

Comment on egusphere-2025-4610'

General comments

This manuscript developed a Hierarchical Bayesian Inversion Algorithm utilizing time-series observations from seven hyperspectral satellites in Shanxi (2019-2023), comprising 215 methane plumes from 26 coal mines to estimate annual coal mine methane emission rates with limited satellite revisit frequency. The results demonstrate coal mine methane emissions in Shanxi follow a right-skewed distribution, and reveal the asymmetric responses to coal price fluctuations. Overall, this article is interesting. However, a few questions and points need to be addressed in more detail, as outlined below.

Major comment

1. Line 94, "Mines with ≥ 3 satellite revisits were classified as having time-series methane observations," Given that the author's study spans the 2019–2023, a five-year data period, is 3 satellite revisits in 5 years representative? Furthermore, since different satellites have different launch dates and revisit periods, is it appropriate to use the same revisits to define?
2. Given that the author used seven different satellites, how did the author assess the impact of detection thresholds across these satellites on the results?
3. Line 116, "Monthly coal prices were averaged annually to analyze economic influences on emission trends." Does this price fluctuate significantly during the year? Given that some satellites may only have 1 observation per year, would using monthly data yield the same results as an annual average?
4. Please explain in the Methods section why a logarithmic distribution was chosen for all data in the model (Section 2.3). Has this distribution compared with other types of data distributions? Regarding seasonal variations, is the logarithmic distribution superior to other distributions?
5. It appears to me that the emissions result is a little too high at the high end. It is suggested that the authors add a comparison with measured or observed data from other platforms to increase the persuasiveness of the data results.
6. How do the authors deal with the changes in atmospheric environmental conditions?

Minor comments

1. Line 65, “TROPOMI can observe atmospheric methane column enhancements at $7\text{km} \times 3.5\text{km}$ spatial resolution,”. The TROPOMI CH₄ data product is given in the form of total column-averaged dry-air mole fraction, XCH₄. On August 6th, 2019, the instrument settings of TROPOMI were changes, the new sizes become $5.6 \times 7.2 \text{ km}^2$ for bands 7 and 8. Given that the term “enhancements” appears in this sentence without being defined, and that the explanation contradicts the TROPOMI user manual, the author should clarify this point to avoid ambiguity.
2. Line 122, “a plume was deemed valid when its elongation direction formed an acute angle with the wind vector (Figure A2a-c)”, however, in Figure 2b, the direction of the plume does not align very well with the wind direction.