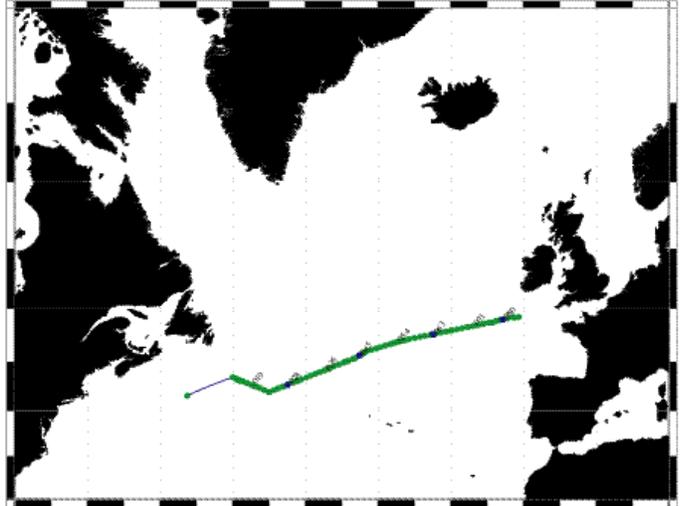


A. Cruise narrative

A.I. Highlights

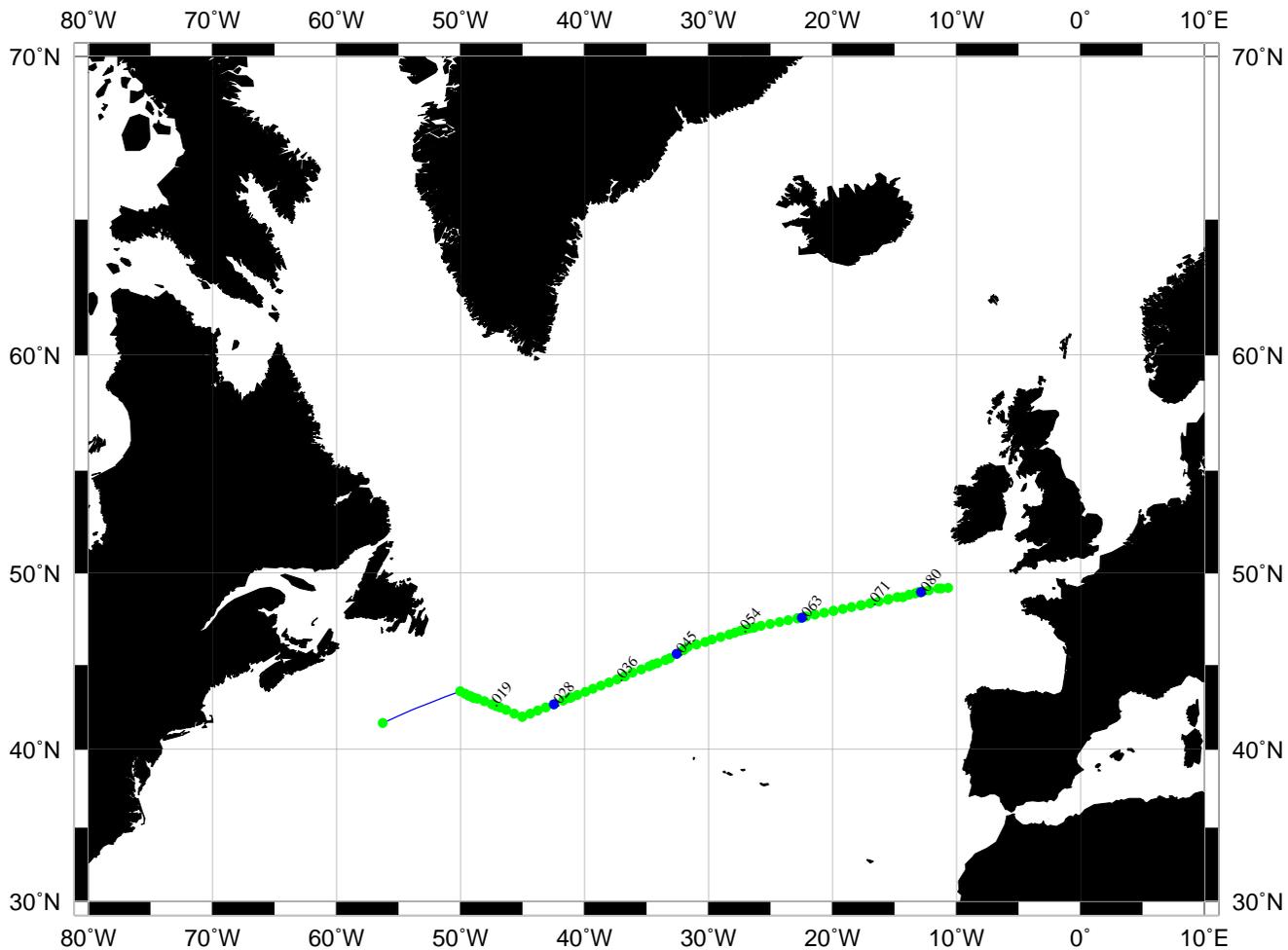
- a. WOCE Line: **AR19**
(repeat equivalent of A02)
- b. ExpoCodes: **06GA226_1**
06GA226_2
- c. Chief scientist: **Alexander Sy, BSH**
- d. Ship: R/V Gauss
- e. Ports of call: Leg 1: Hamburg, Germany to Halifax, Nova Scotia
Leg 2: Halifax to Hamburg
- f. Cruise dates: Leg 1: June 12 to June 30, 1993
Leg 2: July 4 to July 31, 1993



A.2. Cruise Summary Information

- a. Geographic boundaries:
48°N - English Channel to Newfoundland
- b. Stations occupied:
 - 46 XCTD casts to 1000 m (leg 2)
 - 114 XBT casts to 2000 m (leg 2)
 - 75 CTD/rosette stations (leg 1)
- c. Floats and drifters deployed:
Ancillary work included the deployment of 10 surface drifters in the North Atlantic Current. On July 8 and 9 all 10 surface drifters were deployed along the section between 42° 55.4'N, 48° 05'W and 42°22'N, 46°16.4'W.

Station locations for AR19: SY, 1993



Produced from .sum file by WHPO-SIO

d. Moorings deployed or recovered:

A total of five full-depth moorings off the Irish Shelf and west of the Mid Atlantic Ridge (MAR) were deployed. Full-depth, long-time moorings were deployed at the following locations:

Name	Date	Position
G1	June 16	48° 56.0'N 12°56.4'W
G2	June 17	48° 50.0'N 13°59.9'W
K1	June 20	46° 21.7'N 29°59.3'W
K2	June 21	45° 56.4'N 31°49.0'W
K3	June 22	45° 20.4'N 33°15.7'W

A.3. List of Principal Investigators

Measurement	Principal Investigator	Institution
Salinity	A. Sy and H. Bartmuss	BSH
Oxygen	A. Sy	BSH
Nutrients	D. Machoczek	BSH
CTD/02	P. Koltermann	BSH
Thermosalinograph	D. Machoczek	BSH
XBT/XCTD	A. Sy	BSH
Meteorology	A. Sy	BSH
Bathymetry	Surveying group	BSH
Moorings	A. Sy	BSH
Drifters	G. Stelter and Krauss	BSH/IfMK

A.4. Scientific Programme and Methods

Cruise # 226 by RV "Gauss" (call sign: DBBX) was a contribution by Germany's Bundesamt für Seeschifffahrt und Hydrographie (BSH) to the World Ocean Circulation Experiment (WOCE) Hydrographic Programme within the German research programme METRANA (Meridional Transports in the North Atlantic). The cruise began on June 12 in Hamburg and finished there on July 31, 1993. The scientific objectives of the cruise were to carry out a CTD [WHP section AR19 (A02)] and a high density XBT/XCTD survey (VOS line AX-3) from the Irish Shelf to the Newfoundland Shelf. Sampling along the A02 hydrographic section was designed to meet the WOCE requirements for repeat surveys. "Gauss" cruise 226 was successful and the data quality is good. The captain of the vessel on leg 1 was Walter Fietz and on leg 2 Klaus-Peter Walde.

The hydrographic section was to measure the northward flow of the North Atlantic Current and the southward recirculation. The cruise aims to improve the scientific knowledge of the distribution and sources of water masses, and their flows, velocities and patterns by obtaining high-accuracy measurements of temperature, salinity and dissolved oxygen and nutrient content. These data will be used to estimate geostrophic velocities and transports, and to map

water mass properties with which the circulation over the entire depth, particularly of the deep basins, can be deduced.

Besides providing estimates of the water mass characteristics, their spreading paths and mixing history as a snap-shot in summer 1993, the data from this cruise are to be compared with historic data sets and with future repeats to determine long-term changes in these properties. Furthermore, the transport estimates from the Deep Western Boundary Current array and other current meter arrays will be used to calculate the meridional transports of heat, salt and freshwater through this section as well as changes in these parameters. XBT and XCTD data will be used as a supplement to a high density Ship-of-Opportunity programme run by the BSH since 1988.

CTD station work on the A02 hydrographic section began on July 8, 1993, 01:00 UTC at 43.5 °N, 50 °W and was completed on July 25, 14:00 UTC at 49° 14'N, 10° 40'W (Fig. 1b). 75 stations were occupied along the section. At each station the vertical distribution of temperature, salinity, dissolved oxygen content and nutrient content (N03, sio3 and P04) was obtained using a continuously measuring CTD02-sonde as well as water samples from discrete depths. All CTD profiles were distributed worldwide in near real-time via GTS. For test purposes, 8 CTD profiles were measured before and after the main section work.

CTD data processing is under way and will be finished in summer 1994. The data quality is good and is expected to meet the WOCE requirements. All bottle data were analysed on board except nutrients. Nutrient samples were stored in a refrigerator until analysis at AWI (Alfred-Wegener-Institut für Polar und Meeresforschung, Bremerhaven, Germany).

The CTD section reveals considerable changes in the water mass characteristics at intermediate depths since the early 1980s. Labrador Sea Water (LSW), with its clear oxygen and salinity signal, was now found at depths of more than 2000 m in the western basin. Its core temperature was about 3.2 °C. Compared to the last section of comparable quality, worked by the Canadian-CCS 'Hudson' on cruise 82-002 in April 1982, the LSW properties in the western basin are markedly different (Fig. 3). Most conspicuous is the depth of LSW east of Newfoundland that increased by 700 m from about 1400 m in 1982 to more than ~2100 m in July 1993. The temperatures are 0.4 to 0.5 °C cooler, and salinities are only slightly lower, by less than 0.01.

The decrease in changes when crossing the Mid Atlantic Ridge into the eastern basin is also remarkable. Immediately east of the MAR, the LSW is found almost at the same depths of about 1800 m as in 1982; the temperatures are some 0.1°C cooler and salinities have decreased by about 0.01 to 0.02.

A.5. Major Problems and Goals Not Achieved

No serious technical problems arose and no heavy weather interrupted the station work.

A.6. Other Incidents of Note

None noted.

A.7. List of Cruise Participants

Name	Position	Responsibility	Leg	
Andreev, Anton	Oceanographer	Hydrography	1	2
Baering, Stephan	Student	Hydrography		2
Bartmuss, Hans	Technician	Salinity		2
Gottschalk, Ilse	Technician	Hydrography		2
Grothusen, Jan	Student	Hydrography		2
Horn, Ines	Technician	Oxygen		2
Klein, Holger	Technician	Moorings	1	
Kramer, Rita	Technician	Oxygen		2
May, Holger	Technician	Moorings	1	
Machoczek, Detlev	Technician	Hydrography		2
Mauritz, Heiko	Technician	Data processing	1	2
Paul, Uwe	Oceanographer	XBT/XCTD	1	
Schmidt, Adam	Engineer	Ships's data network	1	
Stelter, Gerd	Technician	Chief Technician	1	2
Stolley, Martin	Student	Hydrography		2
Dr. Sy, Alexander	Oceanographer	Chief Scientist	1	2
Ulrich, Jurgen	Technician	XBT/XCTD	1	
Weichert, Hans-J.	Technician	Processing software	1	

B. Underway Measurements

B.1. Navigation and bathymetry

Measurements were supplemented by continuous bathymetry records.

B.3. Thermosalinograph and underway dissolved gasses

Measurements were supplemented by continuous SST registrations.

B.4. Expendable bathythermograph and salinity measurements

On June 15, 23:00 UTC, XBT/XCTD work began at 49°N, 10°W and was completed on June 26, 23:35 UTC at 43°N, 50°W (Fig. 1a). The section consists of 46 temperature-salinity profiles down to a depth of 1000 m and 114 temperature profiles down to a depth of 2000 m (Fig. 2). As part of the IGOSS (Integrated Global Ocean Services System) programme, these data

were input into the WMO Global Telecommunication System (GTS) for worldwide distribution in near real-time. Test measurements of XBT and XCTD versus CTD were carried out at several positions.

B.5. Meteorological observations

Measurements were supplemented by standard meteorological observations.

C Hydrographic Measurements

C.1. Instruments

CTDOJRosette:	NBIS MK-IIIB, GO 24 bottle rosette
DSRT	SIS RTM4002 and RPM6000
Salinometer:	Guildline Autosal 8400A
Titration unit:	Metrohm Titroprocessor 686
Nutrients:	Analysis at AWI laboratory
Thermosalinograph:	Ocean Sensors OS200 TSG
Expendable devices:	Sippican MK- 12 acquisition system, Sippican XCTD, Sippican T-7, T-5
Further instrumentation:	ARGOS tracked surface drifters, Aanderaa RCM, Ternpchains, Seabird Seacats

Filename: G226_02 Datum: 23 AUG 01

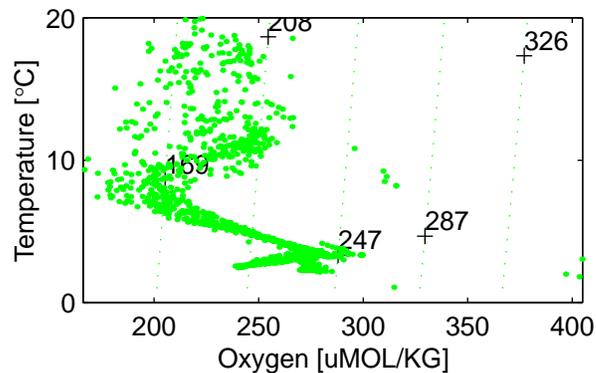
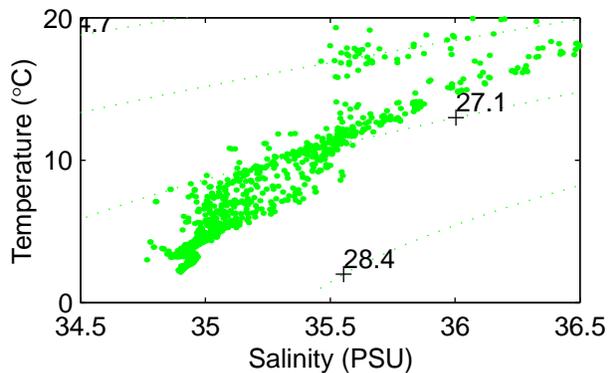
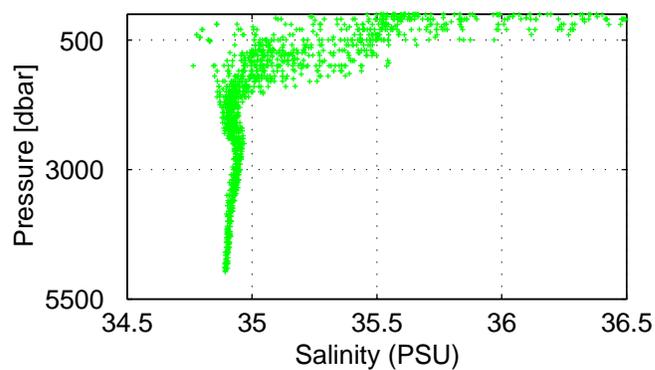
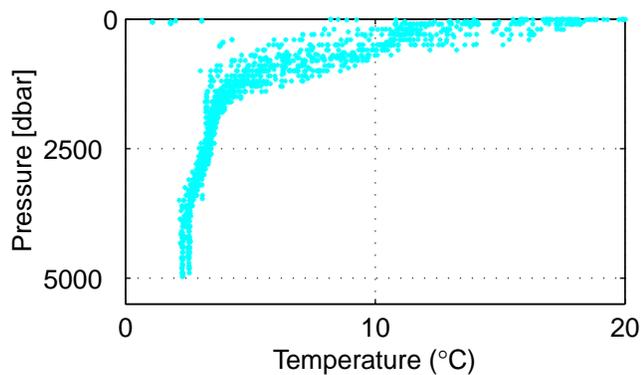
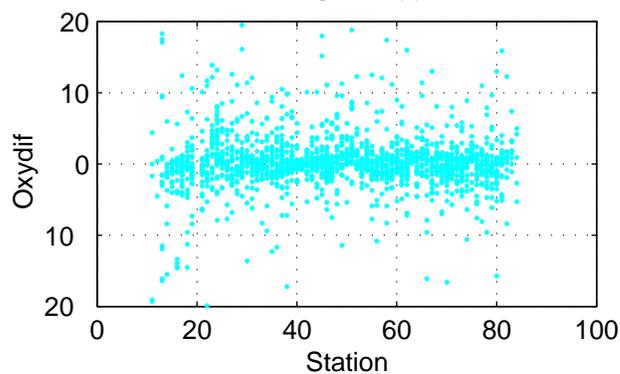
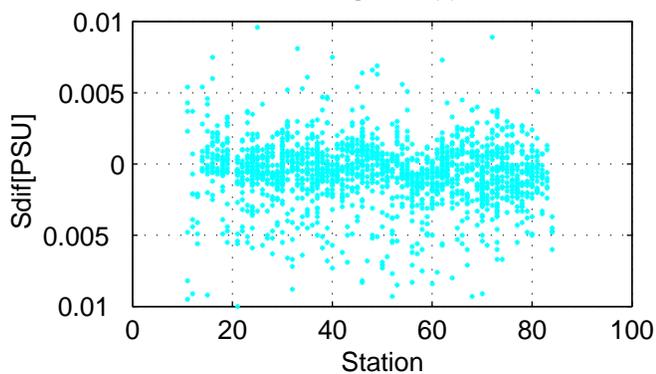
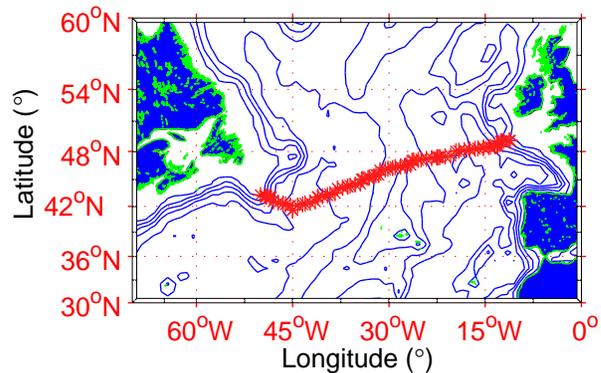
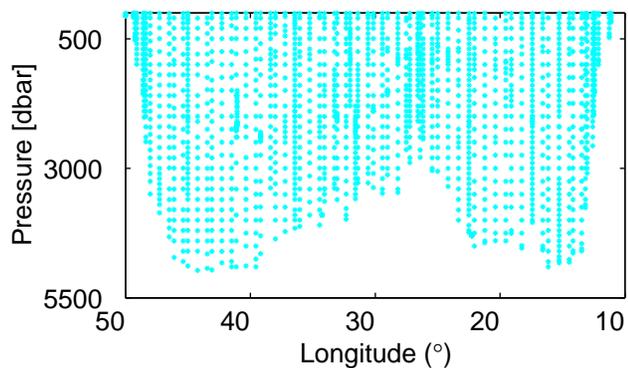
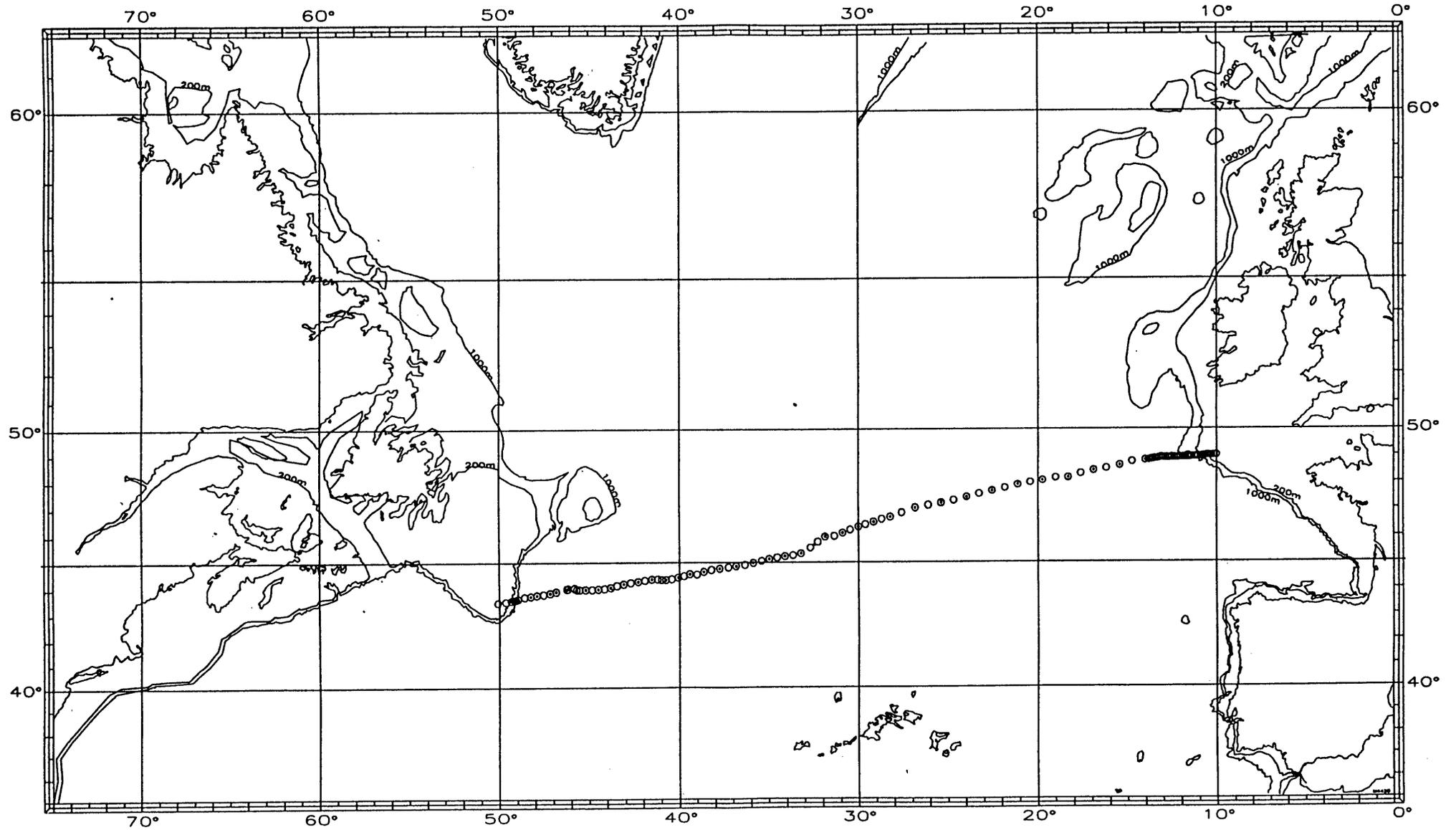


Figure 1a



" F.S. " GAUSS " (DBBX westbound 12.06.1993 - 30.06.1993), Cruise # 226, o XBT, • XCTD

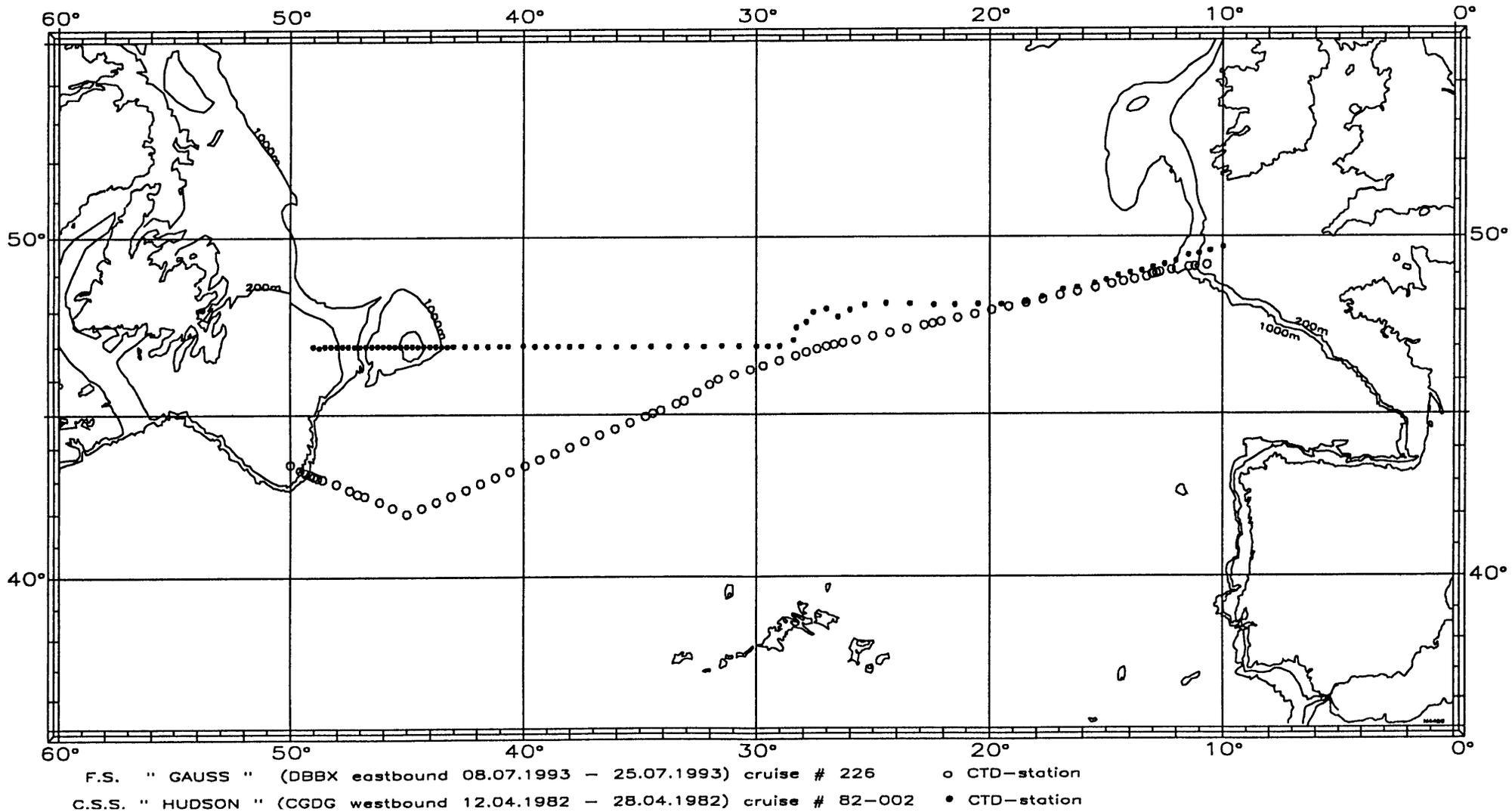
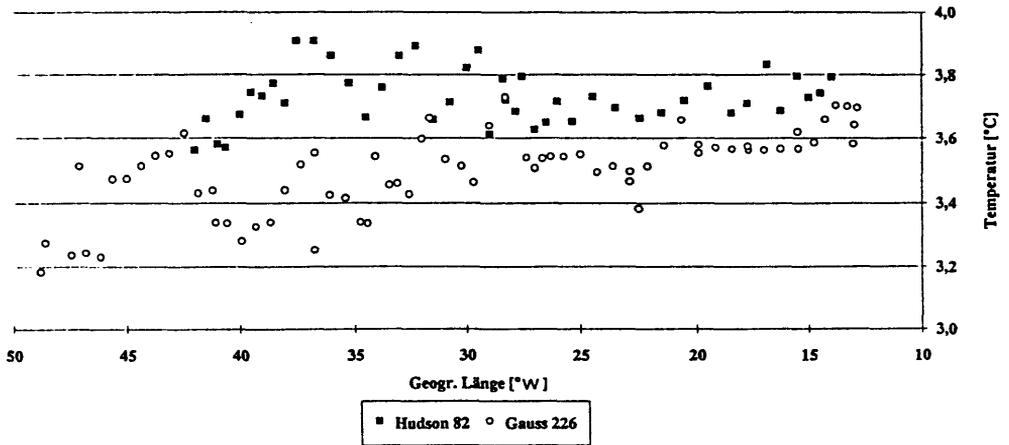


Figure 1b

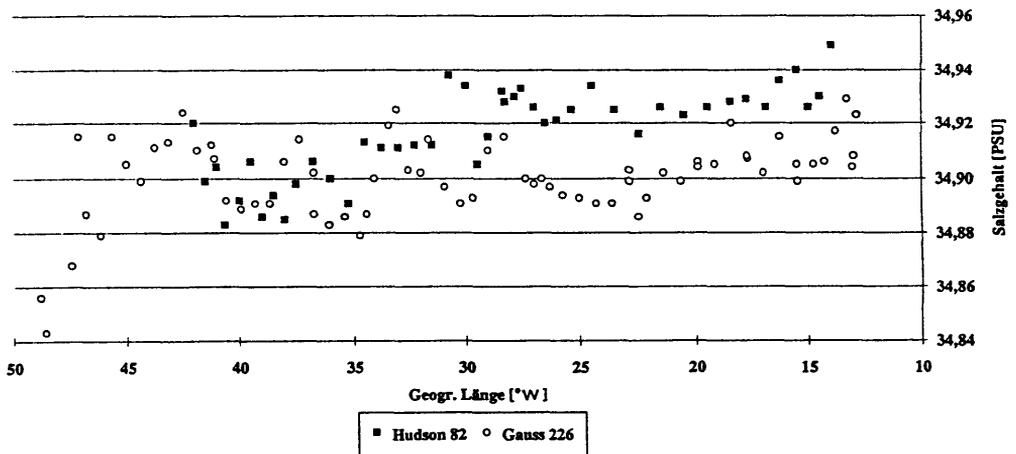
A

Temperaturminimum des Labrador-See- Wassers (LSW)



B

Salzgehaltsminimum des Labrador-See- Wassers (LSW)



C

Tiefenlage des T/S-Minimums des Labrador-See- Wassers (LSW)

