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25 Years of Polarstern Hydrography
(1982-2007)

Eberhard Fahrbach, Gerd Rohardt & Rainer Sieger

with data provided by
Gereon Budéus, Gholam Ali Dehghami, Arnold L. Gordon, Sabine Harms, Gunther Krause, Jens Meincke, Svein Osterhus, Ray G. Peterson, Bert Rudels, Ursula Schauer, Hans-Werner Schenke, Michael Schröder, Jüri Slidam, Manfred Stein, Volker Strass

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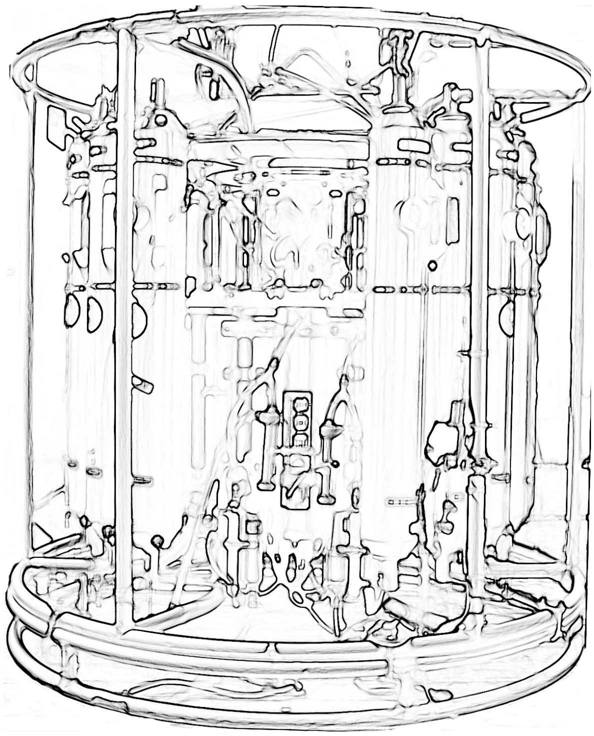

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Diese Zusammenstellung ozeanographischer Daten der Polarmeere, die über 25 Jahre auf der Polarstern gemessen wurden, widmen wir in Dankbarkeit dem Gründungsdirektor des AWI, Herrn Prof. Dr. Gotthilf Hempel. Als "Vater" der Polarstern schuf er die Plattform, die eine Erhebung dieser umfassenden Datensätze in den eisbedeckten Meeresgebieten erlaubte. Als wohlwollender Förderer ermöglichte er uns in einem modernen, leistungsfähigen Institut ihre Auswertung und Publikation.

Eberhard Fahrbach und Gerd Rohardt

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Contents

1. INTRODUCTION

Since her commissioning in 1982 RV *Polarstern* has been operating in the Arctic and Antarctic to carry out scientific research. Between November and March she usually sails to and around the waters of the Antarctic, while the northern summer months are spent in Arctic waters. But also during transits between Bremerhaven and South Africa or South America long-term observations have regularly been performed by using a.o. XBT (Expendable Bathythermograph), CTD (Conductivity, Temperature, Depth), and Thermosalinograph which are standard instruments to carry out hydrographic measurements and are part of the standard instrumentation on board *Polarstern*.

This report presents XBT and CTD profiles as well as sea surface temperature and salinity data recorded with Thermosalinograph during *Polarstern* cruises. In the framework of physical oceanographic studies the measurements were performed as part of international projects (e.g. like WOCE) or to support multi-disciplinary studies.

Over the period of time, from 1983 to 2001, different generations of instruments were used. In addition the data processing was continuously improved. There are also data sets, mainly from foreign groups, where only little background details exist. Details of instruments and the data quality will be discussed in Chapter 2 “Instruments and Data Processing”. Further details can be found in the Cruise Reports which exist as PDF documents, see Chapter 5.

In Chapter 3 an overview about available data from XBT, CTD, and Thermosalinograph is given as a cruise summary with station maps. Examples of temperature and salinity sections are presented in Chapter 4. These plots were made with Ocean Data View (ODV) which is a software package especially designed to view hydrographical data. Download information are given in Chapter 5.

2. INSTRUMENTS AND DATA PROCESSING

2.1 XBT - Expendable bathythermograph

2.1.1 Deck unit and data acquisition

From October 1984 (ANT-III/1) until November 1989 the main XBT system has been from Bathy Systems. The Bathy System controller was linked to a HP85 desktop computer with data acquisition software. Profiles were stored on HP tape cartridges. In October 1990 (ANT-IX/1) the system was replaced by an XBT controller from Nautilus Marine Service (NMS), Bremen. This system comes with DOS based software which stores the XBT profiles on the PCs hard disc. The system is still in use.

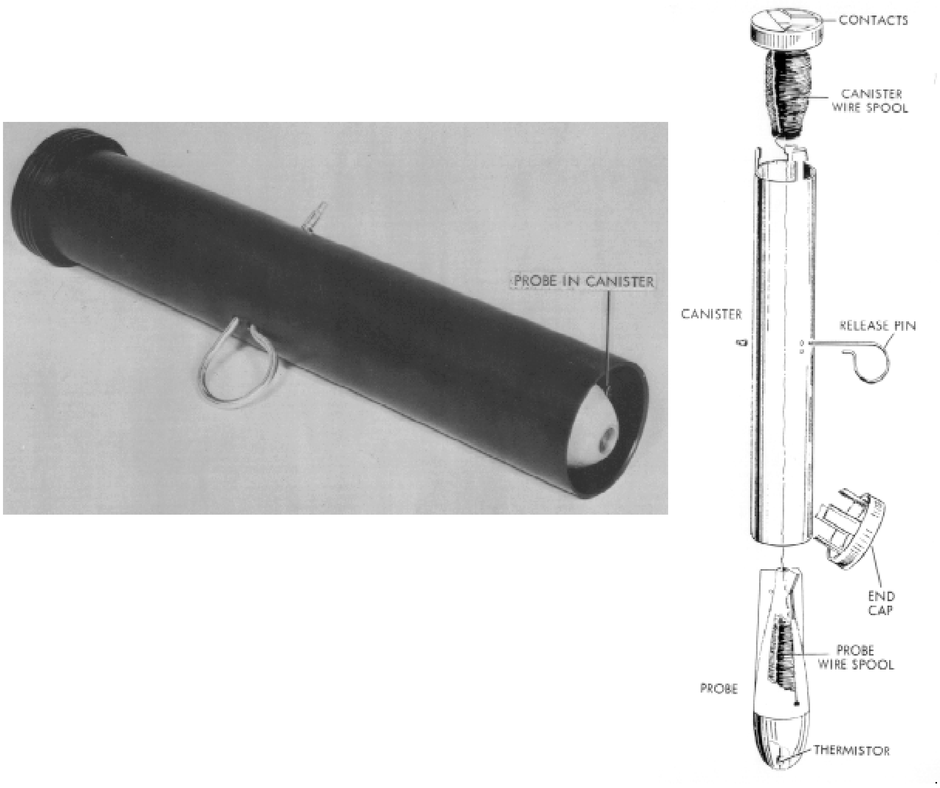


Fig. 1: XBT Probe (www.aoml.noaa.gov)

Bathy Systems was sampling every 0.1 second while NMS's sample rate is 0.125 seconds. Also the conversion from the measured resistance into temperature in °C differs between Bathy Systems (1a) and NMS (1b):

$$T(°C) = 1/(a + b(\ln R) + c(\ln R)^3) – 273.15 \qquad (1a)$$

with
a = 0.00129502
b = 0.000234546
c = 0.000000099434

$$T(°C) = 1/(d + \ln R * (e + f(\ln R))) – 273.15 \qquad (1b)$$

with
d = 0.00134079
e = 0.00021604
f = 0.00000238522

Depth is calculated from the time which passed since the probe had contact with the water.

$$D(m) = 6.472t - 0.00216t^2$$

Fig. 2: XBT Hand Launcher (www.sippican.com)

The controller was first installed in the winch control room. It was connected to the ship's data net thus the hand launcher could be connected directly on deck at the launching place, which was stern port side. In rough sea XBTs couldn't be launched from there and therefore the controller was moved into the airgun's compressor room. This room could be reached by the operator from inside. It was much closer to the stern and easier for the operator handling the handheld launcher with the cable. Nevertheless it was too dangerous launching XBTs in bad weather conditions. 1996 a new and bigger compressor room was built one deck above the working deck. Together with this conversion a plastic pipe was installed from the compressor room to the stern ending over board at about 1.5 m height above the working deck. Through this pipe XBTs could be launched under all circumstances.

Sippican T7 (Deep Blue) probes have been used during almost all cruises except a few when probes from Sparton/Canada were available. Details are given in Table 2 in Chapter 3.1.1. XBT probes measured profiles up to 800 m depth.

Station data were added to the XBT data file after the launch manually. There are data terminals in all laboratories on board *Polarstern* displaying all the needed information. The operator locks the screen of the data terminal just before launching the XBT. By this procedure the station data are fixed to complete the file manually at the end of the launch.

2.1.2 Data processing

All doubtful profiles were removed. Spikes were manually removed using a graphical editor tool. Afterwards the profile was transformed into equal depth spacing of 1 m by linear interpolation. The temperatures of the top 1 to 5 m were replaced by the value measured in 6 m. Comparison of XBT and CTD were investigated resulting in an error of 0.2 K up to 0.7 K (Wisotzki and Fahrbach, 1991).

During the first cruises it was tried to obtain XBT profiles while steaming through the ice. It was found that even thin ice or the obvious ice free wake result in faulty data. Therefore only a very few reliable XBT profiles exist from ice covered areas. In general no XBTs were launched in the sea ice zone.

2.2 CTD – Salinity/conductivity-temperature-depth profiler

2.2.1 Instruments

A CTD is an electronic device which measures the pressure, temperature and conductivity. It is lowered with a winch connected at one-conductor cable. Through this cable the instrument is supplied with power from the deck unit. In parallel the instrument transmits the data to the deck unit. This allows to control the data while the instrument is lowered. The instrument is set up for water depth up to 6,500 meter. A CTD is typically installed inside a round frame carrying up to 24 water sample bottles.

Fig. 3: 24 bottle water sampler; 12 liter size each. The instrument shown here is a SBE32 Carousel. The CTD SBE911plus is mounted vertical behind the bottles.

In the centre of the water samplers carousel, 12 liter size each, there is a “bottle fire unit”. This unit is connected to the CTD. Thus, commands from the deck unit can be sent to the “bottle fire unit”. In this way water samples can be closed by command via the deck unit. Samples were taken during the up cast. The water sampler often is called “Rosette”.

The combination of CTD and Rosette allows checking the CTD data. A laboratory salinometer, e.g. a Guildline 8400B, is able to measure the salinity of water samples, taken from the Rosette, much more precisely than measured by the CTD and without sensor drift. Water samplers also can carry rotating frames with reversing thermometers or reversing pressure meters.

Since 1983 a CTD deck unit contains a processor board doing the data conversion and computing e.g. salinity from pressure, temperature and conductivity. The deck unit also provides the interface to data storage devices. Since 1989 it is a common practise to use PCs for data acquisition and these devices are doing most of the jobs the old deck units did before. With the use of PCs it had become much easier to display the CTD data. During down cast e.g. temperature and salinity versus depth are plotted.

The “bottle fire units” have also been improved. The unit from General Oceanics closed the water samplers in a fixed sequence. It was a mechanical mechanism which often failed - got stuck and than closed two or more bottles at the same time.

In addition the CTD power was interrupted when a command was sent to the bottle fire unit. It took some time until the electronic of the CTD run stable again and CTD data were disturbed or missing just when a sample was taken. The first improvement in this subject was the use of fire modules made by EG&G Ocean Products. This unit did not interrupt the power for the CTD. The unit confirmed a successful bottle fire too, but the disadvantage of the rotating mechanical shift ramp still exists. The “bottle fire unit” was later completely replaced by Falmouth Scientifics “Sure Fire Pylon”. Bottles can be closed by sending the bottle number and a clear confirmation was returned. Seabirds Carousel water sampler works in the same way with high reliability. The performance of Rosette/Carousel is of the same importance as the CTD itself because samples taken from the samplers are used to verify the data quality.

All details about the instruments, quality control on board and particular occurrences during the cast are documented in the cruise reports. The cruise reports exist as PDF documents. More information how to access the cruise reports is given in Chapter 5.

2.2.2 Accuracy

The Mark IIIB CTD which was used during cruise ANT-II legs 3 and 4 was lost due to a winch operation failure. Therefore a post cruise calibration was not possible and the accuracy of the data set carried out with this instrument is uncertain.

A new Mark IIIB, SN 1069 was used on cruise ANT-III/3. The comparison of the CTD data with reversing thermometers and salinity samples confirmed the accuracy given by the manufacturer: +/- 0.005 °C for temperature, +/- 0.005 for salinity and +/- 6.5 dbar for pressure.

Neil Brown CTD type Mark IIIB had been used by the AWI for more than 10 years. This instrument was reliable and performed WOCE accuracy (+/– 0.001 °C for temperature, +/- 0.003 for salinity and +/- 3 dbar for pressure). High quality could be achieved only by pre- and post-calibrations. The pre- and post-calibrations, made by Scripps Institute of Oceanography(SIO), La Jolla, began in 1986 for cruise ANT-V/3 and continued until 1995 (ANT-XII/3). The calibration results from SIO reported a systematic error of the temperature channel. The constant temperature correction shows an explicit step at 0 °C. This characteristic was not known before and couldn't be corrected. Since ANT-V/3 corrections were applied by software and later the internal temperature calibration of the Mark IIIB was shifted by -3 °C.

The reliability of the Mark IIIB had a problem in extreme cold conditions. The C-cell was so small that water froze and broke the cell while getting the CTD from water back on deck. During ANT-V/3 hot air was blown over the sensor.

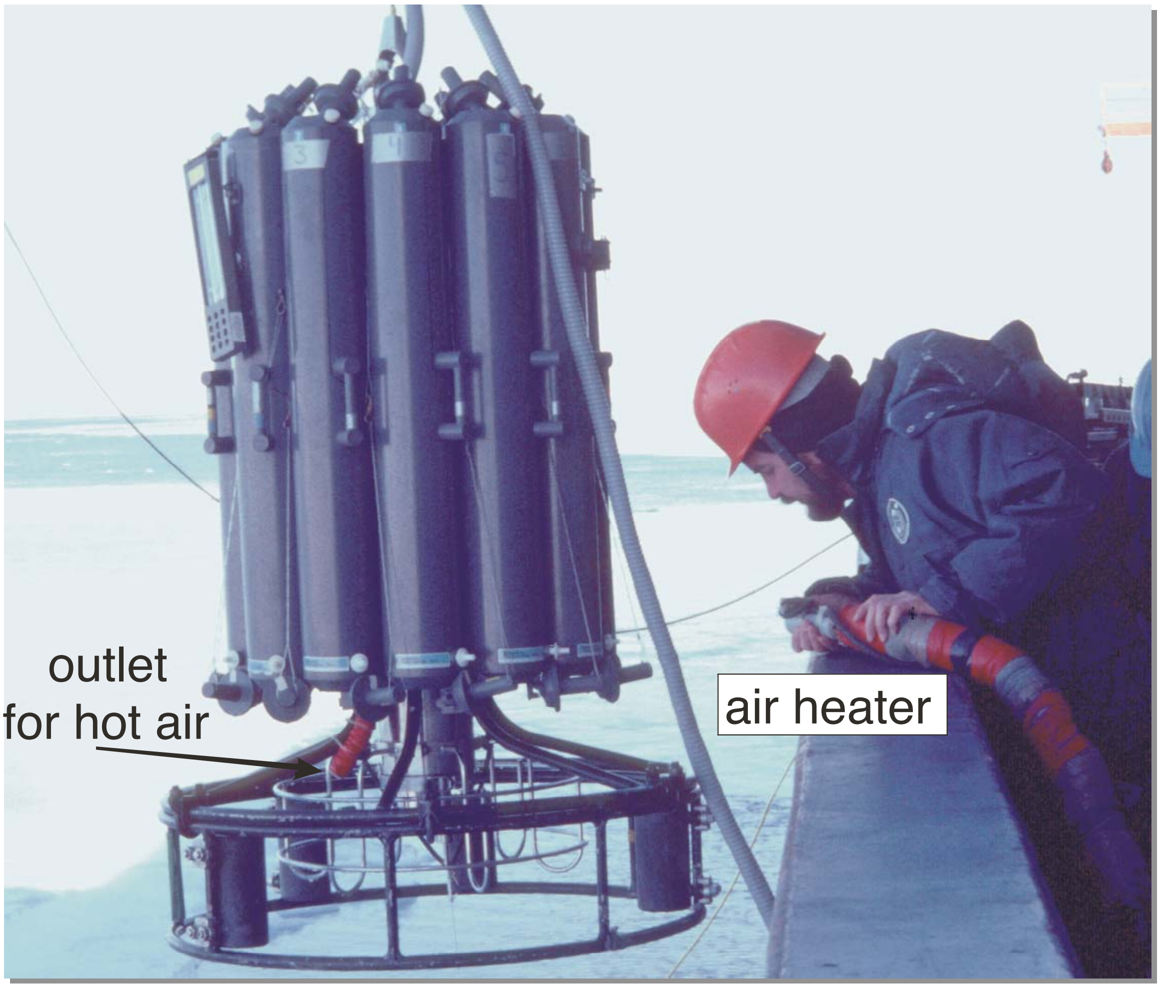


Fig. 4: First exercise with the “hot air” preventing the C-cell for freezing

This prevented freezing and no conductivity cell was broken during the whole cruise. But this method generates a huge hysteresis in the conductivity measurements.

Therefore another tool was developed to protect the C-cell against the cold air. A “cold cover” was build by Hydrobios, Kiel. The “cold cover” is a complete closed housing around the CTD-sensor head. Pressure released cylinders opened or closed the housing at 5 dbar.

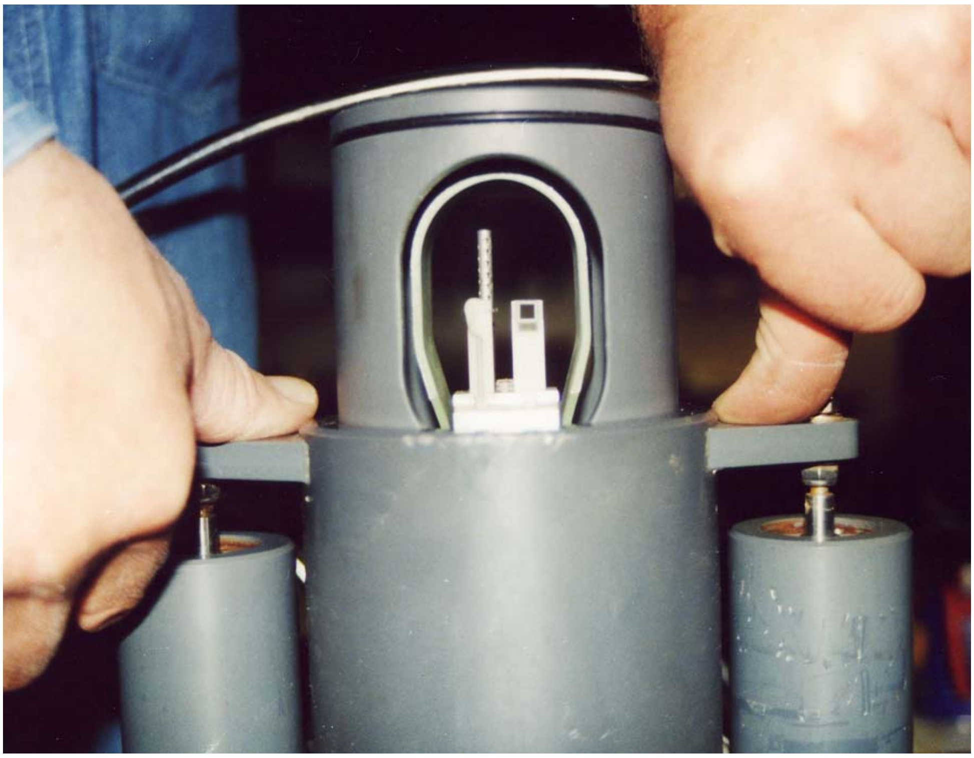


Fig. 5: Cold cover mounted at Mark IIIB CTD. Water pressure greater than 5 dbar forced the housing in the open position which was done here manually by pushing down the pressure releases.

The freezing problem was the essential reason replacing the Mark IIIB by a Falmouth Scientific Triton ICTD with its robust inductive C-cell. SIO continued the pre- and post-calibrations for the ICTD. Compared to the Mark IIIB the pressure hysteresis was negligibly small and made the data processing much easier. The Mark IIIB has a fast response thermistor plus a platinum thermometer. Both output signals were combined in the under water electronics. The advantage of the ICTD was that fast response thermistor and platinum thermometer data are separated in the data record. Further on a redundant platinum thermometer was added. This allows choosing the most stable sensor and adjusting the combination with the fast thermistor.

Since 1998 during ANT-XV/4 CTD a Seabird SBE911plus was used. Seabird's pre- and post calibrations exactly confirmed smallest drift which resulted from salinity samples. The accuracy is better than the WOCE demands. The instrument is equipped with pumped double TC sensor pairs. As soon as an increasing sensor drift became obvious, the relevant sensor was replaced.

Time table of instrument types and their accuracy

1984	Mark IIIB, corrections based on in-situ samples, manufacturer's accuracy
⇩	
1986	Mark IIIB, SIO pre- and post calibration, WOCE accuracy
⇩	
1995	FSI Triton ICTD, SIO pre- and post calibration, WOCE accuracy
⇩	
1998	SBE911plus, pre- and post calibration by SBE, WOCE accuracy and better

Summary of instrument specification given by the manufacturers:

Mark IIIB; Neil Brown Instruments and later EG&G Marine Instruments

	Pressure	**Temperature**	**Conductivity**
Sensor	strain gage bridge	Platinum Thermometer	4 electrode cell
Range	0 to 6500 dbar	-3 to 32 °C	1 to 65 mS/cm
Accuracy	±6.5 dbar	±0.005 °C	±0.005 mS/cm
Stability	0.1 % /month	0.001 °C/month	0.003 mS/cm/month
Resolution	0.1 dbar	0.0005 °C	0.001 mS/cm

ICTD; Intergrated CTD; FSI Falmouth Scientific

www.falmouth.com

	Pressure	**Temperature**	**Conductivity**
Sensor	Precision-machined Silicon	Platinum Thermometer	Inductive Cell
Range	0 to 7000 dbar	-2 to 35 °C	0 to 70 mS/cm
Accuracy	±0.01 % f.s.	0.002 °C	±0.002 mS/cm
Stability	±0.002 % f.s./month	±0.0002 °C/month	±0.0005 mS/cm/month
Resolution	0.0004% f.s.	0.00005 °C	0.0001 mS/cm
Response	25 msec	150 msec[1]	5 cm at 1 m/sec

SBE911plus; Seabird Electronics
www.seabird.com

	Pressure	Temperature	Conductivity
Sensor	Paroscientific Digiquartz®	Platinum Thermometer	4 electrode cell
Range	0 to 6800 dbar	-5 to 35 °C	0 to 70 mS/cm
Accuracy	±0.015 % f.s.	0.001 °C	±0.003 mS/cm
Stability	±0.0015 % f.s./month	±0.0002 °C/month	±0.003 mS/cm/month
Resolution	0.001% f.s.	0.0002 °C	0.00004 mS/cm
Response	15 msec	65 msec[1]	65 msec

2.2.3 Data processing

Mark IIIB and ICTD profiles were processed as described in Mamayev et.al. (1991).
The individual software routines for the CTD processing were continuously adapted to the current available computer hardware and storage devices. During the first *Polarstern* cruises for example data were recorded on magnetic tape. A lot of work and time was needed for the data transfer from tape to the institute central computer. Later PCs came into use and data were stored on hard discs.

Despite of all the rapid development the basic step of data processing software did not change a lot and can be summarized as follows:

truncate profile	In the files the first part of records contains the data obtained while the CTD was still on deck. Then, the CTD was lowered quickly through the waves and stopped to allow the instrument to adapt to the surrounding condition. Typically after 2 minutes the instrument was raised to the surface as far as the wave conditions will allow. From here the profile begins and the first records must be deleted. Towards the bottom the CTD was lowered until the mechanical bottom alarm was activated. This was approximately 5 m above the bottom. The lowering was stopped and the CTD was immediately lifted by ca. 10 m before the recording was terminated. The records from the maximum profile depth to end of file were deleted also.
pre- and post cruise calibration	The pressure - and temperature corrections were applied resulting from the calibration made by SIO or Seabird.

combine temperature (for ICTD only)	While the Mark IIIB did the combination of the platinum thermometer and the fast response thermistor internally the ICTD transmits both of these sensors as separate channels. This allows the user to combine both temperature channels with individual adjustments.
time lag correction	Most of the spikes in the computed salinity profile result from the different time constants of the temperature and conductivity sensors. Most of these spikes were removed applying a digital filter on the pressure - and conductivity records.
pressure reversals	Due to the ships motion the CTD was not lowered with constant speed and sometimes pressure reversals exists in the records. This affects the flow rate through the conductivity cell and along the temperature sensor. Pressure reversals and periods with clearly reduced lowering rate were removed.
averaging	The lowering speed of the CTD was about 1 m/s thus measurements were recorded with a few cm vertical resolution. 1 dbar records were computed by block averaging.
cell correction	Pressure effects on the ceramic conductivity cell which was corrected by applying the cell correction algorithm.
salinity	Compute salt from pressure, temperature, and conductivity
pressure centre	Block averaging did not create equi-distant pressure records. Therefore records were set to constant pressure distant by linear interpolation.
conductivity	Re-compute conductivity from pressure, temperature, and salinity after linear interpolation to constant pressure intervals.
salinity correction	Salinity correction based on salinity samples taking from the water samplers during the up cast

The software for these processing routines was written at AWI and continuously improved during the following cruises.

EG&G Ocean Products took over the production and support for the Mark IIIB which was formerly produced by Neil Brown Instruments. 1989 PC processors were fast enough to acquire all data directly on the hard disc and EG&G

provided a software package for data acquisition and post-processing. A similar package from Falmouth Scientific came up with the use of the ICTDs. Seabird also provides software package for data acquisition and post processing. A detailed description is available on Seabirds website (www.seabird.com).

Density inversions were listed to verify the final data quality. Since most data sets exist from repeated sections, data from new cruises were always compared with all formerly measured profiles. Some areas are characterized by their stable hydrographical conditions which were additionally used to check the data quality.

2.3 Thermosalinograph – Surface temperature and salinity

2.3.1 Instruments

The sea surface temperature measurements reported by König-Langlo et.al. (2006) were measured with sensors inside the box of the fin stabilizer. The so-called Thermosalinograph (TSG) is a device which measures both the surface temperature and the salinity. A temperature sensor and a conductivity cell are placed in a closed housing and surface water was continuously pumped through the housing. Air bubbles should not enter and therefore the water inflow must be sufficient off the surface. The water temperature will rise while it was pumped through long pipes from the inflow to sensor housing. Therefore an external temperature sensor is often placed near the inflow. Since 1984 until 1993 a Thermosalinograph manufactured by Inter Ocean was used. The instrument was first placed at the moon pool. The water was pumped from the moon pool more than 10 meters up to the instrument. It was not clear how long it may last until the water column inside the moon pool was completely exchanged. Therefore the Thermosalinograph was moved into the bow-thrusters tunnel in 1986. Right at the thrusters' tunnel an inlet, outlet, and the plumbing to the Thermosalinograph were installed. Ice was an essential problem. When the inflow was blocked the temperature increased and the salinity decreased due to the melting inside the TSG. The TSG did not work reliable in sea ice covered areas. One of the primary tasks was to reduce the period with ice blocked pipes. It was attempted by changing the flow direction as soon as the normal flow rate decreased. The first system was operated manually and step by step it was modified to a completely self controlled and operating system.

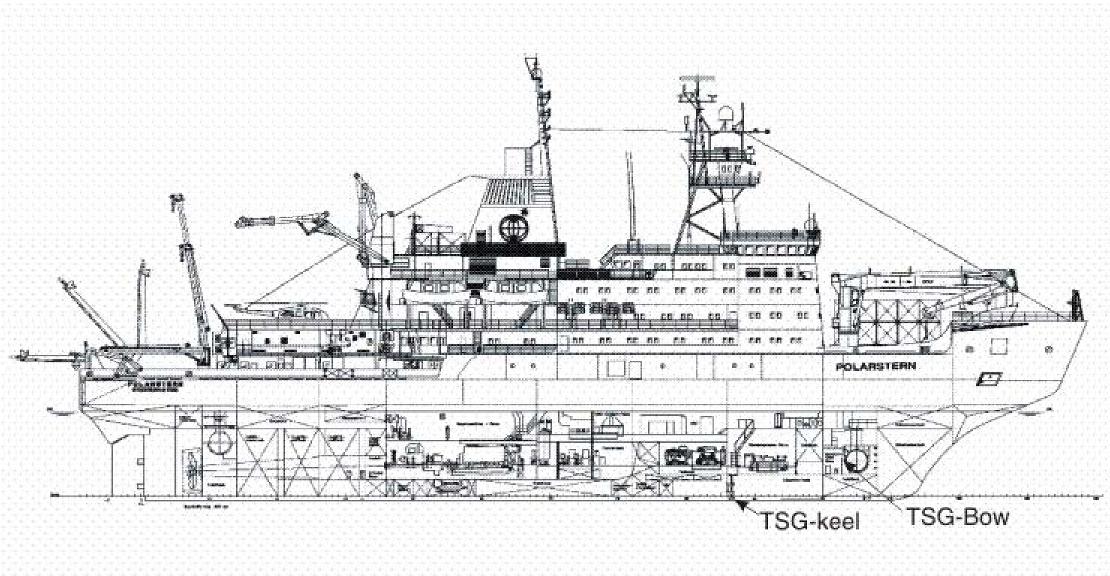


Fig. 6: Side view of POLARSTERN with the location of both Thermosalinographs

1993 the Inter Ocean TSG was replaced by sensors manufactured by ME, Germany. Because blocking inflow by ice still occurred during most of the time when *Polarstern* was operating in ice covered areas a second ME-TSG was placed in the deeper box keel. Here the sample was taken from 11 meters depth compared to the bow-thrusters tunnel TSG which is in about 5 m depth.

Since Seabird sensors were used in CTDs and have been proved as reliable sensors with high accuracy, the TSG system was equipped with Seabird instruments in 2003. The SBE21 was now frequently calibrated by Seabird. There are spare sensors on board. Sensors can now be immediately exchanged as soon as any fault was noticed.

Since May 1993 TSG data have been archived in PODAS. All data recorded before this date exists as the formerly used INDAS file system. Recovering these old data sets still persists.

2.3.2 Data processing

The precision of the TSG data is very much influenced by fouling, ships speed, sea ice conditions and the installation itself. Therefore the sensor specifications given by the manufacturers did not state for the real accuracy. An accurate routine control and correction while running the TSG measuments is essential in getting the most precise TSG record as possible.

Sensor specification given by the manufacturer

SBE21; Seabird Electronics

www.seabird.com

	Temperature SBE38 remote	Temperature	Conductivity
Range	-5 to 35 °C	-5 to 35 °C	0 to 70 mS/cm
Accuracy	0.001 °C	0.01 °C	0.001 mS/cm
Resolution	0.0003 °C	0.001 °C	0.0001 mS/cm

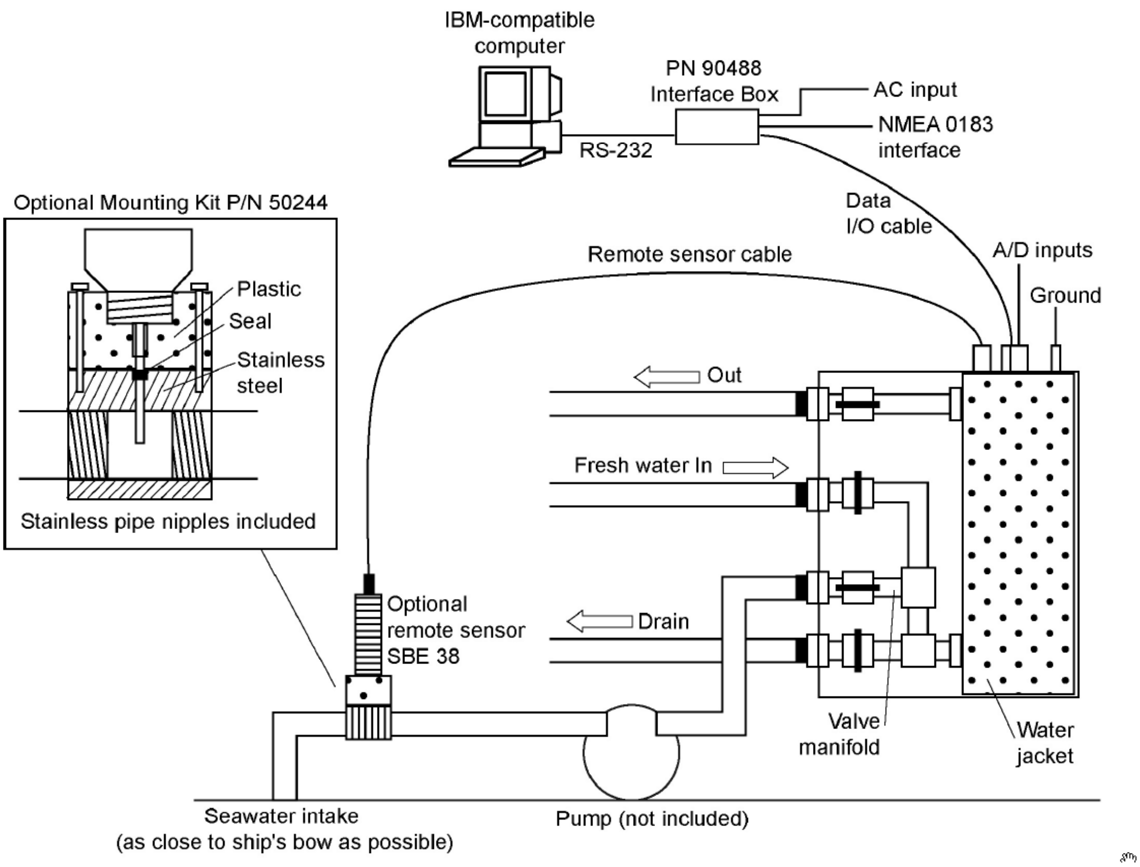


Fig. 7: Sketch of the Thermosalinograph SBE21 installation (Source: www.seabird.com)

Since 2002 water samples were taken once a day from both TSG's – bow and keel by crew members. These samples were measured with the Guildline Autosal 8400B at least every two weeks to determine the salinity correction and to identify possible sensor faults as soon as possible. By this way the TSG is in good service during the whole cruise.

The applied software was developed at the AWI and further improved by Optimare Sensorsysteme to do the final data processing. It works as a graphical editor. TSG records and critical parameters (e.g. ship speed, air temperature and freezing point) are displayed and the following operations can be carried out:

Ship's speed	On stations or even at low speed water temperature rises due to the heat exchange from the ship's hull. Therefore all data are removed from the TSG record when the ship's speed is less than 2 knots.
Blocking by ice	As soon as the inflow of the TSG is blocked it is very probable that temperature and salinity are not correct. All data are removed from the TSG if the temperature is equal to the freezing temperature.
Comparing bow and keel TSG	Density is computed from TSB bow and keel and records with negative density gradient are high lighted. The user can decide whether to remove or keep this record.
Range filter	Unlikely temperature and/or salinity measurements are removed.
Spike filter	Spikes can be removed or can be replaced by linear interpolation.
Salinity correction	The salinity correction derived from the daily samples is applied.

All available TSG records from May 1993 until now have been processed as described. But before 2002 only low quality data had been available because samples from the TSG and Guildline measurements were only taken during cruises with a physical oceanography programme. The sensor drift was constructed from the time series of available corrections and a salinity correction was derived for each cruise.

Optimare Sensorsysteme did the processing of all past cruises. In coordination with the service personnel from Fielax they also processed the data on board *Polarstern* of all current cruises. TSG data processed now are available three months after a cruise is finished. Since 2004 Fielax is responsible for the processing and service on board.

3. CRUISES

In this chapter listings and maps of cruises with XBT-, CTD-, and Thermosalinograph data are presented to give an overview of available data. The tables or maps can be used to search a cruise for a given period or area. Additional tables show further details for each cruise.

3.1 XBT - Expendable Bathythermograph

3.1.1 Summary of XBT Cruises

Tab. 1: Summary of cruises where XBT profiles were carried out; sorted by date

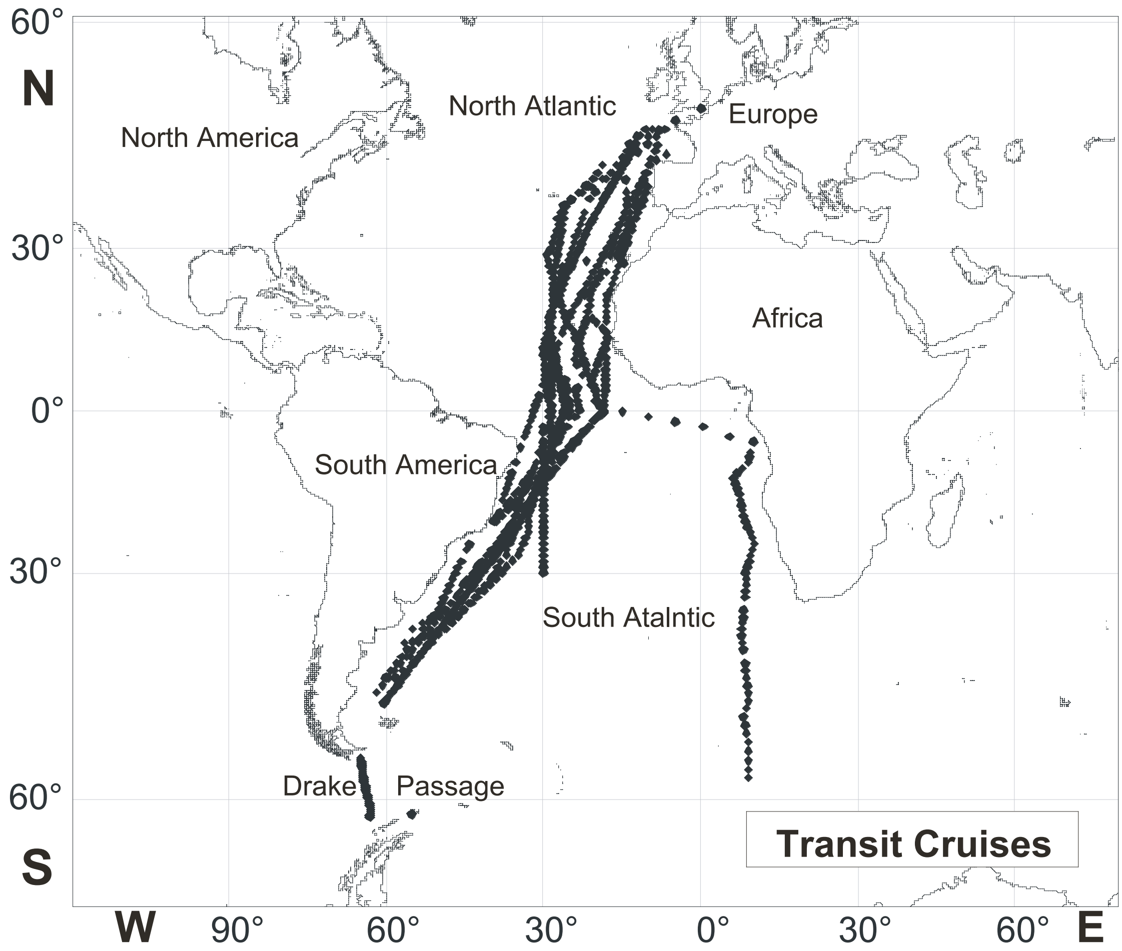
Cruise	from				to			
ANT-III/1	Bremerhaven	9	Oct	1984	Punta Arenas	15	Nov	1984
ANT-III/2	Punta Arenas	14	Nov	1984	Punta Arenas	9	Dec	1984
ANT-III/3	Punta Arenas	3	Jan	1985	Cape Town	5	Mar	1985
ANT-IV/1	Bremerhaven	3	Sep	1985	Rio de Janeiro	4	Nov	1985
ANT-IV/2	Rio de Janeiro	6	Nov	1985	Punta Arenas	2	Dec	1985
ANT-V/2	Bahia Blanca	27	Jun	1986	Cape Town	17	Sep	1986
ARK-IV/1	Bremerhaven	14	May	1987	Longyearbyen	9	Jun	1987
ANT-VI/1	Bremerhaven	24	Sep	1987	Rio Grande do Sul	20	Oct	1987
ARK-V/3b	Reykjavik	2	Aug	1988	Bremerhaven	29	Aug	1988
ANT-VII/1	Bremerhaven	15	Sep	1988	Rio Grande do Sul	10	Oct	1988
ANT-VIII/3	Cape Town	11	Jan	1989	Punta Arenas	1	Dec	1989
ANT-VII/4	Punta Arenas	13	Jan	1989	Cape Town	10	Mar	1989
ANT-VIII/1	Bremerhaven	5	Aug	1989	Puerto Madryn	6	Sep	1989
ANT-VIII/2	Puerto Madryn	6	Sep	1989	Cape Town	31	Oct	1989
ANT-IX/1	Bremerhaven	20	Oct	1990	Punta Arenas	15	Nov	1990
ANT-IX/2	Punta Arenas	17	Nov	1990	Cape Town	31	Dec	1990
ANT-IX/3	Cape Town	3	Jan	1991	Cape Town	29	Mar	1991
ANT-X/1	Bremerhaven	14	Nov	1991	Punta Arenas	3	Jan	1992
ANT-X/4	Cape Town	21	May	1992	Puerto Madryn	6	Aug	1992
ANT-X/5	Puerto Madryn	8	Aug	1992	Punta Arenas	27	Sep	1992
ANT-X/7	Cape Town	3	Dec	1992	Ushuaia	23	Jan	1993
ANT-X/8	Ushuaia	24	Jan	1993	Bremerhaven	23	Feb	1993
ANT-XI/1	Bremerhaven	18	Oct	1993	Cape Town	27	Nov	1993
ANT-XI/2	Cape Town	12	Dec	1993	Punta Arenas	12	Jan	1994
ANT-XI/4	Cape Town	29	Mar	1994	Cape Town	20	Mar	1994
ANT-XII/1	Bremerhaven	18	Oct	1994	Punta Arenas	22	Nov	1994
ANT-XII/2	Punta Arenas	23	Nov	1994	Cape Town	4	Jan	1995
ANT-XII/3	Cape Town	5	Jan	1995	Punta Arenas	20	Mar	1995
ANT-XII/4	Punta Arenas	21	Mar	1995	Punta Arenas	15	May	1995
ANT-XIII/4	Cape Town	17	Mar	1996	Punta Arenas	19	May	1996
ANT-XV/4	Punta Arenas	20	Mar	1998	Cape Town	24	May	1998
ARK-XIV/2	Tromsoe	28	Aug	1998	Bremerhaven	15	Oct	1998
ANT-XVI/2	Cape Town	9	Jan	1999	Cape Town	16	Mar	1999
ANT-XVIII/3	Cape Town	5	Dec	2000	Cape Town	12	Jan	2000
ANT-XIX/2	Cape Town	1	Dec	2001	Punta Arenas	21	Jan	2002

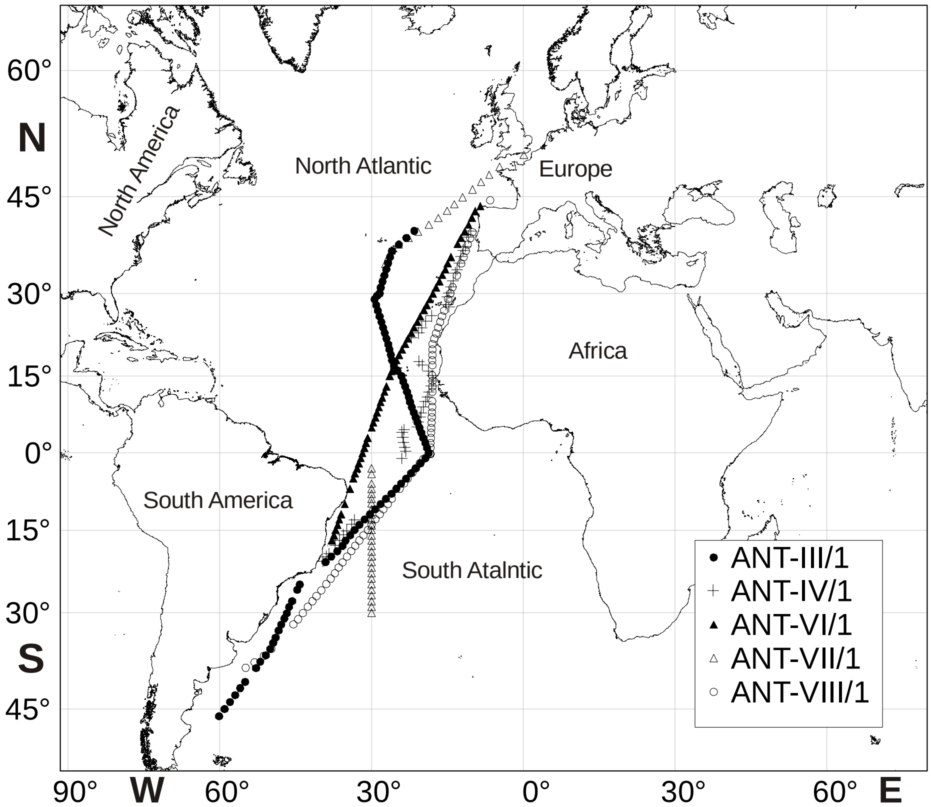
Tab. 2: Details of cruises with XBT measurements. The institution's abbreviation and address are summarised in the appendix**.**

Cruise	Institution	Principal Investigator	Probe	Number of Profiles	Area
ANT-III/1	AWI	Rohardt	Sippican	83	Atlantic Transit
ANT-III/2	AWI	Stein	Sippican	67	Drake Passage Elephant Is.
ANT-III/3	AWI	Rohardt	Sippican	43	Maud Rise
ANT-IV/1 a,b,c	AWI	Rohardt	Sippican	49	Atlantic Transit
ANT-IV/2	AWI	Rohardt	Sippican	43	Rio de Janeiro to Elephant Is. and Drake Passage
ANT-V/2	LDGO	Gordon	Sippican	174	South Atlantic Ocean
ARK-IV/1	AWI	Krause	Sippican	23	Fram Strait
ANT-VI/1	AWI	Rohardt	Sippican	55	Atlantic Transit
ARK-V/3b	UNI-HH	Dehghami	Sippican	7	Greenland Sea
ANT-VII/1	AWI	Krause	Sippican	43	Atlantic Transit
ANT-VII/4	AWI	Rohardt	Sippican	13	Drake Passage
ANT-VIII/1	AWI	Rohardt	Sippican	74	Atlantic Transit
ANT-VIII/2	AWI	Rohardt	Sippican	60	South Atlantic Ocean Drake Passage
ANT-VIII/3	AWI	Fahrbach	Sippican	86	South Atlantic Ocean
ANT-IX/1	AWI	Rohardt	Sippican	95	Atlantic Transit
ANT-IX/2	AWI	Rohardt/	Sippican	142	Cape Town towards Neumayer Drake Passage
ANT-IX/3	AWI	Schröder	Sippican	443	Cape Town towards Neumayer
ANT-X/1 a,b	AWI	Rohardt	Sippican	132	Atlantic Transit
ANT-X/4	AWI	Schröder	Sippican	24	Drake Passage
ANT-X/5	SIO	Peterson	Sippican	65	South Atlantic Ocean
ANT-X/7	AWI	Rohardt	Sippican	202	Cape Town towards Neumayer Drake Passage
ANT-X/8	AWI	Fahrbach	Sippican	157	Atlantic Transit
ANT-XI/1	AWI	Rohardt	Sparton	94	Atlantic Transit
ANT-XI/2	AWI	Fahrbach	Sparton	128	South Atlantic Ocean
ANT-XI/4	AWI	Fahrbach	Sparton	144	South Atlantic Ocean, South of Africa
ANT-XII/1	AWI	Rohardt	Sippican	91	Atlantic Transit
ANT-XII/2	AWI	Fahrbach	Sippican	78	Cape Town towards Neumayer Drake Passage
ANT-XII/3	AWI	Schröder	Sparton	100	Cape Town towards Neumayer
ANT-XII/4	AWI	Sildam	Sparton	142	Bellingshausen Sea
ANT-XIII/4	AWI	Schröder	Sparton	307	South Atlantic Ocean
ANT-XV/4	AWI	Schröder	Sparton	191	Cape Town towards Neumayer Drake Passage
ARK-XIV/2	AWI	Schauer	Sparton	26	Fram Strait
ANT-XVI/2	AWI	Rohardt	Sippican	237	Cape Town towards Neumayer
ANT-XVIII/3	AWI	Schröder	Sippican	83	Cape Town towards Neumayer
ANT-XIX/2	AWI	Schenke	Sippican	5	South Atlantic Ocean

3.1.2 Maps with XBT stations

The following maps show the area and locations of XBT stations carried out during *Polarstern* cruises. The first map presents the summary of all transit sections across the Atlantic Ocean. The next two maps show the transit sections with cruises plotted in different symbols. All other XBT stations are shown as individual maps. The first part starts with the set of Antarctic cruises (page 21 to 33) followed be the set of Arctic cruises (page 34). Both sets of maps are sorted by date and cruise name respectively.

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60°
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North Atlantic
Europe
Africa
South America
South Atalntic
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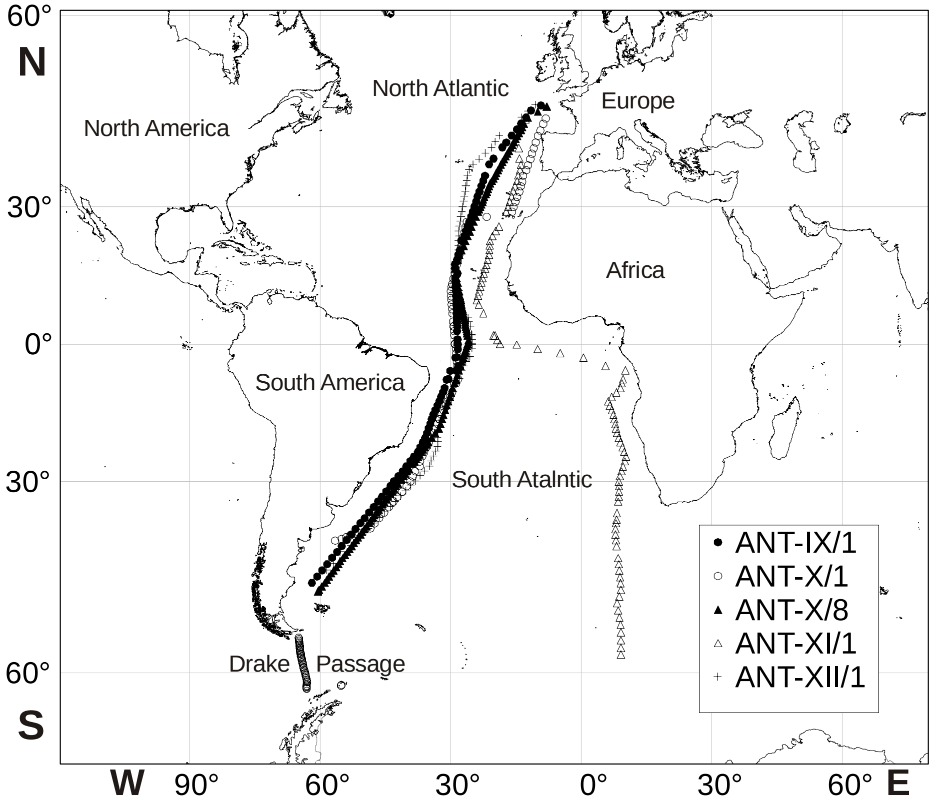
ANT-IV/1
ANT-VI/1
ANT-VII/1
ANT-VIII/1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Africa
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South Atalntic
Drake Passage
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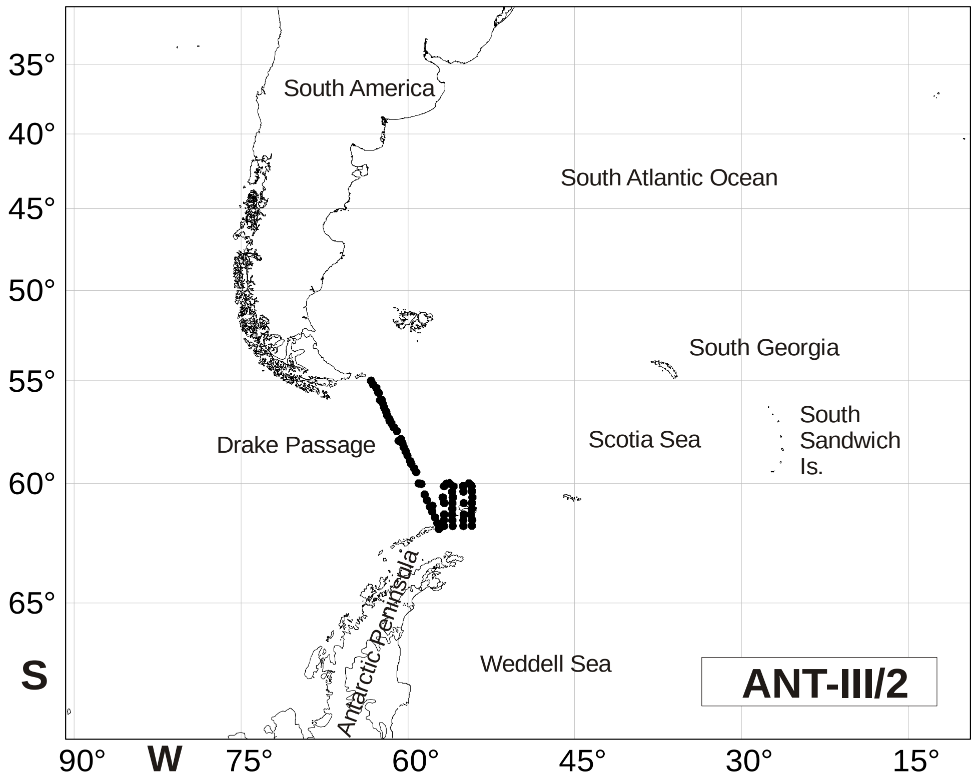
ANT-X/1
ANT-X/8
ANT-XI/1
ANT-XII/1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South Georgia
Drake Passage
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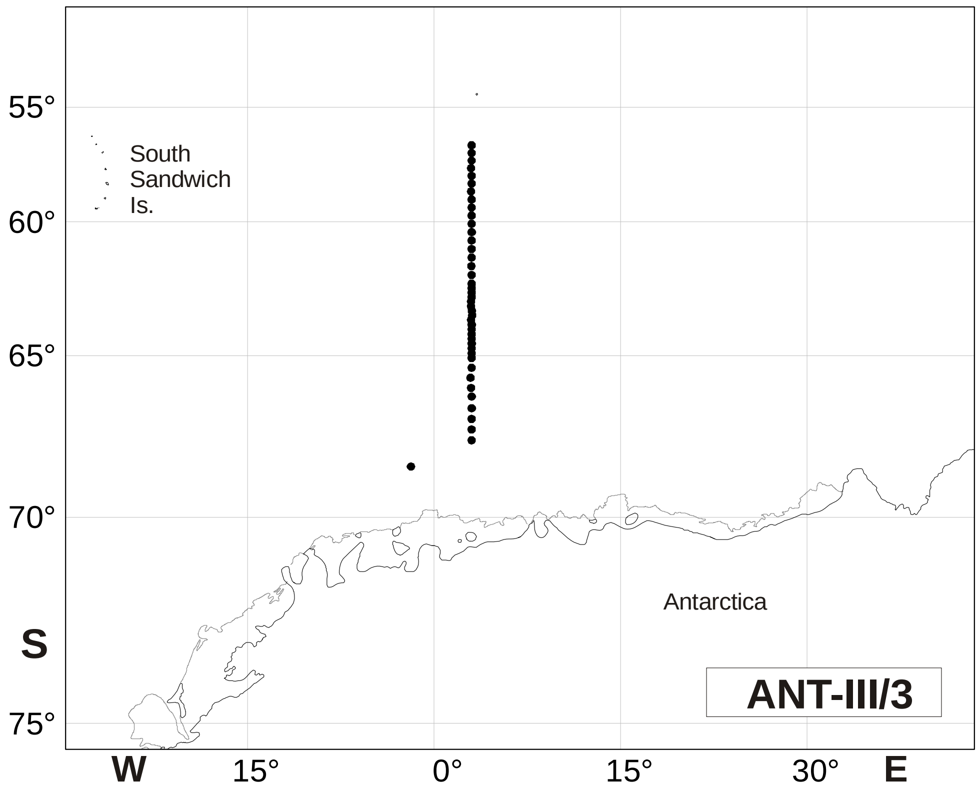
South
Sandwich
Is.
Antarctic Peninsula
Weddell Sea
ANT-III/2
90°
W
75°
60°
45°
30°
15°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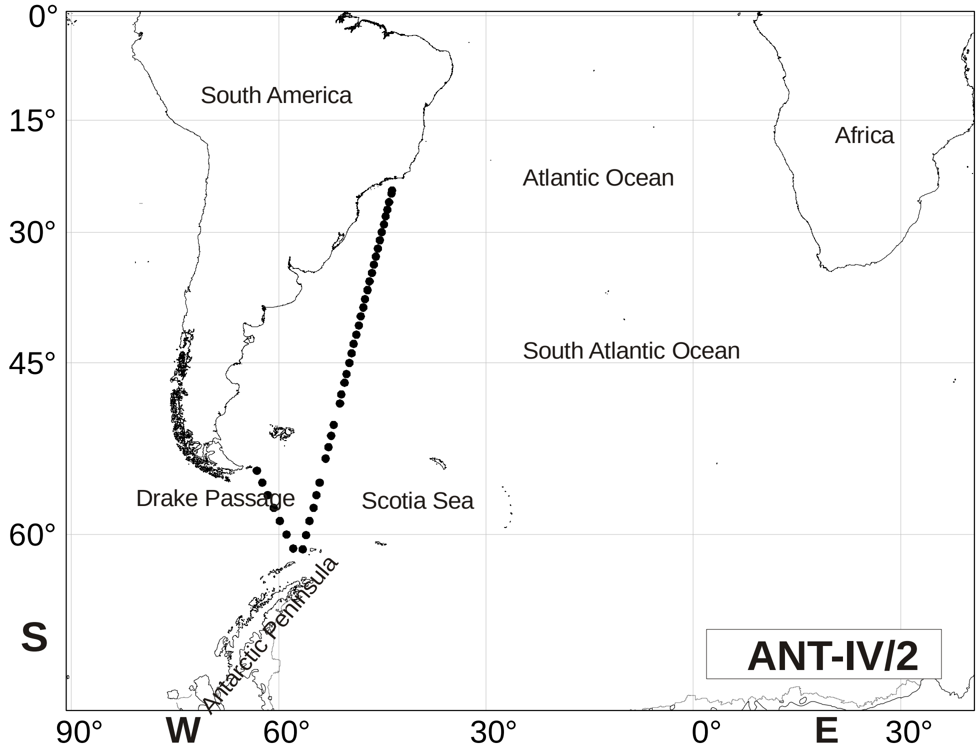
30°
E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E
30°
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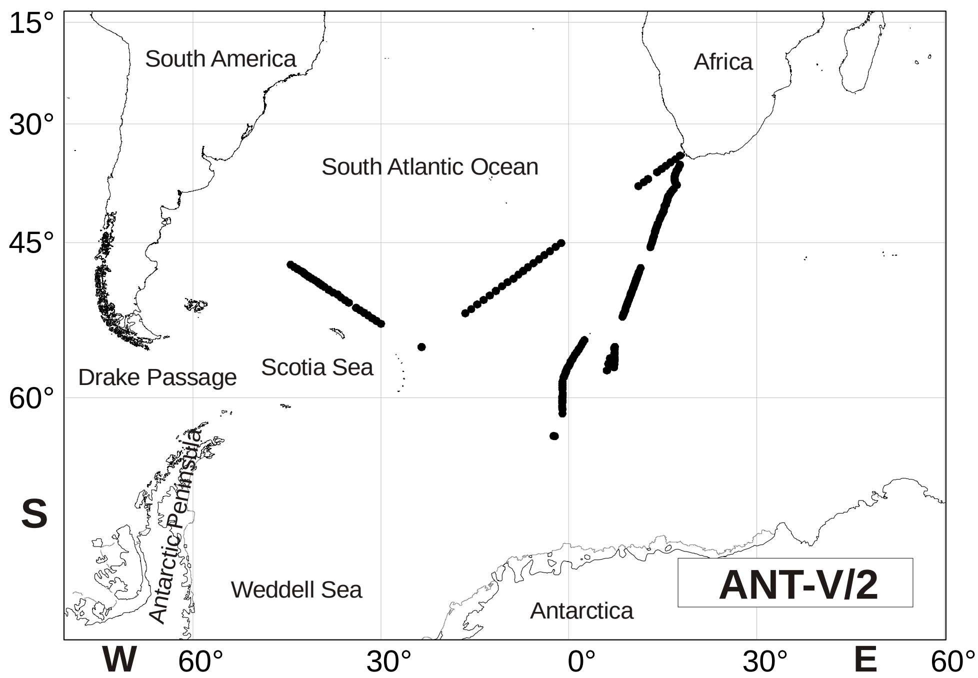
Atlantic Ocean
South Atlantic Ocean
Drake Passage
Scotia Sea
Antarctic Peninsula
ANT-IV/2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Africa
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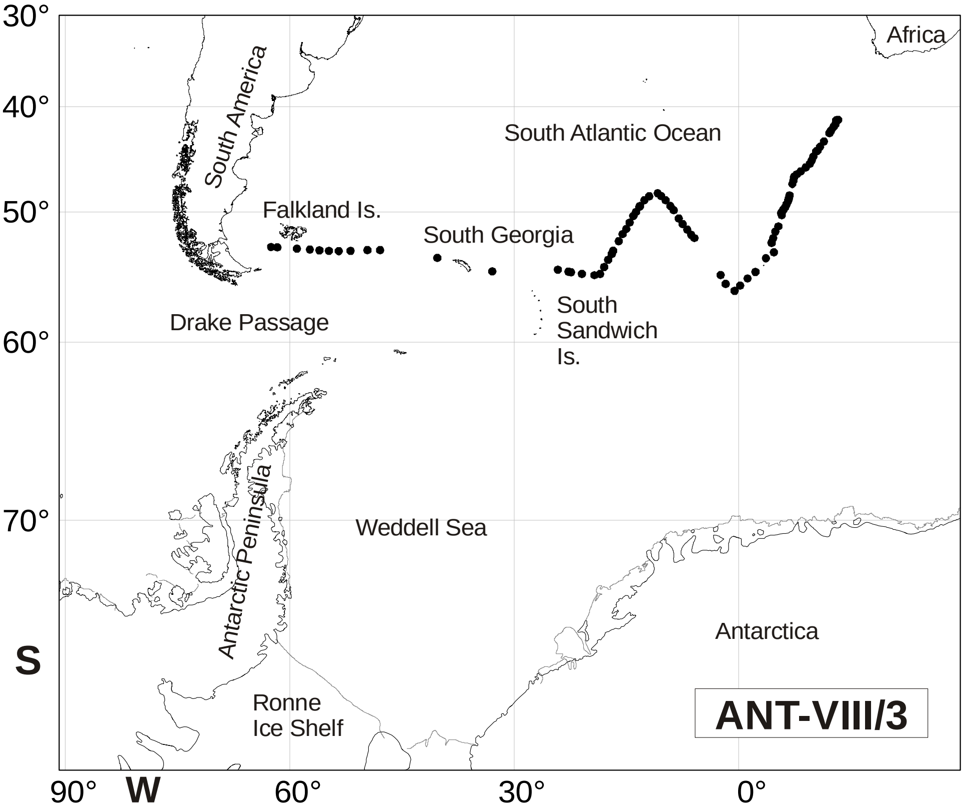
Drake Passage
Scotia Sea
Antarctic Peninsula
Weddell Sea
Antarctica
ANT-V/2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70°
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W
60°
30°
0°
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South America
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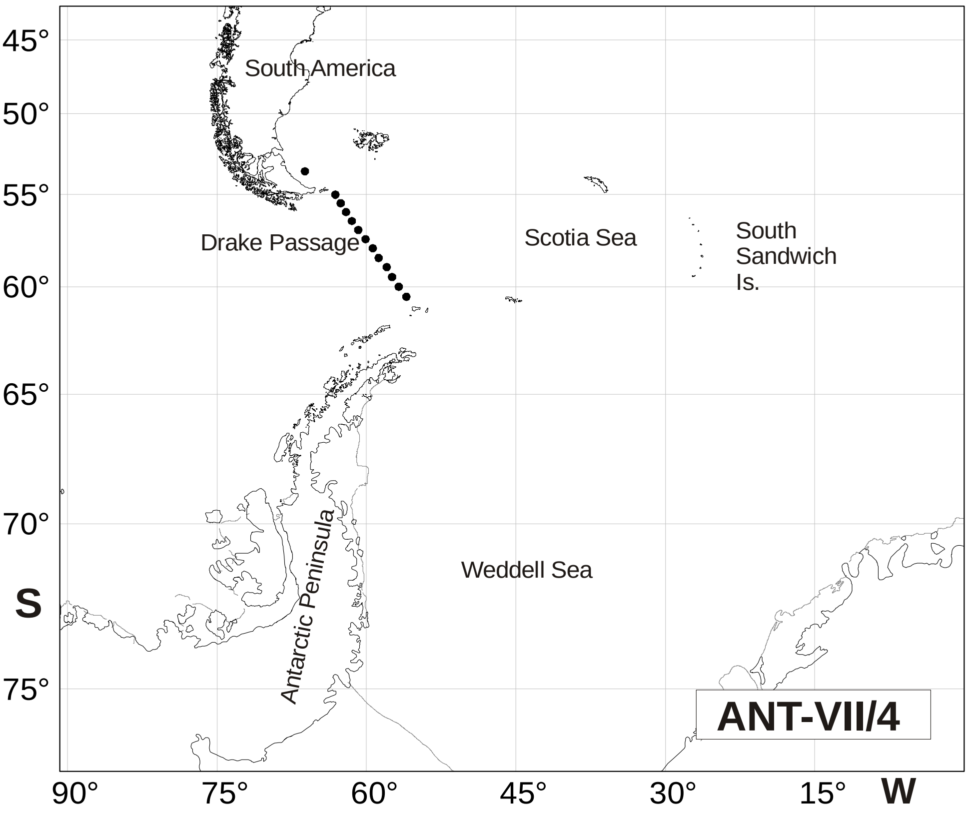
South Georgia
South
Sandwich
Is.
Drake Passage
Weddell Sea
Antarctic Peninsula
Antarctica
Ronne
Ice Shelf
ANT-VIII/3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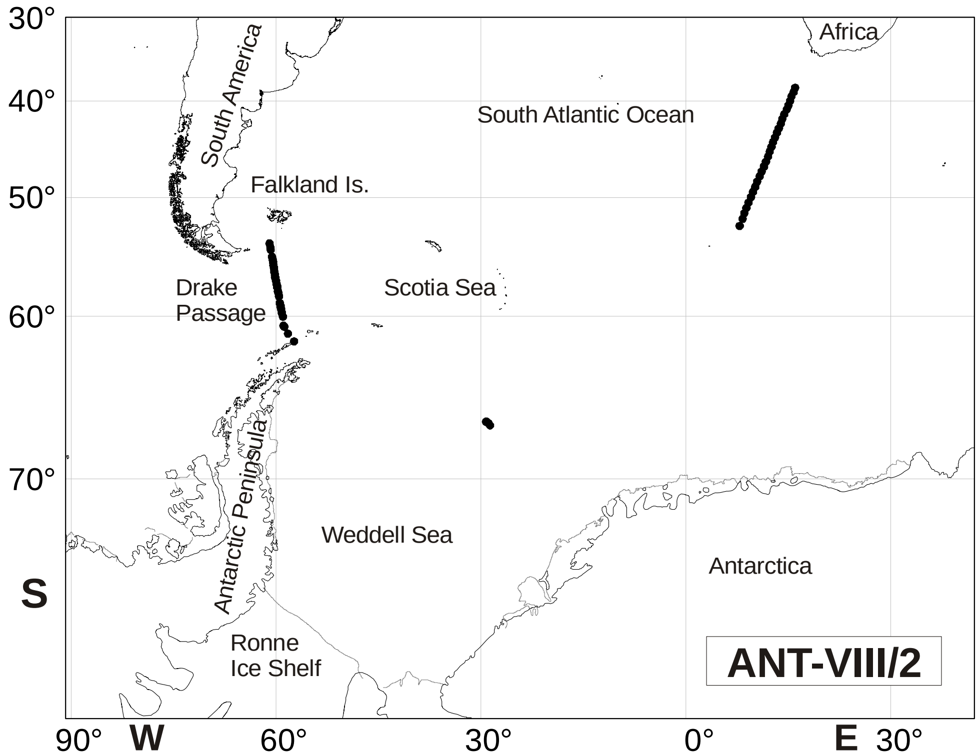
South
Sandwich
Is.
Weddell Sea
Antarctic Peninsula
ANT-VII/4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Passage
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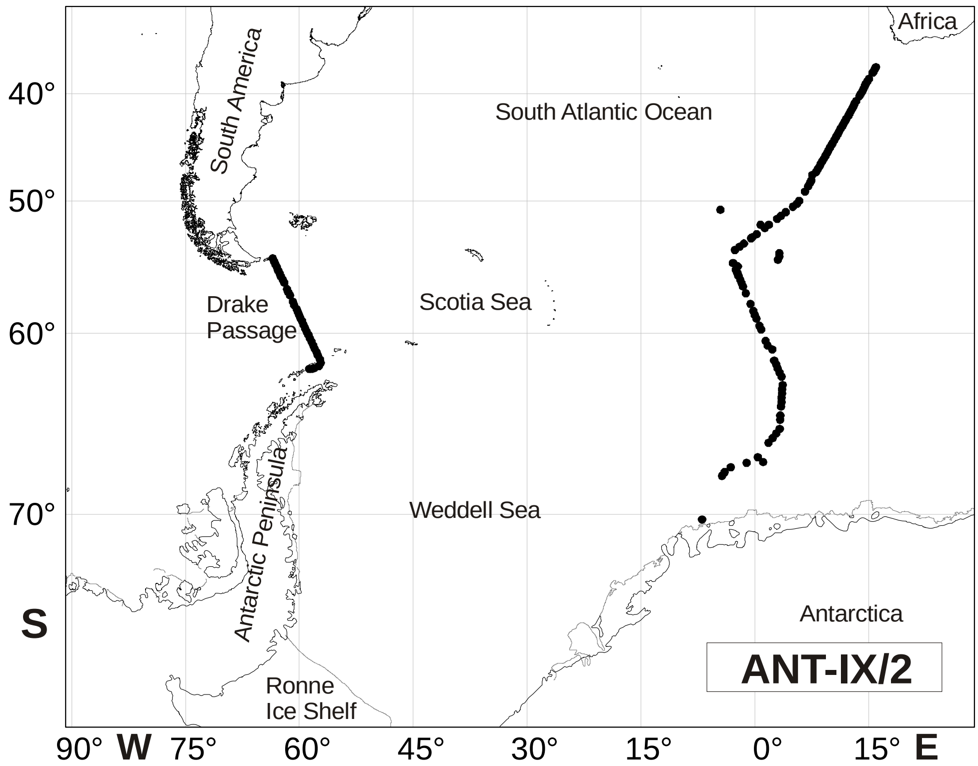
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Passage
Scotia Sea
Antarctic Peninsula
Weddell Sea
Antarctica
Ronne
Ice Shelf
ANT-IX/2
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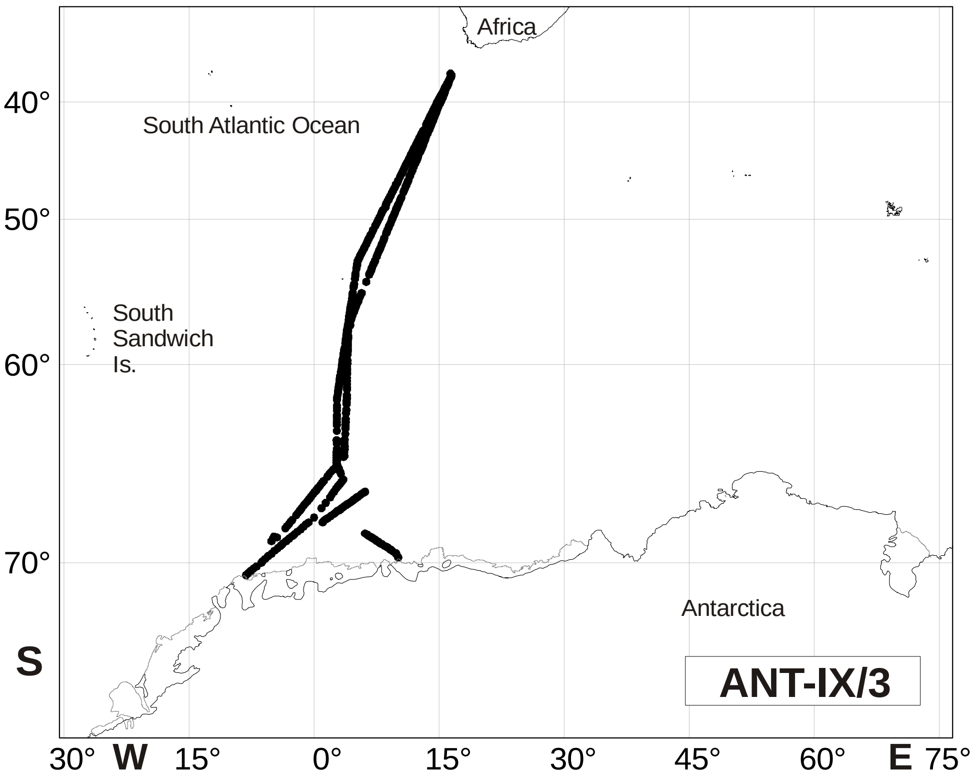
60°
45°
30°
15°
0°
15°
E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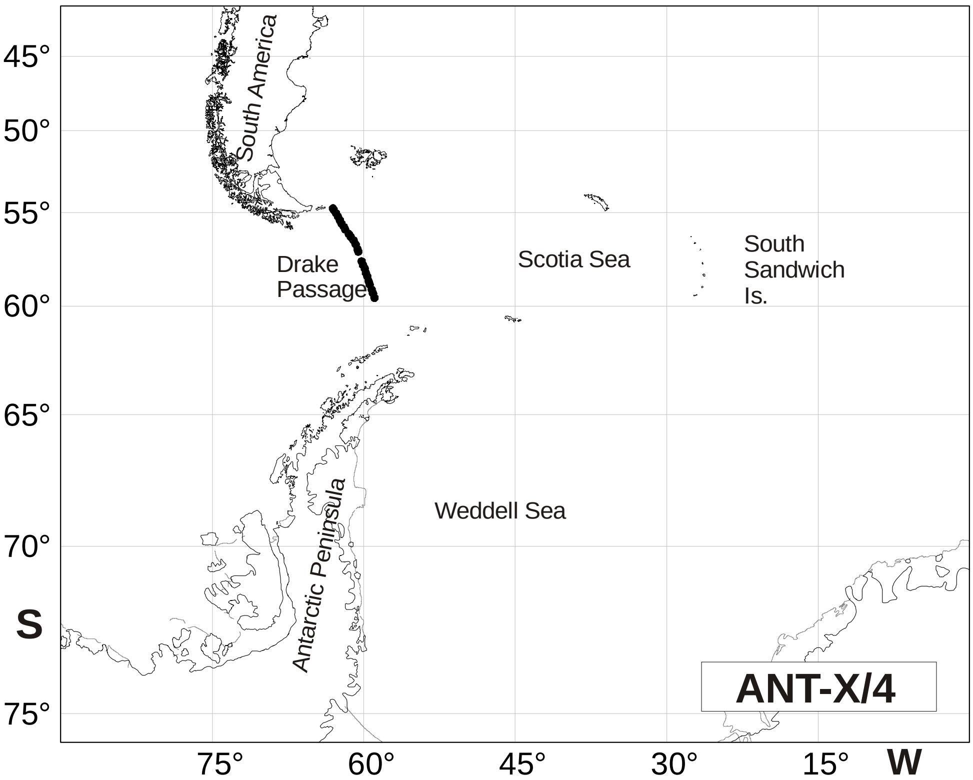
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Scotia Sea
South Sandwich Is.
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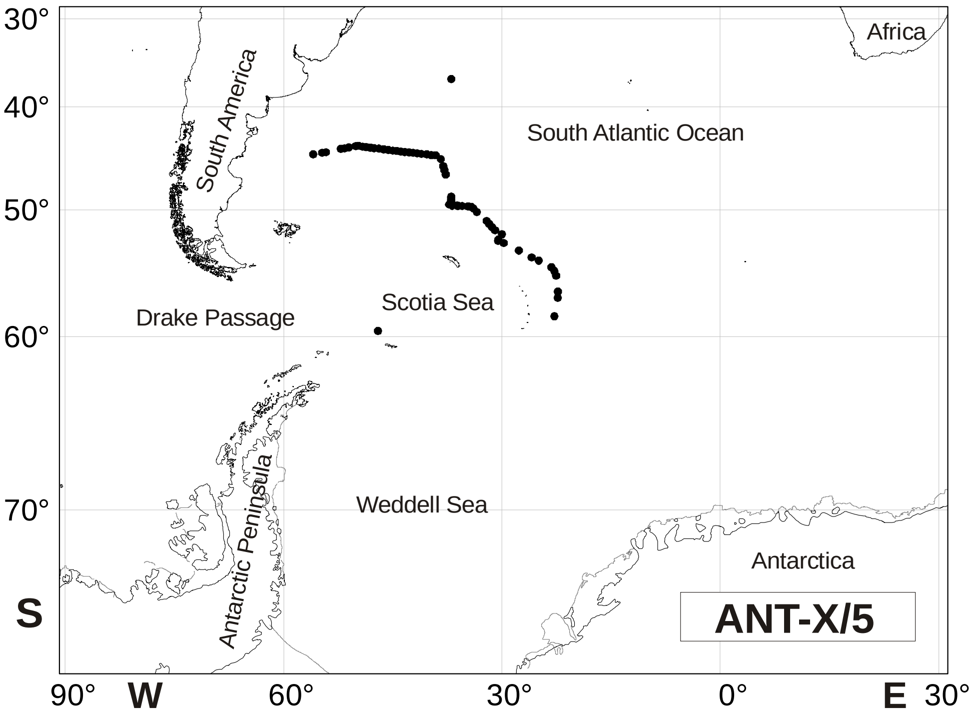
70°
S
75°
75° 60° 45° 30° 15° W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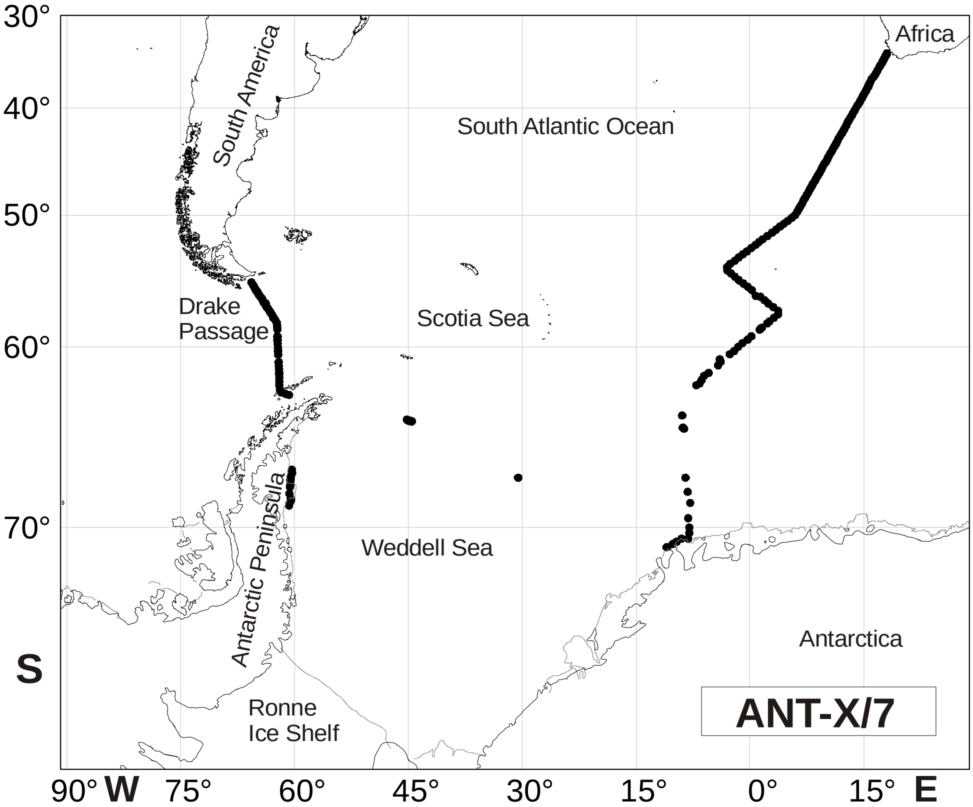
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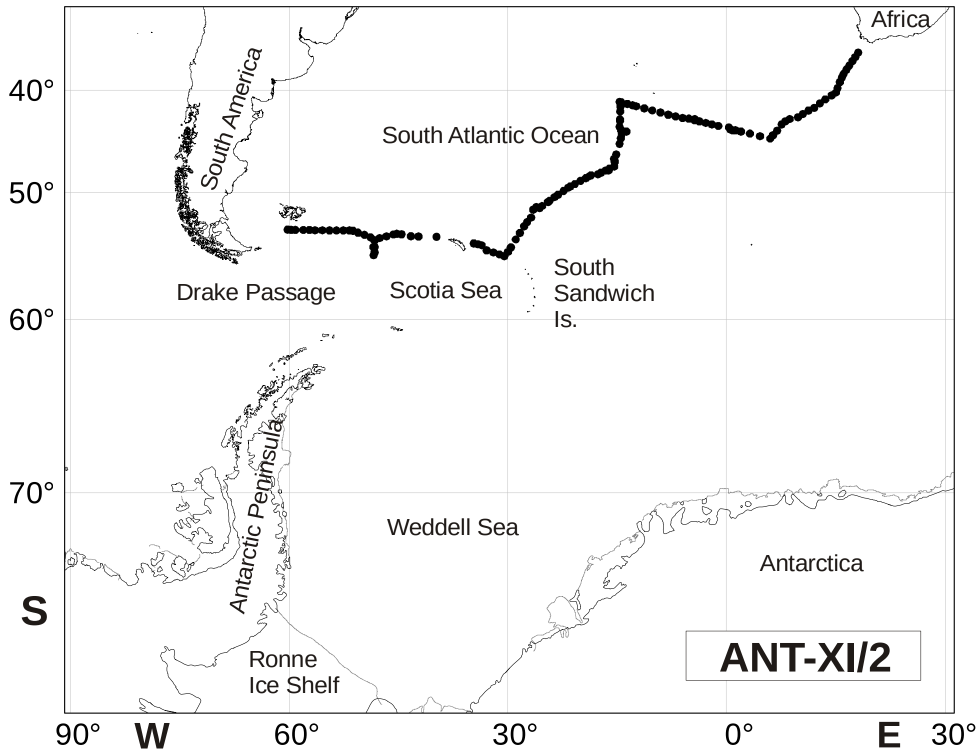
Antarctic Peninsula
Antarctica
Ronne Ice Shelf
ANT-X/7
90° W 75° 60° 45° 30° 15° 0° 15° E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Scotia Sea
South
Sandwich
Is.
Antarctic Peninsula
Weddell Sea
Antarctica
Ronne
Ice Shelf
ANT-XI/2
90°
W
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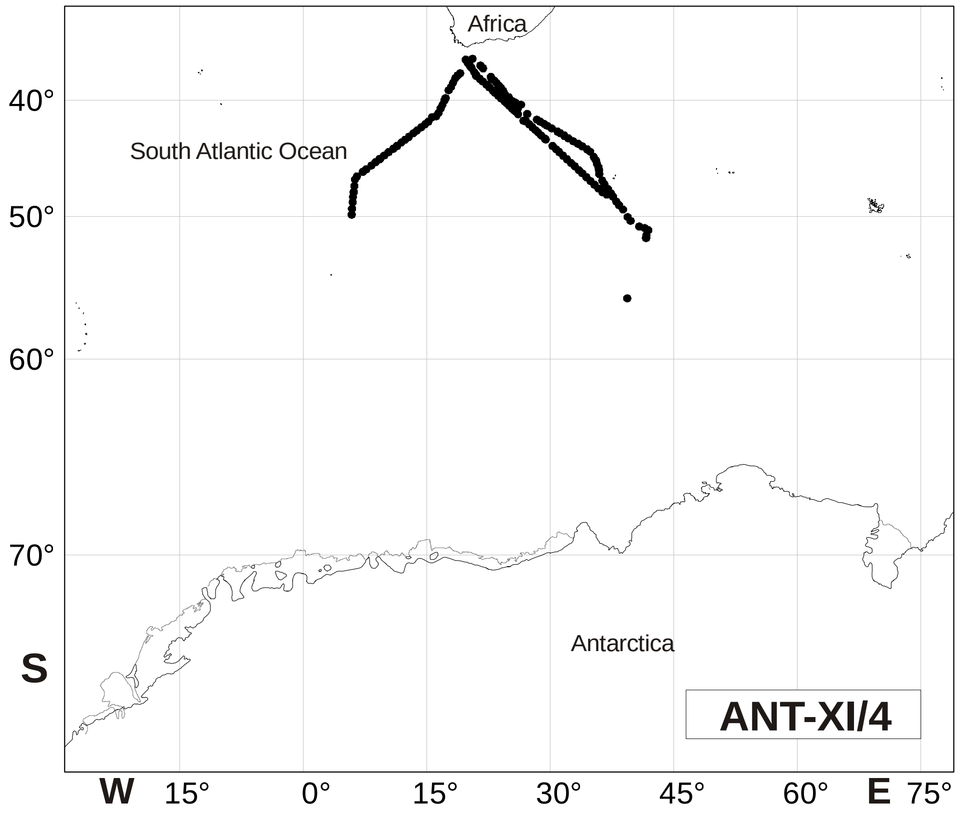
30°
0°
E
30°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South Atlantic Ocean
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60°
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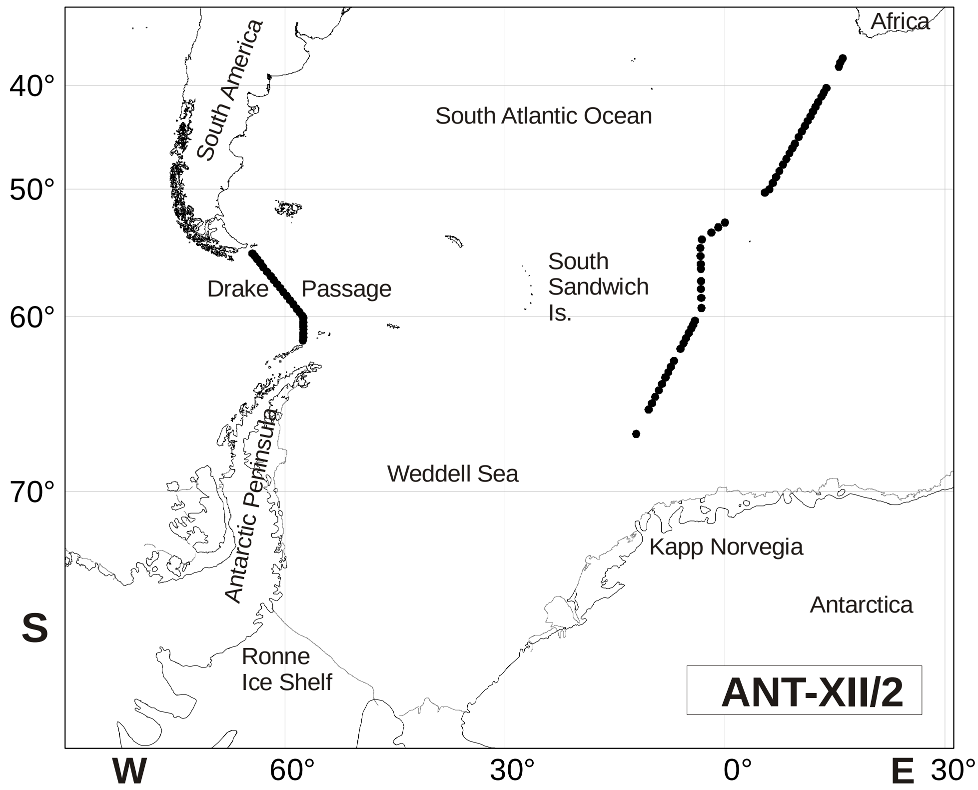
75°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Passage
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Ice Shelf
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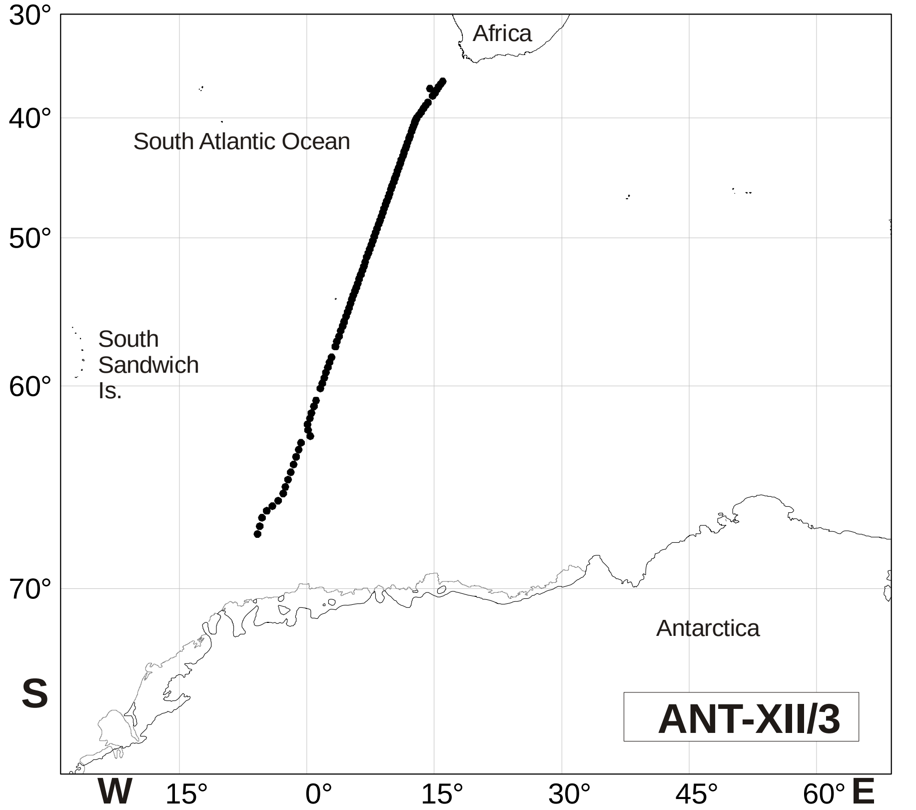
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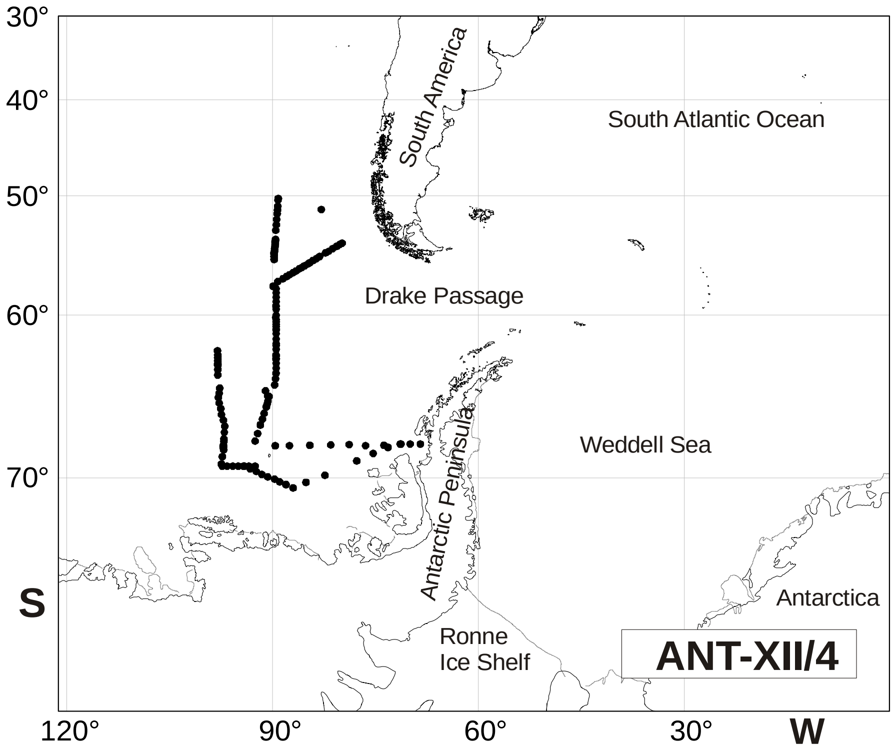
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Ronne
Ice Shelf
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120°
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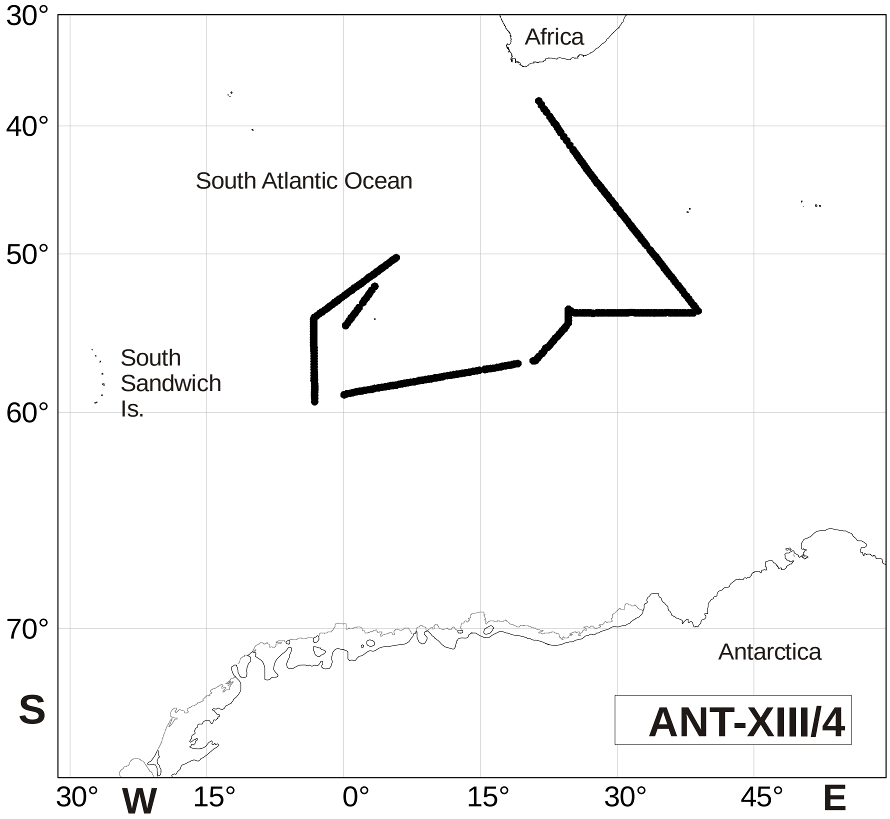
60°
30°
W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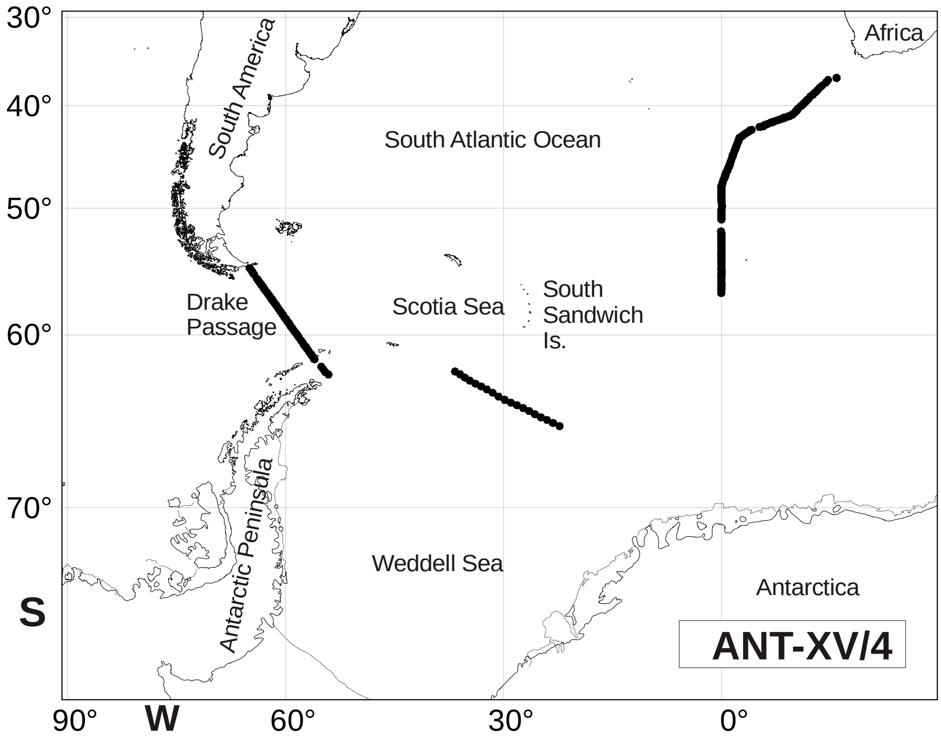
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Drake
Passage
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Weddell Sea
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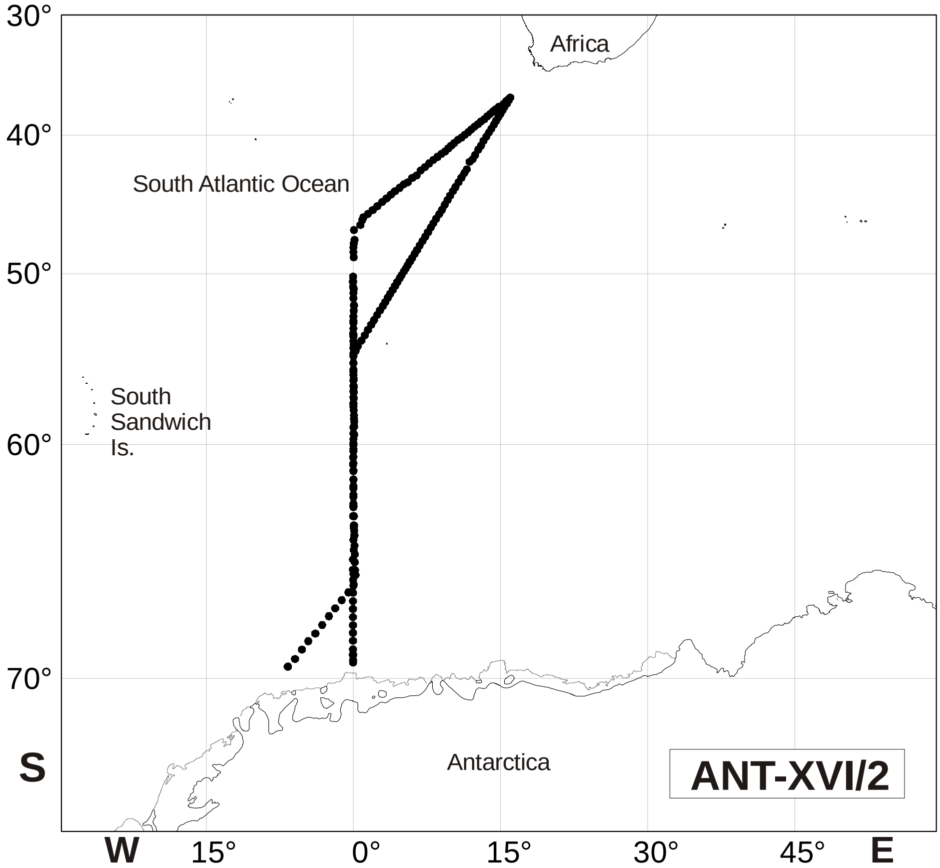
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ANT-XVI/2
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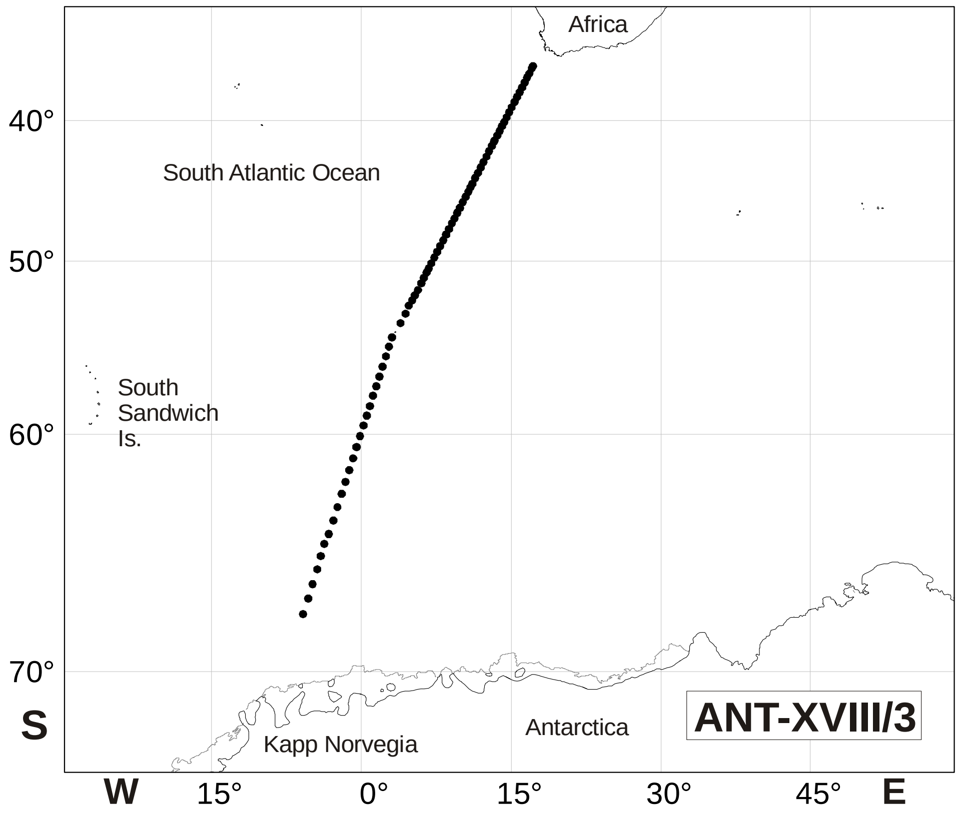
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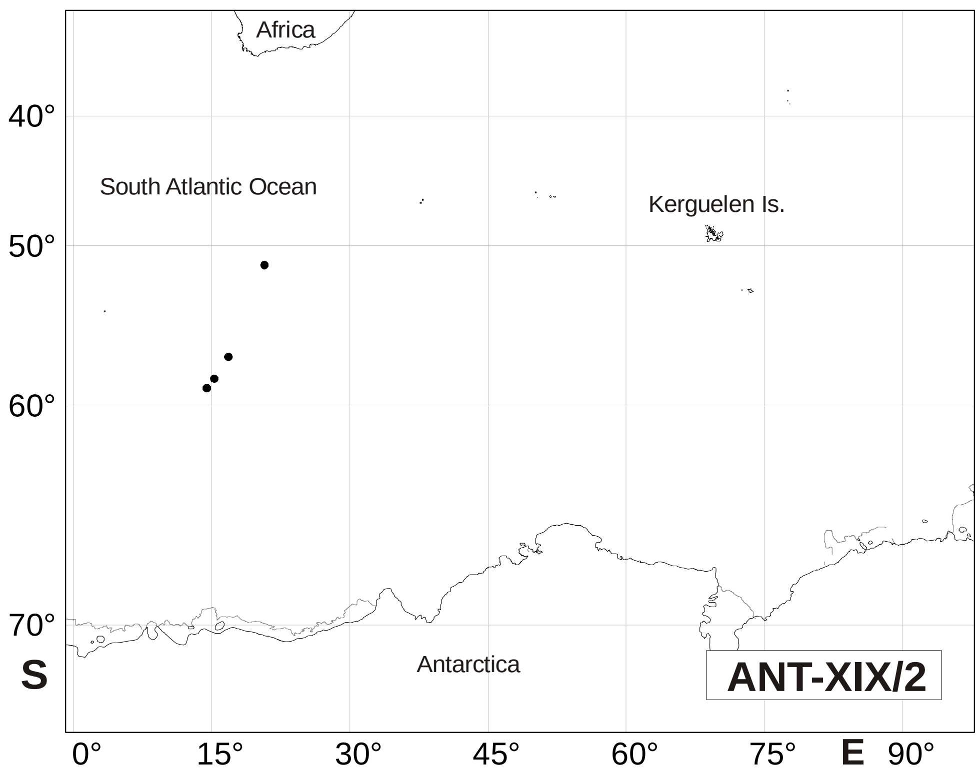
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75°
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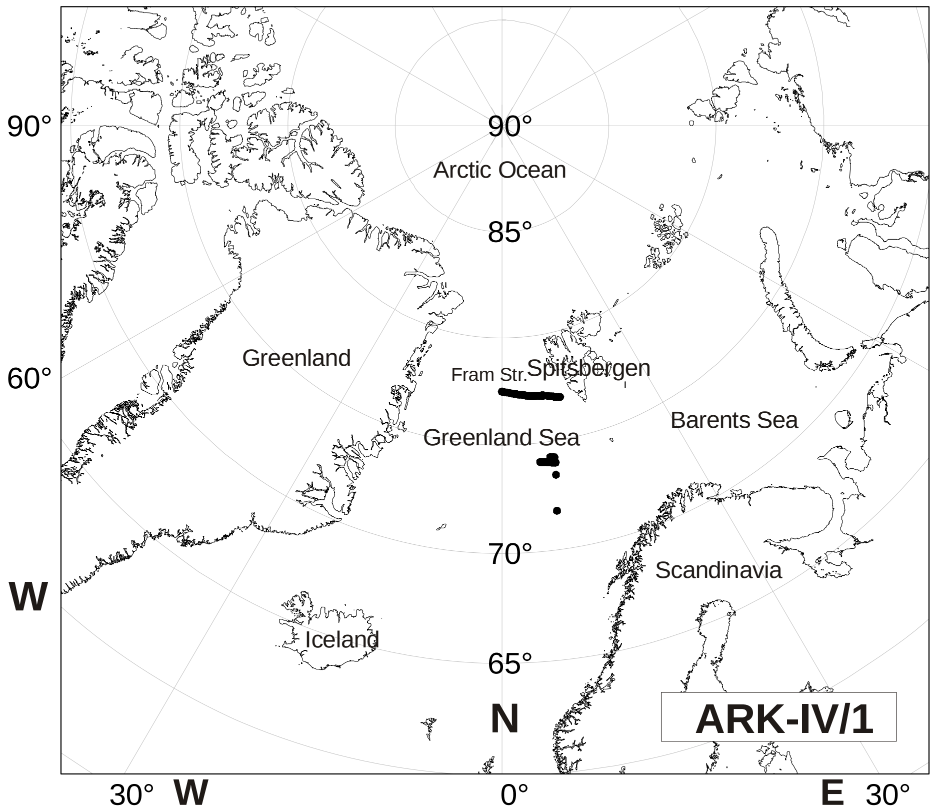
90°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Fram Str.
Spitsbergen
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Iceland
65°
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ARK-IV/1
30°
W
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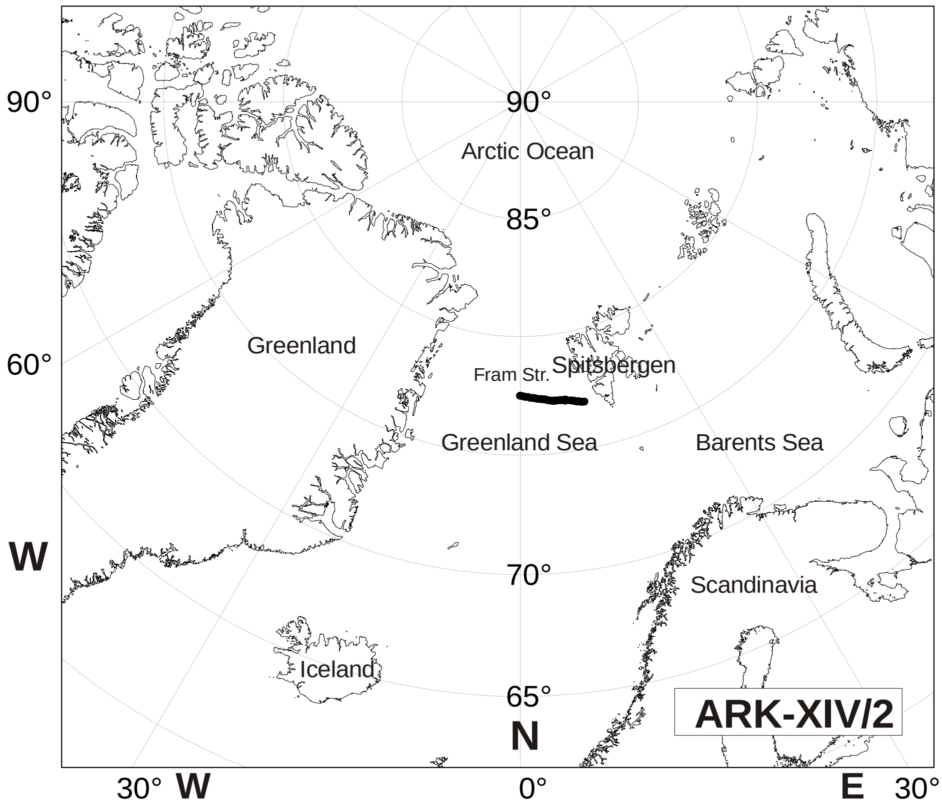
E
30°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ARK-XIV/2
30°
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E
30°

3.2 CTD – Salinity/conductivity-temperature-depth profiler

3.2.1 Summary of CTD Cruises

Tab. 3: Summary of cruises where CTD profiles were carried out; sorted by date

Cruise	from				to			
ANT-II/3	Punta Arenas	22	Nov	1983	Punta Arenas	27	Dec	1983
ANT-II/4	Punta Arenas	29	Dec	1983	Cape Town	10	Mar	1984
ANT-III/3	Punta Arenas	3	Jan	1985	Cape Town	5	Mar	1985
ANT-V/1	Punta Arenas	6	May	1986	Bahia Blanca	20	Jun	1986
ANT-V/2	Bahia Blanca	27	Jun	1986	Cape Town	17	Sep	1986
ANT-V/3	Cape Town	28	Sep	1986	Cape Town	15	Dec	1986
ANT-V/4	Cape Town	26	Dec	1986	Puerto Madryn	16	Mar	1987
ARK-IV/2	Longyearbyen	6	Jun	1987	Tromsoe	2	Jul	1987
ANT-VI/2	Rio Grande do Sul	20	Oct	1987	Ushuaia	20	Dec	1987
ARK-V/2	Reykjavik	6	Jun	1988	Tromsoe	5	Jul	1988
ANT-VII/4	Punta Arenas	13	Jan	1989	Cape Town	10	Mar	1989
ARK-VI/2	Tromsoe	16	May	1989	Tromsoe	8	Jun	1989
ANT-VIII/2	Puerto Madryn	6	Sep	1989	Cape Town	31	Oct	1989
ANT-VIII/3	Cape Town	1	Nov	1989	Punta Arenas	1	Dec	1989
ANT-IX/2	Punta Arenas	17	Nov	1990	Cape Town	31	Dec	1990
ANT-IX/3	Cape Town	3	Jan	1991	Cape Town	29	Mar	1991
ARK-VIII/2	Tromsoe	20	Jun	1991	Tromsoe	31	Jul	1991
ANT-X/4	Cape Town	21	May	1992	Puerto Madryn	6	Aug	1992
ANT-X/5	Puerto Madryn	8	Aug	1992	Punta Arenas	27	Sep	1992
ANT-X/7	Cape Town	3	Dec	1992	Ushuaia	23	Jan	1993
ARK-IX/2	Bremerhaven	16	May	1993	Tromsoe	25	Jun	1993
ARK-IX/3	Tromsoe	25	Jun	1993	Tromsoe	5	Aug	1993
ARK-IX/4	Tromsoe	6	Aug	1993	Bremerhaven	5	Oct	1993
ANT-XI/2	Cape Town	12	Dec	1993	Punta Arenas	12	Jan	1994
ANT-XI/3	Punta Arenas	14	Jan	1994	Cape Town	28	Mar	1994
ANT-XI/4	Cape Town	29	Mar	1994	Cape Town	20	Mar	1994
ARK-X/1	Bremerhaven	6	Jun	1994	Tromsoe	16	Aug	1994
ANT-XII/2	Punta Arenas	23	Nov	1994	Cape Town	4	Jan	1995
ANT-XII/3	Cape Town	5	Jan	1995	Punta Arenas	20	Mar	1995
ANT-XII/4	Punta Arenas	21	Mar	1995	Punta Arenas	15	May	1995
ARK-XI/1	Bremerhaven	19	Aug	1995	Tromsoe	19	Aug	1995
ARK-XI/2	Tromsoe	21	Sep	1995	Bremerhaven	30	Oct	1995
ANT-XIII/2	Cape Town	4	Dec	1995	Cape Town	25	Jan	1995
ANT-XIII/4	Cape Town	17	Mar	1996	Punta Arenas	19	May	1996
ARK-XII/1	Bremerhaven	12	Jul	1996	Bremerhaven	24	Sep	1996
ARK-XIII/2	Tromsoe	25	Jun	1997	Tromsoe	11	Aug	1997
ARK-XIII/3	Tromsoe	12	Aug	1997	Bremerhaven	30	Sep	1997
ANT-XV/4	Punta Arenas	20	Mar	1998	Cape Town	24	May	1998
ARK-XIV/2	Tromsoe	28	Aug	1998	Bremerhaven	15	Oct	1998
ANT-XVI/2	Cape Town	9	Jan	1999	Cape Town	16	Mar	1999
ANT-XVI/3	Cape Town	16	Mar	1999	Cape Town	11	May	1999
ARK-XV/1	Bremerhaven	23	Jun	1999	Tromsoe	19	Jul	1999
ARK-XV/3	Tromsoe	8	Sep	1999	Bremerhaven	14	Oct	1999
ARK-XVI/1	Bremerhaven	30	Jun	2000	Longyearbyen	30	Jul	2000

Cruise	from				to			
ARK-XVI/2	Longyearbyen	30	Jul	2000	Bremerhaven	26	Aug	2000
ANT-XVIII/2	Cape Town	24	Oct	2000	Cape Town	4	Dec	2000
ANT-XVIII/3	Cape Town	5	Dec	2000	Cape Town	12	Jan	2000
ANT-XVIII/5b	Punta Arenas	14	Apr	2001	Punta Arenas	8	May	2001
ARK-XVII/1	Bremerhaven	19	Jun	2001	Tromsoe	30	Jul	2001

Tab. 4: The relation between cruise, instrument and institution of CTD measurements. The abbreviation and address of the institutions are summarised in the appendix.

Cruise	Institution	Country	Principal Investigator	Instrument Type	Serial Number
ANT-II/3	AWI	Germany	Rohardt	MARK IIIB	unknown
ANT-II/4	AWI	Germany	Rohardt	NANSEN / MARK IIIB	unknown
ANT-III/3	AWI	Germany	Rohardt	MARK IIIB	1069
ANT-V/1	BFA-HH	Germany	Stein	ME-OTS-CTD	unknown
ANT-V/2	LDGO	USA	Gordon	MARK IIIB	unknown
ANT-V/3	AWI	Germany	Rohardt	MARK IIIB	1069
ANT-V/4	GIUiB	Norway	Osterhus	MARK IIIB	1069
ARK-IV/2	AWI	Germany	Rohardt	MARK IIIB	1069
ANT-VI/2	BFA-HH	Germany	Stein	ME-OTS-CTD	59
ARK-V/2	AWI	Germany	Fahrbach	MARK IIIB	1069
ANT-VII/4	AWI	Germany	Rohardt	MARK IIIB	1069
ARK-VI/2	AWI	Germany	Fahrbach	MARK IIIB	1069
ANT-VIII/2	AWI	Germany	Rohardt	MARK IIIB	1069
ANT-VIII/3	AWI	Germany	Fahrbach	MARK IIIB	1069
ANT-IX/2	AWI	Germany	Rohardt	MARK IIIB	1069
ANT-IX/3	AWI	Germany	Schröder	MARK IIIB	1069
ARK-VIII/2	AWI	Germany	Schauer/ Strass	MARK IIIB	1123
ANT-X/4	AWI	Germany	Schröder	MARK IIIB	1069 / 1123
ANT-X/5	SIO	USA	Peterson	ME-OTS-CTD	4
ANT-X/7	AWI	Germany	Rohardt/ Strass	MARK IIIB	1069
ARK-IX/2	AWI	Germany	Budeus	SBE911plus	0485
ARK-IX/3	AWI	Germany	Budeus	SBE911plus	0485
ARK-IX/4	AWI	Germany	Schauer	MARK IIIB	1069 / 1123
ANT-XI/2	AWI	Germany	Fahrbach	MARK IIIB	1123
ANT-XI/3	AWI	Germany	Miller/Grobe	SBE 19	unknown
ANT-XI/4	AWI	Germany	Fahrbach	MARK IIIB	1123
ARK-X/1	AWI	Germany	Budeus	SBE911plus	0485
ANT-XII/2	AWI	Germany	Fahrbach/ Rohardt	MARK IIIB	1123
ANT-XII/3	AWI	Germany	Schröder	ICTD / MARK IIIB	1347 / 1123
ANT-XII/4	AWI	Germany	Sildam	SBE911plus	unknown
ARK-XI/1	IFMH	Germany	Meincke	SBE 19	unknown
ARK-XI/2	AWI	Germany	Budeus	SBE911plus	0485
ANT-XIII/2	AWI	Germany	Strass	MARK IIIB	1123
ANT-XIII/4	AWI	Germany	Schröder	ICTD	1347 / 1360

Cruise	Institution	Country	Principal Investigator	Instrument Type	Serial Number
ARK-XII/1	AWI	Germany	Schauer	SIO MKIII	unknown
ARK-XIII/2	IFMH	Germany	Rudels	SBE9plus	313
ARK-XIII/3	AWI	Germany	Budeus	SBE911plus	0485
ANT-XV/4	AWI	Germany	Schröder	ICTD	1347 / 1360
ARK-XIV/2	AWI	Germany	Schauer/ Budeus	SBE911plus	0485
ANT-XVI/2	AWI	Germany	Rohardt/ Harms	ICTD	1347 / 1360
ANT-XVI/3	AWI	Germany	Strass	SBE911plus	0561
ARK-XV/1	AWI	Germany	Budeus	SBE911plus	0485
ARK-XV/3	AWI	Germany	Schauer	SBE911plus	0485 / 0287
ARK-XVI/1	AWI	Germany	Budeus	SBE911plus	0485
ARK-XVI/2	AWI	Germany	Schauer	SBE911plus	0485
ANT-XVIII/2	AWI	Germany	Strass	SBE911plus	0561
ANT-XVIII/3	AWI	Germany	Schröder	SBE911plus	0561
ANT-XVIII/5b	AWI	Germany	Strass	SBE911plus	0561
ARK-XVII/1	AWI	Germany	Budeus	SBE911plus	T1338-C1199

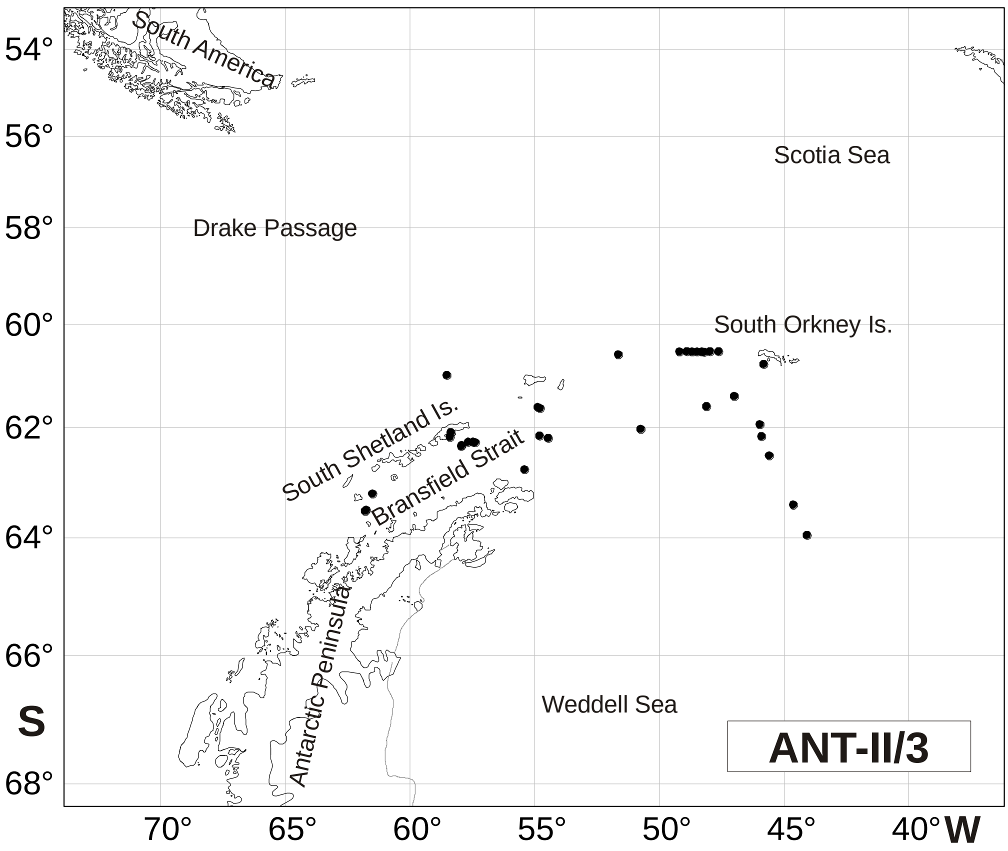
Tab. 5: The relation between cruise and area of CTD measurements

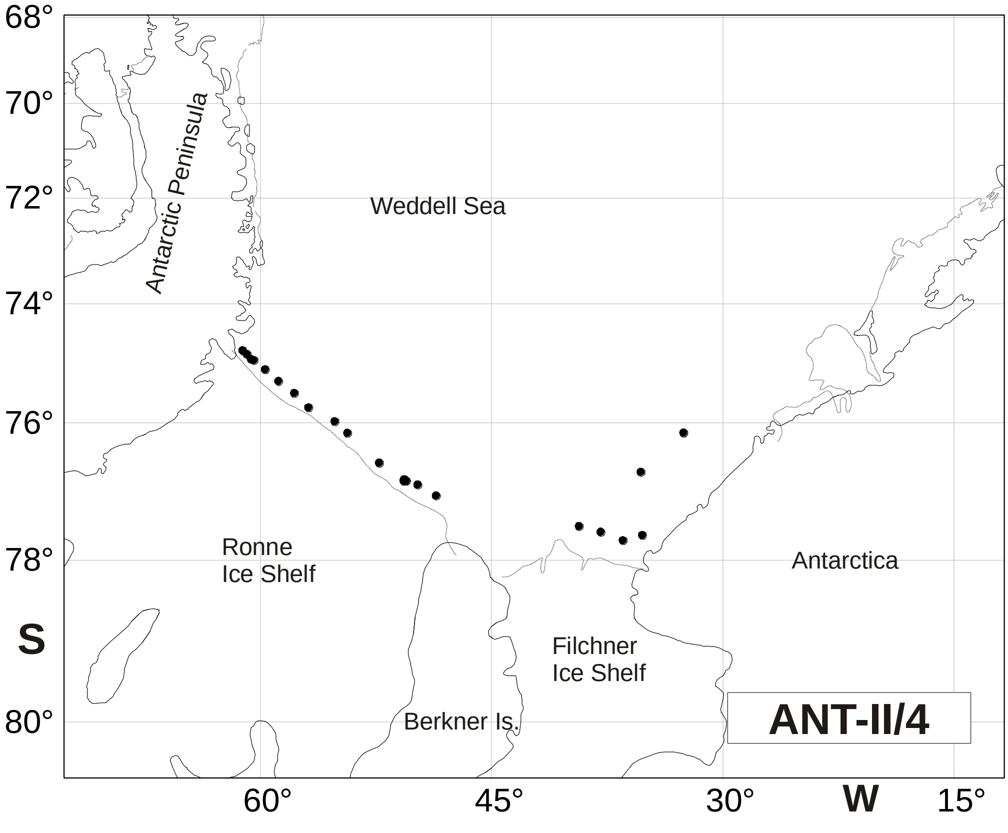
Cruise	Number of Profiles	Area
ANT-II/3	34	Bransfield Strait
ANT-II/4	33	Filchner/Ronne; ice shelf edge
ANT-III/3	116	Bransfield Strait, Vest Kapp, Filchner Trench
ANT-V/1	101	South Drake Passage
ANT-V/2	152	Maud Rise
ANT-V/3	99	Maud Rise, Vest Kapp, Halley Bay
ANT-V/4	35	South Eastern Weddell Sea
ARK-IV/2	81	Fram Strait, Eastern Greenland Sea
ANT-VI/2	23	Bransfield Strait
ARK-V/2	72	Fram Strait, Eastern Greenland Sea
ANT-VII/4	55	South Orkney, Kapp Norvegia, Halley Bay
ARK-VI/2	34	Eastern Greenland Sea
ANT-VIII/2	112	Joinville Is – Kapp Norvegia, Neumayer towards Cape Town
ANT-VIII/3	11	South Atlantic Ocean
ANT-IX/2	85	Joinville Is – Kapp Norvegia,
ANT-IX/3	63	Maud Rise, South Eastern Weddell Sea
ARK-VIII/2	108	Store Fjord, North of Spitsbergen, Barents Sea
ANT-X/4	115	Cape Town – Neumayer, Kapp Norvegia – Joinville Is.
ANT-X/5	63	Scotia Sea
ANT-X/7	81	Kapp Norvegia – Joinville Is.
ARK-IX/2	121	Fram Strait

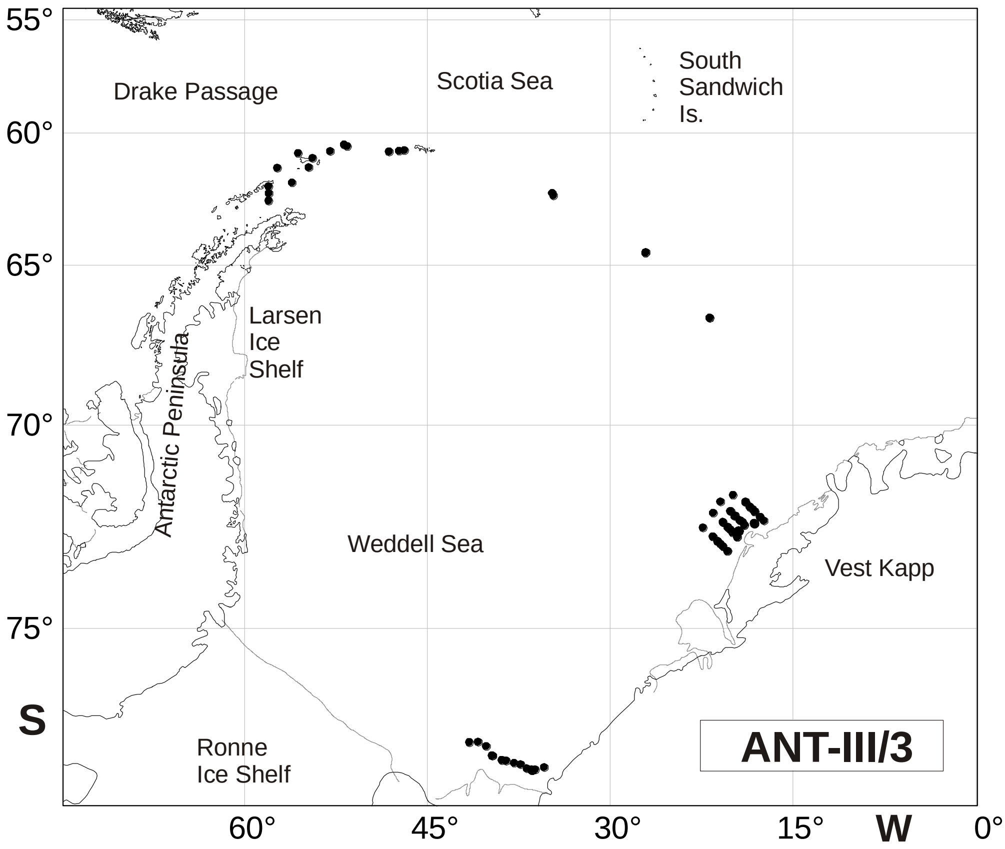
Cruise	Number of Profiles	Area
ARK-IX/3	198	Fram Strait, Greenland Sea
ARK-IX/4	64	Laptev Sea
ANT-XI/2	21	South Atlantic Ocean
ANT-XI/3	17	Bellingshausen Sea
ANT-XI/4	46	South Atlantic Ocean
ARK-X/1	85	Fram Strait, Greenland Sea; 75° N
ANT-XII/2	49	Scotia Sea
ANT-XII/3	63	Southern Weddell Sea, Filchner/Ronne; ice shelf edge
ANT-XII/4	52	South Pacific Ocean; west of Drake Passage
ARK-XI/1	120	Laptev Sea
ARK-XI/2	109	Greenland Sea; 75° N
ANT-XIII/2	56	South Atlantic Ocean
ANT-XIII/4	141	Eastern Weddell Gyre, Greenwich Section, Maud Rise, Kapp Norvegia – Joinville Is.
ARK-XII/1	102	Eastern Arctic Ocean
ARK-XIII/2	55	Fram Strait, Barents Sea
ARK-XIII/3	62	Greenland Sea 75° N
ANT-XV/4	151	Greenwich Section, Maud Rise, north-western Weddell Sea
ARK-XIV/2	287	Fram Strait, Greenland Sea 75° N East Greenland
ANT-XVI/2	256	Southern Weddell Sea, Filchner/Ronne; ice shelf edge, Greenwich Section, Maud Rise
ANT-XVI/3	76	South Atlantic Ocean, Antarctic Circumpolar Current
ARK-XV/1	61	Greenland Sea; 75° N
ARK-XV/3	105	Greenland Sea
ARK-XVI/1	60	Greenland Sea; 75° N
ARK-XVI/2	66	Fram Strait
ANT-XVIII/2	152	South Atlantic Ocean, Antarctic Circumpolar Current
ANT-XVIII/3	68	Greenwich Section, Maud Rise
ANT-XVIII/5b	26	Bellingshausen Sea
ARK-XVII/1	189	Fram Strait, Greenland Sea; 75° N

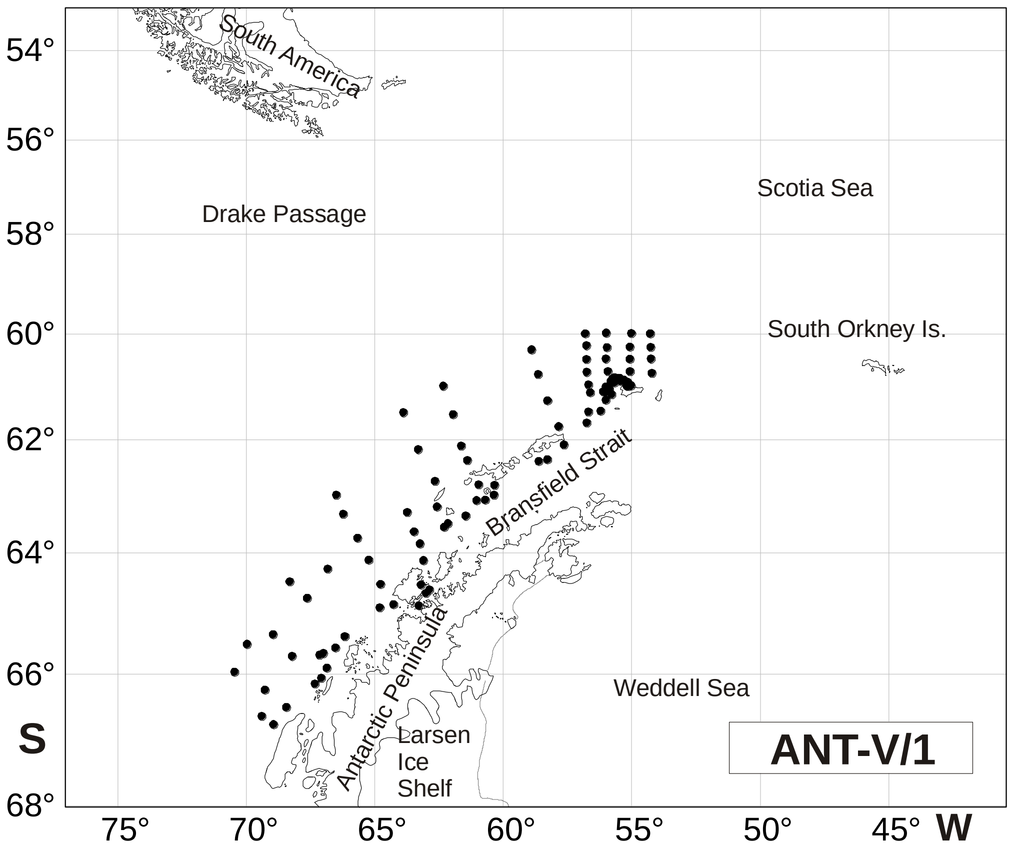
3.2.2 Maps with CTD Stations

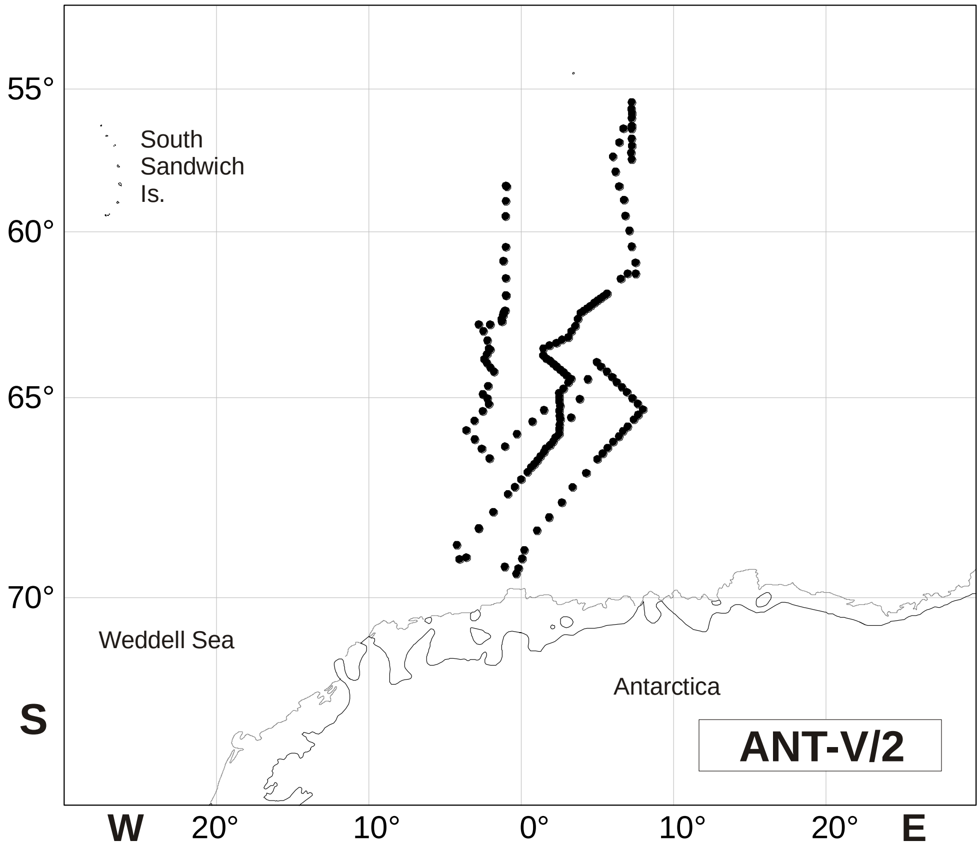
The following maps show the area and locations of CTD stations carried out during *Polarstern* cruises. The first part starts with Antarctic cruises (page 42 to 56) followed by Arctic cruises. Both sets of maps are sorted by date and cruise name respectively.

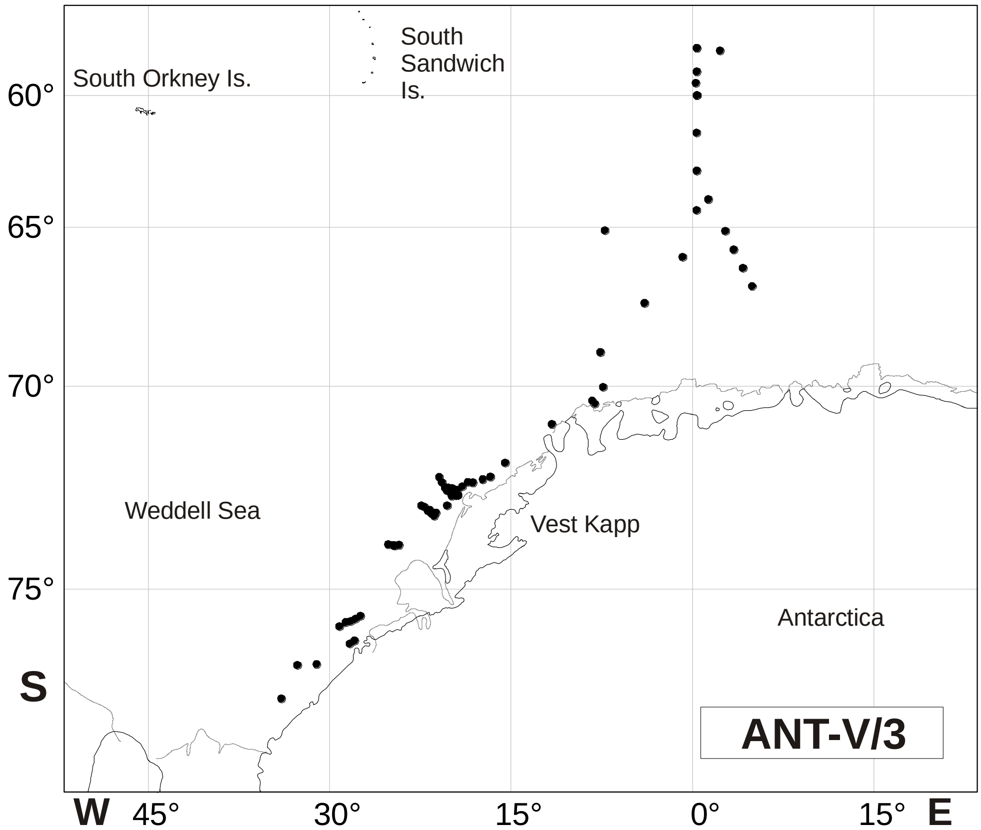

South America
Scotia Sea
Drake Passage
South Orkney Is.
South Shetland Is.
Bransfield Strait
Antarctic Peninsula
Weddell Sea
ANT-II/3
54°
56°
58°
60°
62°
64°
66°
S
68°
70°
65°
60°
55°
50°
45°
40° W

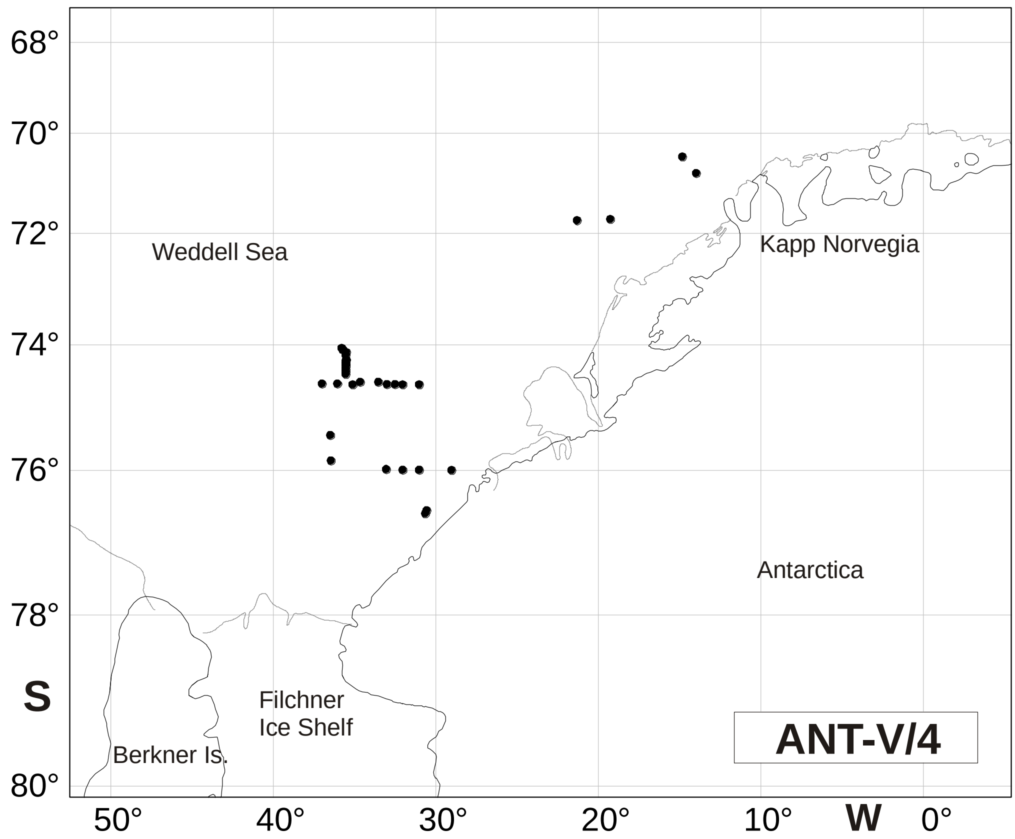

68°
70°
72°
74°
76°
78°
S
80°
Antarctic Peninsula
Weddell Sea
Ronne
Ice Shelf
Antarctica
Filchner
Ice Shelf
Berkner Is.
ANT-II/4
60°
45°
30°
W
15°

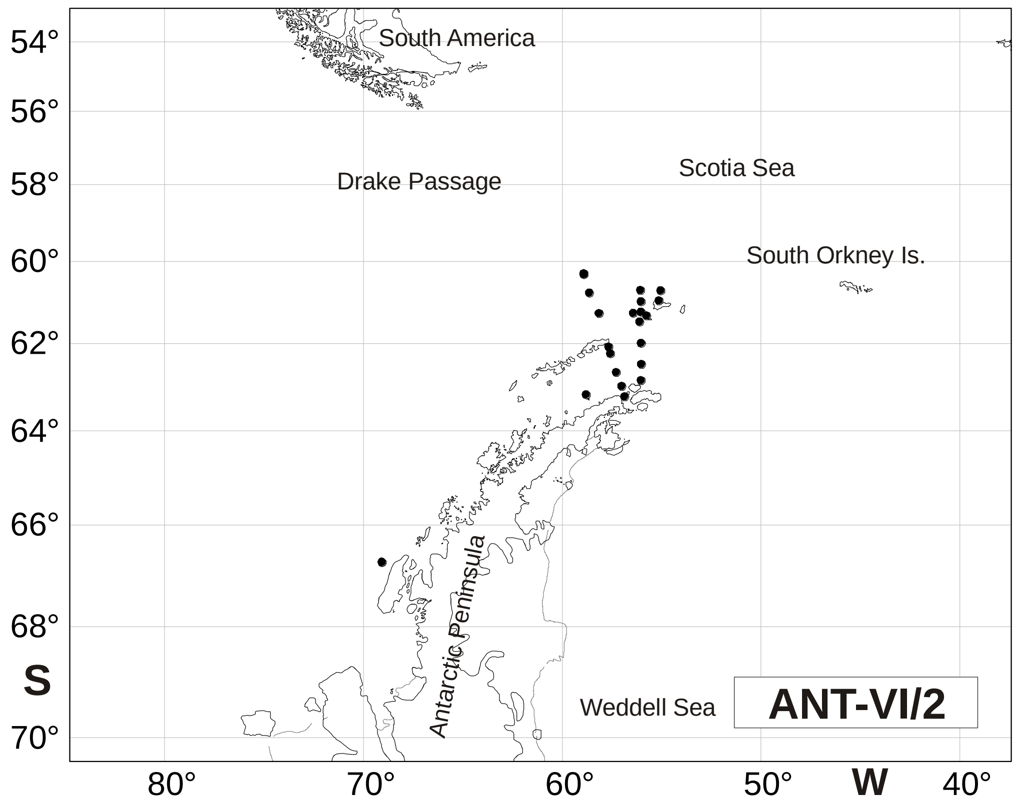

55°
60°
65°
70°
75°
S
Drake Passage
Scotia Sea
South
Sandwich
Is.
Larsen
Ice
Shelf
Antarctic Peninsula
Weddell Sea
Vest Kapp
Ronne
Ice Shelf
ANT-III/3
60°
45°
30°
15°
W
0°

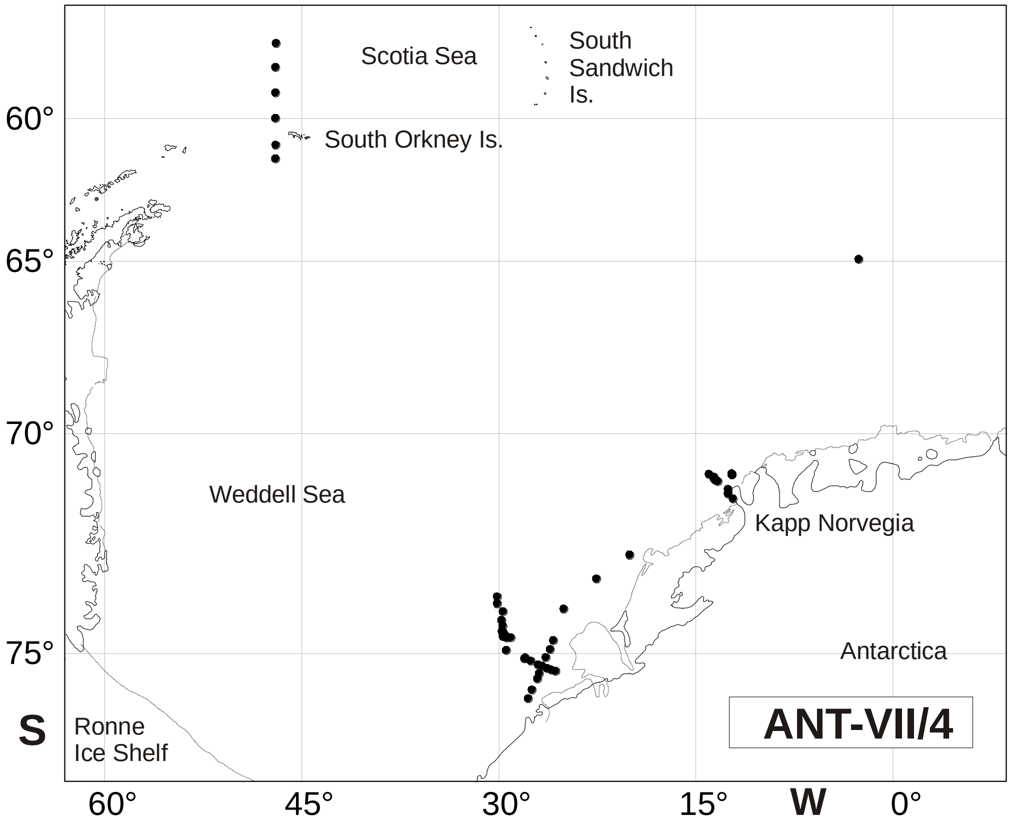

54°
56°
58°
60°
62°
64°
66°
S
68°
South America
Drake Passage
Scotia Sea
South Orkney Is.
Bransfield Strait
Antarctic Peninsula
Larsen
Ice
Shelf
Weddell Sea
ANT-V/1
75°
70°
65°
60°
55°
50°
45°
W

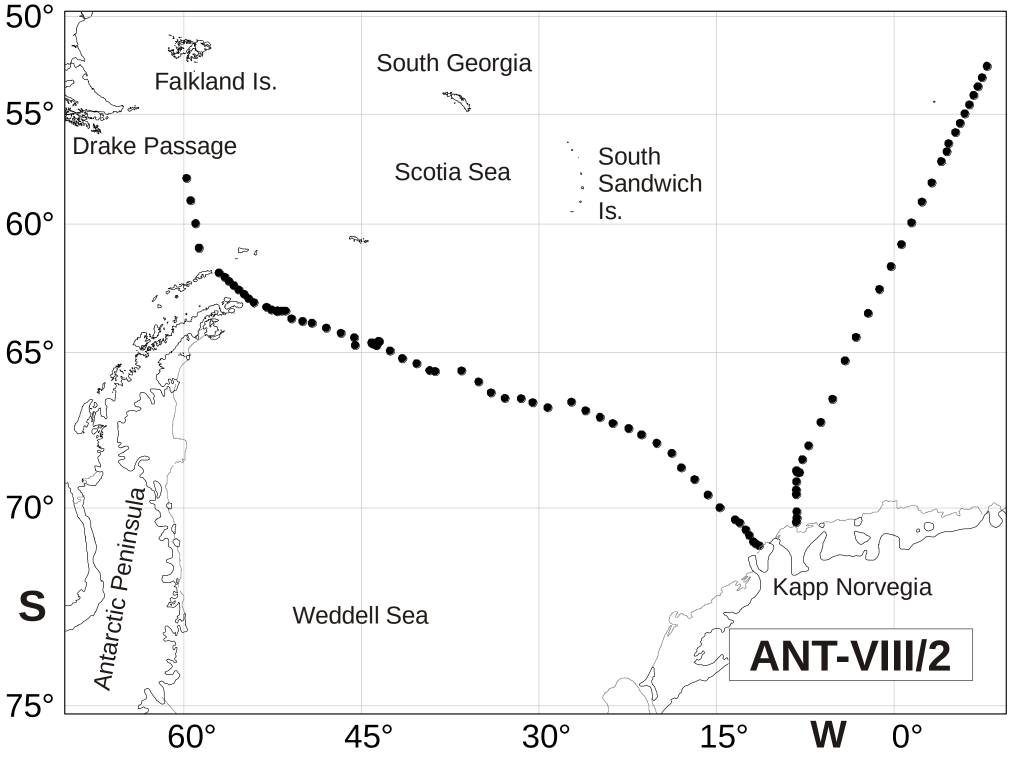

55°
South
Sandwich
Is.
60°
65°
70°
Weddell Sea
Antarctica
S
ANT-V/2
W
20°
10°
0°
10°
20°
E

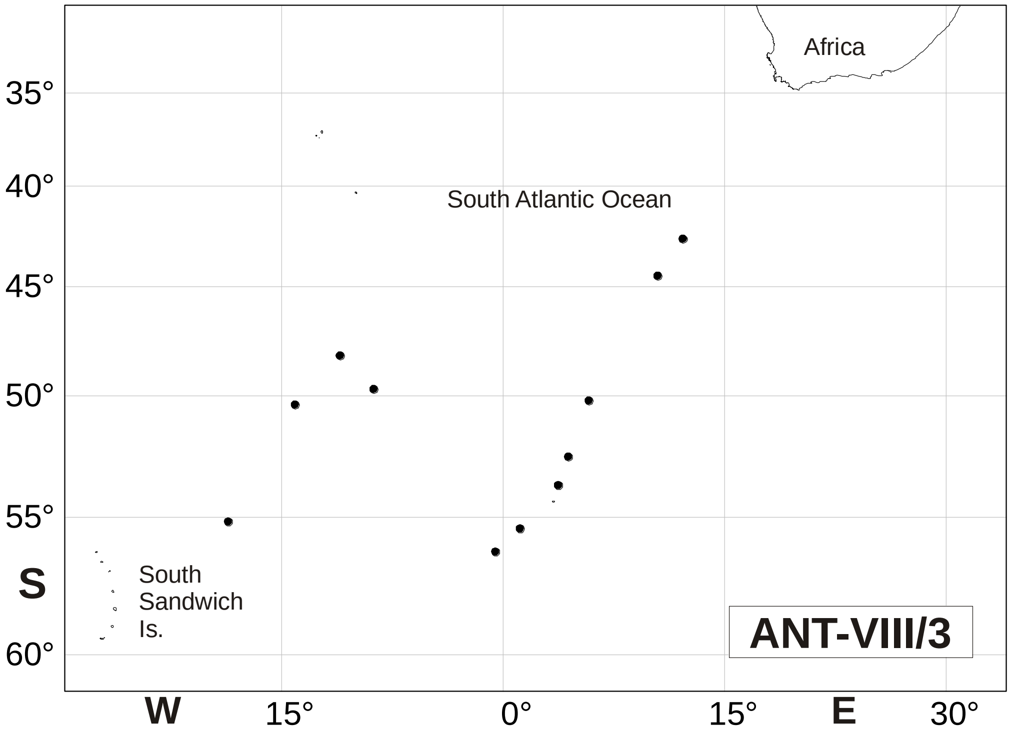

South
Sandwich
Is.
South Orkney Is.
60°
65°
70°
Weddell Sea
Vest Kapp
75°
Antarctica
S
ANT-V/3
W
45°
30°
15°
0°
15°
E

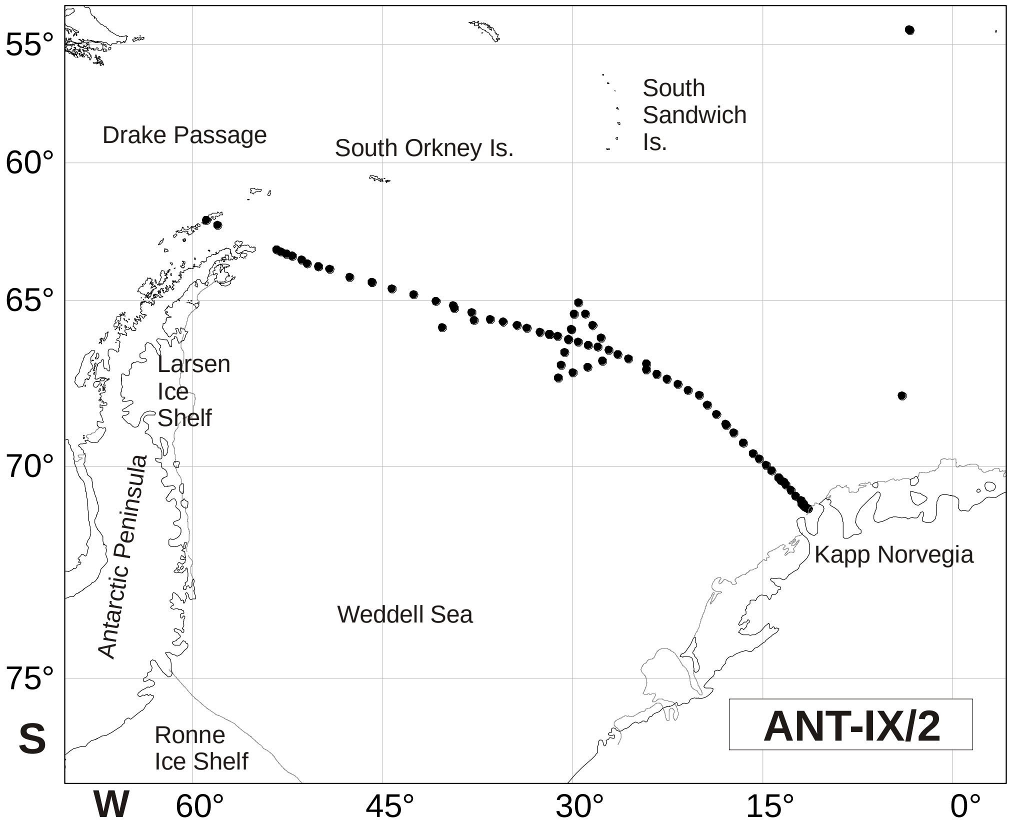

68°
70°
72°
74°
76°
78°
80°
S
Weddell Sea
Kapp Norvegia
Antarctica
Filchner
Ice Shelf
Berkner Is.
ANT-V/4
50°
40°
30°
20°
10°
W
0°

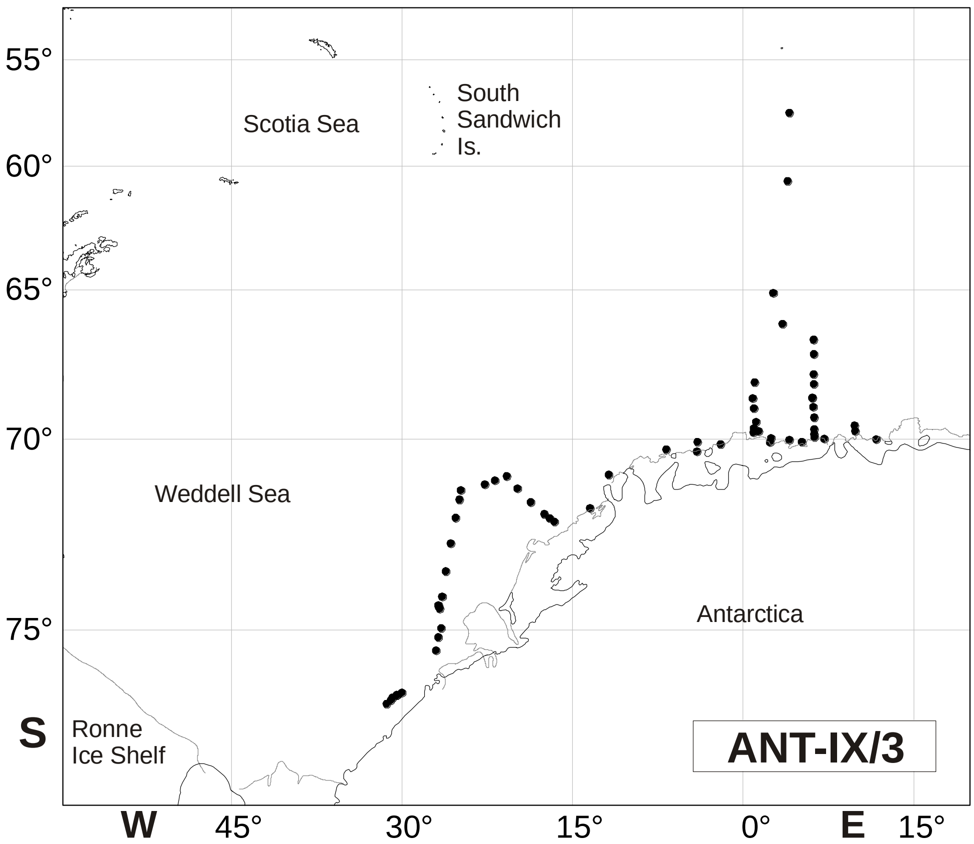

54°
56°
58°
60°
62°
64°
66°
68°
70°
S
South America
Drake Passage
Scotia Sea
South Orkney Is.
Antarctic Peninsula
Weddell Sea
ANT-VI/2
80°
70°
60°
50°
W
40°

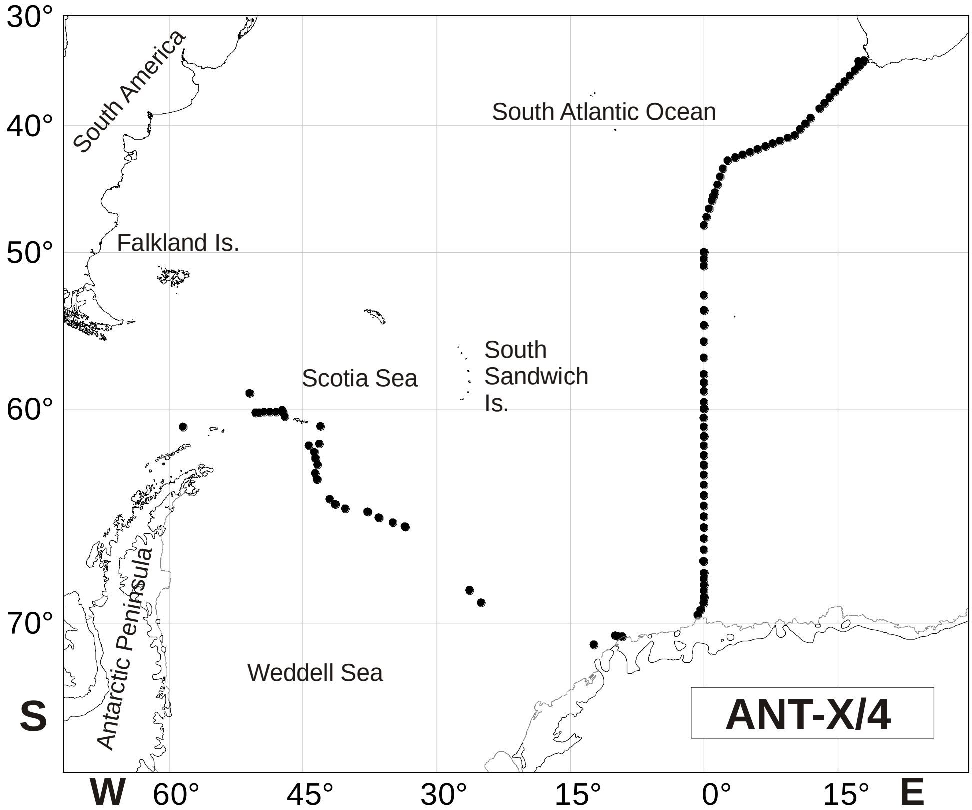

Scotia Sea
South Sandwich Is.
South Orkney Is.
60°
65°
70°
75°
Weddell Sea
Kapp Norvegia
Antarctica
ANT-VII/4
S
Ronne Ice Shelf
60°
45°
30°
15°
W
0°

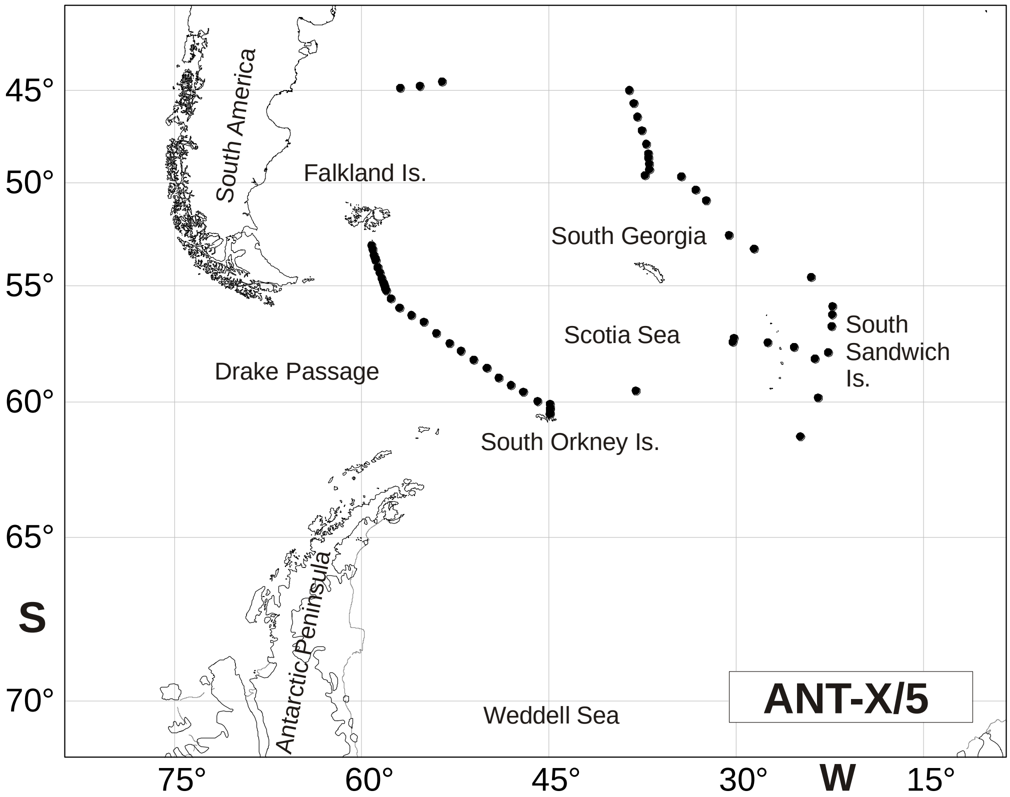

50°
55°
60°
65°
70°
75°
Falkland Is.
South Georgia
Drake Passage
Scotia Sea
South Sandwich Is.
Antarctic Peninsula
S
Weddell Sea
Kapp Norvegia
ANT-VIII/2
60°
45°
30°
15°
W
0°

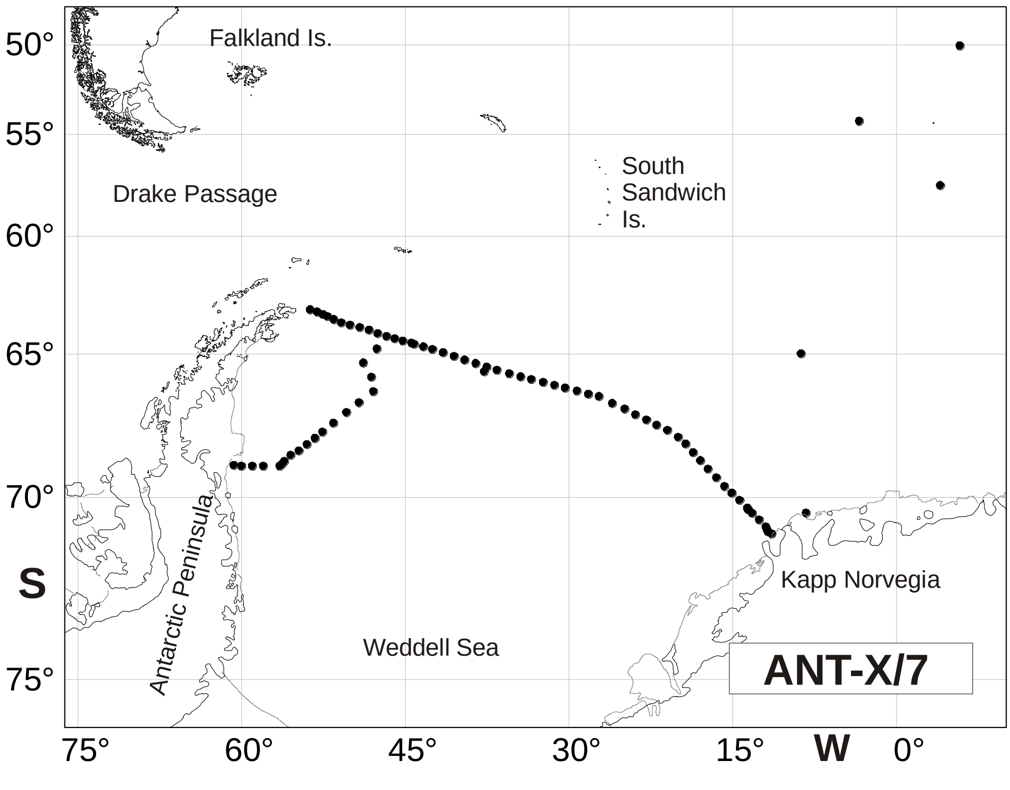

Africa
South Atlantic Ocean
35°
40°
45°
50°
55°
S
60°
South
Sandwich
Is.
ANT-VIII/3
W
15°
0°
15°
E
30°

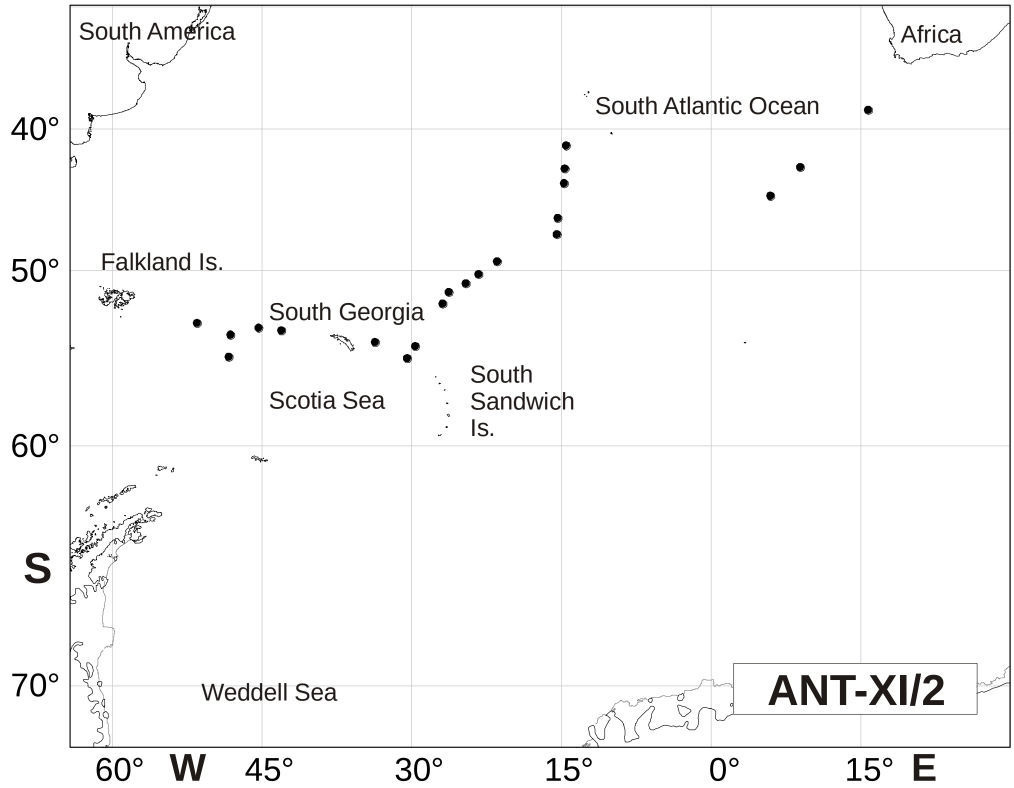

55°
60°
65°
70°
75°
S
Drake Passage
South Orkney Is.
South
Sandwich
Is.
Larsen
Ice
Shelf
Antarctic Peninsula
Weddell Sea
Kapp Norvegia
Ronne
Ice Shelf
ANT-IX/2
W
60°
45°
30°
15°
0°

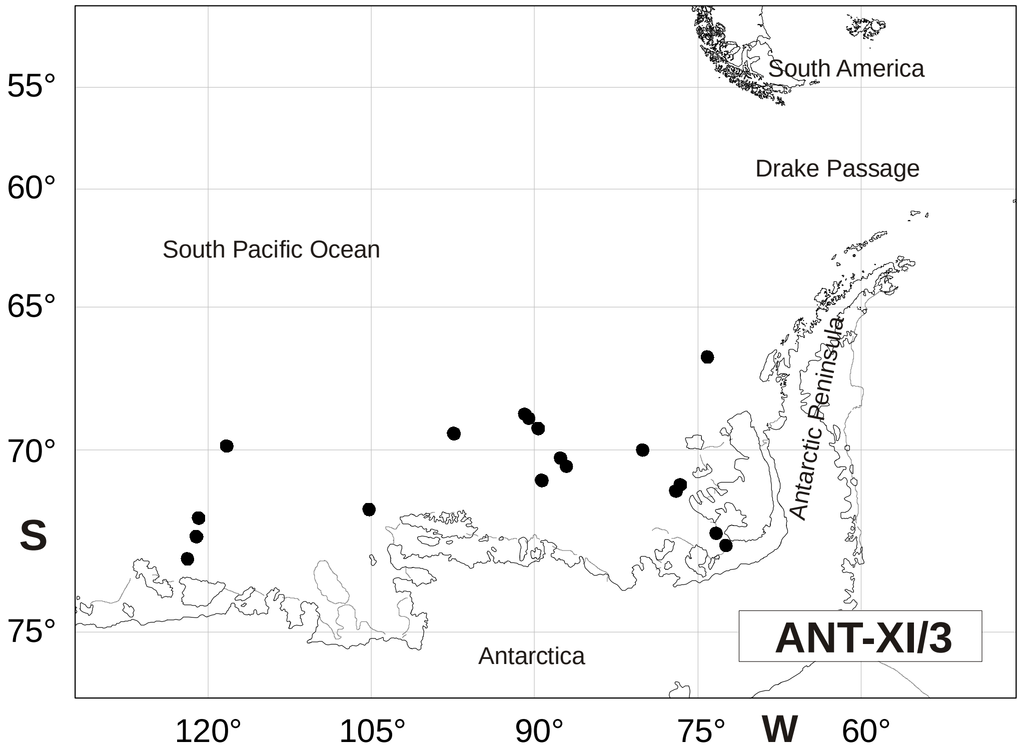

55°
60°
65°
70°
75°
S
W
45°
30°
15°
0°
E
15°
Scotia Sea
South
Sandwich
Is.
Weddell Sea
Antarctica
Ronne
Ice Shelf
ANT-IX/3

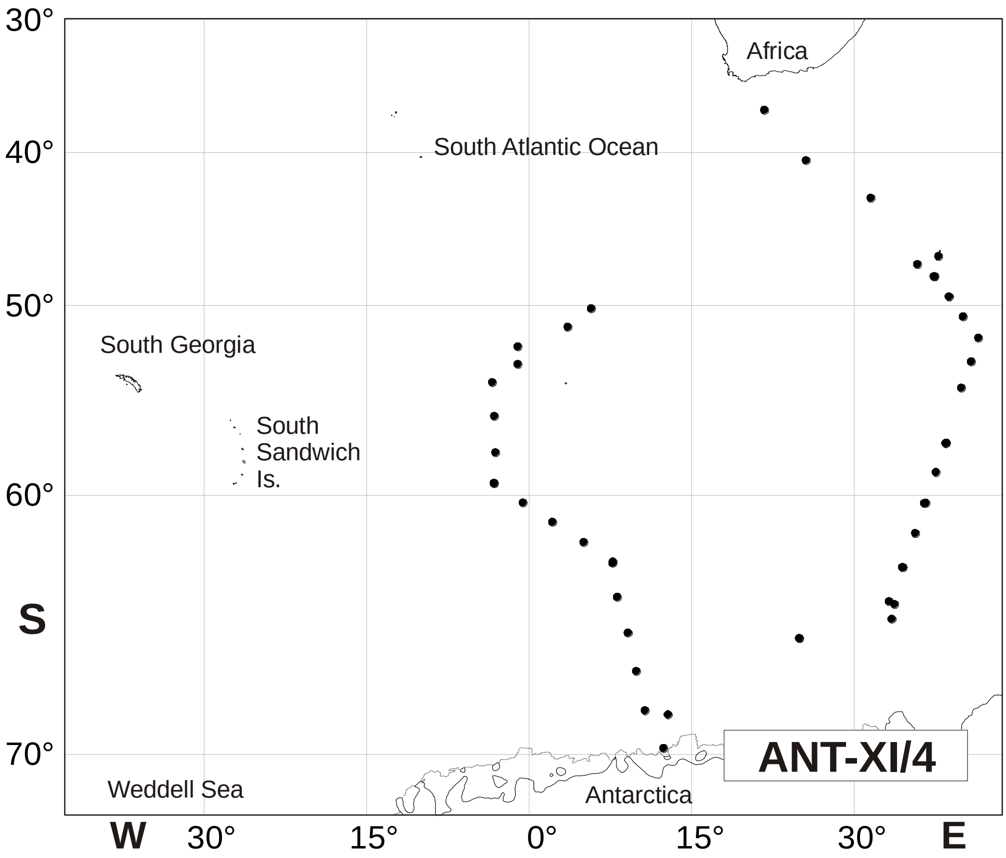

30°
40°
50°
60°
70°
S
W
60°
45°
30°
15°
0°
15°
E
South America
South Atlantic Ocean
Falkland Is.
Scotia Sea
South
Sandwich
Is.
Antarctic Peninsula
Weddell Sea
ANT-X/4

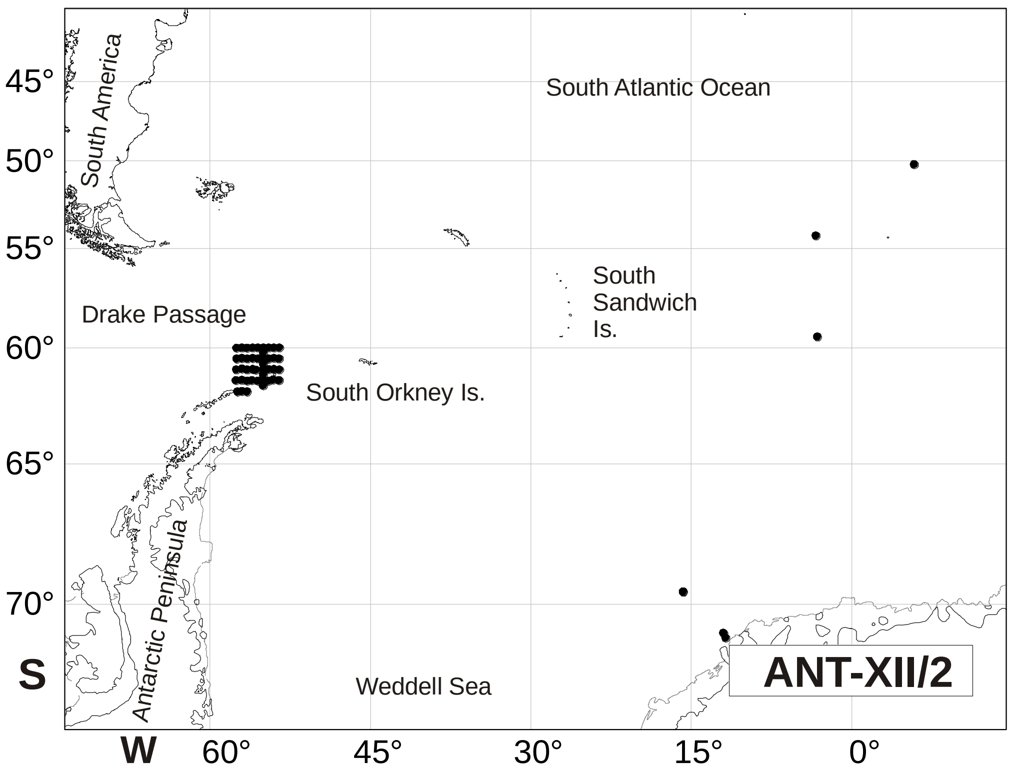

45°
50°
55°
60°
65°
S
70°
75°
60°
45°
30°
W
15°
South America
Falkland Is.
South Georgia
Scotia Sea
South Sandwich Is.
Drake Passage
South Orkney Is.
Antarctic Peninsula
Weddell Sea
ANT-X/5

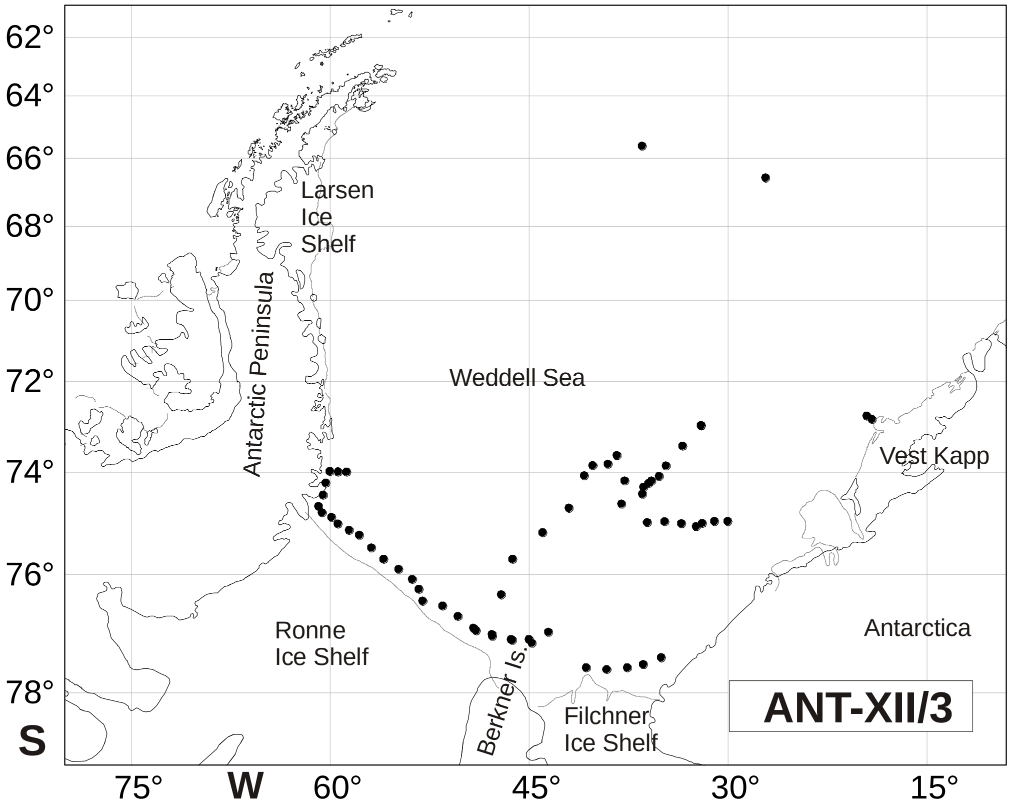

50°
55°
60°
65°
70°
S
75°
75°
60°
45°
30°
15°
W
0°
Falkland Is.
South Sandwich Is.
Drake Passage
Antarctic Peninsula
Kapp Norvegia
Weddell Sea
ANT-X/7

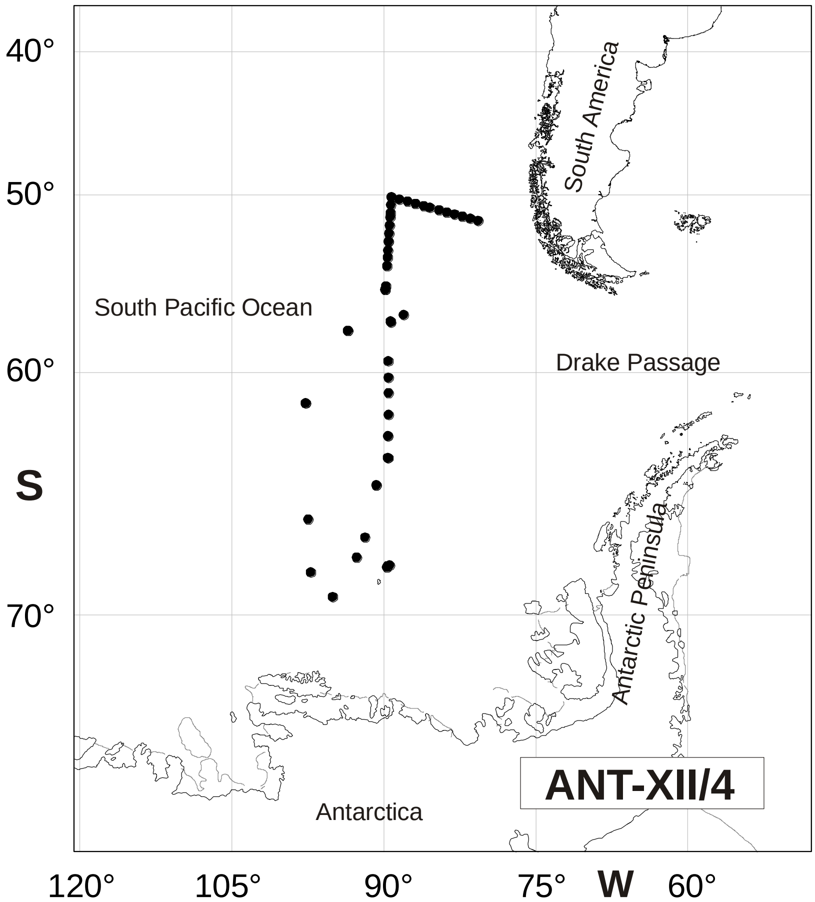

South America
Africa
South Atlantic Ocean
40°
50°
Falkland Is.
South Georgia
Scotia Sea
South
Sandwich
Is.
60°
S
70°
Weddell Sea
ANT-XI/2
60°
W
45°
30°
15°
0°
15°
E

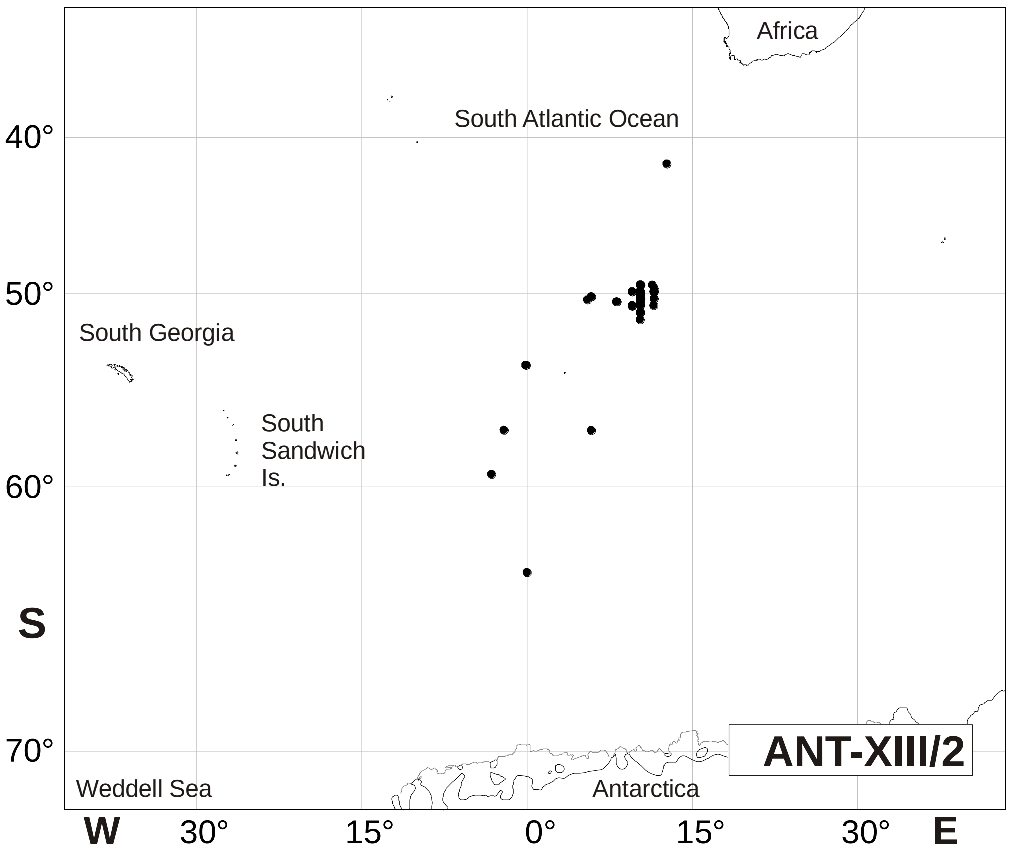

55°
South America
60°
Drake Passage
South Pacific Ocean
65°
Antarctic Peninsula
70°
S
75°
Antarctica
ANT-XI/3
120°
105°
90°
75°
W
60°

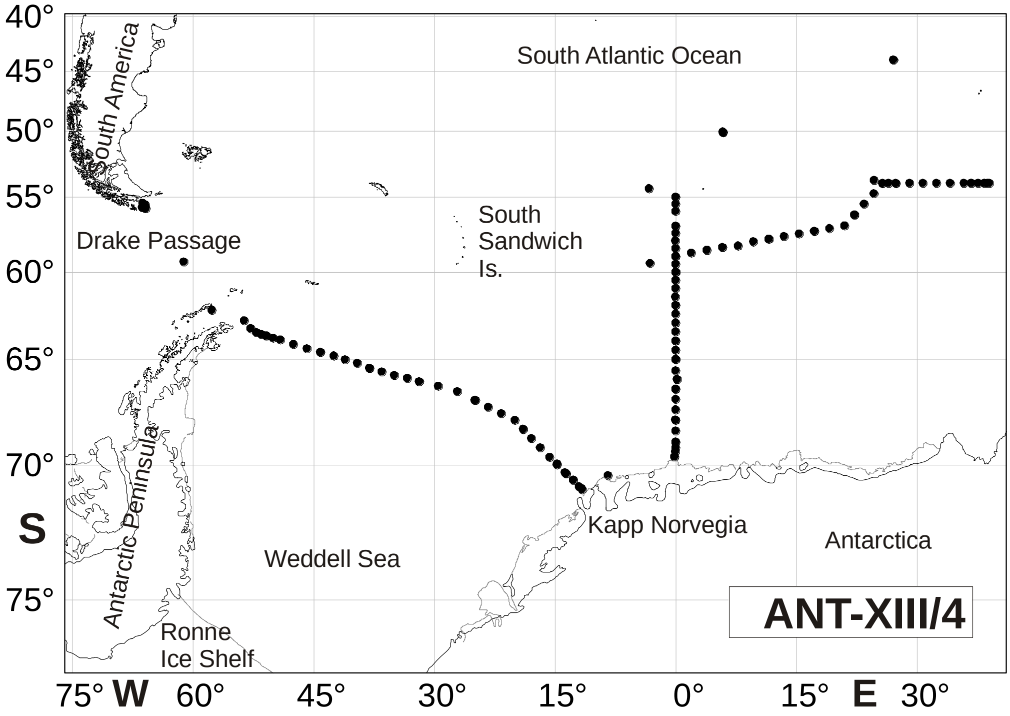

30°
40°
50°
60°
S
70°
Africa
South Atlantic Ocean
South Georgia
South
Sandwich
Is.
Weddell Sea
Antarctica
ANT-XI/4
W
30°
15°
0°
15°
30°
E

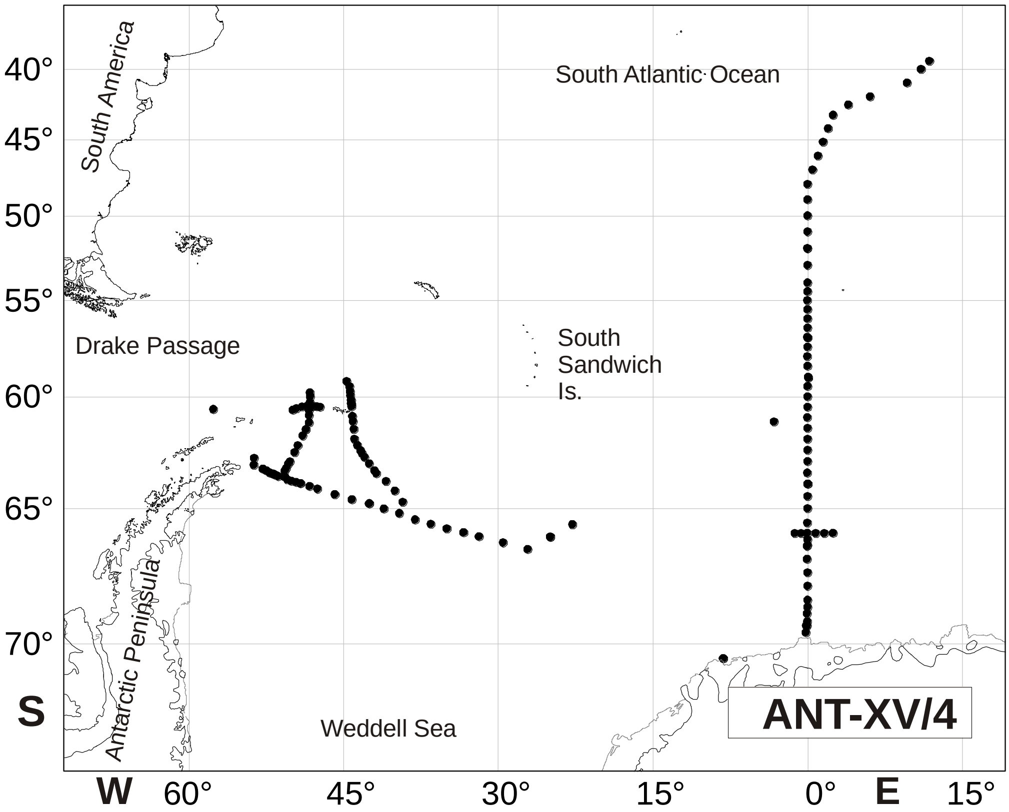

45°
50°
55°
60°
65°
70°
S
South America
South Atlantic Ocean
Drake Passage
South
Sandwich
Is.
South Orkney Is.
Antarctic Peninsula
Weddell Sea
ANT-XII/2
W
60°
45°
30°
15°
0°

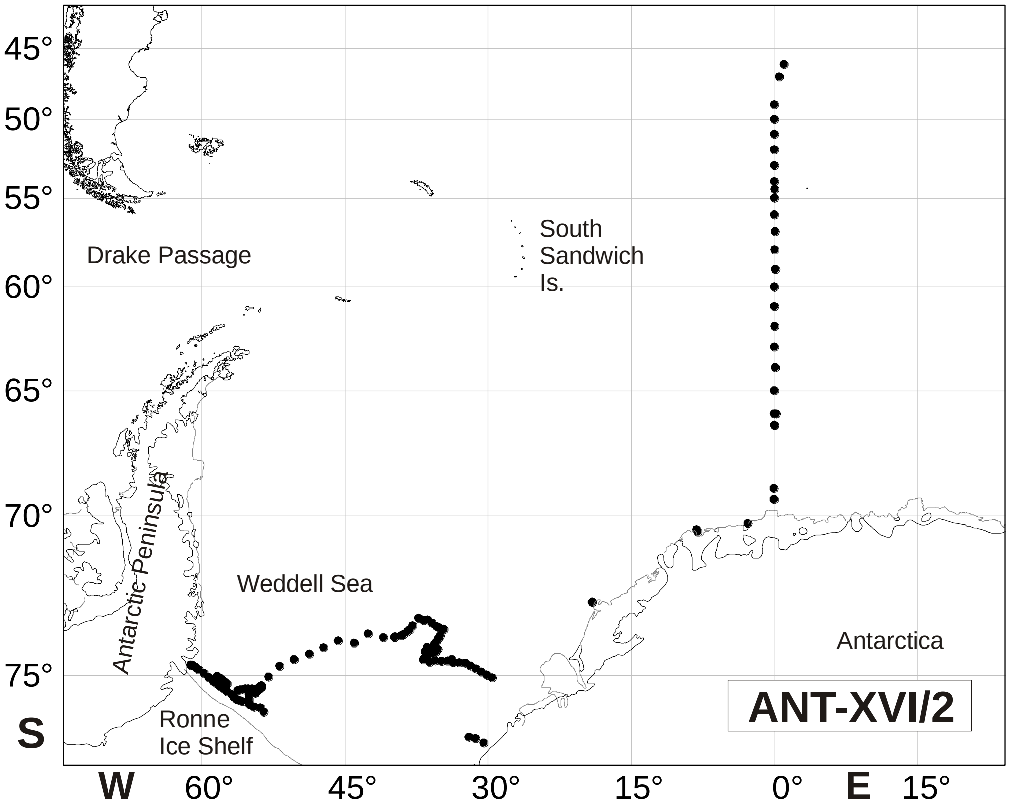

62°
64°
66°
68°
70°
72°
74°
76°
78°
S
75°
W
60°
45°
30°
15°
Larsen
Ice
Shelf
Antarctic Peninsula
Weddell Sea
Vest Kapp
Ronne
Ice Shelf
Berkner Is.
Filchner
Ice Shelf
Antarctica
ANT-XII/3

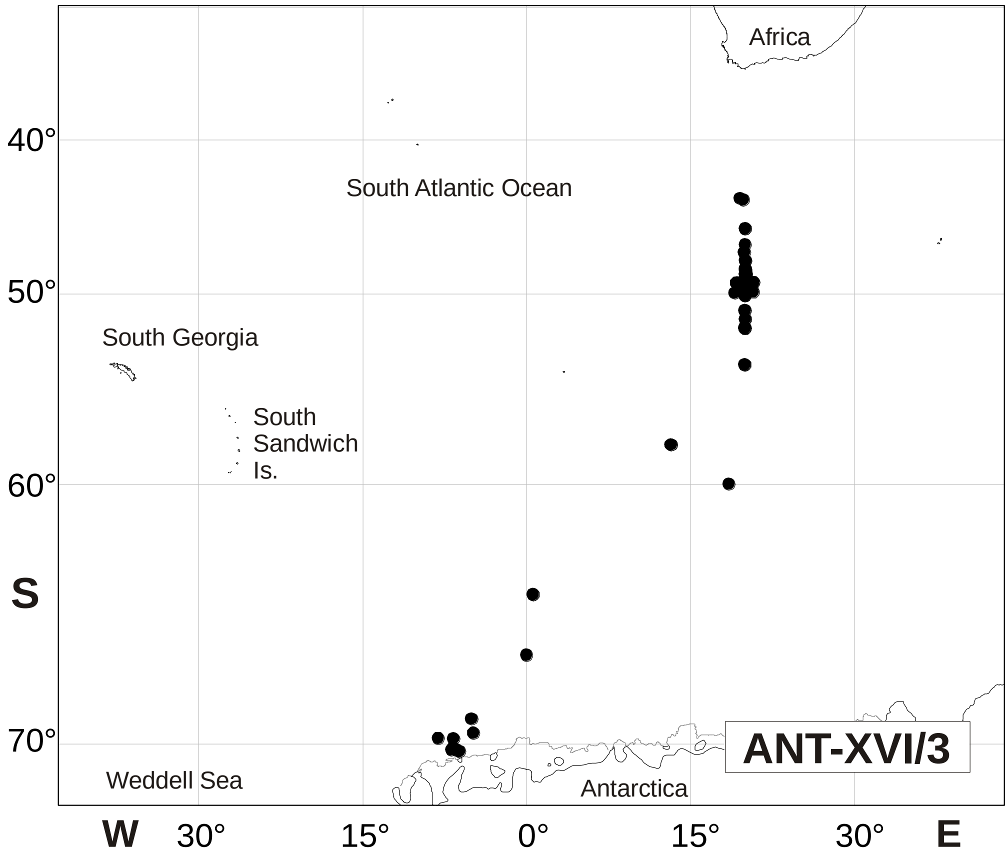

40°
50°
60°
S
70°
120°
105°
90°
75°
W
60°
South America
South Pacific Ocean
Drake Passage
Antarctic Peninsula
Antarctica
ANT-XII/4


Africa
South Atlantic Ocean
40°
50°
South Georgia
South
Sandwich
Is.
60°
S
70°
ANT-XIII/2
Weddell Sea
Antarctica
W
30°
15°
0°
15°
30°
E


40°
45°
50°
55°
60°
65°
70°
S
75°
South America
South Atlantic Ocean
Drake Passage
South
Sandwich
Is.
Antarctic Peninsula
Kapp Norvegia
Antarctica
Weddell Sea
Ronne
Ice Shelf
ANT-XIII/4
75°
W
60°
45°
30°
15°
0°
15°
E
30°


South America
South Atlantic Ocean
Drake Passage
South
Sandwich
Is.
Antarctic Peninsula
Weddell Sea
ANT-XV/4
40°
45°
50°
55°
60°
65°
70°
S
W
60°
45°
30°
15°
0°
E
15°


Drake Passage
South
Sandwich
Is.
Antarctic Peninsula
Weddell Sea
Antarctica
Ronne
Ice Shelf
ANT-XVI/2
45°
50°
55°
60°
65°
70°
75°
S
W
60°
45°
30°
15°
0°
E
15°


Africa
South Atlantic Ocean
40°
50°
South Georgia
South
Sandwich
Is.
60°
S
70°
Weddell Sea
Antarctica
ANT-XVI/3
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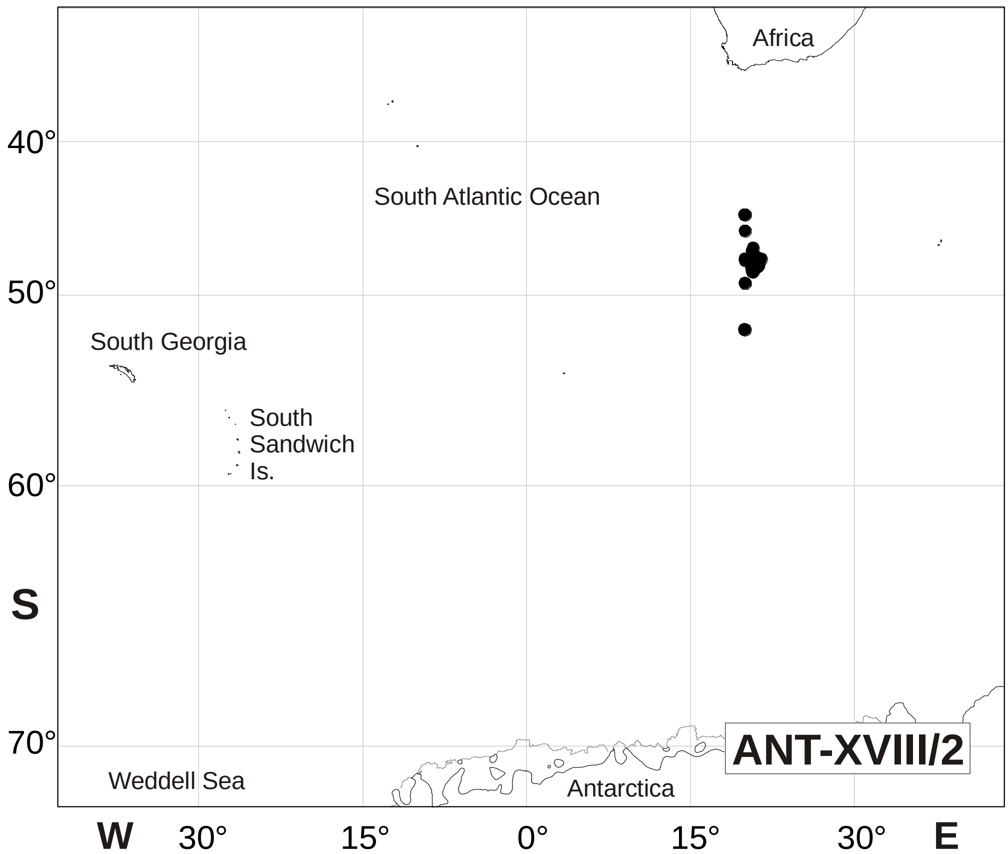
15°
0°
15°
30°
E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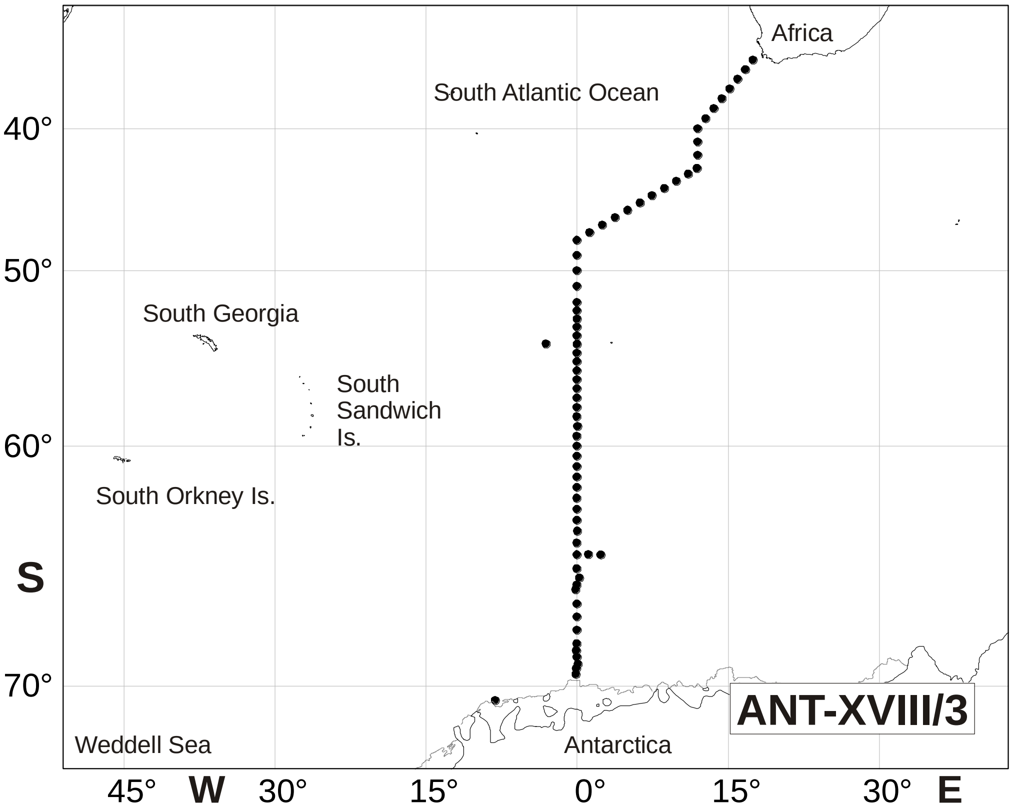
40°
50°
South Georgia
South
Sandwich
Is.
60°
S
70°
Weddell Sea
Antarctica
ANT-XVIII/2
W
30°
15°
0°
15°
30°
E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South Georgia
South
Sandwich
Is.
60°
South Orkney Is.
S
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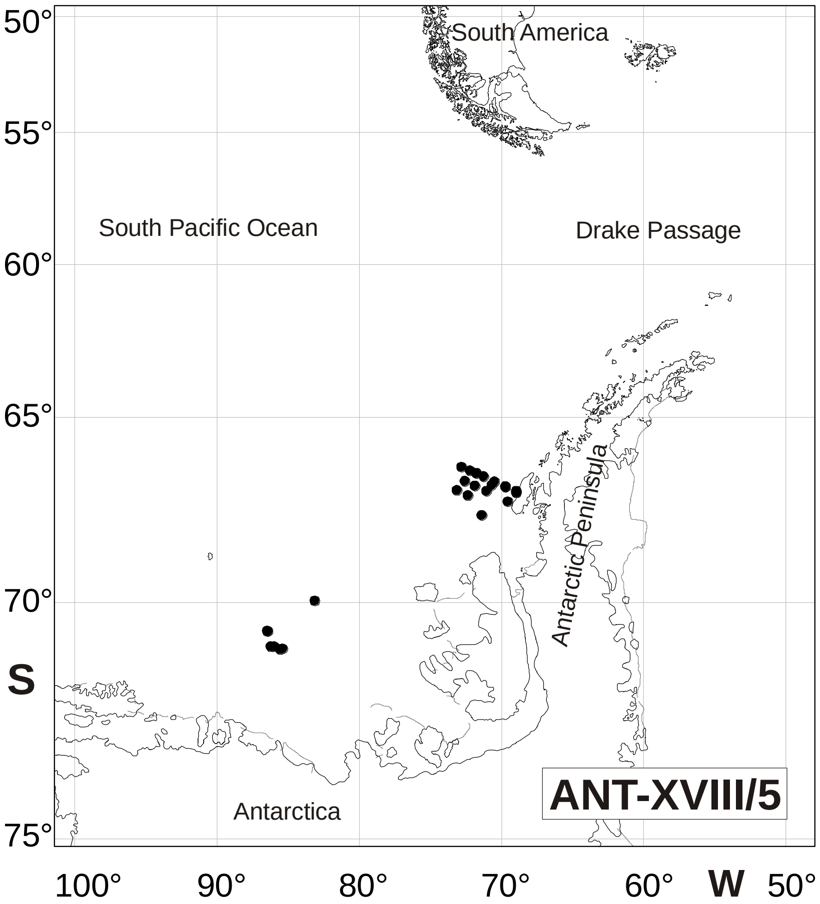
ANT-XVIII/3
Weddell Sea
Antarctica
45°
W
30°
15°
0°
15°
30°
E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55°
South Pacific Ocean
Drake Passage
60°
65°
Antarctic Peninsula
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S
ANT-XVIII/5
Antarctica
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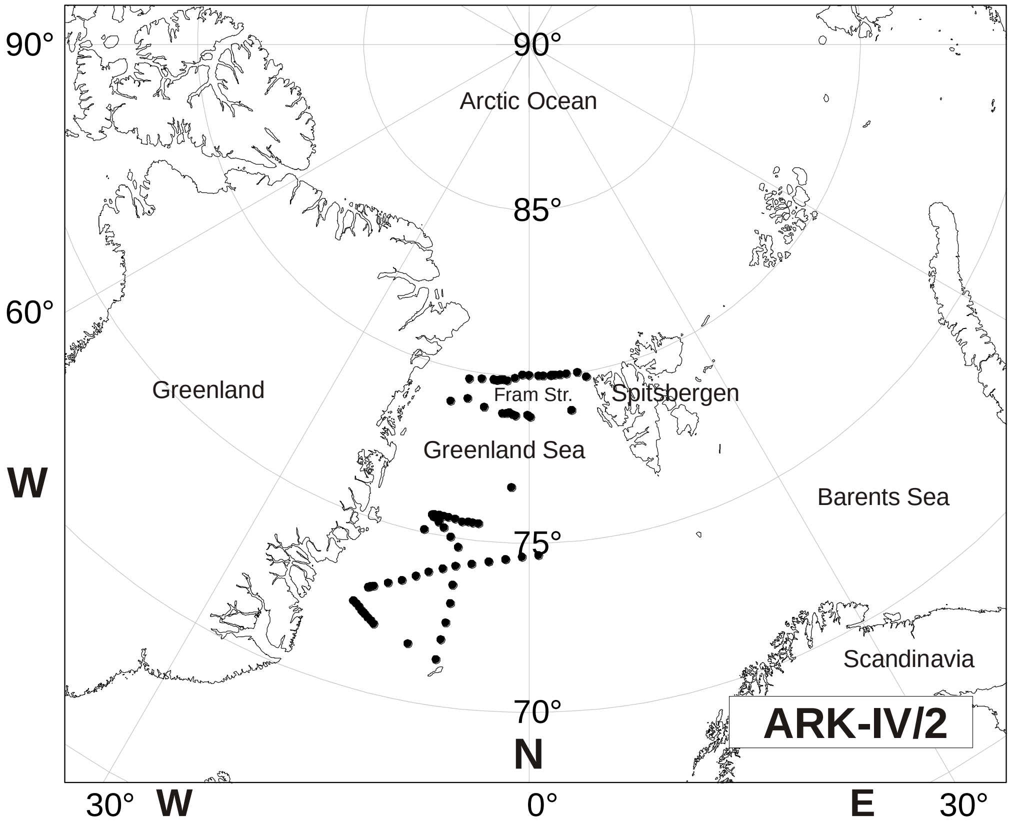
100°
90°
80°
70°
60°
W
50°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85°
60°
Greenland
Fram Str.
Spitsbergen
Greenland Sea
W
Barents Sea
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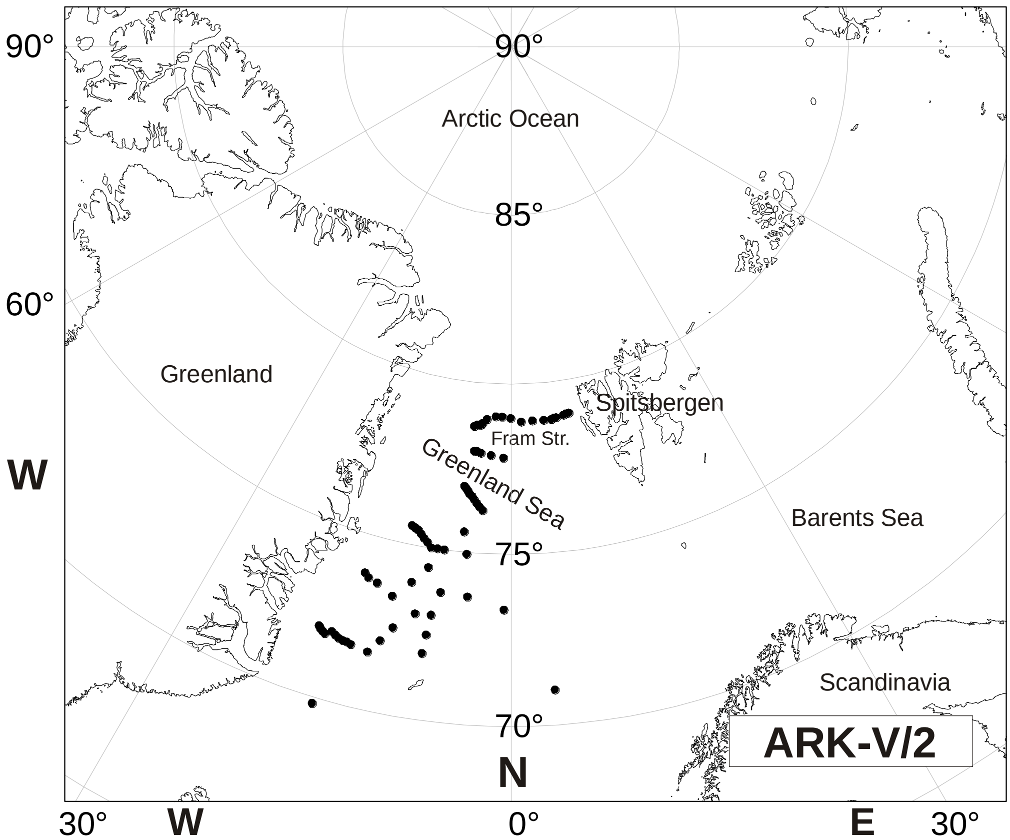
Scandinavia
70°
ARK-IV/2
N
30°
W
0°
E
30°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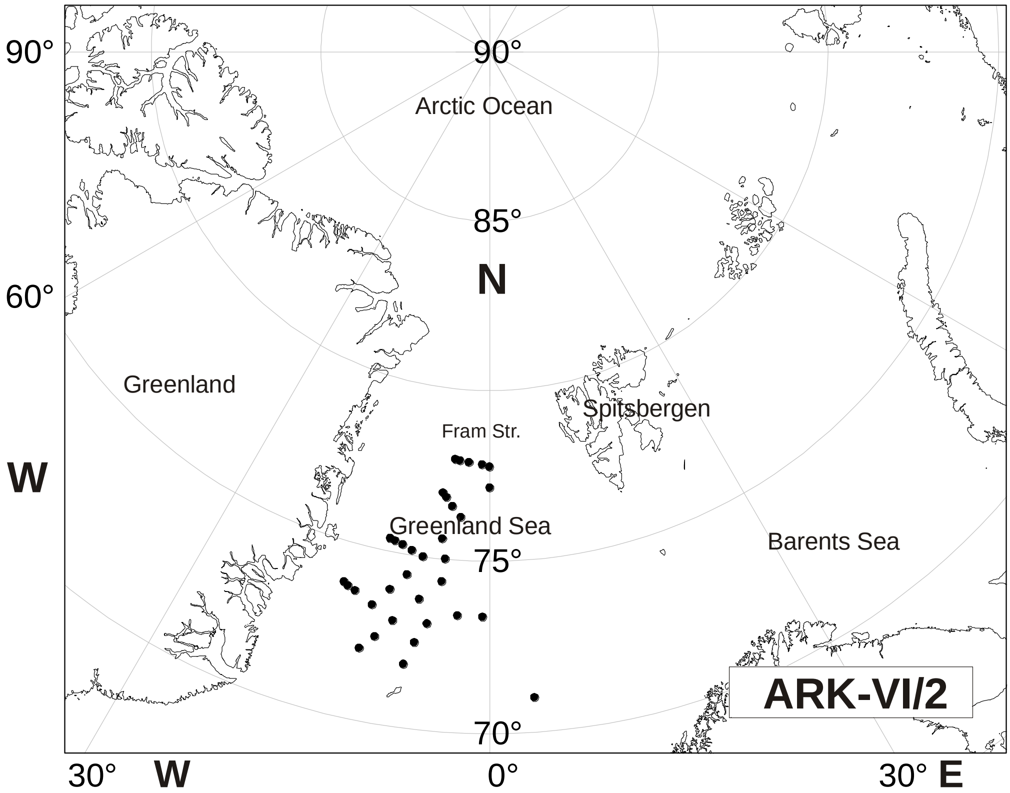
Scandinavia
70°
ARK-V/2
N
30°
W
0°
E
30°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W
Greenland Sea
Barents Sea
75°
ARK-VI/2
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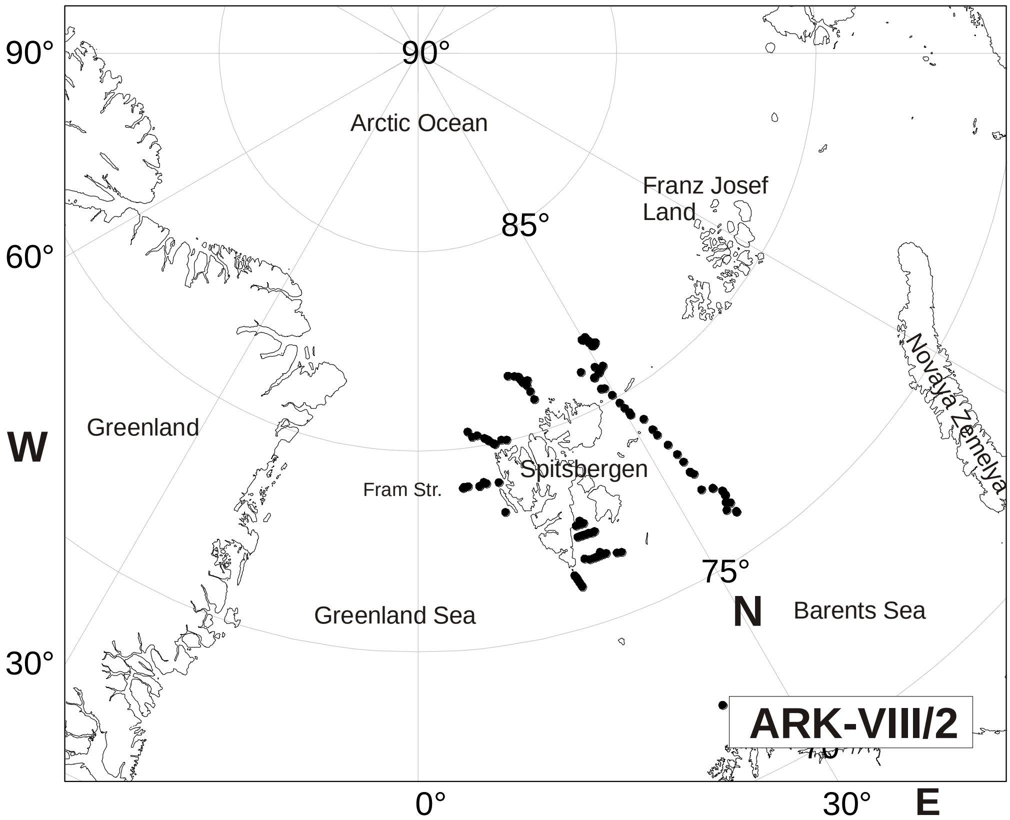
W
0°
30°
E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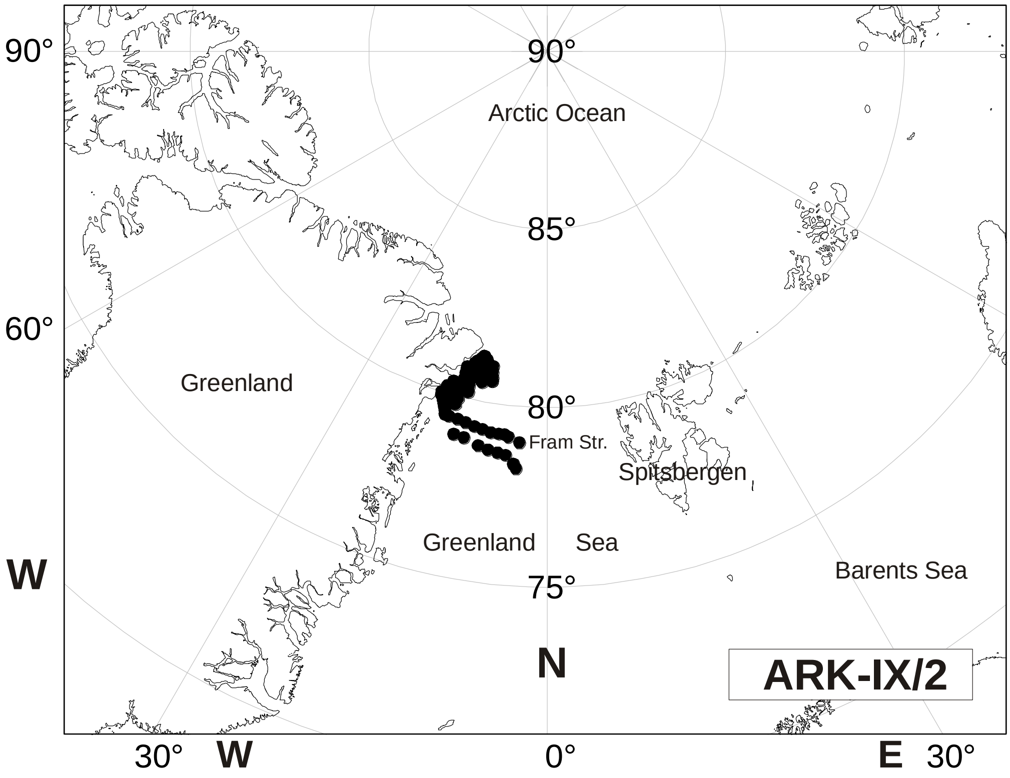
60°
Novaya Zemelya
Greenland
W
Spitsbergen
Fram Str.
75°
N
Barents Sea
Greenland Sea
30°
ARK-VIII/2
0°
30°
E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Arctic Ocean
85°
60°
Greenland
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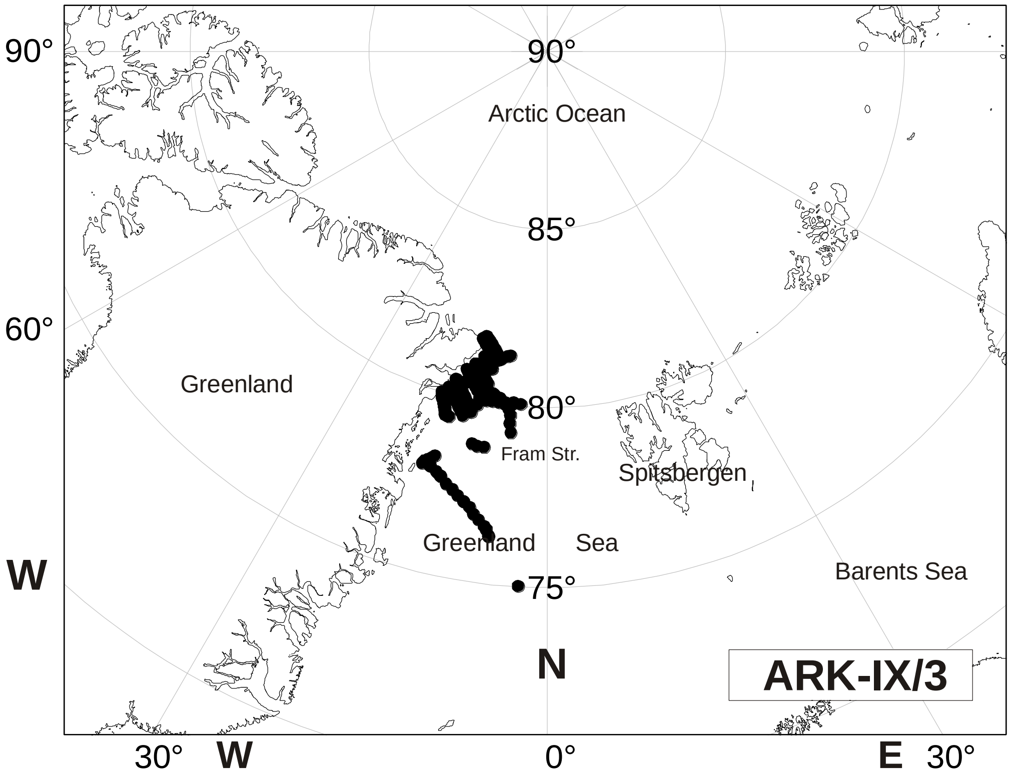
Fram Str.
Spitsbergen
Greenland Sea
W
75°
Barents Sea
N
ARK-IX/2
30° W
0°
E 30°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85°
60°
Greenland
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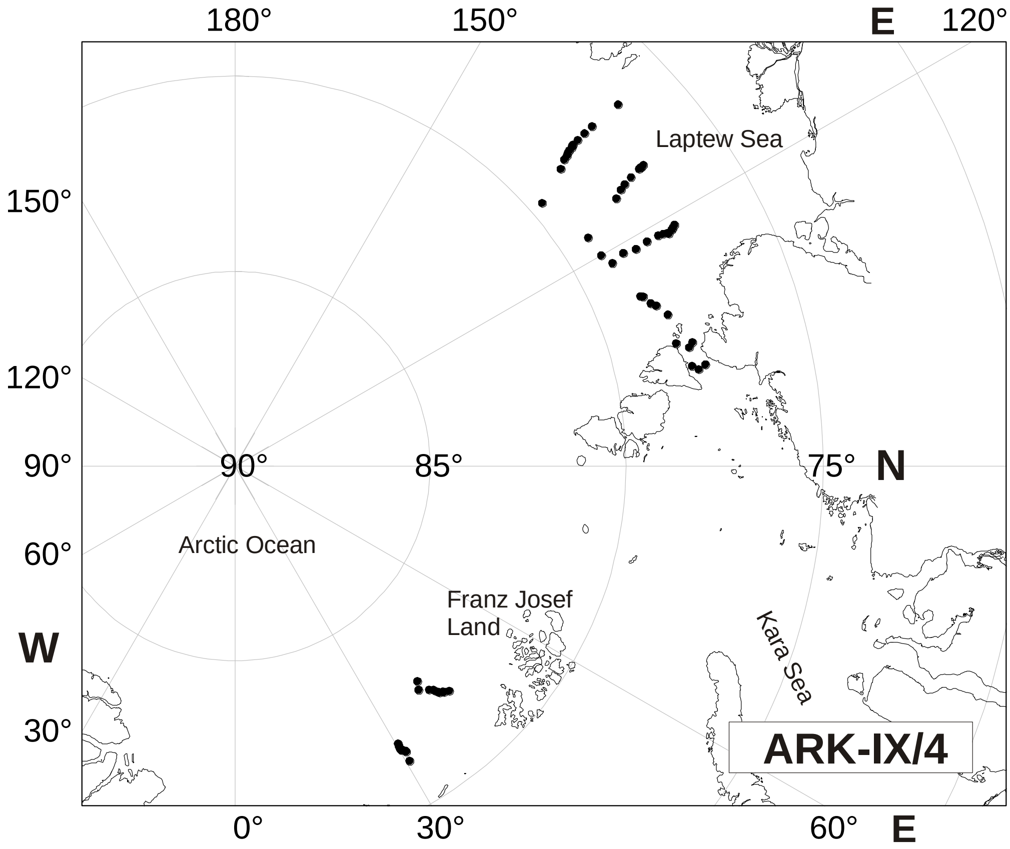
Fram Str.
Spitsbergen
Greenland Sea
W
75°
Barents Sea
N
ARK-IX/3
30° W
0°
E 30°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E
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150°
Laptew Sea
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90°
90°
85°
75°
N
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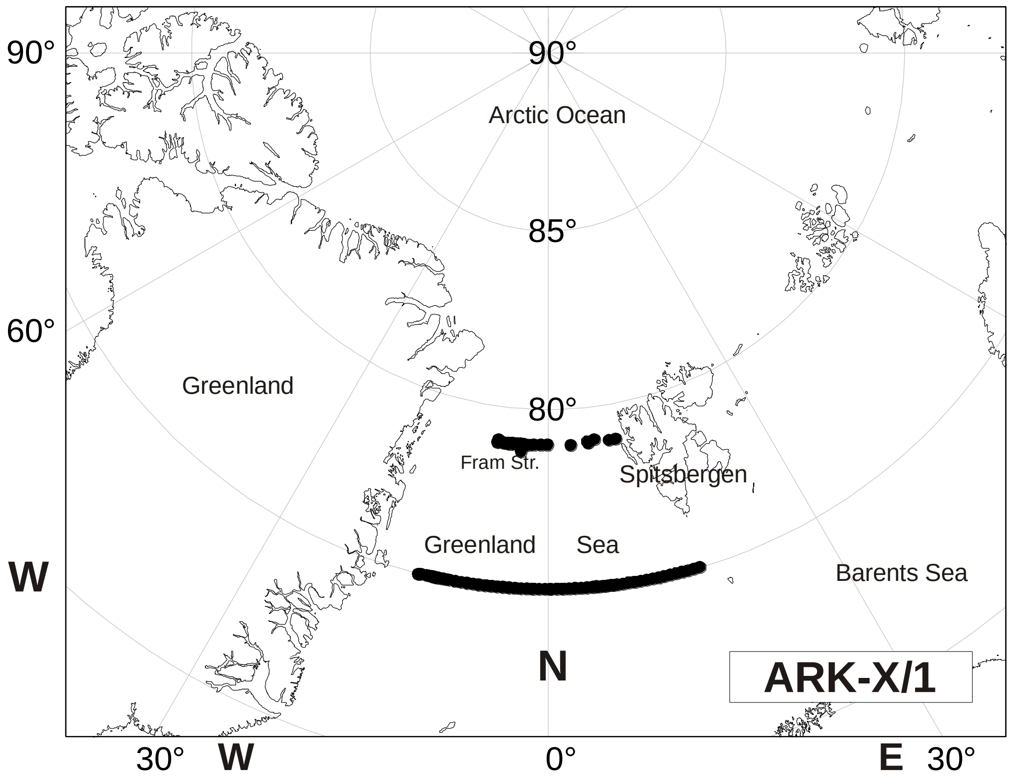
Arctic Ocean
Franz Josef
Land
W
Kara Sea
30°
ARK-IX/4
0°
30°
60°
E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Arctic Ocean
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60°
Greenland
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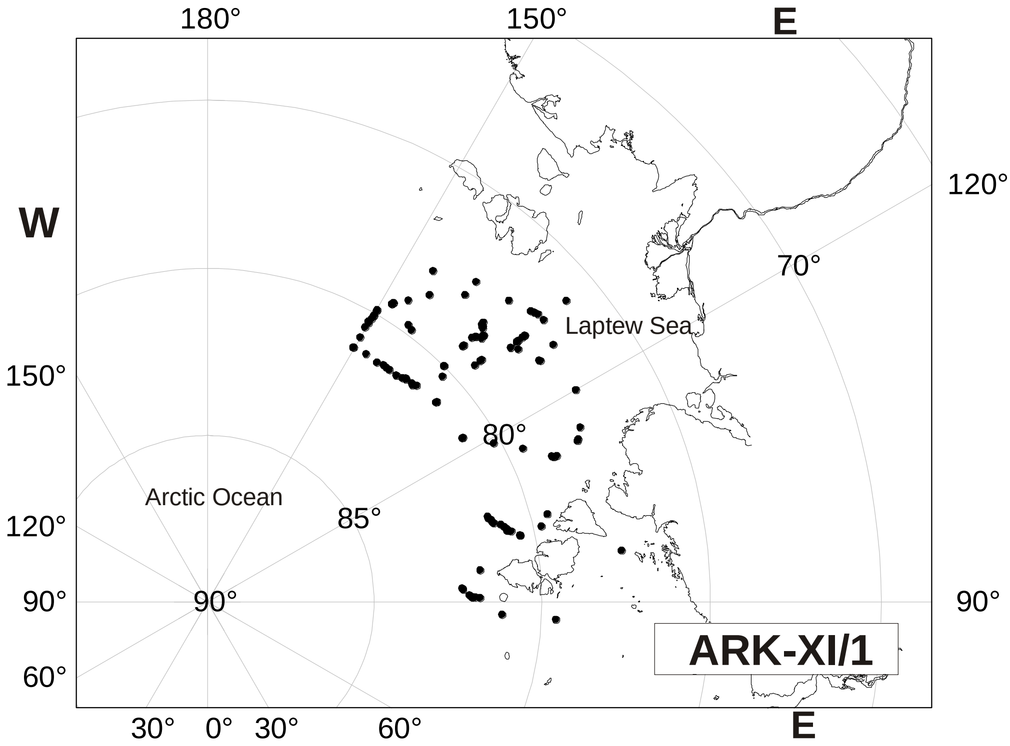
Fram Str.
Spitsbergen
Greenland
Sea
W
Barents Sea
N
ARK-X/1
30°
W
0°
E
30°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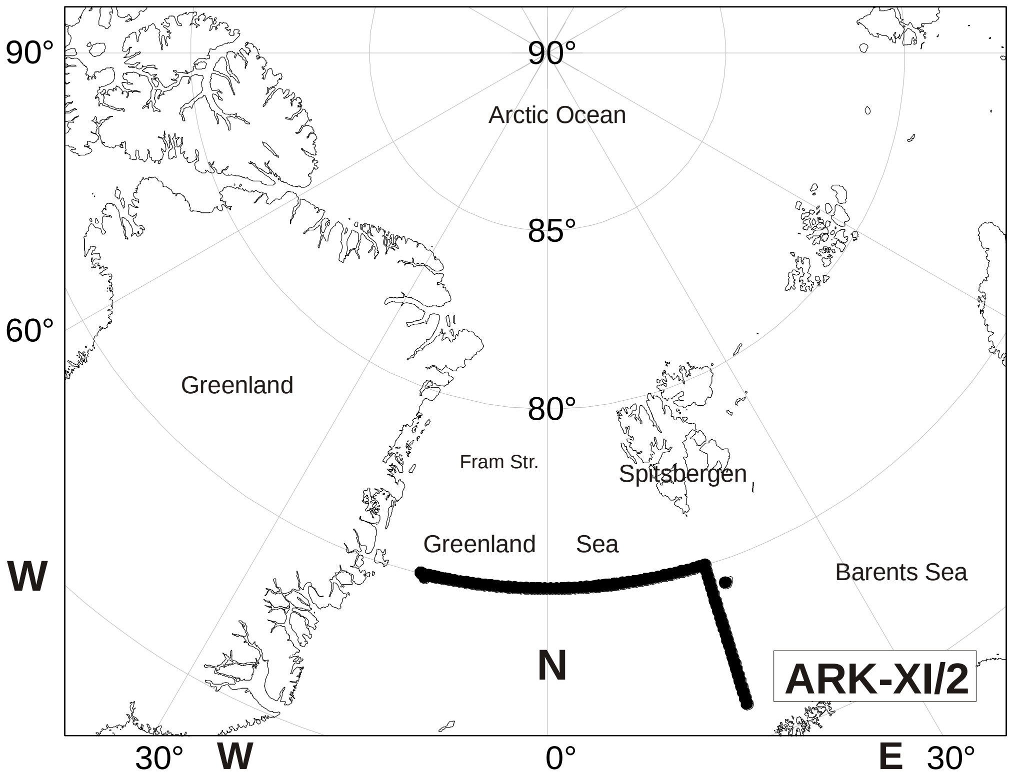
150°
E
120°
W
70°
Laptew Sea
150°
80°
Arctic Ocean
85°
120°
90°
90°
90°
ARK-XI/1
60°
30°
0°
30°
60°
E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Arctic Ocean
85°
60°
Greenland
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Spitsbergen
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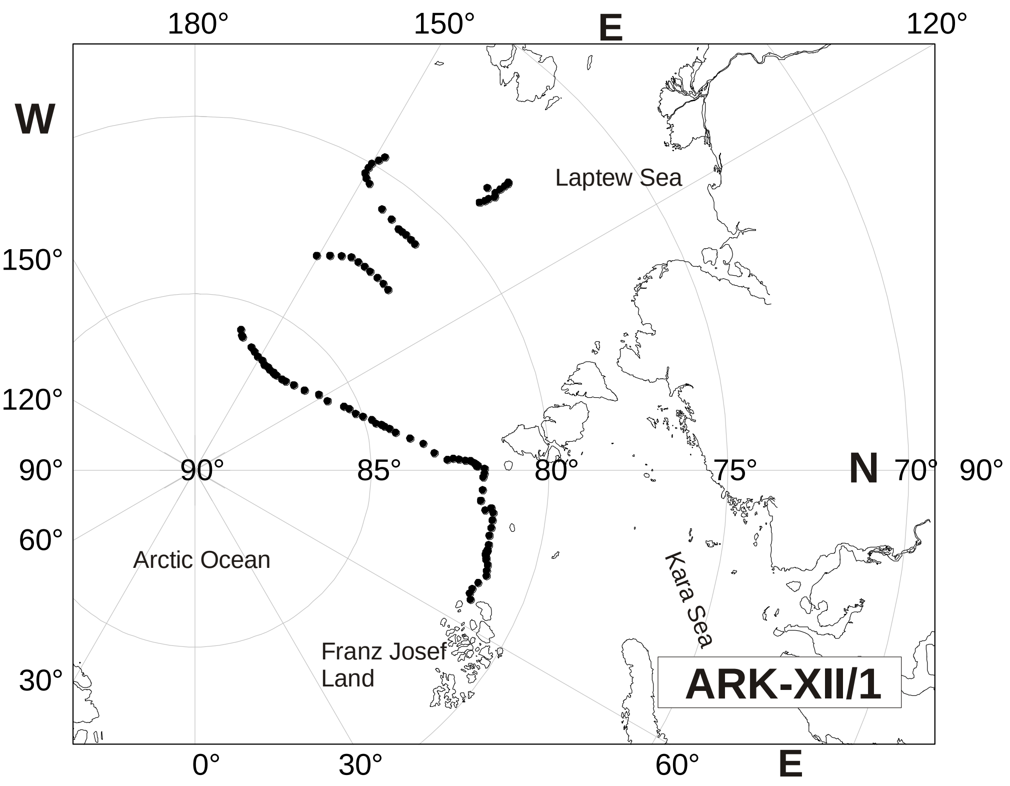
W
Barents Sea
N
ARK-XI/2
30°
W
0°
E
30°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150°
E
120°
W
Laptew Sea
150°
120°
90°
90°
85°
80°
75°
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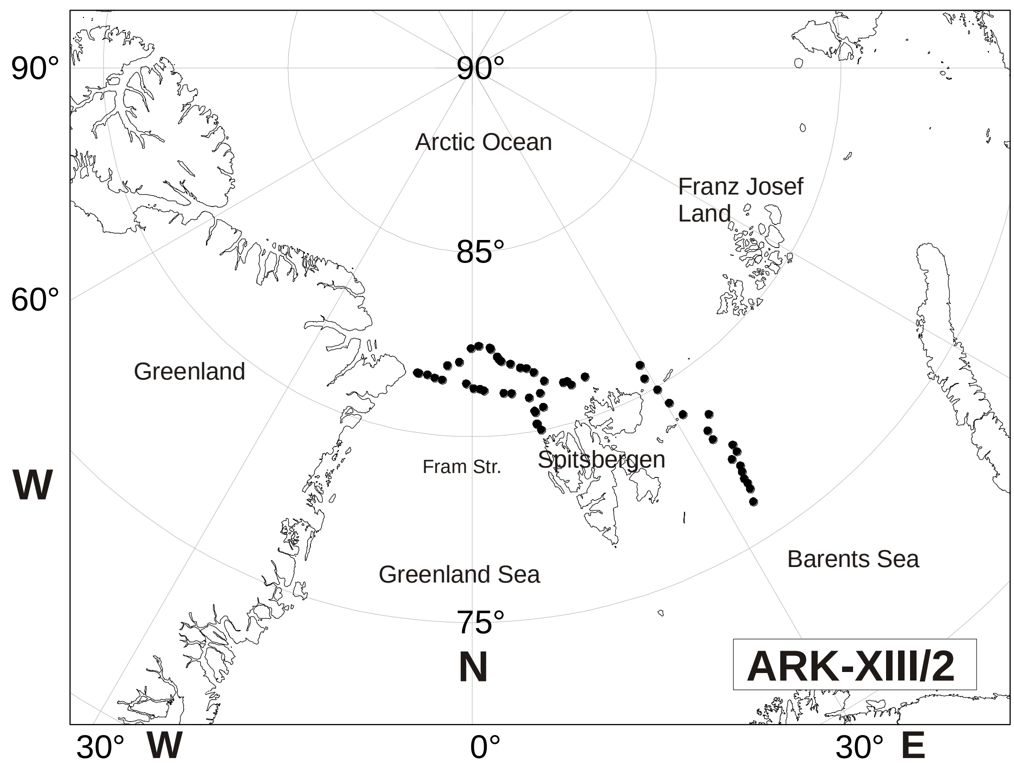
60°
Arctic Ocean
Kara Sea
Franz Josef
Land
30°
ARK-XII/1
0°
30°
60°
E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90°
Arctic Ocean
Franz Josef
Land
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60°
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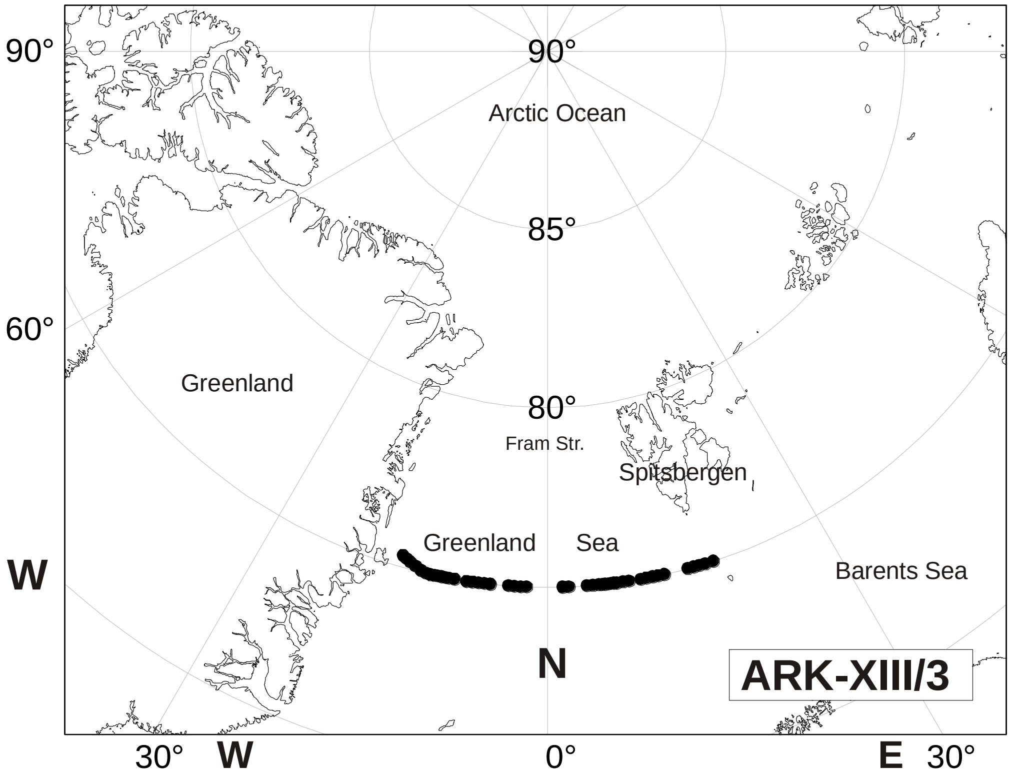
Fram Str.
Spitsbergen
Greenland Sea
Barents Sea
75°
N
ARK-XIII/2
30°
W
0°
30°
E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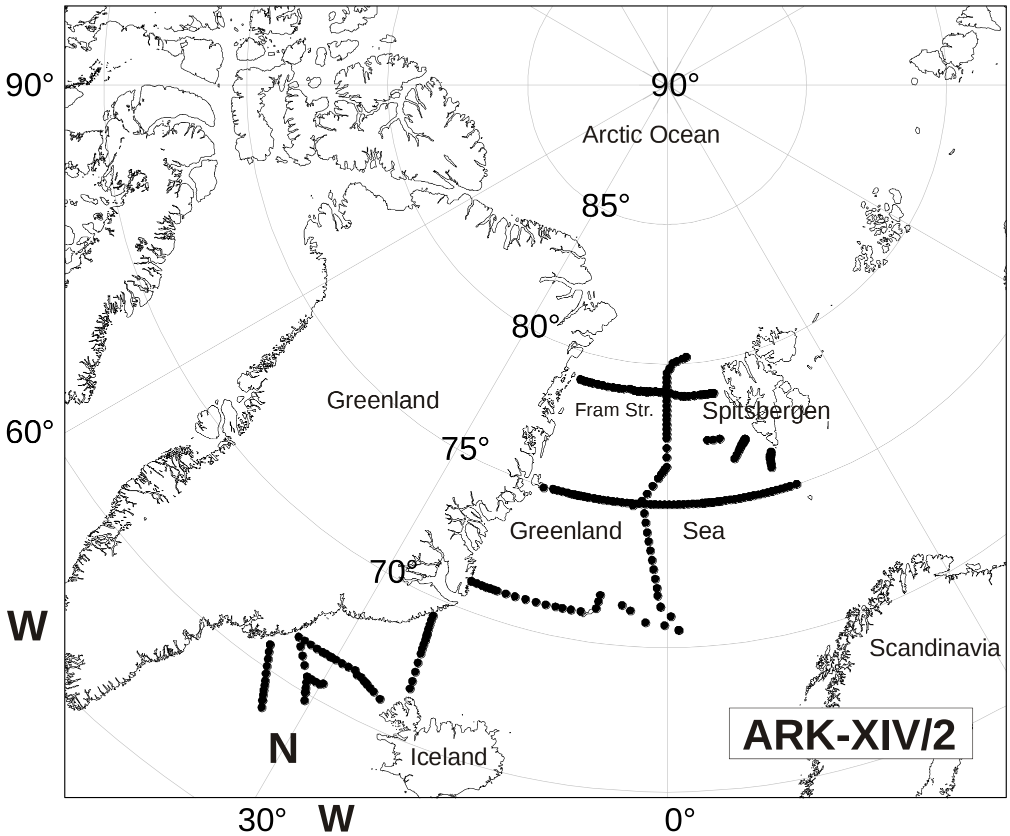
85°
60°
Greenland
80°
Fram Str.
Spitsbergen
Greenland
Sea
Barents Sea
W
N
ARK-XIII/3
30°
W
0°
E
30°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Arctic Ocean
85°
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Greenland
Fram Str.
Spitsbergen
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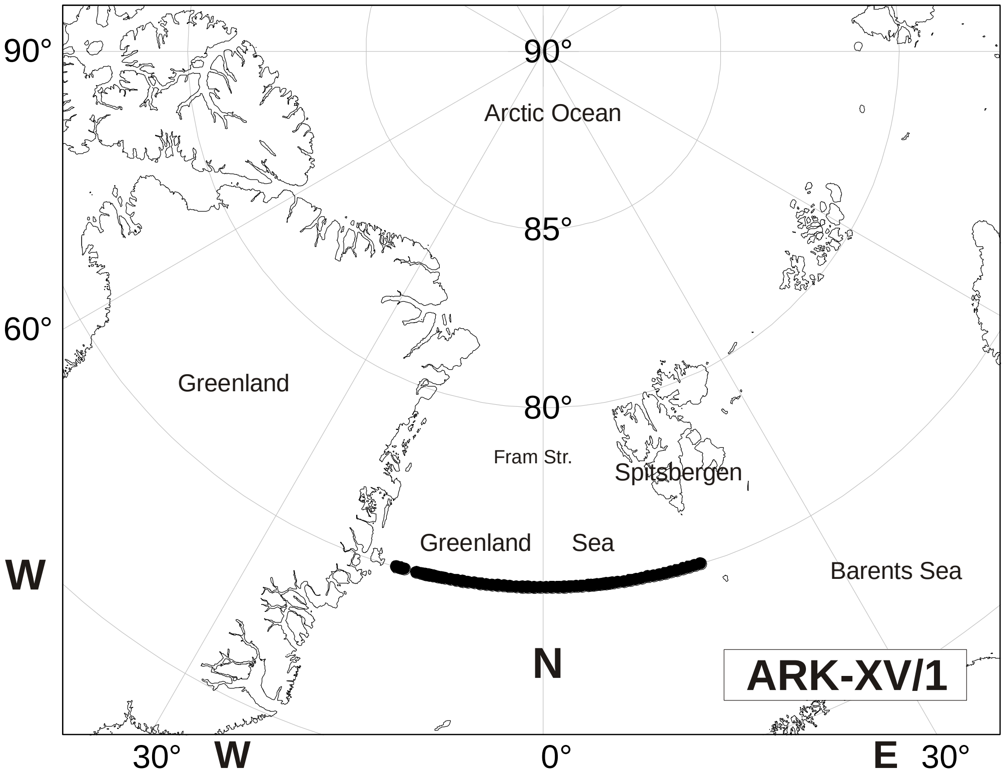
75°
Greenland
Sea
70°
W
Scandinavia
ARK-XIV/2
N
Iceland
30°
W
0°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90°
Arctic Ocean
85°
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Greenland
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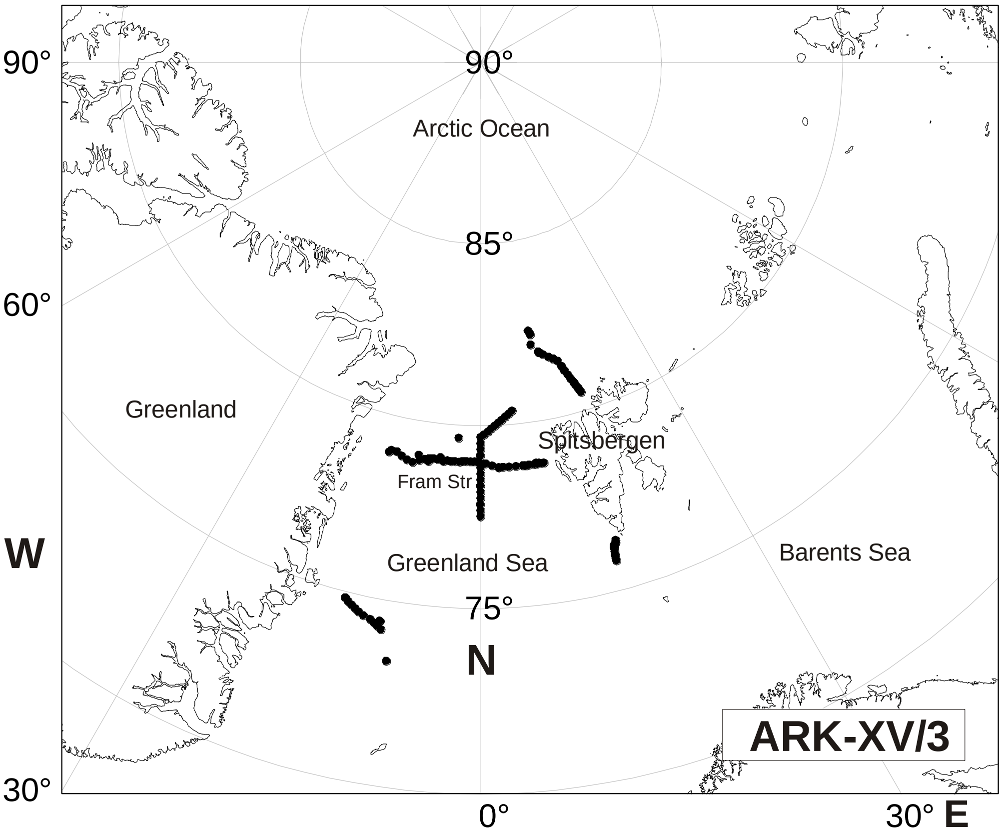
Fram Str.
Spitsbergen
Greenland Sea
W
Barents Sea
N
ARK-XV/1
30° W
0°
E 30°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Arctic Ocean
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Fram Str
W
Greenland Sea
Barents Sea
75°
N
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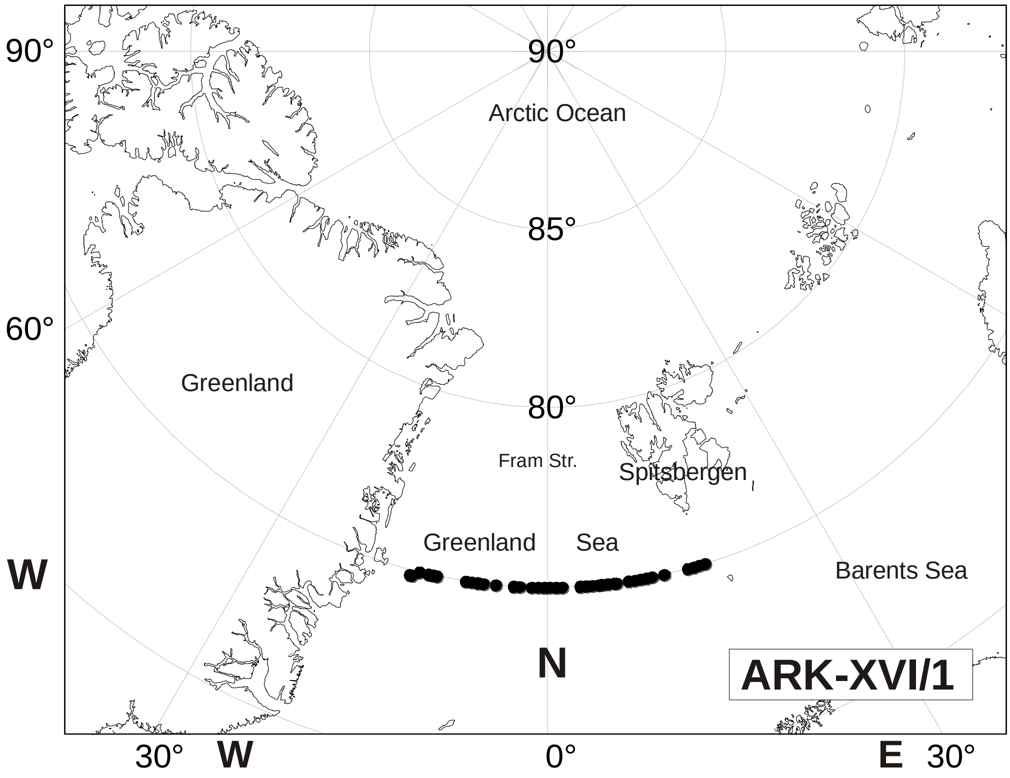
30°
0°
30° E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Arctic Ocean
85°
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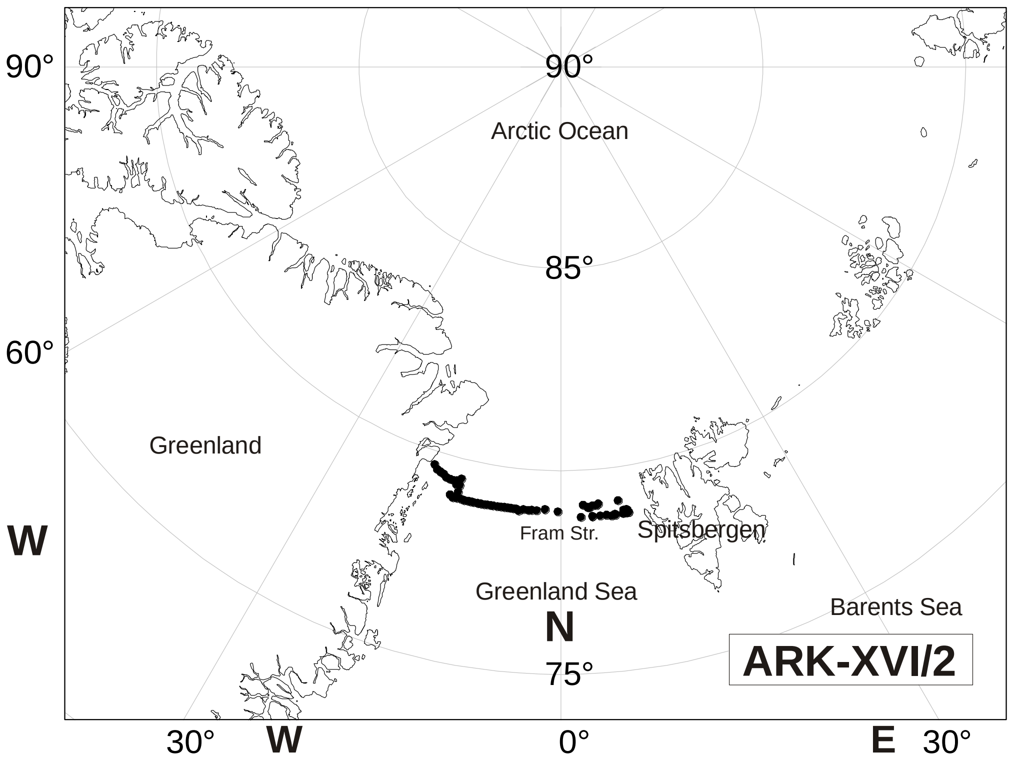
Greenland
80°
Fram Str.
Spitsbergen
Greenland Sea
W
Barents Sea
N
ARK-XVI/1
30° W
0°
E 30°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85°
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Spitsbergen
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Greenland Sea
Barents Sea
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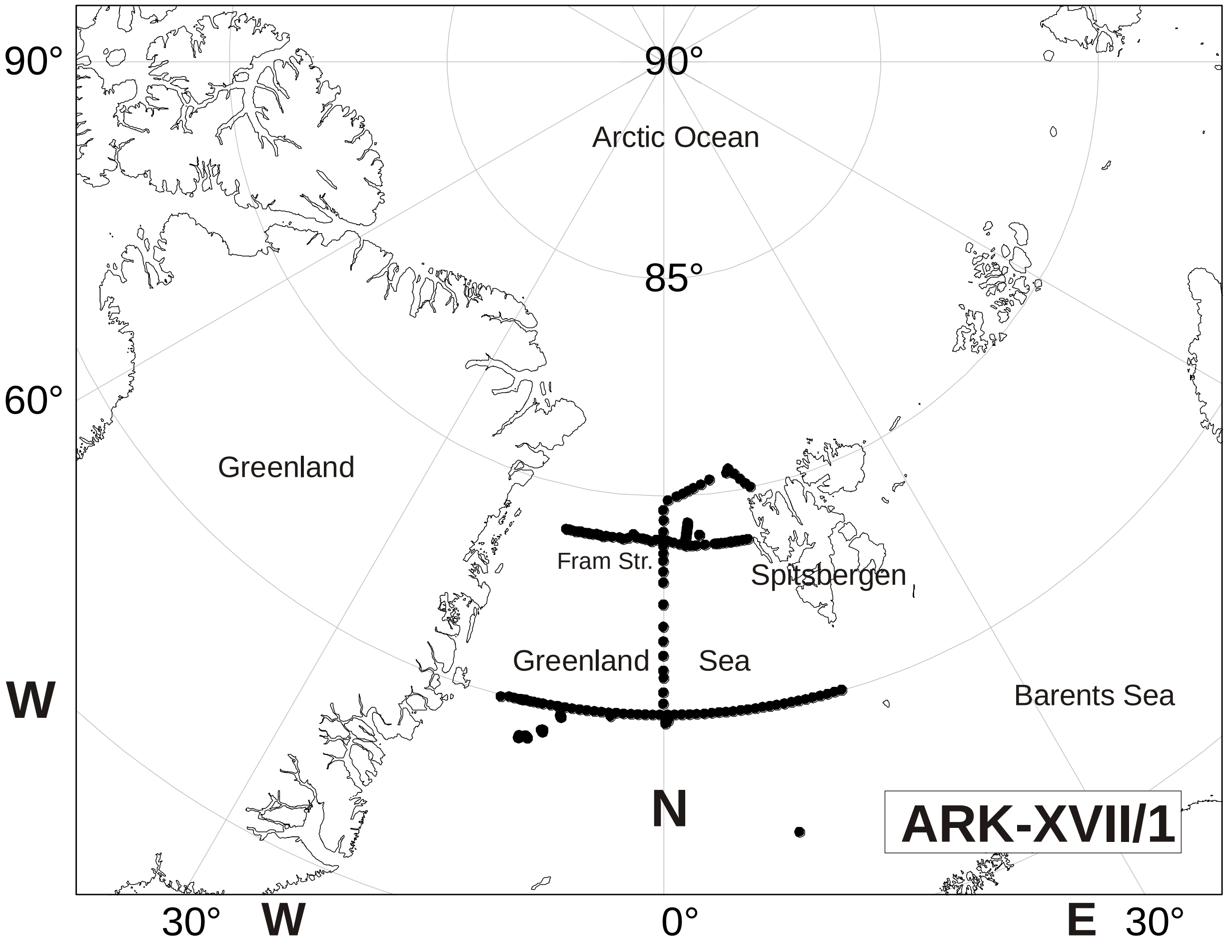
ARK-XVI/2
75°
30° W
0°
E 30°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90°
Arctic Ocean
85°
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Greenland
Fram Str.
Spitsbergen
Greenland
Sea
W
Barents Sea
N
ARK-XVII/1
30°
W
0°
E
30°

3.3. Thermosalinograph – Surface temperature and salinity

3.3.1 Summary of available data sets

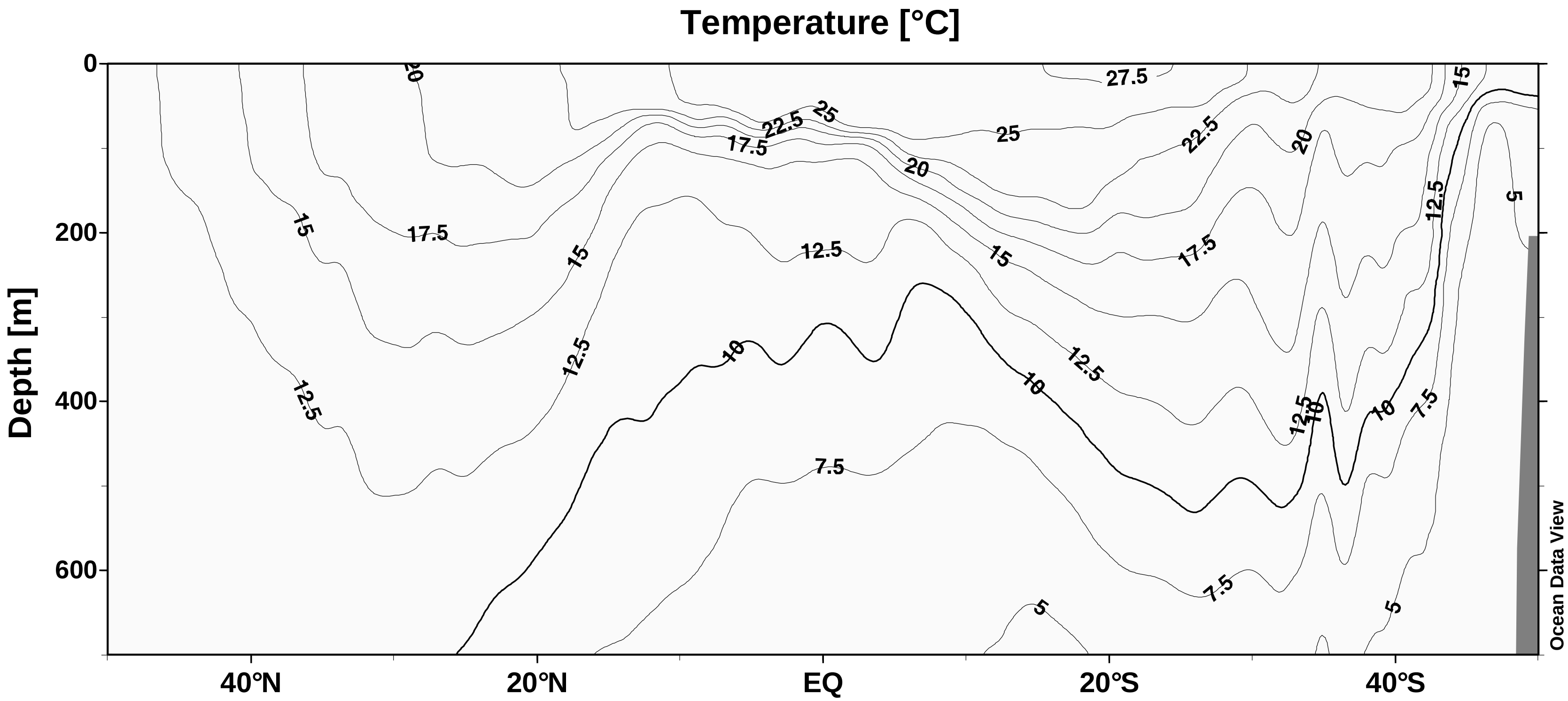
Tab.6: Cruises with surface temperature and salinity record

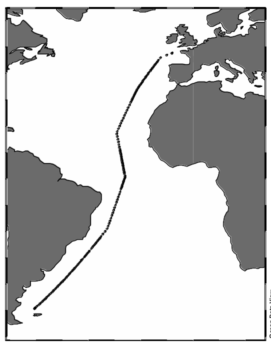
Cruise	Leg	Departure				Arrival			
ARK-IX	2	16	May	1993	Bremerhaven	25	Jun	1993	Tromsoe
ARK-IX	3	25	Jun	1993	Tromsoe	5	Aug	1993	Tromsoe
ARK-IX	4	6	Aug	1993	Tromsoe	6	Oct	1993	Bremerhaven
ANT-XI	1	18	Oct	1993	Bremerhaven	27	Nov	1993	Cape Town
ANT-XI	2	12	Dec	1993	Cape Town	12	Jan	1994	Punta Arenas
ANT-XI	3	14	Jan	1994	Punta Arenas	28	Mar	1994	Cape Town
ANT-XI	5	21	May	1994	Cape Town	18	Jun	1994	Bremerhaven
ARK-X	1	6	Jul	1994	Bremerhaven	16	Aug	1994	Tromsoe
ARK-X	2	17	Aug	1994	Tromsoe	6	Oct	1994	Bremerhaven
ANT-XII	1	18	Oct	1994	Bremerhaven	22	Nov	1994	Punta Arenas
ANT-XII	2	23	Nov	1994	Punta Arenas	4	Jan	1995	Cape Town
ANT-XII	3	5	Jan	1995	Cape Town	20	Mar	1995	Punta Arenas
ANT-XII	4	21	Mar	1995	Punta Arenas	15	May	1995	Punta Arenas
ANT-XII	5	15	May	1995	Punta Arenas	12	Jun	1995	Bremerhaven
ARK-XI	1	7	Jul	1995	Bremerhaven	21	Sep	1995	Tromsoe
ARK-XI	2	20	Sep	1995	Tromsoe	30	Oct	1995	Bremerhaven
ANT-XIII	1	9	Nov	1995	Bremerhaven	3	Dec	1995	Cape Town
ANT-XIII	2	4	Dec	1995	Cape Town	25	Jan	1996	Cape Town
ANT-XIII	3	26	Jan	1996	Cape Town	16	Mar	1996	Cape Town
ANT-XIII	4	17	Mar	1996	Cape Town	19	May	1996	Punta Arenas
ANT-XIII	5	19	May	1996	Punta Arenas	21	Jun	1996	Bremerhaven
ARK-XII	1	12	Jul	1996	Bremerhaven	24	Sep	1996	Bremerhaven
ANT-XIV	1	5	Oct	1996	Bremerhaven	9	Nov	1996	Punta Quilla
ANT-XIV	2	12	Nov	1996	Punta Quilla	1	Jan	1997	Punta Arenas
ANT-XIV	3	4	Jan	1997	Punta Arenas	20	Mar	1997	Cape Town
ANT-XIV	4	21	Mar	1997	Cape Town	26	Apr	1997	Bremerhaven
ARK-XIII	1	14	May	1997	Bremerhaven	23	Jun	1997	Tromsoe
ARK-XIII	2	24	Jun	1997	Tromsoe	12	Aug	1997	Tromsoe
ARK-XIII	3	11	Aug	1997	Tromsoe	30	Sep	1997	Bremerhaven
ANT-XV	1	15	Oct	1997	Bremerhaven	7	Nov	1997	Cape Town
ANT-XV	2	9	Nov	1997	Cape Town	12	Jan	1998	Cape Town
ANT-XV	3	13	Jan	1998	Cape Town	25	Mar	1998	Punta Arenas
ANT-XV	4	25	Mar	1998	Punta Arenas	23	May	1998	Cape Town
ANT-XV	5	26	May	1998	Cape Town	22	Jun	1998	Bremerhaven
ARK-XIV	1	27	Jun	1998	Bremerhaven	27	Aug	1998	Tromsoe
ARK-XIV	2	28	Aug	1998	Tromsoe	15	Oct	1998	Bremerhaven
ANT-XVI	1	15	Dec	1998	Bremerhaven	6	Jan	1999	Cape Town
ANT-XVI	2	8	Jan	1999	Cape Town	16	Mar	1999	Cape Town
ANT-XVI	3	16	Mar	1999	Cape Town	11	May	1999	Cape Town
ANT-XVI	4	11	May	1999	Cape Town	3	Jun	1999	Bremerhaven
ARK-XV	1	23	Jun	1999	Bremerhaven	19	Jul	1999	Tromsoe
ARK-XV	2	21	Jul	1999	Tromsoe	8	Sep	1999	Tromsoe
ARK-XV	3	8	Sep	1999	Tromsoe	14	Oct	1999	Bremerhaven
ANT-XVII	1	14	Dec	1999	Bremerhaven	7	Jan	2000	Cape Town
ANT-XVII	2	7	Jan	2000	Cape Town	15	Mar	2000	Cape Town
ANT-XVII	3	18	Mar	2000	Cape Town	11	May	2000	Punta Arenas

Cruise	Leg	Departure				Arrival			
ANT-XVII	4	14	May	2000	Punta Arenas	20	Jun	2000	Bremerhaven
ARK-XVI	1	30	Jun	2000	Bremerhaven	30	Jul	2000	Longyearbyen
ARK-XVI	2	30	Jul	2000	Longyearbyen	26	Aug	2000	Bremerhaven
ANT-XVIII	3	7	Dec	2000	Cape Town	13	Jan	2001	Cape Town
ARK-XVIII	1	25	Jun	2002	Bremerhaven	24	Aug	2002	Tromsoe
ARK-XVIII	2	24	Aug	2002	Tromsoe	15	Oct	2002	Bremerhaven
ANT-XX	1	26	Oct	2002	Bremerhaven	22	Nov	2002	Cape Town
ANT-XX	2	24	Nov	2002	Cape Town	23	Jan	2003	Cape Town
ANT-XX	3	23	Jan	2003	Cape Town	16	Feb	2003	Bremerhaven
ARK-XIX	1	28	Feb	2003	Bremerhaven	24	Apr	2003	Longyearbyen
ARK-XIX	2	24	Apr	2003	Longyearbyen	15	May	2003	Bremerhaven
ARK-XIX	3a	23	May	2003	Bremerhaven	26	Jun	2003	Tromsoe
ARK-XIX	3b	26	Jun	2003	Tromsoe	19	Jul	2003	Longyearbyen
ARK-XIX	3c	19	Jul	2003	Longyearbyen	7	Aug	2003	Tromsoe
ARK-XIX	4a	7	Aug	2003	Tromsoe	21	Sep	2003	Longyearbyen
ARK-XIX	4b	21	Sep	2003	Longearbyen	13	Oct	2003	Bremerhaven
ANT-XXI	1	22	Oct	2003	Bremerhaven	15	Nov	2003	Cape Town
ANT-XXI	2	17	Nov	2003	Cape Town	19	Jan	2004	Cape Town
ANT-XXI	3	21	Jan	2004	Cape Town	26	Mar	2004	Cape Town
ANT-XXI	4	26	Mar	2004	Cape Town	7	May	2004	Cape Town
ANT-XXI	5	8	May	2004	Cape Town	2	Jun	2004	Bremerhaven
ARK-XX	1	16	Jun	2004	Bremerhaven	16	Jul	2004	Longyearbyen
ARK-XX	2	16	Jul	2004	Longyearbyen	30	Aug	2004	Tromsoe
ARK-XX	3	30	Aug	2004	Tromsoe	3	Oct	2004	Bremerhaven
ANT-XXII	1	12	Oct	2004	Bremerhaven	5	Nov	2004	Cape Town
ANT-XXII	2	4	Nov	2004	Cape Town	20	Jan	2005	Cape Town
ANT-XXII	3	20	Jan	2005	Cape Town	7	Apr	2005	Punta Arenas
ANT-XXII	4	8	Apr	2005	Punta Arenas	22	May	2005	Bahia Blanca
ANT-XXII	5	24	May	2005	Bahia Blanca	22	Jun	2005	Bremerhaven
ARK-XXI	1a	21	Jul	2005	Bremerhaven	13	Aug	2005	Longyeabyen
ARK-XXI	1b	13	Aug	2005	Longyeabyen	18	Sep	2005	Bremerhaven
ANT-XXIII	1	13	Oct	2005	Bremerhaven	18	Nov	2005	Cape Town
ANT-XXIII	2	18	Nov	2005	Cape Town	13	Jan	2006	Punta Arenas
ANT-XXIII	3	13	Jan	2006	Punta Arenas	9	Feb	2006	Punta Arenas
ANT-XXIII	4	11	Feb	2006	Punta Arenas	11	Apr	2006	Punta Arenas
ANT-XXIII	5	13	Apr	2006	Punta Arenas	12	Jun	2006	Cape Town
ANT-XXIII	6	13	Jun	2006	Cape Town	21	Aug	2006	Cape Town

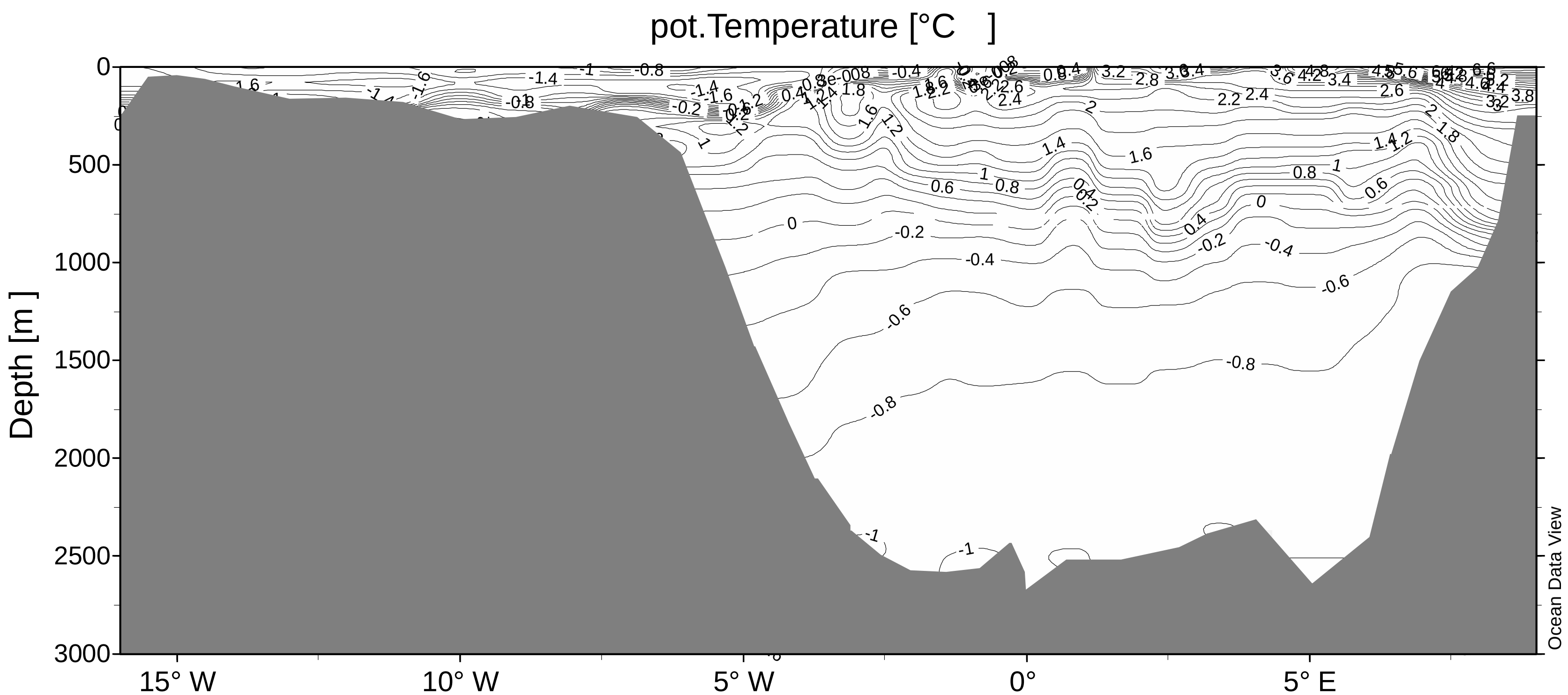
4. SECTIONS

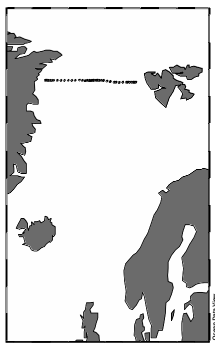
During the past 25 years of *Polarstern*'s operations hydrographical observations were typically carried out along transects. In this chapter a selection of sections were presented.
In the lower left corner of all graphs there is a sketch of the cruise route for guidance.



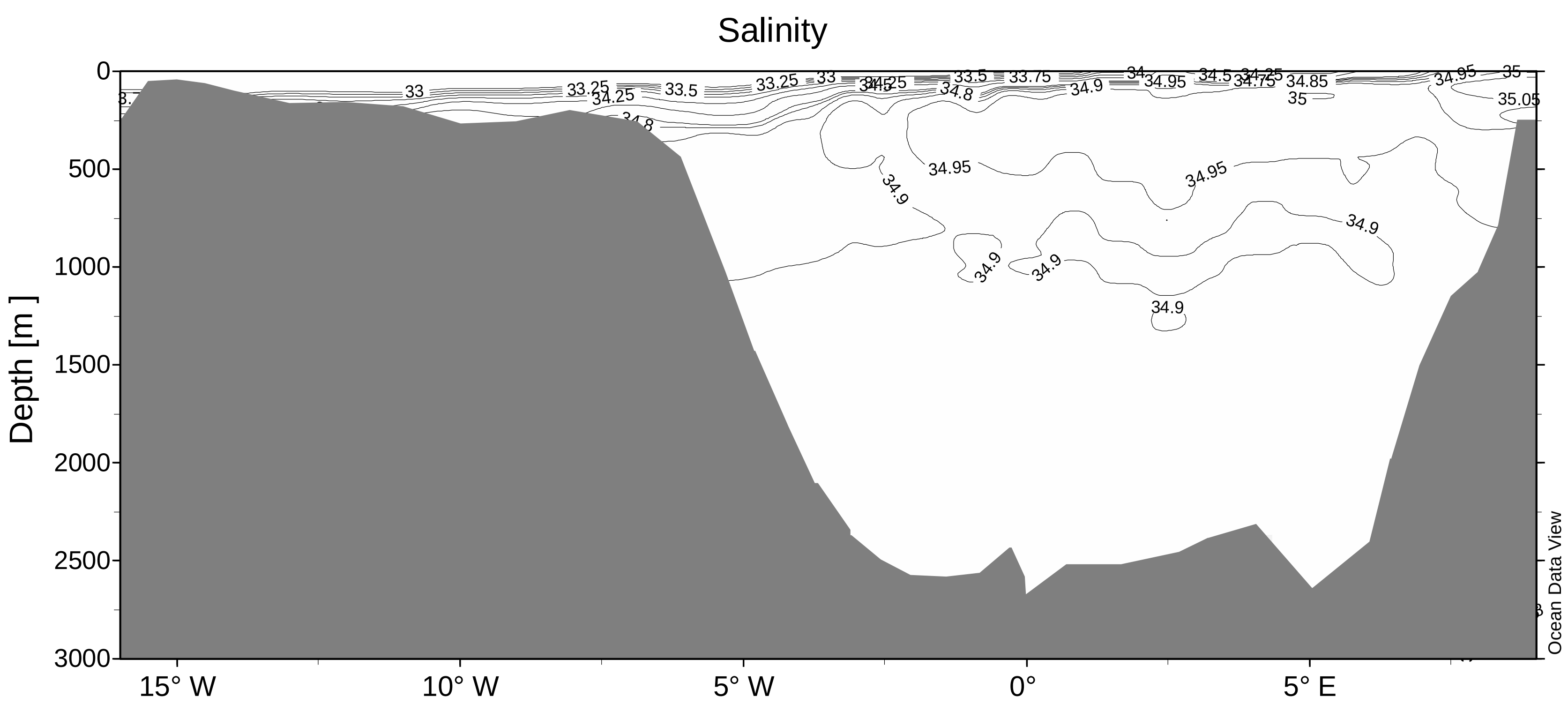


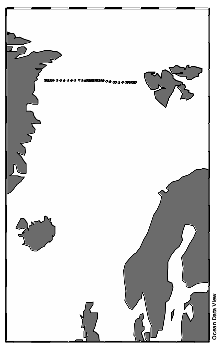
4.1. XBT-Section across Atlantic
Temperature section based on XBT stations carried out during Polarstern cruise ANT-X/8 on transit from Punta Arenas to Bremerhaven.



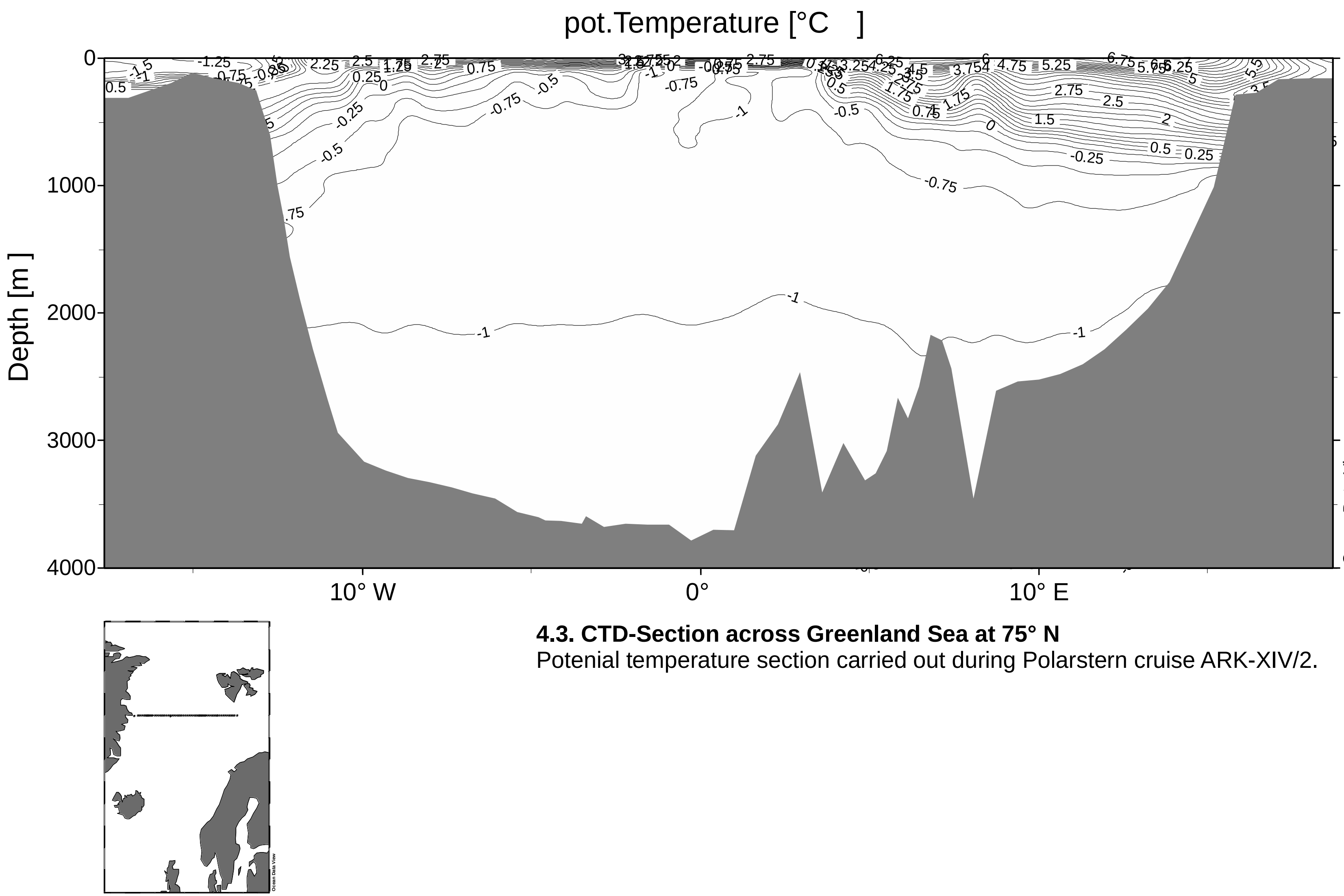


4.2. CTD-Section across Fram Strait
Potenial Temperature section carried out during Polarstern cruise ARK-XIV/2.

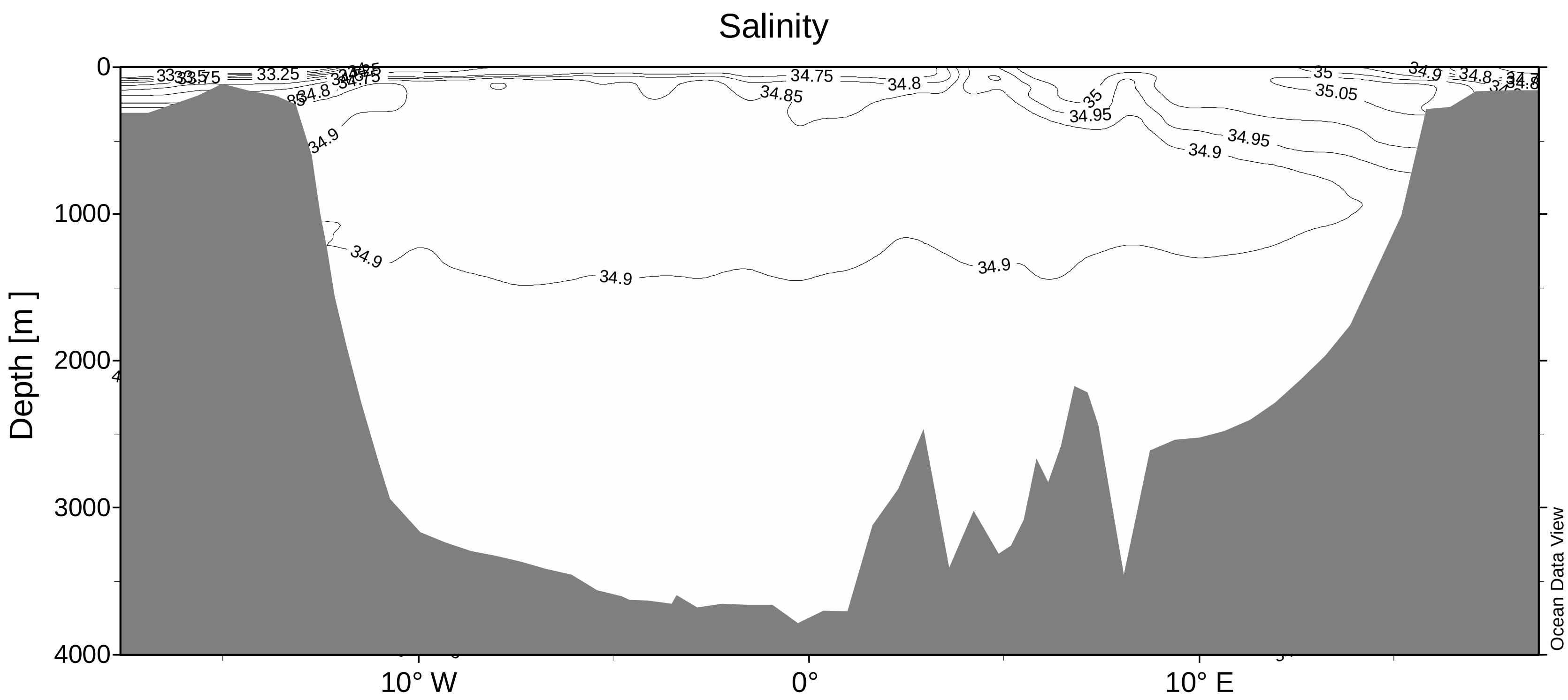


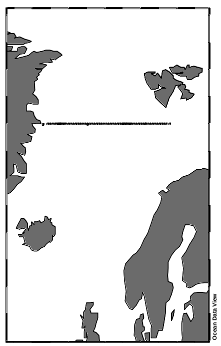


4.2. CTD-Section across Fram Strait
Salinity section carried out during Polarstern cruise ARK-XIV/2.

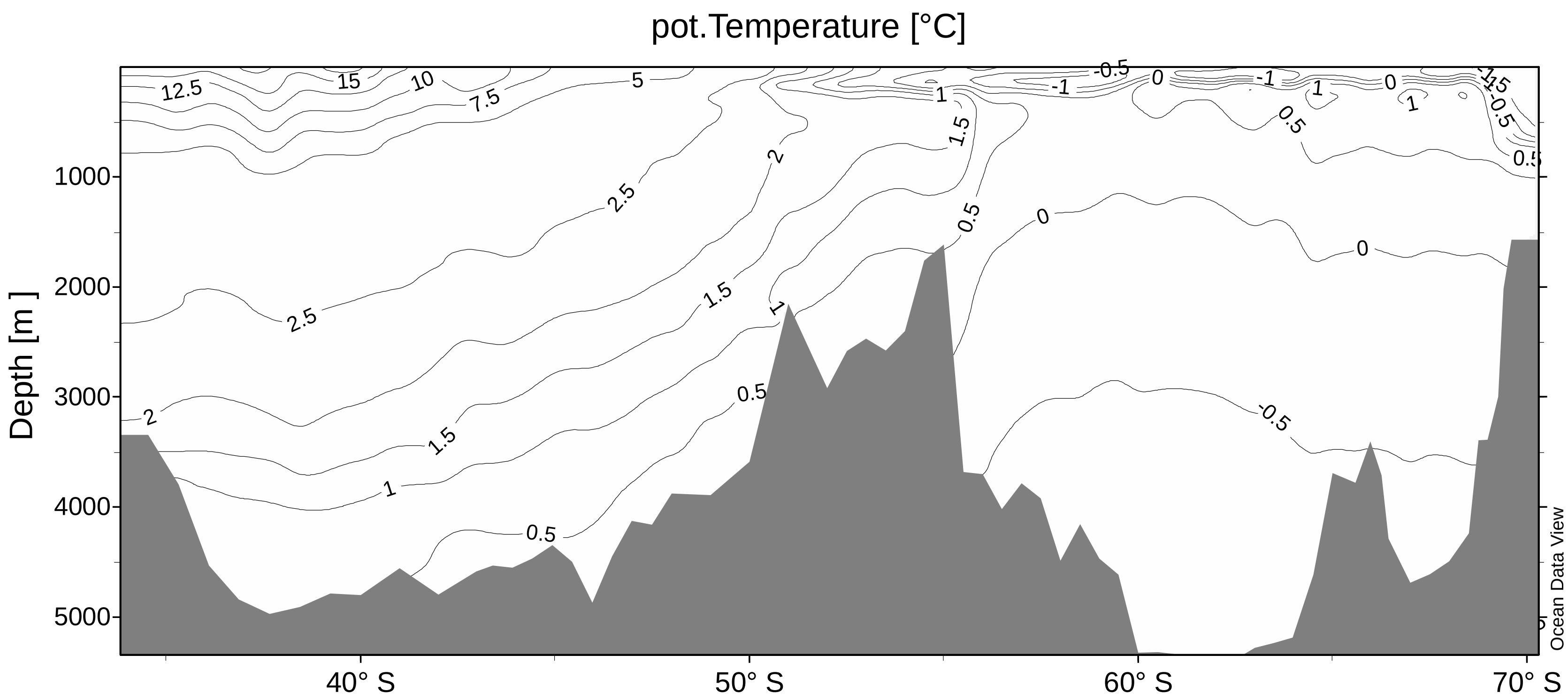


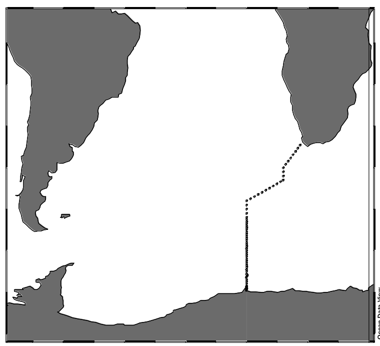
4.3. CTD-Section across Greenland Sea at 75° N
Potenial temperature section carried out during Polarstern cruise ARK-XIV/2.



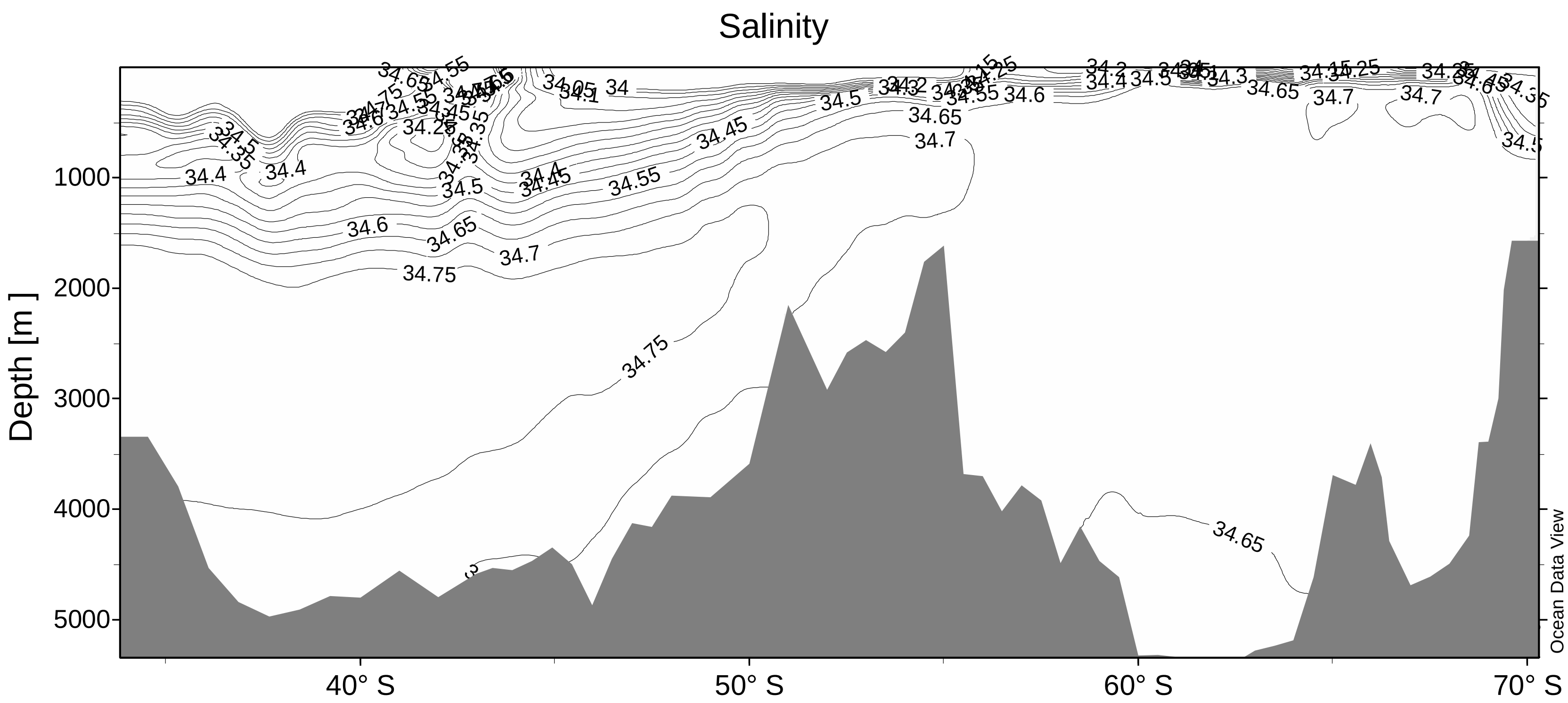


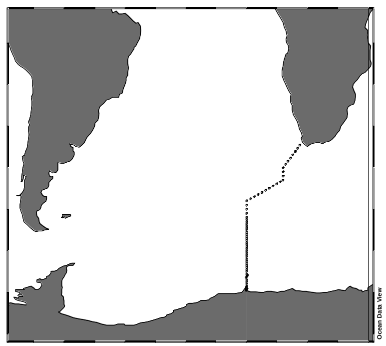
4.3. CTD-Section across Greenland Sea at 75° N
Salinity section carried out during Polarstern cruise ARK-XIV/2.



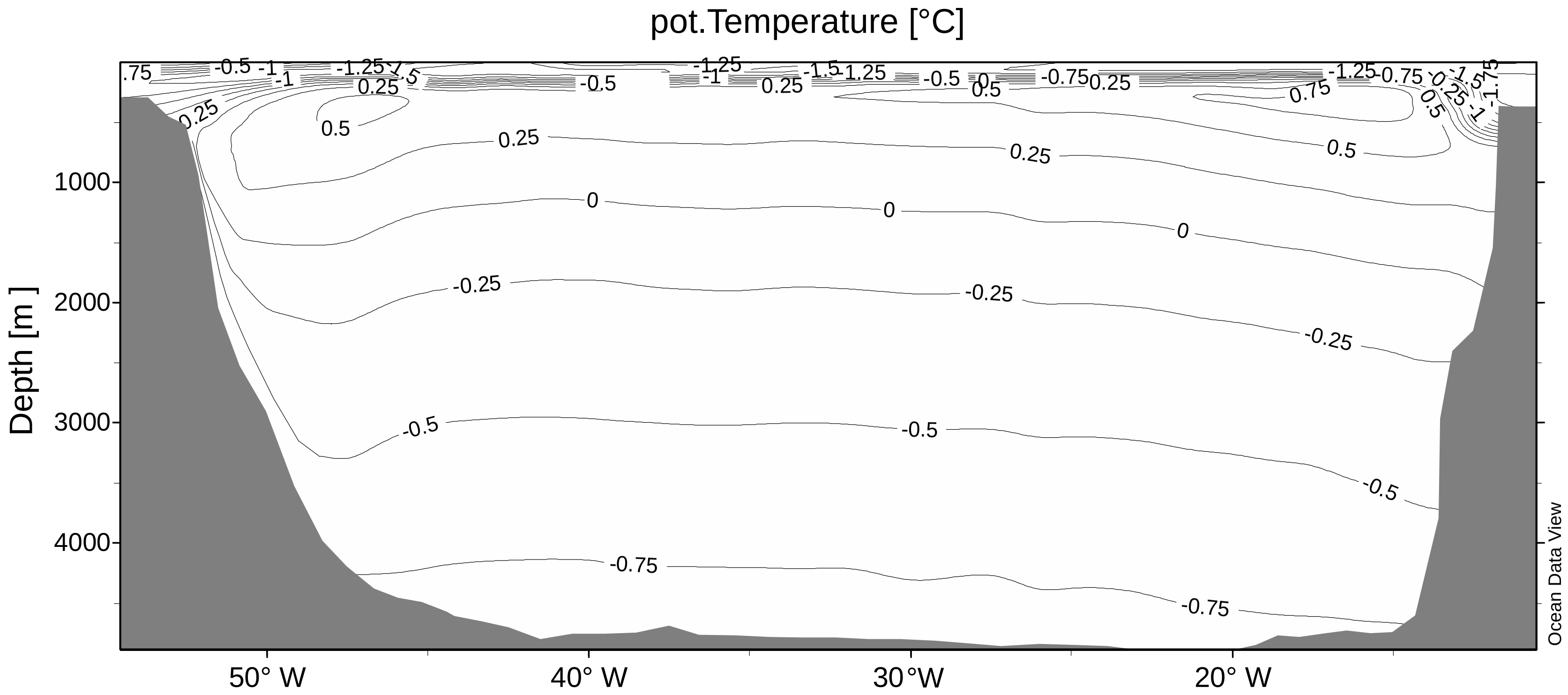


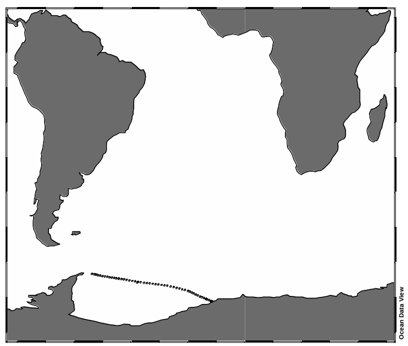
4.4. CTD-Section along Greenwich Meridian
Potenial temperature section from Cape Town to the southwest and then along the Greenwich Meridian towards the Antarctic Continent carried out during Polarstern cruise ANT-XVIII/3.



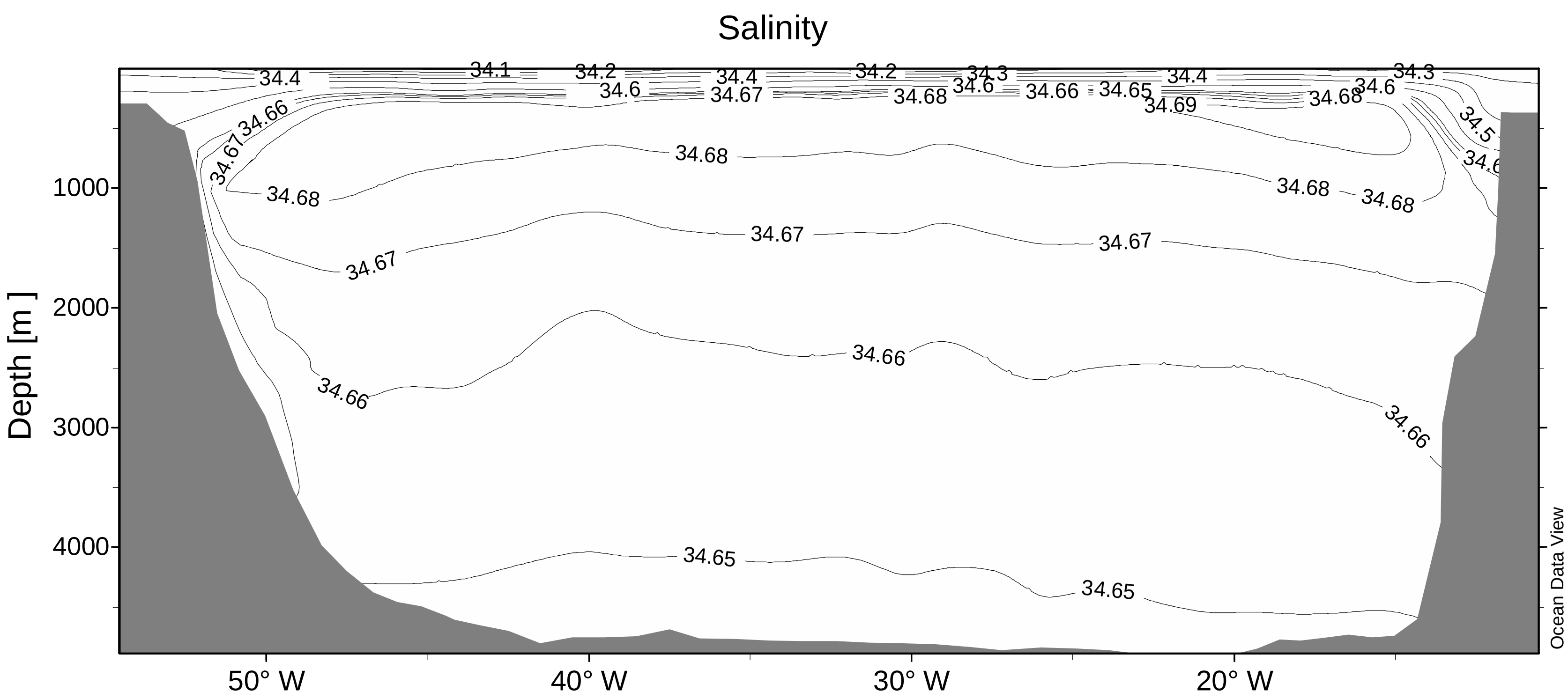


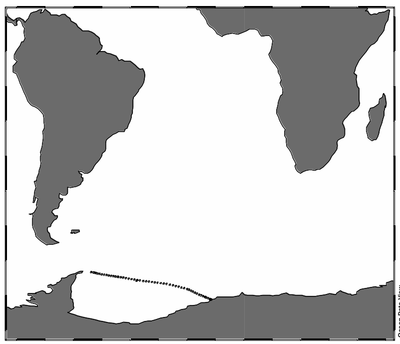
4.4. CTD-Section along Greenwich Meridian
Salinity section from Cape Town to the southwest and then along the Greenwich Meridian towards the Antarctic Continent carried out during Polarstern cruise ANT-XVIII/3.



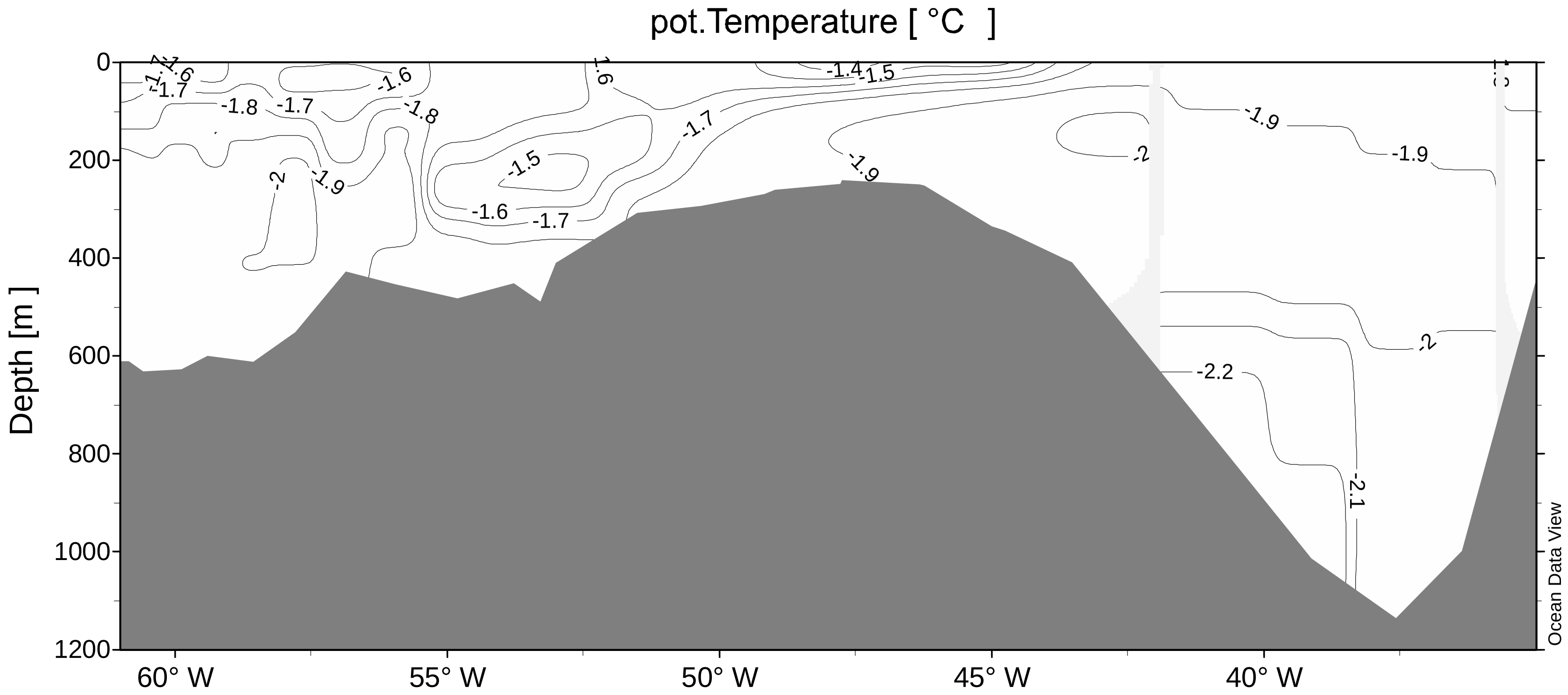


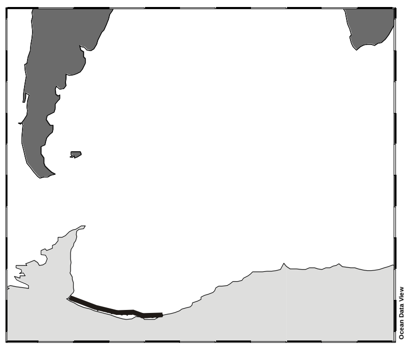
4.5. CTD-Section across Weddell Sea
Potenial temperature section from Kapp Norvegia towards the tip of the Antarctic Peninsula carried out during Polarstern cruise ANT-X/7.



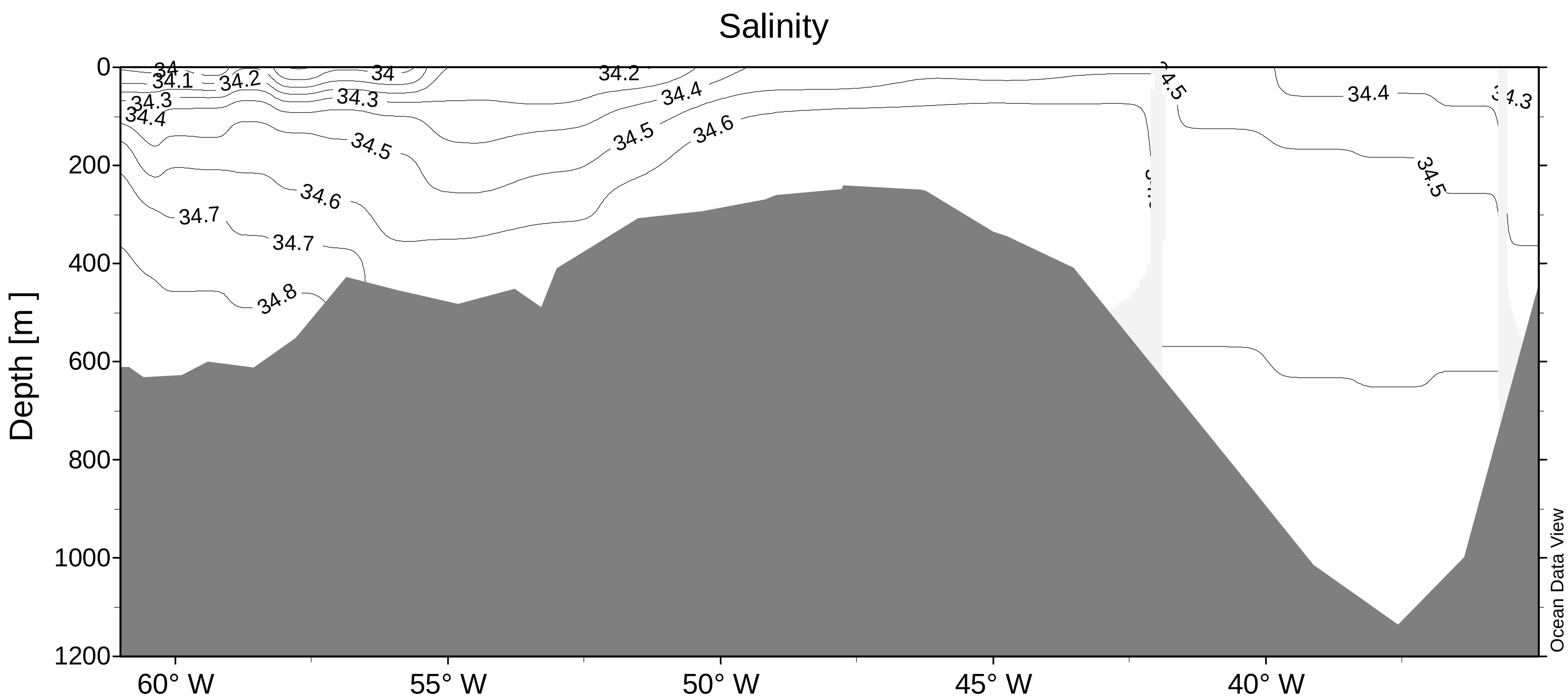


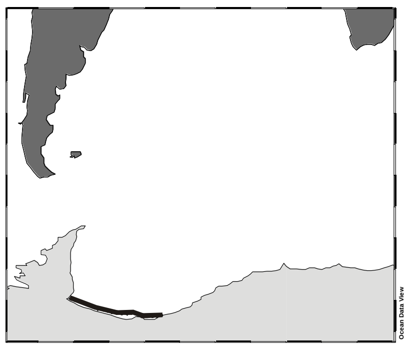
4.5. CTD-Section across Weddell Sea
Salinity section from Kapp Norvegia towards the tip of the Antarctic Peninsula carried out during Polarstern cruise ANT-X/7.



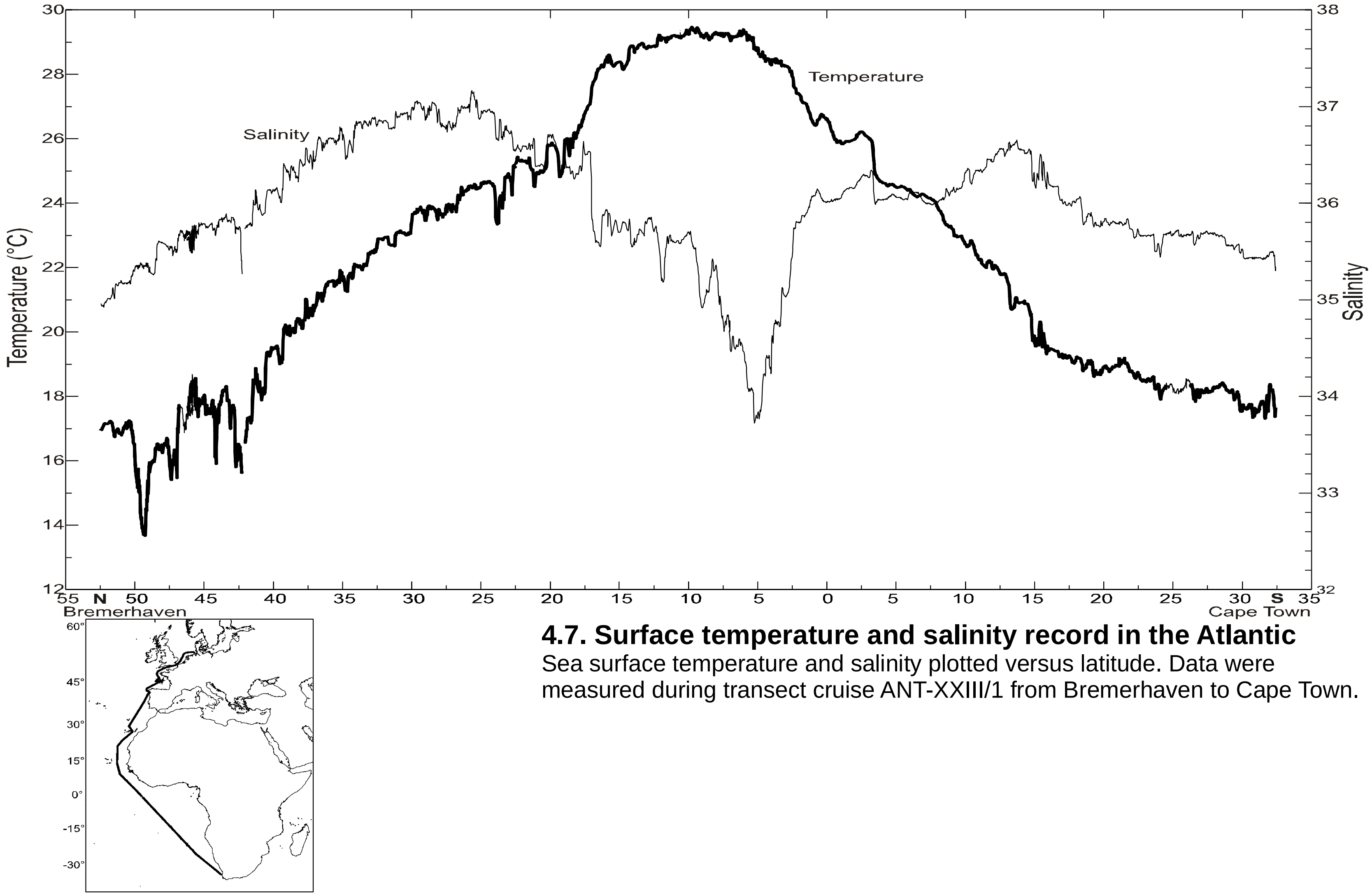


4.6. CTD-Section along Filchner/Ronne Ice Shelf
Potenial temperature section carried out during Polarstern cruise ANT-XII/3.





4.6. CTD-Section along Filchner/Ronne Ice Shelf
Salinity section carried out during Polarstern cruise ANT-XII/3.



4.7. Surface temperature and salinity record in the Atlantic
Sea surface temperature and salinity plotted versus latitude. Data were measured during transect cruise ANT-XXIII/1 from Bremerhaven to Cape Town.

5. DATA FORMAT AND ACCESS

The hydrographic data of POLARSTERN on this CD is a copy of the PANGAEA content at the time of publication. The inventory will continue to grow when future cruises are added; on the Internet at www.pangaea.de always the most recent data will be available. This CD enables the user to access data of the first 25 years of POLARSTERN oceanography through a computer system locally. Data sets are stored in the folder \docs\datasets\ as tab-delimited text (ASCII) files organized in three zip-archives, 4331 CTD profiles, 90 thermosalinograph data sets along cruise tracks and 3706 XBT deployments from 38 cruises in total.

Each name of a file in the zip-archives consists of a six digit number (ignore a leading zero) followed by the extension **.tab*. This number is also part of the DOI; e.g. if a filename is *053243.tab* the related DOI is *10.1594/pangaea.53243*. (see *http://www.doi.org* for further information about the DOI system). Certainly each DOI is a link to find the data set on the Internet, not on the CD.

Each of the 4459 data sets has a similar format which consists of the **Data Description** (metadata) followed by the factual **Data** in a table.

Data Description

consists of the following fields (not necessarily all may be in use):

(1) Citation: is the formal correct citation to use if you refer to a specific data set (e.g., in a publication). Part of the citation is a DOI (Digital Object Identifier) as a persistent identifier for reliable long-term access;
(2) Reference(s): is the related report of the cruise where the data were produced; part of the reference is a link pointing to the full text of the report on the CD;
(3) Project(s): is the framework under which the data set has been produced; (for this compilation it is mostly the physical oceanography division at AWI, some additional projects might be added);
(4) Coverage: gives the four geographic boundaries (W-E-S-N) of a rectangle around the area where the data were measured (if the data are related to one sampling point, e.g. a CTD, W and E as well as N and S have identical values;
(5) Event(s): gives the label of the deployment followed by its latitude, longitude, and elevation, as well as device type, campaign label, and the name of the ship (in this case always POLARSTERN);
(6) Comment: may contain individual remarks (only shown if filled);
(7) Further details: may provide a link to a detailed data set description as provided by the PI (only shown if filled);

(8) Parameter(s): shows the list of parameters with unit for each column in the data set. Each parameter is related to at least one column showing a 'Short Name' as used in the header of the data matrix, the 'Principle Investigator' (PI), the method and (optional) comments; (a list of all parameters is provided in the file *parameter-ps_hydro.txt* on the CD);
(9) Size: displays the number of data points of the data set.

Data

The data table consists of a header followed by the data columns:

- Event label i.e. the lable of the deployment as explained in (5) (only in tables containing data from several locations);
- one to several geo-codes, i.e. *Latitude, Longitude, Depth, water [m], Date/Time*;
- one to many parameter with [unit].

Thermosalinograph and XBT data sets display date/time, latitude, longitude and water depth for each data point, CTD data are accompanied by water depth only with related coordinates in the data description.

Data Access

The data collection is supplied with a simple search engine, allowing access to the inventory. The search engine is running on a local auto installing web server supplied with the CD. Both the web server and the database engine are built on Java™ Technology.

Usually, no manual installation is needed since the CD starts automatically while inserted.

The following software is recommended (minimum requirement):

- *Linux*: SUSE, Novel Linux, Gentoo, Debian, Redhat
- *Macintosh*: Mac OS X
- *Solaris*: Version 8
- *Windows*: Windows 2000/XP using Java Runtime Engine JRE 1.3 or higher

In order to run the database properly, your computer must have a Java Runtime Engine (JRE) installed. On *Linux*, *Macintosh*, and *Solaris* computers JRE is already part of the operating system. Computers using the *Windows* operating system need separate installation of JRE. The start-up routine supplied on the CD will automatically detect the respective computer system, the version of its operating system check the JRE version. If JRE is not installed or the version number is not appropriate, the start-up routine will offer to install the most recent JRE version.

The CD will start automatically once you have inserted it in your CD device. If the CD does not start automatically, you can launch it manually:

- *Windows*: double click the file **winstart.exe**;
- *MacOS X*: double click the **macstart** application;
- *Unix (Linus, Solaris, BSD, ...)*: execute **sh ./unixstart.sh** from terminal and follow the instructions; Solaris users have to mount the CD/DVD explicitely as Rockridge/ISO9660 volume

Important: The local search engine requires a Java VM installed on your system. If for some reason the Java environment is not found, the starting procedure offers the option to install the latest JRE from Sun (see folder "support"). In addition JavaScript must be enabled in your browser.
If your browser does not display the homepage after starting the local webserver, you should disable proxies in your browser configuration. If you cannot do this because of firewall or access restrictions (ask your system administrator), add "127.0.0.1" to the proxy exemptions.

Data Search and Processing

Assuming that the search engine properly displays the search query mask you can create queries. To enter a search query, just type in one to several descriptive words and hit the <Enter> key or click on the <Search> button. Since the search engine only returns data sets that contain all the words in your query, refining or narrowing your search is as simple as adding more words to the search terms you have already entered. A 'Help' text with search examples is provided below the 'Search' button. With *Show map* a simple map is opened showing the location of sites.

The user may search for any words included in a data set, e.g. a name of a principle investigator or a parameter. A link to the *parameter list* is provided on the search mask. A search query typically results in a list of data sets that subsequently can be accessed by striking a hot link. The outcome displays the *Data description* and at its end the options to:

- Download data set as tab-delimited text or
- View data set as HTML.

Additionally, the entire result set (i.e. all data sets found and listed) can be loaded as a zip-archive, see: *- Download complete results as ZIP file -* and can be processed with a variety of analysis and visualization software packages, including **Ocean Data View**, (http://odv.awi.de/), PanPlot or PanMap (*http://www.pangaea.de/Software*).

The converter **Pan2Applic** which is provided with this CD, can be used to transfer single files, folders of files, or a zip-archive from the PANGAEA output format to formats of the applications listed above. Also a georeferenced flat text file may be produced for individual processing. Further output formats of general importance may be included in Pan2Applic on request to *info@pangaea.de*.

6. ACKNOWLEDGEMENTS

The data presented in this report are the result of 25 years of *Polarstern* cruises. Due to this long period and the large number of persons involved in the collection of the displayed data, it is impossible to thank and mention everybody involved by name and to point out the particular contribution. But we can only express our gratitude in general terms.

During the 25 years the instruments needed have been handled with the support of the AWI logistics. The instruments were measuring reliably due to the good service and preparations by the technical personnel. The Ocean Data Facility group form Scipps Institute did a very precise calibration of the CTDs.

We are grateful to the former Hapag Lloyd crew and the present crew from F. Laeisz for the ongoing support the wide range of which does not only cover the CTD winch operation but also the convenient life on board.

The company FIELAX took care of the thermosalinograph and XBT system. They also took great care if technical problems occurred with the oceanographic instruments.

The company OPTIMARE supports the oceanographic cruises with technical personal. They have also carried out the CTD post-processing since the year 2000.

Due to the AWI's computer centre and the Pangaea group the hydrographic data are stored in a database and can easily be accessed by the internet.

Finally we want to thank Birgit Chiaventone who did the final text editing of the document and improved our English significantly.

7. ADDRESS OF INSTITUTES

AWI	Stiftung Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmhotz-Gemeinschaft Am Handelshafen 12 27570 Bremerhaven Germany
BFA-HH	Bundesforschungsanstalt für Fischerei Palmaille 9 22767Hamburg Germany
GIUiB	Geophysical Institute, University of Bergen Allégaten 70 5007 Bergen Norway
IFMH	Universität Hamburg Zentrum für Meeres- und Klimaforschung Institut für Meereskunde Bundesstr. 53 20146 Hamburg Germany
LDGO	Lamont Doherty Geological Observatory of Columbia University P.O. Box 1000 61 Route 9W Palisades, NY 10964-1000 USA
UNI-HH	Institut für Geophysik Universität Hamburg Bundesstraße 55 20146 Hamburg Germany
SIO	Scripps Institute of Oceanography, University of California San Diego, La Jolla, CA 92093 USA

8. REFERENCES

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WDC MARE

www.wdc-mare.org

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