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Interactive comment on "A synthetic satellite dataset of *E. huxleyi* spatio-temporal distributions and their impacts on Arctic and Subarctic marine environments (1998–2016)" *by* Dmitry Kondrik et al.

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Received and published: 24 December 2018

1. Regarding the status of our database.

With all respect for the reviewer, we can't agree with the reviewer's opinion that if any dataset(s) including the parameter(s) listed in our paper already exist(s) then our dataset can not be qualified as unique. The uniqueness of our dataset resides in that that

(A) it combines a spatially and temporarily collocated setof parameters (not solely e.g.

coccolith concentration)inherent in /related to the E. huxleyi blooms phenomenon in a number of polar and subpolar marine regions

(B)over the satellite measurement period of nearly 20 years (1998-2016), it is

(C) based on merged data from several satellites of the modern era (such as SeaWiFS, MODIS, MERIS, VIIRS), and

(D) designed specifically for the user convenience. Thus importantly, the user does not need to compose such a comprehensive database but use the already collected and user-friendly organized data source. Incidentally, this is explicitly corroborated by the reviewer himself/herself: even a spaceborne database on coccolith concentration per se is not available and needs to be retrieved from satellite datasets of PIC.

Summing up:

Given that our E-huxleyi-focused a ready-made database is yet unparalleled in terms of its combined areal+temporal coverage (6 seas in 3 oceans, 19 years, respectively), and the number of concatenated variables/parameters, we insist that, to date, it is veritably unique.

Other critical remarks relating to the issue of our database are commented on below.

2. Regarding the presence or absence of E. huxleyi blooms in the Bering Sea.

We considered this issue in detail in our work (Kondrik et al., 2017a), and it would obviously be improper to give here the respective entire excerpt from the above paper. In capsule:

A. Broerse et al.(2003) recognized that the area in which they took water samples, was on the very edge of the "bright patch". They write: "From the 7 February 2001 satellite image (Fig. 1(5)), it is not clear whether the sampling transect actually reached the edge of bright water patch". It is also worth pointing out that along with the diatom frustules,Broerse et al. also found coccoliths in their samples.

B. The ability of this alga to vegetate under conditions of very low levels of down-welling PAR irradiance is documented by Okada and McIntyre (1979): they have shown through their around-the-year shipborne measurements in the Labrador Sea at a latitudinal location (e.g. Station 'Bravo,' 56.5 $^\circ$ N) similar to the location of the turquoise area in the Bering Sea that E. huxleyi cells indeed vegetated over a very long time period including not only summer time but also the winter period.

C. The appearance of turquoise areas in pelagic marine waters is a very strong argument in favor of attributing them to E. huxleyi blooms as no other hydrocoles possess such optical properties, which would render the truly turquoise color of their communities when observed from above. As Shutler et al. (2010) point out, this is a unique characteristic within phytoplankton species. Optically, diatom frustules are not identical to coccoliths. So that they would not produce the same remote sensing reflectance spectrum as coccoliths do.

An additional, albeit unnecessary argument: the phenomenon of huge blooms of E. huxleyi with extraordinarily high concentrations of coccoliths lasted only a few years and since 2001 have never re-occurred while diatoms blooms and associated release of frustules arethe annual event in the Bering Sea.

D. Finally, (although this argument is certainly optional, it only makes us additionally confident of our interpretation and robustness of our E. huxleyi bloom identification algorithm) we revealed the driving mechanism of the phenomenon of E. huxleyi blooms of exceptional intensity during 1998-2001, but this is the subject of a new paper, and we can't disclose it before its publication (expected in 2019).

In light of the above, the reviewer's assertion that our algorithm is invalidated because of the "false positives" in the Bering Sea could not be accepted.

3. Regarding the contested adequacy of our retrieval algorithms.

3a. On the advantage of our coccolith concentration retrieval algorithm.

We are not going to discuss here the advantages and disadvantages of E. huxleyi bloom detection algorithms suggested by other workers: it deserves a separate paper. Iida et al. (2002) have done it in detail with respect to e.g. the Brown and Yoder (1994) algorithm and pointed to some problems with it. Incidentally, Brown and Yoder themselves acknowledged certain limitationsof a world-wide application of their algorithm. Moore et al. (2012) commented on the feasibility of the algorithms in question developed by other teams that the reviewer specified in the his/her list of references.

The advantages of our algorithm were discussed in Kondrik et al. (2017a), and we hope that the reviewer does not expect us to dwell upon them. They can be epitomized as follows: our algorithm

(i) was developed on the basisof a nearly 20 year merged and skillfully harmonized OC CCI data provided by SeaWiFS, MODIS, MERIS, and VIIRS sensors;a comparative analysis of the OC CCI,GlobColour products, as well as the products from the MEaSUREs was conducted to prove the preference of the OC CCI data.

(ii) is based on extensive statistical analysis of satellite spectrometric [Rrs(lambda)] data fromsix marine environments specifically at high northern latitudes inthe North Atlantic, Arctic and North Pacific Oceans;

(iii) employsseveral criteria in conjunction, viz.: (a) location of maxima at the wavelengths typical of E. huxleyi bloom in Rrs spectra; (b) Rrs absolute value ranges at six wavelengths obtained through a dedicated/ large-size statistical sets of spaceborne data from the six seas; (c) consistency with the results of independent application of the BOREALI hydro-optical algorithm (Korosov et al., 2009; Kondrik et al., 2017a), which through retrieving inter alia the concentration of both coccoliths and chlorophyll-apermits to obtain the spatial distribution of the E. huxleyi bloom. This triple checking assured a higher reliability of the algorithm.

3b. Delta pCO2 retrieval algorithm

Again we believe that it would be improper to give here the respective entire excerpt from the paper on pCO2published in a refereed journal (Kondrik et al., 2018a). In a nutshell:

(i) the algorithm has the accuracy of delta pCO2 retrieval that is characterized by the following statistical parameters r2 = 0.54, pâĽ0.001, and RMSE = 23.4μatm;

(ii) the ensemble of blue data points in fig. 1 (Kondrik e al., 2018a) that looks like an "enormous spread" were obtained using climatological data and added solely to increase the statistical significance of the regression dependence established through using only in situ data that we could find for our study regions (red dots, their number is 187). Most of these points are within the declared error of 23.4 uatm; the indicated red points do not have the problem of Delta_pCO2 values overestimation indicated by the reviewer. It is also necessary to emphasize that a) "confidence interval" the reviewer refer tois in fact the "prediction limit" while the "confidence limit" has a much smaller variation (about 10 uatm). Also, it is important to be aware that the variation is given in uatm(units of partial pressure), but not in ppmas the reviewer writes.

(iii) all corrections for water temperature were duly conducted using the concurrently collected radiometric and IR satellite data.

(iv) the developed delta pCO2 regression dependence has a truly physical basis. Indeed, the increment of pCO2 in surface water within the E. huxleyi bloom is intimately related to the intracellular production of CO2 through the reaction of calcification and associated generation of coccoliths. The latter are very efficient reflectors of sun light coming into water (just because they don't absorb light but only reflect it). Therefore, the greater the amount of CO2 released through calcification, the more intense the optical signal coming out from the bloom area, especially at the wavelength of Rrs maximum – the parameter in our algorithm that is related to delta pCO2. Incidentally, returning to point 2C in our argumentations above, this is an important difference between coccoliths and diatomic frustules as the latter are not solely reflectors but also

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absorbers.

4. The graphical illustration of validation of the retrievals of coccolith concentrations is available in our easily accessible papers published elsewhere, we doubt that the inclusion of those illustrations would be justified.

5. We acknowledge the reviewer's critical remarks in C3 –C4. All necessary changes are entered, the respective references [e.g. Shutler et al. (2010, 2013; Winter et al., 2014] are added to the reference list.

We certainly appreciate the list of references provided by the reviewer although, actually, we were aware of nearly all listed publications. The reason why they were not used is explained in point 1of our answers. As to the worksby Shutler et al. (2010,2013), it is indeed our flaw. We are earnestly grateful to the reviewer for this valuable critical remark.

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