

Dear Dr. Schmidt,

Thank you for guiding the review of our manuscript entitled " Evaluation of the hyperspectral radiometer (HSR1) at the ARM SGP site" (doi: 10.5194/amt-2023-115).

We are now submitting a further revised manuscript in which we have addressed the second round of reviewer comments and suggestions, which helped to further improve the manuscript. The point-by-point responses are included below with the reviewer's comments in black and our replies in blue. The page and line numbers correspond to the change accepted version of the manuscript (i.e., "clean").

Thank you for your consideration of this manuscript.

Sincerely,  
Dr. Kelly Balmes

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Reviewer #1

The authors have done a very good job of responding to the comments from the previous review. However, I still have some minor comments, which are listed below.

Thanks for the positive review. We appreciate the reviewer's efforts to review this paper. See our replies below.

1. P3L79: "This is in contrast to rotating shadowband systems which must make the  $F_{total}$  and  $F_{diffuse}$  measurements separately and, therefore, at different times." – Using two instruments, the two quantities are measured simultaneously.

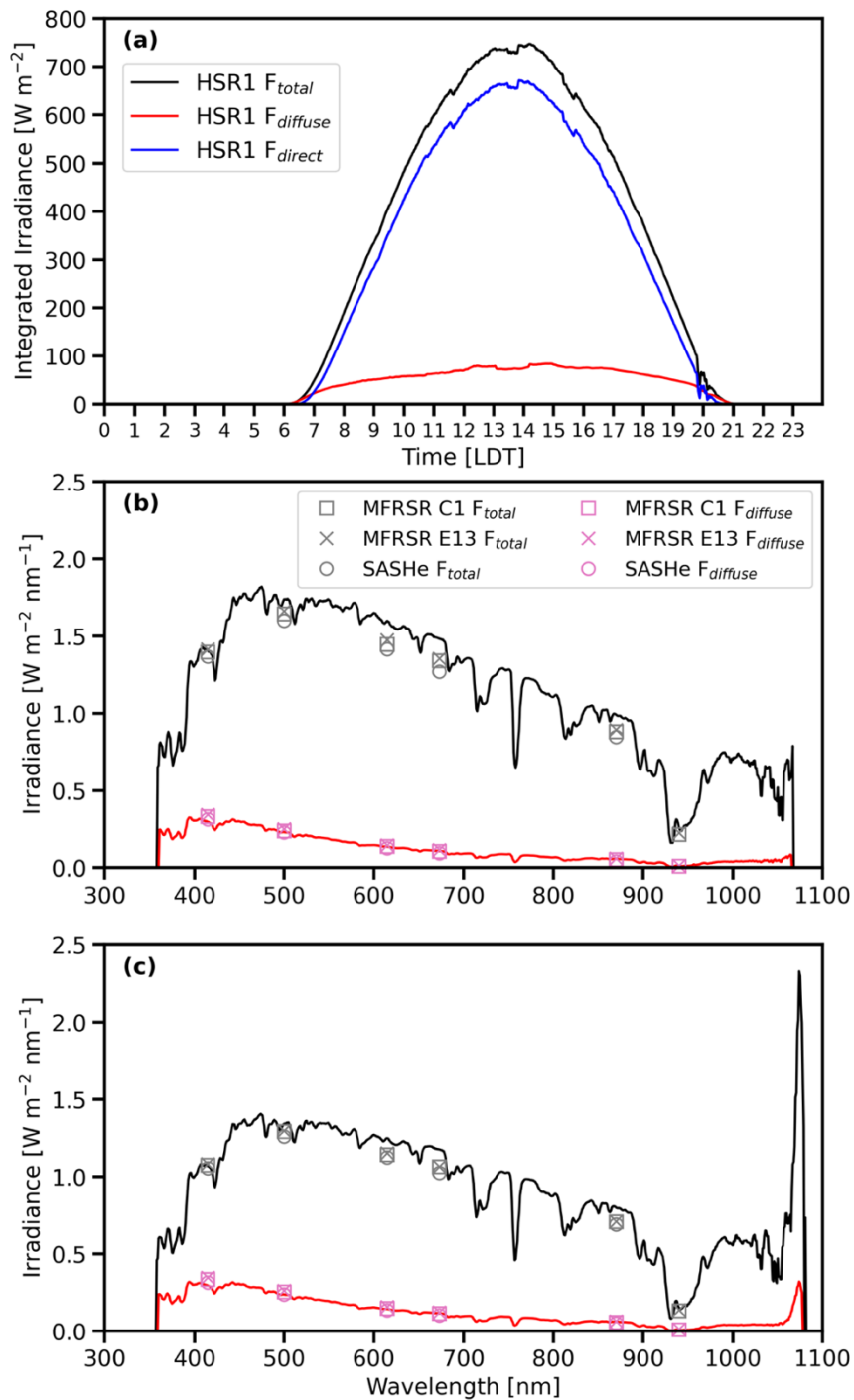
We have revised the text to include the situation of two instruments measuring simultaneously as well (P. 3, L68-72): "Due to the nature of the measurements, the  $F_{total}$  and  $F_{diffuse}$  are measured simultaneously, and can be measured at a frequency up to 1 Hz. This is in contrast to rotating shadowband systems which must make the  $F_{total}$  and  $F_{diffuse}$  measurements at different positions of the shadowband rotation, and, therefore, at different times in the operating cycle. The simultaneously measured HSR1  $F_{total}$  and  $F_{diffuse}$  is similar to two nearby instruments measuring  $F_{total}$  and  $F_{diffuse}$  separately but simultaneously."

2. P3L84: "spectrally disperses the light from the input fibres onto a 2D image sensor" – omit the word "light" which refers to a limited wavelength range. Better use "solar radiation" instead.

Thank you for the suggestion. We have revised the text by changing "light" to "solar radiation" (P. 3, L76).

3. Fig. 2: Use a legend for “Collocated  $F_{total}$  (gray) and  $F_{diffuse}$  (pink) from the MFRSR C1 (square), MFRSR E13 (x-mark), and SASHe (circle)”

Thank you for the suggestion. We have revised Figure 2 by adding in a legend that includes MFRSRs and SASHe information. See revised Figure 2 below.



4. P7L77: “As with all spectrometers, measurements at the two extremes of the spectrum have low sensitivity and, therefore, additional noise is apparent.” – The two extremes are referred to the edges of the spectrum, I guess. Please rephrase for clarification.

We have rephrased the text for clarity by changing “extremes” to “edges” (P. 7, L122).

5. P7L186: ”The dome lensing effect corrected  $F_{total}$  and  $F_{diffuse}$  are discussed further in Sect. 5.” Please rephrase.

We have rephrased the text to (P. 7, L131-132): “The  $F_{total}$  and  $F_{diffuse}$  corrected for the dome lensing effect are discussed further in Sect. 5. These corrections will also be the subject of a future study as noted in Sect. 5.”

6. P8L235: “A reference HSR1 is calibrated by removing the shading mask, and exposing the sensors to a 1000 W ‘FEL’ lamp” Does it mean, that the shading mask itself has no effect on the sensitivity?

The shading mask has no effect on the sensitivity to direct radiation, for those sensors which are not shaded by the mask. The mask geometry does however affect the sensitivity to diffuse radiation, as corrected for by the factor 2 in Eq. 1. This has been clarified by the added sentence (P. 8, L141-142): “This enables identical calibration of the seven sensors to direct beam light. The same sensitivity applies to diffuse light, though modified by the geometry of the shadowmask (Eq. 1).”

7. P8L243: “This means that the HSR1  $F_{diffuse}$  measurement will typically be lower than the corresponding measurements from a sun photometer or broadband tracker system.” Please quantify.

We have added in a reference to the analysis by Norgren et al. (2022), which includes an analysis on the impact of the HSR1’s field of view (P. 8-9, L150-153): “An analysis by Norgren et al. (2022) (see their Appendix A) quantified this for the case of thin clouds, estimating a circumsolar irradiance varying between negligible and ~10% of the direct beam, depending on solar zenith angle and cloud thickness. Implementing a correction for this will be a topic for further study.”

8. P9L250: “The CSPHOT observations considered 250 include the AODs at 440, 500, 675, and 870 nm.” Maybe add “wavelength” at the end.

Thank you for the suggestion. We have added in “wavelengths” to clarify the text for the data descriptions of the CSPHOT (P. 9, L160), MFRSR (P. 9, L164 and L173), and SASHe (P. 9, L180).

9. P9L274: The “Langley calibration” is mentioned here. Please give a reference.

The Langley calibration applied to SASHe is described in Appendix A and Flynn et al. (2016). We have revised the text to add in an additional reference to Appendix A (P. 10, L184).

10. Figure 5: Is not discussed in the text. Leave it out.

Thank you for the suggestion. We have removed Figure 5.

11. Chapter 4: In the fourth chapter, it was difficult to maintain attention. The reader could get tired of all the numbers. Is there a way to shorten it?

Thank you for the suggestion. We have revised Sect. 4 by shortening the text. We have shortened it by combining MFRSR C1 and E13 comparison results when similar. In addition, we have reduced numbers corresponding to correlation coefficient and regression slope values.

12. Appendix A: Is this needed? Giving a reference would be sufficient.

We have included Appendix A since there is currently no reference on the SASHe except for a technical report (Flynn, 2016). This appendix helps provide more instrument details on the SASHe if the reader is interested.

13. Appendix B: As written in my previous review, an extension to PAR is not necessary to emphasize the instrumental capabilities.

We agree that the PAR comparison is not necessary to emphasize the instrument’s capabilities. However, the PAR comparison shows an application of the HSR1 available with hyperspectral radiometers. Therefore, we have placed the PAR comparison in the Appendix instead of the main text.