

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2021-261

Anonymous Referee #2

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Referee comment on "Evidence of a recent decline in UK emissions of hydrofluorocarbons determined by the InTEM inverse model and atmospheric measurements" by Alistair J. Manning et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-261-RC2>, 2021

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Comments on: Evidence of a recent decline in UK emissions of HFCs determined by the InTEM inverse model and atmospheric measurements, Manning et al., 2021, <https://doi.org/10.5194/acp-2021-261>

The manuscript assesses the emissions rate of HFCs from the UK through a top down approach. The inversion method is based on the Numerical Atmospheric dispersion Modelling Environment (NAME) model in conjunction with measurement observations and the Inversion Technique for Emissions Modelling (InTEM) model system. The inverse modelling results point out a decreasing trend of the aggregated HFCs emissions since 2018, in response to the UK implementation of European Union regulation of those gasses emissions. Moreover, the aggregated HFCs emissions calculated are significantly lower (73%) than those reported from the UK to National Greenhouse Gas Inventories (GHGI) and submitted annually to the United Nations Framework Convention on Climate Change (UNFCCC).

General comments

This work is well written, and it is very much appreciated.

Few general comments :

- On page 4 line 98, Does the Carnsore Point, Taunus and Tacolneston measurement data have different calibration scales compared to Mace Head and the two mountain stations ? If the authors provided the intercalibration between those scales it could be

interesting to show it on Table 2.

- It could be useful add more information about the Carnsore Point, Taunus and Tacolneston measurement stations (e.g. sub urban, rural or remote).
- On page 4 line 98, "which greatly enhances the ability..." As you do not show any test that proves it, I would suggest rephrasing it or report some specific test (on Supplementary Material S.M.) that proves how those stations improved the inversion performance.
- As the Taunus station is located in the center of Germany, and it has only 1 weekly measurement, does it really greatly improve the ability of the inversion system for the UK?
- Are the two mountain stations affected by HFCs UK sources ? If not, why did you use them on your inversion system ?
- Did you run the inversions for the central Europe (Fig 1) or only for UK and IE (fig 6) ? I think showing (in fig 1) the European domain as the inversion model domain, but then reporting emission values only for the UK and Ireland (Fig 6) could generate confusion. Unless, you better explain this approach
- On page 5 line 135 , If I well understand the system, using the passive tracer over 30 days of the simulations, it should imply an underprediction of ~5% of the HFC-152a estimates. If so, you shuld mention it.
- On pag 6 line 140, I agree with referee 1, could you please describe the updates on InTem system?
- On page 9 line 204. "when the population under the surface footprint is small", Did you use the same threshold value used for MHD ?

Specific comments:

- On page 4 line 103, I think you could introduce the Site Acronym, and then use them from this point on.
- On pag 12 paragraph 3.1 I think in this paragraph you should report more quantitative analysis of the main important trends described, instead of qualitative indication .
- On page 12 paragraph 3.1 I think it could be useful to show (on S.M.) the plot of the three baseline data and also the MHD baseline data overlapping the observed time-series of TAC, CSP and TOB.
- On page 18 315 "increase rapidly" please report the value of it.
- On page 18 334 "accelerating rate" please report the value of acceleration or trend.
- On page 19 3.6 HFC-227ea "It is also likely to be less tied to population distribution because of its specialist uses" In this case why did you not use a uniform land-based prior as for HFC-23?
- On page 19 348 "HFC-227ea decline markedly from 2018 to 2020" please report the value to indicate it
- I agree with referee 1, a few times the authors use "background" but it seems they rather refer to "baseline". See below the difference and the definition of both words: "Baseline concentrations refer to observations made at a site when it is not influenced by recent, locally emitted or produced anthropogenic pollution. The term global or hemispheric background concentration is a model construct that estimates the atmospheric concentration of a pollutant due to natural sources only." References: HTAP, T., 2010. Hemispheric Transport of Air Pollution 2010 Part A: Ozone And Particulate Matter, Air Pollution Studies No. 17. Cooper, O. R., Parrish, D. D., Ziemke, J., Cupeiro, M., Galbally, I. E., Gilge, S., ... & Oltmans, S. J. (2014).
- On page 2 Table 2 of Supplementary Material. Do the 1 yr inversion correlation values are similar to those ? For clarity, if so, just mention it on the paper or report the Table

of 1 yr inversion correlation values.

- On page 6 line 19 of S. M. . " a significant decline " please report a value of significant decline
- On page 6 line 33 of S.M. " sharp decline from 2017 to 2020" I would suggest to report the value of the sharp decline
- On page 7 of S.M. "small rise".. "dropping sharply" I suggest corroborating these descriptions with quantitative values.