GMD-2017-303

Interactive comment on "Comparison of observed and modelled longwave radiation (2010-2016) at the high mountain BSRN Izaña station" by R. D. García et al.

Anonymous Referee #2:

GMD-2017-303 review

The manuscript presents a concise comparison of 7 years of downward longwave radiation measurements obtained at the Izaña Atmospheric Observatory to two high resolution radiative models using other measured parameters at the site. The results show agreement between the two models and pyrgeometer measurements to within their demonstrated uncertainties. This manuscript only needs minor adjustments for publication and will be of great benefit to both the modelling and measurement communities.

***Authors:** The authors acknowledge the referee's constructive comments, and in the followings, we discuss and respond to the general comments and specific suggestions.*

GENERAL COMENTS

1. There is no indication of what DLR measureands are used in the comparison. Are they single sample, minute averages or longer averages. There is reference to 'instantaneous' measurements but such measurements do not exist as most data acquisition systems integrate over a small but finite period. For example, there is reference to 1-minute surface measurements in 3.0.1 but are they averages or single samples.

***Authors**: The authors have averaged in a 30 minutes period the LDR observations from 11:00 to 11:30 and 23:00 to 23:30 UTC to match the flight time of the radiosonde over IZO. This information has been added to the final manuscript as follows:*

> *"In this section, we present the comparison between LDR measured with BSRN and simulated with LibRadtran and MODTRAN, considering the available and coincident cloud-free BSRN at day-time and night-time, and the inputs indicated in section 4.1 at IZO between 2010 and 2016. A total of 1048 measurements at day-time, and 1014 measurements at night-time were used. The observations were averaged in a time period of 30 minutes, in order match the flight time of the radiosonde over IZO. In particular, we averaged over 11:00-11:30 UTC and 23:00-23:30 UTC periods, for day-time and night-time measurements, respectively. .."*

2. On occasions 'accuracies' are given a quantitative value. In ISO accuracies are a qualitative (good, bad, indifferent) not quantitative. Just because a manufacturer incorrectly uses accuracy as a quantitative term is no reason to repeat bad practise.

Authors: The authors agree with this comment. We have replaced the following uses of accuracy:

Page 2, Line 4:

"…The spectral range covers from 4 to 42 µm with an expected sensitivity of 5 to 15 µV/Wm^{-2}, an uncertainty < 3% for daily totals, and uncertainty < 7.5 Wm^{-2}"

Page 2, Line 18:

"…The above mentioned parameterizations show uncertainties ranging from 9% to 15 % in low altitude sites…"

3. 'Temporal resolution' and 'temporal frequency' are used in 4.1 lines 7 to 15 - but what one thinks is meant is sampling rate.

Authors: We agree, and have modified the two sentences as follows:

Line 7:

"In this work, we have used the AEMET's meteorological radiosondes dataset. Radiosondes are launched twice a day, at 11 and 23 UTC at the Güimar station…"

Line 15:

Since January 2009, the PWV has been obtained every 1h at IZO from a GNSS (GPS-GLONASS) receiver considering GPS precise orbits (Romero Campos et al., 2009)

4. While the AOD at 500 nm is used there is no indication of the aerosol model (i.e. distribution) that scales in the IR.

Authors: Following the referee's recommendation, we have added this information in the final manuscript as follows:

"Atmospheric aerosols are included in the simulation process by means of the column-integrated AOD extracted from AERONET (Level 2.0 of version 2, cloud screened and quality ensured). The AOD is obtained from solar observations performed with CIMEL sunphotometers at different wavelengths (Holben et al., 1998; Dubovik and King, 2000; Dubovik et al., 2006). The Shetle's aerosol model (Shetle, 1989) has been used in this study. The default properties are: rural type aerosol in the boundary layer, background aerosol above 2 km, spring-summer conditions and a visibility of 50 km. In this work, AOD at 500 nm has been used as model input. For day-time we have used the nearest AOD value to 11 UTC, and for night-time the last available AOD value of the day."

Shettle, E.: Models of aerosols, clouds and precipitation for atmospheric propagation studies, in: Atmospheric propagation in the uv, visible, ir and mm-region and related system aspects, no. 454 in AGARD Conference Proceedings, 1989.

5. Figure 3 shows a standard X vs Y plot of various comparison parameters. It would be more instructive as (Y-X) vs X plots with a (Y-X) = zero line.

Authors: *Following the referee's recommendation, we have done a new Figure 3. However, the authors think that as the information of this new Figure is already provided by Figure 5 of the original manuscript, it is more convenient to keep Figure 3 as it was presented in the original manuscript.*

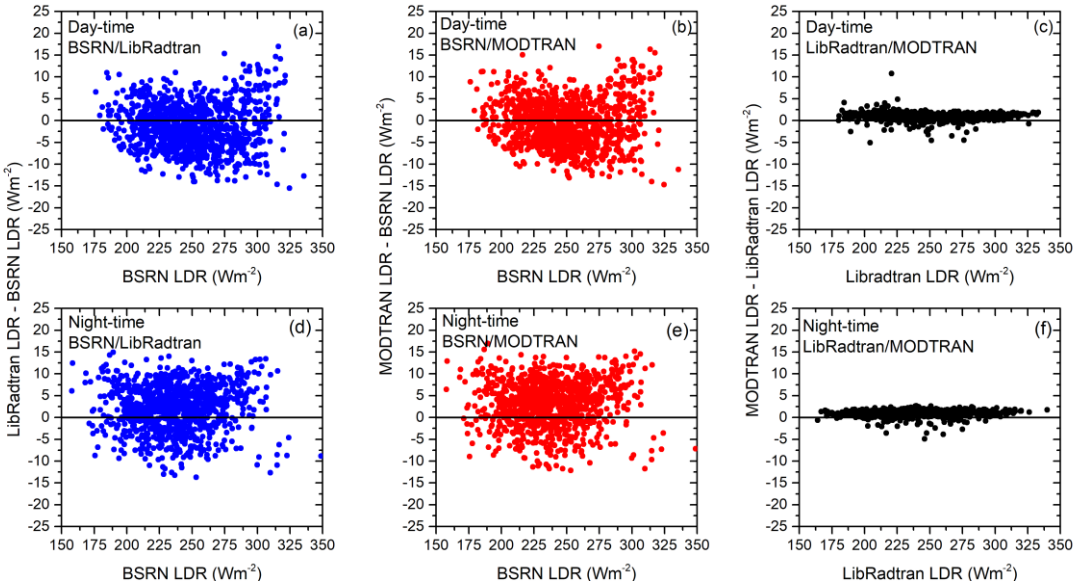

Figure.- Difference between LDR (Wm^{-2}) simulations with libRadtran (blue color) and LDR BSRN (Wm^{-2}) at cloud-free (a) day-time and (d) night-time. Difference between MODTRAN LDR (Wm^{-2}) (red color) and BSRN LDR (Wm^{-2}) at (b) day-time and (e) night-time. Difference between MODTRAN LDR (Wm^{-2}) and libRadtran LDR ((Wm^{-2}) (black color) at (c) day-time and (f) night-time

6. Table 4. Unless one of the variables is the 'truth' then the RSME are really root mean square differences.

Authors: *Thank you for the comment. The authors have been changed the root mean square error (RMSE) by root mean square of the bias (RMS) in the final manuscript.*

7. 5.1.1 - while the step jump on relocation was detected there does not appear to be any comment on the different pygeometers. Was one replaced with another? If not, see point 1 above as it is not clear what measurements were used; a mean between the two?? If one was replaced with another then it would be worth saying that no jump in differences were detected when replacing an instrument.

Authors: The pygeometer was not replaced by any other one. The BSRN instrumentation was moved from the tower to a platform at ground level, because maintenance works at the tower, for a short period of time (approximately one month). Once the works ended the instrumentation was moved back to its original location. The BSRN operations were not interrupted during this period of time.

> *"… When analyzing the BSRN LDR and the simulated LDR data time series separately, we do not observe any change in the simulated LDR, but a change point in the BSRN LDR time series at both day-time and night-time. This change point (October 2012) coincided with a change in the location of the instrumentation within the IZO facilities. The instrument was moved to ground level during approximately a month, until the completion of the works…."*

8. Section 6 line 1-5: 'suggest a scale change of the WISG' - this is an erroneous statement as the WISG is an interim scale until a better one can be found. It might be better to rephrase it to 'The support previous measurement studies that suggest an offset of the WISG to the SI.'

Authors: Following the referee's suggestion, we have modified this information in the final manuscript as follows:

> *"..The observed night-time difference between models and measurements of +5 Wm^{-2} for PWV> 10 mm supports previous measurements studies that report the existence of an offset between the World Infrared Standard Group of Pyrgeometers (WISG), which serves as reference for atmospheric longwave radiation measurements, and the SI."*

SPECIFIC SUGGESTIONS.

a. Abstract line 5: delete 'similar'.

Authors: Done

b. Abstract last sentence: move 'for precipitable water vapor (PWV) >10 mm,' to the start of the sentence.

Authors: Done

c. All references citing 'World infrared standard group' should be replaced with 'World Infrared Standard Group' or after the first use WISG.

Authors: Done

d. Page 11 line 18: the ; before Nyeki et al should be replaced with 'and'

Authors: Done

e. There are a number of other typos that one hopes and editor can correct.

Authors: An English-spoken proofreader has performed a detailed review of the manuscript, fixing the found typos.