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Interactive comment on "Biogeochemical processes and buffering capacity concurrently affect acidification in a seasonally hypoxic coastal marine basin" *by* M. Hagens et al.

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Review of the paper "Biogeochemical processes and buffering capacity concurrently affect acidification in a seasonally hypoxic coastal marine basin" submitted to Biogeosciences for publication, by M. Hagens and coworkers.

The paper "Biogeochemical processes and buffering capacity concurrently affect acidification in a seasonally hypoxic coastal marine basin" by Hagens et al., provides an in-depth analysis of biogeochemical processes and their effects on the pH in a seasonally hypoxic marine basin. The paper covers the relevant aspects in a very comprehensive way, and I find the paper designed and written publication ready. I have one major com-

ment, and a few minor comments as detailed below. Since I think the consideration of my below major point (the role of temperature) appears crucial to the paper, I recommend major revision, although the actual revision might not necessarily major. Beside this point the paper is excellent and will certainly be publishable in Biogeosciences.

Major point: I might have overlooked this point, but I do miss the discussion of the role of temperature and its seasonality in regulating the pH and the buffer capacity. Both pH and buffer capacity depend strongly on the ambient temperature, with the pH decreasing and the buffer-capacity increasing with increasing temperature. This can be seen by simple thermodynamic computations using available software, and is one of the reasons for the low buffer-capacity of polar waters as compared to tropical waters (e.g. Thomas et al., 2007, GBC), or in other terms, for the positive temperature coefficient of the anthropogenic CO2 uptake (e.g. Thomas et al., 2001 GRL). Also from the seasonal perspective this has been discussed for example by Shadwick et al., 2011 (L&O) and 2013 (Nature Science reports), many other examples could be given here, as well. With a little bit of guess work from my side, the temperature role could be evident in the discussion in section 3.2.2, and figures 3-5, when comparing the seasonalities of temperature (Fig 3), then pH or the buffer-capacity (Fig. 4), and GPP/CR (Fig. 5). However, I do not see an explicit discussion here. Also this aspect has been ignored , as far as I can see, entirely throughout the paper. While the proper assessment of the role of temperature is crucial under many aspects, it appears to be key to the closing term estimation of the lateral proton fluxes with seasonal resolution as discussed toward the end of the paper. I think this problem can be easily addressed, since it is inherent to the computations anyway.

Minor points: abstract, line 6: maybe replace "of the hypoxic" by "in any hypoxic"?

introduction, page 15830, l26. Please delete the word "counteract". The only proper term here is "buffer"! Beside the fact that buffer and counteract mean different processes, strong acids/bases can counteract each other, but cannot buffer.

Page 15841, line 24 see above , please replace “counteract” by ”buffer”. If the authors do not like buffer, another option might be resilience toward a perturbation?

Page 15848, 2nd and 3rd paragraphs. Please (re-)consider the use of the term gradient. In this section only concentrations (!) are given, but NOT gradients. A gradient is a concentration change over a certain distance, and a gradient thus carries a corresponding unit (concentration change per distance). In this section only concentrations differences between two compartments are reported.

Page 15855, last paragraph. This paragraph is entirely unclear to me. If needed, please explain the meanings of: depth-weighted, volumetric annually averaged, volume weighted mean value. If these are the same please use only one term.

Interactive comment on Biogeosciences Discuss., 11, 15827, 2014.