We thank the reviewer for their comments, which have improved the manuscript. Below we detail our responses to all comments in bold text.

Figure 1 (a, b) shows that the atmospheric abundance of HCFC-124 has always been greater in the northern hemisphere. At the same time, there are very few measurements in the southern hemisphere. Granted that most of the production is done in the northern hemisphere, it seems strange that this species never mixed completely in the atmosphere in 30 years. Could it be that a notorious lack of measurements in the southern hemisphere is introducing a bias in the calculation? Can authors offer some quantitative idea of how the global mean is affected by this aspect?
The continued interhemispheric difference is due to continued higher emissions in the Northern Hemisphere compared to the Southern Hemisphere. We have added the additional sentence at line 274 for clarity, *"Persistent higher mole fractions in the Northern Hemisphere are indicative of continued higher emissions in the Northern Hemisphere compared to the Southern Hemisphere."*

Authors conclude that HCFC-124 emissions have being increasing globally but the source region for excess emissions is not clear because emissions from Europe, US, and eastern Asia have not increased since 2015. However, looking at Figure 5, 6, and 7, this conclusion seems counterintuitive. Looking at the entire time of the trends presented in the figures, emissions have fallen consistently in Europe and the US, but they have increased in eastern Asia. Thus, it seems that one of the source regions of HCFC-124, precisely, is eastern Asia. Hence, there seems to be either an apparent contradiction or a tacit implication that the authors should clarify.
We have revised our language to make this clearer. In the discussion we now say *"Therefore, based on the emissions estimates in this work, emissions from East Asia are insufficient to explain the entire global increase in emissions prior to 2015, and cannot explain the increase since 2015."* We have changed the abstract to say *"Emissions of HCFC-124 from western Europe, the USA and East Asia have either fallen or not increased since 2015 and together cannot explain the entire increase in the derived global emissions of HCFC-124."*

The previous point is also evident if the figures in the paper are seen as a whole. According to the authors, emissions of HCFC-124 from the US dropped to almost half the amounts in 2015 (0.5 to 0.26 Gg yr-1). Emissions in Europe have dropped in line with phase out regulations. However, emissions of HCFC-124 from eastern China more than doubled in 15 years (0.2 to 0.45 Gg yr-1) and industrial regions are identified. It seems that the authors feel conservative at directly stating that eastern China is a source region. Could the authors comment on this?
We do not want to shy away from stating that China is a source region and have added the following at line 370 for clarity, "Emissions from eastern China are currently the largest of the regions studied and is therefore the largest known source region." However, as the remainder of the discussion in lines 380-388 express, our results show that emissions from eastern China are not solely responsible for the global

increase in emissions of HCFC-124 and cannot explain any of the global increase since 2016, given the uncertainties.

It would be beneficial to the paper and the readership that authors include a summary of the HCFC-125, HCFC-124, HCFC-123 inventories or reported values from every region and contrast the inversion model results with the reported values.
As we do not quantify regional emissions of HFC-125, we would not make this comparison in the text. We do not have independent bottom-up regional inventories of emissions of HCFC-123 and HCFC-124, with the exception of emissions of HCFC-124 from the US EPA. This is stated in the text already, "This estimate agrees with the bottom-up estimate by the US Environmental Protection Agency, who report that less than 500 tonnes of HCFC-124 (no exact value given) were emitted annually 2018-2022 (US EPA, 2024)". Given that no clear quantitative estimate is provided by the US EPA, further analyses are not possible.

The authors use inverse modeling to estimate emissions from source regions (Europe, US, and eastern Asia) for which they use a priori emission estimates. Did the authors consider using a priori values (even if arbitrary as done in this and other papers) to estimate/model potential emissions from other regions such as from Brazil in South America?
Given the lack of measurements in South America, we are unable to estimate emissions for this region.

Looking at the entire trend in Figure 3a, it shows a global decrease of HCFC-124 from 1997 until 2019, when authors indicate that emissions begin to increase again. In Figure 3b, HCFC-123 emissions have continuously increased for the same time period, although with greater uncertainty. In the past 5 years or so, the speed of increase of HCFC-123 seems to have decreased. If both are byproducts in the production of HCFC-125, how is it that only HCFC-124 generally decreased while HCFC-123 generally increased? Although the authors discuss uncertainties in HCFC-123 and acknowledge the different trends, it is not entirely clear/convincing why both trends are so different. The authors should better clarify this portion of the paper.
As you say, given the uncertainties in the derived emissions, it is very difficult to draw any quantitative conclusions about changes in emissions of HCFC-123 over time. We therefore choose not to discuss any apparent changes to the trend in the mean derived HCFC-123 emissions over time, beyond what is already included.
We acknowledge the differences in the historical emissions of HCFC-123 and HCFC-123 at line 324, "*The emissions trend of HCFC-123 since 1993 is uncertain and does not appear to follow that of HCFC-124, perhaps due to their different dispersive uses prior to their phase-down.*"

Also, with respect to Figure 3a, since 2019 HCFC-124 emissions seem to go up again, which
authors point to in the text. However, there are many bumps just like that (or bigger) in previous years in the entire trend and yet as a whole the trend is negative since about 99.

Could it be that this “bump” is similar to the previous ones and the trend could still be negative overall?

This is an important point that we had not discussed. We have added the following to the Discussion:

“The global mean emissions of both HCFC-123 and HCFC-124 have large interannual variability between some years. For HCFC-124, the increase after 2019 is of similar magnitude to the interannual variability in some years, particularly using the NOAA record. This may be due to random errors in the estimation procedure or changes in the atmospheric sink and other dynamic effects not considered in the global box model. For HCFC-124, we believe that the increase in emissions after 2019 is genuine, given that the increase in emissions is driven by a slowing in the decline of the background atmospheric abundances, which are measured directly and precisely, and the global mean is subject to less uncertainty than the derived global emissions. The result is also robust between the independent NOAA and AGAGE networks in both the abundance trends and emissions. If this impact was due to dynamical or loss related changes, this change would be apparent in other atmospheric compounds with loss process dominated by the hydroxyl radical.”

The authors recognize that the global increase in HCFC-123 and 124 emissions does not currently represent a threat to the ozone layer recovery, but they present the important implication of whether other ODS or GHG could be emitted (or are being presently emitted) as intermediates from the production processes of fluorochemicals. This perspective is eye-opening. Could the authors offer some more discussion on potential substances or industrial processes that should be investigated more closely?

We do not have recommendations for potential substances or industrial processes that should be investigated more closely beyond those already discussed in the scientific literature, which we discuss in the introduction, *“Various other CFCs and HCFCs have had persistent, or increasing, emissions (Adcock et al., 2018; Lickley et al., 2020; Vollmer et al., 2021, 2018; Western et al., 2023). The increase in the emissions of these CFCs and HCFCs has largely been attributed to their involvement in the production of other chemicals, most notably hydrofluorocarbons (HFCs) (Adcock et al., 2018; Kloss et al., 2014; Vollmer et al., 2015, 2018, 2021; Western et al., 2023), which is allowed under the Montreal Protocol.”*