

Interactive comment on “Effects of ultraviolet radiation on photosynthetic performance and N₂ fixation in *Trichodesmium erythraeum* IMS 101” by Xiaoni Cai et al.

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General comments

This study explores the effects of ultraviolet radiation on a variety of physiological parameters in a marine, filamentous, nitrogen-fixing species of *Trichodesmium* that is important biogeochemically. Parameters measured include photochemistry, photosynthesis (as measured by carbon fixation), nitrogen fixation as well as chlorophyll concentrations and relative changes in ultraviolet absorbing compounds.

The studies were carried under both natural and artificial conditions using PAR (as a control) with PAR+UVA and PAR+UVA*UVB as treatments. Some experiments were

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undertaken using short exposures and others using longer exposures that show that growth, photochemistry, photosynthesis and N₂ fixation were negatively affected.

The importance of this work is that it shows that ultraviolet radiation affects a bloom-forming species and that prior ship-board measurements may have overestimated the nitrogen-fixing ability of this species by not taking into account UVR in their experimental design. Given that one of the effects of Climate Change and increase sea surface temperatures is a shallowing of the thermocline and thus cyanobacteria will have shorter recovery times from damage accumulated while at the surface. Please see Helbling et al 2015 Scientific Reports). That study is relevant to the this one as the potential consequence is that Cyanobacteria may not be as successful in bloom production.

Overall, this work is well done and has a clear message. My only concern is the terminology used to describe the treatments: there is P, PA and PAB, P', PA' and PAB' and there is UVA, UVB and UVR. It is all rather confusing and I think maybe a small table in which you put the different acronyms with their respective meanings would be very useful. That or else in the methods section, clearly outline all of the different acronyms.

specific comments

I would move or remove the first paragraph about ozone depletion as it does not flow onto the rest of the introduction. The importance of CB is enough to justify the study.

Line 160-163: This movement of P, PA or PAB to “another treatment” – but which? You do not specify and this is very confusing. Then in Figure 2 on Carbon and N₂ fixation you also have UVA, UVB and UVR and I have no idea what they represent in terms of your treatments. Lines 307 to 324 that detail the results using P, PA, PAB, P', PA', PAB' and UVA, UVB and UVR are all confusing.

Figure 1: why are there no damage and repair rates for P treatment? Values for all three treatments are given in the text (lines 259 to 262) but not in Figure 1C.

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Figure 2: For both carbon fixation and N₂ fixation you calculated inhibition induced by UVA, UVB and UVR and termed this IP, IPA and IPAB. Why not use this terminology in the Figures 2B, 2D? – instead you use two different namings –UVA, UVB and UVR– this is confusing.

Line 274: In your UVB treatment, it includes UVA, right so the treatment is actually UVA+UVB?

Line 282: “other phytoplankton” is referred to here and in Figura 3A. Given that you are comparing with other cultures, you need to specify in the methods how they were grown and give their full names as they are abbreviated in the Figure itself. Some readers may not be aware of these species.

Line 294: “addition of UVR significantly reduced the trichome length by 22% and 11%” How can one treatment (UVR) cause two different reductions (22 and 11%)?

Lines 366-368: I think you should cite Neale et al 1998 J Phycol here.

One aspect that should be discussed more is that fact that UV absorbing compounds (most likely MAAs) are expensive to make (see Litchman et al 2002) in terms of Nitrogen in particular so this is an interesting aspect that should be discussed given your results. At the end of the paragraph (lines 465-467) would be a good place.

Technical corrections

Line 31: I suggest changing “especially” to “specifically” Line 34: change “lived” to “live” and “mixing” to “mixed” Line 35: change “UV radiation” to “UV-B radiation” and delete “especially UV-“ Line 36: delete “B” and change “its” to “their” Line 98: change “was” to “and” Line 138, 139 Should “W” be “Wm⁻²”? Line 148: “Cell” should be “Cells” Line 150: delete “respective” Line 169: “interval” should read “inervals” Line 187, 200: “GF/filters” should read “GF/F filters”? Line 228, 229, 230: “inducted” should read “induced” Line 237: “radiation conditions” should read “radiation condition” Line 255: add “the” between “than PAR” Line 264: “treatment” should read “treatments”

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Line 410: “consisted with” should read “was consistent with” Line 429: delete “Study showed” Line 430: Change “natural solar UVR would” to “natural solar UVR can” Line 431: *Anabaena* in italics Line 432: Sothern should read Southern

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