In the manuscript "Performance and sensitivity of column-wise and pixel-wise methane retrieval for imaging spectrometers", Alana K. Ayasse and colleagues investigate the performance of two different types of algorithms for the retrieval of atmospheric concentration columns of CH_4 from spectra acquired by imaging spectrometers. As basis, they not only use observations from the Global Airborne Observatory (GAO), which were collected during two controlled release experiments in 2021 and 2022, but also observations from previous field campaigns. While one of the algorithm (pixel-wise) retrieves CH_4 columns for every single spatial pixel by iteratively fitting a simulated spectrum to the measured spectrum (IMAP-DOAS), the second algorithm (column-wise) uses statistics from observed spectra in a flight column (along track) to retrieve CH_4 column anomalies (column matched filter, CMF).

The two algorithms compared have their distinct advantages and disadvantages, one being independent from other observations within one flight leg but slow (IMAP-DOAS); the other one depending on a sufficient number of additional observations from the same flight leg but fast (CMF). One key finding of the study is the minimum length of a flight leg required for the fast CMF approach to perform equally well as the slower pixel-wise approach IMAP-DOAS. The authors perform extensive tests and comparisons to find well-suited lengths for different flight legs for the CMF approach. For the comparisons, the retrieved CH_4 columns/anomalies are addiationally inverted to fluxes/emissions and they are also compared to the "true" metered emissions. In principle, those findings can be transferred to other imaging instruments and/or similar retrieval approaches. Overall, the manuscript is well-written and conclusive.
The manuscript fits well in the scope of AMT and I recommend publication after some minor modifications along the line of the comments below.

Specific comments:

P2L40: Could you provide already here some references for Carbon Mapper and the Global Airborne Observatory (GAO)? Does GAO only consist of an imaging spectrometer or does it comprise an entire suite dedicated to atmospheric measurements? It is also not entirely clear to me how Carbon Mapper and GAO are connected.

P3L83f: Are there references describing your standard procedures and the assumption you are putting in more detail (Especially for the definitions of unstable plume morphology and unstable wind conditions)?

P4L100: The factor of 7: Has this originated from your long term experience with AVIRIS-ng data or is this based on another study?

P6L175: What is the reasoning behind the two different percentiles for the 2021 and 2022 plumes?

Fig1: Could you add already in the first Figure that error bars represent 1-sigma uncertainties?

Fig2: I would appreciate a little bit more information for the shown graph (Whisker plot?) in the caption in terms of what is 'meant' by the different circles, dots, bars, and lines like the percentiles.

Fig3: Would it be possible to add the fitted line and OLS equation as done for Fig. 1?

Fig4: Same as for Fig. 3. Would it be possible to add fitted lines to left and right panel and the OLS equations?

Fig5: Could you add that the retrieval used for Fig. 5 is CMF in the caption? Additionally, I assume the panels are mixed up. See P8L254 and P9L 259.

In the right panel, it appears that the IME levels-off for larger values. Would you have an explanation for this or is it not significant at all and just a coincidence?

Fig6: What happened to the 1-sigma uncertainties for the metered emissions (x-axis)?

SuppFigS1L26: What is meant by "… both figues…".

Technical corrections:

P1L11 and L15: Could you add that GAO stands for Global Airborne Observatory?

P1L23, P2L44, P3L87, P4L96L107L110L124, …: Could you subscript numbers in chemical formulae: CH4 → CH_4?

P4L97-98: There seems to be a formatting issue regarding new line

P4L124: Please remove one "optical depths for".

P9L259, P9L285L287, …: Please capitalize "figure" throughout the manuscript.

P9L263: "… to require minimum flight…" → "…to required minimum flight…"?

SuppP2L33: Typo: Covid CA 202

SuppFigS1L25: Typo: Duren e al 2019