Response to comments from RC2 posted on 21 Nov 2021:

We appreciate the reviewer for reviewing our manuscript and bringing up his/her invaluable perspectives to this work. We made necessary modifications according to some of the suggestions. Below describes our line-by-line response for each comment.

This study analyzed the atmospheric CFC-11 measurements from two global aircraft surveys - the HIPPO (2009-2011) and Atom (2016-2018) campaigns, to estimate regional scale CFC-11 emissions and the emission changes between two campaign periods. The manuscript demonstrates how a well-designed aircraft measurement can be used to constrain regional emissions estimates.

Overall, the writing and figures are clear, and the methodology maximizes the functionality of high-quality datasets. I encourage the publication of this important work, with only a few minor considerations suggested below.

General comments

1. Global emissions: authors provided their estimates of global CFC-11 emissions for 2009-2011 and 2016-2018 periods in table 1. They were very briefly mentioned in lines 351-355. Authors need to describe more in details how they were determined, which datasets were used for the analysis, and how well consistent they were with the estimates from other studies.

Response: We have used the entire Section 2 to describe how we derived the global and continental emissions from our inversion methods. Section 2.2.1 described the atmospheric datasets that were used for the inversions. Our global estimates agree with other studies (Montzka et al., 2018 and 2021). But they are not completely independent of other estimates because we intentionally chose background thresholds to yield global estimates that are consistent with other studies. Although the inversely derived global emission magnitudes were sensitive to the choice of the background threshold, the relative regional emission distribution or the fraction of regional emissions to the global emission was not. This was all described in Section 2.2.3. No changes were made regarding this comment.

2. Data selection: authors stated that the data included most of the aircraft profiling sampling below 8km. Then does it mean that the HYSPLIT model used to simulate footprint for inversion was also run from the surface boundary layer up to the 8-km altitude? How were the uncertainties associated with the HYSPLIT model analysis analyzed?

Response: In our HYSPLIT configuration, we allowed the particles to travel between 0 – 20 km above sea level. The surface sensitivity was only computed based on the particle density within the planetary boundary layer. The uncertainties associated with HYSPLIT transport simulations were accounted for in the model-data mismatch parameter or the R matrix,

which was calculated from the maximum likelihood estimation using atmospheric observations.

3. Prior emissions: since CFC-11 is an anthropogenic compound, it is reasonable to take population density-based distributions of the global CFC-11 emissions of 67 Gg/yr as prior emissions. But as a base case, authors may need to consider including area-based distributions.

Response: We distributed the global total emission, 67 Gg/yr, based on a global 1^{o} x 1^{o} gridded population density product, which is an area-based product and has a unit of persons per m^2. We can not think of another area-based product that is more relevant to this CFC-11 problem.

4. 6-8: it was stated that the error bars for the emissions changes between the HIPPO and ATom periods were calculated from the sum of 2ð errors derived for the HIPPO and ATom inversions. But propagated errors from a subtraction can be determined by the square root of the sum of the squares of each error. So, the errors shown in the lowest panels of Figs. 6-8 might be overestimated.

Response: Thanks for pointing this out. We actually calculated the error as the square root of the sum squares of each error in the upper and middle panels. The caption for Fig. 6 – 8 was incorrect. We fixed the captions now.