

## ***Interactive comment on* “The Arctic Ocean marine carbon cycle: evaluation of air-sea CO<sub>2</sub> exchanges, ocean acidification impacts and potential feedbacks” by N. R. Bates and J. T. Mathis**

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**General comments** This paper is a well-written paper, which reviews carbon cycles in the Arctic Ocean, focusing mainly on air-sea exchanges of CO<sub>2</sub> and secondarily on ocean acidification. This paper would become one of the best papers reviewing carbon dynamics in the Arctic Ocean. However, I would like to ask the authors to re-consider some parts of the manuscript, although they are minor. They are listed as specific comments in the followings.

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**Specific comments** Abstract: line 20, “negatively” seems to be ambiguous. What is negative, and what is positive for the benthic ecosystem?

Page 6701, line 18, [H+], the parenthesis is usually used to express concentration of a species. So “[H+] activity” is not appropriate.

Page 6702, lines 2-7, Here, relationships between dissociation constants and water temperature are described, but how about relationships between the constants and salinity? We often observe very low salinity like <10.0 in the Arctic Ocean shelves.

Page 6704, lines 5-10, there are two sentences, which repeat almost the same thing.

Page 6710, lines 12-20, very high pCO<sub>2</sub> values up to 844 uatm are introduced. However, were the values found in shelves? not in estuaries? Through the manuscript, distinction between shelves and estuaries seems to be not made. It is better to do the distinction, if possible.

Page 6711, lines 3-, CO<sub>2</sub> fluxes based on the eddy correlation method are introduced here. This method often presents results considerably different from those obtained by the bulk method. As stated in the text, they are often contradictory. The differences are possibly related to methodology. This point should be described in the text.

Page 6701, lines 10-11, “The four directly... pH.” Almost the same thing is already described at lines 22-24 on page 6700.

Page 6717, lines 7-8, “The length of the ... has declined”, only from this phrase, because of shortened ice melting period, cooling seems to occur. Is that what you means?

Page 6719, lines 14, atmospheric (pressure) gradients?

Page 6721, lines 12-15, There are lots of possible carbon cycle changes as a result of ecosystem shift. Why do you raise this change?

Page 6722, lines 10-13, the release of alkalinity from sediments is a result in the North

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Sea. Can this be applied to the Arctic shelves? Any observed results suggesting this process?

Page 6723, line 17 and others, "CO<sub>2</sub> content", the word "content" implies quantity. So in this context, "pCO<sub>2</sub>" is better, because this part states an increase of CO<sub>2</sub> with increasing temperature without changing concentrations (content in a specific volume).

Page 6725, line 6, "high TA", do you mean high TA causes decrease of omega values?

Page 6726, line 27, why does the presence of a deeper shelf cause the attenuation?

Technical corrections Page 6700, line 12, Tanhua et al., 2009 is not listed in the reference.

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