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Atmospheric Measurement Techniques Discussions

Interactive comment on "A two-year intercomparison of CW focusing wind lidar and tall mast wind measurements at Cabauw" *by* Steven Knoop et al.

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We thank Referee #1 for his or her compliments and interesting comments on our paper. We now will reply to the comments one by one. Intended changes to the manuscript are explicitly mentioned.

(1) Line 25: "Coherent lidars also measure the shift of the frequency spectrum, albeit by a different methodology."

Probably this boils down to the question whether measuring a beat-signal is the same as measuring a shift of the frequency spectrum. However, what we had in mind is that

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in direct detection the frequency spectrum of the backscattered light is detected, from which the frequency shift with respect to the emitted light is determined. In coherent detection it is not the frequency spectrum of the backscattered light that is measured, but rather a beat-signal between the local oscillator (which is related to the emitted light via a frequency offset, which also can be zero).

We propose the following minor change: “Direct detection wind lidars measure the frequency spectrum of the return signal”, omitting “the shift of”, which makes more apparent the difference between the two techniques.

(2) Line 60: "It should be noted that changing the focal length also changes the depth of focus (i.e., probe length)."

A statement on the range dependent probe length was already present in the next paragraph (lines 64-65). We don’t think it is necessary to make a change.

(3) Line 65: "It would have been interesting to find cases over the two year period where clouds existed beyond the minimum range to investigate performance of the cloud removal algorithm."

In our comparison of the wind lidar and mast in situ data we have considered the effect of fog and low clouds (see Figure 9 of the manuscript), but we didn’t specifically considered the case of only clouds below 10 m. We can select cases on basis of the visibility sensors, with the condition of fog at 2m, but no fog at all the other levels (starting at 10m). The result of the intercomparison, including this class of clouds, is included here as Fig. 1. The “fog/low clouds” class is as defined in the paper, the new “fog below 10m” as given here. On a first glimpse the results look very good, better than the “fog/low clouds” class. However, one has to keep in mind that here wind speeds between 4 m/s and 16 m/s are considered, and that no information on the vertical thickness of the fog layer is available (rather than MOR<1000m at 2m and MOR>1000m at 10m and upwards). Thus the “fog below 10m” could include very thin and patchy cloud layers. To select events with a persistent fog layer below 10m,

one needs to analyze the visibility measurements on a sub-10 minute timescale and probably lower the upper limit for the MOR. So while we agree that the point raised by the referee is interesting, a thorough analysis of it is beyond the scope of this work.

(4) Line 192: "It seems possible in the broken cloud case that the presence of clouds beyond the maximum range might be leading to more QC failures. Broken clouds might be expected to be higher and more likely to contribute to this effect."

Indeed, the way we have constructed the “low cloud” class and “broken cloud” class leaves open the possibility that in the latter case there are more clouds also above the range provided by the mast (or the wind lidar). However, the observations with the ceilometer showed that a first cloud base height above 100m has little impact on the data availability, and therefore we don’t expect this property of the broken cloud class to be the cause of smaller data availability.

(5) Line 257: "Higher biases at longer range under low cloud/fog conditions could be due to asymmetric range weighting, where the signal at the more distant range of the probe volume has been attenuated relative to that at the closer, resulting in the effective measurement distance being closer to lidar than the focal range."

This is indeed a possible reason for the observed negative bias for the fog/low clouds class. We will include this explanation in the paper.

(6) Line 269-272: "These are quite good results."

Thanks for the comment.

(7) Figure 13 (caption): "Seems like the caption is missing the word "greater" before "than 4 m/s" in line 2."

Thanks, indeed a word (either “larger” or “greater”) was missing in front of the second “than 4 m/s” in this caption, and this will be corrected.

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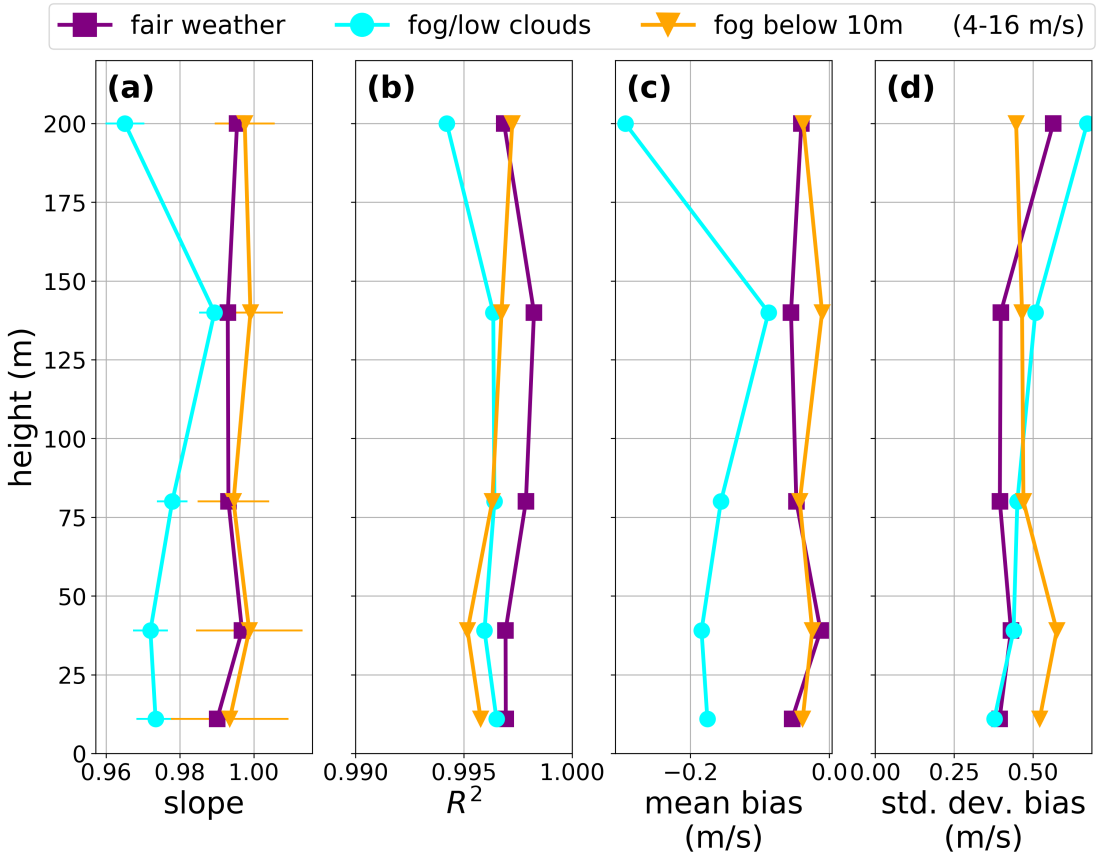

Fig. 1. Same as Figure 9 of the manuscript, but including the class "fog below 10m", with the condition of MOR<1000m at a height of 2m, and MOR>1000m at all other heights (starting at 10m).

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