

Earth Syst. Sci. Data Discuss., referee comment RC1
<https://doi.org/10.5194/essd-2021-250-RC1>, 2021
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Comment on **essd-2021-250**

Anonymous Referee #1

Referee comment on "A global long-term (1981–2019) daily land surface radiation budget product from AVHRR satellite data using a residual convolutional neural network" by Jianglei Xu et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-250-RC1>, 2021

Review of: A global long-term (1981–2019) daily land surface radiation budget

product from AVHRR satellite data using a residual convolutional neural network

by

Jianglei Xu, Shunlin Liang, and Bo Jiang

General Comments

This paper describes a machine-learning convolutional neural network (CNN) method to generate a high-resolution global surface net radiation (Rn) product from AVHRR data with the support of ground observations, reanalysis, and transformed MODIS data (GLASS). Special tools are used to better align point measurements of Rn with the larger-spatial-scale reanalysis and the GLASS Rn products for a spatially representative ground truth. Another component seeks to upscale data within the AVHRR footprint to recover finer-scale surface detail that is smeared out by the atmosphere. Getting finer resolution from coarse resolution data is not easily accepted without clear explanation. You explain that “spatial adjacent effect” is accomplished by applying reanalysis data and angular information of the satellite measurement and solar position. The spatial adjacent effect seems to be the novel advantage of the CNN method over other existing methods, but the explanation lacks detail and examples to help the reader better understand the upscaling process. Does it use reanalysis vertical profiles to correct the path of upwelling radiation to the satellite? Or is it some kind of statistical approach?

Overall, this new method produces a 5 km resolution daily product of Rn over the globe that seemingly outperforms comparable methods. Although it has problems over difficult regions such as the Tibetan Plateau, the Sahara, and snow-covered surfaces that need to be addressed, the overall result is impressive. The authors conduct several spatial and temporal comparisons to their accepted ground measurements and to other global Rn products to prove its worth. Except for a few places on the globe and the last few years of the 39-year dataset, they show good performance. Given that this data has high spatial resolution at a daily time scale, it should be useful tool for climate studies after its flaws are addressed.

Specific comments:

- 14 Include the temporal resolution of the Rn estimates here.

- 20-24 The statement beginning with "Inter-comparisons with three..." is not true. In section 4.3.3 you state: "The validation results in Fig. 8 and Table 7 for the ice/snow surface cover type further confirm that GLASS Rn product may offer a better performance in Greenland region."

- 40 "radiation" is not needed in front of "radiometers"

- 132-161 This section describes the instruments used in the various networks which range from good thermopile pyranometers and pyrgeometers to not-so-good net radiometers. You only provide performance measures for the thermopile pyranometers, which are generally good. You don't provide any performance information on the net radiometers, which are notoriously bad, especially the REBS model. According to Table 2, net radiometers dominate your observational dataset. You should provide performance measures of the net radiometers. Also, Table 2 is incomplete. For some you specify "Eppley PIR," and others just "Eppley."

- 138 By "thermal effect," are you referring to the thermal offset of single black detector pyranometers? If so, there are references for this measurement error.

- 169. What does "along with inverse navigation to relate a specific Earth location to each sensor's instantaneous field of view" mean?

- 414 “under snow and ice surfaces” ? Perhaps use “for snow and ice surfaces” ?

- 453 Change phrasing to “...especially clouds that have significant impacts on shortwave...”

- 454 Where do cloud optical thickness (COT) and cloud water vapor (CWV) data come from?

- 462 The sentence beginning with “Therefore, the performance...” does not make sense. Perhaps the end of that sentence should read: “...is comparable with regard to the accuracy of their Rn retrievals.”

- 512 – 519 I don’t understand your Figure 11. The AVHRR and GLASS Rn’s as a function of COT are nearly on top of each other, yet the bias plotted on the same charts is significant. What am I missing here? Regardless, in the caption please define the bias and what the shading represents.

- 524 Please state how the difference is defined. Jan.- July or July – Jan.

- 525 Do you mean “northern Australia” and “South America” ?

- 545 “produced by NOAA” ? Should this read “replaced by NOAA”?

- 555-560 The four timeseries in Fig. 12 after 2017 for all data sets may be well correlated but are obviously wrong and could not be used for climate studies.

What does the shading represent in Fig. 12?

- 557 Has the AVHRR calibration across all satellites been applied to the AVHRR data shown in Fig. 12?

- 572 Do you mean 0.708?

- 591 What is a wide overpass time?

- 600 What Study?

Technical corrections:

- 164 You don't need ", respectively" in this sentence.

- 425 "BSRN_DRA" site.

- 483 “very low” not “vary low”

- 543 1999-2000

I also attached my review in a file called "Earth Data Science Data review.pdf"

Please also note the supplement to this comment:

<https://essd.copernicus.org/preprints/essd-2021-250/essd-2021-250-RC1-supplement.pdf>