Comment on amt-2022-261
Cristina Ruiz Villena (Referee)


General Comments
In this work, the authors have developed a new benchmarking framework for the validation of Sentinel-2 methane retrievals, including an estimation of detection thresholds for various scenes with different characteristics, and an analysis of the uncertainties. Existing work on Sentinel-2 methane monitoring has demonstrated the usefulness of this sensor to detect and quantify large methane emissions at a global scale, but mostly focused on examples of real plumes. Though similar work has already been done for other sensors such as PRISMA or WorldView-3, to my knowledge, this is the first time that such a benchmarking framework has been developed for Sentinel-2 with simulated methane plumes and the detection thresholds and uncertainties characterised in a more systematic way. This work is valuable as it will aid the validation of future S2 quantification of real-world methane plumes, which is challenging and/or costly to do otherwise (e.g. with ground-based or aircraft observations).

The manuscript is well written and its contents are of high quality and scientific interest. Methane monitoring is currently a hot topic, given the high potential to mitigate further warming by reducing methane emissions, particularly from the oil and gas sector, where it is most cost-effective. The Global Methane Pledge signed by more than 100 countries at COP26 last year is a testament to the current relevance of this topic.

Specific Comments
My comments are mostly focused on making things clearer for the reader in the manuscript. A detailed list can be found in the annotated manuscript.

Technical Corrections
I have spotted a few typos and other technical details to correct, which, in my opinion, would improve the quality of the manuscript. A detailed list can be found in the annotated manuscript.
Please also note the supplement to this comment: