Interactive comment on "Ocean acidification mediates photosynthetic response to UV radiation and temperature increase in the diatom *Phaeodactylum tricornutum*" *by* Y. Li et al.

Y. Li et al.

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Reviewer: Abstract: "The ratio of repair to UV-induced damage showed inverse relationship with increased NPQ, showing higher values under the ocean acidification condition against UV-B, reflecting that the increased pCO2 and lowered pH counteracted UV-B induced harm." This sentence is confusing and from the abstract, I am not sure the meaning. I found this sentence confusing, and I did not understand it in the abstract alone. Perhaps: "The ratio of repair to UV-induced damage decreased as the induction of NPQ increased, so the cells induced NPQ as repair fell behind damage. The ratio of repair to UV-induced damage was higher under the ocean acidification

condition in cells exposed to UV-B, showing that the increased pCO2 and lowered pH counteracted UV-B induced harm."

Response: We agree with the reviewer in that, "The ratio of repair to UV-induced damage decreased as the induction of NPQ increased, reflecting induction of NPQ when repair dropped behind the damage. The ratio of repair to UV-induced damage was higher under the ocean acidification condition in cells exposed to UV-B, showing that the increased pCO2 and lowered pH counteracted UV-B induced harm." We have revised the abstract and discussion accordingly.

Reviewer: Phaeodactylum has multiple cell morphologies. Did the authors track the morphological state of the cultures they studied? +/- frustules?

Response: Yes, we examined its morphology under the microscope, and it was seen that the cells' morphology was unaffected under the OA condition. As a matter of fact, this species has no or mostly undetectable frustule (Lewin, G. C. et al.: Observations on Phaeodactylum tricornutum, J. Gen. Microbiol., 18, 418-426, 1958), so we did not check on this.

Reviewer: Intro - fine. Materials & Methods: Growth light of 70 umol photons m-2 s-1; was this measured with a 4pi integrating sphere sensor or a flat sensor?

Response: It was measured using a flat sensor (cosine response), with the light coming from above. We added the information of the cosine response in Section 2.3.1, line 165.

Reviewer: PAR: UVA: UVB ratio: How was this chosen? Is it based upon values from a particular location?

Response: Yes, the levels of UV-A or UV-B were based on local noontime irradiances (April, 2009; Xiamen, China).

Reviewer: Results: "In order to determine the potential "protecting" role of excess energy dissipation via non-photochemical quenching (NPQ), the variations of the ratio

of repair (r) to damage (k)-r/k," I think better to write: "In order to determine the potential "protecting" role of excess energy dissipation via non-photochemical quenching (NPQ), the variations of the ratio of repair (r) to damage (k), (r/k),

Response: Corrected as suggested.

Reviewer: P. 7206 & 7207; Very similar equations are used to describe loss of photochemistry under excess irradiance and recovery after the stress, but in one case the equation a, b, c are described as 'adjustment parameters' and in the second case they are described as rate constants. In the second case, I do not think that a, b, c are all rate constants; I think c is a rate constant, a is an intercept and b is scaling factor? Also, I think the authors should spell out how a, b, c relate to r & k, which are the rate constants from the underlying model. I think that during the recovery period, 'k' falls to near zero?

Response: Both a, b, c are "adjustment parameters" in the two equations. To estimate reduction of photochemistry under the elevated irradiance, the model $y=a+b*exp(-c*t)$ was used, and the equation $y=r/(r+k)+k/(r+k)*exp(-(r+k)*t)$ was used to calculate the r and k according to Heraud and Beardall (2000), therefore, by combining the two equations, we obtained the following: $a= r/(r+k)$, $b=k/(r+k)$, $c=r+k$, to calculate the r and k. During the recovery period under the low light, since 'k' should have been close to zero, the $\Phi PSII$ recovered almost to the value prior to the exposure under solar simulator.

Reviewer: P.7211 'stimulative' effects of UVA, not 'simulative' (typo)

Response: Corrected to "stimulative".

Reviewer: Figure 1: How many times were the treatments replicated? Also, on my screen there is a problem with the triangle symbols - the bottom of the triangle is a white stripe.

Response: During the experiments, three replicates (representing triplicate cultures)

were carried out for each treatment. About the triangle symbols, in the fig.1, fig.2, fig.5, half solid triangles was used.