

Interactive comment on “Effect of CO₂ enrichment on bacterial production and respiration and on bacterial carbon metabolism in Arctic waters” by C. Motegi et al.

Anonymous Referee #3

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This paper addresses effects of increase of pCO₂ on bacterial community production and carbon flow through bacterial metabolic process in the Arctic region. Despite ocean acidification is a predictable consequence of rising atmospheric CO₂, its impacts on the oceanic carbon cycle and biogeochemistry mediated by microbes is not clear. Thus the topic will be useful for readers of Biogeosciences. However, the manuscript suffered of insufficient presentation on the data (see below). Thus, the manuscript must be reexamined after evaluation of data presentation by authors.

The authors used simple correlation analyses between real pCO₂ value and BPTdR, the Leu : TdR ratio, BGE or BCD obtained from different mesocosm tanks at the same

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day. Although data obtained from same day were compared, biological and chemical environments surrounding bacteria will be varied among the mesocosm tanks. Moreover, elevated pCO₂ could affect bacterial community production and respiration both by direct (change in pH, etc.) and indirect pass way (change in DOM release, food web structure etc.). Delay in bacterial response to increase of pCO₂ through indirect pass way in a few tanks could make true effects blur in the present analysis. Thus the simple correlation analysis might not extract effects of value of pCO₂ on bacterial metabolism. I am not sure whether aim of this comparison is to extract possible factors which affects bacterial metabolism or to extract variability of metabolic rate under different pCO₂ condition. Authors should state their purpose of analysis and should discuss variability of their analysis. (But I recommend addition of other biological and chemical parameters to statistical analysis.) Further, in the comparison between pCO₂ and BP, significant correlation was found only discrete two days. This result is very week to discuss long-term trend in bacterial production under elevating pCO₂ in the ocean because effects of elevated pCO₂ seems to be disappeared within 2 days. As describe above, single day comparison could make effects of elevate pCO₂ blur out. Comparison in commutative values of bacterial parameters for all experimental period or 4 phases like other papers in this special issue may be more effective.

Authors discuss the balance and imbalance growth of bacteria as interpretation of the change in the Leu : TdR ratio. If authors relate the change in the Leu : TdR ratio with bacterial growth condition, authors should compare the Leu : TdR ratio not only with real pCO₂ value but also with sBP, sBR and BGE. Further, I recommend addition importance of the trend in material cycling and competition with phytoplankton for nutrient uptake because it probably is difficult to reveal how mechanism alters the ratio under different pCO₂ condition.

Detailed comments:

P15218 2.4 Bacterial growth efficiency (BGE) and bacterial carbon demand (BCD): Whether were BGE and BCD estimated for only free living bacteria or for total (free

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living + attached) bacteria? Please clarify it in this section.

P15220 Line 24-P15221 Line 2: Does the evidences about BPTdR and HDNA suggest that viral lysis is dominant factor of bacterial mortality?

P15222 Lines 3-6 “Although BPLeu was positively correlated with primary production in...”: Does “phytoplankton” mean abundance? Or primary production? Or both? Please clarify it.

P15223 Lines 14-15. “In particular, the Leu:TdR ratio decreased with increasing pCO₂ concentration at t5 and t7 but this trend changed at end of the experiment.” And following discussion: Although regression lines in Figure 5B, C, K and L show this trend, this trend seems to be based on increase in low pCO₂ tank (the ratio in high pCO₂ tanks seem to be constant relative to low pCO₂ tanks.). Figure 5B shows that the most unfavorable condition during whole of experimental period low pCO₂ condition. Authors should compare not only slope of regression line in each panel but also fluctuation of the ration in each tank.

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