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Atmospheric Measurement Techniques Discussions
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Interactive comment on "Calculating direct normal irradiance from sun photometer measurements" *by* Juan Carlos Antuña-Marrero et al.

Anonymous Referee #2

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The manuscript describes a method for estimating broadband direct solar irradiance at the surface, based on measurements of spectral direct irrandiance at several wavelengths. In my opinion the basic idea of the methodology is reasonable and the presentation is suitable. However, I have some serious concerns about the accuracy of the proposed method. As the usefulness and publication-worthiness of the proposed method greatly depends on its accuracy, and as I believe the discussion of uncertainties needs substantial revisions, I cannot tell what the prospects are for the paper to be suitable for publication after revision. My guess is that the revisions may not require a very long time, and so my recommendation is to return the manuscript to the authors and to suggest major revisions in the hope (but not certainty) that the method will prove useful and publication-worthy once it is revised. Please find my specific comments below.

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Lines 121-124: The uncertainty estimates of 2% and 6% (also mentioned in the conclusions and the abstract) seem to be for the solar constantâĂŤthat is, for the top-of-atmosphere (TOA) solar irradiance. However, the proposed method estimates irradiance at the surface, not at the TOA. I expect that as variations in conditions (e.g., amount of absorbing gases such as ozone or water vapor, vegetation) change the spectral distribution of irradiance at the surface, they make the uncertainty of the proposed method larger for irradiance estimates at the surface than at TOA. Therefore, it seems quite important to examine how variations in atmospheric and surface conditions impact the method's uncertainty (including perhaps even surface pressure variations, which are relevant for Rayleigh scattering).

Lines 103-105: How were the two additional data points determined? How do uncertainties at these points affect the overall accuracy of the proposed method?

Lines 109-114: Similar question to the previous one: How does the assumption of constant irradiance outside the 300-2600 nm range affect the accuracy of estimated broadband irradiance values? Simulations using realistic variations in atmospheric conditions may help address such questions.

Lines 217-220: The intercept by itself does not tell whether the method leads to under- or overestimations. The intercept characterizes the expected Y-values only for X=0, whereas in actual data, X is usually larger than 0. (X & Y are values along horizontal & vertical axes, respectively.) The intercept is sufficient for X>0 only if the slope is 1. Perhaps using the mean difference between X & Y could help in characterizing overall biases.

Lines 244-245: This sentence shows that the proposed method has a smaller RMS error than a method described in an earlier paper, whichâĂŤas the authors noteâĂŤindicates that the new method has potential. However, fully evaluating the benefits of the new method would need to consider not only RMS errors but biases as well. Would it be possible to tell whether the new method reduces biases as well as RMS errors?

Even if this could not yet be determined reliably (for example due to the 10% error mentioned in Lines 158-160), the issue should be discussed.

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