Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-275-RC2, 2020

Atmospheric Measurement Techniques Discussions

Interactive comment on "Detection and Quantification of CH_4 Plumes using the WFM-DOAS retrieval on AVIRIS-NG hyperspectral data" *by* Jakob Borchardt et al.

Luis Guanter (Referee)

lguanter@fis.upv.es

Received and published: 21 October 2020

Review Borchardt et al.

[Apologies for this late review!]

A number of papers in the last years have shown that measurements from the AVIRIS and AVIRIS-NG airborne spectrometers are useful to detect and quantify methane point sources. The manuscript by Borchardt et al. describes the implementation of the WFM-DOAS methane retrieval method, originally developed for satellite atmospheric spectrometers, for AVIRIS-NG data. The motivation for this implementation of the

WFM-DOAS method for AVIRIS-NG is to cover the gap between the potentially less accurate data-driven (particularly Matched-Filter, MF) methods and the computationally-expensive IMAP-DOAS which are typically used for this type of data.

The manuscript is well written and presented, and the topic is timely and falls perfectly within AMT's scope, so I generally recommend it for publication in AMT once the points listed below are taken into consideration.

Major comments:

1. Comparison to Matched Fiter (MF) and IMAP-DOAS methods: according to the authors, the motivation to propose a WFM-DOAS retrieval for AVIRIS-NG is to "fill a gap" between MF and IMAP-DOAS approaches. However, nothing is said about the retrieval performance of the proposed WFM-DOAS with respect to the other two methods.

I believe that the study would greatly benefit from a quantitative comparison of the three retrievals. The MF XCH4 data for the same ABOVE data set seem to be already available (p4, L20), and looking at the author list I understand that it wouldn't be difficult to also have IMAP-DOAS retrievals for at least a data subset containing one of the identified plumes.

2. Selection of the AVIRIS-NG data set used for this: the authors don't provide any explanation of why they select this particular ABOVE AVIRIS-NG data set for the study, but I would say that there could be better AVIRIS / AVIRIS-NG data sets for a study focused on the presentation of a new retrieval method. For example, the data sets from the different campaigns that JPL has run over the last years, including e.g. the one over Four Corners (Frankenberg et al., 2016) and California (Duren et al., 2019), for which the L1B data are surely available, could offer better observation conditions, properly documented plumes and fluxes, and a wider range of emission intensities and types.

So I would recommend the authors to extend the study to other AVIRIS-NG showing other acquisition conditions, and in particular larger emissions. On the other hand, if the authors were interested in the particularly challenging conditions of the Canada sites, this should be discussed in the text.

Other comments:

- Abstract: it might benefit from shortening and removal of line breaks

- p4 L25: “Copernicus”, nested brackets

- Fig. 1 caption: “can not be fully resolved”

- p7, L28: plus surface reflectance shows in general less variability at 1600 nm than at 2300 nm

- Section 3.3., sensitivity analysis: it could also be relevant to include uncertainties in the spectral calibration (position and shape of the spectral response function), if this is not optimized in the retrieval

- p15, L13 “determined by the following”

- p17, L9 – the cross sectional method hasn’t been mentioned until now

- p17, L17: “A wind speed higher by a factor 1.6 means...”? why is this? can you please explain this further?

- Section 4.2 and 4.3 could be merged. In general, a manuscript structure with separate Methods and Results sections would be better.

- Figure captions: perhaps just a matter of taste, but I think they could be shorter and avoid the explanations already included in the main text (e.g. Fig. 8 and 9).

- Fig. 9, Plume P4: at least from visual inspection, it is not obvious to me that that is a real plume. It could also be the effect of background reflectance variations. Would it make sense to show a map of at-sensor radiance at 2200 nm and its slope to discard

this possibility?

- Refs. At least Cusworth et al. (https://doi.org/10.5194/amt-12-5655-2019) and Foote et al. (https://doi.org/10.1109/TGRS.2020.2976888) should be added

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-275, 2020.