Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2017-18-AC1, 2017

Atmospheric Measurement Techniques Discussions

Interactive comment on "Perdigão 2015: methodology for atmospheric multi-Doppler lidar experiments" *by* Nikola Vasiljević et al.

Nikola Vasiljević et al.

niva@dtu.dk

Received and published: 10 May 2017

Note: The structure of the replies to the reviewer comments is as following: (1) the original unchanged reviewer comments are given with regular text formatting , (2) the comments are enumerated and type of comment is indicated (general comment or specific comment), (3) following each comment a response to the comment and description of associated changes in the revised manuscript are provided while the text is formatted *italic*.

General comment 1: Very nice paper and well structured. The wake results are very interesting.

Dear Reviewer,
We would like to thank you for your time and for your insightful comments which were

Printer-friendly version

Discussion paper

used to revise and improve our manuscript.
Find our responses below.

Specific comment 1: Fig 13, is it from Long-range wind scanner or short-range wind scanner? Its not very clear in your paper. If from short-range wind scanner, what is the effect of dynamic focusing on the velocity resolution and accuracy? Can you please refer to some work done someone in your group?

Figure 13 displays measurements acquired by the short-range WindScanner system. In the revised manuscript we have updated Figure 13 caption to indicate this. Also, captions of other figures that show observational highlights (i.e., Figure 11 - 15) are updated in a similar way. To our knowledge, the dynamic focusing does not impact the velocity resolution and accuracy since the number of FFT points used to perform the spectral analysis remains unchanged from one to another focusing state. In general, the focusing in CW lidars has implication on the probe length. The closer we focus the CW laser beam the smaller is the probe length and further we focus the beam the bigger is the probe length. Therefore, in Table 4 one can notice that we provided not a single number but a range of values for the probe length of the short-range WindScanner system that is the result of various focusing states throughout T and Vertical scans.

Specific comment 2: Fig 11 & Fig 14, based on the location of your other Windscanners, the subtended angle "looks" small and maybe below 50 deg, is my assessment correct? You could compare it with a sonic/tower at one of the location, maybe that would help validate your results. And also would be good to make note of the subtended angle between the two beams at the point of measurement.

Instead of the subtended angle let us expresses the geometry of a multi-Doppler laser beam steering in terms of the intersecting and elevation angles. The intersecting *angle we define as the smallest angle between the projections of two intersecting laser beams in a horizontal plane. The intersecting angle can take any value between 0 and 90 degrees. If the elevation angle is zero the intersecting angle is equal to the subtended angle.*

When setting up the layout of a multi-lidar experiment we intend to have an intersecting angle of at least 30 degrees respect to the prevailing wind direction. Based on our simple accuracy model (see Vasiljević, N. and Courtney, M. Accuracy of dual-Doppler lidar retrievals of near-shore winds, 2017, WindEurope Resource Assessment Workshop 2017, https://goo.gl/LFuimU) the intersecting angle of 30 degrees results in the accuracy of about 0.25 m/s for the retrieved horizontal wind speed.

Following this rule of thumb and in connection to the prevailing wind directions (Northeast and Southwest) we design the layout of the Perdigão. Accordingly, throughout the Diamond scan on average the intersecting angle was 49.37 degrees, while for the Ridge scan it was 42.21 degrees. The prevailing flow was such that it was basically going through the middle of the intersecting angle, resulting in a good projection of the wind vector on the lidars line-of-sights. For the both scanning methods the elevation angles at which the laser beams were steered were about 4 degrees. Thus, the beams were almost steered in a horizontal plane.

Since for the Transect, T and Vertical scan the WindScanner systems were run in a triple-Doppler mode there is not a single value for the intersecting angle but three values. For the Transect scan the intersecting angle between Koshava and Sterenn, Sterenn and Whittle and Koshava and Whittle were 84.10 degrees, 54.77 degrees and 41.12 degrees respectively. They remained constant during the scan. In case of the T-scan, the mean intersection angles between R2D1 and R2D2, R2D1 and R2D3, and R2D2 and R2D3 were 44.26 degrees, 55.78 degrees and 49.64 degrees respectively. Finally, the mean intersection angles between R2D1 and R2D2, R2D1 and R2D3, and

R2D2 and R2D3 in the case of the Vertical scanning mode were 28.77 degrees, 59.96 degrees and 49.21 degrees respectively.

In the revised manuscript, the mean intersecting and elevation angles are now indicated throughout Section 4.7.

Our intention was to have a functional met mast installed at site for a continuous sanity check of WindScanners measurements during the campaign. Due to technical difficulties, this was not achieved for 2015 edition of the Perdigão experiment. However, prior and after the Perdigão-2015 we validated WindScanner measurements against a mast at our test site in Denmark. A report of the post-Perdigão validation, which was a pre-RUNE validation campaign (see Floors et al. 2016) for several long-range WindScanners is publically available (see https://goo.gl/FUuPGv).

For the Perdigão-2017 experiment, we followed the recommendations outlined in Section 5.2 (specifically line 16 to 22) of the reviewed manuscript. In accordance with these recommendations, we designed the scanning methods in such way that the location of at least one measurement point of a scanning method coincides with the location of one mast-based sensor. This will allow the validation of the multi-lidar measurements during the Perdigão-2017 experiment.

Specific comment 3: What has been your average range observed by the windscanners at Perdigão?

The average range of the long-range WindScanners was approximately 2.3 km. However, it should be noted that the maximum range we configured was 2.5 km. Therefore, it is hard to judge what would be the actual average range of a pulsed lidar for the Perdigão site.

Specific comment 4: Regarding the filtering criteria in table 5 - Say you have 3 Lidars, and data only from 2 Lidars is available at the location of measurement at a given time. Do you ignore all these measurements to get u, v & w? Or do you just calculate the 2 components (u & v) and the third (w) is a NaN? It would be good to test this out, based on the subtended angle between the two Lidars at the measurement location and elevation angle, maybe?

For T and Vertical scans, we provided reconstructed u, v and w components when all three LOS measurements were available. The exception is made for the Transect scan and only in the case when Whittle measurements are 'NaN'. In this special case, the horizontal wind speed is reconstructed from Sterenn and Koshava since the intersecting angle between the laser beams from these two WindScanners is close to 90 degrees. In case of the Diamond and Ridge scans we only reconstructed u and v components when measurements from both Sterenn and Koshava were available.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-18, 2017.