

**Comments to the author:**

Dear authors,  
thank you for submitting your revisions. My apologies for the delayed processing on my end; I was on field campaign travel for a month. I need to run this by one of the reviewers. I can see that some changes were made, and I lean towards accepting the paper. However, I'd like to better understand some elements of the exchange, including:

Reviewer

If the GOES SW TOA flux product is being produced by NOAA it should be cited. If it is not, then it should also be stated in the text. If this is an algorithm paper of a potential NOAA product that is in development that should be clearly stated.

Authors

Answered to previous comment. It is not a potential product. This is an existing product.

Editor:

Here, it is not clear to me how the paper can be, at the same time, the description of a development effort for products that are posted online, but also an existing product. If this is the introduction of a new product, then the current paper is the first algorithm paper, which would be fine. If a previous paper describing the algorithm exists (which I doubt), then the response does not make sense, in my opinion. Can you clarify? I might be misunderstanding something.

Reviewer

3.1 Satellite data for GOES-16 and GOES17: datasets are used in papers I expect the product name, version number and location should be given. I find section 3.1 completely lacking in this regard. First of all, I searched for <https://www.bou.class.noaa.gov/> and the site could not be found. I do not know if this is the GOES L1b radiance data, since the product name was not given in the text.

Editor:

I agree with the reviewer here that section 3.1 is too short, considering that there is no other paper to go to for more explanation. The table and the caption that is used here, along with the link, are insufficient, in my mind, and some text needs to be written around the product, UNLESS another paper can be cited. Here again, I might be mis-understanding something, but again, a short paragraph on the data description does not sound sufficient to me. I am glad that the reviewer brought this up, and I am sorry to keep insisting on taking the reviewer's feedback to heart.

Reviewer

3.2 Reference data from CERES [...]

Authors

CERES SSF version 4a and FlashFlux version 3c data were used

Editor:

I can see that changes were made in the manuscript text, but please also state in the

response to the reviewers which changes were made in the manuscript to address this particular comment as is common practice.

Reviewer

I looked at the ESMF re-gridding web site, there are multiple grid type options. Could the gridding algorithm just be simply detailed in the text.[...]

Authors:

The ESMF re-gridding program is a complicated package. [...] We felt that an interested user will have to go back to that package and not to rely on a brief summary.

Editor:

I generally agree that information on data attributes (such as the grid they are defined on) that is available elsewhere does not have to be repeated in a publication. However, some of the information you provided in your response to the reviewer should be included in the paper, at least at a superficial level so that the interested reader knows where to go. Also, I am missing a response to the reviewer's comment regarding surface types.

Reviewer

In the abstract the last sentence states: "A satisfactory agreement between the fluxes was observed for both clear and cloudy conditions and possible reasons for differences have been identified." Satisfactory agreement is a relative term. I believe that the authors need to describe who their users are and that the level of agreement is sufficient for their applications.

Editor:

I agree with the response that it is impossible to know the users ahead of time. However, I also agree with the reviewer that "satisfactory" is too relative of a term. A quantitative (rather than qualitative as currently provided) statement would be more befitting of this statement in the abstract.

Since I posted my comments in the interactive discussion, can you please post your response (with any additional edits given my comments above) in direct reference to EC1 by clicking on the "reply" button? That way the exchange is public and part of the record.

05/05/2022

Dear Editor:

We will respond to each comment as it appears in your communication. However, we have a feeling that something went amiss here. Possibly, the Reviewer was looking at an older version of the manuscript since some of the issues raised were already responded to. I will illustrate with some examples:

### Example # 1

The Reviewer writes:

3.2 Reference data from CERES [...]

Authors

CERES SSF version 4a and FlashFlux version 3c data were used

Editor:

I can see that changes were made in the manuscript text, but please also state in the response to the reviewers which changes were made in the manuscript to address this particular comment as is common practice.

### Author Response

Please go to:

[amt-2021-289-ATC2.pdf](#) Date: 04 Apr 2022, Status: File upload (AMT), Iteration: Minor revision, Finalized: Yes

It is stated explicitly in the response to the Reviewer that:

CERES SSF version 4a and FlashFlux version 3c data were used

### Example # 2

Reviewer

In the abstract the last sentence states: A satisfactory agreement between the fluxes was observed for both clear and cloudy conditions and possible reasons for differences have been identified.” Satisfactory agreement is a relative term. I believe that the authors need to describe who their users are and that the level of agreement is sufficient for their applications.

Editor:

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also agree with the reviewer that "satisfactory" is too relative of a term. A quantitative (rather than qualitative as currently provided) statement would be more befitting of this statement in the abstract.

## Author Response

There is no such statement in the latest version of the manuscript as submitted under:

[amt-2021-289-ATC2.pdf](#) Date: 04 Apr 2022, Status: File upload (AMT), Iteration: Minor revision, Finalized: Yes

Now we will respond to each comment as it appears in your communication

Reviewer

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## Authors Response

In our previous response we have stated the following:

Authors

The paper is about the development of methodology to derive TOA SW fluxes at NOAA STAR. This product is a starting point for deriving surface SW fluxes when using the “indirect approach”. There is also a need to know how well the proposed methodology is working. Therefore, the evaluation of the methodology against best available estimates of TOA fluxes is an important element of the paper. The TOA reflected SW flux is produced together with the surface downward SW flux and archived at the NOAA Comprehensive Large Array-data Stewardship System (CLASS) at [avl.class.noaa.gov](#) as archived at the NOAA Comprehensive Large Array-data Stewardship System (CLASS) at [avl.class.noaa.gov](#). It is an end-product just like the surface flux. Since the TOA and surface fluxes

are generated together in the same process by the same algorithm the product/algorithm version numbers are the same.

It is an intermediate product and as such, versions have the same labeling as the final product, namely, the surface SW fluxes.

The method for estimating the TOA broadband albedo developed in the effort documented in the paper has been applied in an algorithm that is used by NOAA to operationally generate the level 2 (L2) reflected shortwave radiation at TOA product since the launch of GOES 16 in November 2016. This product is archived and can be freely downloaded from, the NOAA Comprehensive Large Array-data Stewardship System (CLASS) at [avl.class.noaa.gov](http://avl.class.noaa.gov), in the "GOES-R Series ABI Products (GRABIPRD)" category under the name of "Reflected Shortwave Radiation: TOA". The algorithm/product version number is version 1, revision 0 (v01r00). For the ABI clear-sky mask (cloud mask) and cloud optical depth are also v01r00.

Since the above text seems to be lacking in clarity, we are smoothing the text so hopefully there is no ambiguity. Here is the new version:

This is a first paper that describes the development of a methodology to derive TOA SW fluxes from the Advanced Baseline Imager onboard the NOAA GOES-R series of geostationary satellites that are used at NOAA STAR as a starting point for deriving surface SW fluxes. To find out how the methodology is working evaluation of the methodology against best available estimates of TOA fluxes was also done. The TOA reflected SW flux is produced at NOAA together with the surface downward SW flux and is archived at the NOAA Comprehensive Large Array-data Stewardship System (CLASS) at [avl.class.noaa.gov](http://avl.class.noaa.gov). While the TOA reflected SW flux is a product on its own right, it is also a prerequisite to deriving the SW surface flux; as such, versions for TOA and surface have the same labeling.

We will now add this text to Introduction

Reviewer

3.1 Satellite data for GOES-16 and GOES17: datasets are used in papers I expect the product name, version number and location should be given. I find section 3.1 completely lacking in this regard. First of all, I searched for <https://www.bou.class.noaa.gov/> and the site could not be found. I do not know if this is the GOES L1b radiance data, since the product name was not given in the text.

Editor:

I agree with the reviewer here that section 3.1 is too short, considering that there is no other paper to go to for more explanation. The table and the caption that is used here, along with the link, are insufficient, in my mind, and some text needs to be written around the product, UNLESS another paper can be cited. Here again, I might be mis-understanding something, but again, a short paragraph on the data description does not sound sufficient to me. I am glad that the reviewer brought this up, and I am sorry to keep insisting on taking the reviewer's feedback to heart.

**Authors Response**

The referenced site was:

[www. avl.class.noaa.gov](http://www.avl.class.noaa.gov)

As such, when the search was done for

<https://www.bou.class.noaa.gov/>

nothing was found.

Text was added to the manuscript.

The Advanced Baseline Imager (ABI) data used (Table 6) were downloaded from the NOAA Comprehensive Large Array-Data Stewardship System (CLASS) at <https://www.avl.class.noaa.gov/saa/products/welcome> . Both level 1b (L1b) and level 2 (L2) data were used. These can be found by searching the CLASS site by selecting "GOES-R Series ABI Products GRABIPRD (partially restricted L1b and L2+ Data Products)". The L1b data included the radiances (RadC) in files "OR\_ABI-L1b-RadC-MmCnn\_G1SS\_stime\_etime\_ctime, where "m", "nn" and "SS" indicate the ABI scan mode, channel number (01-06) and satellite identification number (16 or 17), respectively. "stime", and "etime" are the start and end dates and times of the scan, "ctime" is the date and time the file was created on. The ABI L2 product used were the clear-sky mask, cloud top phase, cloud optical depth. The names of these files are constructed similarly to the L1b radiance files, except that the radiance product name RadC is replaced by ACMC, ACTPC, CODC and AODC, respectively, and the reference to the channel number is omitted. For example, GOES-16 with ABI operating in scan mode 6 in the CONUS domain, the name of the clear-sky mask file is OR\_ABI-L2-ACMC-M6\_G16\_ stime\_etime\_ctime. (In the product names above the letter C indicates the CONUS domain.)

The clear-sky mask product consists of a binary cloud mask identifying pixels as clear, probably clear, cloudy or probably cloudy. The cloud top phase product provides cloud classification identification information for each pixel. The cloud phase categories are clear sky, liquid water, super cooled liquid water, mixed phase, ice, and unknown. The cloud optical depth product gives the optical thickness along an atmospheric column for each pixel. All products have a nominal sub-satellite spatial resolution of 2 km.

Reviewer

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## Authors Response

Editor:

I can see that changes were made in the manuscript text, but please also state in the response to the reviewers which changes were made in the manuscript to address this particular comment as is common practice.

## Authors Response

As explained in Example # 1, this statement is in our response as can be seen in: [amt-2021-289-ATC2.pdf](#) Date: 04 Apr 2022, Status: File upload (AMT), Iteration: Minor revision, Finalized: Yes

Reviewer

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## Authors Response

Such information is provided. It reads:

### 3.3 Data preparation

290 291 For the re-mapping, we adopted the ESMF re-gridding package. The detailed information can be found

292 at: <http://earthsystemmodeling.org/regrid/>

293 For an ideal situation, the ABI high-resolution TOA SW fluxes should be mapped into the CERES  
294 foot-print for validation. However, there are reasons that make it difficult to do so. There can be more than

295 18000 pixels in a single swath of the SSF, when constrained to U.S. Different pixels have different times.

296 Neglecting the seconds, there are still more than 30 mins differences (this changes case by case) between

297 the first pixel and the one at the end and this brings up a time matching issue. By remapping the SSF to 13

298 ABI, we can set up a unique time for ABI (ABI is at 5 min intervals) and then constrain the region and  
299 the time range of SSF.

300 Both re-mapping the ABI to SSF and remapping SSF to the ABI bring up spatial matching errors as  
301 recognized by the scientific community (Rilee and Kuo, 2018; Ragulapati et al., 2021). In Fig. 11, we  
302 show the SSF before re-gridding (Figs 11 (a) & (b)) and after re-gridding (Figs. 11 (c) and (d)). The  
303 fluxes after re-mapping CERES SSF to the ABI resolution resemble well the original structure.

Another

304 consideration is the computational efficiency of re-mapping the curvilinear tripolar grid to  
unconstructed

305 grid. For large arrays, it is more efficient to remap the unconstructed grid to the curvilinear tripolar  
grid.

Perhaps, the comment:

The detailed information can be found at: <http://earthsystemmodeling.org/regrid/>

that appears up-front, should have been placed at the end of the section. We have done so  
now. Should be clearer. Thank you.

Reviewer

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## Authors Response

We have checked the latest version of the manuscript that was submitted:

[amt-2021-289-manuscript-version4.pdf](#) Date: 04 Apr 2022, Status: File upload (AMT),  
Iteration: Minor revision, Finalized: Yes

There is no such statement in the Abstract. Possibly, the Reviewer was looking at an earlier version of the manuscript.

Since I posted my comments in the interactive discussion, can you please post your response (with any additional edits given my comments above) in direct reference to EC1 by clicking on the "reply" button? That way the exchange is public and part of the record.



Will do. Thank you.  
Thank you,