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Interactive comment on “Can one detect small-scale turbulence from standard meteorological radiosondes?” by R. Wilson et al.

Anonymous Referee #2

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GENERAL COMMENTS Application of the Thorpe analysis to standard high-resolution radiosonde data appears to offer a much-needed method for identifying atmospheric turbulence on a routine basis. However, as highlighted in an earlier paper of Wilson et al. (2010), particular care needs to be taken when applying the technique in regions of low static stability, e.g. throughout much of the free troposphere. Consideration of random measurement errors in the radiosonde data is absolutely necessary for allowing the Thorpe analysis to be used reliably. Such an approach has not been adopted in a number of recent studies. The present manuscript demonstrates that this leads to an overestimate in the frequency of occurrence of turbulence. This useful piece of work should be acceptable for publication in AMT after some relatively minor corrections have been made.

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SPECIFIC COMMENTS My only scientific reservation concerning this manuscript is that it does not provide any independent verification that turbulence exists where the analysis suggests that it does. However, the same criticism can be applied to many of the papers which attempt to identify atmospheric turbulence. It would be useful if the authors could provide, for example, corresponding radar data from the MUTSI campaign - c.f. Luce et al. (2001). If the authors cannot provide any examples which can be unambiguously interpreted as being turbulent, they should acknowledge that further validation is still required. Even without independent supporting evidence, this manuscript provides a sufficient development over earlier applications of the Thorpe analysis to make it worth publishing.

The following three points require clarification.

The authors use the word "inversion" (page 972 line 9 and elsewhere) to imply the opposite of what is normally understood in atmospheric science, i.e. to imply a superadiabatic decrease in temperature with increasing altitude rather than an increase in temperature. This is slightly confusing, although I realise that it is consistent with the terminology used in earlier oceanographic papers on Thorpe analysis. It would be useful if the authors could highlight this fact for the benefit of the atmospheric readership.

The word "sample" is typically used to imply a single measurement point. However, I think that the the authors are using it here (page 972 line 23, and page 979 line 20) to imply a short series of consecutive measurements. If this is the case, it would be better to use another word, e.g. "data segment".

It is common to use the term "high resolution" to refer to the raw data from a standard radiosonde - as opposed to data recorded only at standard and significant levels. It is acceptable for the authors to use the terms "high resolution" and "low resolution" in the ways in which they do in this manuscript. However, they should define these terms early on and use them consistently. They tend to use the terms "standard", "low resolution" and "raw" interchangeably, which is slightly confusing.

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TECHNICAL CORRECTIONS The meanings of HR and LR (page 972 line 7, and page 973 line 11, respectively) should be given where the abbreviations are first used. I realise that this is done in the abstract, although that should be considered to be separate to the main article in this context.

page 972, line 21. I don't understand what the authors are trying to say in this sentence: "The method is based on a hypothesis test on an order statistics, the data range within the detected inversions."

In a few places (e.g. page 970 line 17, page 970 line 19) the authors refer to "the shape of the distribution decreasing". They should refer to the "probability density decreasing". See also page 983 line 13, and page 984 line 14. Similarly on page 982 line 10, "probability density function" should be "probability densities".

In several places (page 970 line 24) the authors refer to "radiosondes data". This should be "radiosonde data".

page 973 line 6. It would be useful to give an indication of typical vertical intervals for both high resolution and standard resolution radiosonde measurements in the Introduction, rather than waiting for Section 2.

page 974 line 1. It would be better to use the term "altitude resolution" instead of "vertical resolution" as the latter could also be understood to mean the sampling interval in units of time.

page 974 line 12. I do not know what the authors mean by "dispose" in the following sentence, "it is necessary to dispose of data sampled with a regular vertical step".

page 974 equation 1. The authors have not defined the meaning of ΔP , which I presume is equal to $P(i+1) - P(i)$.

page 974 line 21. The authors should make clear exactly what they mean by "first difference". It appears to imply the difference in value between adjacent samples. See also page 977 line 6.

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page 975 line 5. I think that the authors mean "pressure differences" rather than "altitude differences".

page 976 line 9. The authors use the terms "interpolated" and "resampled" interchangeably. It would be better to use just one of these terms. See also page 976 line 20.

page 979 line 6. I think that the authors mean "reliable" instead of "detectable".

page 990 Fig. 1. The label at the top, "(mesured et approximated)" should be "(measured and approximated)". Also, the legends show "Pa" and "Za" as blue lines but these are black on the plots

page 991 Fig 2. There are 4 minor tick marks for each 5000 m on the altitude axis. Although there is nothing wrong about this, 5 tick marks would make more sense.

page 992 Fig 3. Theta is shown incorrectly as "q" at the top of the right-hand panel and as "0" at the bottom.

page 993 Fig 4. Are there both black and grey sections of the curve in the left-hand panel? (There are in the middle and right-hand panels.) If so, it is impossible to distinguish between them.

page 994 Fig. 5. The labels "LR" and "raw" appear to be incorrect. Should they be "without selection" and "with selection"?

page 998 Fig 4. The word "Stratosphre" at the top of the plot should be "Stratosphere".

Spelling mistakes: page 974 line 11. "mentionned" should be "mentioned" page 973 line 10. "forteen" should be "fourteen" page 975 line 12. "cleanly" should be "clearly" page 976 line 3. "independantly" should be "independently" page 976 line 4. "differs" should be "differ" page 977 line 14. "dedrending" should be "detrending" page 978 line 5. "Analyse" should be "Analysis" page 978 line 11. "in details" should "in detail" page 979 line 11. "bins" should be "bin" page 981 line 22. "corresponds" should be

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"correspond" page 982 line 2. "does" should be "do" page 982 line 4. "HR profiles" should be "HR profile" [or "HR profiles reveals" should be "HR profiles reveal"] page 982 line 25. "relatives frequencies" should be "relative frequencies" page 983 line 27. "sizes" should be "size" page 984 line 5. "foorteen" should be "fourteen"

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