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Atmospheric Measurement Techniques Discussions

Interactive comment on "Analysis of the performance of a ship-borne scanning wind lidar in the Arctic and Antarctic" *by* Rolf Zentek et al.

Anonymous Referee #1

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The paper by Zentek et al. describes the use of a scanning lidar for ship-borne wind measurements without a motion stabilisation platform. The authors used data collected with an external Altitude Heading Reference System to correct for the ship's pitch and roll after the measurement campaign. The presented technique and the statistical comparison of the lidar wind measurements to radio soundings as well as to ship measurements is important for the scientific community due to the clear need for wind measurements over the oceans – especially in the polar regions. Such measurements are important for a better understanding of atmospheric processes in the maritime environment. The paper is suitable for publication in AMT and can be published after minor revision.

Major comment:

- The lidar measurements that have been corrected for the ship's pitch and roll after the measurements are performed consist of profiles that are the average of 12 to 15 seconds of individual rays for the PS96 campaign and 1.5 seconds for the PS85 campaign. The movement of the ship during these averaging periods introduces horizontal wind components into the vertical wind. This is an important source of error and should be discussed in the paper. How does the proposed methodology account for movements during the time needed to obtain the averaged profiles that are later motion corrected?

Other comments:

- Page 5, line 12: Can you really assume horizontal homogeneous wind fields? The elevation changes during the scan.

- Page 6 line 30: Doppler velocity due to horizontal wind speed is less than 26 % at this elevation... Is that still true if you correct pitch and roll after the measurements were taken? Your elevation is not stable at 75° due to the ship's motion.

- Page 7 line 9-10: What are the reasons for the different SNR thresholds for the two campaigns? Could it be the different averaging times of the rays? The elevation is not stable during the measurements and you get different horizontal wind components into your vertical wind component. With a longer averaging time the effect might be enhanced.

- Table 2 and Table 3: Similar to previous comment the statistics for the PS85 campaign with a shorter averaging time are better than for PS96 with a longer averaging time. What is the reason for this?

- Page 8 line 19/20: Could the higher bias be explained by not having a horizontally homogeneous wind field? You only correct for the elevation and azimuth but you cannot correct for the horizontal wind component being present in the vertical wind component.

- Figure 6: please add a plot for the relative difference between lidar and radio soundings by height for wind speed and wind direction.

- Figure 7: Please add a plot for relative difference for the comparison of wind speed and wind direction for lidar and radio soundings as well as for lidar and ship anemometer.

- Figure 9: It looks like the lower SNR values between 300 and 600 m Figure 8 (bottom) have more influence on the wind direction than the wind speed. What would be the reason?

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