

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: 5 November 2018

In this study, Kondrik et al. have compiled satellite observations of coccolithophore blooms in the high-latitude northern hemisphere and combined them with various algorithms, published by the authors, to estimate coccolith concentrations and the impact of coccolithophores on the air-sea CO₂ fluxes. The dataset is of considerable interest, with coccolithophore blooms in the high-latitude polar seas generally understudied and often poorly sampled in situ. The 18-year time-series of observations represents an exciting opportunity to examine temporal trends over a relatively long period and I am

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sure the dataset will be used extensively. The manuscript is well written and I only have minor comments/suggestions for further clarity.

pg 1, Ln 1 - How do you know its *E. huxleyi* rather than other coccolithophores? Would it not be safer to say coccolithophores? Though many factors make *E. huxleyi* the most likely source of satellite-detectable reflectance, other coccolithophores can bloom and some can be a significant presence within blooms. Also, its more typical to give the full species name (i.e. *Emiliana huxleyi*).

pg 1, Ln 7 – What do the authors mean by ‘activity’ in the context of the first line of the paragraph? Distribution and impact on the air-sea flux of CO₂ is what is presented.

pg 1, Ln 16 – ‘Ongoing climate change is a background of numerous emerging hot topics’ seems a rather cryptic opening line for the paper and it’s not obviously clear what the authors mean.

pg 1, Ln 20 – ‘most widespread in the world’s oceans’: please clarify this statement, do you mean ‘the’ most widespread coccolithophore?

pg 1, Ln 25 – Rivero-Calle et al. (2015) show increases in occurrence across the North Atlantic rather than a polewards expansion. Other authors have discussed polar expansion ranges (e.g. Smyth et al., 2004; Winter et al., 2014) and are more relevant to the current study.

pg 2, Ln 6 – Please rephrase ‘solely satellite remote sensing approach means..’.

pg 2, Ln 21 – Please explain ‘viz. North’, do you mean the North Atlantic?

pg 4, Ln 30-32 – Please note that the use of a fixed carbon mass per coccolith (m) has limitations and that coccolith content between different morphotypes of *E. huxleyi* can be considerable (e.g., Poulton et al., 2011; Müller et al., 2015) and may lead to over- or underestimation depending on which morphotype(s) is present in the bloom. This directly influences the scaling up of coccolith mass to PIC content in this study, and is an important factor when considering bloom PIC production (see e.g. Poulton et al.,

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2013; Balch et al., 2014).

Figure 2c - What are the units for panel c? Tons per unit area/pixel? Would it not make more sense to express in similar volumetric units as in panel b (i.e. m^{-3})? It is also not clear how the authors get to 30 tons of PIC; e.g. $250\text{-}400 \times 10^9$ coccoliths m^{-3} equates to ~ 50 to $80 \text{ mg C } m^{-3}$ or ~ 4 to $7 \text{ mmol C } m^{-3}$ based on a coccolith mass of 0.2 pg C .

References

Balch, W.M., Drapeau, D.T., Bowler, B.C., Lyczkowski, E.R., Lubelczyk, L.C., Painter, S.C., and Poulton, A.J.: Surface biological, chemical, and optical properties of the Patagonian Shelf coccolithophore bloom, the brightest waters of the Great Calcite Belt, *Limnol. Oceanogr.*, 59, 1715-1732, doi: 10.4319/lo.2014.59.5.1715.

Müller, M.N., Trull, T.W., and Hallegraeff, G.M.: Differing responses of three Southern Ocean *Emiliana huxleyi* ecotypes to changing seawater carbonate chemistry, *Mar. Ecol. Prog. Ser.*, 531, 81-90, doi: 10.3354/meps11309, 2015.

Poulton, A.J., Young, J.R., Bates, and Balch, W.M.: Biometry of detached *Emiliana huxleyi* coccoliths along the Patagonian Shelf, *Mar. Ecol. Prog. Ser.*, 443, 1-17, doi: 10.3354/meps09445, 2011.

Poulton, A.J., Painter, S.C., Young, J.R., Bates, N.R., Bowler, B., Drapeau, D., Lyczkowski, E., and Balch, W.M.: The 2008 *Emiliana huxleyi* bloom along the Patagonian Shelf: Ecology, biogeochemistry, and cellular calcification, *Global Biogeochem. Cycl.*, 27, 1-11, doi: 10.1002/2013GB004641, 2013.

Smyth, T.J., Tyrrell, T., and Tarrant, B.: Time series of coccolithophore activity in the Barents Sea, from twenty years of satellite imagery, *Geophys. Res. Lett.*, 31, L11302, doi: 10.1029/2004GL019735, 2004.

Winter, A., Hendericks, J., Beaufort, L., Rickaby, R.E.M., and Brown, C.W.: Poleward expansion of the coccolithophore *Emiliana huxleyi*, *J. Plankton Res.*, 36, 316-325, doi: 10.1093/plankt/fbt110, 2014.

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Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2018-101>, 2018.

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