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Atmospheric Measurement Techniques Discussions

Interactive comment on "Top-of-the-atmosphere shortwave flux estimation from UV satellite observations: An empirical approach using data from the A-train constellation" *by* Pawan Gupta et al.

Anonymous Referee #1

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Background

The main objective of this study is to assess how well TOA SWF can be estimated using OMI cloud and ozone products with a neural network (NN) approach when CERES data are used for training. To meet this objective, information on cloud/aerosol parameters and total column ozone (TCO) from the Aura Ozone Monitoring Instrument (OMI) has been collocated with the Aqua Clouds and Earth's Radiant Energy System (CERES) estimates of TOA SW flux (SWF). The data have been used to develop the NN based estimates of TOA SWF globally (ocean and land) using only OMI data as

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inputs. The global mean daily TOA SWF calculated from OMI was found to be within ±1% of CERES throughout the year 2007. It is suggested that application of this approach to other ultraviolet sensors, both past and future, may lead to estimates of TOA SWF.

General Comments

1. Not clear what SW parameter at the TOA was used in the regression? Is it the reflected SW or the net SW?

2. p1, line 26 stated:

Application of our neural network to other ultraviolet sensors, both past and future, may provide unique estimates of TOA SWF.

This is correct if past sensors have the same type of information on other input parameters as does OMI, which is not the case.

3. p3, line 21 stated:

In this study, we utilize OMI cloud, and ozone products along with other ancillary data to estimate TOA SWF.

In the title, it is emphasized that what is unique about this approach is that UV satellite data are used. In what is actually done, no UV data are used directly; information on ozone is used that could come from any source. There is a need to explain what is unique about the approach since it could be repeated with information on these parameters from any other source.

4. p4, line 14 stated:

We primarily use 2007 data over global oceans for the training, testing, and validation of neural network models

Since the treatment of surface albedo over oceans and over land is so drastically dif-

ferent, something needs to be said on the impact of such differences and why NNs trained over oceans will perform well over land.

5. p3-4, line 31 stated:

The ADMs heavily depend upon the observed scene type and are sensitive to surface characteristics as well as cloud 1 and aerosol optical properties

This is a very important issue that the Authors did not address. CERES is using ADMs to derive fluxes at the TOA from the radiances. In the proposed approach, radiances are computed. To compare it to the CERES product, the radiances need to be converted to fluxes. How is it done without the use of ADMs?

6. CERES provides daily values that are computed with the help of observations from geostationary satellites. How do the Authors get their daily values so a reasonable comparison can be made with the CERES daily values?

7. Another important issue that was not explained is related to the selection of clear cases from cloudy cases. How exactly do the Authors decide what scene is clear? They do touch upon the method used by CERES to select clear cases but not for OMI.

8. p6, line 20 stated:

The assumed cloud optical depth of 20 is spectrally-independent within the 320-1400 nm wavelength range

What about COD of less than 20?

9. p7, line 26 stated:

OMI and CERES collocated pixels are only included in our training and validation samples when the distance between centers of OMI and CERES pixels is less than 20 km.

At such spatial differences, can one assume that what is clear for one type of observa-

tions would be also clear for the other?

10. p8, line3 stated:

We also mask OMI pixels with AI > 1 to avoid heavy absorbing aerosol loaded scenes where the fc and OCP are known to contain errors If this is the case, how well will the algorithm perform when there are heavy aerosols in the atmosphere?

11. The regression equations derived are not presented. What do they look like? They should be provided so that others can use them.

Specific Comments

1. p1, line 19 stated:

The A-train constellation of satellites provides a unique opportunity to analyze near-simultaneous data from several of these sensors

What exactly is near-simultaneous? $\frac{1}{4}$ of an hour can make a large difference in the reflected SW at the TOA.

2. p2, line 24 stated:

Although CERES provides state-of-art estimates of TOA radiative fluxes, it does not make measurements of individual atmospheric components that impact those fluxes.

This was not the objective of CERES to measure individual atmospheric components so it should not be held against CERES. This comment is not a good argument for the case at hand.

3. Not clear why figure 1 is needed and what it exactly means.

4. In most figures, the legends are not sufficiently informative.

5. Also not clear what is compared to what like for example, figure 3. CERES gives flux while OMI is something else.

6. In figure 4when the difference is taken one can see some striping. Such features usually represent differences in sampling. Needs to be explained.

7. Each figure needs to clearly indicate what time averaging is used.

In summary, this manuscript requires additional work before being considered for publication.

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