

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2022-132

Anonymous Referee #1

Referee comment on "Atmospheric visibility inferred from continuous-wave Doppler wind lidar" by Manuel QueiBer et al., Atmos. Meas. Tech. Discuss.,
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The manuscript suggests correlation between visibility measurements from in-situ visiometers and backscatter coefficient measurements from a continuous-wave wind Lidar. Datasets from two measurement campaigns are used, one in **Cabauw** (Netherlands) and one in **Pershore** (UK). The study falls into the scope of AMT. Yet, there are important differences between visibility from CW wind lidar and visiometers, arising from the different aerosol properties. Also, calibration of CW wind lidar against a visibility sensor in a similar mean aerosol scene area to the one of its intended use is necessary, creating limitations to future applications.

At L 104-106 when describing the CW wind lidars, it is said that "the return signal is not sensitive to atmospheric extinction, but is practically governed by the backscatter coefficient only. This leaves the backscatter coefficient as the most obvious proxy of visibility of a CW lidar." Thought at L43 it has been mentioned that "by measuring light extinction σ , MOR can be derived". Basically, it looks like the most important parameter is overlooked. Could you give more details on that?

L538-539 "This can be explained by different aerosol types and size distributions at play for different backscatter coefficients" I find it hard to understand the grammar of this sentence.

I think that the small agreement between CW Doppler lidar and visibility sensor measurements, mainly for Pershore, should be mentioned in the conclusions and briefly explain the reason of these differences.

Concerning the site specific differences, it should be mentioned that if backscatter from other types of instruments (e.g. ceilometers) was used, the same differences between the two sites would have arisen and also provide an example of correspondingly data. The site specific differences are very important and every site will present different aerosol scene

and properties.

Since the study assesses if backscatter from CW wind lidar can be used to retrieve visibility, a conclusion about seasonality observed for backscatter in the two sites (Fig 10), along with the MOR connection to this seasonality, would be really helpful for the reader.

Have you checked what happens if you use $Ct=2\%$ in eq. (1)? Eq. (8) would change to $4/(\beta(\pi)S(\lambda_1/\lambda_0)^0)$. Would this have an important effect on the results? Also, lidar ratio S is considered constant, but as also described in the manuscript, presents strong variability depending on the aerosol type. This should also be mentioned in the conclusions (L 537-544) along with the "less linear correlation".