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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 #1**

Received and published: 27 September 2019

Review of 'Diel quenching of Southern Ocean phytoplankton fluorescence is related to iron limitation' by Schallenberg et al.

This is a nice contribution that I recommend be published. I do have some comments that should be addressed and these are detailed below. Overall the manuscript is well written and the figures are clear and complete.

My main comment is related to likely potential changes in community structure in the experiments. Samples are incubated for 50-55 hours; in this time there could be significant changes in phytoplankton growth and community structure, in addition to photophysiology. For instance, a switch from being haptophyte dominated to being diatom



dominated. Therefore, without knowing the community structure/biomass data from the treatments, another explanation for the NPQ changes is that community changes are altering measured NPQ capacity between treatments, rather/in addition to the photophysiological impact of Fe availability. I think the potential for this should probably be acknowledged.

Also community structure changes are described in Fig S3 between the warm and cold waters of the transect, including the relative abundances of haptophytes and diatoms. Certainly the higher temperatures and drawdown of nitrate to 'near-zero' (line 467) would be expected to lead to community structure changes. A CHEMTAX analysis might reveal this better than the diagnostic pigment method currently shown in Fig. 5?

Section 3.2.2: Mixed layer depths between the warm and cooler regions are discussed in relation to their potential impact on photoacclimation. While differences in MLDs are discussed, really it is the light availability that is of interest for NPQ; this is a function of incident irradiance and light diffusion through the water column. Can mixed layer irradiance (mean, median), rather than mixed layer depth only, be compared between the two regions?

Paragraph starting line 455: Rates of water column integrated PP will depend not only on methodological differences (mentioned), but on the amount of phytoplankton biomass present, the temperature, and the light availability. Therefore differences in these factors, in addition to changes in Fe availability, will also affect water column integrated PP.

Line 70: Reference for the 90% value?

Section 2.2: So to be completely clear: there was only one replicate 250mL sample per treatment?

Line 174: I do not quite understand how FLCs were 'optimized to yield estimates of NPQ capacity'?

Section 2.4.3: I guess this is the non-acidification method (Holm-Hansen)?

Line 508: Can you reference figure 8 here?

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