

Anonymous Referee #2

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This is an interesting and well-written paper by Schuback & Tortell that examines diurnal variability in photo-physiological characteristics of phytoplankton across two distinct environments. The study follows on from previous work under iron-limited conditions (Schuback et al. 2016) which is both interesting and well-cited in itself (21 citations at the time of review). In doing so, the authors provide additional insight into the effects of Fe-limitation upon primary productivity (PP), making this a nice comparison, and importantly, advance our capacity to apply Fast Repetition Rate fluorometry (FRRf) to measure PP through improved knowledge of  $\Phi_e, C$ . Critically, the study addresses the recently-established link between NSV and  $\Phi_e, C$  in further detail - as this is probably the most significant development in FRRf research for some time, further empirical evaluation of this relationship is exactly the direction this field should be heading in right now. Certainly, the study is both useful and timely (SCOR working group 156 highlights the current significance of this work) and thus merits publication. The methodology and data analysis appear robust, and the figures/tables are of a standard suitable for publication in this journal. Asides from one concern over the discussion of C-lifetimes (which can be easily addressed), I have no major issues with this manuscript and note that Reviewer 1 has done a thorough job pointing out many of the minor issues which I will avoid duplicating here. I have however listed remaining minor issues that could be addressed to improve the manuscript further.

[We thank referee #2 for their kind comments, and address all issues raised directly in the comments below. Page and line reference are given specific to the final, revised manuscript.](#)

Carbon lifetime issue: Pg 6 Ln 5-7 (see also Pgs 8, 11) The authors make an important point about C-lifetimes, however I think they may have this slightly mixed-up (?). As I understand it, fast growing cells allocate more C to temporary storage which actually has a long-half time – therefore in a population of fast-growing cells, short  $^{14}C$  incubations measure something closer to gross PP, and for slow-growing cells, short incubations measure something closer to net PP. In this study (nutrient-limited), I think a 2 hr incubation would likely measure closer to net rather than gross (as stated). If so, this just needs correcting in text as it does not affect their interpretation of the data (as the authors correctly point out). I note that discussion of these trends occurs at three points in the manuscript and therefore minor text amendments may be needed in each of these sections

[We thank the referee for pointing out this mix-up and have corrected the text accordingly \(P6 LN8-16; P8 LN35; P11 LN25-27\).](#)

Minor issues:

Pg 2 Ln 12-23 These reactions, operating on vastly different time scales, are ultimately powered by solar energy and are critically dependent on nutrient availability. (or critically depend)?

[Corrected \(P2 LN12\).](#)

Pg 3 Ln 7-9 Some hyphens could be used here: “high-productivity, recently-published” General Comment: Perhaps nit-picking here but I prefer to see the prime notation ( $\hat{A}$ ) used to denote light-acclimated parameters rather than what appears to be an apostrophe (') as used in this manuscript.

[We agree and changed the annotation throughout the manuscript.](#)

Pg 5 Ln 18. The authors make a great point about achieving a fully dark-regulated state required for ChlF parameters. Is this something that needs to be considered more in derivation of NSV? I really

like the discussion surrounding possible explanations for the differences in slopes between NSV and  $\Phi_e$ , C, and I wonder if an extra sentence or two could be included here to discuss whether the dark-regulated state is also a possible explanatory factor (Low initial Fv/Fm presumably = higher NSV?).

We agree with the referee that under the iron-limited conditions at OSP14 it is less likely that a fully dark-regulated state (i.e. complete relaxation of all NPQ processes) was achieved for the noon samples. However, we do not think that this would affect the  $NPQ_{NSV}$  values derived for in situ light availabilities, or the light-dependent increase in NPQ, which do not necessarily depend on the achievement of a dark-regulated state. Note that in Figure 8, only values derived for daylight hours are shown and used to derive the correlation.

Pg 9 Ln 30 Typo: “pymnesiohytes” should be “pymnesiophytes”.

Corrected.

Ln 22 “photoprotective” should be “photo-protective” (for consistency with surrounding text).

Corrected.

Ln 28 “photophysiology” should be “photo-physiology”.

Corrected.