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Biogeosciences Discussions

Interactive comment on "An algorithm for detecting Trichodesmium surface blooms in the South Western Tropical Pacific" *by* C. Dupouy et al.

Anonymous Referee #1

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General comments

This paper presents a new algorithm for detecting Trichodesmium from satellite ocean color data based on data in the southwest Pacific Ocean, where Trichodesmium blooms have been well documented. While there other algorithms that have developed to detect Trichodesmium from ocean color data, there are issues with them, which the authors discuss in the introduction. The paper also provides a thorough compilation of the all the in situ observations of Trichodesmium over the SeaWiFS time period for their study area. This paper is interesting, well written, and for the most part easy to follow. However there are a number of important aspects that are glossed over and

require more detailed description before it should be published.

While clearly a lot of work went into compiling the data in Tables 1 and 2, there is very little quantitative information here. This is especially important since they used this data to determine what dates had high Trichodesmium abundance, and from these data they developed their model. What threshold was used to define "high abundance" (P5658, L25), particularly from Table 1 which has no quantitative data in it? Furthermore it is hard to compare the text and the tables, as yeardays are used in the text and dates in the table. Be consistent. There are also discrepancies between the information in the text and table. The text says yeardays 6, 13, 18, 32, 35, 40, 44, 47, 49, 52, 59, 62, 66 were used from 2003, but the earliest dates in 2003 on either Table 1 or Table 2 from 2003 are Feb 5 (Table 2) and Feb 18 (Table 1), and presumably yeardays 6, 12 and 18 are all in January.

It is odd that they do not show any radiance spectra at all in the paper. The schematics shown in Figure 1 are hard to interpret without seeing them in the context of actual data. After reading the paper I still do not have a clear picture of what a Tricho spectra would look like and how this would be different from a non-Tricho spectra. This issue is even more surprising when they start to talk about "peculiar" RAS on page 5661. "Peculiar" is a strong word in the English language, and should not be chosen lightly, particularly in a scientific paper. Maybe their discussion in this paragraph explained what exactly was so "peculiar" about these spectra, but it is not readily obvious. A figure showing a "peculiar" RAS and a "non-peculiar" RAS would be very helpful.

The last line in the abstract states "This approach was validated with in situ observations of Trichodesmium surface accumulations for the period 1998–2010." However the only real comparison between in situ obs and the estimates from the TRICHOSAT algorithm are in Fig 8, which covers a period from Dec '02 – Sept '04. As they mention in the paper the correspondence between the two is striking. Perhaps too striking. There is only one mention in the paper of this figure, and no explanation (outside of the caption) of the data that went into it. It is comparing the percentage of pixels in

BGD

8, C1590–C1596, 2011

the SP area, ie 5°-25°N, 160°E-170°W with the in situ observations of blooms taken someplace within this 20°x30° area. How can they realistically justify comparing the Tricho percentage in this huge area against in situ observations made from within a very small subset of that area? And where exactly do the Nb numbers come from – all the observations shown in Table 1 and 2? If so why is it restricted to just this shortened time period? See other comments listed under Fig. 8.

Specific Comments

P5655, L13. Explain why iron enrichment might trigger Trichodesmium blooms

P5656, L5. Isn't PYSAT an acronym? If so define it.

P5656, L7/8. What is the SCHIAMACHY sensor? This is not a well-known sensor.

P5662, L19. The introduction of the name TRICHOSAT for the algorithm here is confusing. Since the algorithm was defined in detail four pages ago in section 2.2, reference to the TRICHOSAT algorithm here suggests it is something different. The algorithm name should be introduced earlier, and it should be mentioned in the abstract.

P5662, L27-28. What constitutes a "large number"? Perhaps "sufficient" would be a better word choice. Statistically what number of images is needed? "Analyzed" would be a better word choice than "screened".

P5669, The 3rd paragraph of the "Conclusions" section should be moved to the "Discussion" section. The Conclusion section should summary the paper, not introduce new ideas, as this paragraph does.

Table & Figures

Table 2. Presumable the asterisk in row 1 is referring to the "Carpenter, pers comm." at the bottom of the table, but there should be an asterisk by that citation to make it clear. What is meant by the "Niskin" and "Bucket" entries at the bottom, and why are there no dates associated with them? In the captions (Table 1 & 2) change "transects effected"

BGD

8, C1590–C1596, 2011

to “transects made”

Fig 1. I’m afraid neither of these panels make much sense. It would really help if they had a representative spectra on these plots with which to determine what they mean by bumps and troughs and slopes and fits, etc. Since this is the crux of the paper it needs to better demonstrated.

Fig 2. It is hard to read the latitude and longitude numbers in panel (a) and it is impossible to make out the values on the color bar. It seems that these two maps are not of the same area, which is confusing. If it is not possible to make their coordinates the same at least indicate on the larger map the area covered by the other smaller map. What are the numbers next to the dots on the bottom panel – the year of the observation? These are impossible to read. Its very hard to see the blue dots, and I can’t make out any magenta dots. Is it possible to show the cruise tracks in such as way that negative observations would be evident? Ie where were no blooms observed? Given that they use two spatial domains throughout the paper, the WP (25S-25N, 160E-160W) and the SP (5S-25S, 150E-170W), it would be helpful to orient the reader if they had a figure that showed a satellite image covering both of these areas, with each clearly delineated. They could then avoid defining these areas in multiple figure captions (Fig 3, 5, 6 and 7) which makes for cumbersome reading. It also seems odd that this comes as Figure 2, and not as Figure 1. It could easily be cited in the introduction to orient the reader to the study area.

Fig 3. The axes labels are difficult to read on most the panels. Since the boxes all cover the same domain the axes labels could be removed on the inner panels, and the figures made a little larger. Why are the islands only visible in panels (d)? However, I’m not sure that the figure adds much to the paper.

Figure 5. It is hard to distinguish the red and brown in the top panel, consider making one blue. What is the difference between the top and bottom plots? Are they just more variables? This is confusing. Assuming they are just more variables over the same

BGD

8, C1590–C1596, 2011

space and time domain it would be better to make a multipanel plot with a separate panel for each variable. This would simplify the figure, particularly since two of the parameters on the bottom plot are also on the top plot. Why do the vertical lines change from being in March in 97-99, and in Feb for 01-10? Make the font larger on the plot.

Fig 6. Caption says that the land is black, when actually it is gray. Make the font larger on the axes labels, they are impossible to read. I know the intent is to keep the pixel size small to not overestimate the size area but it is really hard to make out the points in these plots. A figure showing the climatological seasonal cycle (with std dev) using number of pixels (or total surface area) of Tricho would better make the point about Tricho seasonality.

Fig 8. The similar symbols are confusing, try making the symbols for the satellite obs a small solid dot, so that the in situ observations stand out better. Also why not extend the satellite observations to before Dec 02 to see if it captures the high value seen by the in situ data? The endpoints on the line between the satellite data points are misleading as they interpolate in a direction that the data may or may not go, they should not extend beyond the time of the satellite data. What does Nb stand for? Number of blooms? Even though the caption refers to them as number of slicks? (Is a bloom different than slick?) Over what time and spatial scales does this number come from? Where were the measurements made? They are being compared to satellite data averaged over 600 square degrees. See also points made in the General Comments section.

Technical Corrections

P5656, L1-3. This sentence is a little awkward, mixing regions and sensors.

P5656, L18. Remove “whole”

P5656, L24. Should be “8L”. As written it looks like it might be eighty-one.

P5658, L4. LUT has already been defined.

BGD

8, C1590–C1596, 2011

P5658, L11. Replace “it” with “The LUT”

P5658, L16. Replace “than” with “to’

P5658, L17. Insert commas around “hereafter denoted RAS”

P5658, L19. Replace “compared to” with “and”

P5659, L17. Remove “in situ”, redundant with visual

P5659. Move the first sentence “The criteria. . .” to the start of the next paragraph. As written the reader is left wondering how the criteria permitted rebuilding the spectrum, when in fact it is explained in the next paragraph. Also reword here, and in L14, as the “they can be used to rebuild the RAS spectrum” (ie remove phrasing using “permit”)

P5663, L9. Remove “grand”

P5663, L9. northern, not Northern

P5663, L25-28. This sentence does not make sense, the reproduction is not striking because of the in situ survey. The comparison between in situ and satellite obs can be made because of the in situ survey, and their similarities are striking. But see also comments in the section above.

P5666, L14. Remove “It is well known that”

P5666, L28. Is “CZCS” a typo?

P5667, L5. No need to define acronyms for MAA and DOC as they are not used again.

P5667, L8. Remove “effectively”, change “along Motevas” to “during the Motevas cruise”

P5667, L26/27. Change “We find” to “The” and “to correspond’ to “corresponds”

P5668, L8. “ocean color” not “sea color”

BGD

8, C1590–C1596, 2011

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