

This study evaluates the performance of a novel multirotor unmanned aircraft system for measuring vertical profiles of wind speed, CH₄, and CO₂ mole fractions. It evaluates CH₄ emissions from dairy farm operations using new method, which are crucial for environmental monitoring and understanding the impact of such emissions on the atmosphere. Nevertheless, there are some critical points that require further clarification, such as: the collection and profile retrieval of the AirCore sample are poorly described (or not described at all). This should be clarified and improved, along with the other specific comments mentioned below. Furthermore, additional information about the dairy farm, including details about the farm itself, cattle types, diet, manure management, and more, is necessary. This basic information is essential for readers to assess what emissions could be expected and judge whether the generated estimates make any sense. Also, the CH₄ emission estimates from dairy operations need to be expressed using a more suitable unit (see the specific comments for more details) since this study uses short-period measurement.

Specific comments:

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.

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.

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

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

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?

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 estimate is reasonable.

L194 “...CH₄ emissions from the **enteric fermentation** or **manure management**...” ->

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.

L200 ... C_b is the **background CH_4** measured from the UAAS... -> How is the CH_4 background determined?

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

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

L269 Also the description should be clearer "Comparison of UAAS and ground-level CRDS observations **of CH_4 and CO_2** ." ...of CH_4 and CO_2 mole fractions or profiles?

L306 Figure 9. -> x-axis CO_2 and CH_4 -> CO_2 , CH_4

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

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

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

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

L325 – L335 The CH_4 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?