

Interactive comment on “Methane retrieved from TROPOMI: improvement of the data product and validation of the first two years of measurements” by Alba Lorente et al.

Anonymous Referee #1

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Manuscript “Methane retrieved from TROPOMI: improvement of the data product and validation of the first two years of measurements”, submitted by Lorente et al. for publication in Atmos. Meas. Tech. describes retrieval algorithm improvements and related investigations carried out to generate an improved operational TROPOMI XCH₄ data product in the future. The paper covers a topic relevant for Atmos. Meas. Tech. and it very well written. I recommend publication after the comments listed below have been considered by the authors.

Specific comments:

Abstract:

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Page 1, line 2: I recommend to add “and sampling” after “spatial resolution” as TROPOMI has a similar spatial resolution as GOSAT but much denser spatial sampling.

Page 1, line 5: “The updated TROPOMI CH₄ product ...”: If possible, please add version number. Does this product exist, i.e., is it available for interested users? If not, then please write “The updated TROPOMI CH₄ retrieval algorithm ...”.

Introduction:

Page 2, line 24: Barre et al., 2020: Missing in section “References”. Please add. Please add that there is (at least) one other product as described in Schneising et al., 2019, and Schneising et al., 2020. These publications need to be cited (see References below) and the results shown in Schneising et al., 2020, need to be mentioned, especially those related to the Permian basin (see line 22).

Section 2.1:

Page 4, line 15, and Eq. (4): Instrument noise is not the only contributor to “XCH₄ random errors”, i.e., precision, as also other instrumental (e.g., inhomogeneous scene illumination) and retrieval errors (e.g., unconsidered variability of albedo and aerosols) may contribute. I suggest to add this limitation or, alternative, state that Eq. (4) is the definition of precision as used for this manuscript.

Page 4, line 21: “In cases when VIIRS data is not available, we use a back-up ...”: Does this happen? If yes, I would expect that this results in inconsistencies. Please add more information.

Page 4, line 27 following: “This updated retrieval algorithm is referred to as the beta-version of the TROPOMI XCH₄ data product.” Sentence not OK. An algorithm is not a data product.

Section 2.2:

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Below Tab. 1: “*For the Lauder station the II instrument was replaced on October 2018 to II”. II replaced by II?

Page 5, line 9: If the TROPOMI data are averaged daily then I assume that the TROPOMI XCH4 averaging kernels have not been considered for the validation. Please add more info on this aspect.

Section 2.3:

Page 6, line 17: “both retrievals performed similarly”: With respect to what? Likely not w.r.t. yield as number of data points in proxy product is much higher. Please refine the statement.

Section 3.1:

Page 7, line 4: “and that retrieved aerosol parameters have realistic distributions”. This is a strong (but unproven) statement. It needs to be shown in this paper that this is true.

Page 7, line 12: “19.7 ppb to 24.5 ppb”: What does this mean? Is it a min to max range?

Section 3.2:

Concerning: Page 8, 6-7: “we have decided to use the SEOM-IAS spectroscopy database.” I am not convinced. Was this a “political” decision? I conclude from Tab. 2 that HITRAN 2008 (used so far) is better. Is a slightly better fit quality (which can have many reasons in addition to spectroscopy) really a good argument if bias and scatter are getting larger?

Section 3.4:

Is this bias correction for albedo really new? As far as I know, the current operational XCH4 product already offers a bias corrected product. Please clarify.

Section 3.4:

Page 12, line 3: surface albedo “As”: Is this the SWIR albedo? How is the NIR albedo considered?

Section 4.2:

Tab. 3: Add explanation for numbers in brackets. Is this 1-sigma uncertainty?

Typos etc.:

Page 22, line 4; page 23, . . . , and possibly other places: CH₄: The number 4 must be set low.

References:

Schneising, O., Buchwitz, M., Reuter, M., Bovensmann, H., Burrows, J. P., Borsdorff, T., Deutscher, N. M., Feist, D. G., Griffith, D. W. T., Hase, F., Hermans, C., Iraci, L. T., Kivi, R., Landgraf, J., Morino, I., Notholt, J., Petri, C., Pollard, D. F., Roche, S., Shiomi, K., Strong, K., Sussmann, R., Velazco, V. A., Warneke, T., and Wunch, D.: A scientific algorithm to simultaneously retrieve carbon monoxide and methane from TROPOMI onboard Sentinel-5 Precursor, *Atmos. Meas. Tech.*, 12, 6771-6802, <https://doi.org/10.5194/amt-12-6771-2019>, <https://doi.org/10.5194/amt-12-6771-2019>, 2019.

Schneising, O., Buchwitz, M., Reuter, M., Vanselow, S., Bovensmann, H., and Burrows, J. P.: Remote sensing of methane leakage from natural gas and petroleum systems revisited, *Atmos. Chem. Phys.*, 20, 9169-9182, <https://doi.org/10.5194/acp-20-9169-2020>, 2020.

Interactive comment on *Atmos. Meas. Tech. Discuss.*, doi:10.5194/amt-2020-281, 2020.