Dear Dr. Ad Stoffelen,

Thank you for taking time out of your busy schedule to review our manuscript. In this revision, we made careful modifications based on your comments and suggestions. After these rounds of revision, your critical comments help us a lot in improving the manuscript, we're really appreciate for your help. We are now sending the revised manuscript. Please see our point to point responses to all your comments below.

In this letter, the comments and suggestions you gave are marked in blue, our modifications are marked in black, the original texts are marked in italic black, and our explanation for the modifications are marked in red.

AE's comments:

Thanks for this complete rebuttal and modifications, which indeed render the manuscript acceptable for publication in AMT.

I suggest a few minor more corrections to improve the clarity of the manuscript.

Response: We re-read the paper carefully and made corresponding modifications to some ambiguous places. For example:

Original: Ln 264, P10:

The contours in Fig. 3 denote the differences between the SBRs of the two new orbits and sun-synchronous dawn-dusk orbit, which demonstrates that the dawn-dusk orbit is the optimal observation scenario for minimizing received SBR for Aeolus-type spaceborne DWLs operating on sun-synchronous orbits.

Modified: Ln 263, P10:

The contours in Fig. 3 denote the differences between the SBR of the two new orbits and sun-synchronous dawn-dusk orbit. All the values are positive, indicating that the dawn-dusk orbit is the optimal observation scenario for minimizing received SBR for Aeolus-type spaceborne DWLs operating on sun-synchronous orbits.

Original: Ln 457, P18:

The required energy is determined by temperature, pressure, wind uncertainty, SBR, and noise of instrument, and thus, the required laser pulse energies are different in different bins.

Modified: Ln 458, P18:

According to this method, the required energy is based on the temperature, pressure, wind uncertainty, SBR, and noise of the instrument, and thus, the required laser pulse energies are different in different bins.

Some unclear sentences that have nothing to do with the subject of the manuscript were deleted:

Original: Ln 301, P11:

4) Compared with other regions, the uncertainties in the equatorial region are higher at the bottom of the troposphere and are lower in the stratosphere. The trend of the temperature profile in the equatorial region is the main reason for this phenomenon, which is consist with the trend of the uncertainties. The number density of molecules is inversely proportional to the temperature. A low molecular number density leads to a weak return signal of spaceborne DWLs, which leads to higher wind observation uncertainties.

Modified: Ln 302, P11:

4) Compared with other latitudinal regions, the uncertainties in the equatorial region are higher at the bottom of the troposphere and are lower in the stratosphere.

Original: Ln 313, P11:

As can be seen by comparing between Fig. 4 and 5, the wind observation uncertainties become larger as the impact of the SBR increases. The uncertainties exhibt obvious latitudinal variations. This is mainly attributed to the latitudinal variations in the maximum SBR shown in Fig. 3.

Modified: Ln 311, P11:

As can be seen by comparing between Fig. 4 and 5, the wind observation uncertainties become larger as the impact of the SBR increases.

Some expressions have been added to make the meaning of the manuscript more clearly.

Original: Ln 324, P12**:**

This small degradation of the uncertainties could also be used as an argument for operating Aeolus-type spaceborne DWLs on other sun-synchronous orbits rather than a dawn-dusk orbit.

Modified: Ln 322, P12:

This small degradation of the uncertainties could also be used as an argument for operating Aeolus-type spaceborne DWLs on other sun-synchronous orbits rather than a dawn-dusk orbit, in case of flying more than a single a single Aeolus-type instrument at the same time.

And some other minor corrections.

The new paragraph quoting Marseille et al (2008) ends with "a single Aeolus". However, Marseille et al. showed that up to three Aeolus satellites in an dawn-dusk orbit are effectively contributing to NWP benefits. Please replace the quoted text with "dawn-dusk Aeiolus".

Response: Done.

Some of the red text in reply to the second reviewer may be promoted to the manuscript text for consideration by its readers.

Response: In the modified manuscript, two points in the reply to the reviewers were added.

Point 1 (Ln 327, P12):

According to Rennie (2017), the worst case SBR (154 mW m^{-2} sr^{-1} nm^{-1}, polar summer condition) has noise around 0.5~1.0 m/s lager random error than the best case (night-time condition) at the height of 5~10 km. This result illustrates the degradation of the uncertainties in Rayleigh channel is not large in troposphere and also indicates the correctness of the increase in wind observation uncertainty between different orbits calculated in this study.

The above expression was added. In the above, we get the result that the new Aeolus-type spaceborne DWLs operating on the two new orbits would get a small degradation in average wind observation uncertainties compared to that of Aeolus. To show the correctness of the result, the results in Rennie (2017) was added, which was also expressed in the reply to the second reviewer in former rebuttal.

Point 2 :

Thanks to the first reviewer for explaining the question why the wind observation of Mie channel is more accurate than that of Rayleigh channel in PBL. We cited the reason in the modified manuscript.

Original (Ln 291, P11):

In fact, the Mie channel is mostly used for wind observations due to the widespread presence of aerosols in the PBL. Therefore, the accuracy of the Rayleigh channel in the PBL is not considered in the following section of this paper.

Modified (Ln 289, P11):

In fact, the Mie channel is mostly used for wind observations due to the widespread presence of aerosols in the PBL. Because the aerosols produce strong backscattered signals which can be seen as sharp peaks in the spectrum. The corresponding Doppler shifts can be determined more accurately for the spectra of sharp peaks than those of the broader molecular spectra received by Rayleigh channel. Consequently, the Mie channel wind uncertainties are smaller than those of the Rayleigh channel. Therefore, the accuracy of the Rayleigh channel in the PBL is not considered in the following section of this paper.

Line 20: will is -> will be

Response: Done.