

Response to the Reviewer #2

General comments:

The aerosols transported from South Asia (SA) are the important sources to the Tibetan Plateau (TP). Given the complex topography and limited observations in these areas, the aerosol simulations are still prone to large uncertainties. This paper shows the effects of the assimilation of Geostationary satellite Himawari-8 observations on aerosol forecasts and direct radiative effects (DRE) during the period of pollutants transporting from SA to the TP. The results demonstrate the AOT analysis and forecast fields can both effectively reproduce diurnal variations by assimilating all the observations within 12h window. Compared to the free-run experiment, assimilation experiments with aerosol radiative effect activation significantly improve the prediction of downward solar radiation and thereby enhance the transport of pollutants to the TP.

In general, the paper is well-written, and the results are nicely presented and well discussed with novel scientific findings. The authors did a credible job in analyzing how different experiment settings. The findings help better understand the transport of pollutants from South Asia to TP. Therefore, I would like to recommend accepting it to ACP after addressing the following minor comments

Response: We thank the reviewer for the encouraging comments. We

have revised the manuscript following your comments.

Mainly concerns:

- 1. Compared to DA_REON_12H experiment, the DA_REON_01H experiment performs better results in self-check due to assimilation of the entire window of observation data, but why a little worse in independent verification? Could you explain it in detail?*

Response: Thanks. Considering the analysis fields, it is true that the validation results of DA_REON_01H perform better at the time of the self-test. This is due to the fact that the aerosol field at the hour of assimilation for this set of tests is then examined against itself, which is a much better time match. In the independent test, the analysis field is interpolated to the site of the independent test observations (MODIS or AERONET), which is different in time and space from the assimilated Himawari-8. At this point the asynchronous assimilation, absorbing the entire time window of DA_REON_12H would have performed relatively better. This is because the aerosol field before and after the assimilation time was also assimilated in this experiment.

Changes in Manuscript:

Line 317-320:

The AOT analyses are interpolated to the MODIS, which is different in temporal and spatial distribution from Himawari-8. The AOT analyses in DA_REON_12H absorb the entire window of observations, and this

asynchronous assimilation corrects the AOT analysis field at all times in each window (Dai et al., 2019).

Specific comments:

1. L83 Please rewrite this sentence

Response: Done. Thank you for your comment.

Changes in Manuscript:

Line 81:

Aerosols are second only to clouds in regional surface solar energy simulations.

2. L112-113 Please rewrite the sentence “The observations assimilated are Himawari-8 AOT and the main assimilated region is SA”.

Response: Done. Thank you.

Changes in Manuscript:

Line 116-117:

The assimilated observations are Himawari-8 AOT, and the main assimilated region is SA.

3. L126 It's better to write “Carbon Bond Mechanism Z”

Response: Thank you, we've corrected it.

4. L126 Do you mean NMVOCs (non-methane volatile organic compounds)?

Response: Thank you for your comment, we've corrected it.

5. L247 Replace " Fig. 1b " with " Fig. 1a "

Response: Done. Thank you.

6. L273, L279 and L402, L403 Some figure number need to be consistent, e.g., "Figure 2"vs "Fig. 2", "Figures 9a"vs "Figs. 9b"

Response: Done. Thank you for your comment, uniformly use Fig. or Figs.

7. L281 "high surface albedo" maybe more precise

Response: Done. Thank you for your comment.

8. L282 Please revise the sentence to make it clearer.

Response: Done. Thank you.

Changes in Manuscript:

Line 285-286:

The assimilated experiments perform very well regarding the AOT analyzed fields, which are more consistent with the Himawari-8 retrievals.

9. *L312 Replace " to absorb" with " aims to incorporate " to make it more clarity and fluidity*

Response: Done. Thank you for your comment.

10. *L319 Which statistical indicators?*

Response: The statistical indicators mainly refer to the bias.

11. *L378 change the "Compare" to "Compared"*

Response: Thank you for your comment, we've corrected it.

12. *L479 "surface temperature" maybe more precise*

Response: Thank you, we've corrected it in Line 489.