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Biogeosciences Discussions

Interactive comment on "Diel quenching of Southern Ocean phytoplankton fluorescence is related to iron limitation" *by* Christina Schallenberg et al.

Anonymous Referee #2

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Overall this a good contribution to the literature on using chlorophyll fluorescence as a high through-put, low effort diagnostic tool and I recommend it should be published after some minor corrections. The quantification of NPQ from 'standard' fluorometers is an interesting approach and there would be fascinating work to be done applying this to the treasure trove of underway and moored fluorometer datasets both published and unpublished. I have some broader recommendations for the authors to consider, presented first, and more specific ones detailed below section-by-section.

I have some reservations about describing a 'decrease in NPQ capacity' with Fe addition (e.g. Line 336) – it gives the impression that cells are reduced capability to

upregulate NPQ when that is not the situation, it is that they have increased capacity for directing light to photochemistry – so perhaps a rethink of some of the language would be good. It is better discussed when described as 'increased. . . need to dissipate excess excitation energy as NPQ' (e.g. Line 344).

I agree with the point raised by Reviewer 1 regarding changes to community structure and the impact on the photophysiological parameters, especially after 55 hours of incubation. Supplementary Figure S7 suggests that Silica is limiting in the systems sampled so perhaps there may not have been a strong diatom response, and Nitrate+Nitrite is quite high so perhaps the flagellates may have remained dominant. Regardless, it needs some consideration in the results/discussion. If two populations dominated by diatoms were analysed, one iron limited and one not, would the relationship with NPQ still be as significant and reliable as a diagnostic tool? Also, what do you think was driving the increase in FvFm between the T0 and Tf in the control treatment in the experiment?

Section 1: Line 70: Reference for 90 % quenching of ChlF signal at midday?

Section 2.1 Line 137-139: Perhaps mention that FRRf measurements were done on samples from the underway also?

Section 2.2: Can you provide some justification for the iron treatments? Line 148: 'abeam' typographical error?

Line 158-159: why 51.5-55 hours? Why not subsample for FRRf measurements throughout the experiment – might have been able to see change in NPQ response before community response (if there was one)?

Section 2.3: Lines 168-174: Explanation of the light curves is confusing. Could you provide a graphical demonstration such as Figure 1 in Xu et al. 2018 doi: 10.3389/fmars.2018.00281. Also why where the duration of the light steps different? Line 168-169: 'ensure complete relaxation of all NPQ' – need to be clear here that it

is relaxation of fast-reacting/dynamic NPQ. Not all NPQ will have relaxed after 1 hour. Also, can you estimate the 'low' light intensity?

Lines 173-176: 'Optimisation for NPQ' is unclear. What are you trying to achieve here? 'Details below' is stated but I don't feel that the explanation has been provided.

Line 199: 'respective maximum light levels of the fluorescence light curves' and 'The light levels at which the NPQ parameters were measured are indicated in parentheses'. So there were different maximum light levels for different curves? Why is that and how does that impact on your comparisons of 'NPQ capacity'? Also to be clear perhaps include in the text here in parentheses the two light levels (1000 uE and 750 uE) and which experiments they correspond to.

Section 3.2.4 Line 466: 'macronutrient data from one CTD in that water mass indicate that the warm SST regime was not HNLC' – does this mean there were multiple CTDs collected in the warm water mass. It would be useful to have one more figure in the supplementary which shows position of the CTDs sampled in the 'warm' and 'cold' water masses.

Figures Figure 1: Black asterisks denoting CTD positions are hard to see. Perhaps change to another colour?

Figure 2: I think it is important to remind readers in the caption when adding in that NPQ capacity was measured at 1000 umol photons mˆ2 sˆ-1 (as stated) after 24 mins of increasing the actinic light intensity. Also, probably a good idea to include uE in the parentheses next to the light intensities to avoid confusion – active fluorometry measurements are often reported with excitation wavelength reported in parentheses next to the parameter.

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