

General comments

This manuscript presents a novel matched filter approach (DiffMF) to reducing false enhancements. There's no doubt this is an area that deserves more research. There's a growing number of AI algorithms under development to process entire catalogs of GHG remote sensing data, and false positives are an increasing concern with these methods. As this paper highlights, there are also many ways more traditional plume detection and quantification methods could be improved by false enhancement filtering methods. The motivation for this study is clear, and the authors offer a significant contribution toward the topic.

Overall, the paper is well-written and the figures are interesting and support the key takeaways. I recommend publication after the authors consider the suggested clarifications and improvements below.

Specific comments

Introduction

- Beyond listing instruments, can the technology improvements for GHG spectroscopy mentioned in the first paragraph be succinctly summarized? A short synthesis would clarify why these particular instruments were included.
- Are false enhancements distinct from false positives in a way that matters for this paper? It seemed at times these words were used interchangeably, then at other times distinctly.
- FPs are not widespread, at least historically. So while the novel false enhancement filtering methods may not be “common”, I think it should be emphasized that manual expert removal has been heavily relied on.

Methods

- More detail is needed on the scenes included. How were they chosen, and what regions, topographies, and land covers do they span (urban, forested, etc.)? How might the choice of scenes affect the evaluation of the method? The introduction names clouds and dark vegetation as contributors to false enhancements, so were these well represented?

Results & Figures

Figure 1

- This is the largest figure, yet the two scenes that do not contain boxes A and B are barely discussed. Please explain what the reader should take from them.

Figure 2

- DiffMF is clearly powerful, but the road in panel B is hard to describe as "plume-like" or as needing DiffMF to filter out. Would a morphology assessment or an overlay with road infrastructure maps suffice here? A more plume-like example would be preferable if one is available. If this is the best illustrative example, please discuss whether it is practical to need a method like DiffMF for such cases.

Section 3.2 Rejecting False Positive Plume Detections

- This was the most convincingly worded section on the method's impact and relevance to AI plume detection systems. I believe some of these points merit being reiterated in the introduction. The abstract might be strengthened by a statement on impact and contribution. For example, the following passage is a strong framing of the problem: "Fully automated operational deployments of machine learning-driven GHG plume monitoring systems are impeded by false positive detections (Bue et al., 2026)...)..... This bottleneck fundamentally undermines the utility and efficiency of an automated monitoring system... The ability of DiffMF to eliminate the vast majority of false positive detections with minimal reduction of plume recall is a significant contribution towards a truly automated operational GHG plume monitoring system."
- [Batchu et al. \(2026\)](#) and [Reuland et al. \(2026\)](#) also highlight the ML false positive problem and could be cited here or elsewhere. More generally, the reference list draws noticeably from the authors' own institution, and the authors could broaden it in revision.