

Interactive comment on “Investigating stratospheric changes between 2009 and 2018 with aircraft, AirCores, and a global model focusing on CFC-11” by Johannes C. Laube et al.

Anonymous Referee #2

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This paper is very well written and well referenced. It makes important contributions to; 1) evaluating comparisons of halocarbon measurements from different sampling platforms over a 10 year period, 2) the use of halocarbon measurements to evaluate stratospheric dynamics in a global model using different meteorological reanalyses, and 3) exploring the use of model derived atmospheric dynamics to examine reasons for the reduction in CFC-11 global mixing ratio decreases.

Overall this paper is high quality and should be accepted after addressing the few suggestions noted below.

Line 41: The phrase “allow to gauge” is awkward and should be revised.

C1

Line 88: This is the first use of AoAs and it should be spelled out.

Line 90: Polynomial fit functions of what? I suggest adding in “of AoA vs mixing ratio of each species” or something like that.

Line 93: The bootstrap method isn’t explained fully in Laube et al., 2013 so I suggest including Volk et al., 1997 with the Laube et al., 2013 reference here. A bit more explanation would also be helpful.

Line 108: I suggest including a reference to Figures S5 and S6 here.

Line 112: I suggest referencing Table S2 for the measurement uncertainties.

Lines 114-115: The authors state here that Figure 1 illustrates improved temporal density from 2016, which it does, but goes on to say especially at altitudes above 15 km. There is no indication of altitude in Figure 1. As the authors mention, the lower values are from higher altitudes, but there is nothing that says what those altitudes are, and in fact, the values in Figure 1 are not from the highest altitudes. . . see next comment re Figure 1.

Figure 1: The mixing ratios for all compounds do not reflect the full range of the combined measurements. The full range for CFC-11 and CFC-12 are seen in Figure 2 and for the other compounds in Figures S1-S4. Please indicate in Figure 1 why this is the case.

Line 146: The authors state the MERRA-2 based data stands out producing higher transport times at similar stratospheric CFC-11 mixing ratios. It should read “higher mean ages”, rather than higher transport times. As the authors say in line 148, this results from slower transport times.

Line 176: I suggest including Figure S7 in the main text so the readers can see all four years rather than going to the Supplementary section for 2 of the 4 years.

Line 184: Please reference Figures S8-S13 for this discussion.

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S12 and S13 Figure captions should be MERRA-2 rather than JRA-55.

Line 217: 2.5 Mass flux estimates of CFC-11 (this labeled 2.4 in the text)

Figure 4: What are the “two corresponding time series of tropospheric CFC-11 mixing ratios”? The grey solid line represents the NOAA measurements but it’s not clear what the grey dashed line represents.

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