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Discussions

Interactive comment on "Assessment of the spectral downward irradiance at the surface of the Mediterranean Sea using the OASIM ocean-atmosphere radiative model" *by* Paolo Lazzari et al.

Anonymous Referee #2

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Reviewer comments on

Assessment of the spectral downward irradiance at the surface of the Mediterranean Sea using the OASIM ocean-atmosphere radiative model by

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The manuscript presents a model-observation validation study that compares the OASIM spectral radiation transfer model results at the surface of Mediterranean Sea

to BOUSSOLE and BGC-Argo observations. The comparison has been done in the framework of Copernicus Marine Environment Monitoring Service in order to prepare for development of a new multispectral bio-optical model with advanced data assimilation for marine research. The atmospheric input to OASIM is taken from the ECMWF ERA Interim reanalysis data, and the comparisons cover the years 2004-2017 (which is not clearly indicated). The general result is that at monthly level the model and observations correspond each other well, but daily variations are large, depending mostly on cloud dynamics.

Large amounts of valuable observation data has been used and model simulations performed. The radiative transfer model and observations are described in a sufficient extent, the results extensively presented and analysed. For validation, suitable statistical methods seem to be used. Data and model availability is documented as required. However, the reader is somewhat lost within this vast material as the presentation is not focused and clear enough. Sometimes it is even difficult to understand what the authors want to say. The motivation and aims of this study should be stated clearly in the introduction and the conclusions tied to them. You might consider if all the figures are really necessary in order to support your conclusions.

For example, in the abstract (L10-20) you write that "observations are combined with model outputs to analyse the spatial and temporal variabilities in the downward planar irradiance at the ocean-atmosphere interface". In fact you validate a radiation transfer model against ocean observations. In the introduction, you refer to development possibilities, including everything from advanced assimilation of satellite observations to improved coupled biogeochemical models applying bio-optical in-water light propagation algorithms. How exactly the comparison of a classical atmospheric radiative transfer model to the (new) in-situ observations, which is the topic of the present study, will contribute to those developments, is not detailed or prioritized.

I have one major question for you to consider, as you use ERA reanalysis data and work within Copernicus monitoring services. ERA5 includes output of spec-

trally integrated surface downward UV (0.20-0.44 μm) and SW (0.20 - 12 μm) radiation fluxes (https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview). ERA interim did not yet contain the separate UV flux. These fluxes result from application of the ECMWF radiation transfer model that is fully integrated in the atmospheric model at each time step. The previous version before the scheme described by Hogan and Bozzo, 2018 (your reference at L386-387) was applied for ERA interim and ERA5.

I would suggest you to compare the ERA5 UV and SW to the BOUSSOLE and Argo DPAR and integrated UV measurements. This would give you a possibility to understand if these variables of operational or reanalysis NWP models were sufficient as input to MedBFM within CMEMS. It would give you a basis to request CAMS, ECMWF future output of some more spectral details of the downward global, direct and clear-sky surface radiation fluxes, e.g. UV, visible, near-IR, or more, separately. If this would succeed, you would not need at all the coupling of OASIM within CMEMS but would benefit from the integrated advanced radiation scheme within the ECMWF model?

You have shown that the aerosols play a minor role compared to clouds (L324). In any case, use of detailed aerosol information in the radiation schemes of the NWP models would make the additional use of atmospheric MODIS aerosol data unnecessary for the coupled ocean bio-optical modules. You can find out about CAMS and ECMWF treatement of aerosol information in Bozzo et. al., https://doi.org/10.5194/gmd-13-1007-2020, 2020 and references therein. Some regional NWP models plan to use CAMS aerosol in near-real-time (e.g. Rontu et al, 2020, https://doi.org/10.3390/atmos11020205) for the weather forecast (but with spectrally simple radiation schemes, with output not sufficient for your purposes).

A few specific minor comments follow:

L31-34. Please clarify the complicated sentence, what does it mean?

L121 and elsewhere: photosynthetically available radiation -> photosynthetically *ac-

tive* radiation

L133-134. How to understand this: at a depth shallower than 1.5 metres, with at least 4 measurements in the first 10 metres ?

Section 3.1. What is the role of surface pressure and wind from the point of view of (solar) radiation flux comparison?

L.296 and elsewhere. How to compare fluxes in different units, 600 μmol quanta m -2 s -1 v.s. W m -2 nm -1 ?

L331-336. You are effectively saying that for the radiation flux results it is more important that clouds are in correct place in correct time than how the details of liquid cloud optics are treated in the simulated clouds. Which is true, of course.

L383-387. See the general comments.

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