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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropospheric observations of CFC-114 and CFC-114a with a focus on long-term trends and emissions" *by* Johannes C. Laube et al.

Anonymous Referee #3

Received and published: 7 September 2016

General Comments:

This manuscript discusses recent measurements of chlorofluorocarbons CFC-114 and CFC-114a in the atmosphere. The paper fills a gap in the knowledge of these ozone depleting substances concerning the relative abundance of each gas. The paper covers the recent atmosphere as well as atmospheric history going back to the early use of these chemicals, and will be useful in future Ozone Assessment reports. The paper is well-written and comprehensive. I have no problem with the scientific methods or conclusion reached by the authors.

Specific Comments:

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Discussion paper

Pg. 2, Line 18: Consider using “phase out” in place of “ban”. (minor)

Pg. 2, Line 18: Even though you define consumption = production + imports – exports, and the MP does list control in terms of consumption in many cases, it is more general to say that the MP regulates “production and consumption”. This would then be consistent with the statement on pg 2, line 26.

Pg. 2, Line 20: Suggest “has started to decline” in place of “started to reduce”

Pg. 5, Line 5: Is this column commercially available? If so, please tell us where you purchased it.

Pg. 5, Line 25: It seems that Laube et al 2010 offers the best description of the dilution method. I think Laube et al 2012 should be Laube et al 2010.

Pg. 6, Line 6: Consider using “mole (mass)” in line 6, since it is used in line 7.

Pg. 7, Line 17: The sentence “The recommended values . . .” is missing something.

Pg. 7, Line 21: I believe that Carpenter and Reimann adopted lifetimes based on SPARC (2013), so it would suffice to use SPARC (2013) as the reference for the 100 and 189 lifetimes.

Pg. 7, Line 5: Not really a complaint, just an observation: You used a relatively sophisticated model, and yet the model is driven largely by data from one site (Cape Grim) or firn air (a smoothed record), and UV absorption data needed to be highly tuned using the parameter F to achieve the recommended total lifetimes. It seems a simple model might suffice given the limited data. I suppose you used a model that was readily available.

Pg. 8, Line 11: Not quire sure what is meant by “early day”

Pg. 8, Line 20: Suggest “. . . ratios below 4%”. Given the uncertainties, anything below 4% is clearly not well known.

Pg. 9, Line 10: In, “These two facts imply that increasingly higher emissions of CFC-114a would be needed to sustain increases in mixing ratios above those of CFC-114. “ Do you mean that higher emissions of CFC-114a would be required to sustain the observed growth rate of CFC-114a? The mixing ratio of CFC-114a was never higher than that of CFC-114, so I’m not sure what you mean here.

Pg. 9, Line 16: Carpenter and Reimann (2014) state that the assumption of 10% relates to the abundance of CFC-114a relative to CFC-114, based on measurements from 1990. Please provide a reference for the "current" assumption that the emissions fraction is 10%.

Pg. 10 Line 11: Suggest “AFEAS data, which suggests rapidly increasing emissions to more than 5 Gg/year in the late 1940s, are inconsistent with our emissions estimates.”

Pg 10, Line 12: Suggest “Emission rates above 5 Gg/yr, suggested by AFEAS, are unlikely to have occurred before the mid-1950’s. . ...”

Pg 12, Line 21: I can’t find GWP(100)=8490 in Carpenter and Reimann (2014). In the 2014 Ozone Assessment, GWPs were listed in Chapter 5 (Harris and Wuebbles), where I see CFC-114 listed as 8530.

Figure 3 caption: The caption should read: “Global emissions of CFC-114 and CFC-114a derived from Cape Grim observations (solid lines), with uncertainties represented by dashed lines. The dotted lines represent emissions derived purely from firn air data.”

Figure S1: I don’t know what “scen” means on the titles of the two left-most figures.

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