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Interactive comment on "Two decades of inorganic carbon dynamics along the Western Antarctic Peninsula" *by* C. Hauri et al.

Anonymous Referee #2

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This manuscript represents a very important evaluation of one of the highlights of long tem monitoring of the carbonate system in the Southern Ocean – the PAL-LTER program. The wider utilization of the summertime data to enable extrapolation to annual scales in conjunction with the more prolific surface pCO2 data illuminates the changing nature of the carbonate system and thus ocean acidification. The structure of the work done is very logical and well laid out. The carbonate system reporting and data analysis is generally performed and well described in accordance with common practice. However, data normalization to deep water values between cruises is not performed. Certain broad assumptions are made regarding the development of carbonate system proxies, nutrient utilization and the physical setting that weaken the scientific merit of the paper and subsequent interpretation of the results.The language of this manuscript would benefit from a general sharpening of the text. The sentences are often long

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Interactive Discussion
Discussion Paper

and statements and descriptions of scenarios are repeated. Overall, this manuscript is a valuable contribution to the scientific field and after I suggest that this manuscript be accepted for publication after successfully addressing or challenging the comments laid out below.

General comment: Regular mispelling of ueq – replace with μmeq. Use pHT throughout to clearly denote the scale

Abstract

P6930
L5 “this” dynamic system
L6 change “The discrete” to “Discrete”
L8 remove “Analysis shows”. Propose “Large spatial gradients were seen in. . .“
L8 total alkalinity
L9 remove “from values” and bracket (<1 to 3.9)
L17 These were not “predictions”. They were calculated values but even this is not necessary here. Just use aragonite saturation.
L19 again remove prediction. Replace with measurements?
L23 replace “pointing towards” with “indicating”?
L24 replace “provoke” by “induce”?
L25 remove “what”

Introduction

P6931
L5 use general “change”
L9 higher trophic organisms. Krill and fish are not species.
L11 oceanographic

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P6932
L1 not sure what you mean by “timing of sampling”. Time of year?
L1-2 remove “dark” and “months”.
L8 remove “a” and change timescale to timescales
L22. Replace “has” with “have”.

P6933
L11 remove “of each transit”
L26 “variables” not “parameters”

P6934
L20 replace “calculations” with “procedure” or “program”
L24 remove “well”

P6935
L18 remove “of”
L24. They are “offsets” in CT and AT and not “errors”
L25 “differences” not “errors”

P6936
L6. There is no direct AT v T plot and no correlation information in Figure A2.
L20. An evaluation of the error in calculated pH would be useful here too.

P6937
L10 variables

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P6938
L3 Remove “above-presented”
L10 replace with “can decrease (increase)
L16 How robust is this assumption considering the high ammonium stock in the WAP region (e.g. Nutrients in the Southern Ocean GLOBEC region: variations, water circulation, and cycling Serebrennikova and Fanning, 2004)

P6939
L1 How can you interpret this from Figure 5? The reader should not have to evaluate this from interpreting depth from the salinity.
L2 Where is this “excess” AT coming from relative to the end members? Highight this leading to the discussion on P6945.
L25. Why have you used a constant PCO2 of 390? Why not use the relevant annual (or even better, seasonal) values over the measurement period?
L26 Is this globally averaged transfer rate representative of the Southern Ocean?

P6940
L3 As the MLD can be easily calculated from the CTD profiles, why choose a “d” of 50m. The episodic nature of wind-stress and a rapidly evolving MLD require that a much more locally informed, at a minimum a monthly climatological value should be used.

P6943
L7 sDIC

P6944
L14 replace “overlapped” with “coincided”

P6946
L18 replace “what was” with “that”
L25 Calculate not predicted pH

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P6947
L2 Replace “Additional decades” with e.g. “ A longer measurement period”
L4 replace “predicted” with “calculated”
L16 “to” be able to

Table 1.
Legend: Remove “statistics for”
Why were only selected years chosen for Figure A1?

Table 2. According to your criterion, none of the trends are statistically significant. This needs to be stated more clearly. Why are the regional trends not shown? These are much more important than the dataset mean.

Figure 2. These plots clearly show the offset between cruises in the deep water. Why were the data not corrected according to the practice adopted for CARINA, for example? Or can you show that the offset are due to spatial differences?

Figure 3. This is not a very clear figure. The data density is too great and the colour coding is too similar for many of the years. Please simplify or remove.

Figure 5. This figure does not, contrary to its legend, depict the physical and biological controls on inorganic carbon chemistry

Figure 6. Similarly, the legend is misleading. Not all the processes leading to the movement in TA/DIC space are of biological nature. The grey dots and lines should have a slightly darker shading.

Figure 7. Please explain better the plot in the legend. “Nutrient consumption” is incomplete and incorrect regarding the lower plot.

Figure 8. There are no “dynamics” shown in this plot.

Figure 9. Here is stated that after “clear outliers were removed”. In both plots there are differences between the two approaches of 150ppm. What criterion was used to

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define that these were also not clear outliers?

Figure A2. Remove “prediction”. Plot a. is the specific alkalinity relationship. Plot b. x axis label “observed”

Figure A3.

Correct “temperature”

Interactive comment on Biogeosciences Discuss., 12, 6929, 2015.