

Response of the manuscript “A Bias Correction Scheme for FY-3E/HIRAS-II Observation Data Assimilation (Chen and Guan, 2024)”

Thank you for your professional comments. We have also made corresponding revisions based on your professional comments. Below are the specific responses, highlighted in blue:

General comments

This paper shows verifications of two experiments with bias correction relative to the experiment without bias correction. It is important to show verifications against an experiment without assimilation of HIRAS-II to confirm the impact of the bias correction. If these verifications show degradation, additional discussions about the causes will be necessary, and it may suggest that some bias remain in the observation data.

Re: The experiment without assimilation of HIRAS-II (EXP-CONV) is added in revised manuscript. Its analysis field is also verified against the ERA5 $0.25^\circ \times 0.25^\circ$ data. The vertical RMSE (Root Mean Square Error) profiles of temperature and water vapor from EXP-CONV are added in Figure 8 (a) and (c), respectively.

Compared with experiment EXP-CONV, experiments EXP-2, EXP-GSI and EXP-NOBC assimilated a large amount of HIRAS-II data covering from the ground to the upper atmosphere. Therefore, it can be seen from Figure 8 (a) that the temperature analysis field accuracy is effectively improved (closest to ERA5), including experiment EXP-NOBC. The RMSE of temperature analysis fields from NOBC, EXP-2 and EXP-GSI significantly decrease relative to EXP-CONV in all atmosphere (Figure 8 (a)), the RMSE of water vapor analysis fields slightly decrease relative to EXP-CONV below 800 hPa (Figure 8 (c)). This result to some extent proves that HIRAS-II data have the value for assimilation.

To validate the influence of different bias correction schemes, the RMSE profiles from EXP-2 and EXP-GSI normalized by the RMSE from the experiment NOBC are displayed in Figure 8 (b) and (d). Figure 8 (b) shows that EXP-2 correction scheme effectively improves the temperature analysis fields accuracy in the upper and near-surface levels. EXP-2 scheme shows a better improvement than EXP-GSI schemes, especially in the upper levels. For the water vapor analysis fields (Figure 8 (d)), all BC schemes showed less significant improvements relative to NOBC compared to the temperature analysis fields, with changes in RMSE within 0.5%. It is still the EXP-2 scheme reducing the largest RMSE at 400 to 800 hPa atmosphere. This result proves that the bias correction scheme can enhance the assimilation effect of HIRAS-II data.

For details, please see Line 397-417. In addition, the website for conventional data used in data assimilation experiments is added in “Data availability” (Line 453).

Minor comments

Abstract: There are no explanations about the word EXP-2 in the abstract.

Re: The explanation about the word EXP-2 is added in Line 17.

L5, L26, L46, L64, L72, L88, L93, L98, L104, L105, L119, L120, L170, L178, L203, L222, L297, L337, L412: radiation -> radiance. The word radiance is usually used to mean measured quantity. In some contexts, the words brightness temperature may be more appropriate.

Re: The revision has been completed.

Fig.8: The figures should show confidence range by error bars.

Re: The error bars are added in Figure.8 (b) and (d).

Other points:

L91: but not provide --> but do not provide

Re: The revision has been completed.

L133: with a *solar/viewing* zenith angle?

Re: It is with a viewing zenith angle. The revision has been completed.

L339: WRFDA model *has been* developed

Re: The revision has been completed.

Thank you for your professional suggestions and concern about our manuscript again.