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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 the referee for raising the issue of thermal expansion of the transceiver that could lead to deviations in the position of the focus, and therefore lead to a seasonal dependent bias in the ZephIR wind speed measurements. We will investigate a possible temperature effect on the intercomparison and if we find a significant effect we will include this in the manuscript.

The instrument output includes an internal temperature measured close to the window and we have data on the air temperature from the co-located automatic weather station as well as the meteo station attached to the instrument. This means we can do more

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than a seasonal analysis.

Regarding the comments in the supplement:

(1) “Doppler wind lidars typically cover the atmospheric boundary layer very well and thereby complement other sources of wind information, such as in-situ measurements at surface stations, weather radars, aircraft observations and satellite instruments.”

Referee #2: This is not correct. Direct detection doppler wind technique can cover a much higher range. https://journals.ametsoc.org/bams/article/86/1/73/58297 https://amt.copernicus.org/articles/6/3349/2013/

Response: We are well aware of wide variety of wind lidar instruments. The example of AEOLUS is given in our manuscript that was published online September 30, 2020, on line 25 (Referee #2 unfortunately is considering an earlier version of our manuscript, which was not published online). However, we would not call the AEOLUS wind lidar “typical”. Furthermore, we have stated that those instruments “cover” the boundary-layer, which does not automatically imply that that is also the limiting range.

(2) “These wind lidars operate at a laser wavelength around 1.5 mum, and the backscatter is mainly caused by aerosols. For national meteorological services, like the Royal Netherlands Meteorological Institute (KNMI), data sets measured by these instruments can be valuable for model validation, while real-time access opens the possibility of data assimilation in operational numerical weather prediction (NWP) models and nowcasting purposes. For these applications it is of utmost importance to know the meteorological conditions in which the instruments are able to provide reliable data or not.”

Referee #2: It would be better to add a description between the different lidar techniques, e.g. direct detection, heterodyne. Also specify the used medium (aerosols, molecules)

Response: In our manuscript that was published online September 30, 2020, we had

extended the general discussion on Doppler wind lidar.

(3) “The height range is 10-200 m above the instrument, although up to 300 m can be selected in the software.”

Referee #2: doesn’t matter what you can chose in the sofware. The instrument works when aerosols are available

Response: We agree that this instrument requires aerosols to measure wind. This is also explicitly mentioned in the introduction. However, for our location, and up to a height of 300m, enough aerosols are always present. In fact, we are not aware of limited data availability due to lack of aerosols for short-range wind lidars (such as the ZephIR 300 or the Windcube v2). Could the referee provide publications indicating situations of too low aerosol signal for these short-range wind lidars?

(4) “As a result, the wind lidar can resolve the wind profile better than the mast.”

Referee #2: this is pretty obvious, considering also the different costs between lidar and mast

Response: We don’t understand the point the referee wants to make here. If the referee thinks the lidar costs are higher than the masts, then he or she underestimates the cost of mast wind measurements (including the mast infrastructure, maintenance, calibration).

(5) “The wind lidar and mast measurements are in close agreement for most of the levels, with the exception of some part of the day where the wind speed was around 25 m/s or higher, occurring mostly at 140 m and 200 m”

Referee #2: why those discrepancies at higher wind speeds ?

Response: This is indeed a very interesting observation. Unfortunately, we have no explanation on the bias for higher wind speeds at those levels. As we wrote in Section 5.2.1, we don’t think the discrepancy is due to the cup anemometers.

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