

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2020-480

Anonymous Referee #1

Referee comment on "An alternative cloud index for estimating downwelling surface solar irradiance from various satellite imagers in the framework of a Heliosat-V method" by Benoît Tournadre et al., Atmos. Meas. Tech. Discuss.,
<https://doi.org/10.5194/amt-2020-480-RC1>, 2021

Tournadre et al. developed a new way to estimate downwelling surface solar irradiances (DSSI) from satellite images for Heliosat-V. Similar to previous Heliosat algorithms, the cloud index is needed in the DSSI estimation. In this new method, the maximum and minimum reflectances needed in the cloud index calculations are simulated using radiative transfer model instead of taking from archives of satellite images. The authors have demonstrated that the DSSI derived using this new method have good agreement with the CAMS and HelioClim3 DSSI. The new method is very promising. It has the advantage to be applied to both geostationary and polar orbiting satellites to get a global consistent DSSI data set using the same algorithm. The long term global DSSI data set will be interested by the solar energy and climate related communities. The authors have described the algorithm and results clearly. I think it is a good paper for AMT.

Specific comments

1) Line 19, ' plus a diffuse component due to scattering caused by the atmosphere (clouds, gases, aerosols) ... '

Please also add 'absorption' in the sentence. In Fig. 2 you showed the gas absorptions by O₂, O₃, H₂O.

2) Line 22 'renewable solar energy industries, ...'

Is 'renewable' needed here?

3) Line 41-42. This sentence can be combined with the paragraph from Line 43.

4) Line 50, Please add the following paper in the reference list because they also use cloud properties to derive DSSI.

Retrieval and validation of global, direct, and diffuse irradiance derived from SEVIRI satellite observations

Greuell J. F. Meirink P. Wang <https://doi.org/10.1002/jgrd.50194>

5) Line 100-101 , 'the upper boundary variables Xmax and Xmin'

Change to 'the upper and lower boundaries '

6) Line 165 . This paragraph describes the MACC reanalysis used in the LUT. It is not clear if the MACC reanalysis has day, monthly or yearly AOD and which AOD is used.

7) Lines 184-185 can be combined with the paragraph below it.

8) Line 212 ' Heliomont' Is it a typo?

9) Line 233 "ant", typo?

10) Table1. What are the cloud base heights?

Please also add a table for the clear-sky LUT, including the BRDF, aerosols settings etc.. It is not complete if only having the table for the cloud LUT.

11) Line 258 '....for solar zenith angles lower than 80°'

Why do you use solar zenith angle until 80 degree in the validation? In the LUT, the solar zenith angle is until 85 degree. Is it possible to extend the solar zenith angle until 90 degree in the LUT?

12) Line 268 'However reflectance in the near infrared 0.8 μm channel are significantly higher, so is the absolute value of STD.' Readers might want some explanations why the reflectances at 0.8 micron channel is larger than the 0.6 micron channel. Actually it is explained in the discussion section. This happens also in other paragraphs in the results section.

13) Lines 272 – 275. Figure 7 shows the results compared to measurements at the PAY and CAM SMS stations. Please provide some information about the surface type of the stations used in the figure. When it is clear-sky, the surface type, aerosols are more important.

14) In line 272, Figure 7 should be Figure 6.

Since BRDF is an important feature in the clear-sky LUT, it would be nice to show a figure at PAY, CAM, SMS with diurnal cycle for a clear-sky day. Please use 0.6 and 0.8 channel both when there are green grass on the ground surface.

15) Line 280 'Figure 6' should be Figure 7.

16) Fig. 7 Why the simulated reflectances have better agreements with measured reflectances at SMS than at CAM?

It might not be due to the calibration of MSG because it would have the same bias in the full disk image. It seems the ice cloud LUT has similar diurnal cycle to the 99 percentiles of the measurements but the simulated reflectances are larger than the measurements at CAM. It could be at CAM the cloud are less brighter than at SMS. Does it suggest the simulated maximum reflectance should depend on location?

17) Line 320.

Fig. C1. Why there are some outliers with large reflectances in McClear? Is it due to the model or the aerosol data? I would expect the outliers on two sides of the 1:1 line.

18) The authors did not mention direct irradiances in the paper. Are there any plans about the DNI?