

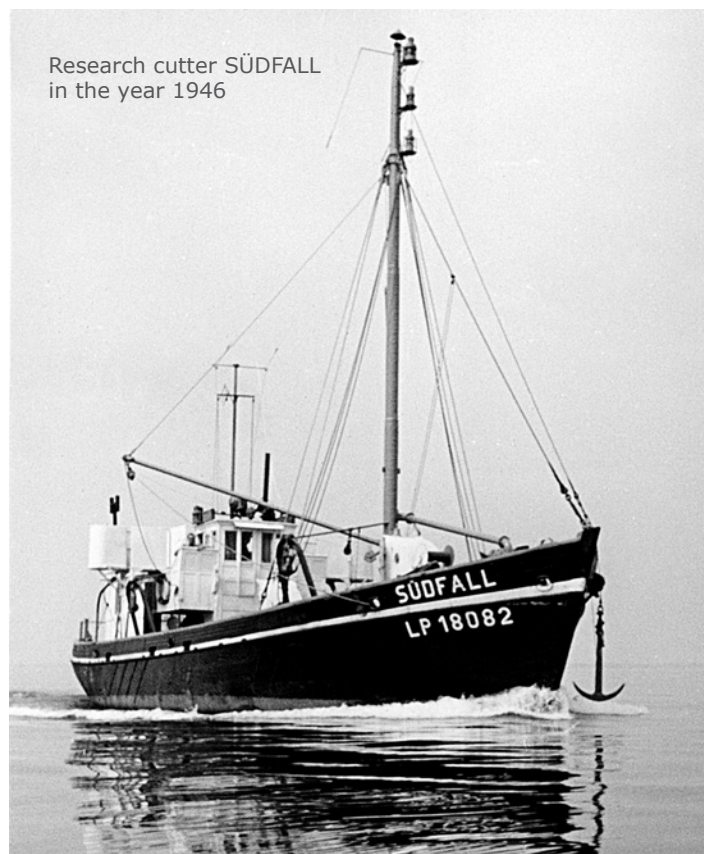


Helmholtz-Zentrum für Ozeanforschung Kiel

The 1946 - 1956 Hydrographic Data Archive at the Institut für Meereskunde, Kiel, digitized

A data-guide by
Thomas J. Müller

GEOMAR Helmholtz Centre for Ocean Research



Berichte aus dem GEOMAR
Helmholtz-Zentrum für Ozeanforschung Kiel

Nr. 58 (N. Ser.)

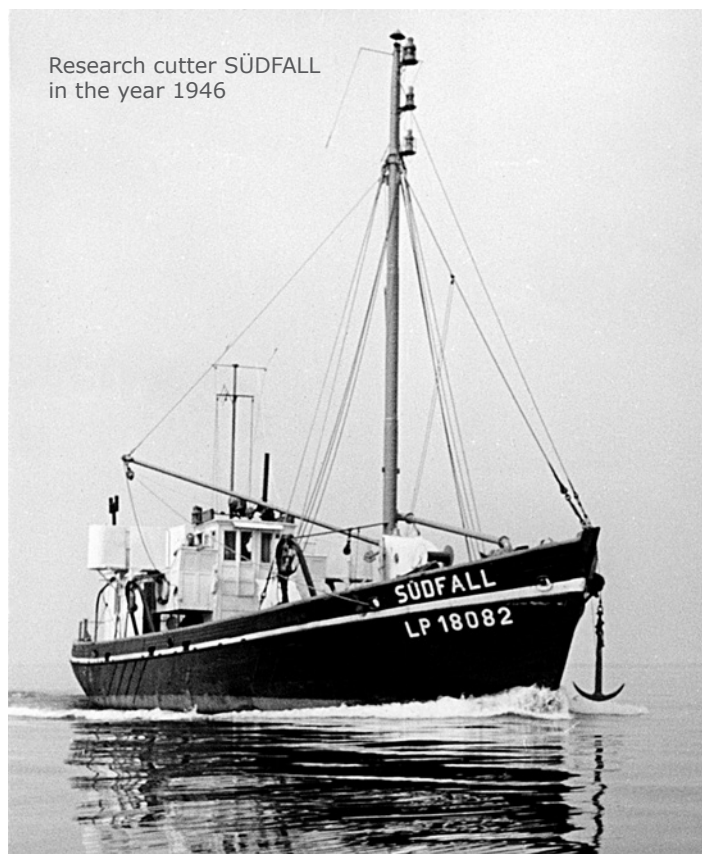
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Summary

This report is thought as a guide to early hydrographic log sheets of bottle data obtained by the former *Institut für Meereskunde, Kiel* (IFMK, now integrated into GEOMAR) in the post-war years 1946 to 1956, and which in summer 2018 when a building used by GEOMAR was to clear were not available in digitized format at GEOMAR. The data mostly were taken by the research cutter *FK "Südfall"* in the Baltic. It turned out that some of these data from 1950 to 1956 were available in digitized form at the on-line data bank of the *International Council for the Exploration of the Sea* (ICES). Comparison with the original logged data sheets, however, showed that they needed to be improved w/r to time and position and to be completed by missing data. This report shortly describes the methods of sampling and measuring these old data, and the processing steps applied to improve the data set by using the data log sheets before archiving and submitting the now improved and complete data set to data centres for archiving.

Zusammenfassung

In diesem Bericht werden hydrographische Daten des früheren Instituts für Meereskunde Kiel (IFMK, jetzt integriert im GEOMAR), aus den Nachkriegsjahren 1946 bis 1956 beschrieben, die während einer Aufräumaktion in einem bisher von GEOMAR genutzten Gebäude in Form schriftlicher Datenprotokolle gefunden wurden, und die am GEOMAR bislang nicht in digitalisierter Form vorlagen. Die Datensätze sind überwiegend in der westlichen Ostsee mit dem Forschungskutter *FK „Südfall“* gewonnen worden. Einige Daten von 1950 bis 19656 waren zwar on-line digital beim *Internationalen Rat für Meeresforschung* (ICES) in Kopenhagen verfügbar. Durch Vergleich mit den jetzt gefundenen Daten-Protokollen stellte sich jedoch schnell heraus, dass dieser bereits digitalisierte Datensatz hinsichtlich Zeit- und Positionsangaben verbessert sowie fehlende Daten nachgetragen werden mussten. In diesem Bericht werden Methoden zur Probennahme und Messung in der damaligen Zeit sowie Schritte der Aufbereitung beschrieben, wie der bislang digital vorliegende Datensatz in der Qualität verbessert und fehlende Daten ergänzt wurden, bevor sie nunmehr verbessert und vollständig bei den relevanten Datenzentren zur Archivierung eingereicht wurden.

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1. Background

In June 2018, GEOMAR needed to clear a building as by contract it would no longer be used by GEOMAR. Since the early 80s, the then *Institut für Meereskunde*, Kiel (IFMK, now integrated into GEOMAR), by the then three physical oceanography departments (PO) and the meteorological department of the IFMK had been using it. In particular within the 15-year long-term research programme SFB133, post docs and PhD students of the four departments were jointly working there.

During a quick first inspection, it became clear, that copies of PO conducted old cruise data were printed out on paper, and that while also some cruise relevant information like cruise reports and station lists were found, none of the then typically used magnetic tapes or data disks could be found as possible electronic storage media of the printed versions. Also, within the now Physical Oceanography research unit (PO) of GEOMAR, it was known that data of some of the SFB's cruises and some about year-long time series data from moored instruments were missing in the present PO data base (PO-DB).

With this background and under the pressure of a 14-day deadline, the responsible heads of GEOMAR's Research Division 1 and the PO Research Unit decided, that all rooms including the roof floor next to the upper floor would be carefully inspected, aimed at *identifying and rescuing possibly so-far lost data*. As I myself had been working next to the then responsible scientists in that building in that time period, I was asked to take the lead.

The major goal was to identify data missing in the PO data base (PO-DB) from about 1957 on when post-war West Germany had begun to join international marine open ocean research programmes like the International Geophysical Year (IGY). The aim was to recover such data for the PO-DB, either from other data banks or by digitizing. Data not being identified at any data centre would then eventually be digitized, archived at the PO data base, and delivered to relevant data centres.

Surprisingly and completely unexpected, however, we also detected an early post-war 1946 to 1956 hydrographic data set in a single file with 25 logged handwritten and later type-writer printed log sheets of hydrographic data, mostly from the Baltic Sea. The file's cover (App. 1) in the English translation reads

Archive of the Institut für Meereskunde

Hydrographic observations from the years 1946, 1947.....1956

(The archive contains the values sent to Copenhagen)

The cover is not dated, nor is it signed. It is this archive that is dealt with in this data guide. The 25 data sets were

- checked if the data indeed were available in digitized form at the on-line data bank of the "*International Council for the Exploration of the Sea*" (ICES, with seat in "*Copenhagen*") as indicated on the cover, and eventually downloaded
- checked for completeness and eventually corrected w/r to accuracy in time, latitude and longitude. Missing data were digitized for completion
- after correction and completion, all data were submitted to the data centre of the ICES, to the *Deutsches Ozeanographisches Datenzentrum* DOD (at BSH), and to the European project *SeaDataCloud* which supported the work
- In addition, relevant subsets were provided to the IOW in Rostock-Warnemünde, Germany, the MRI in Reykjavik, Iceland, the FMRI in Thorshavn, Faroe Islands, and to the LLUR through a cooperation of the LLUR, Flintbek, Germany with GEOMAR (Prof. Bange, GEOMAR, pers. comm.)

2. Data description

The IFMK post-war hydrographic station data cover the almost 10-year time period from November 1946 to August 1956. They were mostly taken in the Baltic Sea, but also during a single cruise in the eastern German Bight in 1954. The ship used was the research cutter *FK "Südfall"*, owned by the IFMK since 1946. Also, two cruises with other ships led to coastal seas around Iceland and the Faroe Islands while supporting German fishery protection there.

Standard parameters measured were temperature and salinity, some in addition with dissolved oxygen, few with phosphorus from phosphate, and very few with alkalinity pH. Chlorophyll and other biological parameters were taken only during the single cruise in the North Sea, and during one of the protecting fishery-activity. No nitrate nor silicate were taken at all.

Of the 25 data log sets some were double or drafts, leaving 18 significant paper-based data log files which maybe characterized in more detail:

- **Baltic Sea**, 1946 – 1956, this is the largest set, mostly from the Kiel Bight, but also from the Danish Belt Sea and from two hydrographic sections between Kiel and the Gotland Basin. Part of the subset from 1950 to 1956 could be downloaded from the ICES data bank.
- **Baltic Sea light vessels**: two sets of repeated station data on an irregular basis from two German light vessels that were operational in the Kiel Bight in these years: *LV "Fehmarn Belt"*, 1947-1949, and *LV "Flensburger Förde"*, 1949-1950.
- **North Atlantic surface and / or near surface data** taken during two cruises:
 - (i) **in 1947** on the German cargo vessel *CV "Alice Freymann"* while (probably) supporting fishery protection along the northern coast of Iceland.
 - (ii) **in 1953** on the fishery protection vessel *FSB "Meerkatze"* (in service 1950 to 1974) from the northern North Sea to the Faroe Islands coastal waters around Iceland.
- **Kiel Canal (NOK), 1952 to 1953**, one year repeated quasi-synoptic salinity section, 164 repetitions at 2 d to 3 d repetition time, 11 stations at ca. 10 Km spacing, samples from the surface (0 m), the bottom (11 m), and in addition from 8 m depth at the eastern four stations where stronger vertical salinity gradients occur. The samples were taken by employees of the canal's administration, and therefore one may speculate that IFMK probably just served with its expertise by measuring the salinity of the samples in the laboratory. No temperature data are listed in this set.
- **North Sea, 1954, eastern German Bight** off the coast of Schleswig-Holstein, a more biologically oriented cruise.

3. Methods of measurements

The data logs always give the date and almost always the time of the station. Also, the location is given with latitude and longitude, however only in very few cases the bottom depth. The precision of these meta data was

- **Date & time:** in most cases logged up to minutes of an hour
- **Latitude and longitude:** in most cases up to 1/10 of a minute (182 m in latitude)

Methods used to measure bottle parameters were standard at that time for the Baltic Sea with its strong vertical and horizontal gradients, and keywords are given for some parameters in two logs, originally in German (App. 2):

- **Sampling depth** was estimated from the hydrographic wire's length while fixing the bottle; sometimes, the combination of pressure protected and unprotected reversing thermometers after *Richter* were used.
- **Temperature** was measured using protected reversing thermometers after *Richter*, 0.01 °C
- **Salinity** was measured using a *Zeiss* refractometer, 0.05 ppt
- **Dissolved oxygen** was measured applying the *Winkler* method, 0.01 ml/l
- **Phosphorus** from phosphate was measured using *Zeiss'* photometric method, 0.1 mg/l. Phosphatic phosphorus in the hydro logs is given in mg/l, and in the ICES downloaded data was converted to µmol/l. The conversion factor is the inverse of the atomic molar mass of phosphorus, $M(P) = 30.9737620 \text{ mg}/\mu\text{mol phosphorus}$. No other nutrients were measured
- **pH** is the negative decadic logarithm of the concentration of hydrogen ions in the sample
- **Chlorophyll a** at the sea surface was measured during the 1953 cruise on the *FSB Meerkatze*
- **Chlorophyll a** together with other biological and chemical parameters on stations were measured during the 1954 North Sea cruise

4. Processing and Data Submission

4.1 General

First, all 25 paper-based logs were e-copied to a total of 25 PDF files. They are all available in the PO data base under *new_po2/cruises/ifmk_1946_1956/**. Those that are double or drafts for others were flagged and stored separately.

Next, surveying the ICES and the DOD/BSH data banks in July 2018, it quickly became clear that – probably with the exemption of the 1954 North Sea cruise – none of the other data sets was completely available, neither at DOD nor at ICES (and none at PANGAEA). Also, in the data set as downloaded from the ICES *on-line* data bank, station time as logged is missing, and latitude and Longitude are rounded to full minutes of degree.

We therefore decided to improve the data set as downloaded from the ICES *on-line* data bank w/r to time and position according to the logs, and also to digitize any missing data to Excel CSV formatted Ascii files as basis for further checks and processing. General processing encompassed.

- **Date, time & time zone:** Only in very few cases the time zone is noted, and if so, then for a Baltic Sea cruise as Central European Time Zone (MEZ in German), e.g. even during the eastern most cruise to the Gotland Basin in 1956. Note also, the ship's home port is Kiel, Germany, and therefore has

local time UTC+1 (there was no switch to summer time at that time period). Therefore, it is assumed that the

- time zone for logged times for all Baltic Sea cruises is UTC+1
- time Zone for logged times for the two fishery protection cruises to the Faroes and Iceland is UTC
- time values missing in logs were to be filled with 12:00 h (noon) reducing the maximum error in time from 24 h to 12 h.
- **Latitude & longitude:** position was corrected or digitized as given in the logs, i.e. almost always to 1/10 minute (185 m in latitude).
- **Time & position check:** After correction and completion of a data set, time and location were checked for plausibility using a “*platform speed*” criterion where the platform speed should not exceed 10 knots (the ship’s regular maximum speed) by more than 20% between stations, otherwise the digitized data were carefully checked against the logs, and eventually corrected.
- **Sampling depth & conversion to sampling pressure:** In data sets submitted to ICES, DOD/BSH and SeaDataCloud, the sampling depth as logged is kept as vertical coordinate. For GEOMAR’s PO-DB, sampling depths are converted to pressure P using Saunders (1991) relation $P = \text{press}80(\text{depth, latitude})$.
- **Plots:** to have a quick view of data density and variability, for each set plots were created, except for the North Sea cruise.

The following data sets resulted; overview plots of the below sets 4.4 to 4.10 are shown in the App. 3.1 through App. 3.7 in the order of appearance below.

4.2 1950 to 1956 period, Baltic Sea data download from ICES, July 2018

These data are not complete when compared with the log sheets. The downloaded data are

- *improved by including time according to the logs;*
- *locations were improved up to 1/10 of latitudinal and longitudinal minutes according to the logs*
- **submitted to data centres ICES, DOD/BSH, SeaDataCloud including a preliminary short report**

4.3 1946 to 1956 period, Baltic Sea, data missing at ICES

None of the data from 1946 to 1949 was available on-line or is available in another form digitally at ICES (*Else J. Green, ICES, October 2018, pers. comm.*) or at DOD/BSH. Also, some data in the downloaded set of the 1950 to 1956 period were missing when compared with the logs

- *Baltic Sea data missing in the set downloaded from the ICES on-line data bank, were digitized according to the data logs, except for the time series data at two light vessels and coastal surface data off Bülk, Kiel Fjord (see below).*
- **Submitted to data centres ICES, DOD/BSH, SeaDataCloud including a preliminary short report**

4.4 1946 to 1956, Baltic Sea (also App. 3.1)

- *The sets under 4.2 and 4.3 were combined to a single set*
- *Sampling depths were converted to pressure.*

- **Stored at GEOMAR's PO-DB** in the local RODB format.
- **Copy to LLUR** through a joint project with GEOMAR (Prof. Bange, GEOMAR, pers. comm.)
- **Report to IOW**, data copy on request

4.5 1946 to 1956, Time Series Station "Boknis-Eck" (also App. 3.2)

In order to extend the station's existing data set (1956 to present) to earlier times, a subset was copied from the whole Baltic Sea set under section 4.4:

- *The criterion was that the "distance of a station to the time series' nominal position" must be less than 1 nm (1852 m) to be accepted as a contribution to the time series at "Boknis-Eck".*
- **Stored at GEOMAR's PO-DB** in the local RODB format.
- **Copy to LLUR** through a joint project with GEOMAR (Prof. Bange, GEOMAR, pers. comm.)

4.6 1947 to 1949, German light vessel LV "Fehmarn Belt" (also App. 3.3)

This data set is missing in the ICES download, and in the DOD / BSH on-line data base as well. It consists of hydro casts with temperature and salinity measurements, repeated on a non-regular time basis. It looks like that IFMK has substituted the then DHI (now BSH) regular measurements for some periods.

- *This data set was digitized according to the data logs.*
- **Submitted to data centres:** ICES, DOD/BSH, SeaDataCloud
- **Stored at GEOMAR's PO-DB** in the local RODB format.
- **Copy to LLUR** through a joint project with GEOMAR (Prof. Bange, GEOMAR, pers. comm.)
- **Report to IOW**, data copy on request

4.7 1949 to 1950, German light vessel LV "Flensburger Förde" (also App. 3.4)

This data set is missing in the ICES download, and in the DOD / BSH on-line data as well. It consists of hydro casts of temperature and salinity, and often dissolved oxygen and phosphorus derived from phosphate measurements. The casts are repeated on a non-regular time basis. It looks like that the IFMK has substituted the DHI/BSH regular measurements for some periods.

- *This data set was digitized according to the data logs.*
- **Submitted to data centres:** ICES, DOD/BSH, SeaDataCloud
- **Stored at GEOMAR's PO-DB** in the local RODB format.
- **Copy to LLUR** through a joint project with GEOMAR (Prof. Bange, GEOMAR, pers. comm.)
- **Report to IOW**, data copy on request

4.8 1947 to 1949, coastal surface data off Bülk, Kiel Fjord (also App. 3.5)

This set of daily surface temperature and salinity from August 1947 to March 1949 is missing in the ICES download.

- *This data set was digitized according to the data logs.*
- **Stored at GEOMAR's PO-DB** in the local RODB format.
- **Copy to LLUR** through a joint project with GEOMAR (Prof. Bange, GEOMAR, pers. comm.)

4.9 1947 and 1953, N.-Atlantic surface and near surface data (also App. 3.6)

These two sets are missing at ICES and DOD.

- *These data sets were digitized according to the data logs.*
- **Submitted to data centres:** ICES, DOD/BSH, SeaDataCloud
- **Copies** to the MRI, Reykjavik, Iceland, and to the FMRI, Thorshavn, Faroe Islands
- **Stored at GEOMAR's PO-DB in the local RODB format.**

4.10 1952 -1953, Kiel Canal (NOK), salinity time series (also App. 3.7)

This set consists of 164 repetitions at 11 stations along the canal, samples from the surface, 8 m depth (eastern part only), and above the bottom (11 m).

This set is missing at DOD.

- *This data set was digitized according to the data logs.*
- **Submitted to the DOD**
- **Stored at GEOMAR's PO-DB in the local RODB format.**
- **Copy** to LLUR through a joint project with GEOMAR (Prof. Bange, GEOMAR, pers. comm.)

4.11 North Sea, 1954, eastern German Bight

Data set from off the coast of Schleswig-Holstein stems from a more biologically oriented cruise. It was flagged "available" at the DOD in 2018, and therefore no action seemed necessary from a PO-DB perspective.

- *Any contact to and copy from the DOD is left to GEOMAR's cooperation with LLUR (Prof. Bange, GEOMAR, pers. comm.)*

5. Further Background Information

For those interested in earlier work of the then IFMK and its history some hints:

Baltic Sea: Literature on the western Baltic until the mid of the 70s has been compiled by Schweimer (1978).

IFMK history, in particular that of its physical oceanography departments, is described by Siedler et al. (2018).


FK "Südfall" became a research cutter at the IFMK already late 1946 after the war. How that had happened under the British post-war military administration is described by Ulrich and Kortum (2006, in German) using notes of the ship's first master, Hans Ohl, and other sources.



6. Acknowledgments

Without the help of students, such work certainly will be more difficult to conduct. In particular, I would like to mention the students' patience while sighting the printed papers in the dusty conditions under the roof during the extremely warm summer heat in June 2018. Also, digitizing data certainly is an annoying job. The students' help in sighting and digitizing was supported through the EU project SeaDataCloud within the EU / Horizon 2020 programme, grant agreement 730960. The coastlines in the Baltic Sea maps gratefully are provided by the "Leibniz-Institut für Ostseeforschung, Warnemünde" (IOW).


7. References

Saunders, P.M (1981), Practical Conversion of Pressure to Depth, J. Phys. Oc. April 1981.

Schweimer, M. (1978) [Physikalisch-ozeanographische Parameter in der westlichen Ostsee: eine Literaturstudie](#). . Berichte aus dem Institut für Meereskunde an der Christian-Albrechts-Universität Kiel, Nr. 61. Institut für Meereskunde, Kiel, Germany, 139 pp. DOI [10.3289/ifm_ber_61](https://doi.org/10.3289/ifm_ber_61).

Siedler, G., Thiede, J.  und Zenk, W. (2018) [Marine Sciences in Germany: The Restart in Kiel After World War II](#).  Oceanography, 31 (4). pp. 180-181. DOI [10.5670/oceanog.2018.422](https://doi.org/10.5670/oceanog.2018.422).

8. Ships

FK „Südfall“: Ulrich, Johannes und Kortum, Gerhard (2006) *Der Forschungskutter "Hermann Wattenberg" (ex "Südfall"): Basis der Forschung und Lehre des Instituts für Meereskunde in Kiel 1946-1976*.  Historisch-Meereskundliches Jahrbuch, 12 pp. 65-80.

CV "Alice Freymann": <http://www.shipspotting.com/gallery/photo.php?lid=3043141>

FSB "Meerkatze": [https://de.wikipedia.org/wiki/Meerkatze_\(Schiff,_1944\)](https://de.wikipedia.org/wiki/Meerkatze_(Schiff,_1944))

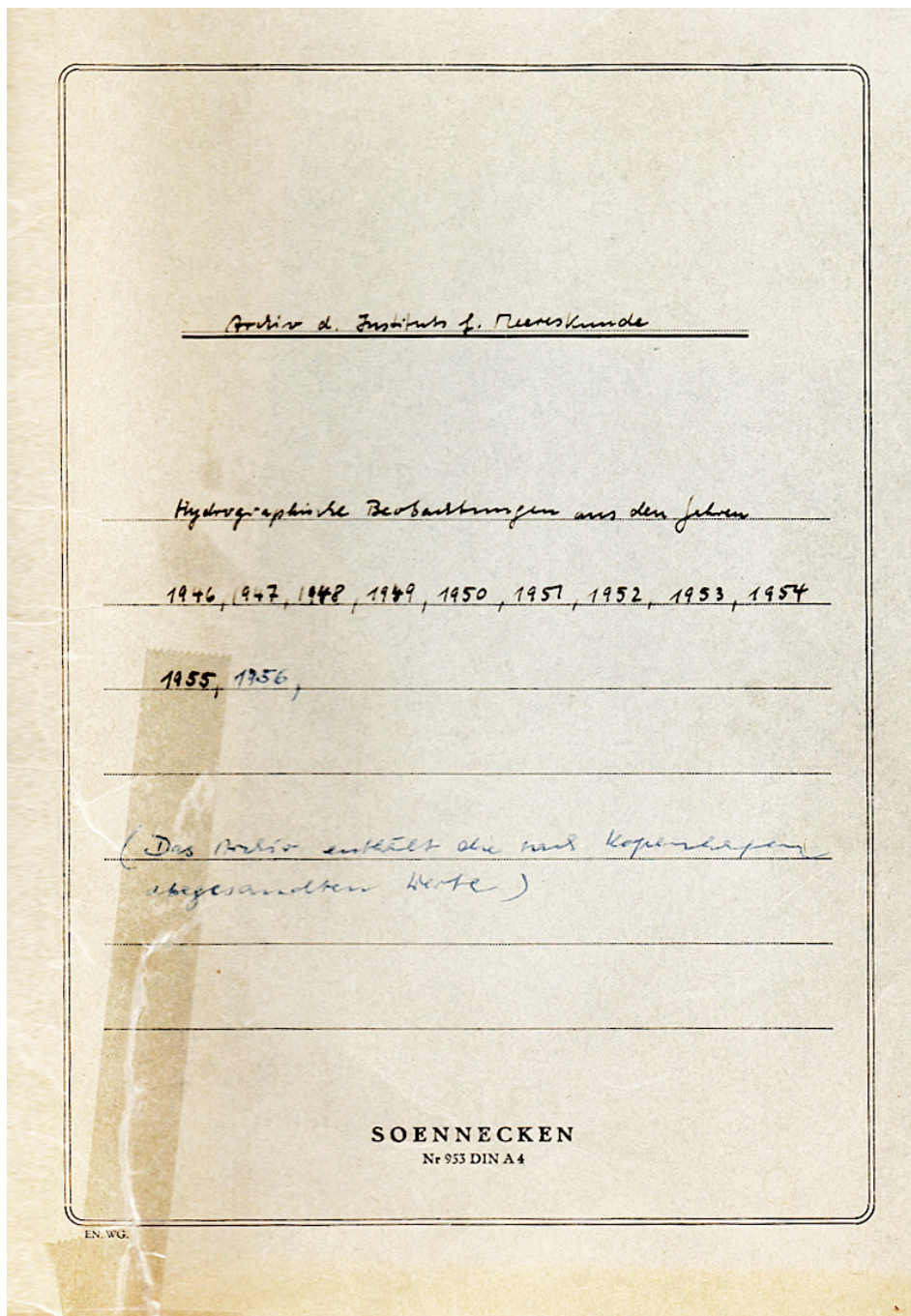
9. Acronyms

BSH	Bundesamt für Seeschifffahrt und Hydrographie, Hamburg & Rostock, Germany
DHI	Deutsches Hydrographisches Institut (now integrated in BSH)
DOD	Deutsches Ozeanographisches Datenzentrum, BSH, Hamburg, Germany
FIMR	Faroe Institute for Marine Research, Thorshavn, Faroe Islands
GEOMAR	Helmholtz-Centre for Ocean Research Kiel, Kiel, Germany
ICES	International Council for the Exploration of the Sea, Copenhagen
IFMK	Institut für Meereskunde Kiel (now integrated in GEOMAR), Kiel, Germany
IMR	Institute for Marine Research, Reykjavik, Iceland
IOW	Leibniz-Institut für Ostseeforschung Warnemünde, Rostock-Warnemünde, Germany
LLUR	Landesamt für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein, Flintbek, Germany
PO	Physical Oceanography Research Unit(s) at IFMK and at GEOMAR
PO-DB	Physical Oceanography data base, GEOMAR, Kiel, Germany

Appendix 1

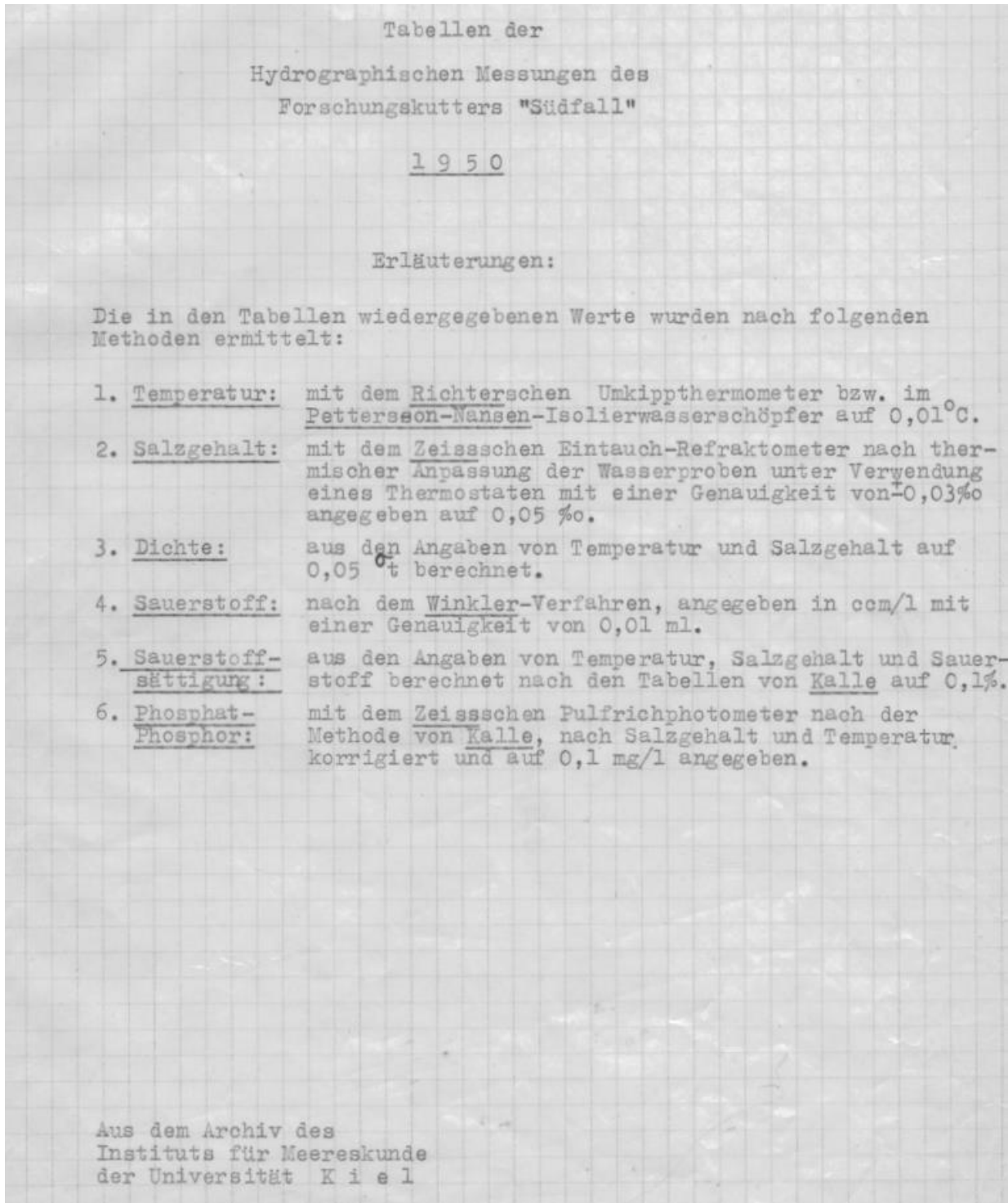
Cover of the file containing 25 hydrographic data sets of IFMK from the years 1946 to 1956. The headlines in the English translation reads:

Archive of the Institut für Meereskunde
Hydrographic observations from the years 1946, 1947.....1956
(The archive contains the values sent to Copenhagen)

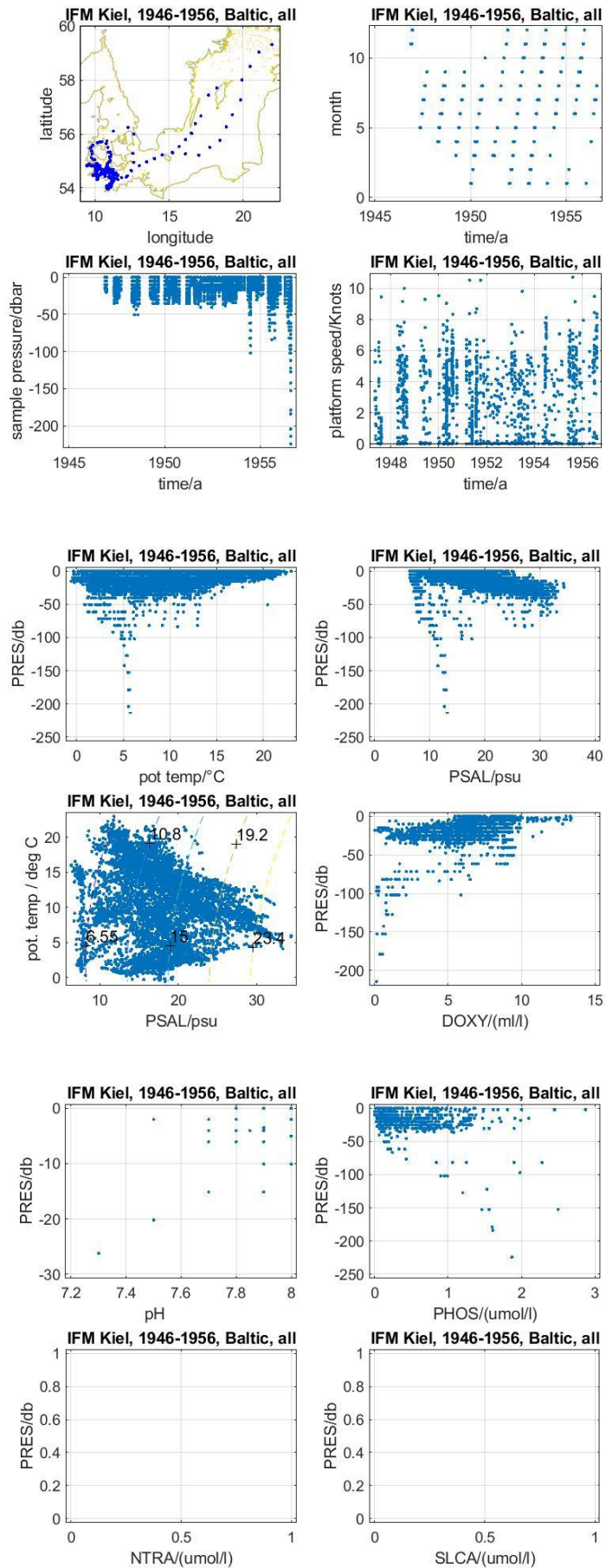


Appendix 2

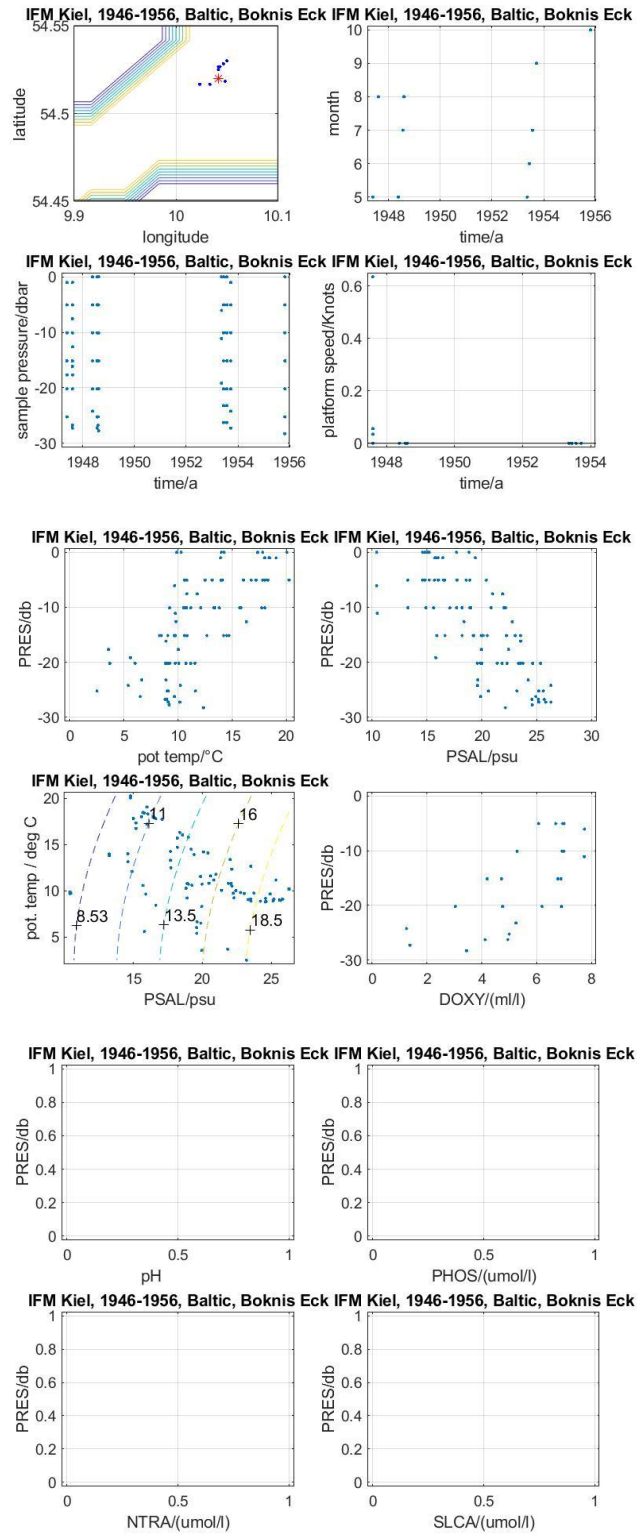
Methods applied to measure temperature, salinity, dissolved oxygen and phosphorus from phosphate during cruises with FK "Südfall" in 1946 to 1956 by IFMK (copy of the cover of one of the data sets, in German; see text for a translation to the English).



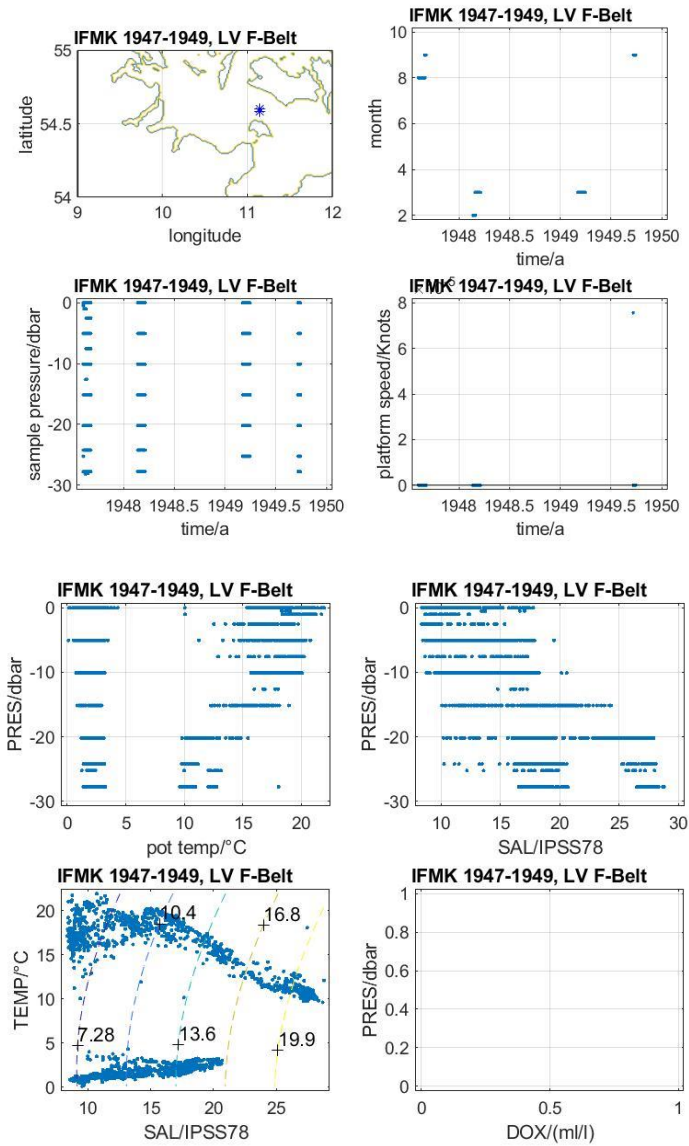
Appendix 3.1: 1946 to 1956 Baltic Sea hydrographic data overview



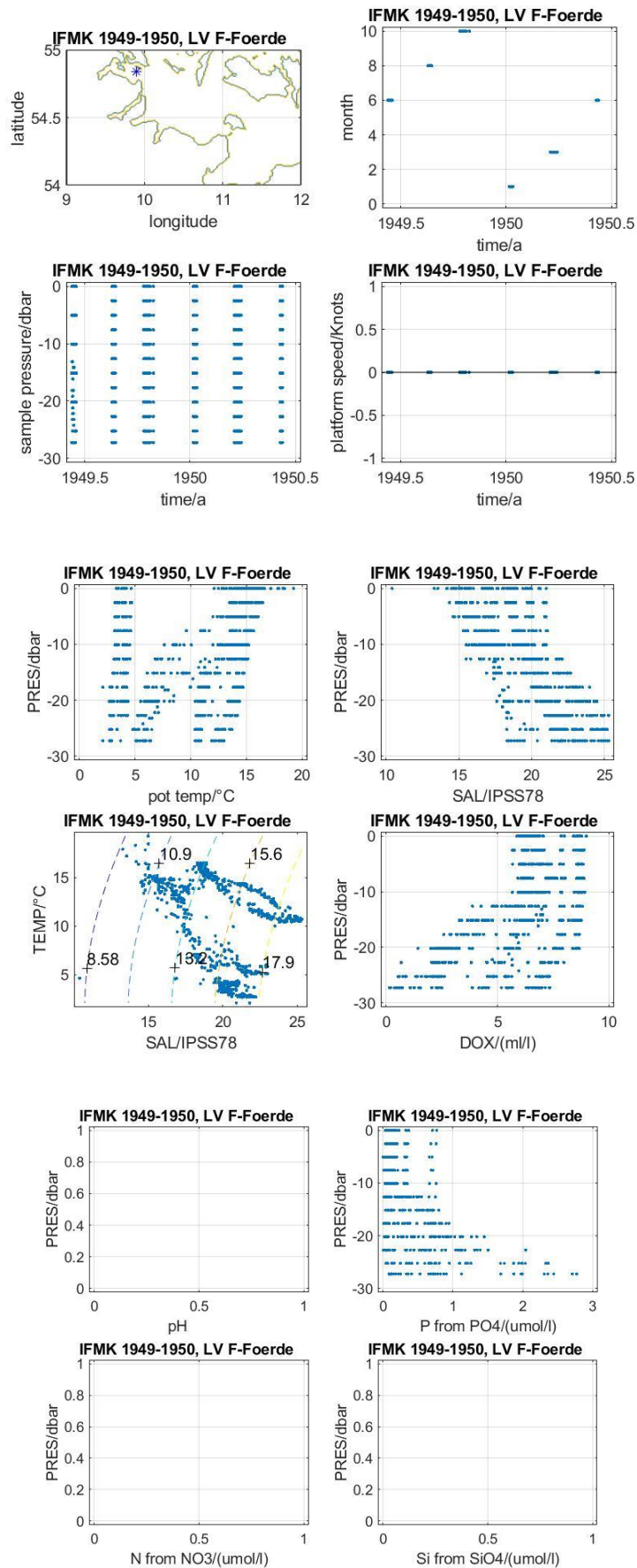
Appendix 3.2: 1946 to 1956 Time Series Station “Boknis-Eck” overview



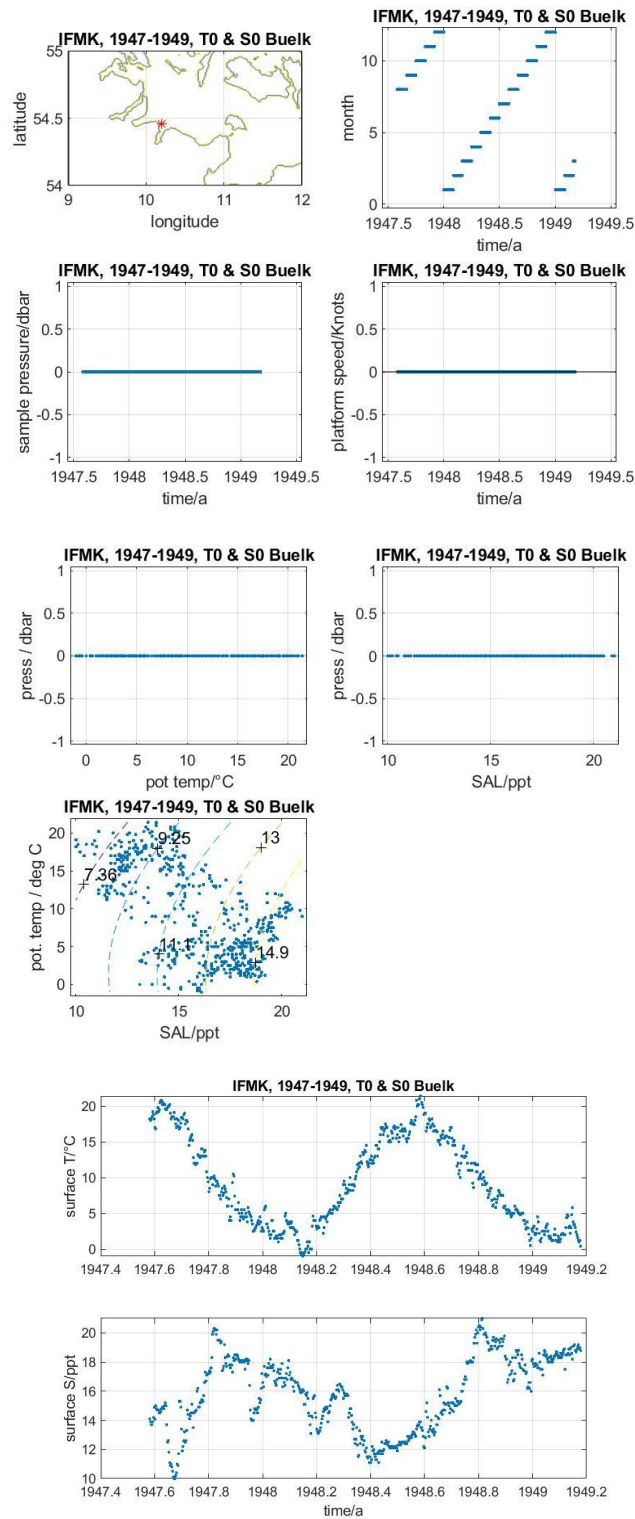
Appendix 3.3: 1947 to 1949, German light vessel LV "Fehmarn Belt"



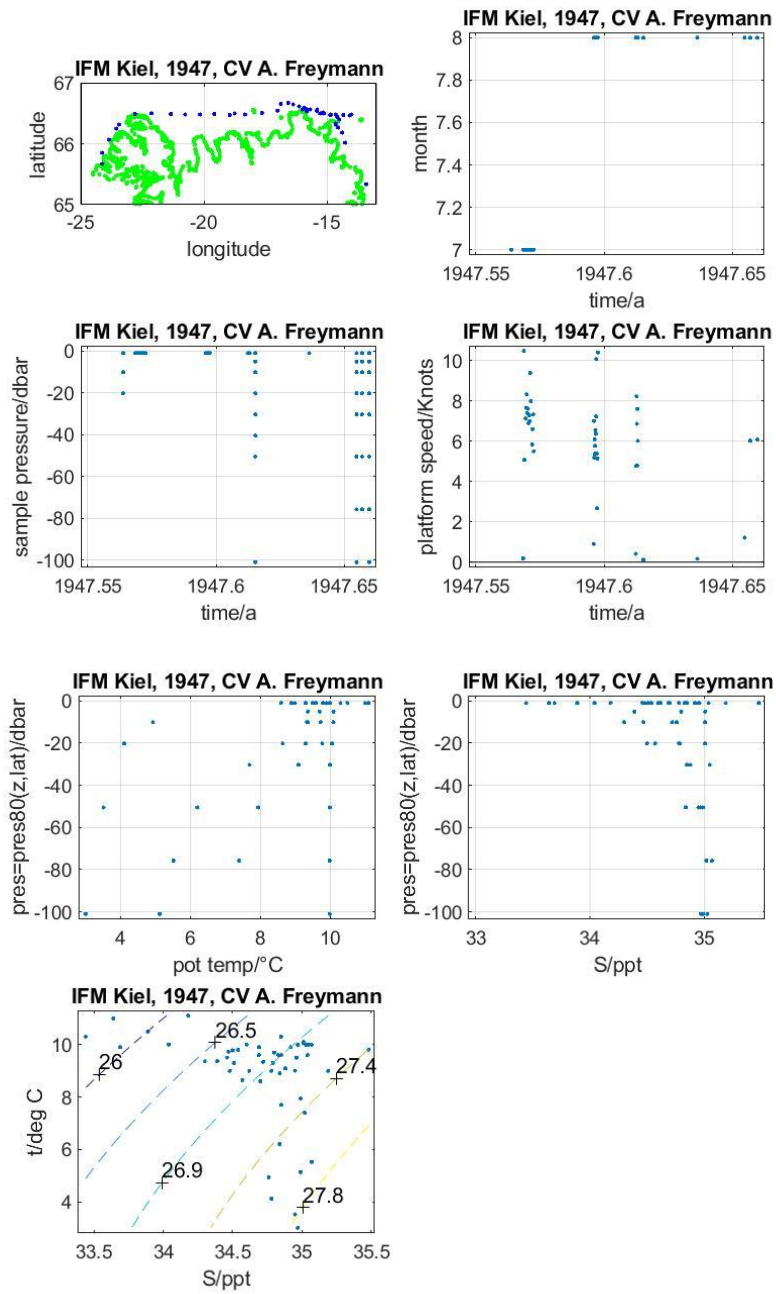
Appendix 3.4: 1949 to 1950, German light vessel LV "Flensburger Förde"



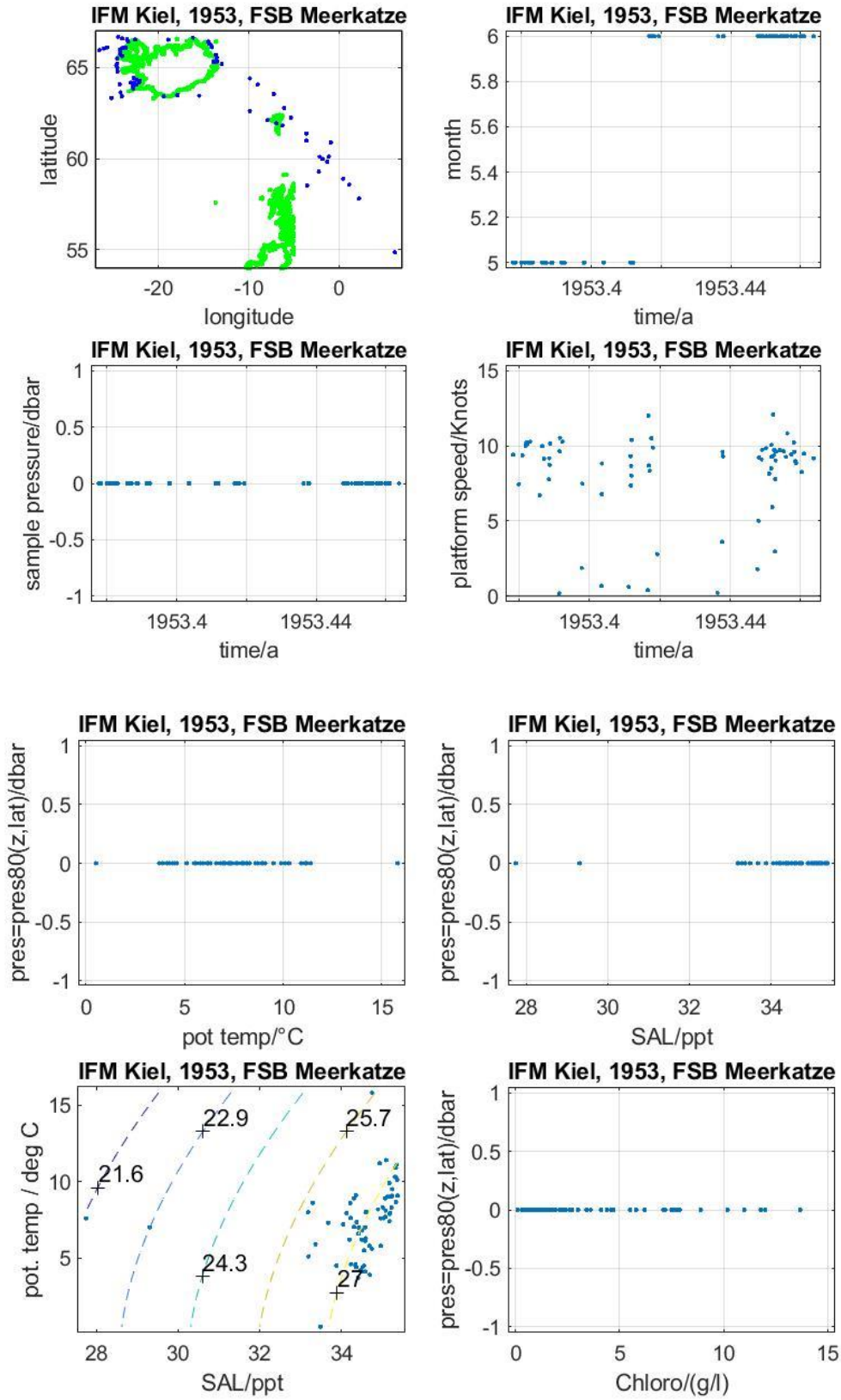
Appendix 3.5: 1947 to 1949, coastal surface data off Bülk, Kiel Fjord



Appendix 3.6.1: 1947, surface data north of Iceland, “CV Alice Freyermann”

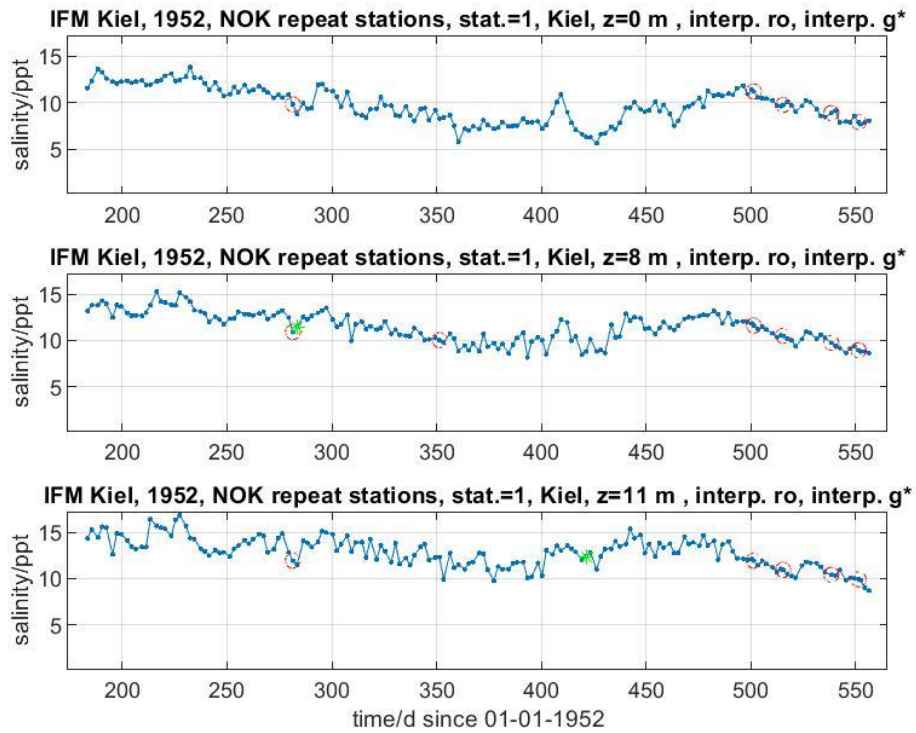


Appendix 3.6.2: 1953, surface data North Sea to Faroe and Iceland, "FSB Meerkatze"

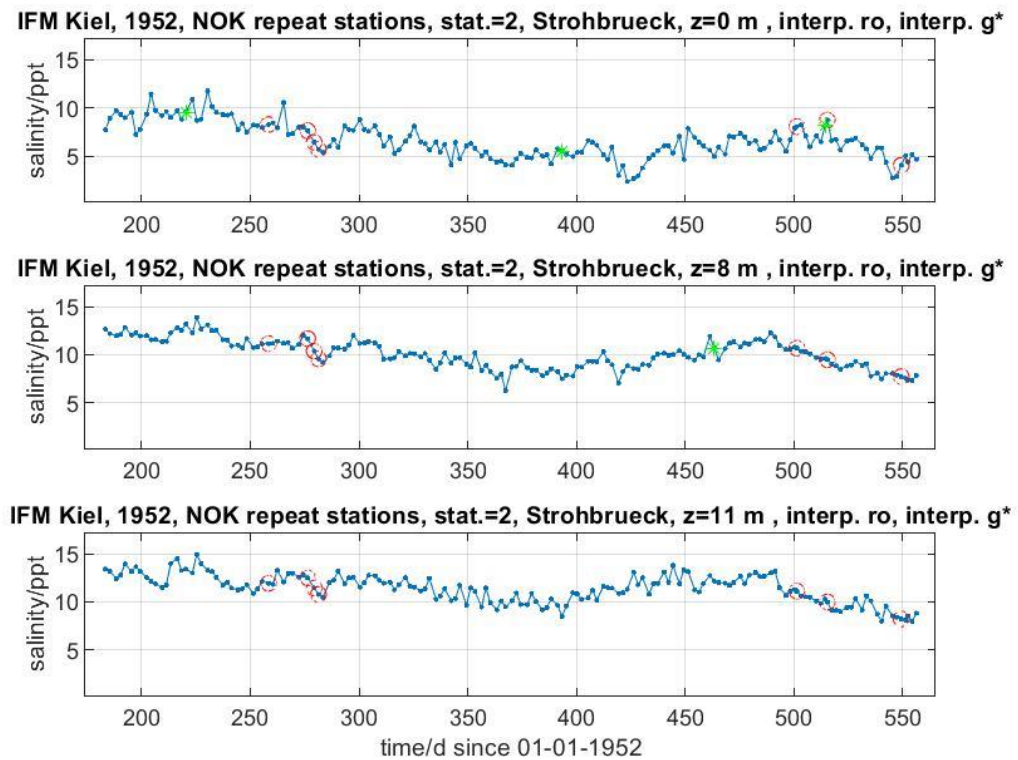


Appendix 3.7: 1952 -1953, Kiel Canal Kiel Canal, salinity time series, 164 repetitions

Station 1



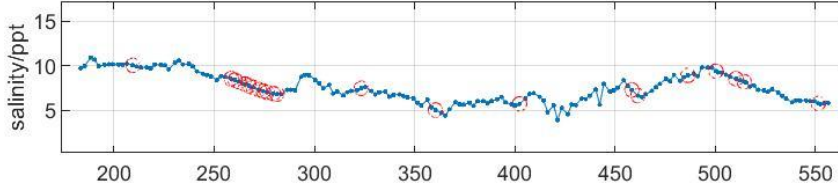
Station 2



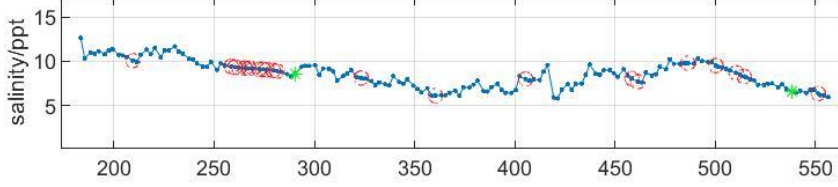
Appendix 3.7 (continued)

Station 3

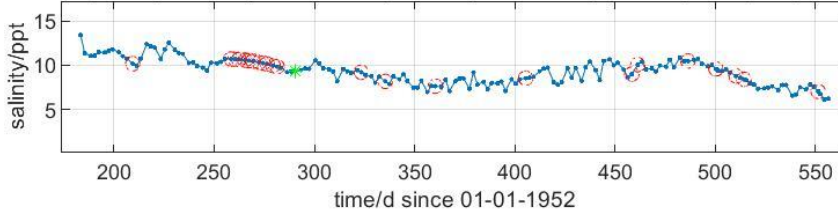
IFM Kiel, 1952, NOK repeat stations, stat.=3, Sehestedt, z=0 m , interp. ro, interp. g*



IFM Kiel, 1952, NOK repeat stations, stat.=3, Sehestedt, z=8 m , interp. ro, interp. g*

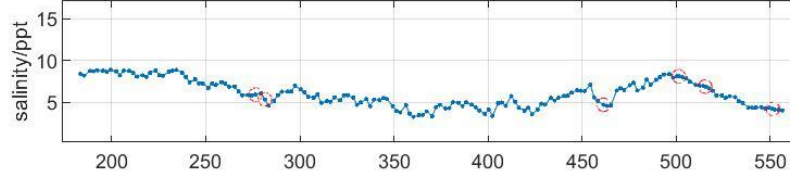


IFM Kiel, 1952, NOK repeat stations, stat.=3, Sehestedt, z=11 m , interp. ro, interp. g*

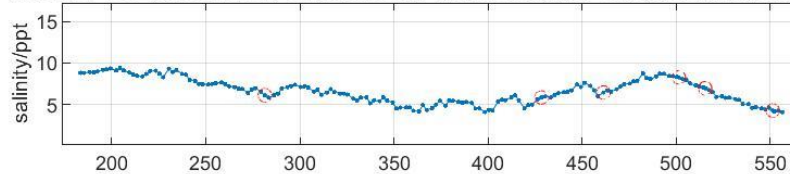


Station 4

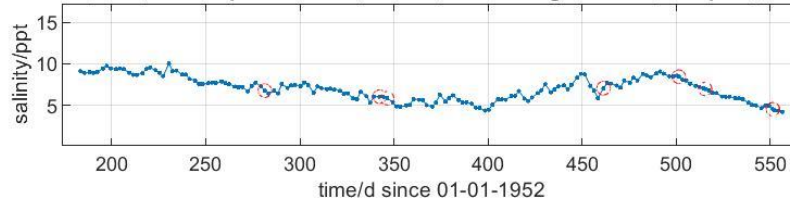
IFM Kiel, 1952, NOK repeat stations, stat.=4, Rendsburg, z=0 m , interp. ro, interp. g*



IFM Kiel, 1952, NOK repeat stations, stat.=4, Rendsburg, z=8 m , interp. ro, interp. g*

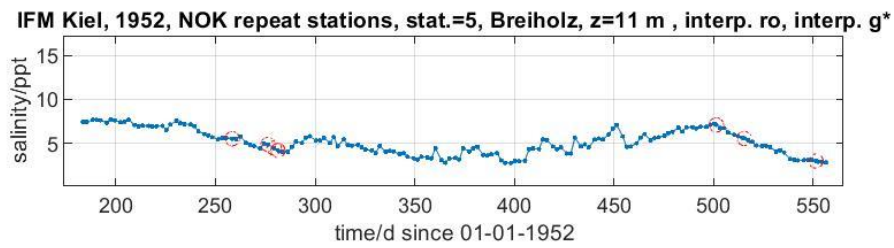
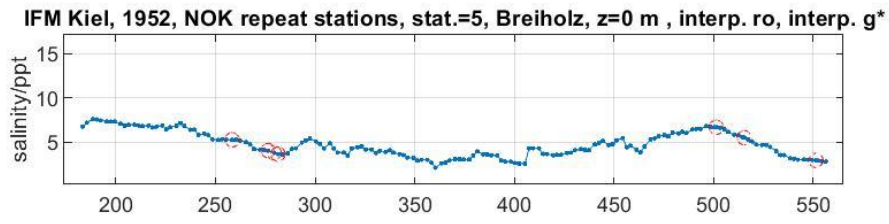


IFM Kiel, 1952, NOK repeat stations, stat.=4, Rendsburg, z=11 m , interp. ro, interp. g*

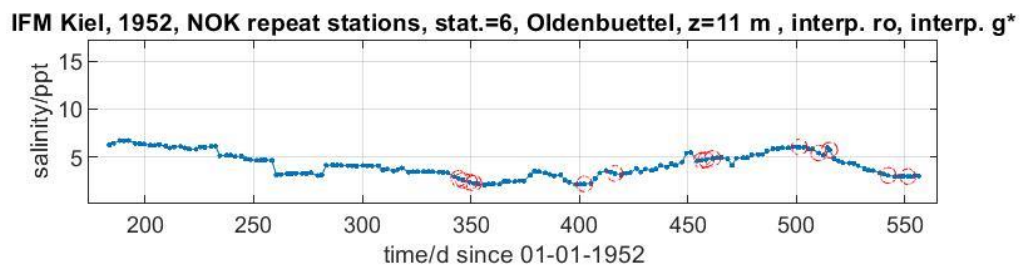
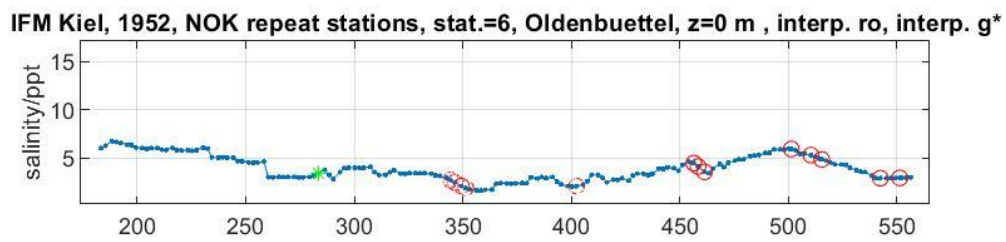


Appendix 3.7: (continued)

Station 5



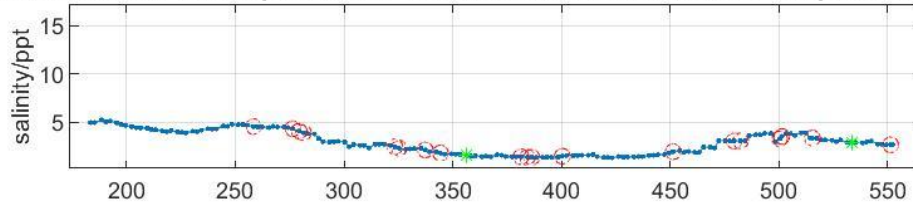
Station 6



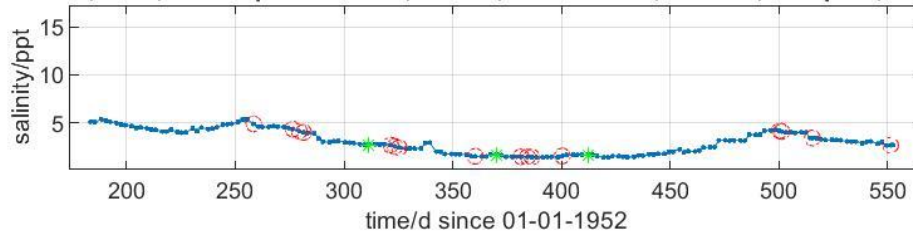
Appendix 3.7: (continued)

Station 7

IFM Kiel, 1952, NOK repeat stations, stat.=7, Hohenhoern, z=0 m , interp. ro, interp. g*

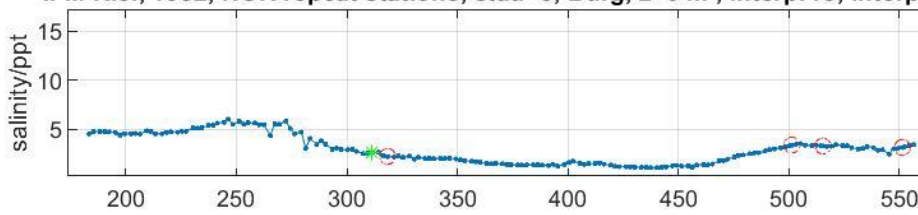


IFM Kiel, 1952, NOK repeat stations, stat.=7, Hohenhoern, z=11 m , interp. ro, interp. g*

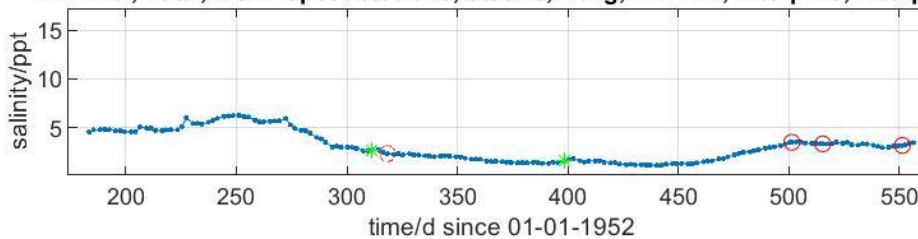


Station 8

IFM Kiel, 1952, NOK repeat stations, stat.=8, Burg, z=0 m , interp. ro, interp. g*



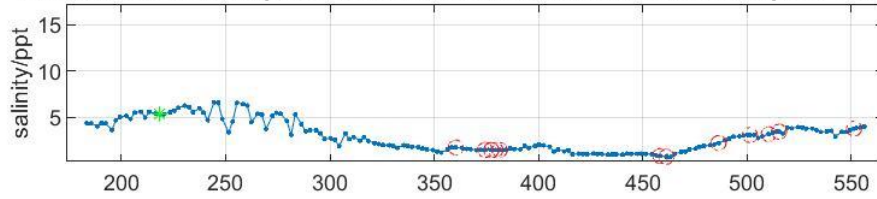
IFM Kiel, 1952, NOK repeat stations, stat.=8, Burg, z=11 m , interp. ro, interp. g*



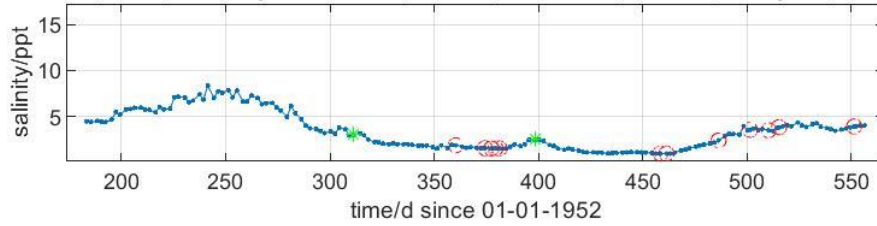
Appendix 3.7: (continued)

Station 9

IFM Kiel, 1952, NOK repeat stations, stat.=9, Kudensee, z=0 m , interp. ro, interp. g*

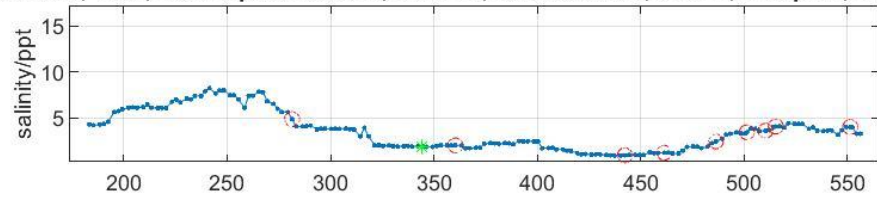


IFM Kiel, 1952, NOK repeat stations, stat.=9, Kudensee, z=11 m , interp. ro, interp. g*

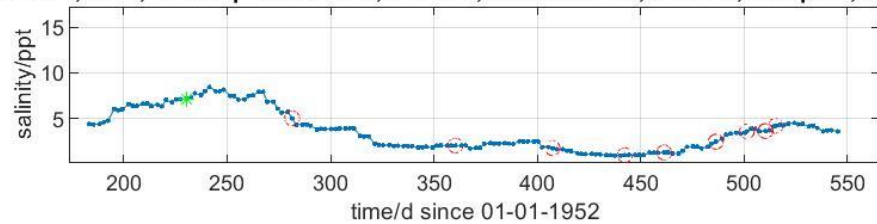


Station 10

IFM Kiel, 1952, NOK repeat stations, stat.=10, Brunsbüttel 2, z=0 m , interp. ro, interp. g*



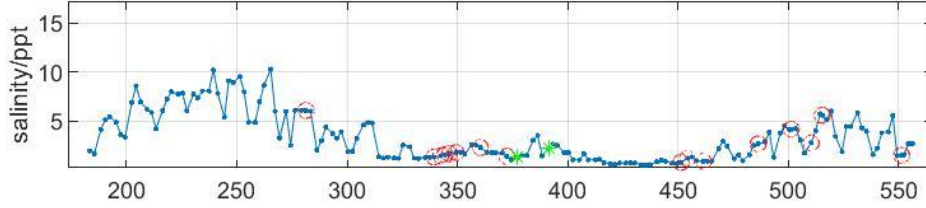
IFM Kiel, 1952, NOK repeat stations, stat.=10, Brunsbüttel 2, z=11 m , interp. ro, interp. g*



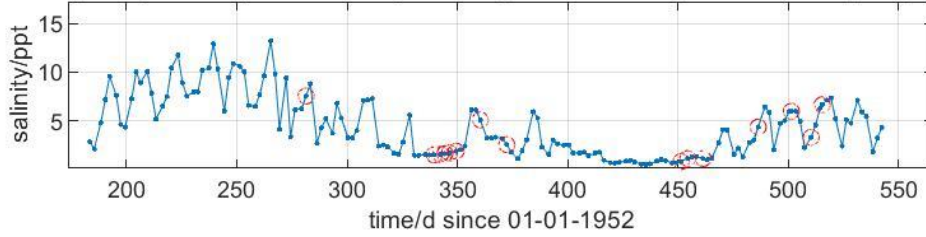
Appendix 3.7: (continued)

Station 11

IFM Kiel, 1952, NOK repeat stations, stat.=11, Brunsbüttel 1, z=0 m , interp. ro, interp. g*



IFM Kiel, 1952, NOK repeat stations, stat.=11, Brunsbüttel 1, z=11 m , interp. ro, interp. g*



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| 11 | RV SONNE Fahrtbericht / Cruise Report SO227 TAIFLUX, 02.04. – 02.05.2013, Kaohsiung – Kaohsiung (Taiwan), Christian Berndt, 105 pp, DOI: 10.3289/GEOMAR_REP_NS_11_2013 |
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