

Interactive comment on “Hurricane Arthur and its effect on the short-term variability of pCO₂ on the Scotian Shelf, NW Atlantic” by Jonathan Lemay et al.

Jonathan Lemay et al.

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Received and published: 15 December 2017

Response to Referee 1:

We very much appreciate this detailed and insight full review. It has helped substantially improve the manuscript. We respond to the referee's points below, and have adopted the points for any revised version of the manuscript accordingly.

“Overall Statements: The manuscript “Hurricane Arthur and its effect on the short-term variability of pCO₂ on the Scotian Shelf, NW Atlantic” by J. Lemay, H. Thomas, S.E. Craig, W.J. Burt, K. Fennel, and B.J.W. Greenan presents the interaction between

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physical and biogeochemical processes on the Scotian Shelf, an open shelf sea with a complex water mass structure. The manuscript focuses on a strong wind event in July 2014. As shown, similar events emerge in this area very often. The authors did the first step in broadening the studied time interval by applying a spectral analysis. But this analysis has no further consequences within the manuscript. I would suggest to omit the spectral analysis or to use its results for further storm event-related carbon flux estimates on longer time scales (or other biogeochemical analysis). “

We agree to omit the spectral analysis, as it, in essence, confirms results of earlier studies. We now reworded the section stating that the data used in the present paper reflect the (reoccurring) winter storm pattern as reported by Smith et al., 1987, Shadwick et al., 2010, or Thomas et al., 2012, but do not present our own analysis and Fig. 6 any longer.

“The manuscript is well structured and is equipped with mostly significant figures, but it contains several partly severe errors. The conclusion repeats more or less the findings. This section could be used for more general statements on storm effects on biogeochemical fluxes. “

We have thoroughly checked the manuscript for severe and less severe errors and apologize for having overlooked these. In the concluding section, we have placed storm events in a broader perspective.

Detailed remarks: L29: land, ocean, sediment, and atmosphere We modified the text accordingly.

L60: give the extent of the Scotian Shelf (lon1-lon2, lat1- lat2) This information has been added to the text (43N-46N, 66W-60W).

L61: at which position are the annual cycles in Fig. 2 valid? This information has been added to the caption of Fig. 2.

L61ff: Which is the origin of the deep high salinity water? This information has been

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added to the caption to the section (the warm slope water).

L70: Indicate "CIL" in Fig. 3 The CIL has already been indicated in our original figure, spelled out though.

L73: I do not see 20 °C in Fig. 3i We agree with this point, however think that this is an issue between observed peak values (20C) and long-term mean values (15C). We have reworded the section to solve this.

L75: The given salinity range does not fit to Fig. 2ii Thank you, this was a typo on our side.

L85: Fig. 2iv Thank you, this was a typo on our side.

L131: At which depth are the measurements taken? Measurements were taken at the surface at approx. 1m depth. We have added this information to the document.

L131: Give here the time interval when the buoy was applied. From February 20th to December 31st We have added this information to the document.

L175: You mean DICS? Where S is upper case? Thank you, this was a typo on our side.

L176: represents the freshwater end member We modified the text accordingly.

L178: + DICS=0 Thank you, this was a typo on our side.

L182: In Wanninkhof (2014) the gas transfer velocity has the unit (cm/h), so I would expect another constant to end up with mol m⁻² s⁻¹. Indeed, the unit in our text contained an error. The corrected unit is 10⁻⁵ mol m⁻² hr⁻¹.

L205: Give a motivation for the choice of the time interval. The reason for the choice of time interval is that a small storm event during that period happened while both the SEAHORSE profiler and CARIOCA buoy were in the water. We have added this explanation to the paper.

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L234: The denoted time interval in Fig. 5 does not fit to the time interval in the text. Thank you, this was a typo in the text.

L263: "Figure 8 also shows that the density steadily increases with depth (Fig. 8a), and .." We modified the text accordingly.

L264: You combine T/S profiles from June 28 (other year?) with DIC profiles in July/August 2014. Why is this valid?

The profiles used in Fig. 8 are from the same year. Fig 8a shows the pre-storm conditions, Fig 8b shows the reestablishment of the system after the storm had passed. We have clarified this in the caption, thank you.

L262: My mixing calculations result in a depth of 40-50m. Mixed T=9 °C. Upper value 14 °C. Makes 4 °C as lower value, to be found at 50m depth.

Thank you, this was a typo on our side.

L278: This sentence fits to my calculation (40-50m). Indeed!

L301: There must be other sources of heat. Mixing alone should have reduced surface temperature. Please discuss this. We agree with this point. We have added the following statement to the text: "As the data presented in Fig. 10 - in particular temperature - show, lateral processes, either cross-shelf or along-shelf may have impacted the system, as well. These features, however, cannot be further resolved referring to single-point moored observations."

L301: From day 186 to the maximum value I see an increase of 40%. Thank you. We assume that this comment refers to the statement in line 306. We agree the increase is approximately 40%. The text has been modified accordingly.

L335: For a reduction of one unit in salinity the mixing should have taken place from the surface to about 70m depth (compare Fig. 2) Thank you for this comment. Again we think that this is an issue between single observations and climatology means as

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shown in Fig 2. We have added a statement reiterating that Fig.2 uses climatological mean values.

L342: where does this number (45 mmolC m⁻² day⁻¹) come from? Which C:Chl ratio did you use? We think that this could be a misunderstanding on the referee's side. The fluxes have been computed directly from our buoy observations. We reworded the sentence for clarity.

L376: Reference missing. We have added the reference to the list, thank you.

L495: Give position. As per our response above, we have added the position of the station to the caption.

L519: Why "Climatologies"? Thank you, we agree. We have replaced here climatologies by observations.

Fig. 5: Please give more time ticks. These will be provided in the revised figure.

L527: which DIC profile is used? July 22 or Aug 3? We used the August 3rd-profile. This has been mentioned in the caption now.

L530: refer to Fig. 8 We have modified the text accordingly.

Fig. 11: Omit this figure. It is not necessary. Omit also "Figure 11" in L365. We no longer use Fig. 11 in the paper.

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2017-370>, 2017.