We sincerely appreciate the reviewer's comments and suggestions. The reviewer's insightful feedback has been very valuable for improving the clarity and presentation of our work. We have carefully considered each comment and suggestion, and have made corresponding revisions to address any critical issue.

L90 Van driving speed expressed in units of km/h, while later in the manuscript, m/s is used for wind speed. Use either km/h or m/s as the unit for velocity, instead of both.

Thank you for the suggestion. We have modified the text in line 90 as follows: "CH_4 and CO_2 surveys were first conducted downwind of dairy farm facilities before each deployment (see Figure 1a) by sampling through the inlet of a Picarro G1301 cavity ring-down spectrometer (CRDS) that was placed through the side window of a van driving at a speed of approximately 9 m s^{-1}"

L98 Ground-based meteorological and gas sensors -> Were any gas sensors used alongside the gas analyzer (Picarro G1301)? If so, clarification is needed because gas "sensors" are typically employed for detecting the presence of gases. They are often simpler compared to gas "analyzers", which provide quantitative measurements of multiple gases and are more suitable for research and detailed environmental monitoring applications.

We agree with the reviewer that the term gas sensor can be misleading. We have modified the title of Section 2.2 as follows: "Ground-based meteorological and gas analyzer instruments."

L114 – L117 Which species were measured using the CRDS analyzer? At what cavity pressure and frequency were the collected samples analyzed? Precision?

The Picarro G1301 measures CH_4, CO_2, and H_2O vapor. The instrument's tested precision for methane is approximately 10 ppb, which is very small compared to the uncertainty introduced by differences in the AirCore sampling time as shown in Table 3. During the analysis of AirCore samples, the cavity pressure of the Picarro G1301 was approximately 4.5 mbar. The corresponding sampling rate of the Picarrro G1301 varied between 0.1 and 0.3 Hz.

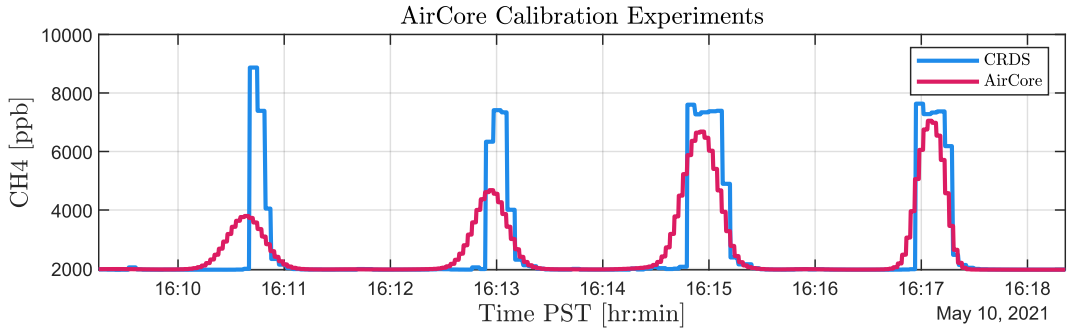
L119 – L124 Mean sUAS speed during the flight? On average, distance of flight tracks compared to the observed source.

During flight operations, the UAAS sampled the air while steadily ascending and descending at an approximate speed of 0.5 m s^{-1}. We have modified Section 2.1 to make clear the ascent and descent rate of the UAAS. Additionally, we have expanded Table 1 to include the distance from source during each flight operation.

L125 – L142 Lacking a proper description of sample collection and profile retrieval. How were the starting and ending points of the collected sample identified? What

is the sampling flow rate of the micro pump attached to the AirCore? The spatial resolution of AirCore measurements?

To mark the starting point of each measurement interval, we placed an ignited lighter in front of the AirCore's inlet before taking off. The end point of each measurement interval was determined from the recorded landing time. We have modified Section 2.1 to include this detail. Additionally, the AirCore's flowrate was measured to be 0.45 standard liters per minute. We have added this information in Section 2.4.1. Lastly, the spatial resolution was determined to be 5 m based on the time response of the Aircore (see figure below). We have expanded Section 3.3 to incorporate this result.



L184 – L190 More information on the farm itself, cattle (average weight), milk production, feed management, and the ratio of dry/young to mature (lactating) cattle is necessary to identify if the CH4 emission estimates is reasonable.

Thank you for the suggestion. We added Table 3, which describes the herd size and average weights of different animal classes. Information on feed management was not available in permit data, and goes beyond the scope of this study. See changes to lines 192-194: "The methane emission sources on this dairy farm consists of wet manure management in five manure lagoons, and enteric fermentation from 3115 milk cows and associated support stock housed in three freestall barns and three cattle corrals (Figure 5b; Table 2). Surface area estimates derived from Figure 5b, and estimates of number of animal units derived from permit data (Table 3)."

L194 "…CH4 emissions from the enteric fermentation, Enteric fermentation and manure emissions appear here for the first time; this needs to be introduced in the introduction (dedicating a small section to dairy cow emissions and also what has been done until now using different quantification techniques and methods, etc.). It cannot appear out of nowhere in the middle of the manuscript.

We agree with the reviewer that more information on dairy farm methane emissions needs to be provided in the introduction. See additional text on lines 36-37: "Facility-level measurements are particularly needed for dairy farms, which can have a large contribution to CH_4 budgets from wet manure management and enteric fermentation emissions, and are important for CH_4 mitigation plans in California (Marklein et al. 2021)."

L200 …Cb is the background CH4 measured from the UAAS… -> How is the CH4 background determined?

Thank you for pointing out this detail. The lowest mole fraction of CH_4 that was measured from the UAAS was used as the CH_4 background. We have updated Section 2.6.1 to make this clear.

L242 Figure 6. Comparison of UAAS and MET wind speed observa5ons. -> not only wind speed, but also the wind direc5on is presented in Figure 6.

Thank you for the suggestions. The caption of Figure 6 has been modified as follows: "A comparison of UAAS and MET observations of wind speed and wind direction."

L269 Figure 8. -> y-axis CO2 and CH4 -> CO_2, CH_4

CO_2 and CH_4 abbreviations have been corrected in Figure 8.

L269 Also the description should be clearer "Comparison of UAAS and ground-level CRDS observations of CH4 and CO2." …of CH4 and CO2mole fractions or profiles?

Thank you for the suggestion. The Figure 8 caption has been modified as follows: Comparison of UAAS **(red)** and groun**d**-level **(blue)** observations of CH_4 and CO_2.

L306 Figure 9. -> x-axis CO2 and CH4 -> CO2, CH4

CO_2 and CH_4 abbreviations have been corrected in Figure 9.

L310 "We selected this set of measurements…" -> Which set of measurements? 20 January 2020? Or all three dates? State it clear.

Thank you for pointing out this ambiguity. We have modified L310 as follows, "The vertical profiles of wind velocity and CH_4 that were collected from the UAAS operation performed on January 20th, 2020 were used as inputs for the dispersion model described in Sec. 2.6.2 to quantify CH_4 emissions from an isolated dairy farm."

L316 "As shown in Figure 10, the dairy farm operation, which is denoted by a black rectangle…" -> there is no black rectangle in Figure 10

Thank you for pointing out this error. We have modified L316 as follows: "As shown in Figure 10, the dairy farm operation, which is denoted by a white rectangle…"

L318 – L319 The dairy farm emission estimate represents the whole-farm emission estimate (enteric fermentation + manure emissions) or per animal? Make it clear.

Thank you for the suggestion. We re-worded lines 337-338: “Results from this analysis show that whole-farm emissions for this dairy were on average 226 kg hr^{-1} with a lower limit of 140 kg hr^{-1} and an upper limit of 277 kg hr^{-1}.”

L320 Indicate the wind direction on the footprint map by adding the arrow that indicates where the wind is coming from.

Thank you for the suggestion. We have modified Figure 10 to include a wind vector.

L325 – L335 The CH4 emission estimate from dairy operations is presented as Gg yr-1, which is ambitious for short-period measurements of ~11-12 minutes. This appears to be an initial attempt at a new methodology, so the focus should solely be on a critical evaluation of the methodology and emissions over daily or shorter timeframes. Also, a more suitable unit is needed, such as kg/cow(head)/day or kg/AU/day, for comparison purposes with other studies or inventories. Where do the results from your study stand compared with dairy cow farm estimates from other studies/inventories?

We used environmental permit data for the studied farm to get an estimated of AU, and converted to units of g/AU/day as in Arndt et al. 2018. Selecting for results from a similar season (winter) and management practice (milk cows housed in freestall barns), we found that our results were comparable with whole-farm emissions estimates from dairy 1 of the Arndt et al. (2018) study, and have added that to the text. Lines 353-357: “we estimated facility emissions of 5430 kg d^{-1} (with a range of 3370-6660 kg d^{-1}). This range overlaps with the yearly estimated methane emissions for this particular farm of 3950 kg d^{-1}, assuming emissions are evenly spaced over the course of a year, from a model that accounts for the number of cows and manure management practices (Marklein et al. 2021). After normalizing for herd size, our estimated emissions of 714 g/AU/d (range of 444-876) are similar to those measured in wintertime at another California dairy with comparable management practices, 752 g/AU/day (range of 700-803) (Arndt et al. 2018).”