

Atmos. Meas. Tech. Discuss., referee comment RC2  
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## Comment on amt-2021-261

Anonymous Referee #2

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Referee comment on "Inter-comparison of atmospheric boundary layer (ABL) height estimates from different profiling sensors and models in the framework of HyMeX-SOP1" by Donato Summa et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-261-RC2>, 2021

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This manuscript is an interesting and relevant topic to ascertain ABL height estimates from different techniques and to compare with model reanalyses.

General comments:

- I recommend that you add some analysis of the results so they are not only quantitative but also qualitative. What does it mean that the ABLH estimates are similar? What does this say about thermal, kinematic and aerosol definitions of ABLH? What do the results say about the model ability to measure ABLH? Is there some time of day that the results differ? It might be interesting to show an hourly composite comparison. Are there some specific weather conditions that the results differ?
- Why do you use the mean of the ABLH estimates as the reference ? This may need some more justification, especially since the ERA5 method has such poor results.
- Why do you average results over a 12 hour period ? Perhaps hourly averages would be more interesting so that you could compare the measurement techniques during the boundary layer evolution.

Specific comments:

- Lines 45-48 : This is a confusing description of ABLH.
- Lines 93-96 : This is unclear to me : The Richardson number gradient method requires observations of profiles wind speed and potential temperature. Perhaps you could clearly state that it can be calculated using radiosondes but only at limited times during launches. And it can be calculated using in situ aircraft profiles but only during ascent and descent. The wind lidar and wind profile continuous observations do not provide the potential temperature information. Please be more clear in that discussion.
- Lines 97-99 : Why do you describe the ABLH using the LLJ technique ? Do you use this technique ? Is that valid only at nighttime ? You do not show any nighttime ABLH measurements in your comparisons. Perhaps you mention this information for completeness ? If so, please state that.
- Line 121 : What is the minimum and maximum height range for BASIL ?
- Line 143 : If there are no data in the lower few hundred meters, could that limit your observations of nocturnal ABLH ? Perhaps you could state here that you are not measuring nocturnal ABLH ?
- Line 157-159 : You note that the applicability of the ABLH technique from a wind profiler can be limited by strong reflectivity peaks due to temperature and humidity gradients. I must be misunderstanding the wind profiler technique because I thought the gradients are what determines the reflectivity peaks. Please further explain the wind profiler technique and how the reflectivity peaks are different from the temperature and humidity gradients. Also please describe how « This aspect will be carefully accounted for .. »
- Figure 5a : Could you please add the results of the other methods of determining ABLH to this figure ? Why does the red line appear to be significantly lower than the maximum aerosol gradient ?
- Figure 5b : Could you please also add the ABLH results on Fig 5b ?

#### Technical and typographical comments:

- Line 52 : Please change to « . . . of recent technological progress. . . »
- Line 53 : Please insert « such » into here : « . . .atmospheric variables, such as particle. . . »
- Line 144 : Please add 'and' here « . . . meters and have marginal . . . »
- Line 144 : Please quantify « marginal effects ».
- Line 173 : Please delete « again ».
- Line 173 : Also, what are marginal effects ? Please be more quantitative.
- Line 181 : Suggested modification : « . . .radiosondes are obtained by using the temperature gradient method. »
- Line 185 : I recommend that you delete « again »
- Line 185 : Please quantify what you mean by « negligible uncertainties ».
- Line 209 : Please correct the typo at the end of the line and change « here » to « where »
- Line 216 : I recommend that you delete « being the »
- Line 222 : Please delete « the » between « observed » and « in »
- Line 222 : What is meant by « and sensors and mothers » ?
- Line 232 : Please tell us the LT for 0900 – 2100 UTC.
- Line 234 : Please correct the typo in the word « its » here : « activity, from its activation . . . »
- Line 234 : I recommend that you remove the words « a quite ».
- Line 257 : I suggest you change it to « scatter plots ».
- Line 286 : Please change to « . . .50-100 ».

- Line 287 : I think that « unfavorable » should be one word.
- Line 303 : Please modify to : « . . .corresponding relative humidity values. »
- Line 306 : I suggest you change the word « map » to « figure ».
- Line 332 : Please remove the word « the » before « them. »
- Line 334 : Please correct the typos : « . . .computed from different sensors are in the range. . . »
- Line 343 : There are two periods at the end of the sentence.
- Figures 2b and 2c : It would be helpful to add a horizontal line at bias=0.
- Line 487 : Suggested modification : « . . .expressed in terms of scatter plots, . . . »
- Figure 3 caption : It looks like the font in the lines 487-488 is different from the font in the rest of the manuscript.
- Figure 3b : Where is the best fit line in Fig. 3b ?
- Figure 5 : Please add (a) and (b) to the figure panels.
- Figure 5b : The x-axis is missing the first « 9 ».
- Figure 5 caption suggestion : « Figure 5 : (a) Time-height . . . , (b) and water vapour mixing ration over the time . . . »