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***Interactive comment on* “Seasonal pH and aragonite saturation horizons in the Gulf of Alaska during the North Pacific Survey, 1956–1957” by S. McKinnell and J. R. Christian**

Anonymous Referee #3

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Apprehending the spatial and seasonal variability of pH is key to the assessment of impacts of ocean acidification on marine ecosystems, as well as to improved projections of future chemical changes. Together with its magnitude, the rate of pH change is central to projections in the context of mitigation strategies. Repeated sections allow a first appreciation of changes that occurred over the last decade. They further allow testing the capability of models to reproduce the temporal evolution of seawater chemistry. Historical data are rare and precious in this context. McKinnell and Christian assessed pH data from the northern North Pacific gathered in summer 1956 and winter 1957. Measuring pH on board of a ship to a high precision is not a trivial task and caution has to be taken when evaluating archived data. In this particular case, J.D.H. Strickland

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was responsible for the measurements. I expect the pH measurements to represent the state of the art of the late fifties. Changing the pH scale from NBS to total scale and the approach selected to derive alkalinity are acceptable. Obviously recomputed data will carry large uncertainties that have to be considered when assessing the saturation state of waters with respect to carbonate minerals. These restrictions are to be kept in mind when discussing seasonal changes and comparing historical data to recent ones. The authors present however an interesting piece of work and contribute an important data set. I recommend the manuscript for publication in Biogeosciences after revisions.

1. Discussion of results in the context of Feely et al. (2008): The manuscript would benefit from a more detailed discussion of results from the 50ties compared to those reported by Feely et al. What will be the impact of ongoing ocean acidification on the seawater chemistry measured in summer 1956 and winter 1957? Is an extrapolation of acidification effects compatible with Feely and coworkers data? What are the likely consequences of inferred changes on marine biota. The discussion of causes of the strong seasonal signal present in the historical data should also be extended. How do the historical data compare to other recent studies in the same area?

2. Presentation of results structured in 'North' and 'South': data are grouped in two distinct geographic areas 'North' and 'South'. What are the limits of these domains and on which basis have they been defined? The rationale for selecting the domains should be presented in early stage of the manuscript.

3. Estimation of alkalinity as an empirical function of temperature and salinity: please provide detailed information on the empirical function. What is the associated uncertainty?

Other comments:

p. 4591 – lines 17-20: please provide synthetic and quantitative information on the adjustment between scales, the range of variability of the full data set, the variation induced by temperature etc. The same holds for uncertainties associated with the

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conversion of pH scales and the derivation of saturation state with respect to aragonite.

p. 4592 – lines 9-17: these lines are not easy to follow for the reader. Please rewrite and, if needed, expand.

p. 4593 – line 4: be more specific on ‘combination of physical, chemical and biological forces’ p. 4593 – line 26: trends in longitude: the authors refer at several occasions to trends in longitude. There is no information in the manuscript that allows the reader to appreciate these trends. This information is missing.

Fig. 5 – What is the vertical axis of these plots?

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6, C589–C591, 2009

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