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Atmospheric Measurement Techniques Discussions

Interactive comment on "Methodology for determining multilayered temperature inversions" *by* G. J. Fochesatto

Anonymous Referee #1

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General Comments

A simple iterative technique for defining temperature inversions within an atmospheric sounding is elaborated. The overall quality of this paper is poor because of lack of clarity and consistency in the writing. The Abstract and Introduction (and literature background) suggests that the major applications of this method are for identifying temperature inversions in a given atmospheric profile. However, the methodology is vague and there is discontinuity between the title, objective, and the results. Moreover, the author has only discussed one real atmospheric profile (Fig. 4), and has not even properly defined the classes of temperature structure being identified for this profile. Rather than focusing on including all classes (such as inversions, stratified layers, cold layers, etc.), the author should focus the analysis on identification of temperature

inversions alone as the title suggests.

Specific Comments

1. The title and abstract suggest that multiple thermal inversions will be detected, but the author states the objective as follows: "to determine all-thermal layers present in a given temperature profile" (pg. 5, line 22). Not sure what the author means by "all-thermal" or "thermal" layers? Does it mean all layers with a uniform temperature gradient? And how are they connected to thermal inversions? The term "thermal layer" is loosely used throughout the paper without a proper definition.

2. Define quantities that are being identified by your method. What is the definition of classes SL, SI, FT, CL mentioned in Table 2 (last column)? What exactly is meant by "free troposphere"? (Note some classes such as SBI top, EI-1 and EI-2 are not even mentioned in the table's caption). What is the basis for using this particular classification? Is this classification profile-dependent? And what is the meteorological (or other) significance of each class? The significance of temperature inversions (SBIs and EIs) has been discussed. But the choice of other classes and the reason for picking them is not clear.

3. The methodology described in this paper cannot be reasonably justified as a standard technique in its present form. Based on the literature review in the Introduction, there seems to be a focus on polar regions, while there is no mention about its applications/limitations in tropical/sub-tropical land/ocean regions. Moreover, only a single profile has been analyzed (Fig. 4). Even in high latitude regions, there can be considerable seasonal and spatial variability in the thermal structure of the lower troposphere (Ueno et al. 2005; Eastman and Warren 2010). Additional profiles should be included in the analyses to warrant the use of this method in other studies.

4. The temperature gradients, dT/dZ, should be clearly distinguished as either positive (temperature inversion), negative (temperature lapse rate) or isothermal ($dT/dZ = 0$). For example, in Fig. 3 it is more sensible to discuss the relation between error and

positive gradient strength (strength of temperature inversion) if the objective is indeed to identify multiple temperature inversions.

5. What about the dependence of the error on the depth of each inversion layer. Maybe shallow weak inversions are not detected as easily as sharp, deep inversions? Once again, the classification includes “shallow inversion” but it is not clear what is the definition of this particular class. It is very plausible that the error strongly depends on the strength and depth of the inversion layer being identified.

6. The Introduction suggests that the atmospheric boundary layer (ABL) inversion will be defined by this method, but nowhere is there a clear/concise definition of the ABL.

Technical Corrections

There are many grammatical and typographical errors which the author should carefully correct prior to final publication. For example, Line 16, pg. 13, “on of” should be “one of”.

References:

Ueno, H., Oka, E., Suga, T., & Onishi, H. (2005). Seasonal and interannual variability of temperature inversions in the subarctic North Pacific. Geophysical research letters, 32(20).

Eastman, R., & Warren, S. G. (2010). Interannual Variations of Arctic Cloud Types in Relation to Sea Ice. Journal of climate, 23(15), 4216-4232.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 10559, 2014.