

Interactive comment on “Extending methane profiles from aircraft into the stratosphere for satellite total column validation: A comparative analysis of different data sources” by Shreeya Verma et al.

Anonymous Referee #1

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The study is well written and addresses an important topic that falls under the scope of ACP. I advice to publish this paper after major revisions.

The study uses the ECMWF C-IFS and TOMCAT/SLIMCAT 3D models for the extension of MOZAIC/IAGOS airborne CH₄ profiles into the stratosphere. This is required to calculate more accurate vertical column densities that fulfill the precision and accuracy demands of modern satellite missions. An exemplary comparison with MOPITT and ACE-FTS CH₄ vertical columns is performed.

The title of the paper states that the study performs a comparative analysis of different

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data sources, however this is missing in the manuscript. More precisely, section 3.3 about climatology based approaches is again only an application of the ECMWF C-IFS and TOMCAT/SLIMCAT model for different spatial and temporal samplings and section 3.4 about satellite a priori profiles is much too short with 7 lines to justify this title.

Major changes:

- I suggest to change the title of the work to "Extending methane profiles from aircraft into the stratosphere for satellite total column validation using the ECMWF C-IFS and TOMCAT/SLIMCAT 3D model."

- p3,l20 - p4,l1-12: This text fragment is strongly overlapping with the following section 2. Please shorten this part and remove the information repeated in section 2.

- p9,l36 -p10,l3: It is not clear how this bias correction is actually done. This text fragment must be improved or removed together with figure 12.

- p8,l35-l36: It is crucial to show that this bias is constant for other seasons of the year. Hence, this must be discussed in more detail (plots, statistics)

- p18, table 1: I don't get how the GOSAT a-priori profile can outperform the mmc-IFS@MIPAS for the variability and mmc-IFS@ACE-FTS for mean bias and variability and even reaches the same performance as the mmC-IFS case. What does that mean? Can you comment on that?

- figure 8: I think figure 8 and the related discussion in the text would be more meaningful when considering the stratospheric partial column instead of only one level at 10 hPa.

Minor changes:

- p1, l34-l38 please name here further satellite missions that are aiming on CH4 and CO2 vertical column measurements and not only GOSAT.

- The panels (a), (b) from figure 6,7,8,9 can be removed the difference to the reference

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is shown so absolute values are redundant information.

- figure 5 can be removed, the information content is too low and is already described in the text.

- I would like to see figure 1,2 in the unit molec/cm² this would allow to relate the partial columns to the total column.

- figure 4 must be improved. The most interesting latitude range 30 - 55 degree is covered by the other data and cannot be seen in this representation.

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