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Atmospheric Measurement Techniques Discussions

Interactive comment on "Low-level mixing height detection in coastal locations with a scanning Doppler lidar" *by* V. Vakkari et al.

Anonymous Referee #1

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The publication by V. Vakkari and co-workers presents a novel approach for detecting the top of shallow mixed/mixing layers by using scanning Doppler lidars. Based on two measurement campaigns, the authors explain the new technique in detail, show various comparisons and finally present results of the derived MLH. The results presented are very interesting and indicate that often very shallow mixing layers are present at the measurement locations which can be captured only by applying the new method. Beside some exceptions, the paper is well written and methodology and results are well discussed. Thus, I conclude that the paper is of major interest, both in terms of technical and scientific nature, for the community and I recommend it for publication after minor revisions.

General statements:

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Interactive Discussion
Discussion Paper

-The authors selected the threshold for the detection of the mixing layer top to 0.05. This “setting” seems a little bit arbitrary because no explanation is given. Is there a theoretical background or is it just the threshold which seems to be the best working? What is your experience when changing the threshold - is there a high sensitivity in MLH determination? You just show 4 case studies, but how stable is this threshold for a longer times series, do you think this threshold can be applied for very different locations? Please discuss this. I personally have no problem with applying a threshold which has been chosen after testing different thresholds for the data set. However, in this case a little sensitivity study would be much more convincing that the chosen threshold is the “right” one. For example, modify the threshold by +-0.01 and show the corresponding numbers (e.g. percentages in sec. 3.3 etc.) also for the varied threshold. If this makes no sense, explain why. Even better if the threshold was chosen on a physical meaningful basis. But then please explain its meaning.

-I do not understand what is shown in table 3 and the explanation for that in the text is not sufficient. What is the reference mixing layer height? Is that a mean? Please extend caption of table 3 and the corresponding text in the manuscript for that comparison and write scientific clearly!

For example: 12230, “. . . VAD based mixing heights agree reasonably well with the vertically-pointing measurements at the lowest vertically-pointing range gate.” What does agree well? The VAD based mixing height with ??? What do you want to express?

Or: 12230: “Mixing heights from 4° and 15° elevation angle VADs also compare well for the lower altitudes of the 15° elevation angle VAD”. What compares well to what? You talk 2 times of the 15° VAD. . .I simply do not understand.

Or: Caption tab 3: What is meant with lowest gate?

Specific comments:

Preface: Even if it seems that most of the comments below are niggling, I am con-

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vinced that phrasing in scientific publications should be unambiguous. Therefore the sometimes colloquial language in the text should be rephrased, so that also a reader without precognition can understand everything clearly. Below, find some examples; most comments are in the introduction which seemed to be written last. . .

-12220, 1: The authors use several expressions for the mixing layer height, e.g. also mixing height, mixed layer height, mixing layer top, MLH etc. . . . I would appreciate very much if the authors could use a scientific correct expression (mixing height is not the one) and use this the always in the text. I.e. MLH was defined but never used - so probably go for mixing layer height and use MLH always after definition of the abbreviation.

-12220, 2: "its" instead of "the" before diurnal, or what diurnal variability you want to capture?

-12220, 15, word 1: Mixing of what? I guess you mean turbulent atmospheric mixing? Please rephrase correctly.

-12220, 16 "Turbulent mixing is regarded as a significant player in aerosol microphysical processes and in cloud microphysics". Please explain the connection to MICROphysical processes. This is not straight clear.

-12220: "representing" instead of "to represent"

-12220, 21: "stable layers": Stable concerning what? What layers? Do you mean thermodynamically stable stratified air layers?

-12221, 5: same as above

-12223, 7: 30° instead of 30

-12223, 28: Please bring reference or explanation of DBS even if not used in the paper or leave out as it is not of interested.

-12224, 6 and several times below: "24-point VAD", points = radials, i.e. azimuthal

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directions? What do you mean with points? This is not clear. Please state clearly.

-12225, 18: “a high correlation indicates that the residuals are dominated by flow patterns in a length scale that is large compared to the 30m radial resolution of the instrument.” Please explain why a high correlation indicates this! It is not simply evident to me.

-12226, 7: Why is a high correlation an evidence for the need of considering the height profile of the wind? Explain in more detail.

-Figure 2d is never referenced nor explained.

-12227, 3-5: It took me quite some time to figure out how you came up with this formula (Eq. 9). Finally, I realized that the text and the formula are not fitting together. Therefore you should modify the text as follows: Thus the proxy variable for identifying turbulent mixing is the variance of the difference of residuals from two consecutive elevation levels in a VAD subtracted by the variance of the corresponding measurement uncertainty.

-12227, 9, Eq. 10: I think the squared (ˆ2) is not at the correct place as you do not square (r+30m) but sigma(r+30m).

-12227,17. 24 points, see comment above

-12227, end: So finally you get a VAD profile, right? So what is the difference between VAD and the so-called PPI scans? Please also state, that you use the whole profile in the following and not only the ONE at distance r.

-12227, end: So for Cyprus you really used the 360°, right?

-12229, 1-5: The 4° figure is not discussed, why?

-12232, 14: “. . .below the lowest measurement at vertical” Please rephrase. Simply “at vertical” is not correct in my opinion.

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-12232, 16: “;” instead of “:”

-12232, end: A short discussion, if the technique could be also used on flat continental sites would be interesting. Or at least give a short statement.

Caption, Fig 9: again rephrase “below vertical” , i.e. below the minimum range gate during the vertical pointing measurements.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 12219, 2014.