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Interactive comment on “Enhancement of photosynthetic carbon assimilation efficiency of phytoplankton assemblage in the future coastal ocean” *by* J.-H. Kim et al.

Anonymous Referee #2

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General comments

Using mesocosms, this manuscript assesses the effects of two possible future environmental conditions (ocean acidification and ocean acidification plus warming) on photophysiology and primary production of coastal phytoplankton. The main result obtained, that is the efficient use of light under acidification and greenhouse conditions, is well presented and summarized in the first paragraph of the discussion. Nevertheless, the manuscript fails when interpreting this result. The authors continuously comment the results obtained by other authors to explain or support what they found. The manuscript also fails when the authors attempt to connect this higher efficiency in light

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utilisation with the lack of differences in primary production and (seemingly) significant differences in chlorophyll concentration. This apparent inconsistency is quickly solved invoking grazing and arguing that more research is needed. Species succession, with winners and losers, as G. Hallegraeff and the reviewer 1 indicate, is only mentioned as a possibility at the end of the last (summary) section. In my opinion, 21 days is a long time period, long enough, to allow species succession not only in the phytoplankton community but also within the whole microbial community. Surely, the succession was different for each experimental condition and the study of these 3 successions would help to interpret the dataset, since changes in the photosynthetic responses can also be due to changes in species composition. In addition, the differences observed in photophysiological (Table 1 and Figure 2 right) and photosynthetic (Table 2 and Figure 3) parameters mainly occurred during the last phase of post-bloom, when divergences among the 3 treatments were more evident (Fig. 1). According to these comments, not only should the discussion be reorganized, the motivation of the research (in the introduction) should also be reformulated. Without complementary information on species composition and succession, the manuscript looks like a short note reporting the interesting results presented in tables and figures.

The results on rETR (Fig. 2) are at least surprising. Differences in rETR among treatments only depend on differences in quantum yield of PSII, because irradiance is the same for the 3 treatments (Chl a fluorescence measurement, line 17). However, differences in quantum yield between treatments (Fig. 2, left) were not so evident. In fact, these differences are not mentioned in the text. Then, why rETR at high irradiance is significantly lower for acidification (in blue) than for greenhouse (in red) on days 15 and 19 whereas maximum quantum yields were similar? Moreover, why rETR was higher for acidification than for the present conditions?

The manuscript must also be checked to improve language

Specific comments

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Abstract The percentages given here are not stated in the main text. Line 15. There is a missing word here: ... were not significantly different between??? and greenhouse conditions,..

Introduction Page 4613, line 14: On the contrary to some microalgae... What microalgae you refer? Phytoplankton are microalgae Page 4614, lines 16.18: Higher abundance of small size phytoplankton in high temperature conditions is not necessarily always true. What commonly occurs is a decrease or disappearance of large phytoplankton. Therefore, I suggest the modification of this sentence to indicate the dominance of small phytoplankton in environments with high temperature.

Materials and methods Page 4615, lines 15 to 18 and lines 24-25: Information on how the CO₂ concentration and pH were controlled must be provided. Why such amounts of nutrients were added?

Page 4616, line 7: KST means Korean Solar Time? Lines 20: The sentence “the curves were fitted to a model with photoinhibition parameter of Platt” is repeated below in line 24.

Results Page 4618: Nutrient levels are not shown

Summary Page 4625, lines 6 to 8: The sentence “The main objective of this study was to investigate the physiological and ecological affects in the phytoplankton community under future climate conditions” looks too ambitious. Physiological and ecological domains are larger than photosynthetic responses.

Tables 1 and 2. Clarify what the letters (a, b, ab) indicate.

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