

## Response to the reviewer comments: reviewer #2, manuscript v3

Remarks on the revised version (v3) of the manuscript

### **Atmospheric boundary layer height from ground-based remote sensing: a review of capabilities and limitations**

Submitted by Simone Kotthaus et al. for publication in *Atmos. Meas. Tech.*

I appreciate that the authors did consider my detailed comments on the previous version of the paper as a valuable contribution to further enhance the quality of the manuscript. I realize that my remarks and suggestions have been carefully taken into account when preparing the revised manuscript. I feel that the manuscript is now ready for publication, and I have just a few (minor, editorial) issues that might be corrected or changed with the final version.

We appreciate the reviewer's positive assessment of the revised version of the manuscript and thank him for providing another set of careful comments. In the following, we address each remark individually.

- When reading the very first sentence of the abstract, a hint on the position of the ABL inside the atmosphere might be considered as useful. E.g. "... defines the volume of air adjacent to the Earth's surface ..."  
Changed according to suggestion.
- I still have a few points related to Figure 2:
  - In the upper right panel, the EZ could be marked by a thin region coloured with a transition colour between pink and blue (as it is done in the upper left Figure, and also in the lower right Figure at the time of profile B).  
Changed according to suggestion.
  - I am still not convinced that the evolution of CBL and SBL just start at sunrise / sunset ...  
Correct. According with the literature we added a slight delay to the growth of the CBL and now the development of the SBL commences at a time slightly before sunset.
  - In line 2 of the Figure caption "horizontal velocity" might be replaced by "horizontal wind speed" (velocity would mean the vector variable).  
Changed according to suggestion.
  - It should be explained somewhere that the vertical dashed lines in the plots of the wind profile are meant to represent the geostrophic wind.  
We added the following sentence in the figure captions: "Dashed vertical lines in the v-panels represent the geostrophic wind reference."
- My original comment "The link to the Rn measurements either calls for some additional explanation or it should be omitted here." has been answered by the authors in their response letter with: "Sorry, we cannot locate the sentence to which this comment is referring to." – This comment now refers to Line 200 of the revised manuscript.  
We agree. The sentence has been removed.
- Line 277f: The original formulation "Bragg-scattered radar signal" was, to my opinion, a more precise characterization than "respective returned signal" – I thus suggest to keep the first one, since it names the process (Bragg scattering) and it makes clear that it is the radar signal in any case for which the Doppler shift is derived.  
Changed according to suggestion.
- Line 357: I suggest to add: "which is linked to the absorption of sound in the air and to ..." (note that the absorption of sound is the basic process limiting the range of a sodar).  
Changed to "This good near-range capability goes along with a rather limited range extent to about 1~km which is linked to the absorption of sound in the air causing a considerable sensitivity of the system to environmental noise."
- Line 388: I am not sure whether one should really speak about an "echo" (an "echo" usually results from reflection but not from scattering and does not experience a frequency change)  
Changed to "signal".
- Line 395: component → components  
Changed according to suggestion.
- Line 397f: What is meant with "multiple instruments" here? I think that this sentence basically says the same as the sentence before, it can thus be omitted while adding the "fluctuations" to the sentence before.  
Rephrased sentence to "Where multiple DWL are deployed to sample the same volume of air, direct retrievals of the three-dimensional wind vector and its fluctuations can be obtained (Sathe and Mann, 2013)."

- Line 436: I suggest to replace “antenna” by “telescope window”  
Changed according to suggestion.
- Line 439f: “... increases with aerosol load ...”  
Changed according to suggestion.
- Line 478: “using aerosol-based retrievals” might be omitted.  
Deleted
- Figure 3, caption, line 4: “comprehensive” → “complete”?  
Changed according to suggestion.
- Line 493: “at fewer stations”  
Changed according to suggestion.
- Line 700: “change” → “non-stationarity”  
Changed according to suggestion.
- Line 789: “... wind and turbulence measurements ...” (note that the sodar-RWP synergy product in Beyrich and Görndorf, 1995, is not based on the wind profile measurements, but on the backscatter signal intensities, representing the refractive index structure parameter)  
Sentence changed to “To cover the full range of MBLH at a given measurement location, wind or turbulence measurements from multiple data sources can be combined (e.g., sodar and RWP; Beyrich and Görndorf, 1995; Beyrich, 1997; Angevine et al., 2003).”
- Line 1031-32: “For the detection of shallow layers a low first measurement level and high vertical resolution ...”  
Changed according to suggestion.
- Line 1093: delete “here”  
Deleted
- Line 1253: “Despite of ...”  
We decide to keep the original version “Despite...”. See [here](#).
- Line 1301f: Aerosol-based methods do not necessarily analyse the results just of mixing processes since the layer boundaries detected can also originate from advection, accumulation or aerosol formation processes.  
Changed to “Aerosol-based methods again analyse the result of recent physical and chemical processes, including mixing, advection, aerosol formation, accumulation or hygroscopic growth, and are able to track both MLBH and RLH. They are not able to determine the cause of the change in aerosol vertical characteristics, e.g. whether the tracers were transported as a result of thermal buoyancy or shear-driven turbulence.”
- Line 1310f: “at greater altitudes”  
Changed according to suggestion.
- Line 1336: large → thick  
Changed according to suggestion.
- Line 1358: DAIL → DIAL  
corrected
- Line 1661: correct: NO <sub>2</sub>  
corrected
- References in general: The authors might consider to harmonize the citations of journals: For some citations, the journal names are given in full, in most cases common standardized abbreviations are used.  
Abbreviations are now used for all journals in the bibliography.
- Line 2033: Maxime, H. → Hervo, M.  
corrected
- Line 2122: Delete “and Iek, T.”  
corrected
- Line 2124: Jore → Joffre  
corrected
- Line 2142: “O’Connor” → „O’Connor”  
corrected
- Line 2320: claculation → calculation  
corrected