

Review of “Characteristics of Arctic low-tropospheric humidity inversions based on radio soundings” by T. Nygård, T. Valkonen, and T. Vihma

This study makes an important contribution to the understanding of humidity inversion characteristics in the Arctic. In addition, this paper identifies how using sounding data produces different results from studies that used satellite data. Also, this study employs a methodology that allows for a clean comparison with the observed characteristics of Antarctic humidity inversions. This paper is very well written and I recommend that it is acceptable for publication after minor revision.

Major Comments:

- 1) Is there a way to test whether there is a bias in statistics of humidity inversions at cloud top due to evaporation on the sensor when the radiosonde emerges from saturated conditions?
- 2) How meaningful are the statistics presented in Figure 4? Figure 5d shows that base heights in North America of 1000m are as frequent as 2500m and the most frequent base heights are closer to 200m. The statistics for median base heights in Figure 4 may not be physically meaningful. It is possible to make a contour plot as a function of RFD for the statistics shown in Figure 4 (as was done in Devasthale et al. 2011).
- 3) Much of the discussion about this study is in the past tense. I think the authors need to go through the paper and reword the discussion in the present tense.

Minor Comments:

- 1) Page 22576, line 9: “...are present on multiple levels nearly all the time...”
- 2) Page 22576, line 14-15: Properties are both relatively weak and systematic? Adding specific examples will help clarify the meaning of this sentence.
- 3) Page 22576, line 22: “...encourage further...”
- 4) Reword the introduction and methods sections so that reference to this study is in the present tense.
- 5) Page 22577, line 10: “keeping”
- 6) Page 22577, line 11: “..., which implies that humidity inversions extend to large spatial scale.”
- 7) Page 22577, line 12-13: “...influence longwave...”
- 8) Page 22578, line 3: “...data that the fraction of humidity...”
- 9) Page 22578, line 8: “...inversions is lower than...”
- 10) Page 22578, line 9-10: “...did not show a seasonality in the frequency of occurrence...”
- 11) Page 22578, line 17: “...a 10yr...”
- 12) Page 22578, line 13: “...from linearity...”
- 13) Page 22581, lines 2-4: “...a selection criteria was used where a humidity inversion...”
- 14) Page 22581, lines 6-8: The meaning of the sentence starting with “The latter correlation...” is unclear.
- 15) Page 22587, lines 27: “...vertically separate...”
- 16) Page 22588, lines 8: “...differ remarkably...”
- 17) Page 22589, lines 9: “...in both polar...”
- 18) Page 22589, lines 12: “...in most...”

- 19) Page 22591, lines 9: "...in North America..."
- 20) Page 22592, lines 9-10: "...inversions frequently occur on multiple levels..."
- 21) Page 22592, lines 14: "...present nearly all the time..."
- 22) Page 22592, lines 16: "...approximately half of..."