Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2016-293-RC1, 2016

Atmospheric Measurement Techniques Discussions
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Interactive comment on "Compatibility of different measurement techniques. Long-term global solar radiation observations at Izaña Observatory" *by* Rosa Delia García et al.

Anonymous Referee #3

Received and published: 28 November 2016

The manuscript describes the calibration and validation of different instrument types to determine solar irradiance and daily total solar radiation energy. Several of these instruments were used at Izana Observatory, when pyranometers were not yet available, and the aim of the study was to first derive their uncertainties and second to calculate the solar radiation time-series over the period 1977 to the present. While the sunshine duration instruments can only be used to derive daily totals of solar shortwave radiation, the bimetallic pyranometers provide solar irradiance levels and by numerical integration can calculate the daily totals. The final product is a time-series of daily total solar radiation energy levels for the period 1977 to the present, consisting of bimetallic pyranometers for the first part of the period and different Kipp&Zonen pyranometers for

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the second part.

Even though the study has been performed with care, I think the study needs to be revised and some concerns addressed before it can be published. My main concerns are listed below:

1) The results are interesting and produce useful information with regard to the uncertainties one can expect with historical instruments when deriving daily total solar irradiation. However as pointed out by the authors themselves, such studies have been performed previously (see reference list, and especially Coulson, 1975, Garcia et al., 2014c, McArthur, 2005, Garg and Garg, 1993), so that this manuscript essentially confirms the results from these studies (see page 11, line 32) but does not add anything really novel. The authors should stress how their results differ from these previous studies.

2) The second objective of the paper was to derive a time-series of solar irradiation levels from historical measurements made at Izana Observatory. The recovered time-series were derived using the bimetallic pyranometers for the period 1977 to 1991 and Kipp&Zonen pyranometers from 1991 to the present (see figure 7). However, sunshine duration meters were deployed at Izana Observatory since 1917 (page 3, line1) and this study demonstrated that daily total irradiation levels could be derived from sunshine duration meters with comparable uncertainties to the bimetallic pyranometers as shown in Table 3. So why not extend the time-series to 1917 using these instruments?

3) I have issues with the derivation of the calibration factor F for the bimetallic pyranometers:

a) It is derived as a monthly factor using modelled solar irradiance and irradiation as reference (page 6). I do not understand why not use the pyranometer measurements from the BSRN instrument, which are certainly much more reliable than modelling results?

b) I am missing a discussion (and figure) on the amount and source of the variability of F, as I wonder why it is not be an instrument constant instead of a monthly varying factor. I would only expect it to vary slowly in time due to instrument degradation for example.

c) There seems to be a circular reasoning in the method used to derive the time-series from 1977 to 1991 (see page 10, last paragraph). The method uses modelled GSR data to retrieve the instrument calibration factors over this time-period, and then applies these calibration factors to the data to derive the solar irradiation from the instruments. But then, how can the solar irradiation levels recalculated from the bimetallic pyranometers contain any more information than the modelled radiation used in the first place to derive the calibration factors? I would suggest to carefully analyse the variability of F, and check if the calibration factors derived in 2014-2015 could not be used for the period 1977-1991.

Some more technical comments :

4) The use of the term global solar radiation (GSR) by the authors is very confusing: Sometimes it is used for the global solar irradiance (W/m2), at other times it represents daily total irradiation (J/m2). The authors should clearly distinguish between these two different parameters, and not use the same term GSR.

5) page 10, section 5: Can the neural networks track sahara dust events and volcanic eruptions (Pinatubo in 1991 and El Chichon in 1982), which are unpredicted events with significant influences on the GSR and the largest sources of aerosols at Izana observatory, for otherwise low AOD background conditions?

Abstract: Please define SD here, not later in the text.

Page 4, line 12: Please explain the method by which the pyranometer performs the diffuse and global measurements (simultaneously?).

Page 6, line 2 : As mentioned previously, why not use the BSRN Pyranometer here,

instead of the modelled solar irradiance using libradtran?

Page 10, line 22, add bimetallic, in ". . .with two pyranometers: "

References: Please remove Garcia et al., 2014a as it is only AMTD and a duplicate of Garcia et al., 2014b.

Table 1: I suggest to define the basic parameter shown as magnitude for MFRSR and CM21 as solar irradiance (W/m2), from which solar irradiation (J/m2) can be derived.

Figure 3: There is a mistake in the bottom figures : OND should probably be corrected to SON?

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