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Interactive comment on "Merging ground-based sunshine duration with satellite cloud and aerosol data to produce high resolution long-term surface solar radiation over China" *by* Fei Feng and Kaicun Wang

Anonymous Referee #2

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This study attempts to generate a high resolution surface solar radiation (Rs) dataset. The idea is to construct a linear model between station based Rs, cloud fraction and AOD, and applies the model to the full study domain (China). While this dataset can be potentially useful, I don't understand how this approach could achieve a better accuracy than CERES 1 degree Rs product. This is because: (1) although the SunDu Rs can represent a much smaller area than the CERES 1 degree grid, SunDu Rs is validated using CERES Rs, which means that SunDu Rs cannot have a higher accuracy than CERES Rs, even at the 1 degree scale; (2) the AOD data used is still at 1 degree

resolution. This does not add much finer information and may be the reason why AOD has little impact on the prediction results. Overall, I don't see much value in this study unless the above question is addressed. Please see the specific comments below:

Major comments

1. The authors used SunDu Rs to train the model and to generate the high resolution Rs dataset. However, SunDu Rs is validated against CERES Rs, assuming that the latter has higher accuracy. On one hand, using grid based data to validate station based data is not appropriate. There can be a lot of variability within this 1 degree box. The authors did compare SunDu Rs with observed Rs but argued that their agreement is not as good as that between SunDu Rs and CERES Rs, and that the agreement between the latter two proofs the reliability of SunDu Rs. I don't agree with this argument. SunDu Rs should be directly validated against surface observed Rs. On the other hand, if CERES Rs is better than SunDu Rs, what's the point of using SunDu Rs to generate the 0.1 degree dataset? I guess using CERES Rs with 0.1 cloud and AOD would achieve at least the same accuracy, if not better. Yet, it has the advantage of full spatial coverage than SunDu Rs. 2. To proof the effect of fine resolution processing, a direct comparison with CERES should be provided. The authors can interpolate the CERES Rs to 0.1 degree and compare with their results. How difference are they? Are the differences physically explainable (i.e., related to cloud variability?).

Minor comments

1. What is the reason of the lower agreement between SunDu Rs and observed Rs? 2. Why using CERES 1dgree AOD? If spatial resolution matters, there are much finer products, such as the MODIS 1km and MODIS 3km products. 3. There are remote locations with very few SunDu stations, such as the Tibet plateau, are the relationships applicable? 4. It would be interesting to look at the spatial distribution of the coefficients. This can tell us some information about where clouds make a bigger impact and where aerosols are important. 5. What's the unit of Figure 2?

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