

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2022-255

Anonymous Referee #1

Referee comment on "Accounting for surface reflectance spectral features in TROPOMI methane retrievals" by Alba Lorente et al., Atmos. Meas. Tech. Discuss.,
<https://doi.org/10.5194/amt-2022-255-RC1>, 2022

General comments:

The manuscript presents the improvement in TROPOMI's methane product retrieval to tackle the effect of surface artifacts that produce anomalous retrieval values and are especially dangerous in areas with potential real methane emissions. To address the effect, the author applies a third-order polynomial in those areas with anomalous retrievals. The result is compared with the retrieval obtained from the second-order polynomial, demonstrating that the effect of the artifacts can be successfully corrected. As a routine method, the authors present the results of the validation of the retrieval obtained with the third-order polynomial.

The results presented in this manuscript are timely and highly relevant, given the importance of TROPOMI data for detecting global methane emission hot spots and sporadic ultra-emissions. The correction of anomalous values produced by surface artifacts should be applied as soon as possible to make the global methane data more accurate and to operate efficiently as soon as possible.

The paper presented here is a high-quality, clear, and well-written document. However, some minor issues need to be clarified.

Specific comments:

Lines 83-84 and in results in general: throughout the text, it is emphasized that the second-order polynomial is optimal for most surfaces, and the third-order polynomial is optimal for areas with surface artifacts even though it shows no improvement in the rest of the surfaces. After reading the text, it is not clear to me if, from now on, the operational product is the TROPOMI data processed fully with the third-order polynomial, if it is a combination of both polynomials depending on the area, or if the operational product is the data processed with the second-order polynomial and the third-order polynomial is provided separately but is not considered for the official product.

Lines 115-116: The authors point out that, in the case of Algeria, the effects do not occur in the major field of the country. However, in Figure 3, the effect of surface artifacts can be seen in the Hassi R'Mel field, west of the image, or the Illizi basin, south of the image (only the northern part of the basin is seen in the image, but the same type of surface extends over several kilometers). In these areas, the O&G production is high, and, for example, Lauvaux et al. 2022 reported ultra-emissions detected with TROPOMI in these areas. Does this imply that the quantified emissions in these areas may have erroneous estimates?

If so, in the same way that the authors mention confidence in the data from the major field in Algeria, it would be convenient to also warn about the danger in the rest of the areas affected by the artifacts.

Figure 3: I suggest adding a label on the left of each row indicating the country or region that is being represented. This is already indicated in the image caption, but I think adding the label in the figure could improve the visualization of the image.

Technical corrections:

Line2: add "a" before "few false..." => pointed to a few false

L14: add comma after "still" => but still, a posterior

L19: measurements have => has

L20: Add comma after "regional" => global, regional, and local

L22: was launch => was launched

L23: remove the second "to" => albedo measurements, update the...

L24: remove "to" before "retrieve" => and retrieve methane

L33: add s in "type" => different types

L36: add comma after "study" => In this study,

L38: asses => assess

L57: add comma after "matrix" => weighting matrix, and

L60: add comma after "algorithm" and "surfaces" => retrieval algorithm, a second order polynomial was selected (Hu et al., 2016), but for specific surfaces, this

L61: show => shows

L70: add comma after "rocks" => minerals, rocks, and

L84: add comma after "section" => In this section, we

L104: add comma after "region" => Over this particular region, the underlying

L105 ad comma after "shown)" => (not shown), which

L112: add s in "type" => different types

L114: this regions => these regions

L119: add comma after "section" => In this section, we

L120: add comma after "ratio" => their ratio, and

L121: add comma after "4c)" and "example" => plot (Fig. 4c), localized artefacts that are removed are clearly visible, for example, in several points

L122: add comma after "Siberia" => over Siberia, as discussed

L133: even the correction => even if the correction

Figure 4: add comma after "polynomial" in the second line => third order polynomial, and

Figure 5: add comma after "polynomial" in the second line => third order polynomial, and

L147: add comma after "(-5.3 ppb)" => -0.2 % (-5.3 ppb), and

L149: add comma after "stations" => the stations, and Fig. 6b

L155: add comma before and after "therefore" => artefacts and, therefore, cannot

Table 1: add "the" before "number" and comma after "bias" and "stations" in the second line => The table shows the number of collocations, mean bias, and standard deviation for each station and the mean bias for all stations, and

L157: add comma after "section" => In this section, we

L164: add comma after "average" => on average, TROPOMI XCH₄

L168: add "the" before "biggest" => that the biggest

L 174-175: add comma after "data" and "algorithms" and add "a" before "few" => TROPOMI methane data, as well as an intercomparison between different scientific retrieval algorithms, pointed to a few false methane

L188: add "to" before "oil" and add comma after "gas" => emissions due to oil, gas, and coal

L196: Asian in capital letter

L198: add comma after "still" and "if" after "even" => but still, a posterior correction needs to be applied. This implies that even if the

L200: add comma after "Finally" and replace "asses" with assess