Dear Reviewer 1, After receiving your comments, we immediately prepared a response, and the following is a point-by-point response to all the questions.

1. I still think the importance of daily sunshine duration data is not highlighted enough in introduction. Besides used in A-P model for estimating global solar radiation, could you give us some sepecific example on the application of sunshine duration?

Thanks for this valuable question. SD is a key parameter of solar power potential forecasting, climate change assessment and agricultural production, and some researchers have found that changes in SD also affect the probability of human diseases. We have added specific examples for each of the above three SD application scenarios. (See revised manuscript Line 43-53)

2. Line 64 in tracked changes: If there are bias in satellite retrived solar radiation, why did you invert sunshine duration from Himawari AHI?

Thank you for your comment.

Remote sensing solar radiation products do have errors due to estimation based on ground reflection information, which is unavoidable.

The Himawari AHI radiation product has a leading edge in terms of temporal resolution for daily-scale radiation estimates, but its errors need to be corrected for by ground-based observation sites. However, the limited number of radiation observation stations and the lack of empirical physical models for satellite-ground radiation correction in China and other parts of the world constrain the accuracy of satellite remote sensing radiation products.

SD is a readily available and cost-effective indicator for monitoring the global radiation resources, there are more than 2,000 regular meteorological stations observing SD in China, which is much higher than the radiation observation stations (145). And there is also a widely used empirical physical model between SD and solar radiation (A-P model). The above two points provide strong support for the calibration of the Himawari AHI radiation products, and we can calibrate the AHI radiation data to high-resolution grid-point SD data based on a large number of SD ground observation stations.

Generally speaking, we believe that the study on SD estimation is easy to validate, and the SD data are more credible theoretically. Until the radiation observation system in China is well developed, we believe that the study on the estimation of SD is valuable.

We have made major changes to the "introduction" section to make it as logical as possible.

3. There is a widespread transition from manual to automatic sunshine duration recorders in 2019 or station relocations. Did you consider this effect on validation by ground observations? Please refer to the paper https://essd.copernicus.org/preprints/essd-2024-493/

Thank you for your such this valuable question, we have taken this into account and therefore used both 2016 and 2023 as validation sets, and we have added additions to the review and cited the literature in the revised manuscript (see Line 136-137).

4. Besides AOD and water vapor, could you analyze the effect of cloud cover on SD estimation?

Thank you for your comment, we have added the analysis the effect of cloud cover on SD estimation. (See revised manuscript Line 234-237 and Figure 10,11)

5. Why there is no data for regions 80°E westward in figure 10, 11 and 12? I do think there are SD observations for 80°E westward in Figure 1.

We apologize for the confusion, Himawari AHI's coverage is at 80°E eastwards (mentioned in revised manuscript Line 106-107), but we still believe that AHI data is not alternative in our research and for the high temporal and spatial resolution and long acquisition time period.

Dear Reviewer 2, We apologize that the introduction to our manuscript, especially the introductory section, did not enable you as well as the Reviewer 1 to fully understand the significance of the study. We have made major changes to the "introduction" section to make it as logical as possible.

Satellite remote sensing is an effective method of monitoring and tracking solar radiation (mainly known as GR). However, GR inversion by satellite sensors based on reflectance information from the land surface is highly susceptible to atmospheric inverted radiation from clouds and aerosols, which need to be corrected for by ground measurement radiation stations.

However, the limited number of radiation observation stations and the lack of empirical physical models for satellite-ground radiation correction in China and other parts of the world constrain the accuracy of satellite remote sensing radiation products.

SD is a readily available and cost-effective indicator for monitoring the global radiation resources, there are more than 2,000 regular meteorological stations observing SD in China, which is much higher than the radiation observation stations (145). And there is also a widely used empirical physical model between SD and solar radiation (A-P model). The above two points provide strong support for our study.

We believe that the study on SD estimation is easy to validate, and the SD data are more credible theoretically. Until the radiation observation system in China is well developed, we believe that the study on the estimation of SD is valuable.

(**We have described it more fully in the "introduction". We would like to thank you and look forward to your consideration!**)