The manuscript presented by Matteo Bramati et al. proposes a stand-alone calibration technique for estimating wind velocity profiles in the lower atmosphere. This topic is of high relevance to the atmospheric science and engineering communities as new advancements in UAS capabilities can help improve the spatiotemporal resolution of wind velocity observations that are critical for characterizing the evolution of the atmospheric boundary layer. However, the manuscript does not advance significantly the state of the art of wind estimation in its current form. Therefore, I cannot recommend this manuscript for publication in the AMT journal.

Does the paper present novel concepts, ideas, tools, or data?

The wind estimation concept presented in this manuscript lacks novelty. Already, previous studies have explored the use of point mass models to infer the horizontal components of wind velocity. Moreover, what is presented as a stand-alone calibration process to characterize tilt as a function of air-relative velocity have already been performed Palomaki et al., as well as Gonzalez-Rocha et al.

Palomaki, R.T., Rose, N.T., van den Bossche, M., Sherman, T.J. and De Wekker, S.F., 2017. Wind estimation in the lower atmosphere using multirotor aircraft. *Journal of Atmospheric and Oceanic Technology*, *34*(5), pp.1183-1191.

Donnell, G.W., Feight, J.A., Lannan, N. and Jacob, J.D., 2018. Wind characterization using onboard IMU of sUAS. In *2018 Atmospheric Flight Mechanics Conference* (p. 2986).

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.

Abichandani, P., Lobo, D., Ford, G., Bucci, D. and Kam, M., 2020. Wind measurement and simulation techniques in multi-rotor small unmanned aerial vehicles. IEEE Access, 8, pp.54910-54927.

Are substantial conclusions reached?

The author's claim to present a technique that does not require the use of a wind tunnel or mast towers. However, the validation experiments discussed in Section 4 were performed using a sonic anemometer, a standard practice for validation sUAS wind estimates (see references below).

Nolan, P.J., Pinto, J., González-Rocha, J., Jensen, A., Vezzi, C.N., Bailey, S.C., De Boer, G., Diehl, C., Laurence, R., Powers, C.W. and Foroutan, H., 2018. Coordinated unmanned aircraft system (UAS) and ground-based weather measurements to predict Lagrangian coherent structures (LCSs). *Sensors*, *18*(12), p.4448.

Barbieri, L., Kral, S.T., Bailey, S.C., Frazier, A.E., Jacob, J.D., Reuder, J., Brus, D., Chilson, P.B., Crick, C., Detweiler, C. and Doddi, A., 2019. Intercomparison of small unmanned aircraft system (sUAS) measurements for atmospheric science during the LAPSE-RATE campaign. Sensors, 19(9), p.2179.

Are the scientific methods and assumptions valid and clearly outlined?

In addition to developing a model-based wind estimation technique, the authors propose simplifying the aerodynamic characteristics of sUAS by enclosing the airframe and electronic components using a Styrofoam sphere. The authors implicitly assume the airframe drag effects to be significant. However, data that support this assumption are have not been presented. On the other hand, a previous study by Powers et al. has shown multirotor sUAS drag effects to be dominated by the propeller and airflow interactions instead of airframe shape. Moreover, quadrotor experiments performed by González-Rocha et al. show the tilt variations as a function to sideslip angle to be within the noise of the measurement at different ground speeds.

Powers, C., Mellinger, D., Kushleyev, A., Kothmann, B. and Kumar, V., 2013. Influence of aerodynamics and proximity effects in quadrotor flight. In *Experimental robotics* (pp. 289-302). Springer, Heidelberg.

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.

Are the results sufficient to support the interpretations and conclusions?

The authors need to perform experiments to compare the inflow angle of nominal and spherical sUAS configurations over a range of ground speeds and sideslip angles.

Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Yes, the description of experiments and calculations are in general complete. However, there are formulae that need to be improved for correctness.

Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Tilt models to estimate wind velocity have been proposed before. It was difficult to understand how the work presented in this manuscript improves upon previous models.

Does the title clearly reflect the contents of the paper?

No, the wind estimation algorithm being presented is not a stand-alone technique. The implementation of this algorithm requires calibration experiments next to a conventional wind sensor.

Does the abstract provide a concise and complete summary?

The abstract does not provide a concise and complete summary of the work presented. It was difficult to appreciate what the authors

Is the overall presentation well structured and clear?

The presentation of the manuscript is well structured. However, there are sections of the manuscript that need to be improved for clarity and conciseness.

Is the language fluent and precise?

The authors can significantly improve the language to be more precise.

Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

The formulae need to be revised. For example, in Eqs. (1) and (2) the rotation matrices need to be defined. Additionally, the transformation presented in Eq (1) need to be transposed for correctness. Moreover, the tilt angle in Eq (3) can be estimated using the product rule.

Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

The abstract language needs to be clarified. As it stands, it is not evident that the authors are proposing a method based on flight transects for characterizing a wind estimation tilt model instead of hovering inside of a wind tunnel or next to a sonic anemometer.

Are the number and quality of references appropriate?

The manuscript does not present a comprehensive survey of model-based estimation techniques.

Is the amount and quality of supplementary material appropriate?

Yes.