

## General comments

This study presents first homogenized century long datasets of observed surface incident solar radiation and sunshine duration derived solar radiation over Japan.

After homogenization, the two independent estimates of surface solar radiation are more consistent in trends, which is also consistent with our expectation from clouds and dust storm. The reviewer recommends this great effort, which provides key datasets to understand regional climate change. It is also useful for studies for energy and water cycle, and ecological process.

Major comment

1. Comment:

I have some major comments to help the authors to improve their presentation. 1. A more comprehensive literature review is needed. Most cited articles are several years ago. This field is fast developed, the authors should add more recent publications and provide more critical literature review.

**Response: Thanks for the reviewer's encouragement. This study was revised fully considering these comments. We rewrote the Introduction section and added more recent publications. We also provided more critical literature review on the global dimming and brightening studies and homogenization procedures in Lines 55-148.**

**In addition, the revised paper presents more details in how to use RHtest method to homogenize the raw  $R_s$  observations in Section 2.2. Finally, we highlight the homogenization of  $R_s$  revisit the global dimming and brightening over Japan. Minor modifications are also made based on the specific comments.**

2. Comment: The homogenization process should be more clearly presented, which is essential for authors to understand the derived dataset.

**Response: According to the reviewer's comment, we rewrite RHtest homogenization method part in Section 2.1 in Lines 172-203 for better understanding.**

Specific comments

1. Comment:

(1) Line 34-35: the specific definition of a sharp decrease and a gradual decline.

**Response: We rewrote this sentence in Line 34-37 in the revisited paper.**

2. Comment:

(2) Line 99: suggest to review all the relative homogenization methods and point out the reason to use RH method.

**Response: According to this comment, we add a literature review in homogenization methods and point out the reason to use RH method in Line 124-138 in the revisited paper.**

3. Comment:

(3) Line 121-122: misleading sentence—"before 1990" may be replaced by "until 1990" or "since 1990" ?

**Response: Corrected it as suggested.**

4. Comment:

(4) Line 129-130: the variables should be italic.

**Response: Corrected it as suggested.**

5. Comment:

(5) Line 145: confirm the reference format. Generally, it should be author(date) format.

**Response: Corrected it as suggested.**

6. Comment:

(6) Line 150: the variables should be italic.

**Response: Corrected it as suggested.**

7. Comment:

(7) Line 187-189: suggest to move this part to method section.

**Response: To address this comment, we added a data processing section in 2.4 and we move this part to this new section.**

8. Comment:

(8) Line 198-199: why figure 5 only show the time series of HAMADA site, how about the performance of other stations. Please provide more related information.

**Response: Details in the improvements after homogenization at most stations can be traced back to Figures 4, 5 and 6.**

9. Comment:

(9) Line 202-203: Please provide some information on how you calculate the average time series in figure 6-7 at 41 sites or 156 sites.

**Response: We add a data processing section in 2.4 in Lines 258-263.**

10. Comment:

(10)Line 262: add the method for trend calculation.

**Response: We add a data processing section in 2.4 in Lines 262-263.**

11. Comment:

(11)Line 327-336: rewrite this part to highlight what you do and the value of this work.

**Response: Thanks for the constructive comments. We rewrote this part in Lines 417-421.**