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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The increasing atmospheric burden of the greenhouse gas sulfur hexafluoride (SF_6)" *by* Peter G. Simmonds et al.

Anonymous Referee #1

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This manuscript bring together SF6 data since 1978 to present (2018) and discusses the global total and regional emissions based on inversion modelling tools. The research topic is relevant and executed nicely. I have enjoyed reading the manuscript which is prepared in a timely manner. I have a few comments for consideration by the authors, before the manuscript can be accepted for publication. I reallly want the authors to explain the anomalies seen the time series of global growth rates, global total emissions and emission from China.

Specific comments:

Should you add at the end of the first para in Abstract: "and demands in the Annex 1 countries"? I think it is becoming clear that the manufacturing is moving from the Annex 1 countries to the non-Annex 1 contries, and that is the main reason for the fast

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rise in power grid development, say in China. Should consumer countries take some part of the responsibility?

lines 78-88: Jochen Harnisch also did some good work using SF6 from Hyderabad and NH high latitudes. May be cited here with a context SF6 loss are likely to quite fast in the high latitudes (Harnish et al., GRL, 1996). More recently Patra et al. (SOLA, 2018) have clearly shown that indeed the SF6 loss in the stratosphere and mesosphere is troublesome, by comparing with model simulations and CO2 profiles. How much will the stratospheric/mesopheric loss affect the global total budget calculatin of SF6 is relevant for this discussion. Hopefully this will be addressed in the future.

lines 126-127: What about Lovelock's work?

line 378: Are the table numbering in Sequence? please confirm.

Figure 1 & 2 and associated text: The change in growth rate during ∼1995-2000 should be discussed, even if it is well known. Several aspects need attention: Quality of data continuity, inversion differences, EDGAR vs inversion differences.

How does the global total numbers compares with other studies, e.g., TransCom-AoA (Krol et al., 2018). Although they did not run an explicit inversion, their simulations are consistent with global mean SF6 growth rates, and should be comparable here. Such a comparison may help establishing a consistency between the 12-box model and 3-D global models

line 430: Is there a reference for this? Why has this to be from the SH but not from Southern areas of Pacific?

Figure 4 and associated discussion: y-axis units - Gg/yr?

The results of Zhou et al. (2018) is likely impossible given that the global emissions are in the range of ∼8 Gg/yr.

How do you explain hump you get by InTEM T-D? The limitations of inverse modelling,

if any, should be addressed otherwise.

How is this (hump) consistent with your global total results in Fig. 2

line 580-583: Interesting twist to the stories of the renewables. Is there are good reason not to have a better Switches for the green tech power distribution?

Figure 8 and discussions: Apparently, you are trying to explain the faster increase in recent SF6 emission increase by the smaller electricity facilities. How many times more leaks the Wind and Solar power grids should have to explain the sharp rise in emissions since the 2000s? Noting that the electrical equipments remain functional for 30-40 years, the installations since 2000 must be working fine even today for Wind and Solar installations.

lines 635-638: Is this because there is some international standard in making the GIS - most are equally good? In principle it is hard to believe the new installation of worst quality than those in the Annex-1 countries only offset, not vastly exceed the emission reductions in Europe and USA.

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