ALKOR-Berichte

Student cruise: Observing techniques for Physical Oceanographers

Cruise No. AL564

14.09.2021 – 17.09.2021

Kiel (Germany) – Kiel (Germany)

MNF-Pher-110

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2022

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1 Cruise Summary

1.1 Summary in English

The main purpose of the ALKOR cruise AL564 was the training of students in observational techniques used in physical oceanography. The students who participated in the trip attend the module "Measurement Methods of Oceanography" which is offered in the Bachelor program "Physics of the Earth System" at CAU Kiel. During the AL564 the students were instructed in instrument calibration and in the interpretation of measurement data at sea. In addition, the students had the opportunity to learn about working and living at sea and to explore and study the impact of physical processes on the western Baltic Sea, the sea at their doorstep. In addition, the students had the opportunity to learn about working and living at sea and to explore and investigate the effects of physical processes in the western Baltic Sea, the sea on their doorstep. During AL564 the students spend two nights at sea (September 14th to 16th 2021) and also visited the Boknis Eck time series site (September 17th 2021) where the students have been introduced in testing of equipments and yoyo CTD profiling.

1.2 Zusammenfassung

Die ALKOR-Reise AL564 diente vorrangig der Ausbildung von Studierenden in Bezug auf Beobachtungsmethoden die von physikalischen Ozeanographen angewandt werden. Die Studierenden die an der Reise teilnahmen belegen das Modul Messmethoden der Ozeanographie das im Bachelor-Studiengang "Physik des Erdsystems" an der CAU Kiel angeboten wird. Während der AL564 wurden die Studierenden in Instrumentenkalibration und in die Interpretation von Messdaten auf See eingewiesen. Zudem bekamen die Studierenden die Möglichkeit das Arbeiten und Leben auf See kennenzulernen und das Wirken von physikalischen Prozessen in der westlichen Ostsee, dem Meer vor ihrer Haustür, zu erforschen und zu untersuchen. Aufgrund der COVID Situation konnten nur Tagetouren durchgeführt werden, in den Fehmarn Belt und zur Zeitserienstation Boknis Eck. Während AL564 verbrachten die Studenten zwei Nächte auf See (14. bis 16. September 2021) und besuchten auch die Zeitserienstation Boknis Eck (17. September 2021), wo die Studenten Tests von Ausrüstung (Verankerung) und in die Erstellung von Yoyo-CTD-Profilen eingeführt werden.

2 Participants

2.1 Principal Investigators

Name	Institution
Karstensen, Johannes, Dr.	GEOMAR

2.2 Scientific Party

Name	Discipline	Institution
Karstensen, Johannes, Dr.	Cruise leader	GEOMAR
Tuchern, Franz Phillip, Dr.	Physical Oceanography	GEOMAR

Schmidtko, Sunke, Dr	Physical Oceanography	GEOMAR
Witt, Rene	Technician	GEOMAR
Lindl, Mario	Student	CAU
Gößling Paula	Student	CAU
Perschon, Justus	Student	CAU
Brunßen, Zoe	Student	CAU
Jung, Jasper	Student	CAU
Raabe, Nina	Student	CAU
Rhein, Janika	Student	CAU

2.3 Participating Institutions

GEOMAR	Helmholtz-Zentrum für Ozeanforschung Kiel (GEOMAR)
CAU	Christian-Albrechts-Universität zu Kiel

3 Research Program

3.1 Description of the Work Area

The cruise operated in the western Baltic region, from little east of the Fehmarn Belt and to the time series station Boknis Eck at the entrance of the Eckernförder Bay. The Fehmarn Belt, which is key region for the water exchange for the Baltic Sea, was surveyed twice to capture short term variability at the section. A section along the deepest ridge from the Small Belt towards Kiel captured the southwest (upper layer) and northeast (lower layer) spreading of the outflowing low salinity and inflowing North Sea water.

3.2 Aims of the Cruise

The main purpose of the ALKOR cruise AL564 was the training of students in observational methods of physical oceanographers. Undergraduate students in the Bachelor program "Physik des Erdsystems" at the CAU Kiel are introduced into modern observational techniques in physical oceanography, including instrument calibration and interpretation of observations. The course (MNF-Pher- 110b) is part of the "Messmethoden" lecture. The cruise will give the students an opportunity to experience the work and life at sea and also to explore and investigate physical oceanography processes in the western Baltic Sea, the ocean at their backyard. The scientific motivation of the cruise is to obtain a rather synoptic picture of the hydrography and water movement in the western Baltic.

3.3 Agenda of the Cruise

The cruise was executed as a 3-day cruise covering the repeat section in the western Baltic. In addition, a 1-day trip from/to Kiel and into the Fehmarn Belt area and to the time series station Boknis Eck at the entrance of the Eckernförder Bay. In the Fehmarn Belt, two sections were made (on 07 & 10.08.) and the tripod mooring could be recovered and deployed again (Fig. 3.1). A section in the western Baltic, from Small Belt southward, was intended to provide the base for a description of the vertical structure of the western Baltic Sea. In particular it nicely shows the decreasing influence of North Sea water towards the eastern Baltic proper. The second section was crossing the Fehmarn Belt perpendicular to the topography. This section was carried out on the 08th and on the 10th August with the intention to show the high temporal variability of stratification in the region.

The work at the different stations should mimic a "real" expedition, including active interactions with the ships crew (CTD stations, mooring operations). At the eastern exit of the Fehmarn Belt a tripod-mooring is installed, located at the periphery of the restricted area "Marienleuchte". The students participate in recovery or deployment and in the data recovery and sensor handling. The time series are discussed (seasonal cycles etc.).

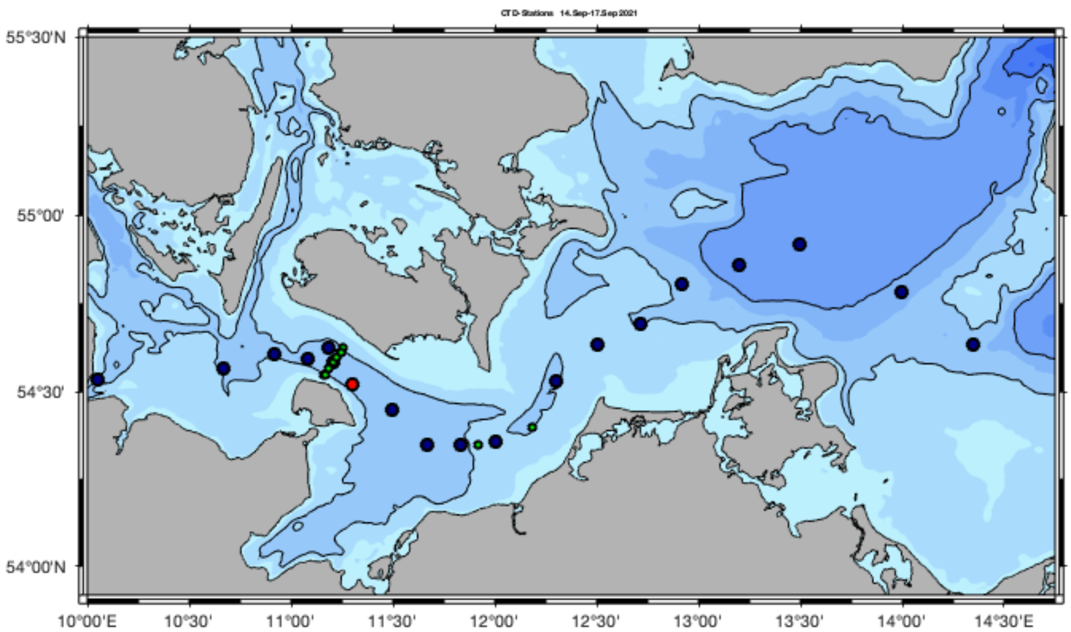

Fig. 3.1 Track chart of R/V ALKOR Cruise AL564. CTD stations along the zonal section (big blue dots) and the strait section along the Fehmanrn Belt (green dots). The red dot marks the position the bottom shield mooring at the southern exit of the Fehmarn Belt.

4 Narrative of the Cruise

Preparation for the cruise AL564 began with loading equipment to the ship on Friday, September 10th 2021 on the east-shore GEOMAR before the ship went over to the Westshore where it was moored for the weekend. On Monday 13. Sept. 2021 all science crew did an PCR test at the GEOMAR east shore building, which was followed by a block seminar were all students presented reviews they did on topic related to the upcoming cruise. On Tuesday the 14th of September 2021 the expedition started and all cruise participants for RV ALKOR AL564 were on board the ship at 07:30 LT (LT – local times; UTC+2). The RV ALKOR departed at 7:55. During departure the science crew attended a safety instruction and a tour-de-ship through by the safety officer (Christian). First science operation was a CTD test station (Profil 1, Praktikumsstation 1) that went well and all systems operated as expected. Fortunately, Svend Mees (GEOMAR, FB3/Marine Evolutionsökologie) did service the CTD and in particular refit the oxygen sensor so the reading all looks nice and smooth. At that station we also occupied a large volume of seawater that was on the following days used to track the stability of the Salinometer (Substandard) that alter will be used, was recovered from the cast. The Fehmarnbelt section was occupied with CTDs and an ADCP section after. The weather was calm and sunny. After a CTD at the mooring position the preparations for mooring recovery began. After release the mooring was recovered without problems and at deck at 18:22LT. Some biofouling was seen but no obvious corrosion. The CTD and meteorological operations continued until about 21:00. During the night we steamed eastward, to the easternmost position of the Standard grid (Station 21). On September 15th, 2021, the work started at 08:00 with the first CTD at long-term Station 21. This followed the begin of the salinometer measurements. The samples from day 1 equilibrated to lab temperature in the meantime and could be analyzed now (approx. 1 day). First, the group of all students was demonstrated the salinometer operations and a calibration of the salinometer was done using Standard seawater (IAPSO batch P160). The whole day the CTD, meteorological and salinometer operations continued in 2 hours shift with 2 students in each shift. The data from the moored instruments was recovered and data consistencies checks and calibrations were applied. Data recovery was high – all sensors (Nortek Signature 500, AADI Optode on GEOMAR logger, SBE37 Microcat) worked without problems and full data coverage can be reported. On the September 16th, 2021, the work started at 5:45 LT with preparation of mooring deployment. The mooring was lowered and released close to the bottom via a Benthos release unit. We steamed towards the C section and began with a CTD section at 06:40 and ended at 08:40 with the last CTD off Denmark. The ADCP section followed and we the steamed towards Kiel Ostufer pier where we moored around noon.

The final day of AL564, the day cruise to the Boknis Eck station started at 07:15 at the Westufer pier. With this time 20 persons on board the ship was complete. The purpose of this day cruise was introducing the students (7 persons) to the deployment/recovery of a surface mooring that was moored for a couple of hours near the Boknis Eck time series station (54° 32.30‘N, 010°03.00‘E). In addition, we had a person from NDR on board who did a report on the radio in the local dialect (see https://www.ndr.de/wellenord/sendungen/binnenland_und_waterkant/Oostseetoern-mit-Forschungsschipp-Alkor,alkor108.html). The mooring deployment also was done in the context of improving the global ocean observing and a film team contracted by the BMBF in the context of the “Europäischer Forschungsraum” initiative (www.forschungsraum.eu). The team used footage from the cruise in an information movie entitled “EuroSea stärkt die europäische und globale Ozeanbeobachtung” www.forschungsraum.eu/SharedDocs/Videos/de/forschungsraum/ 53218_eurosea.html. The mooring deployment and recovery went well. In addition, a CTD time series was recorded close to the Boknis Eck station. We left the Boknis Eck area at around 4pm and arrived at the east shore GEOMAR around 6pm and, after unloading the equipment, headed for the Westshore pier where we moored around 7pm.

5 Preliminary Results

5.1 Conductivity Temperature Depth (CTD) Sonde

During AL564 a Hydro-bios Multi Water Sampler (MWS 12 SLIMLINE) was used. The device is stationed at the R/V ALKOR and maintained by RD3 of the GEOMAR. The sampler is a rosette system with sample bottles and a CTD that hosts additional sensors (oxygen, fluorescence). The rosette is operated via inductive cable and a control unit from the ship's lab. The Temperature sensor is PT-100 type with 150ms response time and nominal accuracy of 0.005°C, the Conductivity a 7-pole cell with 100ms response time and accuracy of 0.01 mS/cm. The pressure sensor is a piezo resistive with nominal accuracy of <0.1%. Oxygen sensor is a Clarke electrode with an accuracy of 1% of measured value and response time of 3sec (60%) and 10 sec (90%). The fluorescence sensor is a Dr. Haardt Chlorophyll A Fluorometer. The CTD system samples with 1 Hz. Temperature, Oxygen and Florescence are not calibrated with discrete samples during AL564 and only salinity (see respective section below).

The Fehrmanbelt Section - C Section

The Fehmarnbelt section was observed two times during the RV ALKOR cruise „AL564", on 14.09.21 and on 16.09.21. On both days six CTD casts were taken between 54°33.4`N and 54°34.2`N (Fig. 5.1). The first section shows several indicators for a quite strong stratification. In the upper 15m we can see a homogenous structure with temperatures between 17.5°C and 18.5°C and oxygen values around 6.0 ml/l. At depths between 15m and 20m a strong gradient is visible. Beneath 20m temperature as well as oxygen show low values with 13.5°C and 1.5 ml/l. Another significant indicator for strong stratification and homogenous layers is salinity. The measured salinity values show three different layers with a big difference between each of them. Highest values were found at the bottom in depths between 25m and 20m, with 24g/kg. The second layer, in depths between 17m and 6m, shows values around 17g/kg while the layer on top has the lowest salinity values between 12g/kg to 10g/kg. Especially the combination of temperature and salinity at the bottom of the track is assigned to specific features of the north-sea water. Because low temperatures and high salinity values lead to high density, the north-sea water pushes underneath the water of the Baltic-sea, which is slightly warmer, less salty and builds the lowest layer. The less dense Baltic-sea water lies above. Furthermore, the influence of freshwater input on the surface layer is evident from very low salinity values. The temperature from 0m to 15m is quite equal because of solar irradiation during the day.

During the days 14.09.21 and 15.09.21 we were facing moderate winds from east-east-south most of the time, with a 15m/s peak in velocity at 12 o'clock on 15.09.21. In the evening of 15.09.21 the wind direction started to shift westward, from south-east to south. On 16.09.21 the western Baltic Sea experienced winds from south-west. In the salinity-plot from 16.09.21, with salty water coming up close to the coastal area, an upwelling process is recognizable. However, winds from south-west on 16.09.21 should tend to push the surface layer in south-east direction due to the Ekman Transport. Therefore, the influence of wind directions over the day 15.09.21 and night from 15.09.21 to 16.09.21 cause a significant change in structure of the water column. The upwelling process also means that the bottom layer with lowest values in all parameters was getting higher, because of a slight overturning in comparison to the second day.

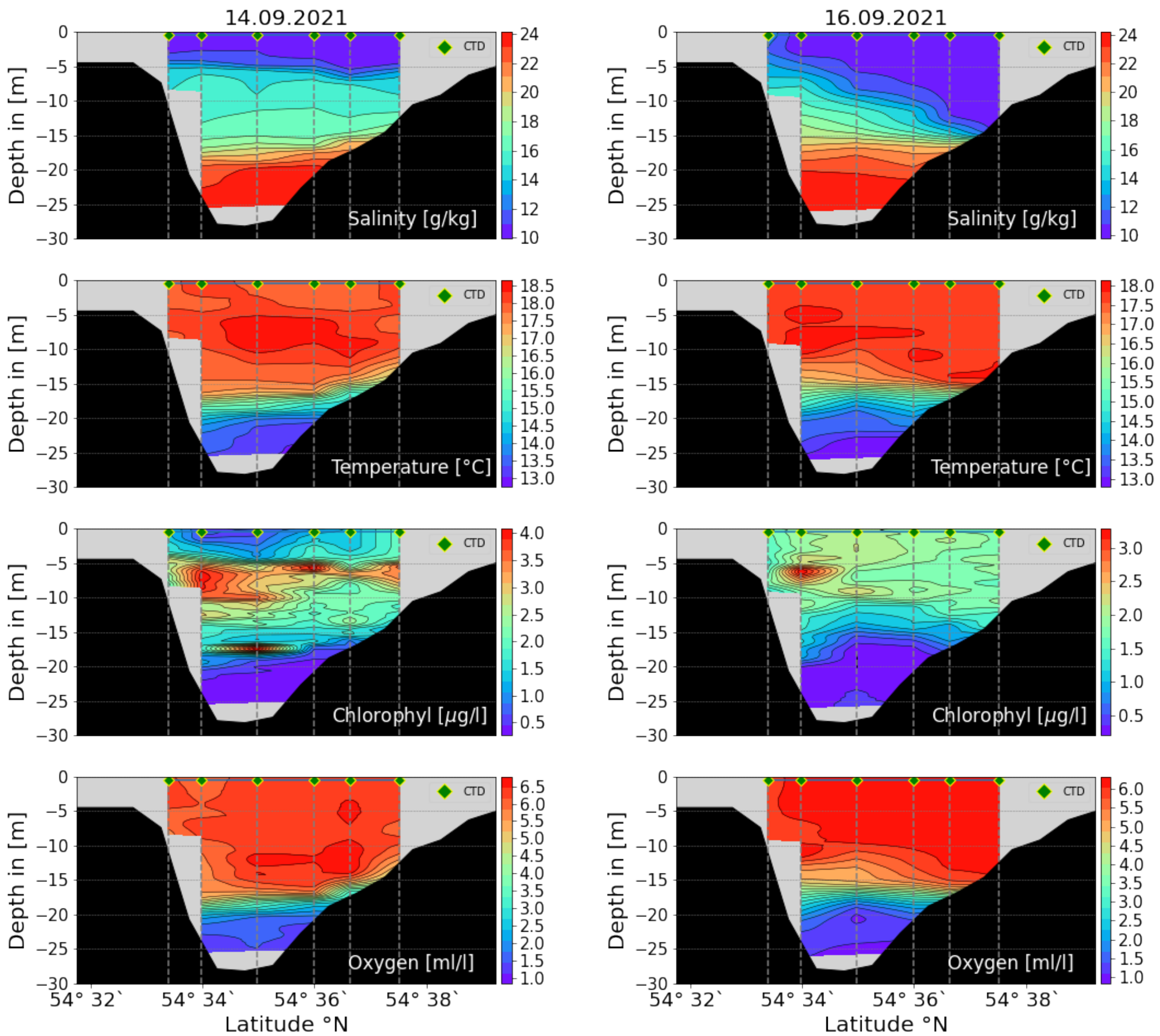

Fig. 5.1 (upper to lower) Absolute Salinity, temperature, cholorphyll-fluorsence and oxygen for the first occupation on September 14th, 2021 (left) and the second occupation September 16th, 2021 (right) See respective color scale for concentrations.

The Zonal Section - L Section

The stations occupied along the L-section are not necessarily synchronized in zonal direction (Figi 5.2). Data was acquired between September 14th to 16th, 2021. The influence of North Sea water can be seen in the west with more saline water, lower temperatures and low oxygen values at the bottom. Chlorophyll values are not indicated by near bottom spreading North Sea water. Still differences in maximum values, for all properties, from west to east are visible. This might be caused by a recent inflow event after a mixing period with no spreading of North Sea water. Bottom temperatures in the east, at 13°30`E, support this presumption due to minimum values at 25m depths and warmer water beneath. The distribution of oxygen shows that the oxygen concentration of the North Sea water is lower than in the Baltic Sea and especially in the west, inflow North Sea water shows the lowest oxygen values.

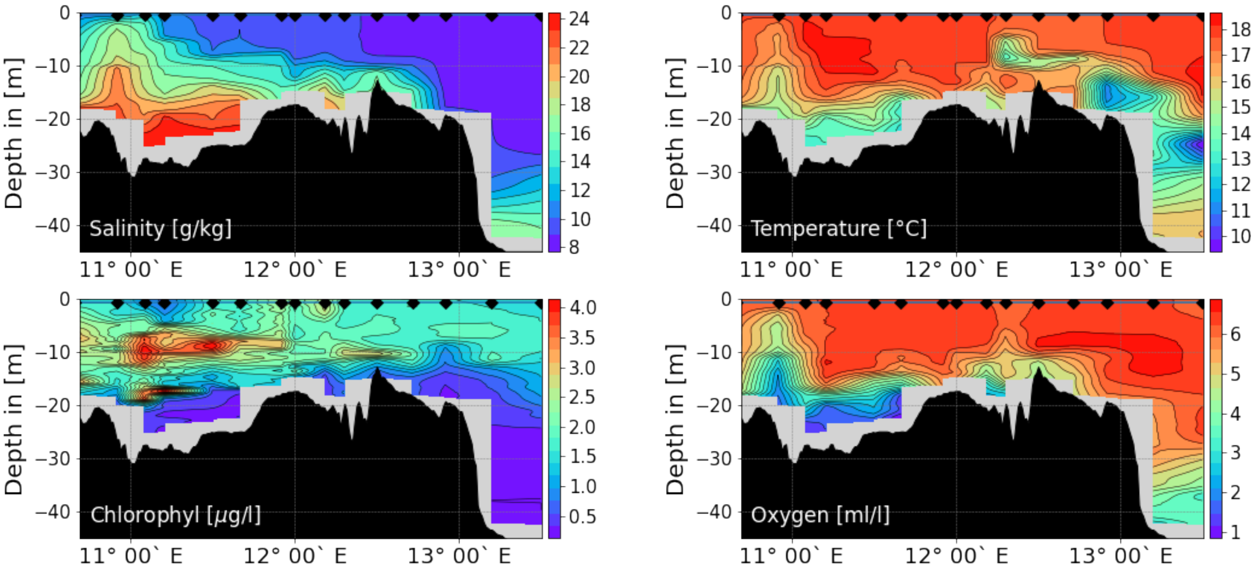

Fig. 5.2 (in clockwise direction, starting upper left) Absolute salinity, Temperature, Chlorophyll-fluoresence, and oxygen along the L-Section during AL564. For values see respective color scales.

5.2 Underway data DSHIP

The RV ALKOR is equipped with a meteorological sensor package maintained by the Deutsche Wetterdienst (DWD). It consists of sensors for air temperature (PT-100; 1/3 DIN B resolution) and a humidity sensor (voltage reading 0-100mV) both mounted in a Young-cage at 27m, air pressure (0.1 hPa resolution) is mounted underneath the bridge, water temperature (PT-100; 1/3 DIN B resolution) recorded at 3m water depth, wind direction (resolution 2.5°) and speed (resolution 0.3m/s) mounted at top of mast at (29m). The IR- and SW radiation is recorded with Eppley PIR and a Kipp & Zonen CM11, respectively. A Thermosalinograph (TSG) is a a SeaBird SBE21 with remote temperature sensor SBE38, a Valeport SV+T Sonde and a Wetlabs ECO-FLRT.

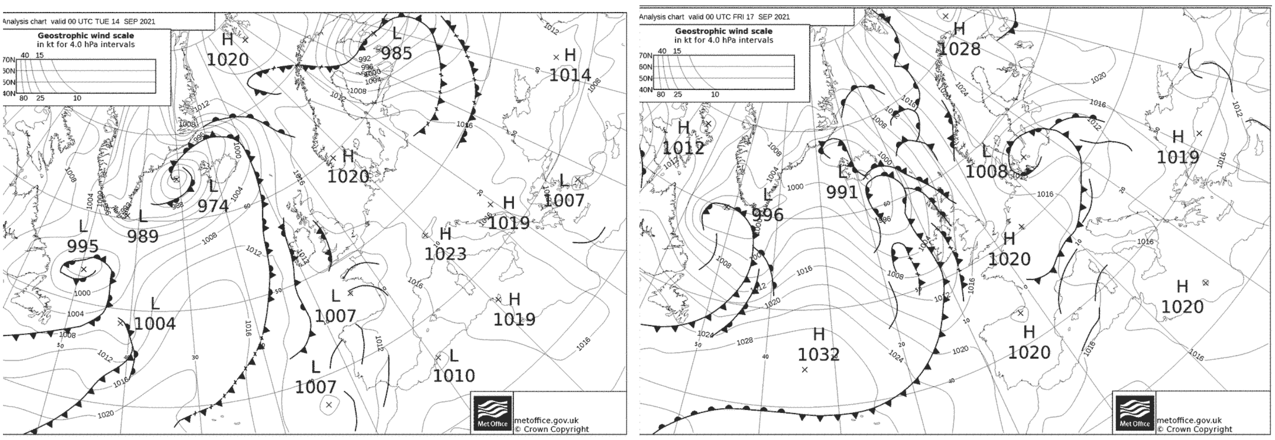

Fig. 5.3 Surface air pressure maps and fronts for September 14th (left) and September 16th (right) (downloaded from the www.wetterzentrale.de archive).

The large-scale weather during the cruise was first influenced by an extensive high-pressure system over Scandinavia but that developed of the course of the cruise time into a low pressure centered over the Skagerrak (Fig. 5.3). Overall, cruise conditions where calm.

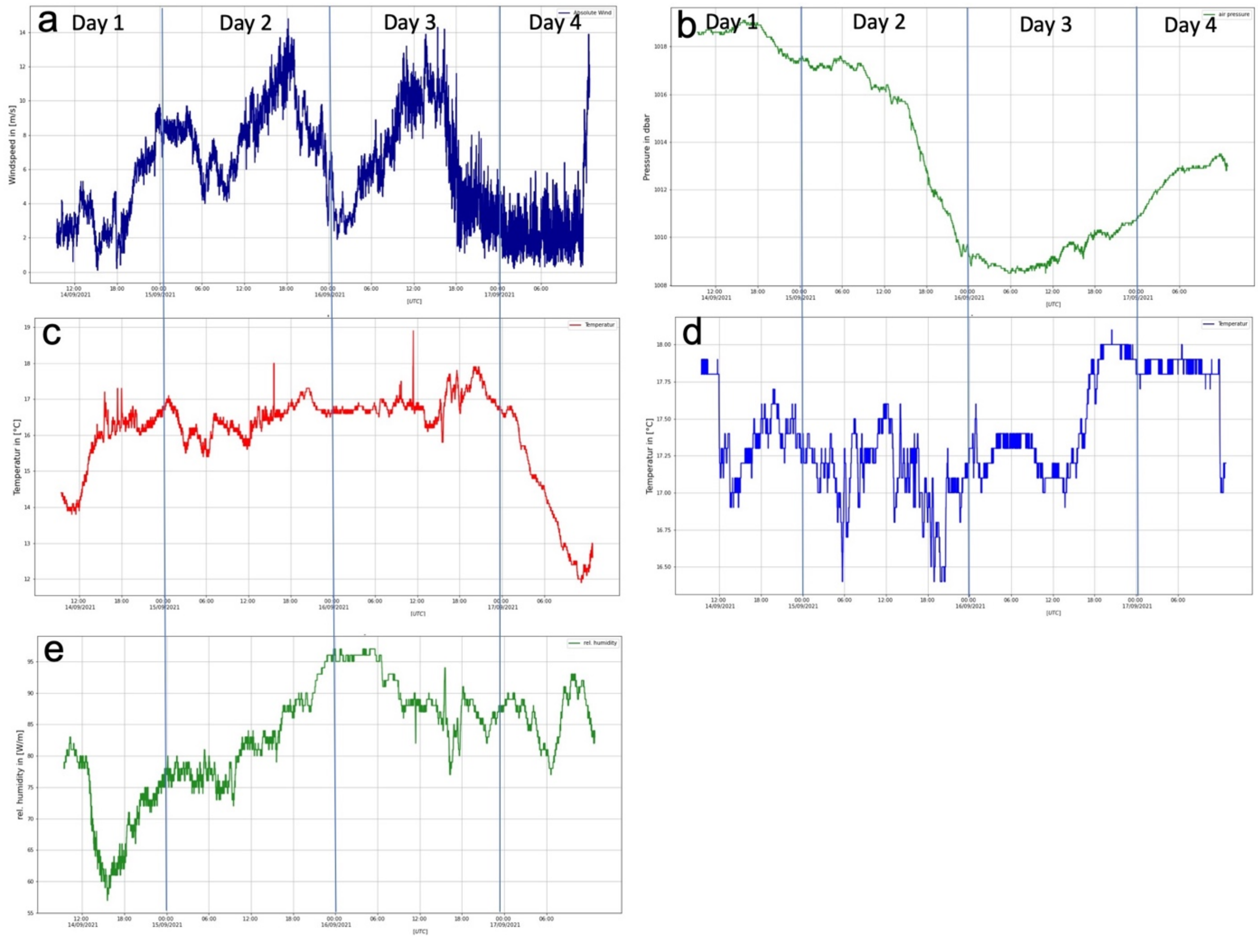

Fig. 5.4 Underway data for all four days of the AL564 cruise: (a) windspeed, (b) surface pressure, (c) air temperature, (d) seasurface temperature, and (e) relative humidity.

The underway data time series (Fig. 5.4) nicely reflect different local/regional conditions as well as the evolution of the synoptic weather situation (Fig. 5.3). The highest wind speed was encountered o day 2, when the RV ALKOR was furthest east, east of the Island Rügen. Likewise, on our way back to Kiel, on day3, we were under the impact of higher wind speed due to the establishing of the low-pressure system over the Skagerrak. The arrival of the low pressure also is evident in the time series of the surface pressure (Fig. 5.4, b) and also in precipitation that is seen in the increase in relative humidity (Fig. 5.4 e). Sea-surface temperature (SST, Fig. 5.4 d) was around 17°C, while the air temperature was similar. Air temperatures where colder in the Kiel Fjord (day 1) as well as in the Boknis Eck area (day 4).

5.3 Salinometer and Calibration

The Beckmann RS10 salinometer was used during the cruise. The Beckman is a portable salinometer that is based on inductive measurements and has no temperature stabilizing bath. Instead, the temperature of the sample is measured directly in the cell during operation. While the manufacturer gives a resolution of 0.0004 in salinity and an accuracy within 0.003, we assume here an accuracy of 0.01 given that the lab temperature was variable. Operations included one standardization with Standard Sea Water at the beginning of the operations to calibrate the salinometer. A substandard taken from the first samples was used from there on and typically measured every forth measurement to calculate a drift.

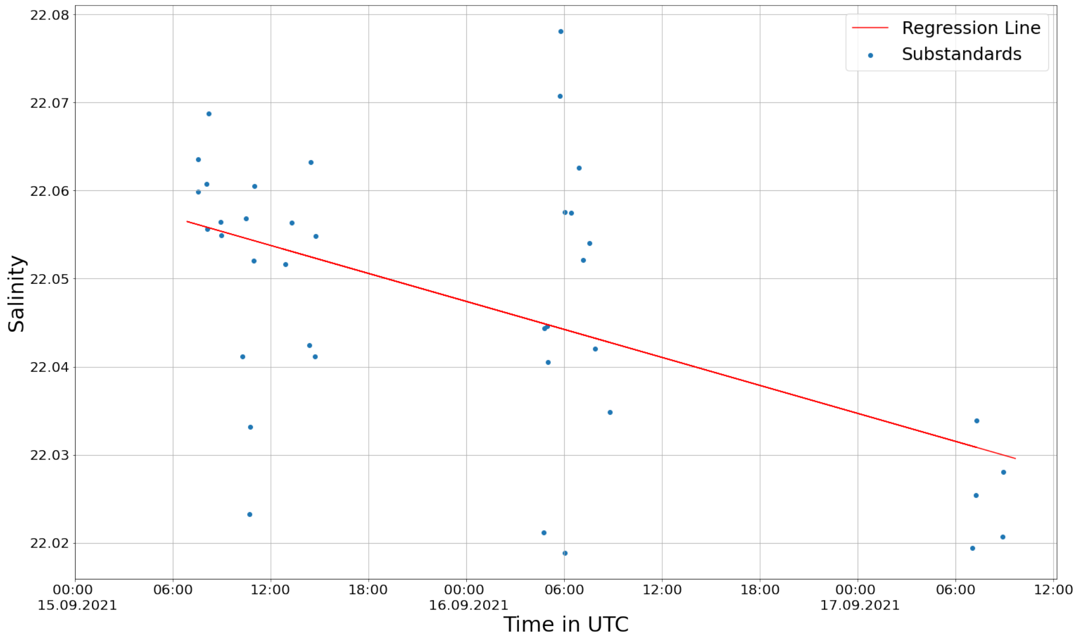

Fig. 5.5 Measured salinity of the substandard (blue dots) over time. A time drift is visualized with a regression line (red).

To analyze the stability of the salinometer, the measured salinities of the substandards were used. Values smaller than 21 or bigger than 23 were removed given that they were most probably caused by poor handling. As seen in Figure 5.5, the measured salinity gets smaller with time, so that a time drift of - 0.0127 per day is assumed. The standard derivation of the corrected substandard salinities is 0.013 and the mean 22.060. The further used salinity values are corrected by the drift.

CTD sample analysis

To correct the CTD-measurements the difference between them and the salinities of the water samples (measured by the salinometer, already corrected by the drift the water samples (measured by the salinometer, already corrected by the drift) is analyzed (Fig. 5.6). Unfortunately, the CTD-measurements of the last bottle closed per station were not in the .btl file. Just once this bottle was used for samples, due to this lack, these values are not considered here. The difference gets bigger with time, therefore the CTD has a drift as well (-0.087 per day, see Fig. 2). After correcting the values by this term, the mean of the differences is -0.024, the standard deviation 0.427. Removing the values exceeding twice the standard deviation leads to a smaller standard deviation (0.263) and a mean of -0.11. This mean of the differences of salinometer and CTD measurements can be seen as the offset of the salinity-values of the used CTD.

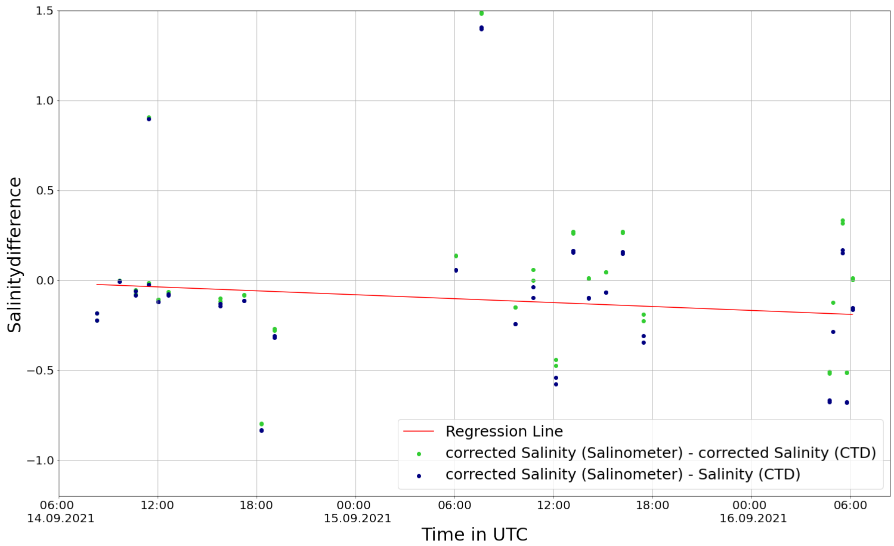

Fig. 5.6 Differences of the corrected salinity measured with the Salinometer and the one measured with the CTD (blue). The measurements of the CTD are corrected by the drift (green).

The differences in salinities of the salinometer and the CTD do not clearly depend on depth. There is a slight incline in the regression line, which could lead to the assumption that the offset of the CTD is smaller in greater depth (see Fig. 5.7). But due to the wide range in differences from 10 to 30 m depth and a high standard deviation compared to the small incline of the regression line, no dependence on depth can be seen.

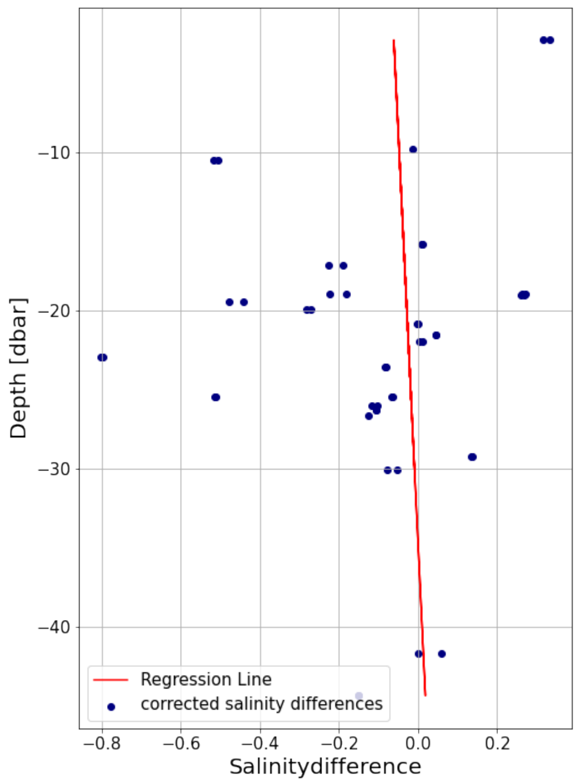

Fig. 5.7 The differences in salinity change a bit with depth, but the range in values in mid-depths shows high uncertainties.

5.4 Mooring V431 at Marienleuchte

During AL564 the mooring time series station in the southeastern part of the Fehmarn Belt, at the military exclusion zone "Marienleuchte", was service. Last service and redeployment of the mooring, that carries the internal code V413, was during with FK LITTORINA in Mid-September 2020 and about 1 month after the student cruise AL529. The system consisted of a GEOMAR made tripod frame that consists of a recoverable frame and a releasable (acoustic) flotation element that is connected with a robe to the frame in order to recover all mooring pieces during service. Mounted to the tripod are a SBE-37 SeaBird MICROCAT (T, C recordings), an GEOMAR logger with AADI oxygen optode and a Nortek SIGNATURE 500 acoustic doppler current profiler.

Time series results

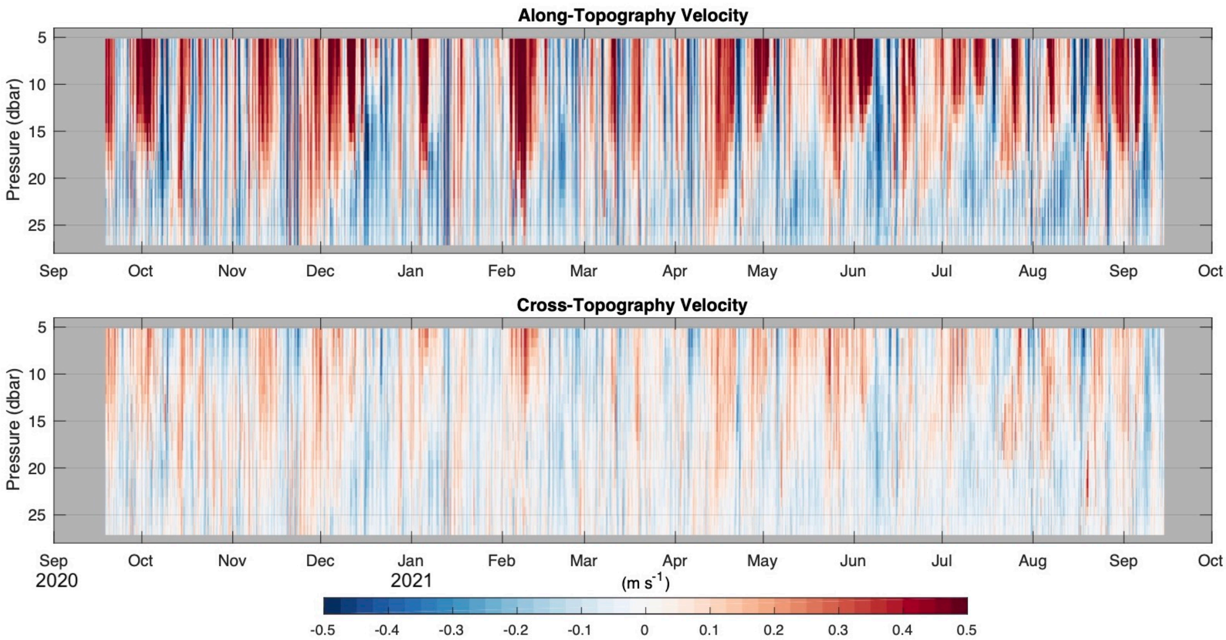

Fig. 5.8 Water velocity (upper) along and (lower) across the mean topography. See color scale for respective values.

From the first time series record of the newly installed tripod mooring in the Fehmarnbelt area Marienleuchte (Fig. 5.8) it can be seen that the recording worked out very well. The velocity records nicely shows a generally two layer flow system in the Fehmarn Belt area with a flow out of the Baltic Sea in the upper layer and into the Baltic Sea below. Also, shorter periods with more barotropic in/outflow situations occur. Some strong events also indicate that the flow that also indicate a rotation of the flow.

Focusing on the strongest event on the record (early February 2021) a possible connection with the local wind forcing was investigated (Fig. 5.9). It was found that the strong wind is synchronous with the high current speed and also the penetration to deeper levels, hampering the inflow into the Baltic. It also can be seen (not shown here) that this event also is aligned with increase and significant vertical velocities.

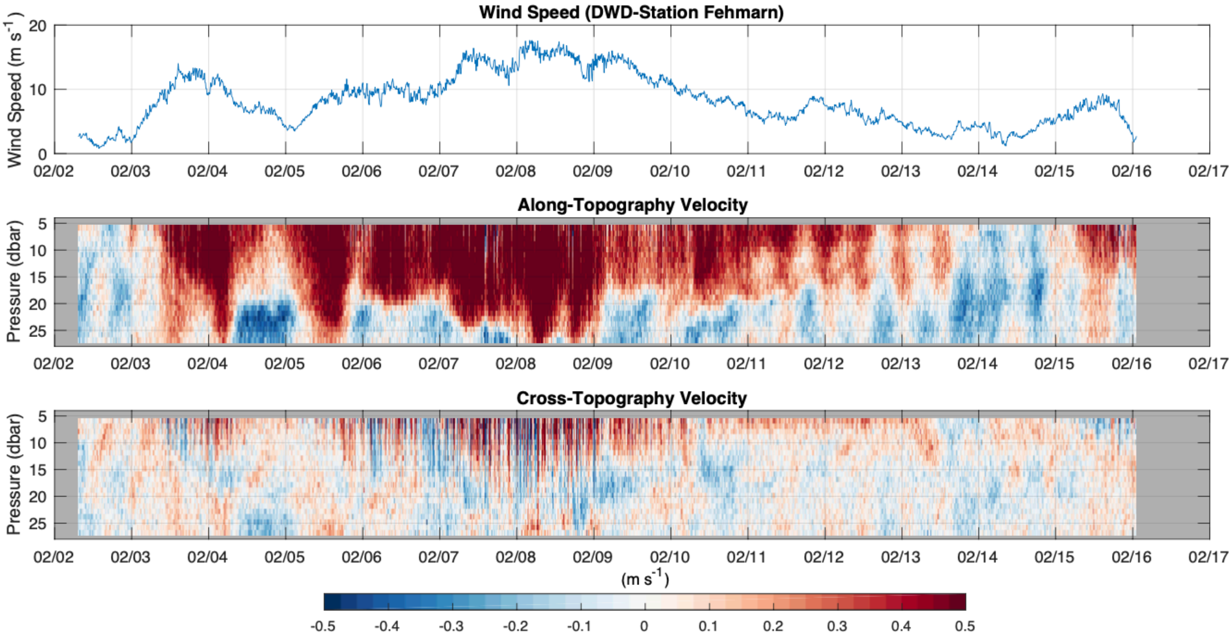

Fig. 5.9 Wind speed from DWD station on the island of Fehmarn (upper) and along (middle) and across (lower) topography velocity. See color scale for respective values

6 Station List AL564

Gear Codes: CTD water: CTD rosette sampling; MOOR: Mooring operations

Device Operation	Device Operation Label	Time (year, month, day, hour, minute)					Latitude (deg)	Longitude (deg)	Depth (m)	comment
AL564_1-1	CTD water	2021	9	14	8	17	54° 33.961' N	010° 39.898' E	57	station #1
AL564_2-1	CTD water	2021	9	14	9	48	54° 36.494' N	010° 55.048' E	23	station #2
AL564_3-1	CTD water	2021	9	14	10	44	54° 35.500' N	011° 05.037' E	9	station #3
AL564_4-1	CTD water	2021	9	14	11	32	54° 32.843' N	011° 09.809' E	0	station #4
AL564_5-1	CTD water	2021	9	14	12	7	54° 33.990' N	011° 11.138' E	36	station #5
AL564_6-1	CTD water	2021	9	14	12	43	54° 35.033' N	011° 12.530' E	18	station #6
AL564_7-1	CTD water	2021	9	14	13	9	54° 36.013' N	011° 13.475' E	52	station #7
AL564_8-1	CTD water	2021	9	14	13	34	54° 36.723' N	011° 14.478' E	58	station #8
AL564_9-1	CTD water	2021	9	14	14	0	54° 37.503' N	011° 15.462' E	45	station #9
AL564_10-1	ADCP	2021	9	14	14	9	54° 37.469' N	011° 15.428' E	45	survey start
AL564_10-1	ADCP	2021	9	14	15	0	54° 32.882' N	011° 09.847' E	46	survey end
AL564_11-1	CTD water	2021	9	14	15	48	54° 31.287' N	011° 18.212' E	18	station #10
AL564_12-1	MOOR	2021	9	14	16	17	54° 30.602' N	011° 18.649' E	57	recovery
AL564_13-1	CTD water	2021	9	14	17	16	54° 26.996' N	011° 29.994' E	41	station #11
AL564_14-1	CTD water	2021	9	14	18	20	54° 21.058' N	011° 39.945' E	15	station #12
AL564_15-1	CTD water	2021	9	14	19	7	54° 21.012' N	011° 49.929' E	2	station #13
AL564_16-1	CTD water	2021	9	15	6	4	54° 37.987' N	014° 21.034' E	20	station #14
AL564_17-1	CTD water	2021	9	15	7	39	54° 47.016' N	013° 59.982' E	24	station #15
AL564_18-1	CTD water	2021	9	15	9	42	54° 55.003' N	013° 29.947' E	3	station #16
AL564_19-1	CTD water	2021	9	15	10	56	54° 51.527' N	013° 11.955' E	58	station #17
AL564_20-1	CTD water	2021	9	15	12	7	54° 48.487' N	012° 54.977' E	4	station #18
AL564_21-1	CTD water	2021	9	15	13	12	54° 41.570' N	012° 42.932' E	43	station #19
AL564_22-1	CTD water	2021	9	15	14	9	54° 37.999' N	012° 30.038' E	21	station #19
AL564_23-1	CTD water	2021	9	15	15	11	54° 31.970' N	012° 18.025' E	7	station #20
AL564_24-1	CTD water	2021	9	15	16	11	54° 23.988' N	012° 11.046' E	8	station #21
AL564_25-1	CTD water	2021	9	15	16	59	54° 21.525' N	012° 00.071' E	19	station #22
AL564_26-1	CTD water	2021	9	15	17	27	54° 21.036' N	011° 55.035' E	8	station #23
AL564_27-1	MOOR	2021	9	16	4	0	54° 30.553' N	011° 18.681' E	56	deployment
AL564_28-1	CTD water	2021	9	16	4	43	54° 32.839' N	011° 09.878' E	38	station #24
AL564_29-1	CTD water	2021	9	16	5	1	54° 34.032' N	011° 11.152' E	39	station #25
AL564_30-1	CTD water	2021	9	16	5	31	54° 35.004' N	011° 12.457' E	7	station #26
AL564_31-1	CTD water	2021	9	16	5	50	54° 36.015' N	011° 13.474' E	17	station #27
AL564_32-1	CTD water	2021	9	16	6	8	54° 36.668' N	011° 14.530' E	7	station #28
AL564_33-1	CTD water	2021	9	16	6	28	54° 37.521' N	011° 15.492' E	11	station #29
AL564_34-1	ADCP	2021	9	16	6	36	54° 37.528' N	011° 15.414' E	42	survey start
AL564_34-1	ADCP	2021	9	16	7	25	54° 33.391' N	011° 09.356' E	53	survey end

7 Data and Sample Storage and Availability

In Kiel a joint Datamanagement-Team is active, which stores the data in a web-based multiuser-system. The data will be made public by distributing them to national and international data archives through the GEOMAR data management team, but also by sending it to the Deutsches Ozeanographisches Datenzentrum (DOD) at the BSH in Hamburg, Germany.

Table 7.1 Overview of data availability

Type	Database	Available	Free Access	Contact
CTD	DOD	12/2021	09/2023	jkarstensen@geomar.de
mooring	DOD	12/2021	09/2023	jkarstensen@geomar.de

8 Acknowledgements

A big thank to Jan Peter Lass (master) and all crew members of RV ALKOR for a successful and comfortable cruise. Also a big thanks to Svend Mees (GEOMAR) for maintain the Multisonde we used for the training.

9 Abbreviations

ADCP: Acoustic Doppler Current Profiler
Bft: Beaufort scale for wind speed
CTD: Conductivity Temperature Depth
DOD: Deutsches Ozeanographisches Datenzentrum
DWD: Deutscher Wetterdienst
IR: Infraread
SSS: Seasurface salinity
SST: Seasurface temperature
SW: Shortwave
TSG: Thermosalinograph