All reviewer comments are copied and pasted below unedited in normal text, our responses are given in blue text.

Reviewer #2:

This paper discusses a method of estimating methane emissions from coal mines in China using in situ measurements at sites in all directions surrounding the facility at various distances. The authors also use a model for source attribution to determine which of the coal mines is impacting the measurement sites in cases where this is ambiguous.

The reviewer found this paper difficult to follow and much of the methodology was not as well described as it could be. Aspects of the measurements, uncertainty analyses and modelling are not well detailed which makes it difficult to assess the validity. The authors show a strong understanding of satellite work in the field of emissions and thus compare their results to this but there are very few references to other measurement work done, of which there is a significant amount. Based on my understanding of what was done I would not expect this to be as accurate a method of assessing emissions as other measurement based studies involving more continuous measurements or using aircraft or mobile measurement methods. Some of the assertions in the results of the paper are not sufficiently supported in this work though they may be accurate. There are several grammatical and spelling errors throughout the paper that should be corrected. I would recommend that this paper requires major revisions before being accepted to ACP.

Major comments:
Section 2.2: This section needs more detail on the operation of the instrumentation. How were the systems calibrated?

The portable greenhouse gas analyzer used in this study was calibrated by the company before first deployed to the field. During field experiments, each day in a background location we re-confirmed that the standard baseline was found within its reliable range. Overall, the instrument behaved stably throughout the experiment, and no significant problems were identified.

We appreciate the idea of using a standard zero air for calibration. However, we did not use this due to the fact that we could not find a commercially available sample air that replicates the high background CH_4 concentration levels and co-contaminants observed in Shanxi. Acknowledging this limitation, future studies will include additional observations using standardized gases, even if these gases do not fully represent the environmental conditions of the area being studied.

How did you ensure measurements were consistent when the location of an instrument was changed?

To ensure measurement consistency when the instrument's location was changed, after relocation, we rechecked the condition against the standard baseline. Furthermore, the instrument was allowed to stabilize and any air from the previous location was flushed out, with the first 10 minutes of measurement data discarded, to ensure that only local air was observed.

The sampling periods are very short, how did you ensure these are representative?

Despite the short measurement period, we adopted a careful measurement strategy when designing the experiment to ensure the maximum representativeness of the results given the limited time available for sampling. Specifically, we selected different directions and distances around the known coal mine to cover key areas of potential methane concentration changes. We carefully considered known sources from villages, coal chemical factories, coal washing areas, major highways as a source of potential leaking CNG vehicles, etc. By comprehensively measuring these areas, we were able to capture the main features of the spatial distribution. As pointed out in the paper, at one further site, we identified a very high value and re-confirmed a passing LNG truck at the time, providing robustness that our outliers make physical sense.

The reason we designed a two-week sampling period was it was the minimum time to capture the typical coal mine operation cycle and associated main activity patterns related to methane emissions (such as mining, high frequency meteorological variability, production peaks, weekend-weekday offsets, etc.). Therefore, although the data time is relatively short, it can still reflect the thinking from the perspective of what is considered the regularity of coal mining operations.

We acknowledge that the short measurement time may limit the long-term representativeness of the data, and in the future endeavor for longer case studies. However, short-term measurements are a common preliminary research method (Gorchov Negron et al. 2020, Shi et al. 2022), especially when resources and time are limited. This study provides important preliminary insights into the characteristics of methane emissions in coal mining areas. One such major finding is that there was an unidentified coal mine of significant emissions amount within the range of our study, which was not previously known and therefore would influence how a future longer-term study would be designed from the start. We also identified and statistically attributed high frequency emissions characteristics. In future studies, we plan to extend the measurement time and combine data from different seasons to further improve the broad applicability of the results.

Gorchov Negron, A. M., Kort, E. A., Conley, S. A., and Smith, M. L.: Airborne Assessment of Methane Emissions from Offshore Platforms in the U.S. Gulf of Mexico, Environ. Sci.Technol., 54, 5112-5120, https://doi.org/10.1021/acs.est.0c00179, 2020.

Shi, T., Han, Z., Han, G., Ma, X., Chen, H., Andersen, T., Mao, H., Chen, C., Zhang, H., and Gong, W.: Retrieving CH4-emission rates from coal mine ventilation shafts using UAV-based AirCore observations and the genetic algorithm–interior point penalty function (GA-IPPF) model, Atmos. Chem. Phys., 2, 13881-13896, https://acp.copernicus.org/articles/22/13881/2022/, 2022.

L55: I disagree with the statement that uncertainties are rarely assessed. There are many publications in the literature where uncertainties are thoroughly assessed for top-down emissions estimates. The two papers cited to support the claim that uncertainties are not assessed are over 10 years old.

Thank you for your words of caution. We acknowledge that the statement regarding uncertainty assessments may have been overly broad and insufficiently nuanced. Uncertainties consist of measurement uncertainties, model uncertainties, and parametric uncertainties. While it is true that recent years have seen a significant increase in studies that assess uncertainties in top-down emissions estimates, this work approaches consideration of these uncertainties on the model and parametric uncertainties themselves to some extent. First, this paper uses a more flexible and robust mass conserving approach, which allows the consideration of the change in wind speed, wind speed itself, the change in concentration, and concentration itself in tandem, without using background subtraction. Typical plume-based papers (Irakulis-Loitxate et al., 2021) do not consider how uncertainties in these variables may changes the size or boundaries of a plume (He et al., 2024), that pooling or concentration enhancement may occur within a plume, uncertainty in the background concentration, or that a plume may not be observable due to observational uncertainties operating along the spatial gradient across the edge of the plume. Furthermore, this work is attempting to introduce a flexible approach that is physically realistic but not as overly constrained as chemical transport models, and is still applicable to sub-grid scale variability. In doing this, our approach offers the consideration of a fuller range of uncertainties, with a particular emphasis on areas which have heavily polluted and mountainous conditions.

Irakulis-Loitxate, I., Guanter, L., Liu, Y.-N., Varon, D. J., Maasakkers, J. D., Zhang, Y., Chulakadabba, A., Wofsy, S. C., Thorpe, A. K., Duren, R. M., Frankenberg, C., Lyon, D. R., Hmiel, B., Cusworth, D. H., Zhang, Y., Segl, K., Gorroño, J., Sánchez-García, E., Sulprizio, M. P., Cao, K., Zhu, H., Liang, J., Li, X., Aben, I., and Jacob, D. J.: Satellite-based survey of extreme methane emissions in the Permian basin, Sci. Adv., 7, eabf4507, https://www.science.org/doi/abs/10.1126/sciadv.abf4507, 2021.

He, T.-L., Boyd, R. J., Varon, D. J., and Turner, A. J.: Increased methane emissions from oil and gas following the Soviet Union’s collapse, PNAS, 121, p. e2314600121, https://doi.org/10.1073/pnas.2314600121, 2024.

Varon, D. J., Jacob, D. J., McKeever, J., Jervis, D., Durak, B. O. A., Xia, Y., and Huang, Y.: Quantifying methane point sources from fine-scale satellite observations of atmospheric methane plumes, Atmos. Meas. Tech., 11, 5673-5686, https://amt.copernicus.org/articles/11/5673/2018/, 2018.

Bruno, J. H., Jervis, D., Varon, D. J., and Jacob, D. J.: U-Plume: automated algorithm for plume detection and source quantification by satellite point-source imagers, Atmos. Meas. Tech., 17, 2625-2636, https://amt.copernicus.org/articles/17/2625/2024/, 2024.

Lu, L., Cohen, J. B., Qin, K., Li, X., and He, Q.: Identifying Missing Sources and Reducing NOx Emissions Uncertainty over China using Daily Satellite Data and a Mass-Conserving Method, EGUsphere [ACCEPTED], https://doi.org/10.5194/egusphere-2024-1903, 2024.

L123-126: This assumption is not commonly made in other papers using in situ measurements to do mass balance emissions estimates. Typically, measurements are taken upwind or out of a plume to determine a background concentration. All the citations in this section are for satellite-based emissions assessments, which this paper is not, so they are not the most appropriate comparison for this work.

Thank you for your thoughtful feedback. We agree that in situ studies typically determine background concentrations by measuring upwind or out of the plume. Actually, we also measured the background methane concentration in the area through this method.

What we aim to convey in this paragraph is that the practice of using the global methane background concentration as a reference to separate plumes may not be applicable to the study area in this paper. This is because the methane background concentration in our study area, as determined through field monitoring, is significantly higher than the global methane background concentration. Furthermore, there is substantial variability in the lowest site observed, as shown in Figure S2. We highlight the importance of accurately determining the range of concentrations in mass-balance emissions estimates, since our cite (as well as likely many others) do not conform to the simple assumption underlying your comment of an enhanced region in one direction and a stable background in another direction. The cited references all utilize the global latitudinal average methane background concentration for plume separation.

Buchwitz, M., Schneising, O., Reuter, M., Heymann, J., Krautwurst, S., Bovensmann, H., Burrows, J. P., Boesch, H., Parker, R. J., Somkuti, P., Detmers, R. G., Hasekamp, O. P., Aben, I., Butz, A., Frankenberg, C., and Turner, A. J.: Satellite-derived methane hotspot emission estimates using a fast data-driven method, Atmos. Chem. Phys., 17, 5751-5774, https://acp.copernicus.org/articles/17/5751/2017/, 2017.

Irakulis-Loitxate, I., Guanter, L., Liu, Y.-N., Varon, D. J., Maasakkers, J. D., Zhang, Y., Chulakadabba, A., Wofsy, S. C., Thorpe, A. K., Duren, R. M., Frankenberg, C., Lyon, D. R., Hmiel, B., Cusworth, D. H., Zhang, Y., Segl, K., Gorroño, J., Sánchez-García, E., Sulprizio, M. P., Cao, K., Zhu, H., Liang, J., Li, X., Aben, I., and Jacob, D. J.: Satellite-based survey of extreme methane emissions in the Permian basin, Sci. Adv., 7, eabf4507, https://www.science.org/doi/abs/10.1126/sciadv.abf4507, 2021.

Lauvaux, T., Giron, C., Mazzolini, M., d'Aspremont, A., Duren, R., Cusworth, D., Shindell, D., and Ciais, P.: Global assessment of oil and gas methane ultra-emitters, Science, 375, 557-561, https://www.science.org/doi/abs/10.1126/science.abj4351, 2022.

Sadavarte, P., Pandey, S., Maasakkers, J. D., Lorente, A., Borsdorff, T., Denier van der Gon, H., Houweling, S., and Aben, I.: Methane Emissions from Superemitting Coal Mines in Australia Quantified Using TROPOMI Satellite Observations, Environ. Sci. Technol., 55, 16573-16580, https://doi.org/10.1021/acs.est.1c03976, 2021.

Brantley, H. L., Thoma, E. D., Squier, W. C., Guven, B. B., and Lyon, D.: Assessment of methane emissions from oil and gas production pads using mobile measurements, Environ. Sci. Technol., 48(24), 14508-14515, https://pubs.acs.org/doi/full/10.1021/es503070q, 2014.

Section 2.4: The citations for the mass conserving approach proposed here all direct to previous satellite analyses but more information could be provided in this paper about how the approach is also applicable to in situ emissions that are not column based.

We have added in references with respect to reviewer 1. Actually, the equations we have used are the original equations, with assumptions, dating back to Cohen and Prinn, 2011, etc papers and even further back. They are the same equations used to solve for the forward and inverse versions of commonly used chemical transport models, including but not limited to WRF-CHEM and GEOS-CHEM. The major differences are first that we have swapped the spatial dimension for time, using the wind speed variable, and second that we have not included all of the second and third order physical driving terms. The equations reduce to the simple two-dimensional plume model assumption (that you are referencing) when the following conditions are all met: Emissions are steady in space and time, wind is steady in space and time, wind is non-divergent/non-convergent, there are no additional sources occurring within the plume, the background is always lower than the plume itself, and the background is not changing. We have also not accessed a three-dimensional version, and in the future it could make a challenging but interesting follow-up work.

A major difference occurs when the user wants to convert from our method's emissions given as ppm/time into a new unit's emissions of kg/time. Under this case, many assumptions are required about the size of the plume and the height of the plume, as observed by other species co-emitted with the methane plume species such as aerosols and water vapor show extreme variability, as demonstrated in Figure Res-1. Furthermore, the boundary layer itself is very complex over our region of interest due to the topographic variability (Guo et al., 2024). For this reason, the majority of our paper does not work using this variable, and we stick to ppm/min.

We believe that the computed emissions in this work demonstrate consistency by being re-run through the 2-box model and showing probabilistic constancy with the distribution of the observations. We believe that this new approach would add further support for other studies, and hope with further community improvement and application, to see it adapted more widely in the future.

Guo, J., Zhang, J., Shao, J., Chen, T., Bai, K., Sun, Y., Li, N., Wu, J., Li, R., Li, J., Guo, Q., Cohen, J. B., Zhai, P., Xu, X., and Hu, F.: A merged continental planetary boundary layer height dataset based on high-resolution radiosonde measurements, ERA5 reanalysis, and GLDAS: Earth Syst. Sci. Data, v. 16, no. 1, p. 1-14.

https://essd.copernicus.org/articles/16/1/2024/essd-16-1-2024.html, 2024.

Figure Res-1. Photograph of typical coal mine plume

Section 2.5: Further details of the uncertainty analysis should be added. The section only states that uncertainty analysis was done and that the results assigned less than 5% to the input variables but does not describe how this was determined.

Thank you for pointing out the need to provide more details about the uncertainty analysis. We have taken the time to carefully go through the entirety of the datasets obtained, with the goal of analyzing the uncertainty in the observations themselves.

The first point is mathematical: the signal contains a real signal plus some amount of white noise, due to the observational uncertainty. Most papers refer to the uncertainty of the observations individually is at most 1% for the CH_4 observations (the uncertainty of portable greenhouse gas analyzers LGR-915-0011 < 1%) and 0.3% for the wind observations (Shi et al., 2022), in net far smaller than 5%. However, it is quite possible that the uncertainty in the region studied due to calibration issues may be larger. We wanted to be very conservative when we chose this number. Therefore, we went to the data itself. First, we acknowledge that any change of 30% or more in the sum of the change in the wind * derivative of concentration + concentration * derivative is considered to be emissions data, and therefore any change which is this large is already considered in the analysis with respect to the emissions itself. The second point is that there is uncertainty in the equation itself, and addressing when the actual equation itself when perturbated by the observations plus uncertainty may yield a value demonstrating actual emissions, as compared to noise which is being mis-represented as emissions. We have searched carefully (Tan et al., 2022)and cannot find a similar analysis applied to their representation of the change in height, wind speed derivative, and concentration derivative at minute-by-minute frequency.

As shown in Figure Res-2 below, all of the data which is in the white noise region (i.e., the randomly occurring errors that occur throughout the dataset, when and where there is no emissions signal) are found to be approximately 5% and lower. It is for this reason that we have selected this value.

We believe that our approach to uncertainty analysis is reasonable and consistent. If the reviewers also want to see us use a larger uncertainty level, we could use a value of 10%, which is higher than all of the uncertainties except for those occurring during extremely high CH4 periods of time. However, based on our results accepted for publication in this other ACP article (Lu et al., 2025) we believe that the approach will not yield significantly different results.

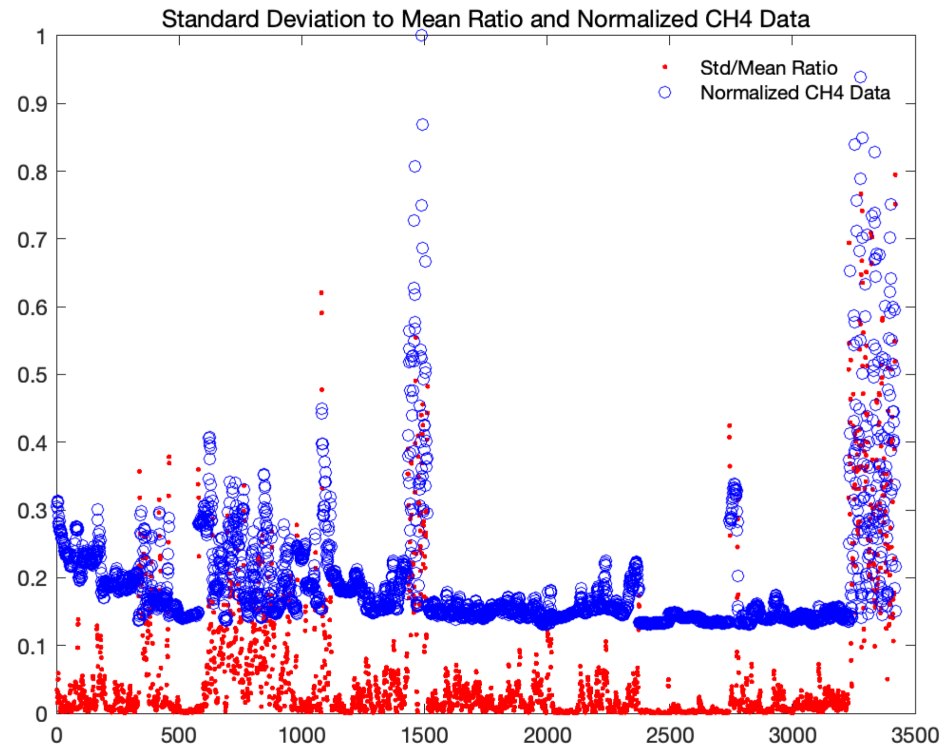

Figure Res-2. An analysis of 3500 individual 1 minute frequency observations of CH_4 used in this work. The blue circles demonstrate the normalized data (data/maximum), while the red dots demonstrate the standard deviation divided by the mean of the normalized data. All data points which are counted as emissions are first filtered. The remaining red dots are considered the uncertainty, which in this case has most of the data with a value approximately equal to or smaller than 5%.

Shi, T., Han, Z., Han, G., Ma, X., Chen, H., Andersen, T., Mao, H., Chen, C., Zhang, H., and Gong, W.: Retrieving CH4-emission rates from coal mine ventilation shafts using UAV-based AirCore observations and the genetic algorithm–interior point penalty function (GA-IPPF) model, Atmos. Chem. Phys., 2, 13881-13896, https://acp.copernicus.org/articles/22/13881/2022/, 2022.

Tan, H., Zhang, L., Lu, X., Zhao, Y., Yao, B., Parker, R. J., and Boesch, H.: An integrated analysis of contemporary methane emissions and concentration trends over China using in situ and satellite observations and model simulations, Atmos. Chem. Phys., v. 22, no. 2, p. 1229-1249. https://acp.copernicus.org/articles/22/1229/2022/, 2022.

Lu, L., Cohen, J. B., Qin, K., Tiwari, P., Hu, W., Gao, H., & Zheng, B. Observational Uncertainty Causes Over Half of Top-Down NOx Emissions Over Northern China to Be Either Biased or Unreliable. (in review) Pre-print DOI: https://dx.doi.org/10.2139/ssrn.4984749

and that the results assigned less than 5% to the input variables but does not describe how this was determined.

We have discussed this above and have included a figure. One set of reasons that even the surface observations have a significant uncertainty is due to the fact that (a) the local concentration is far above standard calibration ranges, and that (b) this area also has a significant number of absorbing aerosols (Tiwari et al., 2025) and have a significant impact on the SWIR wavelengths used to detect CH_4.

Tiwari, P., Cohen, B. J., Lu, L., Wang, S., Li, X., Guan, L., Liu, Z., Li, Z., Qin, K.: A Synergistic, Multi-Platform Approach to Deriving Optically Constrained Aerosol Column Products: Insights into Spatio-temporal dynamics of Black Carbon around Xuzhou and Dhaka, Commun. Earth Environ., 6, 38, https://doi.org/10.1038/s43247-025-02012-x, 2025.

L400: Which emissions are considered in this average? All north and west sites, some subset? How can we equate the emissions calculated from the measurements at sites 1km from the site with those made at a site 5km away?

As explained above and in response to reviewer 1, the two box model equations account for the spatial gradients, which in turn are a function of the distance. Therefore, this is accounted for by the overall set of equations used herein. In theory, we could expand the two boxes to n-boxes, equally spaced and covering each observational site. Then the issue would resolve itself. This is what CTMs such as WRF or GEOS-CHEM do.

Though both may be downwind, the site further away will experience more dilution and thus will always have a lower emission rate calculated from this point unless you measure along a track downwind of the site rather than at a single point to ensure you are capturing all emissions. From the descriptions provided in the paper I do not understand how the rationale for combining emissions calculated from measurements at all the sites into one average.

Thank you for your thoughtful comments and questions. Below, I address your concerns in detail with respect to how we approximated this issue in this work.

The CH_4 emissions of Coal mine A reported in this study use all of the data from the north 1km CH_4 station, the CH_4 emissions of Coal mine B considered all of the data from the west 5km CH_4 station, and the background data came from all of the non-emissions data.

In our study, the observation points used for the final CH_4 emission calculations were both located approximately 1 km from the respective coal mines (north 1km for Coal Mine A and west 5km for Coal Mine B) (Figure 2, and copied below for clarity). Additionally, measurements were carefully selected based on wind direction to ensure CH_4 emissions were taken downwind of the plume. Since the distances are similar and all measurements were taken downwind of the plume, the issue of distance-based dilution does not occur. Therefore, we are confident that the calculated CH_4 emission from the coal mines without significant underestimation due to dilution.

L418: I'm not sure it is fair to say this represents higher sampling diversity. The sampling frequency is higher but all measurements took place over just a 2-week period where satellites have a wider variety of measurements seasonally and annually.

Thank you for pointing this out. We agree that satellite observations, such as TROPOMI, provide broader spatial coverage, and due to its lifetime over the area of study, has a longer time series. However, over this area, the actual time series of available TROPOMI observations is shockingly smaller than expected than in other places of the world, as explained due to the challenging surface reflectance conditions, high absorbing aerosols loadings, and other issues. Recent work has established longer time series over this area, but insufficient to analyze seasonal or annual trends (Hu et al., CITE).

Our intention was not to suggest that the two-week in situ measurement period represents a more temporally diverse dataset overall. Instead, we aimed to highlight the advantage of minute-to-minute sampling frequency and its ability to capture short-term variations and extreme values that might not be detectable in daily or averaged satellite observations. This is especially the case, since the TROPOMI observations as well as in-situ flux tower observations both demonstrate that the emissions are fat-tail/lognormally distributed, and therefore it is critical to observe the amount of both high and low emissions events in order to do a fuller characterization. To address your comment, we have revised the text in the manuscript to better clarify this point and to acknowledge the limitations of our study period.

Furthermore, we agree that longer time series should yield more precise results, and better explain the differences between typical, atypical, high, low and background types of conditions. However, we believe that the results presented herein are still consistent and meaningful. We have identified and attributed a previously unknown source. We have introduced a new approach and methodology which works under highly polluted and variable conditions. We believe that adaption of this approach will allow the community to have a new approach which can help globally with respect to issues of methane emission calculation, monitoring verification, and reporting. We certainly look forward to more community improvement. We are planning to add additional observations in the future, and look forward to updating the community at that time.

Minor Comments:
L35: Should be reworded to say "Emissions from fossil fuel are one of the largest sources of anthropogenic methane"

Thank you for your suggestion. It has been revised in the manuscript.

L37: Should be reworded to say "Coal mines contribute up to X% of China's CH_4 emissions"

Thank you for your suggestion. It has been revised in the manuscript.

Figure 3: Line plots are not ideal for wind direction, would recommend using something else

Thank you for your suggestion. In order to present the information in the figure more clearly, we divided Figure 3 into Figure S1 and Figure S2. Similarly, we divided the same Figure 9 into Figure 10 and Figure 11.

L135: Recommend showing the meteorological stations that were used on the map in Figure 2

Thank you for your suggestion. It has been revised.

L138-139: Were all wind directions used to calculate the statistics? Wind directions are often unreliable when wind speeds are very low.

When using this model to calculate methane emissions, wind speed data was used. Wind direction data is used for data screening when conducting methane emission attribution analysis in the 2-box model. A flowchart of the application of the methane emission and attribution analysis model has been added to Section 2.6 of the article.

During times when very low wind speed was observed are not found to have an impact on the emissions calculated, as discussed more in-depth below in response to a different but similar question raised.

L142: Please provide more information on how temperature and pressure were measured

We appreciate the reviewer's suggestion to provide more information on how temperature and pressure were measured. It has been revised in the manuscript.

L181: What is u? (lower case u has not been defined)

Sorry, that's a mistake, it should be upper case U means wind sped (m s^{-1}). It has been revised in the manuscript.

L184: Would recommend a more recent reference

Thank you for your suggestion. We have incorporated a new reference into the manuscript.

Figure 6: Wind speeds are quite low here, what is the uncertainty in these wind directions due to the low wind speed?

During the time period that the wind speed is less than 0.9m/s, there were only three sets of emissions which are quantifiable, due to the rest of the data not meeting the minimum 30% change condition imposed by the methodology. The emissions computed during these times are found within the central 20^{th} to 80^{th} percentile of the net PDF of emissions from this cite, and therefore do not add bias to the resulting emissions distribution. If during these times, the instrument had an observational error more than 30% in the wind direction, then it may have influenced the emissions computed. We have not considered that the wind direction error may have been more than 30% during these times. However, since the emissions computed do not change the distribution, we do not believe that it would change the final values.

If we assume that these values are the result of a measurement error, then we should remove these points and re-compute the attribution analysis. We have found that the resulting emissions are from within the central portion of the distribution, and therefore that there is no change on the final results. This demonstrates the uniqueness and robustness of the approach herein, since there is not an assumed linear relationship between the wind-speed and emissions, and therefore there is no bias on the end results of excluding points which may have a higher chance of observational error (i.e., due to very slow wind speeds).

L249-251: Sentence is confusing

Thank you for your feedback. I am sorry for the original sentence might be unclear. Here's a revised version for better clarity and have been revised in the manuscript:

"The wind direction predominantly blew from CM-A towards the observation point (wind direction is between 150° and 210°), for about 60% of the daily observation time. Only one day (August 15) observed at 1km north with a significant amount of wind from the west (wind direction is between 240° and 300°), accounting for approximately 92.8% of the observation time on that day."

L296: Figure 10 does not have letters labelling the panels

Thank you for your suggestion. We have updated Figure 10 (now Figure 12) and Figure 11(now Figure 13) in the manuscript.

L402: Suggest showing a figure of the fat tail distribution

There is not sufficient data to produce a PDF of the per hour emissions unit. However, we do have sufficient data to produce a PDF of the per minute emission results, which demonstrate a clear fat-tail distribution, as given below, and now in the updated paper as (Figure Res-3).

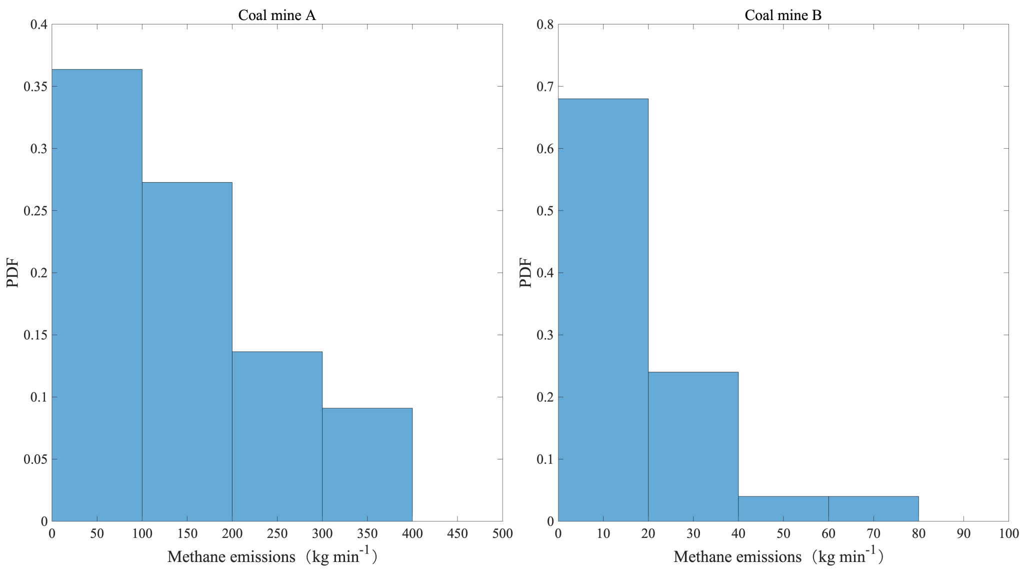

Figure Res-3. Both coal mine A and coal mine B display a fat tail distribution.

L419-421: Not really supported that this is the only likely reason why you did not see the expected distribution for the 2nd mine.

Thank you for pointing out that the sampling time might not be the only likely reason why the maximum CH_4 emissions at CM-B were smaller than the maximum estimated from TROPOMI. We agree with your assessment and have revised the manuscript to explicitly acknowledge additional potential reasons for this discrepancy.

L422-424: Only 2 coal mines were measured in this study. That's not enough data to make this claim.

Thank you for your suggestion. We acknowledge that only two coal mines were measured in this study, which is a limitation and does not provide a comprehensive dataset to establish a definitive relationship between production and CH_4 emissions. However, our intent was not to generalize this finding but to highlight that the observed emissions from these two coal mines align with the concept that higher production coal mines in geologically similar environments tend to emit more CH_4.

To clarify the misunderstanding, I have deleted this passage in the manuscript

L508: Recommend citing the chapter so people can easily find this information as it is the basis for the paper.

Thank you for your suggestion. We have cited the chapter and revised the manuscript accordingly.