Thank you. These valuable comments (anonymous referee #2, received on 17 Oct 2023) are highly appreciated. The corresponding answers of the authors are given below in blue color; changes in the manuscript are highlighted in green color.

Interactive comment on "First measurements of 3-Dimensional winds up to 25 km based on Aerosol backscatter using a compact Doppler lidar with multiple fields of view" by T. H. Mense et al.

(Author response)

Original Comment:

In the introduction, the importance of wind field measurement, the methods of wind field measurement and the shortcomings of various methods are introduced in detail, which leads to the development progress of coherent lidar. And explains the reasons why spaceborne lidar need to use both Mie and Rayleigh lidar, thus leading to the technical progressiveness of this manuscript. Shows the capable of detecting Mie signals that better than ALADIN.

In line 115, the angle correction methods is very good, effectively avoiding wind field errors caused by angle deviation.

Thank you. Quite some effort went into ensuring the correct alignment of the instrument.

In line 145, 'For data processing the individual pulse raw dat…', seems syntax error.

Thank you, but we don't think there is a syntax error here. The system measures each individual laser pulse and the laser has a repetition rate of 500Hz, thus we get a pulse to pulse time resolution of 2ms. The electronics run with 150Mhz giving an altitude resolution of 1m.

We added in line 148:"…electronic altitude resolution of 1m,…"

Above 150, eight resolution of 1 m for each individual field of view. What is the width of the laser pulse?

The length of the laser pulse is 1.1 microseconds temporally (FWHM) and thus roughly 165m in length.

We added in line 149:" The laser pulse itself has a length of approximately 165m (full width at half maximum) in the atmosphere."

In line 205, obviously, it can be used to correct ECMWF, but the transmission of gravity waves above 11km is only a guess, and a simple wavelet analysis can be done for simple analysis.

We changed in line 202:" While above 11~km the winds fluctuate around zero, presumably due to the passage of gravity waves, below a constant background flow of descending air can be observed."

A closer analysis of the fluctuations in the vertical winds are planned for our future work. At this point of the work you are correct, that the attribution of the fluctuation to gravity waves is only a guess, albeit a reasonable one given the shape and temporal evolution of the fluctuation seen in figure 7.

In figure 11. The satellite and lidar are several tens of kilometers apart, and this comparison result is still very good, can you explain the reason?

During the time of the Aeolus overpass there was no quick change in wind was observed, both in ECMWF and in our lidar measurements. We thus assume that the wind field was quite homogenous.