Biogeosciences

Discussions

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Interactive comment on "Deriving Photosynthetically Active Radiation at ground level in cloud-free conditions from Copernicus Atmospheric Monitoring Service (CAMS) products" *by* William Wandji Nyamsi et al.

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First of all, we thank Referee #2 for the constructive remarks on this article. The authors believe that they have understood the concerns of the referee. All remarks have been taken into account for revising a part of the text following recommendations of the referee.

Background

In 1999 Nyamsi et al. published in Adv. Sci. Res., 12, 5-10, doi:10.5194/a descrip-

tion of an approach to derive PAR under clear sky conditions from the correlated-k approximation of Kato et al. (1999). This approach is computationallyefficient, initially applied for calculations of the broadband solar radiation under clear sky conditions in 32 specific spectral bands. The authors used this approach for assessment of the photosynthetically active radiation (PAR) from 400 to 700 nm using twelve of these spectral bands. The method has been evaluated against detailed spectral calculations of PAR derived with the radiative transfer model libRadtran. In the present study, the Copernicus Atmosphere Monitoring Service daily estimates of aerosol properties, and column contents of water vapor and ozone are used as input to the method to derive PAR under clear sky condition. The results are compared with measurements of global Photosynthetic Photon Flux Density on a horizontal plane made in cloud-free conditions at seven sites of the Surface Radiation network (SURFRAD) in the USA.

General Comments

Comment 1. The methodology used here has been described previously.

Answer: Thank for this comment. As commented by the referee #1, apparently, we were not able to emphasize clearly enough those parts of the method that have been already published from those that are discussed and published first time. We appreciate this comment and we have tried to clarify these issues in the revised manuscript. Moreover, we want to stress that the core objective was to validate this approach (at PAR range) against ground-based measurements. This is done first time in this manuscript and is entirely new contribution.

The method we described is a combination of three parts: (1) use of CAMS products to describe the atmospheric state, (2) irradiances of correlated–k approach over only eleven bands covering the PAR wavelengths by the means of libRadtran and (3) the resampling technique for computing PAR estimates. Only the third part has been previously published by ourselves. The goal of this current manuscript is to focus on the entire approach (e.g. also including the other two parts) and to present the ground-

based validation.

Since estimation of PAR under cloud-free conditions at any time and place is an important first step in calculating PAR in all-sky conditions, in this paper, we concentrated first on these conditions.

Based on the above referee comment, we have re-written several parts of the text accordingly. For instance, a part of introduction is re-written as follows:

"This resampling technique has not been validated in operational conditions, i.e. using available inputs to describe the atmosphere in cloud-free conditions and the properties of the ground, and tested against ground-based measurements. This paper is making this step forward and aims at describing and evaluating the entire method when tested against measured PAR in cloud-free conditions."

Comment 2. The methodology has been implemented with actual auxiliary data to match ground observations of PAR. It was found that the bias ranges between 1-6% from the mean value. It is claimed that these errors are less than 5% than the uncertainty of the measurements. It is claimed that this demonstrates the very good level of accuracy of the proposed method (which is not obvious how).

Answer: Thank you for this remark. We fully agree with you. We have re-written the relevant parts of the text and especially we have made a discussion part, newly added in the revised manuscript.

Comment 3. Not clear what is the added value of this evaluation since the methodology itself was already evaluated. Seems, this is just an exercise what is achieved if the CAMS product is used. Would it be worse with other sources of products?

Answer: Thank you for this remark. The comment is almost similar to the comment #1. We have re-written a part of text. We have given comparisons with a method using CERES products. We found that the performances of our method are similar or better in most stations. These comparisons were mentioned in the Discussions part.

Comment 4. Not clear how this work brings us closer to obtain information on PAR under all sky conditions (information that is needed).

Answer: Thank you for this remark. We have re-written the relevant parts of the text.

Comment 5. The approach proposed is not unique and in principle, any radiative transfer model can be used to estimate PAR. Therefore, the unique contribution of the described effort was not demonstrated clearly and neither has it been shown how this gets us closer to obtain large scale information on PAR under all conditions.

Answer: Thank you for this remark. We have re-written the relevant parts of the text.

Comment 6. Relevant references are very limited.

Answer: Thank you for this remark. We have added more relevant references in the manuscript.

Comment 7. Addressing all of above concerns is needed before considering publication.

Answer: Thank you for your comments. We believe that we have understood above concerns. The remarks have been taken into account for revising a part of the text following recommendations.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2017-512, 2018.