

## ***Interactive comment on “Pigment signatures of phytoplankton communities in the Beaufort Sea” by P. Coupel et al.***

**Anonymous Referee #1**

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### General comments

The authors have put together a strong manuscript that presents novel analyses of a dataset of phytoplankton taxonomy and pigments from the Beaufort Sea. They were cautious in their use of CHEMTAX as an approach to determine the relative presence of different phytoplankton types, in that they optimized the input ratio matrix for their phytoplankton communities. A comparison of the CHEMTAX results to both cell abundance and carbon biomass is useful in the interpretation of the pigment data, and highlights the differences in phytoplankton community descriptions that arise from the use of different measurement techniques. The authors could focus more on the importance of using different methods to characterize the phytoplankton community, and it seems that even after pointing out some of the misinterpretations and challenges with

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using CHEMTAX they still promote it as the most accurate method. The manuscript will be stronger with less emphasis on CHEMTAX as a way to monitor phytoplankton populations, and more as a component in the suite of measurements that are needed to characterize phytoplankton communities accurately and for diverse applications. Overall the work is thorough and relevant, and will potentially be useful for future analyses of Arctic Ocean pigment data.

### Specific comments

14489, 20-22: Given the previous statement about the uncertainties in the CHEMTAX method regarding dinoflagellates that lack peridinin and heterotrophic prey pigments, it may be more accurate to say something like “. . . variability in several different phytoplankton populations that are not affected by these misinterpretations”.

14490, 17: Although, different measurement approaches provide different information on the phytoplankton community – so while they are hard to compare, only using one approach will limit the breadth of knowledge. 26: And, all four of the satellite methods listed were developed using in situ data that were not from the Arctic (i.e., the Arctic may require its own regional tuning).

14491, 22: An “Arctic-specific” parameterization may not be realistic. . . maybe it would be more appropriate for the parameterization to be for a region and season, and could be used as a starting point for other Arctic CHEMTAX work.

14497, 14-15: The difference in scales for TChl a values is not immediately clear in Figure 2. . . maybe make a note in the Fig. 2 caption alerting the reader to this fact.

14499, 2: “a greater contribution of Pras during the relatively icy summer of 2002” is vague – was it found near the ice, near shore, which part of the Arctic, etc.

14508, 7: The last sentence of the paper seems to make a claim that was not supported throughout the manuscript – it implies that CHEMTAX is the accurate approach while others (microscopy, flow cytometry) are not. However, earlier in the paper the

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limitations of using pigments only (C:Chl a variations, detection of ingested pigments by heterotrophs) were discussed. So, there may be a better way to end the manuscript that emphasizes the need for multiple measurement types, or at least the consideration of these uncertainties when using HPLC pigments and CHEMTAX “for detecting seasonal or interannual changes in phytoplankton communities”.

Figures 8 & 9: It may be useful to look not only at the correlation values but also at the predictive capabilities (RMSE) of cell abundance and carbon biomass from the CHEMTAX-derived algal groups.

Technical comments

Throughout the manuscript, “matrix ratio” should be “ratio matrix”; also all genus and species names should be italicized.

14489, 15: Should be “Microscopic counts” 24: First sentence of the introduction is a little awkward. Perhaps replace “experiences” with “is undergoing”. 26: Can leave out “in terms of” in this sentence.

14490, 2: Can leave out “sized” in this sentence. 4: “Ice free” should be “ice-free” 22: “Other techniques. . .” is vague; perhaps list them.

14491, 5: “to characterize” should be “characterization of” 13: Remove “Only” (or use “Only a few”) 20: “underscored” should be “underscores” 23: Should be “CHEMTAX in the Arctic Ocean”

14492, 8: Maybe rephrase to “The pigment ratios of these dominant Arctic groups were then found. . .” 10: This final sentence is vague, maybe say something more specific about the study being presented, such as “This work demonstrates the use of CHEMTAX to describe phytoplankton populations, and similar studies conducted in the future could be used to investigate changes in populations over time”.

14493, 28: Could be “phytoplankton were distributed among 10 classes. . .”

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14494, 3: Could be “unidentified cells were  $< 5\mu\text{m}$ ” 3: The sentence starting with “Microscopic analysis. . .” is not clear – it could just start with “Enumeration of picophytoplankton. . .”

14495, 10: Should be “Two inputs. . .” 14: Chlorophyllide has not yet been spelled out (add the full name and the abbreviation in parentheses) 17: Should be “allowed us to accurately” or “allowed accurate definition of. . .” 18: Should be “due to the fact that their specific pigment. . .”

14496, 1: Should be “raphidophytes and dictyochophytes” 2: “Allo” should be spelled out (this goes for other pigments throughout as well, at least the first time they are mentioned they should be spelled out) 7: Should be “containing the pigment Pras” 8: Should be “associated with” (this comes up multiple times; change throughout) 19: Should be “The ratio of pigment/Chl a” 25: Probably should not be a new paragraph

14497, 5: “ie” should be “i.e.” 13: Should be “twice as high” (and again later in the manuscript) 23: It would be clearer to add commas: “These two pigments, characteristic of diatoms, represented. . .”

14498, 9: Can remove the word “pigments” 15: “at the expense of” implies that one only increased because the other decreased (which may be true, but no real evidence of it) – it might be more accurate to say “. . .increased while diatom pigments decreased”

14499, 4-6: Should be “characteristic of. . .” 22: Replace “matix” with “matrix”

14500, 13: Replace “the cluster 3” with “cluster 3” 14: Should be “no longer present” 20: Maybe instead of “It is consistant” use “This is consistent” (note spelling change as well)

14501, 1: Replace “underlines” with “underlined”, or “described” 26: The y-axis label of Fig. 5 should be “Nitracline” to match the caption and text; if all nutrients and not just nitrite/nitrate are being considered, then “nutricline” could be used, but it should be made clear which is represent in Fig. 5.

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14502, 15: Replace “provide” with “provides” 16-18: Maybe rephrase this sentence – it currently sounds like CHEMTAX can be used to monitor environmental changes (which may be true indirectly, but it is not a first order application). 19: Maybe replace “footprint” with “indication”

14503, 15: “Fig. 3a and c” is meant to be Fig. 4a and c? 22: Fig. 8 and Fig. 9 are switched

14504, 26: For consistency, label figures 8d and 9d the same.

14505, 10: “ingested it” should be “ingested them” 14: Should be “likely to be significant...”

14506, 12: Should be “observed in the Arctic Ocean” 25: Remove “availability” 24: “at deep” should be “at a deep”, or if kept “at deep” then “maximum” should be “maxima”

14507, 1: Remove the second “of the” i.e. should be “of a deepening nutricline...” Also replace “since a decade” with “over the past decade” 4: “induced” is a bit awkward, maybe use “introduced” 25: Should be “in the Arctic Ocean”, also “averaged” should be “average”

14508, 5: This sentence makes it sound a bit like the alternative being suggested is not a blind use of CHEMTAX, implying that earlier it was suggested to do so – obviously that is not the case so it may be worthwhile to rephrase the sentence.

14517: In the first sentence of Table 3, the word “light” should follow “(surface samples)”

14520: First sentence in Table 4 caption should have “mean  $\pm$  standard deviation”. Also, “The cluster 1” should be “Cluster 1”. Also, the “.” after “radiation” should be “;”

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