Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2022-314

Anonymous Referee #1

Referee comment on "Estimating turbulent energy flux vertical profiles from uncrewed aircraft system measurements: exemplary results for the MOSAiC campaign" by Ulrike Egerer et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-314-RC1, 2023

General comments:

This paper introduces an innovative effort to reconstruct turbulent energy fluxes in the Arctic ABL using limited measurements from an sUAS – DataHawk. Because there is no direct vertical velocity measurement from the DataHawk, the authors derived the flux gradient based on a parameterization, which combines the HR horizontal wind speed measurements with formulations for the turbulent dimensionless numbers and anisotropy depending on stability. This unique method has great potential to extract valuable information from the sUAS, especially in the undersampled area. However, the below clarifications should be made to aid the audience in understanding the approach and to evaluate the suitable parameter ranges for the application.

- Figure 2 shows a 2 s spectrum for pitot and hotwire fluctuations. Is 2 seconds interval spectrum sufficient for such a turbulence structure analysis? For example, a typical ECOR system uses at least 10 mins data.
- Line 200: How does the author select the value of C? What is the appropriate range of the C values? Similar situation for the appropriate range for the Kolmogorov constant (in line 222). Will you please provide a guideline for those parameters' determination? For example, are those constants unique to the Arctic environment or general cloudy conditions?
- How many flights do you compare the DH2 measurements with BELUGA? Do you have some statistics to confirm the DH2 performance?
- Figures 9, 10, and 11 show that the temperature difference between DH2 and BELUGA (for the potential temperature profiles) is 2-4 C. That is relatively large. Do you have any explanations for the data quality and the meaningfulness of using the comparison? Do you have other ground comparisons to determine the temperature measurement's uncertainty range? Similar concerns with the dissipation rate, wind speed variance and the gradient Richardson number. They were plotted on a log scale, and it is hard to understand how accurately the new approach derived parameters compared with BELUGA.

Specific comments:

Equation 9 used equation 10 in Siebert et al. (2006) for the u component. How do you derive C2 =2.6 for vertical velocity components?

In section 2.3.1, the structure of this section is confusing. Before Line 232, the author introduced the method used by Siebert et al. (2006), then starting in line 332, "a different established method is applied to derive dissipation rates." Please list the equations for the other method. What are the connections between the two methods? Do you plan to compare them? Or do they complement each other? Which method is more suitable for the Arctic environment? What are the pros and cons of choosing each method in Fig 3?