

Authors' Responses to Reviewer 2:

General Comments:

Muller and Pfeifroth present a review paper summarizing the physics and techniques that go into satellite based retrievals of solar surface irradiance data (SSI). The authors give a nice overview of the subject with extensive references. With the ever increasing need for accurate SSI data this paper should serve as a useful reference in the field.

The authors also present a good argument for the well-established technique of using the observed effective cloud albedo (CAL) for the retrieval of the cloud transmission as opposed to the more indirect method of determining cloud transmission from the derived microphysical parameters of the cloud (cloud optical depth and effective radii) and RTM.

The English grammar could use some work, but my suggested edits below should help.

Overall, this paper addresses a relevant scientific topic within the scope of AMT. I recommend acceptance after minor revisions.

Specific Comments:

Abstract: The abstract is concise and provides a good summary of the paper.

→ [Thanks](#).

Section 1, Introduction: The authors do a good job in the introduction of motivating the need for accurate SSI data, why satellite observations are the most useful for getting SSI, and in explaining the current satellite data sources.

→ [Thanks](#)

Section 2: The authors give a good overview of the basics of the methods and physics that go into deriving SSI from satellite data.

→ [Thanks](#)

Section 3 and 4: The authors do a good job of describing the indirect and direct path methods.

→ [Thanks](#)

In Section 1, Lines 99-101: A reference, or web link, for GEWEX should be given

→ Thanks. We added the [GEWEX web link](#).

In Section 1, Lines 109-113: A reference, or web link, for CERES should be give.

→ Thanks. We added the [CERES web link](#).

In Section 2.1, Equation 4, d_{cor} should be explicitly defined

→ Thanks, we added „ d_{cor} is a correction factor for varying distance between the Earth and the Sun“

Line 216: The wavelength dependence for Rayleigh scattering should be λ^{-4}

→ Thanks, corrected.

Section 7.1, Lines 450-459: These lines seem out of place in this paper. They are more of a philosophical lecture that comes across as condescending to the reader. I think these lines should be deleted. Just get right into the Heliosat project and the CALSAT method, why the cloud microphysical method was suggested, etc.

→ Yes, we agree it is a bit philosophical, we deleted the paragraph and replaced it by.

„A central paradigm of science is the goal to make things as simple as possible and as complex as necessary and to benefit from the knowledge gained. In this context, we we would like to briefly review the lessons learned within the Heliosat-3 project.“

Section 7.1.1, Lines 487-488: The text reads as if the HRV channel is only available over Europe, and only applied over the European mountains, which I don't think is the case, is it? These 2 sentences should perhaps be more generalized to indicate the HRV channel improves things not only over the European mountains, but over all mountainous terrain.

→ Thanks, we apologize the misleading phrase, the RSS service is only available over Europe. HRV covers parts of Africa. We added „*and large parts of Africa*“

Section 7.2, Lines 570-578: I don't think there's a need to actually list the C-code here. My opinion is that it is too much detail for this type of paper and could be taken out.

→ Thanks, we moved the C-code lines to the appendix.

Technical Corrections:

Here are suggested grammatical corrections. They are minor corrections, but there are a lot of them:

Line 40: Change to “and 9.3% in Germany in 2020”

→ Thanks. done.

Line 51: Remove redundant phrase “flying in low orbit around Earth”

→ Thanks: Removed.

Line 60: Change ‘primary’ to ‘primarily’. Change ‘conversation’ to ‘conservation’

→ Thanks, Done

Line 65: Spell out acronym ‘BSRN’ the first time used

→ Thanks, Done

Line 80: Change ‘provider’ to ‘providers’

→ Thanks, Done

Line 85: Change to “...based solar irradiance: the Climate...”

→ Thanks, Done

Line 88: Delete ‘also’

→ Thanks, Done

Line 109: Suggest starting new paragraph at “The Clouds and the Earth’s ...”

→ Thanks, Done

Line 117: Change to “ PVGIS allows one to visualize...” Change to “... selected sites. Different data...”

→ Thanks, Done

Line 118: Start new sentence...”...sources can be selected. In addition to ...” and deleted ‘also’ at end of line.

→ Thanks, Done

Line 119: Change to “...(Hersbach et al., 2020) are available.”

→ Thanks, Done

Line 119: Should ‘servide’ be ‘service’?

→ Yes, corrected

Line 120: Change to “SoDa was commercialised...”

→ Thanks, Done

Line 153: Change to “...constant is somewhat misleading...”

→ Thanks, Done

Line 157: Change to “...the year on the order of ...”

→ Thanks, We believe „the year in the order of“ is correct.

Line 158: Change to “...leading to a respective...”

→ Thanks, Done

Line 174: Change to “powerful”

→ Thanks, Done

Line 187: Delete ‘also’

→ Thanks, Done

Line 187: I don't think it's correct to start a sentence with ‘E.g.’ I think you should spell it out at the beginning of a sentence, that is “For example, after 4 years of...” The use of ‘E.g.’ at the beginning of the sentence was done a few times throughout the paper, so all should be changed to ‘For example,...’

→ Thanks. Replaced e.g. by for example

Line 194: Change to ‘calculations’

→ Thanks: Done

Line 205: Change ‘nevertheless’ to ‘is somewhat’

→ Thanks: Done

Line 207: Change ‘modify’ to ‘to modification of’

→ Thanks: Done

Line 210: Change ‘E.g.’ to ‘For example,’

→ Thanks: Done

Line 212: Change to ‘acting as a strong...’

→ Thanks: Done

Line 218: Change ‘are leading to’ to ‘follow’

→ Thanks: Done

Line 238: Change 'hybrids' to 'hybrid'

→ Thanks: Done

Line 246: Change 'neglected in' to 'neglected to'

→ Thanks: Done

Line 246: Change 'trough' to 'through'

→ Thanks: Done

Line 247: Change 'equals in' to 'equals to'

→ Thanks: Done

Line 263: Is there a reference for Skartveit and Olseth?

→ No, it was a personal communication during the Heliosat-3 project. This info has been added to the manuscript.

Line 263: Add a comma after 'indirect path,'

→ Thanks: Done

Line 288: Add 'to as the prototype'

→ Thanks: Done

Line 298: Change 'induces' to 'induce'. Add 'the use of the direct path'

→ Thanks: Done

Line 351: Change 'has been retrieved' to 'have been retrieved'

→ Thanks: Done

Line 354 and 355: The reference 'Kulesza, 2021' is repeated

→ Thanks: Is fixed.

Line 367: Change 'ist' to 'is'

→ Thanks: Done

Line 368: Delete 'used and for' to 'used for'

→ Thanks: Done

Line 396: Change 'a adaption' to 'an adaptation'

→ Thanks: Done

Line 407: Change 'larger' to 'longer'

→ Thanks: Done

Line 424: Change 'E.g.' to 'For example, '

→ Thanks: Done

Line 435: Change 'met' to 'meet'

→ Thanks: Done

Line 438: Change 'Further, a running' to 'Further, running'

→ Thanks: Done

Line 446-447: These lines seem out of place and redundant here at the end of this section. Seems like they should go at the beginning of the section where you are motivating the need to forecast SSI

→ Thanks the sentence has been moved to the introduction of the section.

Line 470: Change to 'approach as not been replaced by'

→ Thanks: Done

Line 472: Change misspelling to 'conservation'

→ Thanks: Done

Line 473: Change to 'In these terms'

→ Thanks: Done

Line 482: Change to 'possible improvements to these retrievals'

→ Thanks: Done

Lines 484-485: Change to 'is relatively coarse, approximately 3-5 km over the European mountains.'

→ Thanks: Done

Line 488: Change to 'which means about', that is, remove 'of'

→ Thanks: Done

Line 493: Change 'digitally' to 'digital'

→ Thanks: Done

Line 503: Change 'pixel' to 'pixels'

→ Thanks: Done

Line 509: Change 'rho' to the actual Greek letter

→ Thanks: Done

Line 539: Add 'satellite information lines including...'

→ Thanks: We changed satellite information to satellite instruments.

Line 540: Change to 'However, melting periods of snow are still sometimes...'

→ Thanks: Done

Line 587: Change to 'independent of cloud height'

→ Thanks: Done

Line 589: Change 'E.g.' to 'For example, '

→ Thanks: Done

Line 610: Change to 'Based on those results'

→ Thanks: Changes it to ...on these...

Line 622: Add acronym for neural networks here, that is 'neural networks (NN)' then you don't have to keep redefining it throughout the first paragraph on pg. 24

→ Thanks: Done

Line 623: Change to 'This also includes the estimation...'

→ Thanks: Done

Line 625: Change to 'neural networks is their black box character'

→ Thanks: Done

Lines 652-653: Change to 'However, climatologies can also be used in...'

→ Thanks: Done

Line 661: Remove 'European Medium Range Weather Forecast' since you already defined ECMWF earlier

→ Thanks: Done

Line 665: Remove 'of' at end of sentence, that is, 'SAL is about'

→ Thanks: Done

Line 668: Change 'E. g.' to 'For example, '

→ Thanks: Done

Line 670: Change to 'This is of particular importance for regions...'

→ Thanks: Done

Line 671: Change to 'as these are the main drivers for huge...'

→ Thanks: Done

Line 672: Change to 'and its miss-classification'

→ Thanks: Done

Line 681: Change to 'parameters'

→ Thanks: Done

Line 694: Change to 'relatively dark'

→ Thanks: Done

Line 697: Change to 'yet, for hygroscopic aerosols the AOD depends on the relative humidity...'

→ Thanks: Done

Line 699: Change to 'with an accuracy higher than approximately'

→ Thanks: Done

Line 701: Change to 'relatively'

→ Thanks: Done

Line 707: Change to 'has great potential'

→ Thanks: Done

Line 718: Change misspelling to 'Heliosat'

→ Thanks: Done

Line 727: Change to 'concepts'

→ Thanks: Done

Line 734: Change to 'enable'

→ Thanks: Done

Line 744: Change to 'index or'

→ Thanks: Done

Line 752: Change to 'plane-parallel'

→ Thanks: Done

Line 764: Change to 'eventually into the development'

→ Thanks: Done

Line 769: Change to 'and is therefore recommended'

→ Thanks: Done

Line 771: Change to 'retrievals also have limitations'

→ Thanks: Done

Line 771: Change to 'extensions have'

→ Thanks: Done

Line 774: Change 'significantly' to 'significant'

→ Thanks: Done

Line 775: Change 'works' to 'work'

→ Thanks: Done

Section 'Meaning of eigenvector approach'. Shouldn't this be labelled as an Appendix

→ Thanks: It is in the appendix section in the tex file, we added "appendix" to be concise.