Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2017-440-RC1, 2018

Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluation of Himawari-8 surface downwelling solar radiation by SKYNET observations" *by* Alessandro Damiani et al.

Anonymous Referee #1

Received and published: 25 January 2018

This study evaluates the AMATERASS product of the Himawari-8 satellite based on the EXAM algorithm. Ground-based measurements from SKYNET, JMA and BSRN were used for this evaluation under all-sky and clear sky conditions. It is a well written paper which with some minor revisions it could be published in the AMT journal.

My most serious comments have to do (i) with the lack of comparable results from the bibliography and (ii) with the non-inclusion of an aerosol input to the model. This fact makes the evaluated product almost blind to the aerosol effects. However, the impact of this additional uncertainty was assessed, but there is still a reliability gap. I recommend the authors at least to provide some information about potential sources of operational aerosol optical properties and ways of integrating them into the EXAM algorithm (additional extension or a new model approach?). On the other hand, the

discussion about RE effects is valuable for the improvement of satellite algorithms as to take them into account, but the overall impact in terms of estimated solar energy potential for the natural energy resource exploitation is meaningless compared to the aerosol effect.

In the Introduction section, the authors provide good bibliography about hourly-based validations but there is no reference for higher temporal resolution. There is a need here for additional references using satellite data in finer time steps.

On page 2, lines 3-4, rephrase as "However, to implement such an EMS system, surface solar irradiance data must be supplied as accurately as possible."

On page 2, lines 29-30, the percentages seem to refer to relative RMSE.

On page 3, line 7, provide reference.

Page 3, lines 20-21: Indeed the RE can introduce bias into the evaluation of satellite estimates. Mention other uncertainties (altitude corrections, aerosol optical properties (aod, angstrom, ssa), sza and shading from adjacent mountains) with relevant references.

Page 4, line 10: The EXAM algorithm will include the aerosol effect in the same neural network or in a separate one only for cloudless conditions? The combination of clouds and aerosols in the same NN could result further uncertainties with aerosol mixtures, aerosol and cloud mixtures, multiple aerosol and cloud layers etc. Explain in brief how this inclusion will be addressed.

Page 4, line 11: The mentioned bias from the absence of aerosol inputs may be confused with the aforementioned RE and this is an issue for the reliability and accuracy of results. A clarification is needed here (e.g. underestimation for RE conditions and overestimation because of aerosols). Provide also reference for the aerosol impact on radiation and relevant sensitivity analysis in order to quantify the overall bias by the absence of aerosol input.

Page 4, line 20: The applicability of EXAM with the Himawari-8 input, needs to be tested under various climatological conditions, so the selection of ground-based measurements may include stations in high altitude, mainland, near the sea, near to urban sites like Chiba etc. Here, one station is near urban site, and three affected by desert and continental regions. Discuss the representativeness of the stations selected as well as further necessary test cases for future similar evaluations.

The overall evaluation was performed with Skynet, BSRN and other stations from the JMA, so the Title of this paper could be optionally renamed as "... by ground-based measurements".

On page 5, line 25 and page 9, line 30, is there a classification of sky conditions in the bibliography based on the CSI? This will be helpful for the readers in order to have a sense of quantification for the various sky conditions.

Page 6, line 4: Mention additionally the minimum solar energy potential in such large SZAs for strengthening this consideration.

On page 7, lines 4-5, there is a need for discussion of these results (MB and RMSE) with the mentioned (line 3) or additonal references, as to provide direct comparison with similar approaches and satellites.

Page 7, line 17: This is an important aspect and it needs a short description of the magnitude of this effect (with reference).

Page 7, line 22: Is there a need for an altitude correction for the satellite estimations?

Page 10, line 24: Provide comparable results from the bibliography.

Page 11, line 25: What about high aerosol loads without the impact of PW? Huttunen et al. (2014) explains only this (effect of water vapor on the determination of aerosol direct radiative effect). A more focused reference is needed. Percentages of energy attenuation are also welcome (lines 22-23) in order to be useful for pv reduced production because of high aerosol loads.

Finally, on page 12, lines 4-5, provide comparable results from the bibliography. In the end of this paragraph the author may provide a short description of the potential EXAM upgrade with the inclusion of the aerosol impact.

The high spatial and temporal resolution of the Himawari-8 satellite in conjunction with near real-time algorithms like the EXAM, will improve the precision of the solar farms planning and production control with clear benefits for the local energy transmission and distribution system operators. This paper after the above corrections could be a step forward to the efficient and full integration of the natural energy resource to the electricity grid and will contribute to the development of upgraded energy management systems.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-440, 2018.