Atmospheric
Measurement
Techniques

Open Access

EGU

Discussions

Interactive comment on "Validation of Aeolus wind products above the Atlantic Ocean" *by* Holger Baars et al.

Anonymous Referee #1

Received and published: 8 June 2020

The authors present a unique and highly valuable data set, based on radiosonde launches from the Polarstern cruise across the Atlantic, to assess the performance of Aeolus in the early phase of the mission (autumn 2018). The paper is very clearly written and the results are important to validate the unique Aeolus mission. Still, some corrections are needed upon publication.

Major comments ==============

line 2: Aeolus measures horizontal wind profiles => Aeolus measures profiles of a single horizontal wind component

line 127: 30 x 2.7 = 81 not 87, please correct. It is more like 30 x 2.85.

line 152: "It is obvious that only two out of this four wind products are useful, namely the

Rayleighclear and the Miecloudy product." Well, this is not that obvious. Also Rayleigh-cloudy can provide a useful wind because the L2B can correct for Mie contamination, in principle, using the scattering ratio as input. It is true that until now this has not been succesful enough for operational use. So please update your text accordingly.

Figure 2 is from Raman-polarization lidar Polly, I guess? Please mention in the caption of the figure.

line 133: "In contrast, it was obviously not detected by the Aeolus measurement due to the fact that the Miecloudy wind is obtained practically only from return signals of the cloud and thus only from the height range at which the cloud was observed within this one range bin of 1 km thickness." I guess the problem here is that Aeolus only measures the wind at cloud top, so for a fair comparison you should compare with the radiosonde value at the cloud top. On the other hand, Aeolus cannot determine the exact location of the cloud top inside the vertical bin and the best one can do is to assign the Mie wind to the bin centre location, hence giving the large error the authors observe. Note that the Mie channel is much more sensitive to such height assignment errors than the Rayleigh channel (X. J. Sun, R. W. Zhang, G. J. Marseille, A. Stoffelen, D. Donovan, L. Liu, and J. Zhao, The performance of Aeolus in heterogeneous atmospheric conditions using high-resolution radiosonde data, Atmos. Meas. Tech., 7 , pp. 2695-2717, 2014, doi:10.5194/amt-7-2695-2014)

line 268: "Thus, these wind measurements at this altitude should be neglected until the hot pixel correction is in place." Since figure 5b does not show altitude, it would be good to explicitly mention to ignore the (dark) red colors, which indeed contradict with the Rayleigh-clear winds above (discontinuity).

line 318: "Due to its large vertical resolution". This is incorrect. Should be "coarse vertical resolution" or "large vertical bins"

Figure10a/11a. Data analysis from Aeolus have shown substantial differences between statistics from ascending and descending orbits. In figure 10a and 11a it would be

interesting to indicate this by using different colors for the dots in the scatterplot.

line 345: "Considering the relatively small amount of measurements for this statistics, an almost Gaussian shaped distribution is found. Thus, one can conclude that the deviation between Aeolus and the radiosonde wind observation is normally distributed." You cannot conclude this based on the shape of the distribution in figure 10b. Please rephrase or otherwise apply a statistical analysis to test this Gaussian hypothesis.

line 353: Please mention that the MAD is less sensitive to outliers and equals 0.674 x STD for a perfectly Gaussian distributed stochastic variable. This gives a good handle on how to interpret the value of 3.33 m/s in the next line, i.e., it corresponds to 4.94 m/s error standard deviation, the metric more commonly used in error quantification and data assimilation.

Table 2. Why differs the value of 3.26 for Rayleigh-clear MAD from 3.33 in the text? Please correct.

line 364: "This is caused by the generally lower Rayleigh return signal compared to the Mie channel. Rayleigh scattering is orders of magnitude lower than the Mie scattering." The difference is not only SNR, it is also different interferometers and different type of processing for wind retrieval (peak fitting versus fitting of measured Rayleigh Response to temperature and pressure dependent (Rayleigh Response, Doppler shift) curves/tables). Please rephrase to something like: "This is mainly caused by the generally lower SNR of the Rayleigh return signal compared to the Mie channel, besides the different measurement and retrieval techniques".

line 373: "Some instrumental effects, like the hot pixel issue, have not yet been corrected" In the mean time, the main reason for biases of Rayleigh winds has been found: temperature variations over the telescope which are not fully compensated for by the instrument. Please mention this too.

line 374: "Despite the mission requirements could not yet be achieved, the mission can

be seen as success as it was already demonstrated that winds are globally observable from space by active remote sensing with an accuracy needed for assimilation in NWP." I would end with "........ active remote sensing with sufficient quality to demonstrate positive impact in NWP [Ref]". With a reference to results presented by ECMWF or ESA outreach publications.

line 397: "horizontal heterogeneity". I guess you mean: "horizontal atmospheric heterogeneity"? Please add.

line 421: "was not sufficient to capture the maximum wind speeds in relatively thin strong-wind regions, here discussed in terms of the example of the tropical jet stream". I would rephrase to: "was not sufficient to capture events of strong vertical wind-shear such as near the tropical jet stream".

line 434: you could add: "in fact, Rayleigh-clear winds have proven more beneficial for NWP than Mie-cloudy winds".

line 436: "..... and random error of 3.3 m/s for the Rayleigh ...." This is very misleading as this value does not represent the usual STD but MAD, see comment above. So please translate this value to STD.

line 438: "Some known instrumental effects and calibrations have not yet been implemented in the retrieval algorithms" Rephrase to: "In the mean time discovered instrumental and calibration imperfections were not yet implemented in the retrieval algorithms used for the 2018 autumn data set"

In this context, do you have plans to use reprocessed, unbiased, Aeolus data with the same radiosonde data set presented here? I would very much encourage the authors to write a follow-up paper, once the reprocessed data for the autumn 2018 period become available. If so, please mention in section 5.

Minor comments / typos ======================

line 39: observation => observations line 62: chosen => selected line 89: around ≈;

remove either 'around' or '≈' line 94: to retrieve wind retrievals => to retrieve winds line 100: correction => corrections line 110: the data must be available within 3 hours => the data must be available within 3 hours after measurement time (timeliness). By the way, this is not true for ECMWF who wait about 5 hours before they start there analysis run. This is valid for medium-range forecasts. Mesoscale meteo centers need the data within 3 hours for operational use. line 116: parameter => parameters line 129: The currently applied method by ESA is the use of the scattering ratio => The currently applied method by ESA is the use of the scattering ratio, which is determined as part of the L1B processing (ref) and used as input for the L2B processing. line 135: comprised => comprises line 159: please explain DISC line 164/166: pixel => pixels line 166: increase => increased line 246: the resolution is simply too low => the resolution is simply too coarse