Atmos. Meas. Tech. Discuss., 8, C1559–C1562, 2015
www.atmos-meas-tech-discuss.net/8/C1559/2015/


Atmospheric Measurement Techniques
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Discussions

# *Interactive comment on* "Error estimation for localized signal properties: application to atmospheric mixing height retrievals" *by* G. Biavati et al.

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Received and published: 15 June 2015

The comments provided by the anonymous referee number 1, are almost the same provided during the preliminary stage of the reviewing process. Therefore we reply using the same arguments: The referee states in quotes, replies in plain text.

*"The manuscript deals with the determination of the uncertainty in the boundary-layer height from a single radiosounding. [.....] The temperature fluctuations in atmospheric convective conditions are likely larger than this."*

In our paper we are not dealing with the physical processes that create atmospheric



turbulence. The spatial variability of the signals and in particular their fluctuations from the time or space averages are not considered, because they do not related to the goal of the paper. The errors that we considered are only the measurement errors of the radiosonde. They are collected in Table 1. Physically, turbulence is not related to the uncertainties of the radiosonde measurement. Rather, the variability of the measured temperature is an effect of turbulence. Temperature variability and measurement uncertainty are only related in a way that the variability has to be considerably larger than the uncertainty to be detected.

In the synthetic example used to illustrate the methodology for assessing the localization error we used an error for the potential temperature of 0.125 K. It was chosen together with the excess temperature at the ground in such a way to define a convective near-neutral profile. This measurement error is reasonable for temperature measured by radiosondes as can be seen in Table 1. However, for sake of clarity we added few sentence in order to remove any doubts on the reason the signal and error are chosen as we did. (Sentence inserted from line at line 73).

*"My main criticism of the manuscript is related to the lack of accounting for the physics of the convective boundary layer. [...] the updrafts/downdrafts"*

We fear that there is a fundamental misunderstanding here: the paper is about a new and very general method to derive signal properties like location of a peak, threshold detection etc. in a noisy signal. Unlike other established methods, our method also provides uncertainty estimates based on error propagation for the derived quantities.

The paper is not about turbulence nor the physics of the PBL. This field and especially the application to mixing height retrieval was chosen just as an illustrative example. We could have chosen other signals totally unrelated to atmospheric science. However, we chose mixing height detection because this is also the application we developed the method for. There are many methods used in the literature that estimate mixing height simply based on the estimation of signal properties (potential temperature, Richardson

Bulk method, lidar backscatter). However, none of them provides an uncertainty.

Therefore when the manuscript deals with an estimate of the uncertainty of the mixing height estimated by analysis of a single radiosonde profile – it is misleading. The method in the manuscript does not account for the physics in the entrainment zone, which is the real source of uncertainty in the determination of the mixing height from radiosonde profiles."*"A radiosonde provides a snapshot of the temperature/wind profile and therefore does not account for the oscillating behaviour of the border between the convective boundary layer and the free atmosphere. The real mixing height is somewhere in the entrainment zone and cannot be derived from a radiosonde profile (gives only a snapshot estimate, this limitation is well known in the community and one of the sources for the many comparisons of mixing height estimates in the literature).*

*Therefore when the manuscript deals with an estimate of the uncertainty of the mixing height estimated by analysis of a single radiosonde profile – it is misleading. The method in the manuscript does not account for the physics in the entrainment zone, which is the real source of uncertainty in the determination of the mixing height from radiosonde profiles."*

*As said before, the method is independent of the actual application. And the estimation of mixing height from single radiosonde profiles with the Richardson Bulk method is a widely used operational method in meteorology. We share the doubts of the referee that this might not be a reliable way to provide mixing height. However, this is not the topic of this manuscript.*

*"Considering the reputation and high scientific level of the Atmospheric Measurement Techniques journal, I find the method described in the manuscript too simplified and lacks essential physics to justify publication."*

*Our method is mathematically sound and can be used to improve other well-known*



*methods by providing uncertainties to parameters that are estimated from signal properties. It might not be specific to atmospheric science but it can certainly be useful there as well.*

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*Interactive comment on Atmos. Meas. Tech. Discuss., 8, 5105, 2015.*