

Low $p\text{CO}_2$ under sea-ice melt in the Canada Basin of the western Arctic Ocean

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Anonymous referee

General comments

This paper describes results from a single cruise conducted in the autumn of 2013. The hydrography in the region investigated is complex and with large seasonal signatures.

The analysis of water types from salinity and alkalinity provides a convincing picture of the distribution of water from different sources and is thus a key to the interpretation of the surface and water column data on dissolved oxygen and carbon dioxide.

The primary result reported, as seen from the title of this communication, is a low subsurface $p\text{CO}_2$ and negative AOU in the Canada Basin. The authors suggest that this feature, a hidden CO_2 sink formed previously in the year, may have significance in the changing Arctic Ocean. Two figures are used to demonstrate this feature, numbers 5 and 6. Strangely, there are much more $p\text{CO}_2$ data points for Canada Basin Water in Fig. 6 than in Fig 5e. Fig. 6 indicates a qualitative relation between $p\text{CO}_2$ and AOU. This reviewer finds it necessary that to make the paper acceptable for publication, the authors explore these relations deeper and quantitatively in order to underpin the roles of photosynthesis, respiration and mixing. Also to examine the likely influence of time from formation to observation.

Specific comments

Page Line

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| 3 | 1 | Add information on where cruise started and refer to Fig. 3. |
| 3 | 8 | Is the instrument calibration response linear? What is the estimated uncertainty of measurements reported significantly outside the calibration range? |
| 3 | 9 | Add reference to the „WMO scale“. |
| 3 | 16 | Name of author is here Midorikawa but Mirorikawa in the list of references. |
| 3 | 26 | Were the DIC bottles closed after filling? |

- 3 28 The reference (Nippon ANS, Japan) is insufficient for a description of the instrumentation of extraction/coulometric titration system.
- 4 4 To which depth were water samples collected?
- 4 8 Change „same physical conditions“ to „same potential temperature and salinity conditions“.
- 4 10 How were the chlorophyll measurements calibrated?
- 4 14 The reference (Nippon ANS, Japan) is insufficient for a description of the instrumentation used for TA measurements.
- 4 18 Which computation package is used to compute ocean carbonate chemistry?
- 5 7 Change TARRO to TARro
- 6 5 Analysis of satellite imagery is not mentioned in the Data and Methods section. Which data and how processed needs to be added.
- 6 9 The calculation of CO₂ flux and quantification of $\Delta p\text{CO}_2$ reduction needs more detail.
- 6 20 Change „High“ to „Near equilibrium“ conditions.
- 7 10 At what depth lies the NSTM?
- 7 19 Suggest changing „affected“ to „contributed to“.
- 7 31 A figure is needed to illustrate the distinctiveness of the CBW subsurface minima.
- 14 Fig.1 The placement of this figure as Fig. 1 is strange. It should be after Data and Methods.
- 15 Fig. 2 The placement of this figure as Fig. 2 is strange. It should be after Data and Methods.
- 19 Fig.5 Using the calendar date of data collection on the x-axis is unusual. Particularly as there is no date information with the cruise tracks in Fig. 3. Is it possible to use distance sailed instead?
- 20 Fig. 5f The colour scale does not include the blue observed at lower depths.