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Interactive comment on “Phytoplankton community structure in the North Sea: coupling between remote sensing and automated in situ analysis at the single cell level” by M. Thyssen et al.

Anonymous Referee #3

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The manuscript by Thyssen et al., “Phytoplankton community structure in the North Sea”, describes in situ observations obtained by scanning flow cytometry and other instruments to characterize the phytoplankton community structure found in the North Sea during a measurement campaign, and its relation to signals of satellite ocean color. This is certainly an interesting and important subject that will likely show progress with the current instrumental developments. The manuscript is overall well written and interesting. However, I would recommend developing the descriptions of the methods, and really strengthening the discussion.

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Some methodological aspects are described too succinctly, particularly for non-experts. This is the case with Section 2.1 that would deserve some general explanatory sentences in several paragraphs to make it clearer. This is also the case for the optical classification used to select the match-ups. How was it derived and applied? Same comment for the PHYSAT approach. It has been well described in the literature but at least the equation defining the anomaly (Ra in the text, nLw^* in Fig9) would complete the manuscript. The additional material does not need to be long but should help in making the overall text clearer and more fluid without the necessity to consult the cited literature. It would also ease the discussion. See also more detailed comments below.

The discussion (Section 4) is interesting but should be completed. For instance for a non-expert, it might not be clear to what degree the associations between clusters and phytoplankton types (p.15638–15639) are solid or informed speculation. What about Micro1 in that respect (it is not mentioned)? Something should also be said in terms of optical properties: do the types preferably found associated with anomalies N1 and N2 have specific optical properties, and are these consistent with the anomalies? See also more detailed comments below.

Another point of discussion is about the optical classification. A working hypothesis is that the selected match-ups are characterized by relatively clear waters not affected by sediments. Still the considered area is known to often present significant amounts of sediments and/or CDOM, and the data used in Vantrepotte et al (2012) are mostly from coastal waters. Overall, could the anomalies in nLw be explained by subtle changes in sediment and/or CDOM concentrations? It would be nice to also illustrate the nLw spectra associated with the match-ups, and not only the anomalies (Fig .9). This is important to understand how specific the findings are: are they likely to change completely from one cruise to the next, or are there elements to suggest that they can be the first blocks to actually build a bridge between in-situ determinations of community structure and remote sensing?

These points would make the discussion stronger and offer the possibility of building

more general conclusions from the work. Currently, the discussion (and the work overall) does not go sufficiently beyond the description of results.

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Detailed comments:

Title: I don't think that 'coupling' is a fortunate choice here; it is often associated with other contexts. 'Combination' or 'synergy' seems more appropriate.

p.15623

I.11: "with a high spatial resolution (2.2...)"

I.21: "and remote sensing"

I.21: "two to three times better": is that clear in the text?

p.15624

I.13: "such a proxy"

I.13: "does not"

I.22: define DMSP at first use

I.24: the last properties, though relevant for the biogeochemical cycles are not directly linked to the elemental cycles.

p.15625

I.7: I'd suggest: "algorithms applied to remote sensing data".

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I.17: introduce the acronym HPLC

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I.21: "SeaWiFS"

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I.25: I'd start a new paragraph after "available".

I.29: "It is critical in understanding...": that does not sound correct.

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p.15626

I.16: "in situ data describing phytoplankton . . ."

I.18: "with a totally"

I.25: "remotely-sensed"

I.27: "significantly distinct"

Section 2.1: the use of several paragraphs would help in making the description of methods clearer.

p.15627

I.17: "1-10 cm³ of seawater"

p.15628

I.5: are the 2 trigger levels associated with the 2 photomultipliers?

I.8: "from less concentrated"

I.10-13: this should be explained better.

I.22: "two-dimensional cytograms": could the authors characterize this in more details?

I.28: PMT: Photo-Multiplier Tube?

p.15629

I.1-2: sentence not well written

I.6: "pre-determined": what does this mean?

I.12: "ship's seawater . . ."

I.18: MODIS on-board Aqua I guess

p.15630

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I.6-7: please correct this sentence. Are the data Level-2 or Level-3? (the latter if they are 4-km data).

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I.14: “defined as the depth associated with an observed temperature difference of more than 0.2C with respect to the surface...”

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I.16: “remotely sensed”

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I.21: “aerosol optical thickness” ?

I.22-23: “coastal areas, that are not considered as open waters for remote sensing”: this sounds awkward; remote sensing (of ocean color) responds to optical properties.

I.24: please develop this point (optical classification) somewhat more. Vantrepotte et al (2012) distinguished 4 classes. I guess that class memberships were used to select the conditions of analysis; which criteria were used?

I.25: “which previously rendered...”: it sounds like that this has changed in the meantime. Is it the case? In general, a sentence explaining why PHYSAT is not recommended for turbid waters would be welcome.

p.15631

I.9: “irradiance” or “radiance”? Some more details about how the anomaly is computed are due here.

I.14: “normality was not applied”: applied is not the proper word here.

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I.18: “remotely”

p.15632

I.3: three of four?

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I.5: “associated with”

I.5: “samples varying between..”

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I.14: “depths”

I.18: “3 E” ?

I.25: repeating “cluster” each time may not be necessary

p.15633

I.3: “within the Micro2 cluster”: what about the other clusters? Is it related to size?

I.5: “25 pictures collected within 47 counted cells”: what does it mean exactly? Is it random or related to size?

p.15635

I.3: “remotely”

I.7-9: this further selection is not so clear to me.

p.15636

I.8: “associated with”

I.10: “synthesis”: please explain this further.

I.12: “tongue”?

I.18: “spatial”

p.15637

I.15: I’d remove “which are”

p.15638

I.16: “inter-bloom”: please specify what that refers to.

I.19: “cells cm⁻³”

I.21: “... fell when...”: considering what’s said before, this sounds contradictory.

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p.15639

I.8: Dodge et al. (1977) or Dodge (1977)?

I.11: “spatial”

I.17-20: not clear what is meant here about the PHYSAT algorithm.

p.15640

I.1: “The combination of SFC...”

I.2: “associated with”

I.6: “Spatial succession...”: it should be made more explicit why and how this applies to the presented results in terms of species. How is it relevant to the identified clusters?

I.17: “Myrionecta”: please specify what this species refers to, zooplankton? (isn’t “rubra”?)

I.21-27: how does this paragraph relate to the rest of the discussion?

p.15644

I.11: “phytoplankton”, “growth”

Fig.2: “Presented data are”

Fig.3: are the colors consistent across the different panels? (do they always refer to the same cluster?)

Fig.3b: “Maximum” (y-axis) does not appear fully on my copy.

Fig.7: “Small black scares”: “diamonds”?

Fig.9: is there a unit for nLw^* ? Is it the same thing as Ra referred to in the text?

Fig.10: “Wilcox”?

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Fig.11: "Wilcox"?

Fig12: it is not easy to distinguish colors in the blue-green range, so it is hard to see the distribution of frequencies. They seem low, particularly for N2. . . .

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