Review of Differential photosynthetic response of marine planktonic and benthic diatoms to ultraviolet radiation under various temperature regimes
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Wu et al. present a study of the photophysiological responses of two diatoms as affected by the temperature during exposure. The responses are observed during short-term exposures to high light (with and without UV) and subsequent recovery periods in low light. By tracking the kinetics of PSII quantum yield during the treatment, inferences can be made about the relative contribution of damage and repair processes to the variations in response between temperature. Additional information can be obtained by exposing the diatoms in the presence of the repair inhibitor lincomycin. This type of approach has been in previous studies of how variation in environmental factors influence inhibition and recovery kinetics, however most studies have focused on a single time scale of treatment, usually on the order of hours to a few days. This study is distinctive in comparing the response to a short-term increase in temperature to responses for cultures acclimated over some growth period to the same temperature. One detail that should be added, however, is how long the acclimated cultures were maintained at their growth temperature before the experiment.

In general, the authors do a good job of presenting the experimental approach and results. I list below some specific comments that should be addressed. I think the discussion could do a better job of putting the results on damage and repair rates in the context of other studies. How do these diatoms compare with other taxa that have been studied and what does that say about their (relative) resistance to PAR and UV inhibition? One study that is not referenced is that of Sobrino et al. (2007) which examined the responses of the centric diatom, Thalassiosira pseudonana following a similar approach as used in the present study, i.e. comparing the effects of both short-term and long-term shifts in temperature. Sobrino et al. found that moderate short-term increases in temperature increased damage and repair rates but both rates decreased with long-term acclimation to the same temperature. It would be interesting for the authors to compare their results with this previous study. One conceptual difference with the present study is that Sobrino et al., on the basis of exposure-response curves, base their kinetic determinations on an equation that assumes that repair operates at a fixed rate due to an apparent saturation of repair rate at high rates of damage. This equation is:

$$P = \left(\frac{r}{k} + \frac{r-k}{r} \right) * e^{-kt}$$

Here "P" represents relative rate as a function of time (cf. P_t/P_0). This differs from the Kok equation (the author's equation Line 168) which assumes that the contribution of repair to the active pool is proportional to damage. Which equation is used does have implications for the inferred repair rate which will have different implied units depending on which equation is used, the rate is specific to the pool size of damaged "sites" for the Kok equation but is an absolute rate, fraction of pool repaired with time, for the Sobrino et al. equation. So the rates can't be directly compared, but the patterns of variation with temperature can.

If further studies are performed on these species, it would be informative to examine different exposures and see if the exposure-response curve is better fit using the model with repair increasing over the full range of exposure (Kok model), or whether repair "saturates" to a fixed rate as for *T. pseudonana*. The latter situation has been generalized into the E_{max} model (Neale et al. 2014), which seems to be broadly applicable to marine phytoplankton.

Specific Comments:

Culture: As mentioned, specify how long cultures were maintained at each temperature before the experiment. Semi-continuous growth – how often were cultures diluted? Growth rates-Methods to determine growth rate (tracking of F0-fluorescence, lines 115-118) more appropriately included with culture conditions section. Specify what was the time interval between T1 and T2. Were multiple determinations made of growth rate for each replicate culture?

Spectra: Line 114-115 discussion of filter transmission is out of place, add to Experimental set up where the cut-off filters are described.

Experimental set up: No information was available on the internet for the radiometer used, please a specific source or details filter type, bandwidth, calibration, etc. Note that a 280 nm cutoff in conjunction with a Xenon lamp means that the samples are being exposed to some irradiance at wavelengths < 290 nm which do not occur under natural solar exposures.

Temperature change: A 10 deg shift could occur in the intertidal benthic environment, but this is not a change that *Skeletonema* is likely to encounter

Chlorophyll fluorescence: It is stated that yield measurements were made on subsamples withdrawn from the treatment tubes. What was the light condition during measurement – I'm guessing it was low or dark. Also, was there a dark adaption period before measurement? If the measurement is not on the sample in treatment irradiance, what is measured is not an effective yield under actinic light, different from what is stated on lines 154-156. Instead the steady-state fluorescence is (or is close to) F_0', minimal fluorescence in the presence of non-photochemical quenching (NPQ) which persists after highlight exposure (depending on the extent of dark adaptation), and the yield is the maximal (or intrinsic) yield. Maximal yield (not dark adapted) will reflect the induction and dissipation of NPQ as well as changes in functional PSII.

Data Analysis: How was "k" estimated from lincomycin treated results – fit to an exponential curve? For both the "k" and "r" fits, statistics should be reported on the standard error of the parameter estimates (available from most non-linear regression routines) and R2 of the fit. In some of the cases of UV exposure, it does not appear as though the Kok equation would give a very good fit as the yield never stabilizes to a steady-state (e.g. results from 15 deg exposures).

In these cases, the uncertainty in parameter estimates will far outweigh the variability associated with replication.

Line 186: While …
Not a sentence, no verb

Lines 222-225 Not clear what is meant by a “similar pattern”. The decrease in yield in the presence of lincomycin is obviously much greater due to the presence of the inhibitor

Line 229-230 – In the range..
Not a complete sentence

References:

Sobrino, C., and P. J. Neale. 2007. Short-term and long-term effects of temperature on phytoplankton photosynthesis under UVR exposures. J. Phycol. **43:** 426-436.

Neale, P. J., A. L. Pritchard, and R. Ihnacik. 2014. UV effects on the primary productivity of picophytoplankton: biological weighting functions and exposure response curves of *Synechococcus*. Biogeosciences **11:** 2883-2895.

Respectfully submitted,

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