NORDMEER 86 - RV VALDIVIA cruise 48
CTD observations in the Greenland Sea
Technical Report 2-87
Detlef Quadfasel and Dirk Grawunder
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Summary

This report summarizes CTD data collected during RV "VALDIVIA" cruise 48 in August 1986. The survey area covered the eastern part of the Greenland Sea and Fram Strait. Given are standard level listings of temperature, salinity, potential temperature and density, dynamic height anomaly and Brunt-Väisala frequency as well as profile plots of potential temperature and salinity.
Introduction:

From 1. to 30. August 1986 a large scale hydrographic survey of the eastern Greenland Sea and Fram Strait was carried out from RV VALDIVIA. This cruise 48 (NORDMEER 86) was part of a long term study of the "circulation, transformation and convection of water masses in the North European Polar seas", carried out by the Institut für Meereskunde during 1986 to 1988. The program is part of a special research project (SFB 318 at the University of Hamburg) on climate dynamics.

The major aim of VALDIVIA cruise 48 was to map the vertical distribution of temperature, salinity and dissolved oxygen in the Greenland Sea as a measure of the large scale circulation and transports. A first account on the regional circulation has been given by Quadfasel and Meineke (1987), based upon measurements with expendable bathythermographs.

Along six sections a total of 69 CTD profiles were taken (Figure 1). Four of these sections crossed the Arctic front that separates the Greenland Sea gyres from the warm and salty northward flowing Norwegian Atlantic and Westspitsbergen Currents. The sections were designed to form three closed boxes to allow calculation of transport budgets. Usual station spacing was 30 nautical miles except along the Fram Strait section at 78°50' N where sampling was increased to 15 mile intervals.

During the first two thirds of the cruise the CTD profiles were run to within 5 m of the bottom. At station 86 the conducting wire broke and the CTD was switched to another winch containing only 1100 m of cable. However, the former wire was used to run additional Nansen casts to ensure coverage of the deeper positions of the water column on these stations. These bottle data will be reported elsewhere.

A list of all CTD stations with some background information is given in table 1.

2. Data processing and calibration

The ME-Kiel Multisonde CTD (No 73) used for the hydrographic measurements provided data with a resolution of 0.2 dbar for pressure, 0.0015°C for temperature and 0.002 mS/cm for conductivity. It was supplemented by a Hydrobios
Rosette water sampler equipped with 20 bottles, 10 of which carried protected and unprotected reversing thermometers. Salinity samples were analysed by use of a Guildline Autosal Salinometer. Altogether 1950 water samples and 900 thermometer readings were taken, providing in-situ calibration values for the CTD-data.

The raw data from the CTD were stored directly on digital magnetic tape at a rate of 8 cycles per second. In addition every 8th cycle was logged onto a Kontron PSI 82 computer to serve as basis for quick-look plots and printouts. The latter data were not used in the final data evaluation. Here only the raw data from the undisturbed downcasts were used for further processing.

During the upcasts the CTD was stopped at up to 20 depth levels to operate the rosette sampler. When triggering the bottles the CTD data were averaged over 10 cycles and manually entered into a log sheet. These values were later compared with the sample salinities and thermometer readings.

Following the established procedure of CTD-data processing at the Institut für Meereskunde, Hamburg, these steps were taken:

- conversion of raw data into physical units using the polynomials based on pre-cruise laboratory calibration.
- eliminating all "upcast" data in the downcast profile that were introduced through ships heaving in heavy seas. This reduced the amount of data to about 40 %
- applying the second level calibration polynomials based on the comparison of bottle and in-situ CTD values. The differences between corresponding bottle and CTD values were checked for dependences against pressure, temperature and conductivity.

The resulting accuracies of the calibrated CTD data are then p = ± 3 dbar for pressure, T = ± 0.009°C for temperature and C = ± 0.005 ms/cm for conductivity, corresponding to S = ± 0.006 o/oo for salinity.

- eliminating spikes in the profiles by running a 7 point median filter (Sy, 1985). This filter gets rid of spikes but keeps sharp gradients in the profile as they are often observed in the upper thermo- and halocline of the
Polar ocean.

- Calculating salinities from the pressure, temperature and conductivity data by using the UNESCO (1983) algorithm. The median filter was then also applied to the salinity profiles.

- All data were then averaged over 2 dbar intervals centered at 0, 2, 4, 6... dbar etc. Missing values were linearly interpolated and near the surface extrapolated, respectively.

This 2dbar step data set of temperature, conductivity and salinity served as a basis for further computations and analysis.

3. Presentation of data

The final data are presented in the form of standard level listings and plots of potential temperature and salinity versus depth.

Aside from pressure, temperature and salinity the listings contain several derived quantities: depth, potential temperature, density, potential density, dynamic height and Brunt Väisälä frequency. These were calculated using the UNESCO (1983) algorithms.

For the upper 500 dbars the profiles are plotted at an expanded scale to account for the larger vertical gradients of the hydrographic parameters in the upper layers. When near surface salinities fall out of the range of the plot ($S < 34.2 \, {^0}/oo$) the surface value is given as SSS. The reader is then referred to the listing given to the right of the plot.
Acknowledgements:

We like to thank captain and crew of RV VALDIVIA for their valuable support at sea. Andrea Frische, Ingo Harms, Ester Schelenz, Klaus Schulze, Norbert Verch and Norbert Winkel shared the CTD-data acquisition. Fritz Geitner and Jens Meincke determined salinities. Ulrike Rühmkorf typed and assembled this report. Financial support was granted by Deutsche Forschungsgemeinschaft (SFB 318).

References:


Figure 1:

Positions of the CTD stations occupied during RV VALDIVIA cruise 48 in the eastern Greenland Sea and Fram Strait during 1. to 30. August 1986. See table 1 for further details.
Table 1: List of CTD stations

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**Latitude:** 70°29.6  
**Date:** 04.08.86  
**Time:** 09:22  
**Ship:** Valdivia 488
### POT. TEMP. (DEG. C)  SALINITY (PPT)

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### Remarks

- **Valdivia, 188 Station 14**
- **Date:** 04/05/88
- **Time (UTC):** 13:22
- **Latitude:** 75°35.8' N
- **Longitude:** 175°14.8' W

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