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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global and regional emissions estimates of 1,1-difluoroethane (HFC-152a, CH_3CHF_2) from in situ and air archive observations" *by* P. G. Simmonds et al.

Anonymous Referee #1

Received and published: 21 September 2015

General comments

English language editing recommended, especially for punctuation and articles.

The organisation of the paper could be improved. Example, some description of the method is given in the Results section while this should go in section 3 (see specific comments).

Some information on the method is missing, specifically, details on the uncertainty estimates for the inversions, and also how the posterior uncertainties were calculated.

In the Discussion section (section 5) it is sometimes unclear which method is being

discussed (see specific comments).

I suggest that the authors include a paragraph (possibly at the end of the discussion) placing their results in the wider context of anthropogenic emissions of greenhouse gases, specifically halocarbon species. Example, based on their results, how important is the contribution of HFC-152a to radiative forcing by halocarbons?

Specific comments

P21337, L1-6: This is a very long sentence and is difficult to follow. I recommend splitting it into two sentences, starting with the fact that HFC-152a growth rate has been determined from observations, and the required emissions to explain this growth rate have been estimated. Then give details of the measurement sites etc.

P21337, L12: It would be helpful to specify the approximate lifetime of HFC-152a in abstract.

P21337, L25-26: Could the authors please quantify "a significant underestimate" referring to the estimate of the UNFCCC?

P21339, L4: By "centred on Germany" it is not clear what is meant – was the study centred on Germany or were the emissions centred in Germany. Could the authors please rephrase this sentence more clearly.

P21341, L24: Since when are archived samples available and used in this study? Please add this information here.

P21342, L19: This sounds a bit circular: baselines were calculated by removing above baseline enhancements. Please see my comment below.

P21342, L21-22: It would be helpful to add a brief description of this algorithm here, especially of the identification criteria used for selecting baseline data (for details it is of course fine to refer the reader to the two references).

P21343, L27: Appears to be one height missing.

P21344, L2: Over what period were the emissions estimated?

P21344, L5-6: Please include what these uncertainties were. Was any additional uncertainty (that is in addition to the measurement uncertainty) used for the observations to account for the uncertainty in the baseline determination?

P21344, section 3.2: Again, please include information on the uncertainties that were used in the inversion. Were the full observations assimilated in this inversion model? I presume so, since a high resolution transport model was used, however, this should be stated.

P21345, section 3.3: Again, please include information on the uncertainties and specify for what period the emissions were estimated.

P21345, section 3.4: And again, please include information on the uncertainties and the period for which the emissions were estimated.

P21346, section 3.5: It seems surprising that either CO or fossil fuel CO2 would be good proxies for HFC emissions in general, since these species are not co-emitted and the source sectors are also quite different. Is CO or fossil fuel CO2 a better proxy than simply economic activity?

P21348, L19-20. How do the simulated concentrations compare to the observed ones?

Figure 6: Are the points observations – if so which sites? Please add this information to the caption.

P21349, L6: It would be helpful to specify that this section discusses the results from the inversion using the 12-box model.

Figure 9: What do the cyan coloured bars indicate and how was the uncertainty on the inventory estimates (red error bars) calculated?

P21352, L10-24: This information should go in the methods description in section 3.4.

P21354, L21: Which species were used as the reference in the study of Liu et al. (2011)?

P21355, L4-5: The authors state that the enhancements above baseline were used to estimate the emissions, but the method used is not stated.

P21355, L20-21: Are these the estimates from this study?

P21356, L8-9: In the comparison of the contribution of Australian emissions to the world total, with respect to other regions contributions, is the population difference and GNP taken into account? Australia is much less populated the Europe, East Asia and North America. Also, I question the reliability of using CO emission as a proxy for HFC-152a emission, considering that the emission sources are quite different for these species. Another consideration is how well the CGO observations constrain the Australian emissions. The uncertainties given for the InTEM method appear to be quite small (order of 2 Mg), how were these uncertainties calculated?

Technical comments

P21337, L10: Arguably, HFC-152a does not “exhibit” a growth rate but its concentration has grown at a substantial rate.

P21337, L11: Please change “annualised” to “annual” (and in all instances)

P21338, L17: Suggest replacing “Recent papers” by e.g. “Previous papers” as some of the studies listed are not that recent, i.e., up 8 years old.

P21339, L4-5: “. . .estimated an average. . .” and “for 1995-1998”

P21339, L8: “. . .estimated a European emission. . .” and “for 2000-2012”

P21339, L19: By “through 2014” do the authors mean “up to and including 2014”? Please revise the use of “through”.

P21339, L22: “. . .determine HFC-152a emissions on. . .” or “. . .estimate HFC-152a

emissions on. . .”

P21346, L25: Please add a comma after “baseline” and then “and these are”

P21348, L7: Please add “respectively” to the

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