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Interactive comment on "Evolution of dissolved and particulate chromophoric materials during the VAHINE mesocosm experiment in the New Caledonian coral lagoon (South West Pacific)" *by* M. Tedetti et al.

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Anonymous Referee #1

GENERAL COMMENTS

This is an appealing piece of work presenting a very complete study about chromophoric dissolved organic matter, biogeochemical and biological parameters in a mesocosm experiment in a tropical oligotrophic LNLC ecosystem, which have been poorly studied. The novelty of this work remains in the dynamic of the dissolved and

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particulate organic matter with that of N2 fixation, where N2 fixers and picophytoplankton play an essential role. The experimental approach used by the authors is appropriate to support the scientific findings of the manuscript, it is very well written and structured, and obtain sound conclusions. In summary, the work is of interest for the audience of Biogeosciences and meets the high standards required for publication in this leading journal.

SPECIFIC COMMENTS

Page 12. Lines 1-13. The conversion factor from quinine sulphate to raman units is very valuable due to the lack of uniformity regarding fluorescence normalization and conversion units, which hinder the comparison with other studies.

Answer: Yes indeed, we think it is important to provide this conversion factor, which allows comparisons with other studies.

Page 22. Line 3. Why did not you start measuring the slope at 350 nm instead of 370 nm? Have you calculated the slopes over the range 350-500 nm? This would allow the comparison with other studies that use this range as you mention in Line 4-5 of page 22.

Answer: We could not determine the slope over the spectral range 350-500 nm because the measuring range of the PSICAM instrument was 370-726 nm, as mentioned in the manuscript:

- “Chromophoric parameters we examined here were absorption coefficients of CDOM [ag(λ)] and particulate matter [ap(λ) = aÏŢ(λ) + anap(λ)], determined over the spectral domain 370-720 nm.” (page 7, lines 150-152 in the revised ms). - “The cavity of the PSICAM was filled with purified water (Milli-Q water), air bubbles were removed from the cavity wall and the central light sphere by gentle shaking, and a reference intensity spectrum was recorded between 370 and 726 nm.” (page 9, lines 216-219 in the revised ms). - “The mean precision of the PSICAM within the range 370-700 nm is $\pm$

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0.0008 m-1" (page 10, lines 228-230 in the revised ms).

The PSICAM instrument is not influenced by adverse scattering effects and has a reasonable absolute sensitivity (Röttgers and Doerffer, 2007; Röttgers et al., 2007). Also, it allows for a rapid retrieval of particulate absorption (phytoplankton + NAP) from measurements on unfiltered (CDOM + particles) and filtered (CDOM) samples. On the other hand, the main current limit of the PSICAM is that it does not supply absorption measurements below 370 nm due to the low light intensities delivered at these short wavelengths inside the instrument (Röttgers and Doerffer, 2007).

Page 23. Lines 10-14. I disagree with the photo-resistancy of UVC humic-like fluorophore (peak A). In fact, the increase with depth of the humic-like FDOM components in the upper 200 m has been followed as a regular pattern previously reported for open ocean waters. See for example the studies of Kowalczuk et al., 2013; Lønborg et al., 2015; Timko et al., 2015 in the Atlantic, Yamashita et al., 2007 in the Southern ocean, Omori et al., 2010; Yamashita et al., 2015 in the Pacific ocean or the global cruise of Jørgensen et al. (2011).

Answer: The Reviewer #1 is right saying that UVC humic-like fluorophore (FDOM component "C1") is not necessarily resistant to photodegradation. This point was also mentioned by the Reviewer #2. This fluorophore presents a fluorescence maximum at λEx/λEm of 230/476 nm. Thus, it theoretically no longer absorbs directly in the spectrum of natural solar radiation. However, it may undergo secondary photochemical reactions induced by radical species produced from various organic or mineral photosensitizers.

- In the revised ms, we thus replaced the part ". . .this humic-like component is recognized as a photodegradation product of marine organic matter that is no more photodegradable due to its absorption solely in the UVC wavelengths (Yamashita et al., 2008; Ishii and Boyer, 2012). Besides its resistance to photodegradation, the UVC humic-like fluorophore appears to be resistant to biodegradation (Balcarczyk et al.,

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2009; Fellman et al., 2010)." by the part "this humic-like component is recognized as a photodegradation product of marine organic matter (Yamashita et al., 2008; Ishii and Boyer, 2012) and appears to be resistant to biodegradation (Balcarczyk et al., 2009; Fellman et al., 2010; Lønborg et al., 2015)." (page 23, lines 556-559 in the revised ms).

- We also removed the part: "...which would represent a kind of "ultimate" refractory humic compound in marine waters (no more photodegradable, no more biodegradable),..." (page 29, line 703 in the revised ms).

Nevertheless, we do not fully agree with The Reviewer #1 when he mentions that the humic-like FDOM components increase with depth in the upper 200 m of open ocean waters. This is true, but not for all humic-like FDOM components. Actually, this increase with depth mainly concerns the UVA + UVC humic-like fluorophores (i.e. peaks A + C and peaks A + M in the Coble 1996's classification, corresponding to components 2 and 3 in the Ishii and Boyer 2012's classification) but not necessarily the humic-like fluorophore we found in the present work: the UVA humic-like alone (i.e. peak A in the Coble 1996's classification, corresponding to component 1 in the Ishii and Boyer 2012's classification). Indeed, this increase with depth in the upper ocean was observed for peaks A + C and peaks A + M by Jørgensen et al. (2011), Kowalczuk et al. (2013) and Timko et al. (2015), for peak M by Yamashita et al. (2007), Omori et al. (2010) and Lønborg et al. (2015), and for peak C by Yamashita et al. (2015). On the contrary, Yamashita et al. (2008) found that the peak A alone (our fluorophore) exhibited the highest intensities in surface waters and decreased with depth.

TECHNICAL CORRECTIONS

Page 24. Line 20. Remove ">" before 0.040 Answer: Done (page 24, line 589 in the revised ms).

Page 28. Line 24-25. Remove "Tryptophan- and tyrosine-like fluorophores are part of the DON pool" because it is repeated in Page 29, Line 14-15. Answer: Done (page 29, line 698 in the revised ms).

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