Atmos. Meas. Tech. Discuss., 6, C928–C933, 2013
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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieving wind statistics from average spectrum of continuous-wave lidar" *by* E. Branlard et al.

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Received and published: 17 May 2013

Thanks for the constructive comment on our manuscript. Here are the intended changes to the manuscript based on the requests of the referee:

Equation 1, lower limit Change: at the end of the paragraph: "The lower limit of the integration should actually correspond to the position of the lidar. It is here taken as $-\infty$ for simplicity. This choice is also convenient since the Laurentzian function does not have a compact support. Nevertheless, this limit could be replaced by the position of the lidar if it is ensured that the weighting function is normalized to unity on the integration domain. This is the property of the weighting function used in section 2.2."

##Equation 12, first line: Comment: Thank you for noticing this. Change: This term should be added in the integral of the first part of equation 12 : $\exp^{-2 \pi i f t}$

##pg. 1950, line 18: Comment: The reviewer is right. To approximate (13) with a Gaussian at low wind speeds is probably not good. We did in order to get a measure of the width, which could be compared with the width obtained from the data. Change: We insert into the text at line 18: "The sinc^2 function is not fitted well with a Gaussian, but is similar to the way widths are obtained from the data, which then allows for the comparison in Fig. 11".

##pg. 1951, line 4: reference needed for the number of particles travelling through a focus point Change: The following reference will be used:

Single-Particle Laser Doppler Anemometry at 1.55 μm Michael Harris, Guy N. Pearson, Kevin D. Ridley, Christer J. Karlsson, Fredrik Å. A. Olsson, and Dietmar Letalick Applied Optics, Vol. 40, Issue 6, pp. 969-973 (2001) http://dx.doi.org/10.1364/AO.40.000969

In this paper from Harris et al. they observe that at ranges smaller than approximately 50 m you may have only very few particles in the probe volume. Their observations open the path for better signal analysis at close ranges. A report by Chris Hill also assesses aerosol concentrations: http://www.upwind.eu/media/633/D6.14.1.pdf

pg. 1951, section 3.1: Comment: What is pointed out can indeed be seen as an inconsistency. If (3) is multiplied by v_r and integrated, one gets (1), so it is right that (1) says that we are using the barycenter, not the median. The reason for this choice is just convenience. It is easier theoretically to handle the barycenter than the median. The theoretical investigation of the median should be done in a future work. Change: A reference to Angelou 2012 is added where the use of the median method is justified and was observed to be less noisy.

##pg. 1952, ln. 15: Reference for the 3 sigma threshold @in-book{1f977c3c164943b09baf57320e343385, title = "Challenges in noise removal from

Doppler spectra acquired by a continuous-wave lidar", author = "Nikolas Angelou and {Foroughi Abari}, Farzad and Jakob Mann and Torben Mikkelsen and Mikael Sjöholm", year = "2012", pages = "S5P-01", booktitle = "Conference proceedings",

} ##pg. 1953, ln. 15: Change: at the beginning of the first sentence: "To account for possible installation misalignment"

##pg. 1954, line 21: Comment: This experiment was performed as part of a different campaign and in the context of this paper the choice of 45 m/s and 55 m/s is coincidental. The context of this experiment was to test blade mounted lidars in the wind tunnel.

##pg. 1957, ln. 2 : Comment: There has been a small confusion in this sentence. The R2 can be considered identical. Change: The sentence should be : "A slightly inferior slope of 0.992 is found..."

##pg. 1957, ln. 27: Comment: It was first chosen to remove the lidar wind speed time series pdf for clarity. But comments reveal that there is a need for it. Change: A new figure is enclosed. The following sentence should be added at the end of figure 3 caption: "The pdf from the lidar time series(Lidar PDF) has been added to the figure."

##Section 6.2: Comments: For the field experiment in the atmosphere the difference between the two methods (average spectra or time series pdf) is small (see fig 5 and p1961 line 13). This can also be seen in the new figure 3. This explain the high correlation coefficient found for the lidar time series. Yet, the conclusions of 6.2 and 6.3 can be moderated indeed since the results are not as strong as the wind tunnel experiment.

Changes: * Paragraph 6.2 The sentence "This emphasizes the potential of the method in circumventing the effect of the spatial averaging effect." » replaced by "The potential of the method in circumventing the effect of the spatial averaging will be further emphasized by the results of the wind tunnel experiment." * Paragraph 6.3: The two

sentences: "It is seen that the standard deviation from the average spectra systematically shows a better agreement with the sonic standard deviation. The gain of this method is hence obvious for the determination of the turbulence statistics." » replaced by : "It is seen that the standard deviation from the average spectra systematically shows a better agreement with the sonic standard deviation. Though this gain is minor in the field experiment, it will appear obvious from investigation of the wind tunnel experiment that a better determination of the turbulence statistics is obtained by this method."

Comment: For the comparison of the statistical distributions, a Kolgomorov-Smirnov test was applied, but it was chosen to discard the method for its application when the mean is corrected could be questioned. The test could still be performed of course, care should be taken.

Suggested addition : Before the conclusive paragraph of section 6.2, a new figure enclosed, and a new paragraph: "A common method used for comparison of probability distributions is the Kolgomorov-Smirnov(KS) test which is based on the maximum distance between two cumulative distribution function(cdf). The correction on the mean is applied since it is not an inherent feature of the pdf but a considered as a measurement error. Results are shown in figure [?? 5 ??] using averaging periods of 30min. In coherence with the correlation analysis the KS test reveals that the distance between the sonic cdf and the average spectrum cdf is in average smaller than the distance between the sonic cdf and the lidar time series cdf." Caption of the figure: Kolgomorov-Smirmov test with respect to the sonic cdf using 14 30min periods.

##Section 6.3: Causes for bias bwteen sonic and avg spectra A comment on that could be added in the discussion, e.g. p1961 l.10. "Yet differences in standard deviations of the order of 3% are found between results from the averaging spectra method and the sonic measurements. Several factors could influence the method and explain theses differences, mainly: the assumptions leading to equation 3, the noise suppression method and the scaling method of the spectra."

##Section 6.4: Comment: The authors can not really explain these differences between runs.

##Technical Corrections: Comment: Thank you for your corrections, they will be applied in the final manuscript. (See also new figures enclosed with "spectrum" instead of "spetrum")

Table 1: Change: the legend of figures 6-9. In Table 1 “Lidar hist.” should be “Lidar PDF”.

Figure 11: Change: the legend of the figure.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 1943, 2013.

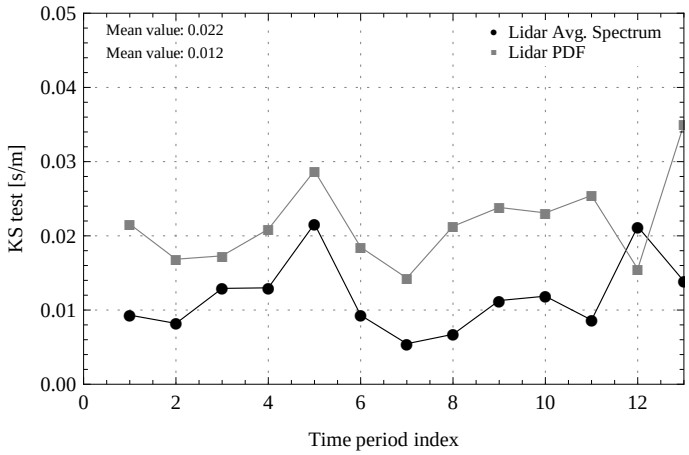

Fig. 1. Kolgomorov-Smirmov test with respect to the sonic cdf using 14 30 min periods.