

# ***Interactive comment on “Statistical variations of lower atmospheric turbulence and roles of inertial gravity waves at a middle latitude radiosonde site”***

**by Jian Zhang et al.**

**Anonymous Referee #1**

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This manuscript estimates turbulent energy dissipation rates from the potential temperature derived from the radiosonde data applying the Thorpe displacement technique which has been previously developed in studies of oceanic turbulence and adapted to the atmosphere. With the multiple atmospheric parameters simultaneously measured with radiosonde, the authors present an interesting comparison between energy dissipation rates and Richardson number as well as the gravity waves on a statistical basis. The findings are encouraging.

However, this manuscript suffers from a significant fatal limitation that the authors do not provide any quantitative discussion on the uncertainties of the derived dissipation

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rates and no error bar of the derived epsilon. As the equation (Page 11, line 229) shows, the derived dissipation rate critically depends on the parameter  $c^2$ , which has been theoretically and experimentally demonstrated to vary within a large range covering  $\sim 2$  orders of magnitude. Further, the trajectory of the radiosonde is not vertical due to the balloon drift. Does the ascent rate of the balloon under the influence of the drift have influence on the derived dissipation rate? The authors try to validate the derived epsilon with radiosonde by comparing them with the radar measurements. However, the radar is located more than 400 km away and the observations with both instruments were not carried out simultaneously and even not in the same year, which makes the comparison not convincing. Last but not least, many expressions are not precise and confusing with some of them indicated below and the authors should carefully look through the manuscript before they resubmit it.

Major comments and suggestions listed as follows (and not limited to):

1. Page 2, line 27, better to add “based on the current dataset” in the end of the sentence since there is no consensus on the distribution of the turbulence intensity.
2. Page 2, lines 28-30, the sentence is not precise. Please reformulate it.
3. Page 2, line 32, “whereas an encouraging argument”, what does this mean?
4. Page 4, lines 74-75, recent studies show there is an increase of epsilon with altitude, see Kantha and Hocking JASTP 2011; Haack et al., JGR 2004; Li et al. JASTP 2016 and etc.
5. Page 6, line 117, covers => measures
6. Page 6, lines 123-125, the sentence is not precise. Please reformulate it.
7. Page 6, line 126, “time interval”, what does this mean? time coverage?
8. Page 6, line 132, kept => used
9. Page 7, line 135, this is misleading, since the resolution is not reduced after the



interpolation.

10. Page 7, lines 149-151, the sentence is not precise. Please reformulate it.
11. Page 9, lines 181-184, the sentence is not precise. Please reformulate it.
12. Page 10, line 219, "negative influence", what does this mean?
13. Page 11, line 223, does this mean that  $L_D = d_i$ ?
14. Page 11, line 240, the sentence is not precise. Please reformulate it.
15. Page 12, line 249, basically yield => mostly occur
16. Page 12, line 251, increased => maximum
17. Page 13, line 273, extend beyond => exist in the condition with  $Ri$  larger than the critical value of  $Ri$ .
18. Page 13, lines 282-284, Why? Could you please provide more explanation?
19. Page 13, line 285, the use of  $Ri_C$  is confusing, since  $Ri_C$  in the literature is used as the critical value of Richardson number (normally 0.25). Due to the definition of  $Ri_1$  in the manuscript, why do you just choose  $Ri_{0.25}$ ?
20. Page 14, lines 290-291, normally,  $N^2$  show nearly constant values in the troposphere and lower stratosphere:  $1e-4 \text{ s}^{-2}$  and  $4e-4 \text{ s}^{-2}$ , respectively (see fig. 2(c) in this manuscript). Why are the enhanced values not caused by  $N^2$ ? Could you give more explanation for this?
21. Page 14, line 300, latitude => altitude
22. Page 14, line 300, it's hard to tell if there is an increase with altitude in the lower stratosphere.
23. Page 14, line 303, have decreased values => their values decrease
24. Page 15, lines 312-315, both sentences are not precise. Please reformulate them.

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25. Page 15, line 316, match => correspond to . . ., respectively.
26. Page 15, lines 317-318, the sentence is not precise. Please reformulate it.
27. Page 15, lines 321-323, the sentence is not precise. Please reformulate it.
28. Page 16, line 341, seen => considered
29. Page 16, lines 348-349, the sentence is not precise. Please reformulate it.
30. Page 17, lines 353-354, the sentence is not precise. Please reformulate it.
31. Page 17, lines 366, these regions => in these regions E and E\_V show maxima . . ., respectively
32. Page 18, lines 375-376, the sentence is not precise. Please reformulate it.
33. Page 18, lines 382-383, please add citation
34. Figure 2, relative humility => relative humidity
35. Figure 8, it's confusing with different parameters on plots and in the text, see fig.8(c) and (d)

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Interactive comment

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Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2018-114>, 2018.

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