Atmospheric
Measurement
Techniques

Discussions

Interactive comment on "Assessment of Mixed-Layer Height Estimation from Single-wavelength Ceilometer Profiles" *by* Travis N. Knepp et al.

Travis N. Knepp et al.

travis.n.knepp@nasa.gov

[amtd]copernicus

We appreciate the thorough review from referee #1. The manuscript has been updated to implement these recommendations as described below.

1. "... being as clear as possible such as when describing averaging time and vertical resolutions, and exactly which CL51 data processing algorithm is being depicted in each figure..."

C1

  (a) Clarification was made throughout the text to aid the reader in knowing what averaging, resolutions, and algorithms are being used.

2. Page 2, Line 21-23: Do you have a reference for this statement from the US NRC?

  (a) Reference has been included.

3. Page 2, Line 24: This reference seems incomplete

  (a) Reference corrected

4. Page 2, Lines 29-34: These lines are written in passive voice. Please rewrite

  (a) Paragraph rewritten

5. Page 2, Line 34: The way this line is written makes it seem like you are comparing three CL51s from Colorado against sondes from CAPABLE.

  (a) Sentence corrected.

6. Page 3, Line 26: It's never stated why BLView truncates data at 4.5 km. Are there concerns about measurement uncertainties or S/N ratios at higher altitudes? I realize this probably doesn't have an effect on the MLH calculations.

  (a) That is unknown to us and is one of the challenges in using proprietary software as it remains a black box. Any comment we provide on this would be speculative, so we will not comment.

7. Page 4, Line 12: Are the 1 min and 30 m resolutions from the MPL what you've chosen to record specifically for this study? Please state

  (a) Stated

8. Page 5, Line 25: Delete "to be."

   (a) Deleted

9. Page 5, Line 26: clouds not cloud.

   (a) Changed

10. Page 6, Figure 2: The .5s are missing on the y-axis labels

    (a) y-tick labels corrected

11. Page 7, Line 3: What parameters specifically? Averaging time? Vertical resolution?

    (a) Correct. Now specified in text.

12. Page 7, Line 10: "A detailed description of the UMBC algorithm has been published in Compton et al. (2013)."

    (a) Recommendation implemented.

13. Page 7, Lines 10-14: These lines contain jargon that receives no other mention. You can probably tack the single sentence on line 10 to the end of the previous paragraph and delete the rest.

    (a) Change implemented.

14. Page 8, Line 2: farther not further

    (a) Change implemented.

15. Page 9, Line 11-13: Are you saying that there were two CL51s at the BAO-Tower? I'm confused about the instrument set up here.

C3

    (a) No, they housed the CL51 used in the current study. Text changed to "the CL51" instead of "a CL51" to indicate this.

16. Page 9, Line 15: "CL51 data were collected ..."

    (a) Change implemented.

17. A figure showing average diurnal MLH from each of the three sites would be very helpful here and would give context for the statement that Golden often does not observe a well-developed boundary layer.

    (a) New figure (Fig. 3) inserted and text added within body.

18. Page 9, Line 25: Only the CL51 and MPL data were averaged to 5 min resolution, correct? There are a lot of time and vertical resolution averaging numbers being thrown around and they should all be clear.

    (a) That is correct. Due to the nature of sonde data we cannot resample to a longer time period. Clarification is made within the text.

19. Page 10, Line 23: "... the standard deviation of MLH was calculated ..."

    (a) Recommended change implemented

20. Page 11, Figure 3: Somewhere in the text it would be useful to state that all times presented are in local standard time

    (a) Statement added in analysis section

21. Page 11, Lines 4-9, Figure 5: I found Figure 5 to be confusing and in need of some clarification. How should this figure be interpreted? That variability within the 5 min measurement period is generally very low when the methods agree, and peaks when the difference between the two methods is between .5 and 1km?

C4

Shouldn't relative standard deviation (σ/xbar) be unitless? It has units of km on Figure 5. Please clarify.

(a) You are correct, σ / xbar should be unitless. While this figure is interesting, it is only mentioned in the text once and we do not feel that it adds significantly to the manuscript. Rather, inclusion only distracts the reader and may cause unnecessary confusion. The intention of including this figure was to further support the selection of filter criteria, though we feel these criteria are adequately supported without this figure. The figure was removed from the manuscript.

22. Page 15, Figure 7: The color bar and what's plotted on the z-axis are not the same as Figure 6. Did you mean to plot data density rather than relative standard deviation? The current Figure 7 seems to present similar data as Figure 5 in a different way.

(a) We appreciate the reviewer's sharp eye to catch this. Figure 7 was properly labeled, but the caption needed updated and supporting text within the manuscript's body needed clarified. The caption was updated and descriptive text was added within the paragraph beginning with "For regulatory and modeling applications...".

23. age 19, Line 8: According to Figure 9, the correlations are actually 0.81, and 0.82, not 0.82 and 0.83.

(a) Statistics corrected.

24. Page 19, Figure 9: Do these statistics significantly change based on processing method? What do the error bars represent? In general, many of the figures would benefit from more detailed captions.

Page 19, Figure 9: Can you add additional plots to Figure 9 showing the STRAT and sonde comparison?

C5

(a) Yes and no. Text was added to explain this, as were two additional figures. The STRAT algorithm gets tricked in places (as discussed in the added text) and will need further refining before it is capable of operating to lesser degrees of human intervention. However, this may be a strength of the open source software paradigm in that the end user can adjust the algorithm to train it for specific purposes, if desired.

25. Page 19, Figure 9: Please adjust the axes to less than 7 km so spread in the data can be better visualized.

(a) Figure changed.

26. Page 19, Figure 9: I'm curious what the correlation of MLH with all sondes is. Better or worse than the individual sites?

(a) That is an interesting thought. The composite correlations are not much different than the weighted average of the individual statistics. A "composite" dataset has been added to Table 5.

27. Page 19, Line 20: "It is somewhat surprising that the filtered..."

(a) Change implemented

28. Page 19, Line 20: It's difficult to definitively say that correlations at one site are "better" than another given the small sample size. What are the 90 or 95% confidence interval limits on these correlations?

(a) You are correct that marking one set as "better" is challenging due to the small sample sizes. However, calculation of a Pearson's coefficient of correlation confidence interval is highly unreliable due to the size of the data sets. We do not feel this would be representative of the true population statistics, so we will forbear including this statistic here. This may be a beneficial statistic to include in future work that involves larger data sets.

C6

29. Page 20, Line 20: Yes, there is similar behavior at CAPABLE in the comparisons on Figure 8. This is worth future exploration for the BLView output. Did you look at STRAT processing vs. the MPL? Does this invariance feature disappear? Can you add additional plots to Figure 12 showing the MPL vs. STRAT?

    (a) Similar behavior is seen with the STRAT and BLView algorithms. An additional figure has been added to show CL51 comparison with MPL via the two algorithms.

30. Page 20, Line 21: "Removal of MLH below 500 m..."

    (a) Suggested correction implemented.

31. Page 21, Figure 10: Why do the CL51 profiles only go up to 3 km here? Same with Figure 11.

    (a) The focus of the manuscript is on the mixed layer or boundary layer, which is well below 3 km throughout the study. As nothing of relevance is within the 3 km+ profile the profile was truncated to prevent the figure from becoming overly crowded and allow inclusion of text within the upper-left corners of each figure.

32. Page 23, Figure 13: Please adjust the y-axis on plot C so we can better observe the variability in MLH differences

    (a) Axis changed to show full-scale variability.

33. Page 23, Figure 13: Please adjust the y-axis on plot C so we can better observe the variability in MLH differences.

    (a) Change implemented.

34. Page 24, Line 20: sites' not sites

    (a)

35. Page 24, Line 22: A good up-to-date reference from DISCOVER-AQ Colorado on these types of circulations and how they affect pollution distribution is Sullivan et al. (2016, JGR...

    (a) Reference included