

This paper presents a comparison between observed and modelled LDR from 2010 and 2016 at the Izana station for both day-time and night-time. I really enjoyed reading this paper, which is quite clear and presents very interesting and important results for the community. I do recommend this paper for publication, but after some minor revisions. I have also some few questions that need to be addressed and could improve the paper. I have only one major comment about the paper regarding the way the authors are estimating the uncertainty of the models (section 4.2).

Specific comments/questions:

Page 1 lines 16-17: Are there any more recent reviews regarding the anthropogenic greenhouse gas?

Page 1 line 18: What are the uncertainties required on LDR measurements to assess completely their impact on climate changes?

Page 2 line 4: Could you specify how much represents 7.5 W. m⁻² over the [4-42 micrometer] band?

Page 2 line 13: "Stefan-Boltzmann" is misspelled wrongly several times within the paper.

Page 4 Figure 1: Can you explain what the physical meaning of the upper and lower limit?

Page 4 lines 5-6: You are mentioning the calibration date of the instruments. How do these instruments degrade over time (% per year)? Has been any degradation characterization?

Page 5: There is no need for a 3.0.1 title here.

Page 5: from your regression study, it is possible to estimate the uncertainty about ϵ_{AD} .

Page 7 line 6: why do you consider the spectral range from 4 to 100 micrometer, when your spectral band of interest is [4-42] micrometer?

Page 7: I found the section 4.1 about the input parameters a bit confusing to follow, and I would suggest organizing things a bit more neat. The text would be easier to follow if the input parameters are presented as a clear list, with an equivalent structure.

Page 8 about the section 4.2: the method used by the author to estimate the uncertainty is rather simple, and is not statistically relevant and I would strongly advise the authors to change their method. A Monte-Carlo approach considering a normal distribution for each uncertainty parameters would definitely give a more appropriate estimate of the RT model global uncertainty. It requires however more computing time than the one run approach from the authors. In that case, the table 3 is no longer needed and can be replaced by a much smaller table resuming the global uncertainty using a Monte-Carlo approach.

Page 8 Table 3: the combined uncertainty for Modtran model is wrong (I guess a copy-paste from the combined uncertainty for the LibRadtran model).

Page 10 lines 6-7: Could you explain the main differences between the two models? It is not clear at all what makes these two RT models different, and the excellent comparison with the BSRN data does not shed much light about the RT performances differences.

Page 11 Table 4: Please change $R \rightarrow r$ for the Pearson correlation coefficient. Why showing the correlation coefficient r and not R^2 , which in your case of a linear regression is the square of r . R^2 represents the proportion of variance that can be explained by the linear regression. For day time with BSRN/LibRadtran, $R^2 = 0.962$ so 3.8 % of the variance is not explained by the linear regression. Also, why do the authors mentioned here the STD, since there is no reference within the text? What more information can bring the STD here when this clearly the RMSE that is valuable for the authors?

Page 11 line 10: I cannot find any mention of the LOWTRAN model earlier in the text. Please introduce it by explaining the differences with MODTRAN and LIBRADTRAN. Same for the SBDART model.

Page 12 line 21-22: I do understand that this outside the scope of this paper, but the authors should discuss which are the further ways or analysis needed to understand those discrepancies. This would indeed considerably make the paper more valuable other than just a data set description (although valuable for the community).

Page 12: The authors presented box plot of bias versus PWV. And what about the same results versus AOD (2nd uncertainty source)? Would the authors find also a clear pattern as for the PWV?

Page 13 Figure 5: What does represent the vertical dash line for January 2013? The authors mentioned in the text a “change point” for October 2012? I would also suggest here to add the histograms of the bias to have a better view of the distribution of the residuals. Assuming a normal distribution of the residuals, then the STD of table 4 would then be meaningful. But there is no reason that the distribution should be normal. Especially after what has been discussed with the impact of the PWV and the temporal stability.