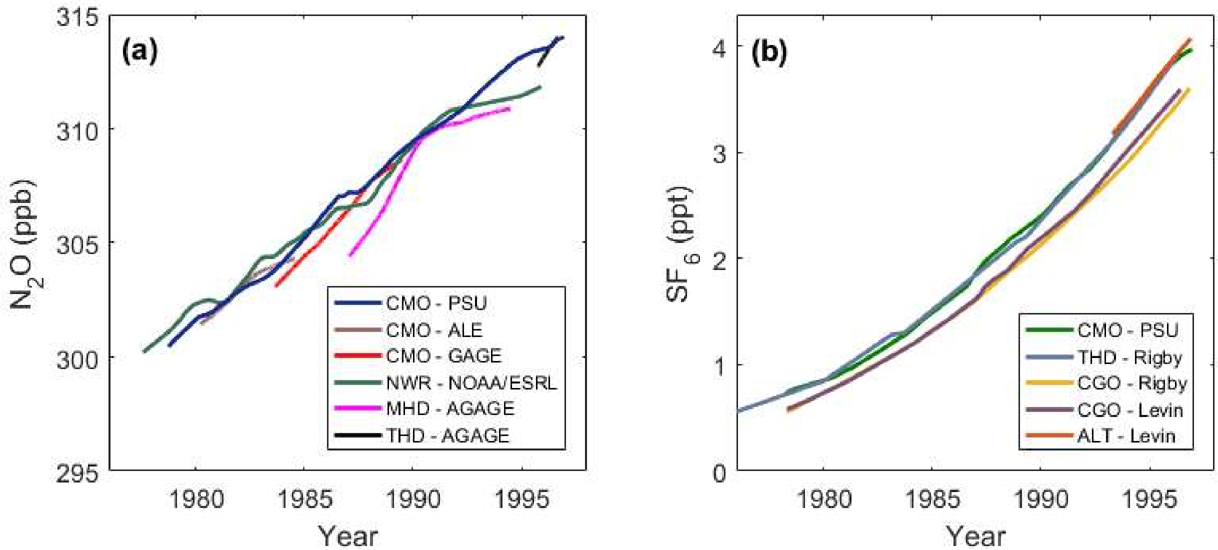

Figure S2. 3-year LOWESS regressions of measurements of mole fraction versus date of collection, N_2O (a) and SF_6 (b). Station codes: CMO = Cape Meares, Oregon, USA, NWR = Niwot Ridge, Colorado, USA, MHD = Mace Head, Ireland, THD = Trinidad Head, California, USA, CGO = Cape Grim, Tasmania, ALT = Alert, Canada. N_2O data sources: Atmospheric Lifetime Experiment (ALE, now AGAGE), Massachusetts Institute of Technology, Building 54-1312 Cambridge, MA 02139-2307, https://agage.mit.edu/; Global Atmospheric Gases Experiment (GAGE, now AGAGE), Massachusetts Institute of Technology, Building 54-1312 Cambridge, MA 02139-2307, https://agage.mit.edu/; National Oceanic and Atmospheric Association / Earth System Research Laboratory (NOAA/ESRL), 325 Broadway Boulder, CO 80305-3337, http://www.cmdl.noaa.gov/index.html; Advanced Global Atmospheric Gases Experiment Science Team (AGAGE), Massachusetts Institute of Technology, Building 54-1312 Cambridge, MA 02139-2307, https://agage.mit.edu/. N_2O data collected from World Data Center for Greenhouse Gases (WDCGG) https://gaw.kishou.go.jp/. SF_6 data is digitized from plots in Rigby et al. 2010 and Levin et al. 2010.

Pg. 10, lines 23-25: Also, seasonal transport from the stratosphere can influence SF_6 due to the high growth rates, especially in these early years. Growth rates of ~10%/yr means that stratospheric air with a mean age of 2 years will have ~20% lower concentrations compared to tropospheric values. For example, the seasonal cycle of CFCs have a minimum in the summer of each hemisphere due to the transport of relatively low concentrations due to photochemical destruction (e.g. Liang et al., JGR, 2008).

We thank the reviewer for this valid point and have updated the final paragraph of section 3.3 to address it specifically:

> *Seasonal transport from STE adds relatively depleted SF_6 air into the troposphere from the stratosphere. The seasonal phase of SF_6 observed at Cape Meares closely reflects seasonality phasing observed in CFCs in the northern hemisphere driven by STE (Liang et al. 2008). Modeling atmospheric transport effects on SF_6 at Cape Meares could help confirm amplitude and phase reported here.*