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.

First, when using the UAAS tilt to calculate the wind speed – does the model consider the payload underneath the drone? Since the AirCore and the drone are connected by a 5-meter-long stainless-steel tube, I am wondering whether this part will affect the model results or not. Also, in theory, will this algorithm be accurate at higher wind speed?

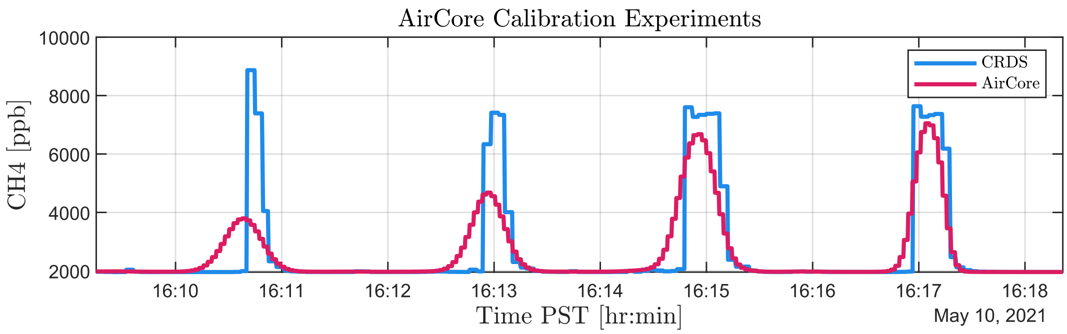
The reviewer's concern regarding the limitations of the kinematic model used to infer wind velocity is well-noted. The kinematic model does not account for the payload carried underneath the hexacopter, likely resulting in wind speed estimation errors as wind conditions increase since the tilt range of aircraft is limited by the added weight. Wind direction estimates obtained from the kinematic model, on the other hand, are not as much affected by the aircraft payload. Future work will explore how higher-fidelity rigid-body models like the ones characterized by Gonzalez-Rocha et al. (2019, 2020), which do account for aircraft mass, can improve the reliability of UAS-based wind estimates.

González-Rocha, J., Woolsey, C.A., Sultan, C. and De Wekker, S.F., 2019. Sensing wind from quadrotor motion. Journal of Guidance, Control, and Dynamics, 42(4), pp.836-852.

González-Rocha, J., De Wekker, S.F., Ross, S.D. and Woolsey, C.A., 2020. Wind profiling in the lower atmosphere from wind-induced perturbations to multirotor UAS. Sensors, 20(5), p.1341.

Second, it seems that the sample collection and analysis procedure of AirCore is not carefully described. The authors did a flow-through experiment demonstrating the AirCore can preserve CH_4 spikes nicely, however, the results of such experiment are not reported in the manuscript. This part is important because air inside AirCore could diffuse during sampling stage & the storage between payload landing & analysis, smearing out peaks & spikes of AirCore samples. Also, will the inside of AirCore release/absorb CO_2 and CH_4? This can be tested by filling the AirCore with gas of known CO_2 and CH_4 mixing ratio, then store them overnight before measuring them again (see Karion et al., 2010). Such tests will ensure the quality of AirCore measurement.

We acknowledge the need for a more detailed account of the AirCore sample collection and analysis procedure. Section 3.3 has been extended to include AirCore characterization results shown below. We also expect the AirCore's Teflon material to minimally influence the release or absorption of CO_2 and CH_4.



In addition, the flow pattern during AirCore sampling might need some further clarification – this will be important when registering the CRDS results to altitude. When pumping in air, how does the flow into/out of AirCore look like? Is the pressure gradient inside AirCore in steady state throughout the entire flight? These will all affect the altitude registration of CRDS measurements and can be clarified by reporting results of some simple tests.

We appreciate the reviewer's input regarding the flow pattern during AirCore sampling. We assumed the pressure gradient is existing to be in steady state and the flow inside the Aircore to be turbulent flow. This article's focus is in combination with the model on interpreting the Aircore's measurements. Detailed discussion about the filling process inside the Aircore can be found in the reference below

Tans, P.: Fill dynamics and sample mixing in the AirCore, Atmos. Meas. Tech., 15, 1903–1916, https://doi.org/10.5194/amt-15-1903-2022, 2022.

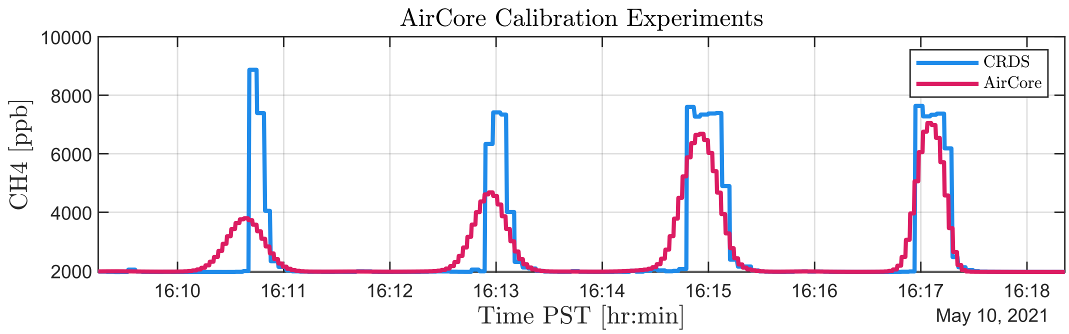
Detailed comments:

Line 127: what is the flow rate of micro diaphragm pump when pumping air vs. pumping AirCore? Since AirCore is a long, thin tubing, it may create some resistance to the pump. It is also important to make sure that air is entering the AirCore without too much turbulence. Also, how do you control the on/off of the pump?

Flow control was achieved by using a metal orifice that effectively constrained the flow rate as long as the upstream vacuum pressure remained below its specific threshold (Refer to the provided flow chart for comprehensive details). Under the vacuum conditions provided by the micro-diaphragm pump at 16" Hg, an inlet flow rate of approximately 0.45 LPM was registered within the Aircore. The operational modulation of the pump was executed by employing a remote relay connected with the pump's power cable.

Line 135: here the authors introduced the laboratory test of AirCore-CRDS system, however, the results of such tests are not reported in detail. Section 3.3 do not have figures to show the real-time measurements of CH4. In addition, as mentioned above, the "cleanness" of AirCore sampling system need to be carefully checked before measuring real-world samples.

We thank the reviewer for bringing this information gap to our attention. The real-time CH4 measurements have been visually represented in the figure below. The intended procedure involves preconditioning the Aircore with zero air before starting the sampling process. Unfortunately, due to challenges in preparing zero air source and conducting consecutive measurements, this protocol could not be executed during this deployment. Nevertheless, we ensured that the pump continuously drew in ambient air from the ground for an adequate duration between measurements. Given the generally low ambient concentrations of CH4 and CO2, this approach was expected to yield a consistent and uncontaminated baseline.



Line 166: in real flights, will the AirCore payload affect the b3 **Vector?**

Yes, the weight of AirCore is likely to limit how the hexacopter adjusts its attitude in the presence of a wind gust, resulting in a smaller inflow angles and more significant wind speed prediction errors as wind conditions increase. However, the estimates of wind direction obtained by projecting of the b3 vector onto the i1-i2 plane are not as much affected by the weight-induced attenuation of the vehicle's response to wind velocity variations. We have expanded our discussion of the wind estimation results to clarify these two points for the readers.

Line 223: how long did it take between AirCore landing and analysis during each flight?

On average, it took less than 5 minutes between AirCore landing and analysis.

Line 253: how do you define the start of ascent and end of descend? Is there a special gas that distinguish sample air vs. air left inside the AirCore? Will a variable wind speed condition affect your sample collection?

We placed an ignited lighter in front of the Aircore's inlet before the drone took off. By doing so, a CO_2 spike was identified as the start of ascent. The end of descend was identified based on the start of ascend plus the flight time. A variable wind speed condition would not affect the sample collection process.