

Interactive comment on “On the effect of moisture on the detection of tropospheric turbulence from in situ measurements” by R. Wilson et al.

Anonymous Referee #1

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General Comments

The paper presents an important improvement to the application of Thorpe scale analysis to atmospheric data, a technique which has in recent years has been shown to hold great potential for routine atmospheric turbulence observations from high resolution radiosonde data. The method detailed accounts for the effects of saturation on the static stability by applying the moist Brunt-Vaisala frequency of Lalas and Einaudi (1974) to the calculation of the potential temperature, the key parameter used to determine the scale of turbulent overturns. This represents a major improvement over previous studies utilising this technique which either ignored the issue or noted that their analysis was not valid within clouds. The use of colocated MU radar aspect ratio

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data is a little ambiguous but broadly supports the radiosonde methods described.

Specific Comments

p8228 l4: The authors state here that the potential temperature in subsaturated regions is calculated from Equation (4) using the square of the dry Brunt-Vaisala frequency. Previous studies employing the Thorpe analysis have either used humidity in the calculation of the (virtual) potential temperature or in the absence of such measurements have noted that doing so would be appropriate (in addition, in some cases, to noting that their methods are invalid in the presence of saturation/liquid water). The authors of the present study note that in the context of the unsaturated free atmosphere the effect of water vapour is negligible. This seems to be in conflict with the previous studies and could benefit from a suitable reference or further explanation.

p230 l16-20: Balsley et al. 2010 reported that their humidity measurements were unreliable due to insufficient ventilation of the sensor as a result of the reduced ascent rates. Was this considered/accounted for in the present study?

Figure 2: The use of different grid lines for potential temperature and Thorpe length in the bottom panels is confusing. Since the relationship between the scales of potential temperature and Thorpe length is arbitrary they should be made to correspond to the same grid lines or be removed completely.

Figure 3: If it is expected that isotropic turbulence is responsible for the radar echoes in regions where the aspect ratio is near unity, what is the explanation for the lack of turbulence observed by the radiosonde technique in certain regions, for example around 4 km and 6 km? Does this indicate the presence of turbulence at scales smaller than the radiosonde technique can observe?

Technical Corrections

p8226 l18: Reference to Eq. (4) should be to Eq. (2)

p8231 l8: Figure 2 show -> Figure 2 shows

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Figure 2 caption: thorpe -> Thorpe

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