

## ***Interactive comment on “Nordic Seas dissolved oxygen data in CARINA” by E. Falck and A. Olsen***

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We would like to thank the reviewer for the helpful comments. We have carefully considered each, and have made several changes to the original manuscript in response. In the following we go through the comments one-by-one. The reviewer comments are in italics and our response in normal font

*About three fourths of the abstract contain statements related to the CARINA project in general. Only the part starting in line 16 (p. 538) is directly related to the manuscript.*

We have rewritten the abstract so that it mainly contains information on the oxygen.

*Nothing is said about applied methods or the fact that some cruises/time series stations could not be evaluated.*

We have now included a lengthier section on the methods, Sect. 3. In a subsection of

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this (3.2) we explicitly explain why some of the cruises could not be evaluated because they had no data from below 1900 dbar, which was used as the cut-off depth in the consistency analyses.

*Out of 35 cruises available for the Nordic Seas region 32 cruises delivered oxygen data. Out of this number 26 could be quality-controlled and of these cruises 4 had to be adjusted. I fully accept that this paper is one of a series of CARINA papers, and this may lead to repetitions, but page 540 and large fractions of page 541 are almost fully identical to contents presented in other CARINA papers. And these particular contents rather refer to CARINA in general than to the oxygen QC of the Nordic Seas data.*

When planning this special issue, all editors agreed that each individual paper should include an introduction to the CARINA project and database and that repetitions were unavoidable and acceptable.

*In contrast, when it comes to describing the QC methods applied to the oxygen data, the authors rely too much on the fact that potential readers know the content of the cited methodological papers.*

We agree that a more extensive description of the methods would benefit the paper, and have included this in section 3 of our revised version.

*As is mentioned in the 'Introduction' section, the QC itself consists of a primary and a secondary QC. Though the manuscript deals with the secondary QC it would be of interest to learn as well about the primary QC and the respective outcome, and I suggest to provide a few more details.*

We have included more information on the primary QC in Sect. 3.1 of our revised manuscript

*The secondary QC, which is the focus of this manuscript, was applied by evaluating results derived from a crossover and inversion analysis. At present it is hardly possible for the reader to understand these methods and rationales behind without going back*

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*to the original papers. Though I understand that there is a particular paper dealing with quality control methods applied to CARINA data, I would expect a small summary of the methods with particular emphasis on the oxygen analysis for the Nordic Seas. For example, Tanhua et al. (2009) note that the crossover analysis was carried out either on pressure, temperature or density surfaces. It is unclear what has been done in the present manuscript, since any details are completely missing.*

In Section 3.2 of our revised manuscript we have now included a more extensive description of the procedures implemented during the secondary QC of the oxygen data, and for instance we clearly state that it was carried out using depth as the ordinate, due to the small temperature and density gradients in many places of the Nordic Seas.

*Section 2 is entitled "Data provenance and structure", but this title is a bit misleading, since no information is provided concerning the real data provenance. From the title one would also expect to get information about data origin. It should be noted that number in brackets inserted after the expocode denote CARINA cruise numbers.*

The title has been changed to "Oxygen data" in our revised manuscript. A sentence is added explaining the number in brackets inserted after the expocode.

*Please, provide more information on how those cruises were handled that had CT-DOXY data only. Which cruises were affected, and what is the effect on the QC results? We agree that this part of the manuscript was a bit vague. The authors knew of three cruises that had used ctd oxygen that was calibrated with some samples analysed by Winkler titration.*

We have added a column in Table 1 to show which cruises were affected and have added some words in the text. As far as we have been able to check, these are the only three. They have been treated the same way as the other cruises during the QCs and we can't see any effect of this in the QC results.

*Concerning the results presented in figure 2, it is unclear to me, why on the one hand*

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*side stations have been excluded from the analysis because they were located inside an eddy (cruise 128), but the single anomalous station of cruise 129 (flagged 3 by the data originator) was included. Please explain the rationale behind.*

The anomalous station of cruise 128 was identified after the consistency analysis (some words added on this in 3.3.1), whereas the eddy stations of cruise 129 were well known before. Thus these were excluded from the analyses, whereas the anomalous station of cruise 129 was included. Note that the station was excluded when the crossover and inversion for the consistency test was carried out (section 4). The anomalous station was not supposed to be in Fig. 3 (now Fig. 2) and has been removed.

*It would be helpful to have some more details about, how the uncertainties were derived.*

The uncertainties are calculated in the least square models that are applied in the inversion analysis. This has been stated in section 3.2. For the equations we refer the reader to Johnson et al. (2001) as this provides a very comprehensive description of the approach.

*Figure 3 is nice in principal, but actually does not add much information that is used in the text. It is only mentioned twice (page 544, lines 6 and 11), and in the respective context the focus is on the location of a few particular cruise rather than on the respective data range shown in Figure 3.*

This is a figure used in all the Nordic Seas papers and it gives a comprehensive overview of the data, it also enables the reader to clearly identify the station positions of the cruises that could not be included in the secondary QC - addressing a later comment of this review. We have therefore retained this figure in the revised version of the manuscript, have mentioned it in section 2 (and therefore changed to Fig.2), referred to it in section 3 and included some more explanation in section 4.

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*Specific comments p. 541, line 11: reference 'Olafsson and Olsen (2009) is missing*

Included

*p. 542, line 16: please, define 'vicinity'*

This is now defined explicitly in section 3.2

*p. 542, line 23: please, be more precise on 'special region'*

Special region was referring to the polynya area northeast of Greenland. We have rewritten this in section 3.2 using cruises with no stations deeper than 1900 dbar instead. We also have included a reference to Fig. 2 which shows the station locations of each individual cruise.

*p. 543, lines 1-4: Please, provide details. What period is considered when talking about a decreasing oxygen trend in the deep Greenland Sea, as was reported by Blindheim and Rey (2004)?*

This is added together with the reference, we have also added another reference.

*p. 543, lines 17-18: earlier on this pages rationales are given why CARINA cruises 129, 130, 135, 91, 116 should be considered in more details. This is not the case for the cruises 176, 120,121, 122. It may be a matter of properly structuring the contents of page 543.*

We acknowledge that it was not clearly explained, and have revised this section. We hope the structure is better now, the rationale for all these cruises are given at the end of section 3.2.

*p. 544, line 20: please, be more precise on 'seems OK' and 'if not a bit high', what is the criterion for this decision? We have rewritten this part and deleted this sentence.*

*References section: please, list references in alphabetical order.*

Done

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*Reference 'Jeansson et al. (2009) is listed twice. Reference 'Olafsson and Olsen (2009)' is missing.*

Fixed

*Figure 1: It would be helpful if data from those positions that could not be evaluated, are highlighted in a different color. Also adding bathymetric lines would be of interest, since it is easier to distinguish between the shelf regions, the ridges, and the deep basins. Please, also indicate which stations are excluded from QC due to shallow water depth? The data distribution shown in Figure is obviously the full data set, but according to the text only stations having data at levels deeper than 1900m were considered in the crossover and inversion analysis. This should be displayed separately in the figure.*

To address this we have added bathymetry at 500, 1000, 1500, 1900, 3000 and 4000m. The 1900 m isobath is highlighted and show clearly which stations are over bottom depths larger than 1900 m and could be used in the crossover analyses. For the position of the cruises that were excluded from QC, these are plotted in Fig. 2 We would also like to remind the reviewer that the full details of each crossover is available through the CARINA homepage – as is stated in the manuscript

*Figure 2: Dashes are missing in the labels of cruises 134, 136, 176. Therefore, CARINA IDs and expocodes are mixed in these cases.*

We have added the missing dashes

*Table 1+2: Please, use only two digits in your 'recommendations', 'adjustments' and 'covariance' values. Footnote of Table 1: use capital letters for 'Carina'*

This has been changed

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Interactive comment on Earth Syst. Sci. Data Discuss., 2, 537, 2009.

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