Comments of the authors to review of the anonymous referee 2 (C1909)

The authors thank the reviewer for his comments to improve the paper. Below we respond (italic) to the author comments (standard).

--

This paper describes the development of a database of atmospheric parameters to be used for a range of different simulation studies forESA's ADM/Aeolus mission. The database is developed using two primary sources of data: ECMWF meteorological analysis fields, and aerosol information obtained through CALIPSO backscatter measurements.
The idea is to combine data from these two sources into a unified set of data in a form that is close to what will be seen by ADM. The authors to go great lengths to address - and where possible correct - the primary difficulties or deficiencies in these data: The ECMWF analysis fields have a relatively coarse temporal resolution of six hours, a variable nominal vertical resolution ranging from tens of meters in the boundary layer to kilometers in the stratosphere, and a near-constant (but inadequate) nominal horizontal resolution of 25 km. Some aspects of atmospheric variability are underestimated in the analysis fields, partly but not only due to the limited spatial resolution. The CALIPSO orbit is higher than the ADM orbit, it has an early afternoon equatorial crossing time whereas ADM will be flying in a dawn/dusk orbit, and the respective lasers operate at different wavelengths.

As far as I can tell, the way in which these differences are addressed is sound throughout the article, although some of it by necessity is somewhat speculative; for instance there is no unique way of "adding information" to compensate for the lack of variability in the meteorological fields, something that is clearly acknowledged by the authors.

A couple of general comments:

As far as I know, the burst mode operation of the ADM laser is being reconsidered (and may already have been formally abandoned) by ESA, and the manuscript should be updated to reflect the latest information about the planned mode of operation.

That is right, although the change from burst to continuous laser mode operation is not formally confirmed yet at this stage.
We will add a sentence on this in the Introduction section where burst mode is mentioned

While I do not dispute that this database will be very useful for simulating many aspects of the ADM algorithms, I do think the authors are overstating the application to the vertical sampling strategy for the instrument. The introductory section gives the impression that this is main reason for developing the database, and I do not think this should be the case. The vertical sampling of ADM can be changed up to eight times per orbit, a feature that can be used to accommodate atmospheric variability. However, this cannot be done on the fly but must be pre-programmed on a weekly basis.

The paper is in my view missing a fundamental discussion of what one would gain by using an elaborate database such as the one developed here over simply basing the choice on robust, repeatable and predictable parameters such as known topography and the climatological boundary layer and tropopause heights.

The first ideas of developing an atmospheric database for Aeolus studies originate from the 1990's and have evolved over time with the advent of spaceborne laser instruments (LITE, CALIPSO). The application to vertical sampling strategies was a next motivation in further developing the database.

It is true that the vertical sampling can not be adapted on the fly and that the climatology of many geophysical parameters is pretty well known. What is not well known is how to distribute the 24 Mie and Rayleigh bins to yield maximum benefit for NWP, taking into account e.g. zero wind ground calibration constraints.
This was considered in a separate study. One aspect here is the quality and coverage of winds obtained from the Mie and Rayleigh channel in heterogeneous atmospheric scenes. For instance, increasing the resolution of the Mie channel (to 250 or 500 meter) in regions of large wind shear and cloud/aerosol variability will reduce height assignment errors for Mie channel winds and improve the quality winds from the Rayleigh channel through a more accurate cross-talk correction. Statistics of the occurrence and location of such events is obtained from the database and used as input for optimizing the vertical sampling strategy. Aeolus simulation tools like LIPAS (Marseille et al., 2003) can simulate the impact of various sampling scenarios on the quantity and quality of retrieved winds from the database input.

Another aspect is improving the characterization of the stratospheric flow with Aeolus, i.e. either through an improved tropospheric flow and upward propagating waves into the stratosphere or through directly sampling the stratosphere. This aspect has been addressed in an operational NWP context through experiments at ECMWF for various sampling scenarios with a realistic distribution of simulated Aeolus winds, based on the database.

A main driver for the meteorological side of the database is to capture the additional variability of the wind field down to the 3.5 km resolution of the CALIPSO dataset. This can be used to predict the performance of ADM over scenes with large along-track gradients in the wind field, and I believe that this is a far more important application than the vertical sampling. The horizontal spacing between individual ADM shots is 70 m (with a laser PRF of 100 Hz) while the nominal resolution of the derived wind projections is 50 km. Some additional discussion of why 3.5 km was chosen as a horizontal resolution and what is the sensitivity of the predicted ADM performance to wind variance within the 50 km shot accumulation and/or averaging distance would be welcome.

At the time of writing, the on-board horizontal accumulation was still at discussion. Mentioned numbers were 1 km and 3.5 km, the so-called measurements. In both cases the 50 km horizontal along track accumulation length is oversampled giving flexibility for the ground-processing to handle along track gradient in the wind field.

The measurement length is mainly determined by the SNR constraint. The SNR of single shots is too low for ground processing, 3.5 km is a compromise between sufficient SNR for advanced processing (classification between particle and particle-free measurements) and maximum resolution, e.g. for the identification of along-track wind gradients.

From wind power spectra of e.g. aircraft data (Nastrom and Gage, 1985) it is known that the wind variance along a 50 km track is about 1 m^2s^{-2} *on average, i.e. well below the 4-9* m^2s^{-2} *mission requirement random error variance.*

We will add the above discussion to the text.

I did not attempt to correct the fairly large numbers of typographical errors encountered throughout the manuscript.

We will go through the document carefully again to reduce the number of typographical errors

In conclusion, I think the paper deserves to be published, and while I encourage the authors to modify it as suggested above, I would not consider doing so a “major revision”.