

## ***Interactive comment on “Nordic Seas and Arctic Ocean CFC data in CARINA” by E. Jeansson et al.***

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We would first like to thank the reviewer for carefully reading the manuscript and providing valuable comments. This resulted in improvements on the manuscript, which especially clarified the description of the method and the reasoning behind some of the adjustments. Below we will go through the comments, one by one. The comments are in italics and the response comments in normal font.

General comments: *The authors publish a data set to receive proper recognition in the reviewed literature. To make it thus available is applaudable. In setting QC measures they refer almost exclusively to the parameters they measured, which is CFC data. There is some implicit reference to the other parameters that are normally measured along with CFC data. All these data are taken from sea water samples, or calibrated*

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*against sea water samples. It is, though, not clear how these data have been used to ascertain the quality of the CFC data, or discuss possible significant variations due to different water masses present in the profile, or region. Keeping the discussion to the parameters they measured avoids discussing their data with those PIs that did the other measurements. That is regrettable.*

We agree with the reviewer that the quality or validity of a measured parameter should be done together with other parameters measured from the same water sample. This is exactly what has been done in the primary quality control where the validity of individual measurements is judged. This process resulted in a quality flag for each datum. These were always made in agreement with the data originator, if possible. For details of the primary QC, see Key et al. 2009. In this article we present the results from the secondary QC, where systematic biases in the data are assessed. One of the assumptions in this process is that there are small temporal changes in the deep water. We realize that this is not always true, and we realize that the transient nature of the CFCs makes the secondary QC difficult. That is why we not only compare deep water values, but also use surface saturation as a criterion for biases. Only offsets in deep water values that are consistent, in direction and magnitude, with offsets detected in the surface saturation did result in an adjustment. We believe that this reduces the risk of erroneously making any adjustment to the data.

The CARINA data base is relatively large, and the secondary QC has been extensive. That is why the CARINA is presented in a special issue with 20 articles, each describing a subset of the CARINA data. This does not mean that other parameters were ignored during the secondary QC process, it is simply not always reported here, for reasons of overview. More details to the process can be found on the CARINA website at CDIAC, [http://cdiac.ornl.gov/oceans/CARINA/Carina\\_inv.html](http://cdiac.ornl.gov/oceans/CARINA/Carina_inv.html).

Specific comments: *(1) Although lines 21 – 25 refer to the CARINA data base there is no reference to the QC standards and procedures for the other parameters. There is only a reference to the WHP exchange format (line14). There is nevertheless a WHP*

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*Manual and accepted standards, so a reference to the quality of the “ancillary data” would have been helpful.*

We have add a link to the WHP Manual (<http://whpo.ucsd.edu/manuals.html>), and references to the other ESSD papers of the Nordic Seas CARINA data, in addition to a reference to Key et al. (2009) describing the overall project. We have clarified that the CARINA merged data product consists only of data that are considered to be of “good” quality.

*Depth or pressure is not referred to, so is it unimportant?*

Pressure is included in the table in the beginning of the paper. No adjustments were made to pressure data, i.e. they are assumed to be correct. However, in some instances it was not possible to find out whether pressure or depth were reported, in other cases, pressure was calculated from reported depth.

*And there is no statement on the precision or accuracy of the CFC data!*

We do state that the analytical precision is, generally, 1-2% (p. 498, line 9), and that we consider the overall accuracy to be within 5% (p. 502, line 4-5). In addition, the CFC data from each individual cruise will be different. If reported, these data can be found in the metadata accompanying the individual cruise files, [http://cdiac.ornl.gov/oceans/CARINA/Carina\\_inv.html](http://cdiac.ornl.gov/oceans/CARINA/Carina_inv.html).

*(2) The description of the crossover analysis is fine (chap 4), nevertheless it could have been used to review the relationship with the other parameters measured.*

As this Special Issue has been planned all parameters are considered separately for the secondary QC. The primary QC, however, does compare several parameters in order to identify outliers. We hope that the CARINA data base will encourage studies of relations between measured parameters. With the CARINA data this can now be done with our best shot at consistency.

*(3) The depth profiles (fig. 2 cont'd) for some cruises show a wider scatter in parts of*  
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*the profiles. This is used to argue time effects (5.1 18HU19829228) or group decisions (5.3 34AR19970805), or linking it to surface saturations arguments (58GS20030922). For (77DN20020420) there are only arguments left about “some problems) that are not detailed.*

There were some analytical problems with the CFC-113 and CCl<sub>4</sub> data from this 2002 cruise, but the actual reason for this is not known. In any case this caused the quality of these data to be too low, and they subsequently got flagged by Bob Key in an early stage of the process. This is now mentioned more clearly in the text.

*(4) To make life easier and avoid the need to crack the expo-code table 1 should have one separate column with the year of the cruise.*

This is a good idea; a year column has now been added in Table 1 and 2.

*So mostly the quality argumentation is internal to the CFC data set; if technical arguments do not hold the argumentation gets close to hand-waving. Almost all cruises that show larger variations in the parameter, property-property plots or against depth levels are in regions with strong salinity and temperature gradients or variations because of the regional highly variable composition of water masses of polar, subpolar or even Atlantic origin. For a serious discussion I would have thought that using the “ancillary parameters” the discussion would have first focused on the possible regional and temporal variations. There are ample publications on the hydrography of the Greenland Sea, Fram Strait, the Arctic Ocean or the Greenland-Island-Scotland Ridge that will be helpful to make that final decision that the CFC data set in part has technical problems.*

It is certainly of importance to evaluate any apparent offsets, and high data scatter, in view of the hydrography and regional variability, and we are well aware of the hydrography in the Nordic Seas, and the references literature. Nevertheless, the deep waters of the region are rather homogeneous, with a relatively small variability. The decision to flag any data as “uncertain/bad” (primary QC) is taken after careful consideration of all available quality assessment tools; surface saturation, inversion, depth profiles and

prop-prop plots. As stated above, any decision of an adjustment has here mostly been based on comparison between the results of the inversion and the calculated surface saturation. This should reduce the dependency on variability since it is less likely that variability in the surface layers and the deep layers are consistent.

*For consideration: I suggest to the authors to consider this additional analysis and argumentation. From ESSDD announcements I see that other parts of the CARINA projects are being presented. AS a simple reader of this paper under review should O read all the others or can't the authors give some key findings on the contents, quality, and relevance of the other parts of the CARINA data sets?*

As mentioned above this work is a part of a larger Special Issue dealing with the CARINA data, for all the three geographical regions included in the data product. The other papers in this special issue gives detailed information on various parameters and regions, that one need to read to fully understand what went into the CARINA work. However, two papers in this special issue is overarching and covering the CARINA project as a whole (Key et al, 2009) and the methodology deployed (Tanhua et al., 2010).

*The editors might also consider how the objectives of ESSDD to provide a reference platform for scientific data sets can be better focused to avoid single data set presentations that obviously are not in the context of what essentially is physical oceanography. It is about measuring a parameter in sea-water! No regional, no temporal, nor hydrographical background is used.*

This comment is not pointed toward the authors; however, one of the aims of the journal is to publish original data, or data collections which are of sufficient quality and potential impact to be used by the Earth System Science community. It is important to point out the criterion of "potential impact" in the guide lines for ESSD; this will hopefully be a filter against unfocused and small data sets to get published. The way the CARINA issue is planned is much in line with this. The aim of the journal, and the publication

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of these data papers, is not only about physical oceanography, but rather to serve an opportunity to give access to observational data in a way that gives recognition to the persons collecting and working up the data, something that has not been possible before in this way. Any interpretation and actual science is left for the next phase in the scientific process.

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Interactive comment on Earth Syst. Sci. Data Discuss., 2, 493, 2009.

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