

Review #1's comments:

I thank the authors for addressing most of my comments and accounting for my suggestions in the revised manuscript. Although the manuscript has been substantially improved, you will find below a few additional comments and corrections:

The authors thank the reviewer for the very thorough, very careful, and very helpful suggestions and comments.

Line 51 : The reference Liu et al. 2022 is this manuscript under review! This self-reference should be removed.

The reference Liu et al. 2022 is removed.

Line 186 : In the response to my comment on Line 190 (first submission), the authors state that "In the future, we plan to explore the benefit of the scene-dependent L2B estimated errors on Aeolus wind assimilation. The information has been added to the text". I however could not find this information in the revised manuscript. Could you indicate where this information had been added in the text?

This sentence was missed and is added at the end of Section 2.3.

Lines 281-282 : This explanation is too broad. Could you elaborate more on the role of the large random error ratio for the Rayleigh winds (Fig. 6) in the OLS regressions?

The following is added to the text to explain the differences in the OLS and TLS bias estimates:

"If the predictor (either Aeolus or FV3GFS winds) has very small errors. the OLS regressions would be close to perfect. and the OLS and TLS regressions would give very similar results. In such situation, the random error ratio would be either infinity small ($\ll 1$) or infinity large ($\gg 1$), However, the Aeolus and FV3GFS winds have considerable errors, and the actual random error ratio is about 2-3 for the Rayleigh winds versus FV3GFS winds and about 1.2-1.5 for the Mie winds versus FV3GFS winds (Fig. 6). This leads to the large differences in the OLS and TLS bias estimates. Specifically, the OLS bias estimates using Aeolus winds as a predictor have larger differences from the TLS estimates than the OLS estimates using FV3GFS winds as a predictor."

Fig. 14 : Panels a, b and c are nearly identical to those in Fig. 13 of the original manuscript, except panel d, which is significantly different. What is the reason for this?

There was a bug in the plotting script for Fig. 13d of the original manuscript. This is fixed in the revised manuscript.

Lines 342-349 : It is interesting to examine the impact of the additional bias corrections made to the Aeolus data on a particular case, such as the one presented in the new section 6. However, the fields and scores shown in Figs. 17-19 for this case study need some clarifications and further explanations. Why did you average the 0000 UTC wind vector and IVT fields over 2 days instead of showing these fields for a particular date (e.g. 0000 UTC 27 November 2019)? Why did you not average the 24-h

accumulations shown in Fig. 18 over the same forecasts as in Figs. 17 and 19 (i.e. 1200 UTC instead of 0000 UTC)?

The wind vector and IVT fields are now shown for 0000 UTC 27 and 28, November 2019, separately. In general, similar results are found for the particular dates, as from the previous averaged statistics.

The caption of Figure 19 was not accurate. Now it is corrected and reads as “The forecast skill scores for 24-h accumulated precipitation for 156-h to 180 -h forecasts verified against the NCEP precipitation raingauge data analyses and validated from 1200 UTC 26 to 28 November 2019.” Therefore, the statistics in Figures 18 and 19 are consistent.

Figs. 17 and 18 : These figures show day-7 forecasts for the BASE, AEOM, AEOT experiments. I suggest adding the verifying analyses, which could be useful for assessing which experiment gives the best IVT, wind vector and precipitation accumulation forecasts.

The ECMWF analyses of IVT and wind vector are added to the new Figures 17, and the NCEP precipitation raingauge data analyses is added to the new Figure 18. In general, the IVT, wind vector, and precipitation fields in the AEOT experiment are closer to the analyses, as demonstrated quantitatively in the original Figure 19.

Fig. 19 : Panels c and d show the differences in ETS and bias with respect of BASE and their significant levels. These panels are not discussed in the main text. Consequently, I suggest removing these plots.

We believe that the statistical significance from panels c and d would be helpful and so we prefer to keep these panels. A reference of the statistical significance of the precipitation location forecast is added to the text.

Line 361 : FT3GFS should be FV3GFS

Corrected.