The authors would like to thank the reviewers and editors for their insightful questions and feedback. These comments have undoubtedly improved the quality of this manuscript. Author responses to each individual comment are outlined below.

Author’s response to Anonymous Referee #1
Referee’s comments are bold and italicized, and the author's responses are plain text.

Recommendation:
Accept with minor revisions

Summary:
The authors present a method for correcting temperature/RH observations collected by small UAS with particular focus on addressing errors associated with sensor response. The method is described thoroughly and includes the motivations and justifications for the decisions made. The method is tested using both synthetic and actual data and performance is evaluated using appropriate techniques.

Overall, this is a solid manuscript describing a method for addressing a common source of measurement error applicable to many observation platforms. I have one “major” comment listed below with minor comments listed according to a reference line in the text.

We thank you for the positive summary. We’ll address your concerns below.

Comments:
This is a rather elaborate method for addressing errors principally originating due to sensor response. I believe the authors have made a compelling case for the merits of this method but they haven’t demonstrated its performance relative to much simpler methods designed to correct for hysteresis (e.g., Miloshevich et al. 2004). This is the 800 lb gorilla in the room and it really should be addressed using both the synthetic and actual data included in their evaluation.

Thank you for the positive feedback, we appreciate your suggestion about comparing the performance of the IDMP with other methods. The authors were aware that the paper does not show enough evidence to support the performance of the IDMP method in real-world conditions. However, we believe it was enough to show the feasibility of using the IDMP outside the ideal conditions of the simulations. Based on the presented case study, it was shown that the IDMP remained stable throughout both flights, hence, proving to be a candidate solution. From this point forward, we are going to work on improving the method and prepare it for real intercomparison experiments with other methods which can be a perfect sequel for this study to be addressed in another paper.

Line 25: It's probably worth emphasizing that the measurement errors due to the "turbulent micro-environment around the body" are much more of an issue with multi-rotor UAS than fixed-wings.

The reviewer is correct, the authors failed to specify the type of UAS that is affected by turbulence on a larger scale. We decided to modify this sentence, which now reads: "Radiosondes have the advantage that their sensors are exposed to the medium they are sampling without much disturbances, as opposed to their Unmanned Aerial Systems (UAS) counterparts which produce an inherent turbulent micro-environment around its body (Greene et al.,2018). This issue is particularly more severe for multi-rotor UAS compared to fixed-wing UAS."

Line 216: Need to cite Waugh (2021) here.

We appreciate the literature recommendation. After reading the paper, we think that the citation to this paper will fit better in chapter 5 "Considerations for Sensor Placement on UAS" since the paper has relevant information about radiation shield design as well as a guide for sensor placement and installation.

Line 233: If temperature changes significantly across a RH shock (which is often the case), doesn't this add to the error when assuming a mean temperature? Is this dealt with during optimization?

We agree with the reviewer about the errors introduced into the RH readings by the thermal shock. We think that the explanation given in lines 228-236 is enough to answer the first question. In regards to the second question, the proposed solution was also given in the above-mentioned lines. In other words, the water vapor diffusivity is a function of RH and temperature. Therefore, for every RH shock step, the experiment must be repeated at different air temperatures to create a lookup table (or matrix). Interpolation can be used in between these values.

Line 402: An airspeed of 45 m/s for small fixed-wing UAS is not typical. I've worked with a number of FW sUAS and they all operate at airspeeds around 15-30 m/s. Sure, some of them can fly 45 m/s but this operation mode is in the tails of the distribution.

We think the reviewer is correct in that it is hard for a sUAS to reach speeds over 30m/s. However, we think that a good evaluation of the method also includes testing it close or even outside the operating envelope of the sUAS. Seeing satisfactory results under these extreme speeds means that the method can easily handle nominal operating conditions.

Line 423: Need to include the FAA authorization under which data were collected (e.g., COA number or "Part 107" [including exemptions required to operate up to 1300 m AGL]).

Thank you for letting us know about this missing information in the paper. Given the high altitude in which the sUAS was flying, it is important to state that all the flights were carried out using a valid Part 107 license with an approved COA from the FAA authorities. The COA information was included in the revised paper, the lines 421-424 now read:

"These flights were conducted in CBL and FTI weather conditions, respectively, at the Kessler Atmospheric and Ecological Field Station (KAEFS) in Purcell, Oklahoma, USA, located 30km southwest of the OU Norman campus. The Certificate of Authorization (COA) with number 2020-CSA-6030-COA, issued by the Federal Aviation Administration (FAA), allowed us to fly the CopterSonde above 400ft with a flight ceiling of 5000ft."

Miloshevich, L. M., Paukkunen, A., Vömel, H., & Oltmans, S. J. (2004). Development and Validation of a Time-Lag Correction for Vaisala Radiosonde Humidity Measurements, Journal of Atmospheric and Oceanic Technology, 21(9), 1305-1327.

Thank you for the reference.

Waugh, S. M. (2021). The "U-Tube": An Improved Aspirated Temperature System for Mobile Meteorological Observations, Especially in Severe Weather, Journal of Atmospheric and Oceanic Technology, 38(9), 1477-1489.

Thank you for the reference.