

Second review on “Exploiting the entire near-infrared spectral range to improve the detection of methane plumes with high-resolution imaging spectrometers”

Major Comments:

None

Minor Comments:

Line 139: “Different original values, characterized by diverse deviations, could have also led to overestimated δXCH_4 values. Therefore, deviations from the model will probably introduce biases in the retrieved values.” – As I understand it, I wouldn’t call this a bias. The calculated enhancements just include the noise of the underlying data, as is to be expected. In the case of a two-channel retrieval, this noise is high, but it reduces with increasing information content from more channels (up to a point, as you illustrate in Figure 4). I suggest rephrasing to something like “Natural enhancements scatter around their true value since the measurements are subject to noise, thus an overestimation would have been equally likely.”

L156: “... which leads to a background noise reduction but also an underestimation of enhanced pixels.” – You’ve shown that with your plot, no need to use “could”.

L159: I think you should state here clearly that artifact reduction is a major selling point of the retrieval. You should refer that it is a result of your investigation - something along the lines of “New retrieval artifacts may appear when including the 1700 nm absorption window, but overall, the increased spectral interval mitigates false detections efficiently, as is shown in section 3.”

L165: Since the 0-radiance pixels between 1800-1950 nm do not cause an increase in variability, I am not convinced that your explanation is correct. Does the retrieval noise shrink again when you exclude the water bands?

In any case, it is reasonable to exclude these intervals, they may cause trouble, and do not add value to the retrieval. But it seems to me more like the non-zero values below 1400 nm cause the rise in uncertainty, which is somehow interesting.

If you have strong evidence that it is the water bands (like the decrease of noise after exclusion), state it explicitly. If not, just note that you are removing the water bands for the abovementioned reasons and that the noise increase is due to the addition of the bright channels below 1400 nm.

L176: Since the SWIR range from 1000-2500 nm shows a higher noise, why didn’t you choose the interval from 1500-2500 nm for the COMBO-MF? I guess the even broader interval might be more capable of reducing artifacts, even though it has a larger variability. If you chose it because of that, you should state it here to avoid confusion.

Caption Figure 8: Add the subscript CH_4 to the Q in the caption. Also, you should mention in the caption that the constant enhancement of CO_2 and H_2O is only added to the plume pixels.

Figure 8+10: You might consider flipping the colorbar of the red-to-blue differences, it is more common to denote positive values with red and negative with blue.

L353: “Therefore, an appropriate use of Combo-MF should take into account the surface composition

beneath potential methane emissions.” – This is hard to accomplish in reality, right? In any case, you can be more optimistic here. It is also possible that the COMBO-MF removes the influence of the air pollutants, which seem to significantly increase noise in the 2300-MF.

Figure 11: I think you should state here one time clearly that all shown plumes pass your plume masking procedure, and a-d are taken out as examples.

L380: I suggest adding a sentence which gives a broad overview, like “We investigated the retrieval performance in real observations of spectral imagers on satellites and airplanes, both using real and simulated plumes, and found a significant increase in the plume identification capability.” The investigation of the retrieval using a broad spectrum of scenes and instruments was done thoroughly and detailed in this study, and should be highlighted in the beginning of the summary.

L390: You don’t mention that you recommend the Mix-MF for emission quantification. You should mention it in the summary, and it fits when you point out the caveats of the COMBO-MF.

Technical corrections:

L156: make*s* the

L203: “Moreover, in Figure 5 we can see ...” is wordy and somehow colloquial. I suggest rephrasing to the more concise form of “Figure 5 shows ...”

L330: “that can be more appreciated” → “that is more pronounced”

L351: “appreciate” → “identify”

L368: “We can observe” → “We observe”

L379ff: Excessive use of the passive tense, consider rewording using an active form of “We investigated the influence ...” or similar in at least part of the sentences.