Review of essd-2024-295: "A hyperspectral and multi-angular synthetic dataset for algorithm development in waters of varying trophic levels and optical complexity" by Jaime Pitarch, Vittorio Ernesto Brando

General comment:

This manuscript details the generation of synthetic dataset of the "apparent optical properties" (AOP) of different water types based on radiative transfer (RT) computations. The authors collated a large set of "inherent optical properties" (IOP) from the literature on which they applied statistical treatment to encompass the natural diversity (and cross-correlation) of the absorption and scattering features of the optically active component of the water column. This effort is a prerequisite to further study the (non-linear) relationships between IOP and AOP in order to advance in remote sensing algorithm development. Nevertheless, such a dataset should have been validated on actual data (e.g. optical closure) to evaluate the numerous assumption/approximation of the spectral IOP (e.g., phase function, spectral slope of the scattering coefficient, specific absorption/scattering…). In the present form, the computed AOP cannot be considered as a reference dataset to be shared as is to the scientific community. The manuscript is closer to a research paper than a data paper. The computations are of interest and should deserve deeper analysis especially on the anisotropy properties of the remote sensing reflectance in a dedicated research paper before publication as a "data paper".

Specific comments:

The manuscript structure could be significantly improved to introduce the terms/equations before their usage in the text body (hard to follow in the present shape). I would advise to start with the radiative transfer equation and detail the terms to be used as input to solve the equation to provide the AOP outcomes

L.11: "optical domain" is very large, maybe, replace with "UV-visible to near-infrared range".

L.18: from 350 nm to ??? nm (give the upper limit)

L.40 and L.42: please avoid to use "C" and "N" which could be understand by Carbon and Nitrate in the biogeochemical community

L.130-131: B_ph not defined. Why using "ph" for both whereas the latter is for "non-algal"

L.152: "A" and "E" not defined

L.154: "spectral slope" not defined

L.155: "..scattering coef. are set constant": you mean spectrally constant?

L. 181-183: B_ph, b_ph,b_b,ph : not defined

L.188: "more realistic angular variation", is this statement demonstrated, any reference?

L. 229: you could introduce here the concept of "specific absorption", it would be nice as well to discuss the impacts of different specific absorption coefficients in your study (e.g., different phytoplankton species/mixture)

L.256 and 260: could you elaborate on the choice of the thresholding values

L.272: it would be of interest to show the phytoplankton specific absorption in a dedicated figure.

L. 310: "the offset was removed"... be careful with this assumption that is true for CDOM but not for minerals that might absorb in the red and near-infrared

L.312: title "particle backscattering" is for phytoplankton and non-algal particles/ minerals?

Table 1: several terms are not defined for instance U, N , etc. that I understand as being uniform and normal distributions… but you used N for concentration of non-algal particles

L. 435: why using h=0.7 ??
L. 450 and 457: “a_ph < c_ph which is unphysical”, I think you would mean the opposite “a_phy > c_phy …
L. 459-464: on the setting of “B_ph”, I think in your study this setting is critical to compute the angular shape of the VSF and therefore the impact of the anisotropy of the remote sensing reflectance (e.g. BRDF)
Fig 5: x-label “C/N” very close to carbon to nitrate ratio….
L. 704: “1300 angles”, could you give the range (and increment) of the viewing zenith and azimuth angles
L.748: letter “Psi” not definedL. 765: “... for a turbid water scenario”, could you give the sediment (SPM) concentration

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