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Atmospheric Measurement Techniques Discussions

Interactive comment on "McClear: a new model estimating downwelling solar radiation at ground level in clear-sky conditions" *by* M. Lefèvre et al.

Anonymous Referee #2

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The paper describes a look-up table based model to estimate surface global downwelling shortwave radiation, including its direct and diffuse components. The model is based on the libRadtran radiative transfer model and uses information on the atmospheric composition from MACC. The approach is straightforward and sound, though not new. The paper can be accepted after the following comments are taken into account.

General comments

The authors claim that their 'results are much better than those from state-of-the-art models'. Comparisons demonstrate that McClear performs indeed better than HelioClim-3v3, but there may be other clear-sky models around. I am at least aware of

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one: the SICCS algorithm described by Greuell et al. (2013) follows a similar approach for clear-sky SSI modelling as McClear, and appears to achieve similar results. The authors should thus withdraw their claim.

The paper is clearly structured, but the use of English language could be improved. At the end some technical corrections are given, but I recommend having the manuscript checked by a native speaker.

Specific comments

P3368, L9: I haven't seen the word abaci in this context before. It seems to be a term invented by the authors, but why not use the word look-up table (LUT), which I am sure most readers are familiar with. I strongly suggest to remove the term abaci.

P3368, L14-18: Theses sentences are somewhat hard to read, because they contain two radiation components in combination with two limits (lower and upper). I suggest to write in one sentence the correlation coefficient, bias and RMSE for global radiation, then in a second sentence the values for direct radiation. By the way, I don't think mentioning the correlation coefficients is useful here: the large dynamic range of radiation almost automatically yields a high correlation, as is indeed stated by the authors in their manuscript.

P3368, L18-19: Remove the sentence 'These results ... models.' (see general comments).

P3369, L8: What is meant by 'a suitable supplement to rare long-term SSI measurements'? Please clarify.

P3369, L12-13: What is meant by 'the clear-sky model'? A radiative transfer model? And which one? And does the clear-sky model set the upper limit of the SSI? I would say the upper limit would be given by an 'empty' atmosphere. Please clarify.

P3371, L20: I don't count 10 parameters. Clarify.

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P3371, L23: ‘atmospheric profiles’: of what?

P3371, L27: This seems a duplication. Only one height should be necessary. What is meant by altitude? The height above mean sea level? We’re dealing with radiation at the surface, so why the elevation above the ground?

P3373, L10-12: What is ‘obey the uniform law’? Do you mean ‘have a uniform distribution’? Does this mean that the water vapour column PDF is assumed to be uniform?

P3374, L2: Do you mean Eq. (4)?

P3374, L5: Shouldn’t the sky albedo S be independent of the surface albedo. Please explain.

P3374, L9-10: What if the water vapour column exceeds 100 kg/m2? This is certainly possible in the Tropics.

P3374, L13-14: Why are two heights necessary? (see earlier comment)

P3375, L2: Is the MCD43C2 product gap filled? If not, what do you do in case of gaps? Also, I believe the MCD43C2 product is snow-free. What do you do in case of snow?

P3375, L5: Please explain shortly what these three parameters are.

Section 3.2: Atmospheric profiles of what? Please clarify.

Section 3.3: I don’t understand the altitude correction. Please explain more clearly.

P3379, L14: Please include the definition of air mass.

Section 4: I strongly suggest to clarify this algorithm with concrete data, for example by showing a time series of which various parts are disregarded because of either of the three criteria. Can you comment on the percentage of measurements filtered out on the basis of Eq. (9)? Does that vary between the BSRN stations?

P3379, L19-20: How much more restrictive is this algorithm compared to existing ones? This is important because the more restrictive, the better the validation scores

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will probably become. Thus this should be taken into account when making intercomparisons.

P3381, L9: What does ‘compact’ mean here?

P3381, L25: I am surprised that there is no clear trend of the validation statistics of, for example, Eˆglo with the solar zenith angle. For larger angles, Eˆglo will decrease. At the same time the air mass increases and thus the absorption by ozone and water vapour. With more absorption one would also expect more uncertainty in the absorption. Thus, I would expect the RMSE to increase with the solar zenith angle in absolute terms, and certainly in relative terms. Can the authors comment on this? I strongly suggest to illustrate some of the dependences in a Figure.

P3381, L27-28: Isn’t this a consequence of the smaller solar zenith angle in summer (see previous comment)? Please explain.

P3382, L2: Is there any explanation for the very poor correlation for Xianghe, both for global and direct radiation? Any issues with the BSRN measurements for this station? I am surprised that, while the correlation for Xianghe is very low compared to other stations, but the RMSE does not stand out. Can this be explained? Could you include a scatter plot?

P3385, L5-8: Please remove this statement (see earlier comments).

P3385, L16-20: What is the reason for mentioning this reference? If the RMSE estimate of 10-15% represents a theoretical limit due to spatio-temporal mismatching. How can the present results then be (far) below that limit?

Technical comments

P3368, L4: McClear implements . . . A model does not implement something; scientists do that. Please rewrite.

P3368, L13: in several stations -> at several stations

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P3370, L1: is -> has been

P3370, L4: performances -> performance

P3370, L5: Suggest to change ‘published similar works’ to ‘the existing literature’.

P3370, L7: Swap denote and Ediff.

P3370, L9: Remove the brackets.

P3370, L10 and furtheron: Subscript the 0 in E0.

P3371, L4-5: ‘e.g. 15 min values over a year’ can be omitted.

P3371, L16: resolution -> solution

P3371, L20: MCClear -> McClear

P3371, L22: in -> of

P3372, L5: summarization period -> integration time

P3372, L10: twice ‘available’.

P3372, L25: Suggest to replace ‘decrease as much as possible’ by ‘minimize’

P3373, L16: What are ‘spatial’ missions?

P3375, L24: Remove ‘as’.

P3377, L8: watersoluble -> water soluble

P3378, L4: in -> of

P3379, Eq. (9): As stated here the left-hand side should equal 1.08 or 0.92 (for the first line). I’m sure the authors mean the interval between those numbers, so please correct.

P3380, L13: coefficient is -> coefficients are. Also add ‘respectively’ in this sentence.

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P3380, L29: add ‘of SSI’ after ‘estimates’

P3381, L3: increase -> increases

P3384, L16: than -> that, and ‘figures of merit’ -> ‘statistics’?

P3384, L20: of -> in

P3385, L5: comparaisons -> comparisons

Table 7: The percentage symbol is missing for the relative RMSE for Sede Boqer.

Fig. 2: What is GHI?

Fig. 3: Add one more digit to the densities at the right of the colorbar. Same for Figs. 4 and 6.

Fig. 5: Please add same statistics as in Figs. 3 and 4 in the plot. Also in Fig. 6.

Reference

Greuell W., J. F. Meirink, and P. Wang (2013), Retrieval and validation of global, direct, and diffuse irradiance derived from SEVIRI satellite observations, J. Geophys. Res. Atmos., 118, 2340–2361, doi:10.1002/jgrd.50194.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 3367, 2013.