

## ***Interactive comment on “Toward resolving the mysterious budget discrepancy of ozone-depleting CCl<sub>4</sub>: An analysis of top-down emissions from China” by Sunyoung Park et al.***

### **Anonymous Referee #1**

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**Paper Summary:** This paper uses observations from the Korean Gosan station to identify the location of CCl<sub>4</sub> sources and the specific industrial processes involved with the CCl<sub>4</sub> emissions. There are two basic techniques used to analyze these data. First, trajectories are used in a source/receptor analysis technique to identify the CCl<sub>4</sub> emission locations. The major sources originate in Eastern China. Second, a positive matrix factorization (PMF) analysis technique is used to fingerprint the specific sources of CCl<sub>4</sub>. This analysis reveals that the emissions are primarily from chloromethane production (CH<sub>3</sub>Cl), perchloroethylene production, and fugitive emissions from feedstock usages. These estimates are larger than those from the SPARC CCl<sub>4</sub> report, with the fugitive emissions being 10x larger than SPARC!

C1

**Review Summary:** This is an excellent paper that NEEDS to be published. My overall comments are with regard to improving the writing in the paper and some of the structure.

#### **Paper Suggestions:**

While the paper mentions the SPARC (2016) CCl<sub>4</sub> report, there ought to be more discussion of how this paper seems to resolve the discrepancy between their emissions based upon measurements. SPARC had a top-down emissions calculation of  $40 \pm 15$  Gg/y, a hemispheric gradient method of  $30 \pm 5$  Gg/y, and a regional emission estimates of  $21.4 \pm 7.5$  Gg/y. The SPARC regional 21.4 Gg/y had a 15 Gg/y contribution from China. The higher estimate herein of 24 Gg/y from China would bring this 21.4 SPARC number up to 30 Gg/y - in precise agreement with the gradient method and within the uncertainties of the 40 Gg/y top down estimate.

The discussion in the summary of the CCl<sub>4</sub> sources should be broken out with more definitive statements. The SPARC report used industrial estimates to characterize potential sources [Sherry et al., 2016], and this paper provides the **“first observational basis”** for these sources, but this paper also makes the case that Sherry et al. is perhaps too conservative in their estimates.

The paper is fairly well written, but many of the current paragraphs need to be broken up into more distinct sections or primary thoughts. The extended paragraphs of the current version obscure the thoughts, logic of the paper, and the overall content of the text. For example, the 2nd para of the Introduction (P2, 4-30) talks about top down emissions, bottom up emissions, . . . I would break this up into paras on: 1) top down emissions (4-12); 2) a SPARC bottom up para (12-16); and 3) a discussion of regional emissions.

In the 1st para of section 3 (P. 4 line 18 to P.5 line 32 - 46 lines!), there are a broad range of paragraph thoughts. The paragraph starts with a discuss of the interspecies correlation and ends with a thought on an underestimate of Chinese emissions. Please

C2

break this up to improve the flow of the text.

The "Data Overview" section both discusses the data and shows results. I would re-structure sections 2 and 3 into: a data, methods, and results sections. The Supporting Information ought to flow better into these data and methods sections.

Again, break up the single paragraph of the conclusions into short paragraphs. The main messages are lost in this "run-on" paragraph.

Figures are good. For Fig. 4, put some vertical lines on the plot to see how the bars line up with chemical names at the bottom.

Fig. S5. What are the colors for? Do they indicate statistical significance?

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