# *Interactive comment on* "Global radiation, photosynthetically active radiation, and the diffuse components dataset of China, 1981–2010" *by* Xiaoli Ren et al.

**Xiaoli Ren et al.**

hehl@igsnrr.ac.cn

This paper describes a significant and impressive undertaking in an important region. The authors succeed in describing the relevant points and steps of the dataset production process. The dataset itself will be very interesting to environmental modellers and is presented in a readily usable format. Apart from minor adaptations listed below I recommend publishing the article in ESSD.

Reply: Thank you very much for your valuable suggestions! We have carefully addressed all your comments throughout the revised manuscript.

General comments: 1) It would be interesting to include a figure, which displays the number of stations (y axis) for each year (x-axis) with available observational data. The bars could exhibit the number of stations with data separated in global, diffuse and PAR in a form as given in Fig1 (attachment)

Reply: We really appreciate the suggestion! We have added a figure that displays the numbers of stations with valid observations of sunshine duration, global radiation, diffuse radiation and PAR per year from 1981 to 2010 (Fig. R1). We have added this figure to the revised manuscript as Fig. 3, and described the figure in Section 2.1.2 (P3, L24).

2) Would it be possible to include the original observational data in the Zenodo record or give a link to where this data can be obtained from? This would be very helpful for people trying to reproduce the data generation process or for those that would like to use the observational data itself. As this might be a data-owner/copyright issue I do understand if this is not possible.

Reply: The original observational data were obtained from China Meteorology Administration (CMA) and Chinese Ecosystem Research Network (CERN). We have provided the links (http://data.cma.cn/en and http://www.cern.ac.cn) to where the users can obtain the original observational data. Due to the data-owner and copyright issue, the original observational data are not shared in this manuscript. If the users need the original data, they can access the aforementioned links to derive. Sorry for the inconvenience.

3) I am missing a discussion on the influence of smog/aerosols in urban areas on radiation values. Could that influence the results of the data expansion in some areas?

Reply: Good point! The influences of aerosols on radiation were incorporated in the observational data of sunshine duration, global radiation, diffuse radiation and PAR. Therefore, the estimation models parameterized using the observational data implicitly included the influences of aerosols on radiation expansion. The relative importance of

aerosols may differ among regions, and the net effect of aerosols on radiation depends on a balance between the reduction in global radiation and the enhancement in the diffuse fraction. Therefore, to consider the regional differences, we parameterized the estimation models for eight different geographical regions separately. In addition, the influences of aerosols on radiation can be clearly seen through the anomalous high values of diffuse radiation in 1982, 1983, 1991 and 1992 (Table 1 in the manuscript), which may be caused by the El Chinchon eruption in April of 1982 and the Pinatubo eruption in June of 1991. Actually, we have discussed the influence of aerosols on radiation in detail in Ren et al. (2013). Specifically, aerosols can influence the total and partitioning of solar radiation into direct and diffuse components. Atmospheric aerosols can be categorized into sulfates, carbonaceous particles, sea salt and mineral dust; and the sources involve volcanic eruptions, human activities and so on. Pure sulfate aerosols primarily scatter solar radiation, and produce much more diffuse radiation without reducing the total radiation substantially, while carbonaceous aerosols absorb and scatter solar radiation. In addition to the direct radiative forcing, aerosols also have indirect effects on radiation through their modification of cloud properties. Increases in cloud cover and scattering aerosols enhance the diffuse fraction of the radiation, whereas increasing concentrations of absorbing aerosols just reduce the total solar radiation. These effects can be reflected by clearness index, i.e. the ratio of global radiation to extra-terrestrial radiation, and diffuse fraction, i.e. the ratio of diffuse radiation to global radiation. We have revised the manuscript to make this point clear (P4, L7-12).

Ren, X. L., He, H. L., Zhang, L., Zhou, L., Yu, G. R., and Fan, J. W.: Spatiotemporal variability analysis of diffuse radiation in China during 1981–2010, Ann. Geophys., 31, 277-289, https:/doi.org/10.5194/angeo-31-277-2013, 2013.

Specific comments: P1 L15: delete the word "the" in the sentence ": : :freely available from the Zenodo: : :"

Reply: We have deleted the word "the" following your suggestion.

P1 L16: remove the blank after "DOI:"

Reply: We have revised that accordingly.

P1 L 18: there is a blank missing in front of the reference bracket. This is also the case in P1 L27, P2 L15, P2 L27 and so on)

Reply: Thank you for the reminding! We have carefully checked the whole manuscript and revised the similar errors throughout the manuscript.

P1 L20, L21, L25: I am not a fan of the "/" used e.g. in "global radiation/PAR". Please replace the "/" with "and", "or", "vs." or whatever else is meant.

Reply: Sorry for the confusion. We have revised all the "/" throughout the manuscript following your suggestion.

P2 L1: Maybe write "However, in China, global radiation, PAR, diffuse radiation, and diffuse PAR are not generally measured in contrast to other meteorological variables such as sunshine duration"

Reply: Thank you for the suggestion, and we have revised that accordingly.

P2 L2: Maybe write: ": : : and diffuse PAR is required for a better understanding of the ecosystem carbon dynamics in China as well as: : :."

Reply: Thank you for the suggestion, and we have revised that accordingly.

P2 L11: Change the sentence beginning with "Then" to "They then generated the radiation dataset in China from 1981 to 2010 and analysed the spatio-temporal variations." I do hope I understood right that the dataset was created by Ren et al.?

Reply: Yes, you understood right. We have revised the sentence following your suggestion.

P2 L16: When you write at the end "In this paper" which one do you mean, the one I am reading or the one of Ren et al. 2017c? If it was the current (ESSD) one I would

begin a new line to clarify that.

Reply: Sorry for the confusion. The "In this paper" means this current ESSDD manuscript. We have begun a new paragraph from there to make this clear (P2, L19).

P3 L18: where does the 40% come from, do you have a reference on that?

Reply: Yes, we have a reference on that. Tsubo and Walker (2005) reported that the extra-terrestrial PAR is 40% of the extra-terrestrial global radiation. In the meantime, PAR is no larger than extra-terrestrial PAR, so PAR is no larger than 40% of extra-terrestrial global radiation. We have added the reference to the revised manuscript (P3, L21).

Tsubo, M. and Walker, S.: Relationships between photosynthetically active radiation and clearness index at Bloemfontein, South Africa, Theor Appl Climatol, 80, 17-25, https:/doi.org/10.1007/s00704-004-0080-5, 2005.

P3 L22: in the formula, what requirement has to be fulfilled if Q/Q' is between 0.2 and 0.6?

Reply: The formula was used to eliminate the questionable data points following Reindl et al. (1990) and Ren et al. (2013). Specifically, under cloudy conditions with low values of clearness index, it is reasonable to expect a large portion of incoming radiation being scattered by the clouds, thereby a large value of diffuse fraction. Similarly, under clear conditions with high values of clearness index, there should be a small value of diffuse radiation. Eq. 1 is used to place limits on the values of diffuse fraction under the aforementioned cloudy and clear sky conditions, so it does not include the requirements for intermediate sky conditions, i.e., when Q/Q' is between 0.2 and 0.6.

P4 L7, L16/17: here again the blank in front of the reference bracket is missing

Reply: Thank you for the reminding! We have carefully checked the whole manuscript and revised the similar errors throughout the manuscript.

P4 L18: replace "performance with other models" by "performance compare to other models"

Reply: Thank you for the suggestion. We have replaced "performance with other models" by "performance compared to other models".

P5 L13, L18: blank in front of the reference brackets missing

Reply: Thank you for the reminding! We have carefully checked the whole manuscript and revised the similar errors throughout the manuscript.

P5 L17: The title sounds a little odd, maybe just "Dataset generation"?

Reply: Thank you for the suggestion, and we have revised the title following your suggestion.

P6 L3: You begin points 2) to 4) with a verb, you should do it the same way for point 1)

Reply: Thank you for the reminding. We have revised point 1) to start with a verb, i.e., "1) Scale daily radiation data to monthly and format the data following the instructions of ANUSPLIN using MATLAB software; resample the DEM data to 10km×10km using ArcGIS software" (P6, L10).

P6 L14: again, I am not a fan of the "/" – rather use "and", "or" or whatever is meant here

Reply: Sorry for the confusion. We have revised all the "/" throughout the manuscript following your suggestion.

P6 L20: replace the "We can see" with "It can be seen" or something similar

Reply: Thank you for the suggestion. We have replaced the "We can see" with "It can be seen" in the revised manuscript.

P6 L26: I like Table 1, but do you think giving a mean of the total of China as done in line 26 is of any meaning? I would leave it at having means of the regions as given in

Table 1.

Reply: Thank you for the suggestion! We have calculated the values of global radiation, diffuse radiation, PAR, and diffuse PAR averaged from 1981 to 2010 for each region. From Table R1 and Fig. R2, it can be seen that the global radiation is the highest in Qinghai-Tibet Plateau and the lowest in Central China, while the diffuse radiation has the highest value in Southwest China and the lowest value in Northeast China. We have added this point (P#, L#) and Table R1 as Table 2 in the revised manuscript.

P6 L27: replace "which was consistent" with "which is consistent"

Reply: We have revised that following your suggestion.

P6 L29 and P7 L6, L23: blank in front of the reference brackets missing

Reply: We have revised all similar errors in the revised manuscript.

P7 L13: maybe better to say ": : :. was derived"

Reply: We have revised that following your suggestion.

P7 L14: replace "leaved" with "left"

Reply: We have revised that following your suggestion.

P7 L14: better "with the remaining data" (instead of rest data)

Reply: We have revised that following your suggestion.

P7 L15: maybe better ".. and then the average performance of site expansion was derived"

Reply: We have revised that following your suggestion.

P7 L16: "Table 2 shows" (instead of showed)

Reply: We have revised that following your suggestion.

P8 L4ff: I would rather write: "The dataset is freely available from the Zenodo website at : : : (DOI:10.11: : :.)."

Reply: We have revised that following your suggestion.

P8 L8: Instead of "There are two formats: : :" I would write "Two formats are offered, i.e. ArcGIS : : :."

Reply: We have revised that following your suggestion.

P9ff - Reference list: I am missing the article dois in the References chapter

Reply: Following your suggestion, we have added the article dois in the References section.

P17 Table1: It would maybe be nice to have a figure on that, too.

Reply: Thank you for the suggestion. To avoid information abundance, we chose table over figure on this. We believe the specific values in Table 1 can be more helpful to those who need these annual data.

Please also note the supplement to this comment:
https://www.earth-syst-sci-data-discuss.net/essd-2018-4/essd-2018-4-AC1-supplement.pdf

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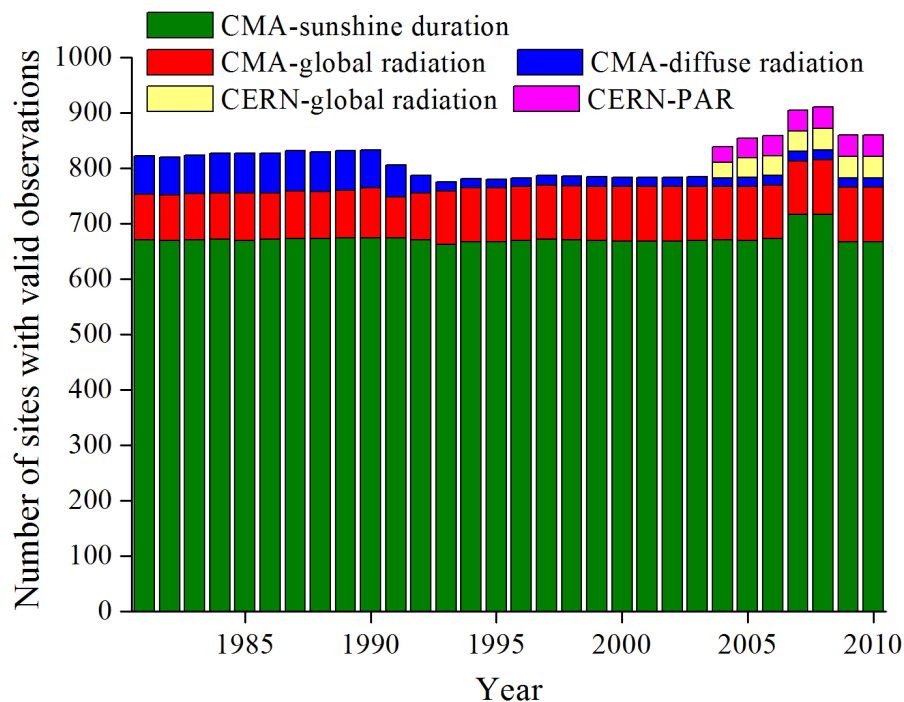
**Fig. 1.** Figure R1. The numbers of sites with valid observational data of sunshine duration, global radiation, diffuse radiation, and photosynthetically active radiation (PAR) per year from 1981 to 2010.
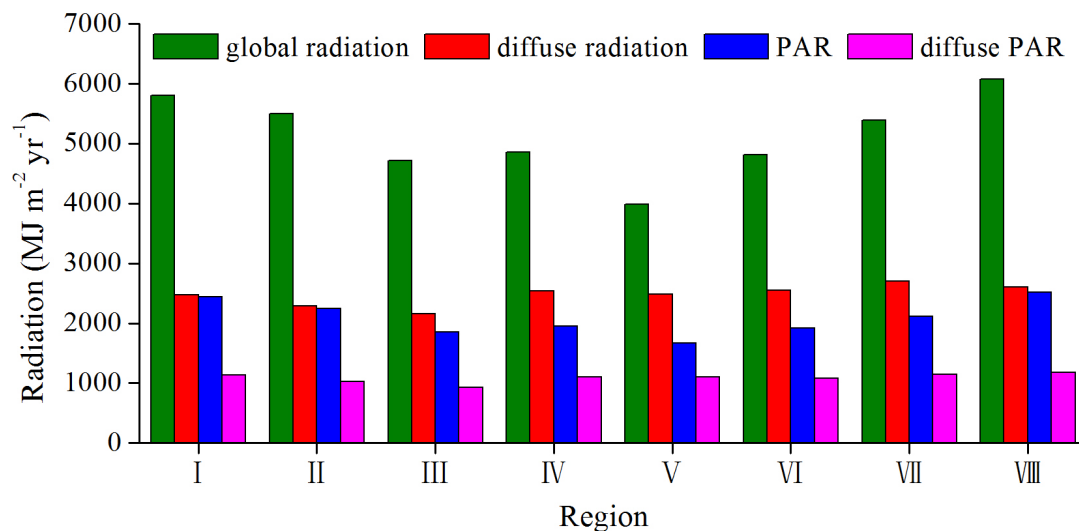
**Fig. 2.** Fig. R2. Global radiation, diffuse radiation, PAR, and diffuse PAR averaged from 1981 to 2010 for each region in China

| Region ID | Region | Global radiation | Diffuse radiation | PAR | Diffuse PAR |
|---|---|---|---|---|---|
| I | Northwest China | 5801.8 | 2473.4 | 2435.9 | 1142.0 |
| II | Inner Mongolia | 5503.5 | 2287.7 | 2245.2 | 1030.7 |
| III | Northeast China | 4716.1 | 2160.3 | 1851.8 | 929.8 |
| IV | North China | 4858.7 | 2542.7 | 1948.9 | 1106.7 |
| V | Central China | 3983.9 | 2479.1 | 1666.4 | 1104.6 |
| VI | South China | 4819.8 | 2557.3 | 1914.5 | 1081.4 |
| VII | Southwest China | 5390.5 | 2707.5 | 2117.8 | 1148.3 |
| VIII | Qinghai-Tibet Plateau | 6072.3 | 2601.3 | 2514.7 | 1177.5 |

**Fig. 3.** Table R1. Global radiation, diffuse radiation, PAR, and diffuse PAR averaged from 1981 to 2010 for each region in China. Units are in MJ m-2 yr-1.