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Discussions

Interactive comment on "CO_2 perturbation experiments: similarities and differences between dissolved inorganic carbon and total alkalinity manipulations" *by* K. G. Schulz et al.

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We would like to thank for the posting of this short comment as it provides us the opportunity to resolve an apparent misunderstanding. Recognising the similarities and differences between carbonate chemistry manipulation methods within certain CO_2 ranges is the key for suitable experiment design and subsequent data interpretation.

Our manuscript discusses the chemical changes in seawater inflicted by human induced ocean acidification. Therefore, we have adopted a 'realistic' CO_2 range from about 300 to 700 μatm, representative for preindustrial and projected year 2100 levels, respectively. Within this range together with typical oceanic temperature and salin-

ity combinations, the two fundamental manipulation methods (TA constant at changing DIC and vice versa) result in identical carbonate chemistry speciation changes in terms of trend (compare Fig. 2). Hence, different carbonate chemistry manipulation methods within boundary conditions of human induced ocean acidification during this century, will invoke the same biological reaction, regardless the responsible carbon chemistry specimen (CO_2, HCO_3^-, CO_3^{2-},H^+).

When extending our analysis towards higher CO_2 levels and lower pH values, we agree that HCO_3^- concentration changes start to diverge between both manipulation methods (compare Fig. 4). Here it could be added that also relatively low CO_2 levels (below 100 μatm) result in significant differences. This means that the alkalinity manipulation method for CO_2 levels, used for instance in physiologically orientated studies, far beyond 700 μatm might not equally be suitable for simulating ongoing ocean acidification. This, however, is only the case if the process under study is sensitive to HCO_3^- concentration changes because all the other carbonate chemistry species change in nearly the same way, regardless of the manipulation method. We agree, that a paragraph on different dissolved inorganic carbon acquisition and utilisation strategies by various organisms could here be beneficial.

We disagree, however, that the conclusions regarding the response of *Emiliania huxleyi* to various carbonate chemistry manipulation methods cannot be drawn. Despite the perhaps statistically low sample size *Emiliania huxleyi* is one of the most studied organisms regarding the effect of ocean acidification. As raised by Cornwall et al. and shown in table 2, on top of the differences in carbonate chemistry manipulation between experiments there are numerous others such as strain and culturing types, PAR levels and nutrient conditions. In face of all the experimental differences between these studies the response of photosynthesis and calcification towards ocean acidification is strikingly uniform within a certain CO_2 range. This does not leave room for the hypothesis that the carbonate chemistry manipulation approach chosen will influence the biological responses and confirms what is expected from the chemical speciation calculations (compare Fig. 2).

Concerning the minor issues raised, they will be dealt with during the revision process.

Interactive comment on Biogeosciences Discuss., 6, 4441, 2009.