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Atmospheric Measurement Techniques Discussions

Interactive comment on "Solar irradiances measured using SPN1 radiometers: uncertainties and clues for development" *by* J. Badosa et al.

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Here we supply responses to the referee comments RC C2500 :

There should be a description of TBM measurements so that we have confidence that the usually errors associated with these measurements are not contributing to the differences seem. For example, one major concern of this referee is whether offsets are corrected for TBM DHI measurements?

Authors' response: TBM measurements followed the BSRN standards in terms of maintenance, with dome/window cleaning an alignment check at least once per week (and several times per week for the BSRN stations at Payerne and Palaiseau). All pyranometers were ventilated. IR loss corrections were applied for data at Golden and for

the unshaded global irradiance pyranometer at Addu Atoll. For Payerne and Palaiseau these corrections would be very small (of the order of 1-2 W/m2) as the CMP22 pyrnameters with quartz dome (which highly reduces IR losses). For the tropical sites (Addu Atoll and Roseraye), IR loss is by nature small due to the fact that the air is very moist.

p. 8151, line 3; I would disagree with high maintenance costs and frequent and complex . . . since we usually just have to clean instruments, which I am sure you have to do for the SPN1 Authors' response: BSRN-like TBM concern three sensors plus the suntracker so there are more elements to maintain and change and, by probability, more chance of failures and need for replacement. Calibration costs would be higher for the same reason. It is true that cleaning plays a similar role for TBM and SPN1, it was done at the same frequency for both types of instruments for the data we obtained. But what makes a big difference is the expertise that is needed for the TBM, in terms of training and time for instrument labeling, checking for the horizontality, tracker operating. . .

p. 8151, line 19; How does one get +/-8% to equate to +/- 10 WmËĘ-2 Authors' response: SPN1 specifications give an accuracy of ±8 % ±10 W m−2 which reflects the fact that there is generally a group of errors which are proportional to the measurement value (e.g. calibration errors) and also a group of errors which are independent of the measurement value (e.g. electrical offsets, noise etc). The overall error bounds are the sum of these two types of error.

p. 8154, lines 24 (for example) "Data were" should replace "Data was" throughout the manuscript. Authors' response: We agree that if we followed the Latin, we would use data as the plural of datum, a countable noun. However, the use of data as a bulk noun (e.g. saying how much data we have collected for this study instead of how many data) is now recognised as normal usage in both Wikipedia and the OED. We would prefer therefore to keep our existing usage.

Fig 2 caption should read SPN1 vs TBM Authors' response: Correction to be applied in the next version.

Fig 3 I do not understand the peak in the negative sector in the rightmost frame since Fig 2 seems to have most SPN1 points higher than the TBM points. Authors' response: The difference between the two figures is that, for Figure 3, SPN1 data has been corrected with the linear slopes found in Figure 2. More specifically, GHI and DHI SPN1 measurements for each site were re-calibrated by dividing by the corresponding regression slopes from Fig. 2 and Table 4. SPN1 DNI was then calculated from the re-calibrated DHI and GHI (DNI=(GHI-DHI)/cos(SZA)). This re-calibration make the peak for DNI differences fall in the negative sector for Figure 3.

In meteorology azimuth is measured clockwise from north, e.g., east would be 90 degs; it seems that you have chosen to measure azimuth counterclockwise Authors' response: For Figures 9 and 10, we measure azimuth increasing from 0° at North, through East, South then West. We have made this choice following the polar convention, which is clockwise if one looks down on a map, but anticlockwise if you look up at the sky. We have used the same projection of the sky hemisphere as would be seen by an all-sky camera.

Section 5.1.2, Please, add an figure for this dome lensing effect that explains why nearer (to sun direction detectors have higher response and vice versa. Authors' response:

This diagram in Fig. 1 shows ray traces of parallel rays from the sun incident on the SPN1 detectors, showing the effects of refraction by the glass dome. The effect of this is that the detector furthest from the sun (on the left side of the diagram) absorbs a slightly smaller part of the solar beam than the detector closer to the sun (on the right side of the diagram). We propose to include this diagram as supplementary material. The graph in Fig. 2 shows the percentage variation with zenith angle for the 7 detectors for a 0° of sun position in the SPN1 frame of reference (so not necessarily the solar azimuth).

p. 8163, line 28; I do not think the aureole brightness and extent depends on water vapor Authors' response: We meant water vapor and liquid, ice content in the atmosphere. We will change the statement accordingly.

p. 8165, lines 4-6; Please clarify this statement. Are you suggestions the DHI between 0.266 and 2.5 equals all of the rest of the DHI? Authors' response: We are using 'Aureole energy' as the excess energy over what would be expected from uniform sky brightness. Specifically, the aureole energy between 0.266° & 2.5° will be of a similar magnitude to the energy we have measured between 2.5° and 6.5°. We will clarify this in the next version.

I find "Modelling of SPN1 effective aperture" difficult to understand. Perhaps, an illustration explaining "first touch angle" would help. Authors' response: The diagram in Fig. 3 shows a projection of the 7 detectors onto the shadowmask in the direction of the sun (dark ovals). For the fully shaded detectors, the largest possible cone directed towards the sun that is still fully shaded is drawn (red circles). The half-angle of this cone gives the first touch angle for the detector – in this case 4° for detector 4, 12° for detector 7. The largest first touch angle is taken as the diffuse first touch angle for the given solar position, in this case 12°. The solar aureole out to 12° will be wholly excluded from the diffuse measurement in this case. We propose to include this figure as the supplementary material.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 8149, 2014.

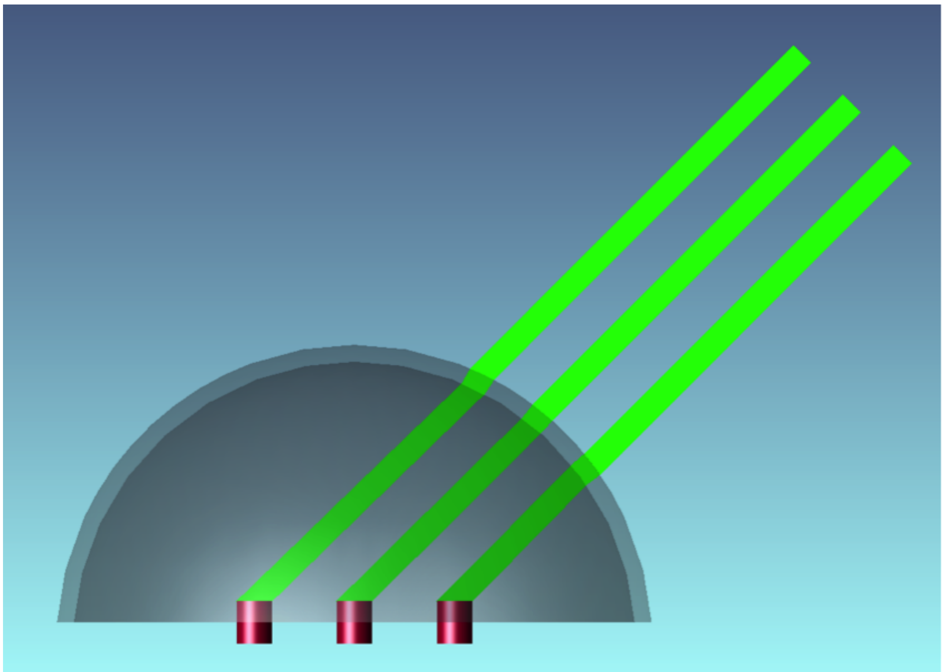

Fig. 1. Dome lensing effect diagram

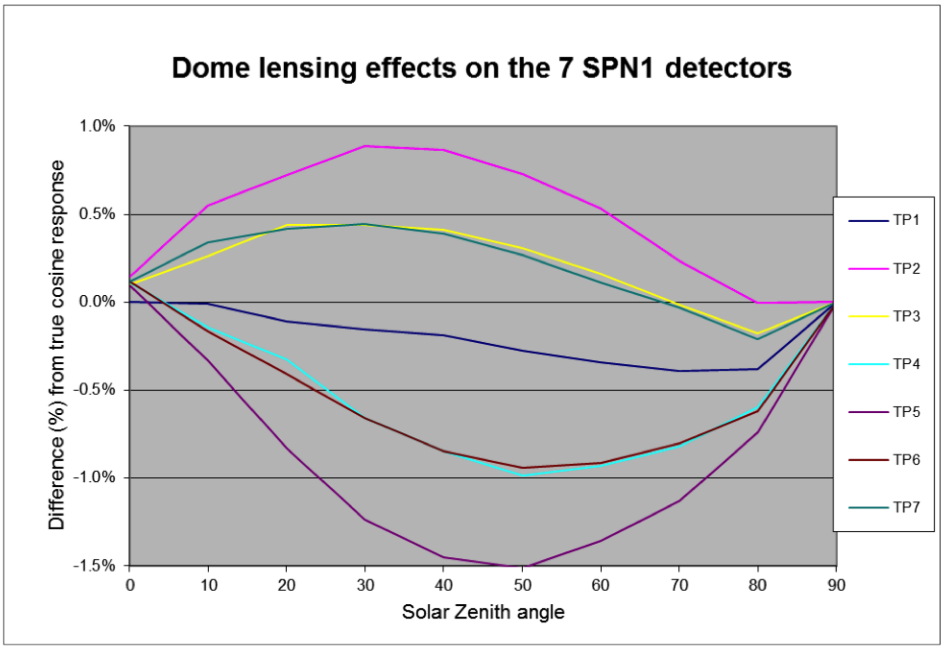

Fig. 2. Dome lensing effects on the 7 SPN1 detectors

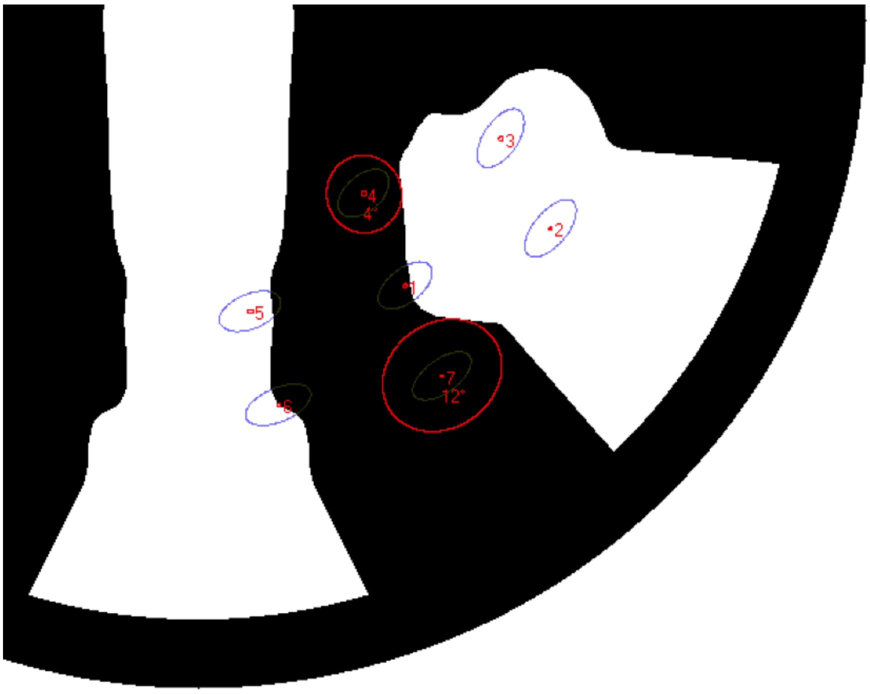

Fig. 3. Diffuse first touch angle diagram