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Atmospheric Measurement Techniques Discussions



# *Interactive comment on* "Combined wind measurements by two different lidar instruments in the Arctic middle atmosphere" *by* J. Hildebrand et al.

**J. Hildebrand et al.**

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**abstract: reiterate time averaging of 1 h when discussing inhomogeneity**

Actually for this issue the time averaging was nearly 4 h, we will state this in the abstract.

**line 7: add Tepley, 1994 to list of references**

done

**page 4, line 22: change“is” to “are”**

done

**pages 6–7: beam divergence of Na lidar greater than its field of view**

we used wrong numbers: actually FOV (600 µrad) is bigger than beam divergence (450 µrad).

**page 4, line 17 and page 7, line 13: confusing symbols for frequency ($\nu$) and wind velocity ($v$)**

we will use $f$ for frequency

**page 7, line 16: record length 33 s instead of 33 ms**

done

**page 9, third paragraph: clearer writing**

We revised this section seriously. The wind and temperature dependence of Doppler ratio (including Fig. 5) is now discussed in Sect. 2.1. This allows us to shorten the discussion in Sect. 4.1.

**page 10: introduction of ECMWF**

included in manuscript: “The European Center for Medium-Range Weather Forecasts (ECMWF) provides an operational forecast model (Integrated Forecast System, IFS) which assimilates real data. We use IFS version Cy35r1, T799, extracted for 69.28°N, 16.01°E.”



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5, C1998–C2001, 2012





**page 10, lines 20–24: is this paragraph needed?, typo**

This paragraph is needed, it mentions shortly why we use another method of calibration.

Changed “this” to “that”.

**page 11, line 3: typo (change “were” to “where”)**

done

**page 12, line 20: better word for “wrong”**

changed to “inaccurate”

**page 14, line 14: equation for amplitude of gravity wave**

Actually we want to add an offset to the exponential growth of the amplitude. We considered also the form $\hat{u} = a \cdot \exp(z/H_{\hat{u}})$, but this was not sufficient, especially for lower altitudes. So, we used additional offsets for amplitude and altitude: $\hat{u} = a + \exp((z+b)/H_{\hat{u}})$. This form matches the data better and includes a constant scaling factor as well: $a + \exp((z+b)/H_{\hat{u}}) = a + \exp(b/H_{\hat{u}}) \cdot \exp(z/H_{\hat{u}})$.

**page 14, line 17: weak conclusions**

done: “we may conclude”

**page 17: downward phase progressions in meridional wind at 96 to 87 and 109 to 95 km altitude might be semidiurnal tides**

we included this consideration



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5, C1998–C2001, 2012

**page 17: are the authors working on a follow-up study of inhomogeneity of wind field?**

This is not scheduled yet.

**page 18, line 1: typo (change "looses" to "loses")**

done

**page 18, line 7 typo (change "the extend of" to "the extent of")**

done

**page 18, line 9 vs. page 7, line 5: comparable size of sounding volumes**

Compared to much larger sounding volumes of radars ($\geq$100 km at 85 km altitude) the sounding volumes of both lidars have comparable sizes (15 and 48 m at 85 km altitude). Also the separation (40 m at 85 km altitude) is quite small. Structures with smaller scales are beyond the scope since we use integration times of 1 h. We include in the manuscript: "For the applied integration time of 1 h this is fulfilled in our study: the sounding volumes of both lidars are in the order of tens of meters, separated by the same order of magnitude."

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