

Author Response to Reviewer 2

Antonio R. Segales et al.

We thank Reviewer 2 for the positive assessment and the insightful comments. We appreciate the observation that the manuscript is close to publication readiness and that the experiments are appropriate and clearly described. Below, we address each comment individually. Reviewer comments are shown in **black**, and our responses in **blue**. References to line numbers refer to the revised manuscript unless noted otherwise.

Comment 1 (Line 57): *“Please include references to UAS data from TORUS and TORUS-LiTE [...] and/or citation to Houston et al. (2026).”*

We have added the TORUS and TORUS-LiTE dataset references and the Houston et al. (2026) citation in the Introduction. The new sentence reads: “We also invite the reader to explore other datasets to become familiar with the variety of WxUAS platforms used in atmospheric studies, such as those collected during TORUS (Targeted Observations using Radars and UAS in Supercells) in 2019 and TORUS-LiTE in 2021 (Houston et al., 2026).”

Comment 2 (Line 63): *“The authors refer to ‘conventional methods’ as the reference for data quality and I assume this to mean radiosondes but if you have other examples in mind you should mention them here.”*

We have clarified this phrase to explicitly name the reference instruments: “conventional instruments such as radiosondes and Doppler wind lidars.”

Comment 3 (Line 70): *“Check formatting of this citation.”*

We have revised the citation formatting in the indicated introduction paragraph. The authors will ensure that all citations render correctly.

Comment 4 (Line 73): *“The authors refer to the possibility of assimilating UAS data into NWP models. You should include citations to illustrate that this can (and has been) done.”*

We have added two citations demonstrating successful UAS data assimilation into NWP models: Murdzek and Ladwig (2025), who validated OSSE framework for assessing UAS impacts on NWP, Jensen et al. (2021), who assimilated thermodynamic UAS observations into convection-allowing forecasts, and Flagg et al. (2018), who studied the impact of UAS observations on numerical weather prediction in the coastal zone.

Comment 5 (Line 151): *“Expand GNSS.”*

GNSS has been expanded to “Global Navigation Satellite System (GNSS) antenna” on first use in Section 3.1.

Comment 6 (Table 1): *“Hover time isn’t really a useful metric to provide here. [...] The authors really need to specify the assumptions made to get to an estimate of 3000 m max altitude.”*

Regarding hover time: while we agree it is not directly relevant to vertical profiling, it serves as a standardized baseline for comparing multirotor endurance across platforms and is commonly reported in UAS specifications. We have retained it but welcome removing it if the reviewer feels strongly. Regarding the 3000 m altitude: the Table 1 caption has been substantially revised to specify that parenthetical values are analytically derived upper bounds based on the propulsion system’s rated specifications (maximum motor RPM, ESC current limits, battery discharge capacity) under idealized conditions (sea-level air density, no wind, nominal motor efficiency). The 3000 m value specifically assumes a standard atmosphere density profile and calm winds with the high-energy LiIon battery configuration.

Comment 7 (Line 163): *“The authors need to be more specific what ‘theoretical maximum capabilities achievable under the right conditions’ actually means.”*

This phrase has been replaced with: “analytically derived upper bounds based on the propulsion system’s rated specifications under idealized conditions (see Table 1 caption for details).” The Table 1 caption now lists specific assumptions: sea-level air density, no wind, and nominal motor efficiency.

Comment 8 (Line 281 and Figure 9b): *“A ‘green trend’ is referenced but not included.”*

We have revised the text to reference “the deviation from the red one-to-one line at higher wind speeds” to be clear that we are referring to the one-to-one agreement in the scatter plot.

Comment 9 (Line 310): *“I think the authors mean ‘non-NOAA-related’.”*

Corrected. The text now reads “non-NOAA-related UAS missions.” Thank you for catching this.

Comment 10 (Line 324): *“The authors need to explain why the nocturnal inversion would cause sensor response to have ‘an influence on the results’.”*

We have added an explanation: “which features sharp vertical temperature gradients that test each sensor’s response time: a sensor with slower thermal response will lag through the inversion layer, producing a smeared temperature profile relative to a faster-responding instrument. This timing was chosen specifically to maximize the discriminating power of the intercomparison.”

Comment 11 (Line 335): *“I’m not sure what ‘tighter alignment’ means. [...] The authors are assuming that ‘smoother and more consistent temperature and relative humidity curves’ equate to more accurate measurements. Can the authors defend this?”*

We have replaced “tighter alignment” with “smaller deviations from the radiosonde reference (i.e., lower point-to-point differences).” We have also added an important caveat: “We note that smoother profiles do not inherently guarantee higher accuracy; however, the simultaneous reduction in RMSE relative to the radiosonde supports the interpretation that the CSWX’s enhanced

aspiration, solar shielding, and tilted-body design effectively mitigate self-heating and radiation biases, rather than simply filtering out real atmospheric variability.”

Comment 12 (Line 340): *“Lower RMSE will be heavily influenced by the variability in the profile.”*

We agree and have added: “We acknowledge that RMSE values are influenced by profile variability and the spatial and temporal separation between instruments; nonetheless, the consistent improvement across both profiles supports the effectiveness of the CSWX’s design changes.”

Comment 13 (Line 349): *“RMSE for vertical wind < 1 m/s isn’t a valid benchmark. You should note that the RMSE for vertical wind is ~0.25 m/s.”*

We have replaced the vague “below 1 m s⁻¹” statement with the specific values: “with a mean horizontal wind RMSE of 0.63 m s⁻¹ and a mean vertical wind RMSE of 0.25 m s⁻¹.” Thank you for pointing out this imprecision.

Comment 14 (Line 463): *“Nowhere is it mentioned that the Coptersonde cannot consistently collect reliable observations on descent. This has to be stated somewhere.”*

We have added an explicit statement in the Conclusions: “A current limitation is that the Copter-Sonde cannot consistently collect reliable thermodynamic observations during descent, because the reversed rotor wash draws heated air from the platform’s body and electronics across the sensor scoop; consequently, only ascent-leg data are used for atmospheric profiling.” We have also added “investigating descent-leg data quality” to the list of future work items.

Reference provided by Reviewer 2:

Houston, A.L., C.C. Weiss, E.N. Rasmussen, M.C. Coniglio, C.L. Ziegler, B.M. Argrow, and E.W. Frew, 2026: Targeted Observation by Radars and UAS of Supercells: TORUS. *Bulletin of the American Meteorological Society*, Accepted. DOI: <https://doi.org/10.1175/BAMS-D-23-0265.1>.

This reference has been added to the bibliography.