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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Humidity observations in the Arctic troposphere over Ny-Ålesund, Svalbard based on 14 years of radiosonde data" *by* R. Treffeisen et al.

R. Treffeisen et al.

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Answers to anonymous Referee #2:

We are also grateful to the fruitful comments on our paper. We like to take the opportunity to comment on suggestions and how we changed the manuscript for improving the paper and its content. We will resubmit an overworked version of the manuscript including the new figures and tables. We also like to mention that due to the overwork we included now as well the year 2006 in the data analysis. Please also check our comments to the review of Mr. Milosevich.

p. 1263, l. 5 The statement ąÈtypical stratospheric humidity of a few percentąÉ is at least misleading. Look at your own data in figure 4b: there is quite some ice supersat-

uration above the tropopause.

Sentence is changed to avoid the misunderstanding.

p. 1268, par. 3 It seems to me that you have applied the temperature correction twice, although with different formulas, one with 4.5 from W02 and once with M01. This might cause overcompensation, and indeed, the black curves in Fig. 2 show overcompensation see also text at the end of section 3.3). Are these two corrections really additive? Furthermore, is there any correction applied to the RS92?

We believe that this is a misunderstanding. The temperature correction for the RS80 sondes is only used once. There are two possibilities to realise the corrections. One is the way with the W02 and followed by M04. The other one is the statistical way using M01. This correction is not applied IN ADDITION TO other corrections, but rather is a separate statistical approach that implicitly includes all sources of measurement error by removing the RS80-A mean bias relative to the NOAA hygrometer as a function of T. RS92 sondes were corrected as the RS90 sondes. We add this in the text.

p. 1269, ll. 18 The statement However mean RHi...ąis probably wrong. Why should RHi vary more than RH. This would need rather peculiar temperature variations. Probably you are misled by the choice of your colour bar. Please check.

These sentences were might be not precisely enough. We reworded the section and hope this will be now understandable. We did not change the colour bars.

p. 1272, ll. 22 The sentence the local maximum...should be deleted. The measurement uncertainties are given as ś10%, so that just above and just below saturation is not distinguishable.

We did some rewording here to account for the measurement uncertainty.

p. 1273 Here the reader needs more information on the method applied. How do you compare regions inside and outside ice supersaturation layers, since outside here means above or below. Or is it in statistical sense at the same altitude? The finding of

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warmer supersaturated than subsaturated layers certainly deserves more investigation on the reasons for that unexpected result. Does the mixing of various altitudes lead to this result?

We overworked this part.

sect. 4.4, 1st par. The text is confusing and I cannot see how it is related to the rest of the section. It should be deleted completely.

We did some rewording here and hope the section is more understandable now.

table 2 left, figure 7 and corresponding text: As you have 14 years of data it may be possible to find out whether the seasonal variation of the b values is statistically significant. I suggest the following procedure to find that out: 1) Normalise the frequency distribution for supersaturation (i.e. compute pdf(Si)), then compute from the pdf the cumulative distributions. Then apply a Kolmogorov-Smirnov (KS) test to pairs of the cumulative distributions. The KS test is described and a routine is given in the Numerical Recipes book for instance (e.g., Press et al., 1990).

The test was performed and the results are added in the revised version of the manuscript.

Minor points

Language Generally write frequency of occurrence. This is changed.

Seasons - Why do you divide the year in only 3 seasons (no fall)?

These subsets were chosen to cover the dark part of the year, and following other studies to count for observed changes in the Arctic troposphere between May and June (Ström et al.,2003a ; Treffeisen et al., 2006). This is added in the manuscript to explain the chosen subsets.

p. 1263, l. 11 Gierens (2004) is cited for a statement that ice supersaturation is due to absence of ice nuclei. While this might be so, there is nevertheless no such statement

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in that paper. Please correct. Has been changed.

p. 1264, ll. 24 Sentence duplicated. Sentence was deleted.

p. 1266, l. 20 replace real by actual. This is replaced.

p. 1267, l. 2 replace different by various. This is replaced.

p. 1268, l. 22 Probably the word absolute can be deleted (also in the figure caption of Fig. 2). What you show is simply a difference. Yes, but the comments to the manuscript in its first version did like to have the wording absolute here. So we keep this.

p. 1270, l. 6 clear air. This is changed.

p. 1271, l. 1 better write p $<$ 10-3 or similar. We changed this.

p. 1272, l. 1 Give more details. The reader cannot know what is q and why b = ln q. We add here one sentence for the geometric distribution and the reference Gierens et al. 1999 to make this point clear.

p. 1272, ll. 9 the outdated statement that ice nucleation needs 30% supersaturation should be deleted. The word affords should be replaced by needs or requires. This is changed.

p. 1272, l. 15 MOZAIC This is changed.

p. 1272, l. 18 ... compares to their results.Something compares always to something else, so this statement is a bit meaningless. Wording is changed.

p. 1274, l. 11 Sentence duplicated. This sentence is deleted.

p. 1274, l. 22 40 m. Please check whether this small variation is statistically significant. If not, leave out the statements and the corresponding figure.

40 m was a typing error. We rechecked this part and did some slightly rewording in order to improve the section.

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table 1 Please explain in the text what these numbers mean exactly. For instance, does 24 mean that 24 profiles had supersaturation, that 24% of all profiles had supersaturation, or that 24% of all layers above x km had supersaturation. Do not forget the units (i.e. %).

Thanks for this helpful comment. Indeed we haven been very precisely in describing the numbers. We changed this to improve the understanding of the Table. We add %.

tables 2 and 3 Why do you show temperature differences together with the b values in one table, but humidity differences in the other. This is illogical. It makes more sense to couple the differences together in on table or to have 4 tables.

Following your suggestion we coupled now the two tables.

figure 4 The black CV contours in the figure are useless. First there are open ends within the figure, and second there are other plotting artefacts like loops. Obviously your contouring routine is not able to handle your CV field. So either use a better routine or delete the CV lines.

The routine is able to handle the CV field. The ąÆopen endsąÇ are just the result of taken the middle of the month as starting point instead of the beginning. This is changed and should now be plotted in an appropriate way.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 1261, 2007.