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Comment on amt-2021-38

Anonymous Referee #1

Referee comment on "Sensitivity of Aeolus HLOS winds to temperature and pressure specification in the L2B processor" by Matic Šavli et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-38-RC1, 2021

This study examines the sensitivity of retrieved HLOS Rayleigh winds to temperature and pressure fields that should be provided to the Aeolus L2B processor for the Rayleigh-Brillouin correction. The sensitivity to Mie-contamination correction is also assessed. The difference between IFS and ARPEGE short-range forecasts are used to estimate the uncertainties in temperature and pressure fields. These differences are likely to be smaller than real temperature and pressure short-range forecast errors because the IFS and ARPEGE forecast systems are based on the same NWP model and their forecasts rely on the same observing networks. Hence, it is not surprising that the differences found in this study are generally small and lead to L2B HLOS wind variations less than 0.15 m/s in 99% of cases. Although using differences between short-range forecasts from two NWP models as a proxy for the temperature and pressure errors is questionable, there is no obvious and valuable alternative. As such, the article is relevant and represents an interesting follow-on paper of Dabas et al. (2008), which shows that the retrieved HLOS Rayleigh wind is most sensitive to the prescribed temperature and its uncertainty should be less than a few degrees. This requirement is generally met by using short-range forecasts of temperature and pressure from modern NWP models, which is confirmed in the present article.

An interesting aspect examined in section 4.3 is the correction of L2B HLOS winds (oper) using differences between the reference temperature from IFS and the short-range forecast temperature from ARPEGE. It is shown that this correction is generally small, but could be significant over some specific locations such as in the stratosphere, near-surface polar regions and jet streams, leading to substantial HLOS wind corrections. However, these corrections remain smaller than the estimated FM-B HLOS wind errors, which is approximately 4 m/s during the period examined. This investigation will be useful to other NWP centers that use the L2B product generated at ECMWF for their research and operational applications.

The authors provide many technical details about the processing of Aeolus data at Meteo-

France that make the article somewhat difficult to read, especially for readers outside the NWP community. Eliminating some technical details in sections 3.1 and 3.2 would improve the manuscript. A careful revision of the English is also recommended.

Specific comments:

Lines 8, 10, 12 and elsewhere in the text: It is stated that model errors for prescribed temperature and pressure are not taken into account in the estimation of HLOS winds. However, what are actually not accounted for are forecast errors, which include both model, representation and initial condition errors propagated in time. It is important to make that distinction because near-surface errors over the poles (model and representation errors) are not of the same nature of errors near jet streams (mostly from initial condition errors). This confusion between model and forecast errors should be corrected throughout the manuscript. Alternatively, this issue could be discussed in the introduction by stating that model error in this article means the sum of model, representation and initial condition errors. Another source of errors could be the difference in the forecast lead-times of IFS and ARPEGE temperature and pressure used in the AUX_MET files (i.e. 6-h and 30-h forecasts for IFS vs 3-h to 9-h forecasts for ARPEGE).

Lines 53-55 : The reasons and limitations of using the difference between short-range forecasts from two NWP for assessing the impact of temperature and pressure uncertainties should be further discussed and justified here. In particular, the underestimation of the temperature errors due to error correlation between IFS and ARPEGE short-range forecasts.

Line 58 : The definition of AUX_MET should be provided here instead of in line 98, or simply replace AUX_MET here by the plain definition 'auxiliary meteorological data input' .

Line 71 : This expression is not a linear interpolation but a first order Taylor expansion. Replacing linear interpolation by linear approximation would be fine.

Line 129 : AUX_METoper are the met data generated from the IFS short-range forecasts. Hence, it would be easier for the reader to replace AUX_METoper by AUX_METifs or AUX_METecmwf.

Line 209 : Is it 89 km or 87 km as usually reported many Aeolus studies?

Lines 212-214 : Do you also consider a background check quality control?

Lines 262-264 : It should be mentioned that the temperature difference between IFS and ARPEGE are expected to be smaller than the real temperature uncertainty because of the similarities between the two forecast systems.

Line 284 : I suggest inverting Fig. 7 and Fig.6 to make these figures appearing in the right order in the text.

Lines 289-290 : It is hard to say that the granulation is due to model error because the truth is unknown. What we see here is the difference between two background fields.

Line 358 : 'Regarding the results presented further this has been found insignificant'. This sentence is not clear.

Line 399 : Could also be due to differences between the IFS and ARPEGE data assimilation systems.

Lines 400-401 : This comparison between the short-range forecast differences and the EDA spread should be discussed earlier in the text (e.g. lines 262-264). This is an important element to justify the use of temperature differences between the IFS and ARPEGE forecasts as a proxy for reference temperature errors.