**Atmospheric
Chemistry
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Discussions**

Interactive
Comment

Interactive comment on "The mixing height in urban areas: comparative study for Copenhagen" *by* A. Baklanov and A. Kuchin

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General comments:

The paper reports an interesting data set and analysis of urban mixing heights. Several methods to estimate the mixing height are compared. This gives a valuable contribution to a relevant topic. The paper is of good scientific quality. The language needs to be smoothed to make this interesting paper easier to read. Many sentence constructions are very long and difficult to understand, even after several times reading. Try to rephrase. I recommend publication after revision considering the specific comments outlined below.

Specific comments:

Page 2845 last line - page 2846: This sentence is not clear for a reader without back-

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ground knowledge on mixing layer parameterisation. It might be helpful to add a sentence on the difference between diagnostic and prognostic methods.

Page 2846 line 6-13: All methods used in this paper should be briefly explained in this paper to an extent that the reader can follow the main points of the discussion without further reading. E.g. on what kind of data is each method based: surface observations from what stations and/or data from the radio soundings and/or NWP data and/or aircraft data. I suggest to make a much clearer separation in the text and also in the Tables and Figures between methods using surface data and data from radio soundings. This is for my understanding a fundamental difference between the methods that should be considered in the discussion.

Page 2846 line 6: Indicate how the classification into SBL and CBL was defined. Were there also neutral situations? How do you treat cases where stable stratification is found over water and unstable over land? Captions in Table 3 and 5 state 'convective or neutral BL' while in other places only CBL is used.

Table 1 was taken from Zilitinkevich and Baklanow, 2002 including their evaluation with a different data set than the here discussed one. This is a bit confusing for the reader since the Table 1 is not discussed in detail in the present paper and why to repeat this earlier published table? I suggest to either (a) conduct the complete evaluation for all methods in Table 1 for the Copenhagen data set if possible or (b) reduce Table 1 to only the two methods used in this paper AR81 and BS and delete the last three columns. For option (a) several follow-up questions have to be addressed in this paper: How was u* estimated? The last three columns of Table 1 give the empirical evaluation. Which MH do you use as reference for this evaluation, the measured ones from the radiosonds, estimated by which method? (Indicate in the caption and/or text) A more specific discussion of Table 1 and its results is missing in the text. Which method gives the best results and why?

Page 2846 last line: Will the 'user-friendly computer tool' be public available?

Page 2847 line 19-22: In Fig. 2&3 and also for other analyses in the paper selections of the radio sounding data according to wind directions sectors are made. Each sector is connected to different surface properties. How do you intent to separate the effects of the surface properties from the different synoptic situations related with different wind direction sectors. E.g. in connection with Fig. 2a) it is discussed that the 'water' sector has a lower wind speed while the rural and urban sectors are similar. How much of this is caused by the different surfaces and how much by different synoptic? Please comment on this and guide the reader in the discussion to the points in Fig.2+3 that are caused by action of the surface. Would it be possible to normalise the plots for the synoptic influence, e.g. by dividing with the values in upper layers of the atmosphere that are not/less influenced by the surface action? In Fig. 1 the very dense network of meteorological stations is shown, in the paper only Jægersborg is used so far. Could analysis of additional stations or data help to separate the above discussed surface and synoptic effects.

Page 2850 line 22-24: The similar problem of 'synoptic bias' (or how to call the above discussed problematic) appears here, when comparing the averages of MH estimates for different wind sectors in Table 2 and 3. If one sector has higher/lower wind speed than the others this will give a bias towards higher/lower MH without any surface influence. How large you would this bias be?

Fig.3 gives very similar results as Fig. 2; maybe it is possible to omit Fig.3?

Page 2849 lines 7-14: It is not necessary to repeat the list of parameters a reference to section 3 should do.

Page 2850 lines 15-16 and Page 2851 lines 23-25: Some of the methods correlate better with each other (e.g. AR81 - BS and PARC-PADV-RI) probably because they are based on similar assumptions or principles. This must not mean that they are therefore more accurate than the other methods. And a missing correlation for other methods must not mean that they are less accurate, since you do not know the correct values

(see page 2849 line 25-26). Figures 4 and 5 and related Tables 4,5 can show, which methods are similar, but they could be 'similar wrong'.

Page 2851 lines 26-28: What kind of combination do you suggest and why? E.g. average of all methods?

Page 2852 line 6-12: The discussion in this paragraph is not clear to me. What are the different 'criteria for the sector choose'? What is plotted in Figure 6: Water or urban/suburban sector? Wind direction used: at first height or at 500m?? Could this paragraph and Fig.6 be omitted?

Technical corrections:

Caption of Fig 2 and 3: State that these are measured data from the radio soundings. The graphs contain no 'black squares', you mean 'blue diamonds'. Maybe it is better to omit the parenthesis altogether since a clear legend is given in the figures.

Caption of Fig 3: not 'wind' but 'winter'

Table 1 line 1: 'Aria' should read 'Arya'

Table 1: which of the two AR81 equations was used in the further analysis in this paper. Indicate by adding the later used abbreviations AR81 (and BS) in Table 1, e.g. under 'Reference'.

Page 2847 lines 20-22: Better omit to name the symbols in parenthesis here. It is given in the Figure.

Page 2850 line 17: Not Table 2 but Table 3.

Page 2851 line 23: Not SBL but CBL.

Page 2866 Fig 6: The label 'SURF: 1 Water' is confusing since it contradicts the Figure caption 'semi-urban and rural'. The CBL (right) plot uses one additional method WSMAX that was not used for CBL before and also changes the order of the methods

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compared to e.g. Fig.5. Better use a similar plot as in Fig 5.

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