Responses to the reviewers' comments

Reviewer #1:

This study presents the first high-resolution dataset of low-level atmospheric turbulence parameters in China by combining radar wind profiler and radiosonde observations. It reveals vertical attenuation patterns (e.g., linear decrease of turbulent dissipation rate, ε, with altitude) and seasonal variations (stronger turbulence in spring/summer), providing critical data support for model parameterization. The research design is robust, data sources are reliable, and the methodology demonstrates innovation. The findings hold significant value for understanding boundary layer turbulence dynamics and aviation safety applications. The manuscript is suitable for publication after minor revisions.

Response: We are glad to receive your positive and encouraging comments, which are invaluable in improving the quality of our manuscript. For clarity purpose, here we have listed the reviewer's comments in black plain font, followed by our response in blue italics.

Specific Suggestions and Clarifications Required:

1. Ensure all abbreviations (e.g., Turbulence dissipation rate (ε)) are defined only once at their first mention. Avoid redundant definitions in the Abstract, Introduction, or other sections. Check consistency for other terms.

Response: We sincerely appreciate the reviewer's comment regarding the inappropriate use of abbreviations. In the revised manuscript, all abbreviations have been spelled out upon their first occurrence to avoid redundant definitions in the following sections.

2. Line 123，revise "see Chen et al., 2022b" to "Chen et al., 2022b" (remove "see").

Response: Corrected as suggested.

3. Equation 1, define the variable h (height/altitude). Ensure consistency in height representation: Equation 4 uses z for altitude, while other equations (e.g., Equation 1) should use the same notation.

Response: In the revised manuscript, all instances of altitude rather than height in the equations are consistently denoted by the variable z, with corresponding definitions provided.

4. Equation 2, define T (temperature) and P (pressure) explicitly.

Response: Thanks for pointing this out. The definitions of T (temperature) and P (pressure) are added explicitly in the revised manuscript.

5. Symbol Consistency in Equations 4 and 6: Equation 4 uses φ (phi), while Equation6 uses ψ (psi). Clarify their definitions and ensure consistency in notation.

Response: In the equation 4, φ (phi) has been corrected as α (alpha) which represents the beam zenith angle of the radar beam. In equation 6, the double integration is taken between 0 and π/2 for both spherical coordinates ψ and φ.

6. Equation 6, define ϕ (phi) in the context of the equation.

Response: In Equation 6, the double integration is taken between 0 and π/2 for both spherical coordinates ψ and φ.

7. Equation 8, specify the value of kinematic viscosity (v) and cite relevant references for its calculation.

Response: Thanks for pointing this out. Corrected as suggested. "Where v (units: $m^2 s^{-1}$) is the kinematic viscosity, $v = 2 * 10^{-5}/\rho$, and ρ represents atmospheric density which can be calculated based upon the pressure and temperature profiles measured by radiosonde (Eaton and Nastrom, 1998; Solanki et al., 2022)."

References:

Eaton, F. D. and Nastrom, G. D.: Preliminary estimates of the vertical profiles of inner and outer scales from White Sands Missile Range, New Mexico, VHF radar observations, Radio Sci., 33, 895-903, 10.1029/98rs01254, 1998.

Solanki, R., Guo, J. P., Lv, Y. M., Zhang, J., Wu, J. Y., Tong, B., and Li, J.: Elucidating

the atmospheric boundary layer turbulence by combining UHF radar wind profiler and radiosonde measurements over urban area of Beijing, Urban CLim., 43, 13, 10.1016/j.uclim.2022.101151, 2022.

8. Clarify how N^2 is calculated at times other than 00 and 12 UTC, given its reliance on twice-daily radiosonde data. Explicitly state the temporal resolution of N^2 in the methodology.

Response: Thanks for pointing this out. In this work, N^2 was computed solely based on the 00 and 12 UTC radiosonde observations, as no sounding data were available at other times. Therefore, N^2 has a twice-daily temporal resolution (00 and 12 UTC) throughout each day."

Reviewer #2:

Low-level turbulence in the atmospheric boundary layer remains a critical component for understanding near-surface exchange processes, mesoscale dynamics, and safe aviation operations, yet remains under-characterized due to data scarcity. This manuscript presents a new turbulence dataset derived from a synergistic combination of radar wind profiler (RWP) and radiosonde observations at different sites across China. The authors employ the Doppler spectral width method to estimate a suite of turbulence-related parameters including ε, N^2, κ, l_0, and LB, and offer a comprehensive analysis of their spatial, vertical, and seasonal patterns. The paper is technically sound and analyses low-level turbulence climatology over China. As the dataset can be very important and helpful for boundary layer modeling, I believe this study is suitable for publication following a few minor revisions.

Reply: We thank the reviewer for his thoughtful and excellent comments and suggestions. We have tried as much as possible to address all the concerns and have revised the manuscript accordingly. The reviewer' comments are written in normal font, and our point-to-point responses to the reviewer' comments are in blue italics.

Minor Comments:

1. The manuscript would benefit from improved clarity and precision in defining symbols and variables, especially within different equations. For example, in Equation (1), the height variable (h) is introduced without definition, while other equations such as (4) use z for altitude. A consistent notation may be easy for readers to understand.

Response: Per your kind suggestions, we have carefully reexamined and revised all variable nomenclature, definitions, and symbolic representations in both the main text and mathematical formulations to guarantee precise and consistent expression throughout the revised manuscript.

2. The variables (e.g., T, P, ϕ, ψ, v) are mainly given their names. I suggest the authors add the physical meaning of these variables in section 2 for clarity, thus being more accessible for readers unfamiliar with the PBL scheme.

Response: Thanks for pointing this out. We have thoroughly examined and revised all variable nomenclature, definitions, physical meanings, and symbolic representations in both the main text and mathematical formulations to guarantee precise and consistent expression throughout the revised manuscript. The variables are now consistently defined with their physical context upon first use in the text.

3. The term "high-resolution" is mentioned several times, which may cause confusion. It would be clearer to specify that the dataset offers high vertical resolution, as the temporal resolution is limited to twice daily observations.

Response: We appreciate this insightful comment. In the revised manuscript, we have carefully replaced all instances of the general term "high-resolution" with the more precise description "high vertical resolution" when referring to the dataset. This clarification explicitly distinguishes the vertical resolution (which is about 5 to 8 m) from the temporal resolution (limited to twice-daily observations).

4. Line 123: The use of "see" before the citation appears unnecessary and is inconsistent with the citation style used elsewhere in the manuscript.

Response: Per your kind suggestions, we have revised as suggested.

5. Abbreviations such as ε, N^2, and K are repeatedly redefined. For example, ε defined third times in Sections 1-2.

Response: Per your kind suggestion, in the revised manuscript, we have deleted the redundant definitions for the variables you mentioned.