Cruise Report

F.S. ALKOR Cruise No. 229

Dates of Cruise: 15.09. to 18.09.2003

Projects:
BASEWECS
and
Student course in phys. oceanogr.

Areas of Research: Physical oceanography
Port Calls: Warnemünde (15.09. and 18.09.2003)
Institute: Institut für Meereskunde, Kiel, Germany
Chief Scientist: Dr. Johannes Karstensen
Number of Scientists: 10

Contents

1 Scientific peronal **3**

2 Scientific Background **4**

3 Cruise Narrative **5**

4 Preliminary results **11**

4.1 Mooring V431: fifth deployment period 11

4.2 Meteorological observations 15

4.3 Hydrographic conditions along section C and L 19

4.3.1 CTD - Measurements 19

4.3.2 ADCP - current profiles 21

5 Equipment/instruments **24**

5.1 CTD/Rosette and Salinometer 26

5.2 Underway Measurements 27

5.2.1 Datadis 27

5.2.2 Navigation 27

5.2.3 Meteorological Data 27

5.2.4 Echo sounder 27

5.2.5 Thermosalinograph 28

5.2.6 Vessel mounted ADCP 28

6 Acknowledgment **29**

7 Appendix **30**

Chapter 1

Scientific peronal

Cruise code: AL229
Cruise dates: 15.09. - 18.09.2003
Port calls: Kiel - Warnemünde - Warnemünde - Kiel

Table 1.1: Scientific personal on AL229
Institut für Meereskunde an der Universität Kiel, Kiel, Germany
IOW: Institut für Ostseeforschung Warnemünde, Warnemünde, Germany

Name	Institute	Function	on bord
Karstensen, Johannes	IFMK	Chief scientist	all
Schmidt, Sunke	IFMK	Phys. Ocean.	all
Schmidt, Hauke	IFMK	Phys. Ocean.	all
Blöhdorn, Björn	IFMK	Phys. Ocean.	all
Smarz, Christopher	IFMK	CTD lab.	all
König, Jochen	IFMK	Phys. Ocean.	15.09. to 17.09. (8:00)
Seiffert, Larissa	IFMK	student	all
Denker, Claudia	IFMK	student	all
Neumann, Uta	IFMK	student	all
Fischer, Tim	IFMK	student	all
Fiederling, Ole	IFMK	student	all
Maurer, Horst	IFMK	student	all
Heene, Toralf	IOW	technician	16.9.

Responsible for Report:
Johannes Karstensen phone: ++49 (0)431 600-4156
Institut für Meereskunde fax: ++49 (0)431 600-4152
Düsternbrooker Weg 20 e-mail: jkarstensen@ifm.uni-kiel.de
24105 Kiel, Germany

Chapter 2

Scientific Background

The ALKOR cruise AL229 was the last of three cruises in 2003 in the framework of the BMBF project Baltic Sea Water and Energy Cycle Study (BASEWECS), subproject C (grant#. 01LD0025). The purpose of the cruises was to obtain a rather synoptic picture of the property distribution and velocities in the western Baltic and to maintain a mooring site.

In general two section are occupied: one section crossing the Fehmarnbelt (section 'C') and one section following the deepest topography from about 10°40 E to 14°21 E (section 'L'). Along both sections CTD/rosette sampling is performed as well as continuously recording of current velocities using a vessel mounted ADCP.

A mooring site (V431) is maintained, located at the southeastern end of the Fehmarnbelt. The mooring consists of a Workhorse-ADCP (300 kHz), and a self containing CTD (Type MicoCat) mounted in a commercial shield (Flotation Technology).

During AL229 an additional meridional section have been occupied in the eastern Mecklenburger Bucht to test the performance of the vmADCP in comparison with a towed ADCP mounted on a commercial catamaran (Top Cat).

Besides the scientific motivation, the cruises are utilized for educational purposes. Undergraduate students are introduced into modern observational techniques of physical oceanography and in the basics of instruments calibration and interpretation of the observations. In addition it should give the students a chance to explore/investigate the Baltic Sea, their ocean at the front door.

Chapter 3

Cruise Narrative

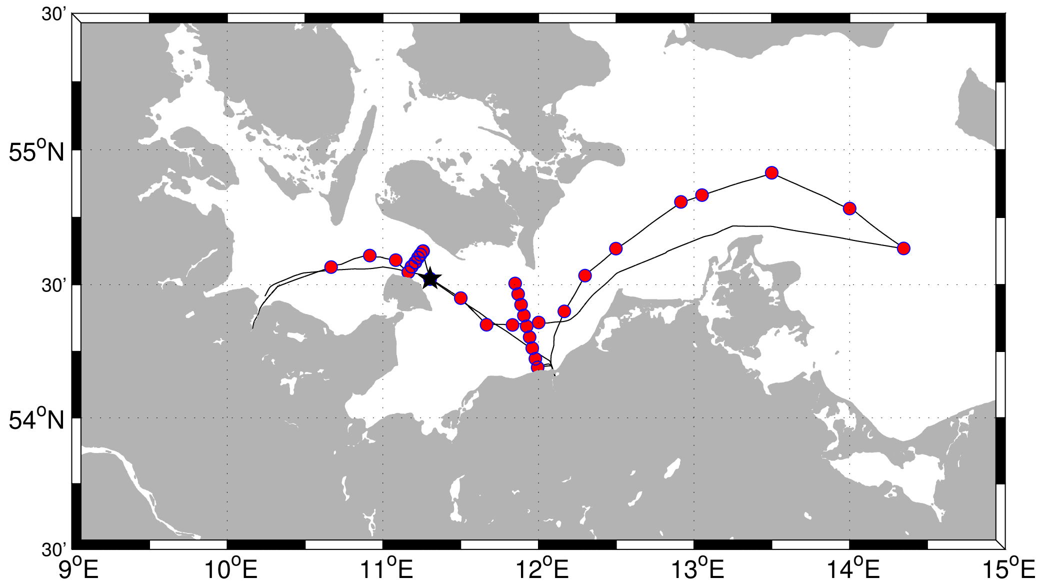

Figure 3.1: ALKOR 229 cruise track (black line, based on DATADIS recordings). Red dots are the CTD stations, black star is the location of the V431 mooring. tADCP/vmADCP parallel observations are sampled along the meridional section in the eastern Mecklenburger Bucht (west of Warnemünde). AL229 had two port calls for Warnemünde: 15.09. to 16.09. and 16.09. to 17.09.2003.

DAY 1:
We left IfM Kiel pier at 8:00 and headed for the first test CTD station in the central Kieler Bucht, which is also the western most station of the 'L' section. All equipment was already installed on Friday except of the ADCP which was however prepared (computer set up) on Friday but not mounted in the hull. After a introduction into the behavior in case of an emergency on board from the first officer a short introduction into the program for the next 4 days was given. After sampling two other CTD stations along 'L' we reached the

southern most station on the 'C' section, crossing the Fehmarnbelt. The CTD section to the north was followed from a ADCP section to the south.

After completing it we headed for the V431 mooring at the southeastern opening of the Fehmarnbelt. About 0.3 nm away from the nominal position of the mooring the release command was send but the mooring did not appear on the surface immediately. Several trial with the hydrophone in different depth weren't successful either. The releaser is not able to send a respond signal. Finally we went directly 'on the spot' (54°31.31 N/ 11°18.23 E) and send the release code again which was successful. The shield was on board at 16:32 and we headed for the first port call at Warnemünde.

Figure 3.2: Shielded mooring V431 on board ALKOR after its fifth deployment period (09.07.2003 to 15.09.2003).

We reached Warnemünde port on the 15.09. at about 20:30. As we had to go for the Überseekai it took us more than 0.5 hour to reach the final destination after entering the port. Toralf Heene from IOW, who joint us for assistance with the tADCP, waited already a few hours at pier 31, a rather unpleasant and a noisy place. Fortunately, he and a colleague had already mounted the whole catamaran which carriers the ADCP at the pier and the whole device was ready for loading with the board-crane of ALKOR. After the device was on board technical aspects for next day launching where discussed with the boats man and the captain. It was agreed on a trial over the back using the A-frame but alternatively a release over starboard would have been possible, as it is done on the IOW own ships (PROFESSOR A. PENCK, ALEXANDER VON HUMBOLDT).

DAY 2:
The second day was dedicated to the work with the two different ADCP system in parallel. As this program was planned to take one day we stayed near Warnemünde. The original plan was to re-occupy a section running over the Darsser Schwelle but it had to be canceled as it would take to long for transit. A section east of Warnemünde was chosen to avoid the sometimes heavy traffic directly north of Warnemünde with speed-boats, ferries, and diverse carrier ships.

First, hydrography was measured with stations order 2.5 nm apart from each other (Praktikumstation # 22 to 30). The first station was occupied at 54°11.4 N/ 11°51.0 E. In combination with the direct velocity measurement from the two different ADCP systems the data can be used to calculate heat and freshwater transports as a supplement to the data acquired from the Fehmarnbelt on the first day.

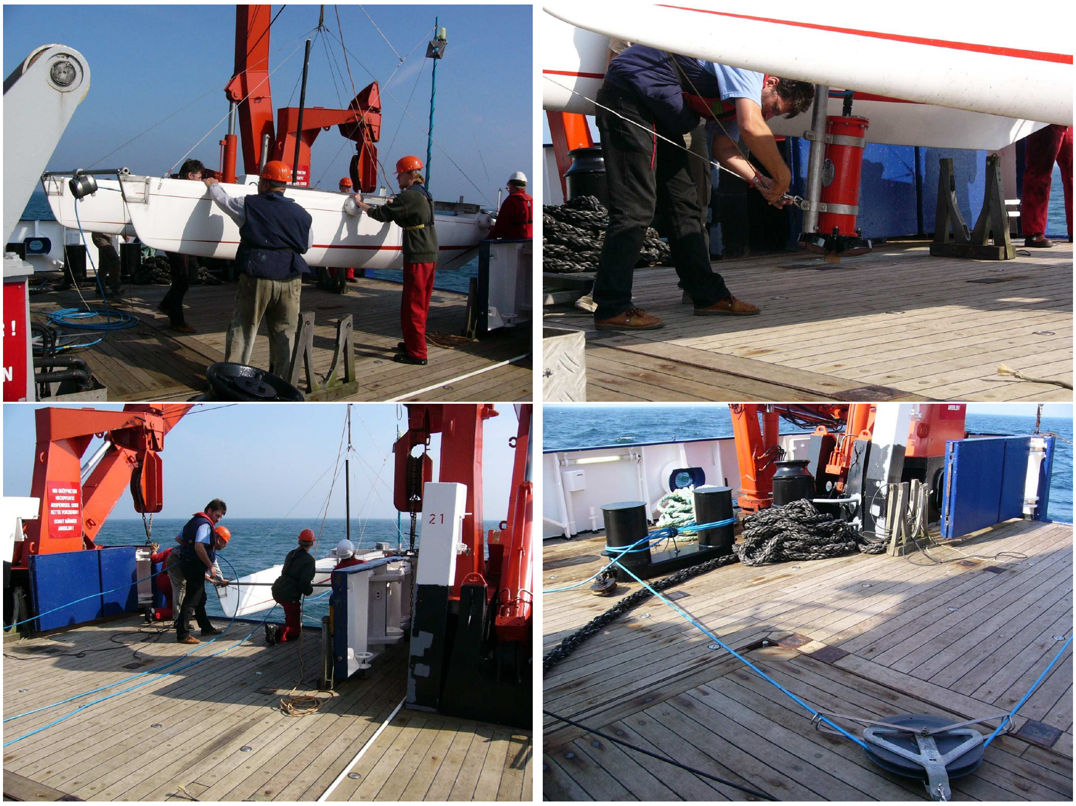

Figure 3.3: The tADCP catamaran launched and fixed (lower, right) on board ALKOR during towing.

After finishing with the hydrographic work, the tADCP was launched near the northern most station (54°30.3 N/ 11°51.0 E) end of the section just after lunch (12:30) (Figure 3.3). Launching over the back turned out to be easy, although the catamaran was about 20 cm too long for a free launch without contact with the vessel's side. The weather was exceptional calm (during all four days of the cruise) and it is difficult to guess how launching would be during higher sea states.

Figure 3.4: The tADCP catamaran towed behind ALKOR on 16.09.2003.

The catamaran has in principle a remote controlled steering system (essentially a commercial yacht auto pilot but with an improved housing) but it was not used. Instead the steering was fixed before launching in a certain angle that drives the catamaran out of the ALKOR wake to avoid ship induced disturbances. Usually the device is towed about 100m behind the ship on the lee side and if possible with the wind/wave to diminish the effect of the sea state on the measurement (Figure 3.4).

For our purpose we recorded data in parallel with the tADCP and the vmADCP steaming with different speeds (2.5, 7 and 5 kn). This was done as it was know that the vmADCP produced most erroneous velocities during steaming and presumably related to the ship speed. A correction 'function' has been derived in the past based on comparison between on station profiles with the profiles obtained from the moving ship. It is anticipated that the parallel recording during AL 229 can be used for a better correction 'function'.

On board ALKOR both measurements could be directly visualized using the vmDAS software provided by RDI. The tADCP is a 600kHz ADCP. Using approximately the same depth for display the differences between the two devices became immediately obvious. The tADCP, besides its wider depth range, produced more coherent data while the vmADCP, although recording data with a similar trend in speed and direction was more noisy. In particular the 7th bin was totally out of range, presumably an effect of the reflection problem in the hull.

The mission was ended at about 16:30 and the catamaran was on board again at 16:45. Again, it was recovered over the ships back. This time, however, to avoid contact with the vessel's side, the catamaran was first turned to be parallel to the back and after being over the deck it was turned to allow for bringing it on deck. Later that day the catamaran was disassembled on board (Figure 3.5). After reaching again the Warnemünde Überseehafen the pieces where unloaded with the ALKOR crane on an IOW truck.

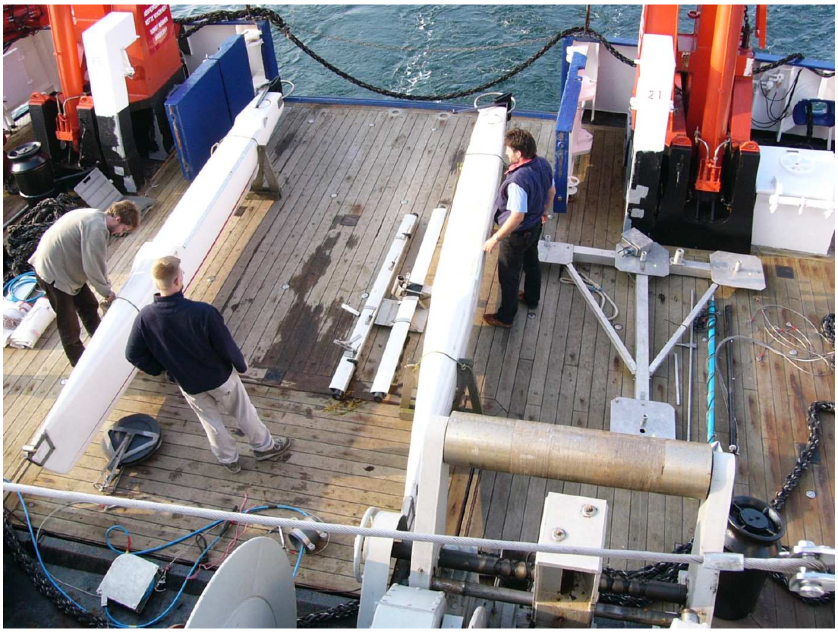

Figure 3.5: The re-sampled tADCP catamaran shortly before uploading to the IOW truck at Warnemünde port.

DAY 3:
We left Überseehafen Warnemünde at 8:00 and headed for the next station on the L section. J. König left ALKOR in Warnemünde to gather data from the IOW, mainly from the Fehmarnbelt. As Toralf Heene showed us the day before IOW will share data from a number of Fehmarnbelt crossings using the tADCP system and hydrography. The rest of the day was routine CTD measurements along L section. Before noon we passed along the IOW moored station at the Darsser Schwelle.

During the day the components of shield mooring (MicroCat, ADCP) where prepared for their next deployment. A certain problem occurred with the ADCP as a timing command for delayed starting was not correctly recognized by the instrument. It turned out that the command syntax was not correct as written in the manual. Later that night the shield was assembled and ready for deployment.

DAY 4:
Station work was started early at 5:00 to allow for a better timing at the end of the cruise (unloading equipment etc.). After occupying a number of CTD stations we completed the 'L' section and approached the military zone of Marienleuchte at 8:00. The assembled shield was the 6th times redeployed at 8:32 at position 54°31.32 N/ 11°18.22 E. After redeployment we headed for the second hydrographic profile of the Fehmarnbelt section ('C') followed again by an ADCP section. The scientific program was over and we headed for Kiel and reached IfM Pier at 15:30. All our equipment was unloaded immediately after mooring.

Chapter 4

Preliminary results

4.1 Mooring V431: fifth deployment period

Temperature and conductivity (salinity) near the bottom are variable and follow the warming trend of the spring season summer (with a certain time lag). A noticeable feature is the sudden increase in conductivity around 10 to 15. May 2003.

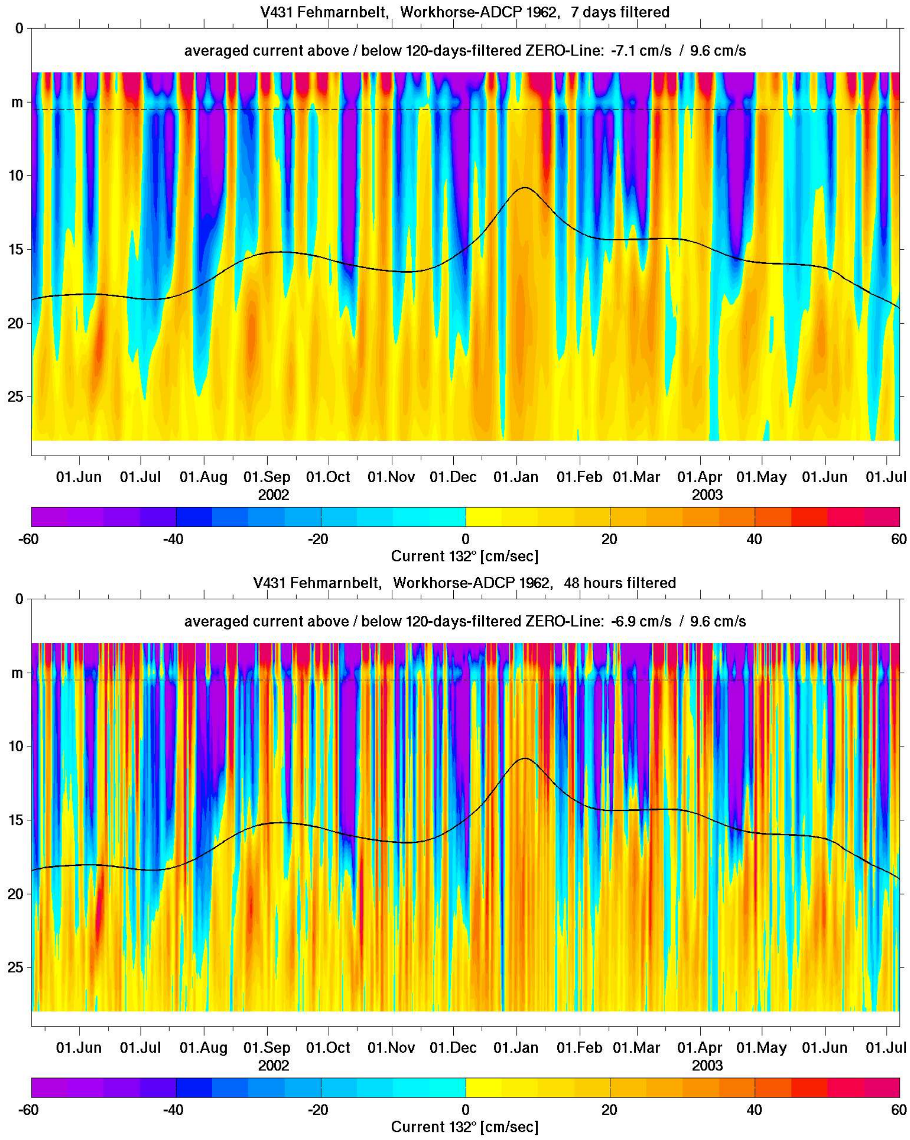

Figure 4.1: Mooring V431, upward looking Workhorse 300kHz ADCP - velocity component along 132°. Complete time series since deployment May 2002. (Upper) averaged over 168 hours (7 days), (lower) averaged over 48 hours.

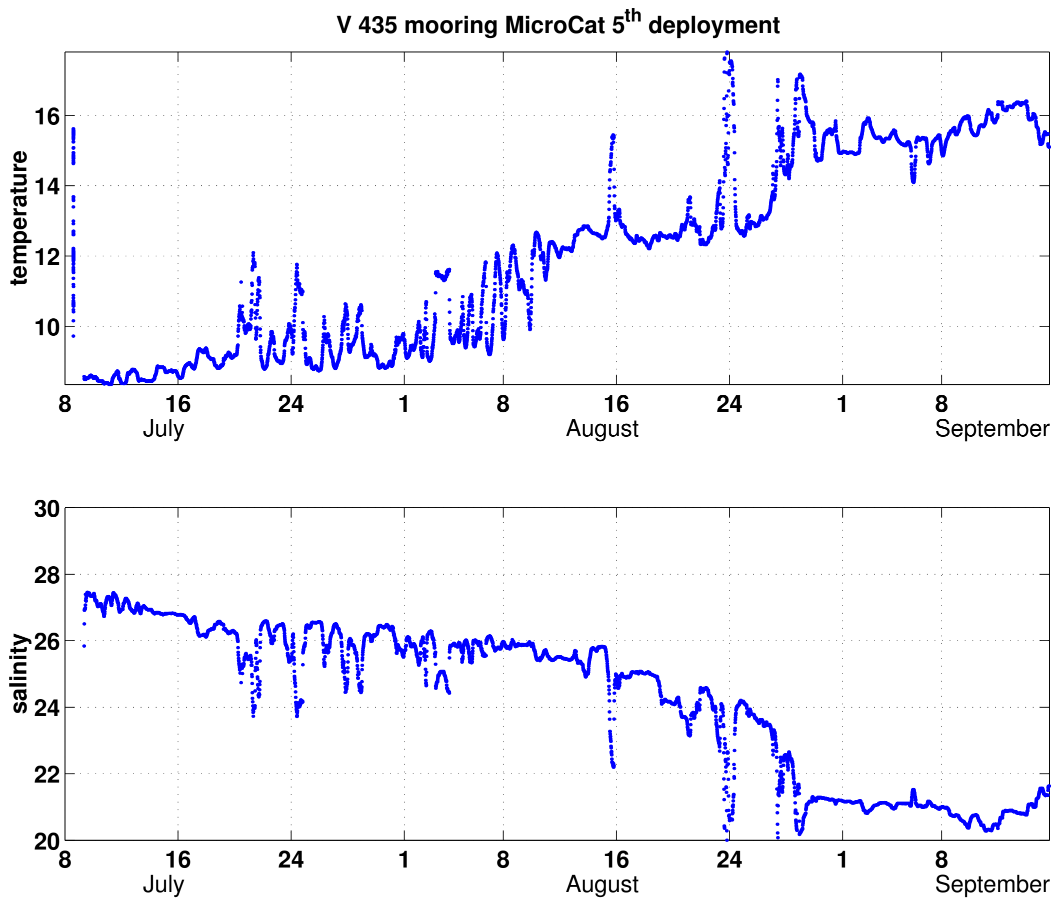

Figure 4.2: Mooring V431 - fifth deployment period (upper) temperature and (lower) conductivity.

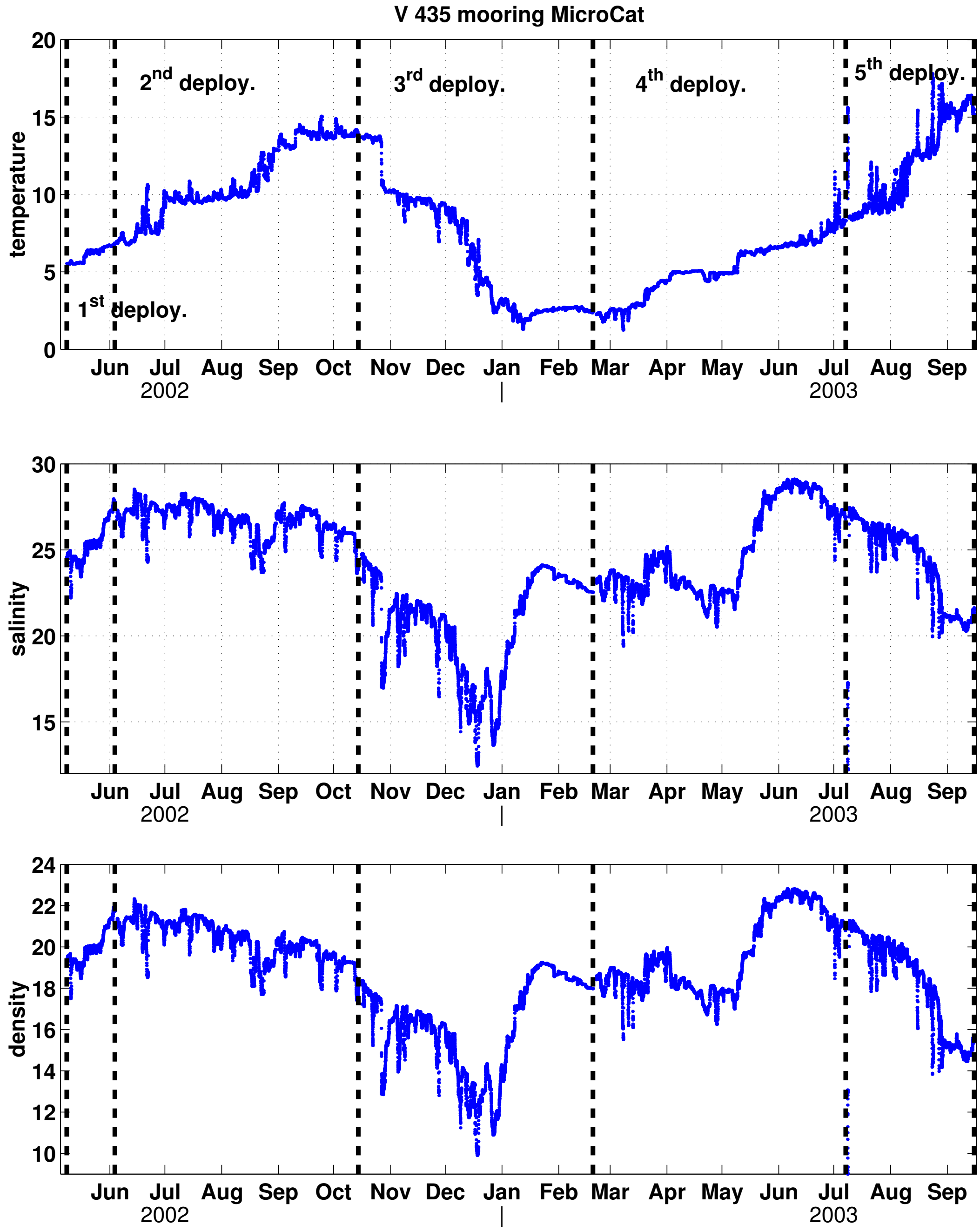

Figure 4.3: Mooring V431: Temperature (upper), salinity (middle), density (lower) at 28.m depth for the whole deployment period.

4.2 Meteorological observations

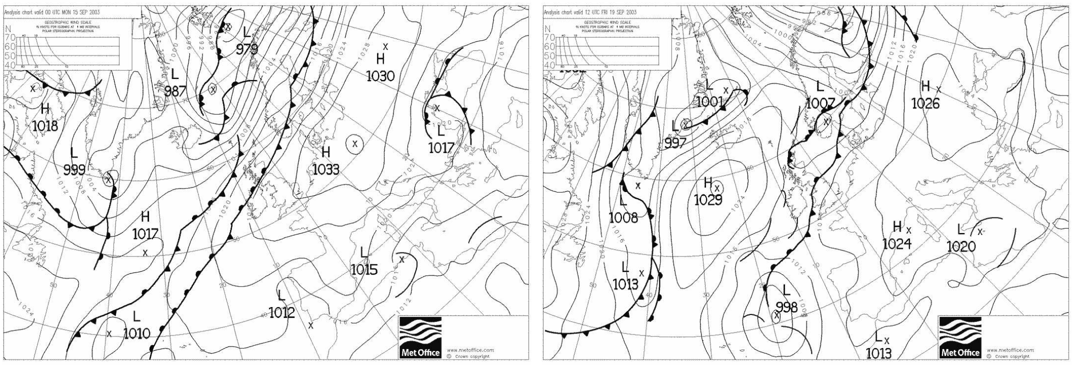

Figure 4.4: Large scale surface pressure (Braknell/UK Met Office).

The weather situation was determined by a pronounced high-pressure-region shifting from Southwest- to East-Europe during the time of our cruise (4.4). This was noticeable in constantly fine weather with just minor cloudiness and low westerly winds. The low pressure branch situated over Scandinavia did not reach us at any time.

The following plots show several time series (all time-data are given in UTC which means CET - 2h). The gray parts of the plots represent the time we spend in the harbor of Rostock where the FS ALKOR landed for two nights.

The air temperature represented in figure 4.5 shows a typical day course. The maxima on the first two days were around 18.5°C. On Wednesday, 17th September, it still was around 17°C over the day and nearly 15°C during the night. Thursday the temperature had its day maximum of nearly 22.5°C as we arrived in Kiel. The wet-bulb temperature measured by a thermometer wearing a little wet cotton sock is always beneath the air temperature because energy needed for evaporation leads to cooling.

The air pressure decreased constantly from 1028 hPa down to 1023 hPa over the first day (figure 4.5). On Tuesday afternoon and during the night it was constantly close to 1020 hPa. On Wednesday morning pressure rised up again to 1022 hPa followed by a pressure decrease down to 1015 hPa until we arrived in the Bay of Kiel. Those changes were the results of the eastward shifting high-pressure-region and the different Day routes.

The values of the thermosalinograph probes depicted in figure 4.5 give information about the surface water temperature. Over the first two days temperature varied around 16.5°C. During the time in the harbor of Rostock temperature has been 0.5 to 1°C higher than the open Baltic Sea values. On the way to the Arkona Basin (in the North East) and back to Kiel (Thursday) we measured the biggest temperature variations (between 15°C and 17.2°C) while passing different region of seawater temperature.

The relative humidity (figure 4.5) gives information about the relation between prevalent vapor pressure and the saturated-vapor pressure depending on air temperature. It is

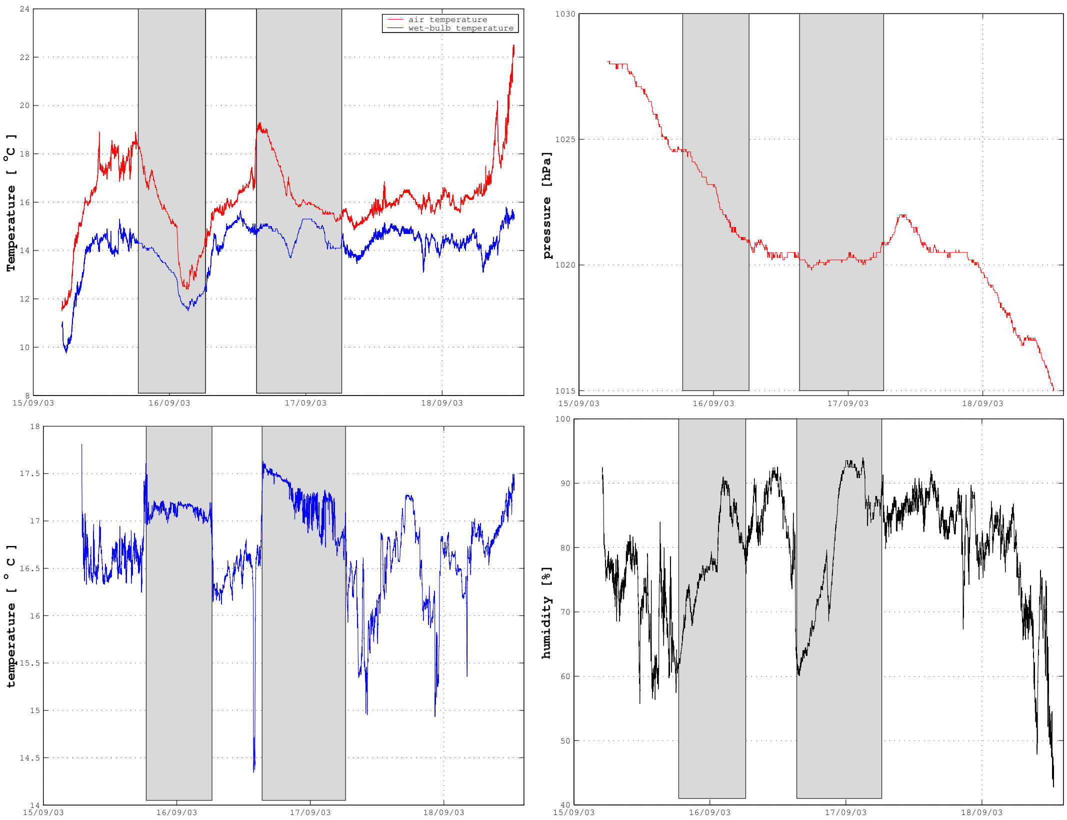

Figure 4.5: Air temperature, pressure, sea water temperature (from TSG) and relative humidity during ALKOR cruise AL 229.

possible to calculate relative humidity from the difference between air and wet-bulb temperature (refer to fig.1). During the cruise relative humidity varied between 60% and 90%. It decreased with rising air temperature. On Wednesday we had low air temperature which laid around 16°C so that relative humidity was comparatively high between 80% and 90%.

The wind velocity is measured by an anemometer, the wind direction with wind flags. Two pairs are installed on starboard and port. The measurements are influenced by the ship heading and speed relative to true wind direction and speed. Figure 4.6 shows the true wind (in kn), which is corrected for heading and ships speed. The velocity of 1 knot is adequate to 0.51 m/sec. During the whole cruise there was only a light breeze. The lowest wind velocities were particularly recognizable during the lay times in the harbor basin. Fig. 6 shows the wind direction. Monday we had South West wind (225°) with some gusts from the North. Tuesday the wind direction turned to West. Wednesday and Thursday we had WSW and SSW wind directions.

On ALKOR two radiation sensors are installed. One measures shortwave solar radiation, the other one the long wave radiation (last one was out of order). It was only possible to measure shortwave signals (a combination of direct and diffuse solar radiation). First measurable values are just before sunrise (diffuse radiation). Shortwave radiation reached its maximums of 550 Wm^{-2} at the afternoon and decreased until sunset as shown in Figure 4.6. The value of measured incoming radiation depends on cloudiness and angle of entry of sun radiation changing by latitude and time of day.

The sensible heat flux (Figure 4.6) occurs if a difference between water and air temperature exits. The flux is always directed from higher to lower temperature. Almost every night and in the morning water temperature was higher than air temperature leading to a heat flux from ocean to atmosphere. In this case the Baltic Sea lost energy (10 to 17 Wm^{-2}). The second half of the day water temperature was lower than air temperature; resulting in an opposite heat flux with lower values (about 7 Wm^{-2}).

The latent heat flux represented in Figure 4.6 gives information about the energy flux due to evaporation or condensation of water. It depends especially on the difference between vapor pressure and saturated-vapor pressure as well as on wind velocity. During the cruise we only observed negative heat fluxes varying from close to 0 Wm^{-2} up to about 70 Wm^{-2}, sometimes even more.

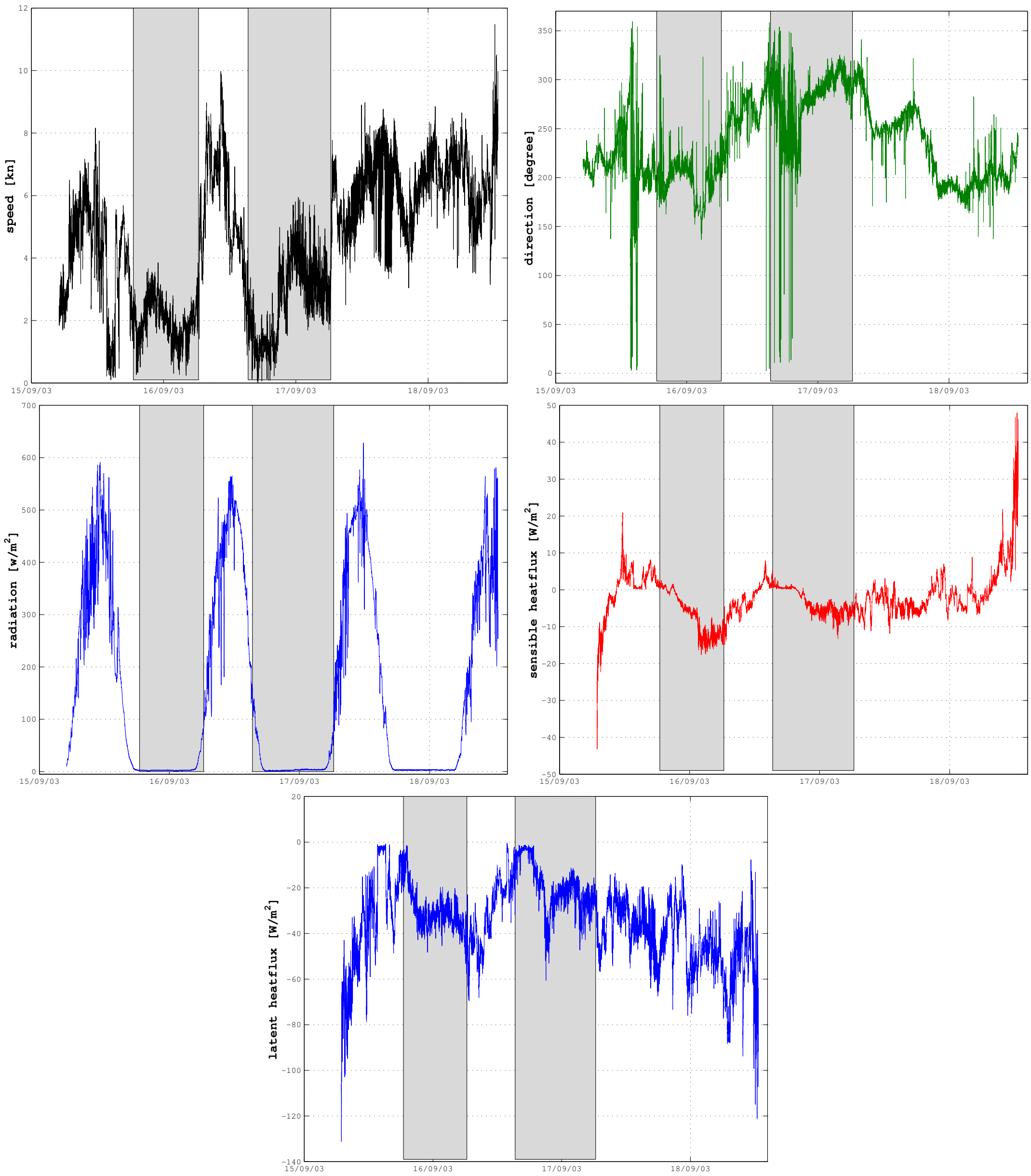

Figure 4.6: True wind speed and direction, short radiation, derived sensible heat loss and latent heat loss .

4.3 Hydrographic conditions along section C and L

As a general comment: at the beginning of 2003 a major salt water inflow event took place and the consequences were still visible in September 2003: high salinity level and oxygen content, especially in deeper water.

4.3.1 CTD - Measurements

First we take a look at the CTD temperature - and salinity - profiles.

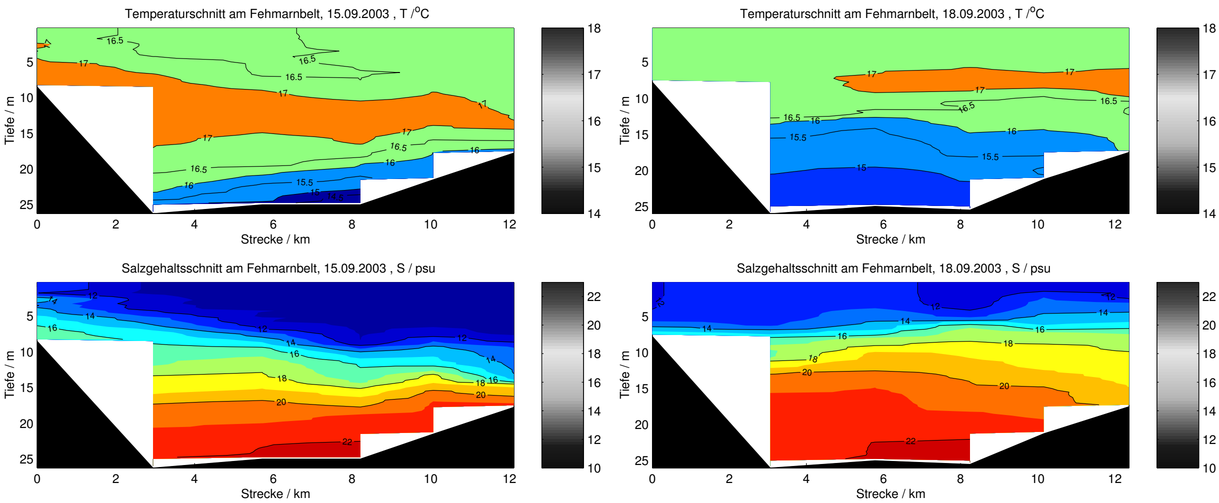

Figure 4.7: *Cross sections Fehmarnbelt (C section): 15. Sept. (left) and 18. Sept. 2003 (right).*

In figure 4.7 and 4.8 we can see, as referred in figure 3.1, the crossed sections of the Fehmarnbelt (A) and near the Darsser Schwelle (B). Both sections are seen from the east in westward direction. Figure 4.9 shows the zonal section along the whole route composed from stations occupied during the three days.

Temperature

For a typical September situation we expect a well mixed temperature in the upper layer, caused by cooling and mixing of the warm surface with the water subsiding it. Especially for the Belte we would not expect a bottom layer with significant different temperature in normal years, because the temperature of the North Sea water is rather similar to the Baltic.

2003 was characterized by very warm water temperatures in July and August as well as by the salt-water intrusion of February. As visible in figure 4.7, the temperature was nearly homogeneous, except a cold layer at the bottom, which still results from the intrusion, as we

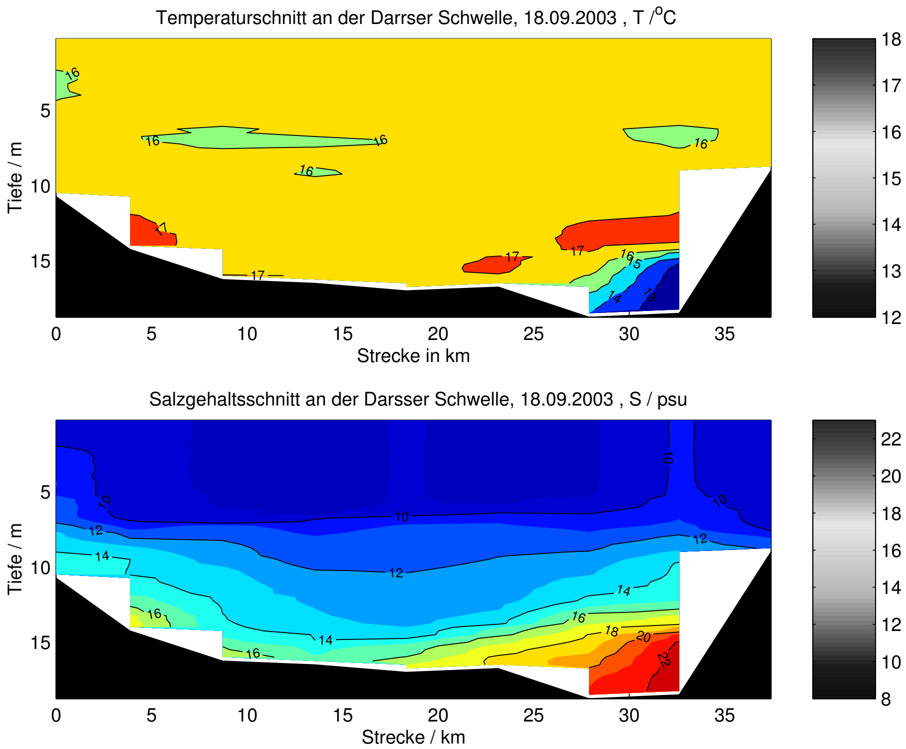

Figure 4.8: *Cross section Darsser Schwelle*

will see in the next chapter. For depths around 10 to 15 meters we find higher temperatures as at the surface, including higher salinities and therefore stable, but apparently caused by cooling out in the beginning autumn. Similar situation in figure 4.8, where we can see a rest of warmer water in depths around 10m and a cool water core at the bottom, below the depth of the Darsser Schwelle (18m), which is prevented to flow off. In figure 4.9 we can see some well-marked warm water-cores in the Belte as well as a core of cold water in the eastern basin, the Arkonabecken. This core is left from the last winter, when a massive homogeneous and sweet layer is built by convection. In summer, only the upper part of this layer is increased in temperature and the result is a core of cold and sweet water in the deeper basins which is conserved in depths below 30 to 50 m overlying the warmer but more saline bottom-layer. In this figure we can see the edge of a very warm water core in the bottom of the Arcona Basin, which must result from saline cold water from the intrusion mixed with warmer upper water.

salinity

The salinities in the Belte were very high this year, according to the intrusion if February. Normally we would expect salinities up to 15, but this year we can find salinities of 22psu at the bottom. The salinities there are not as homogeneous as the temperatures, so we could assume that it is a result of mixing. But as we can see, higher salinities are nearly

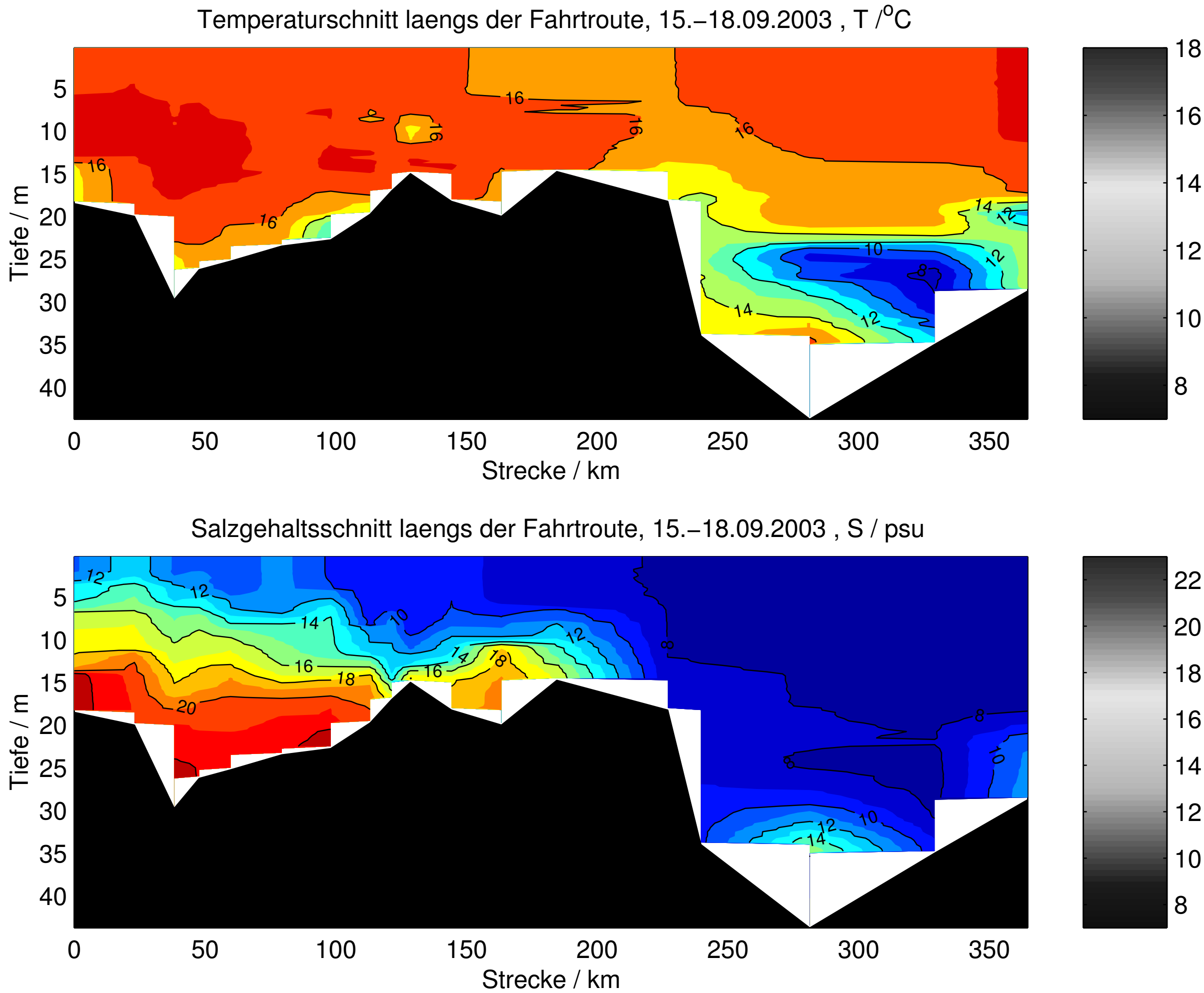

Figure 4.9: *Zonal section along the travel-route (L section)*

below the depth of the Darsser Schwelle. In figure 4.8 we can find very warm water near the bottom, which might be caused by mixing during Juli or August, when the surface was nearly 20 degrees.
In figure 4.9 we can see the slope of the halocline towards the western end of the Baltic Sea, as we would expect. Also can be seen very clearly, how the heavier (and cooler) saline water lies in the bottom of the basins. In comparison to the temperature we do not see a middle layer in salinity profile in the Arcona Basin, as discussed above.

4.3.2 ADCP - current profiles

In the vertical current profile at the cross section near Darsser Schwelle we could not find significant movement. In north-south-direction, we only found a small amount of northward flow at the surface, increasing to the northern edge of the profile, where flow

reaches around $0,5m/s$. But in comparison with the calculated surface-current in result of the meteorological evaluation, we find a distinctive current profile in east-west direction. As we can see in figure 4.10, which is seen from west to east, there was a significant eastward current in the northern part of the cross-section about $0,6m/s$, while in the southern part we find westward flow in the order of $0,3m/s$. this is in agreement with the meteorological calculations. In fact, the intensity of flow does not change with depth, so we can say that this current is not only driven by wind but it is rather in geostrophic balance. As seen above, we do not have significant horizontal temperature- or salinity gradients, so we can assume the conditions to be barotrop. In addition to the local wind field we had increasing west wind, which caused increasing inflow to the main Baltic sea. It can be imagined, that this flow would pass rather the northern part od the cross section, because of topographical reasons.
The errors of measurement in the ADCP-profiles were mainly in the range of $0,03m/s$, except near the bottom, where it could reach $0,1m/s$

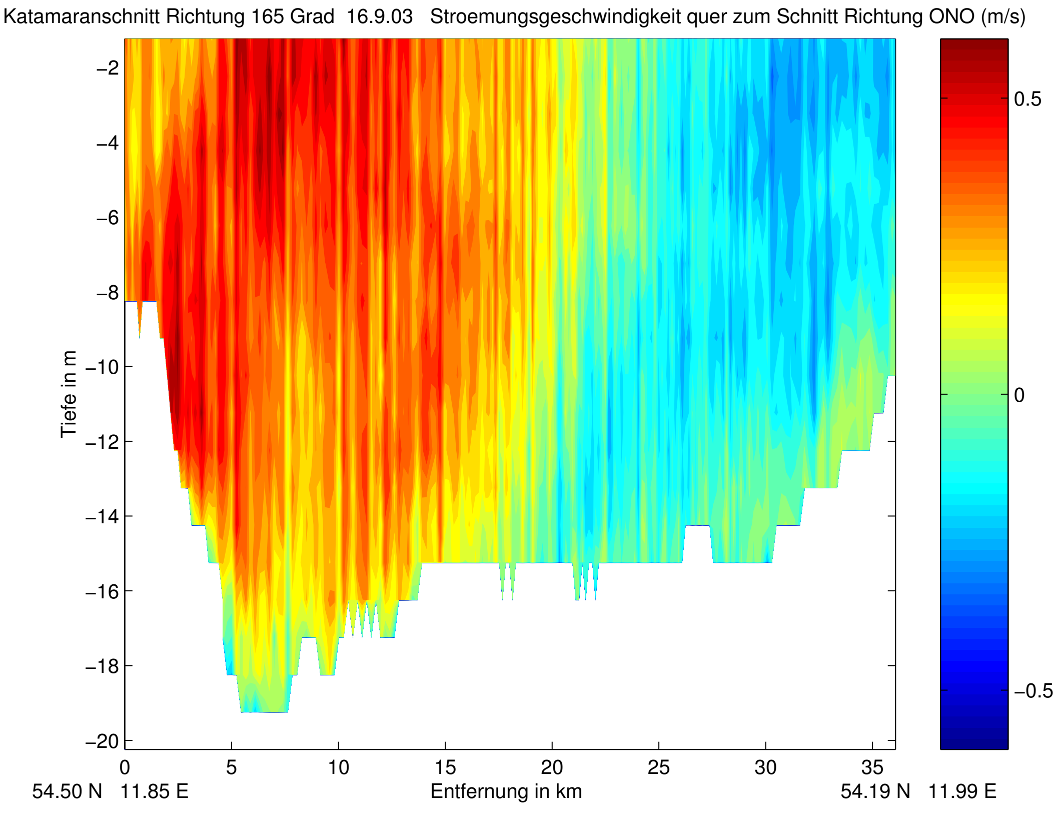

Figure 4.10: *Zonal Current section at Darsser Schwelle.*

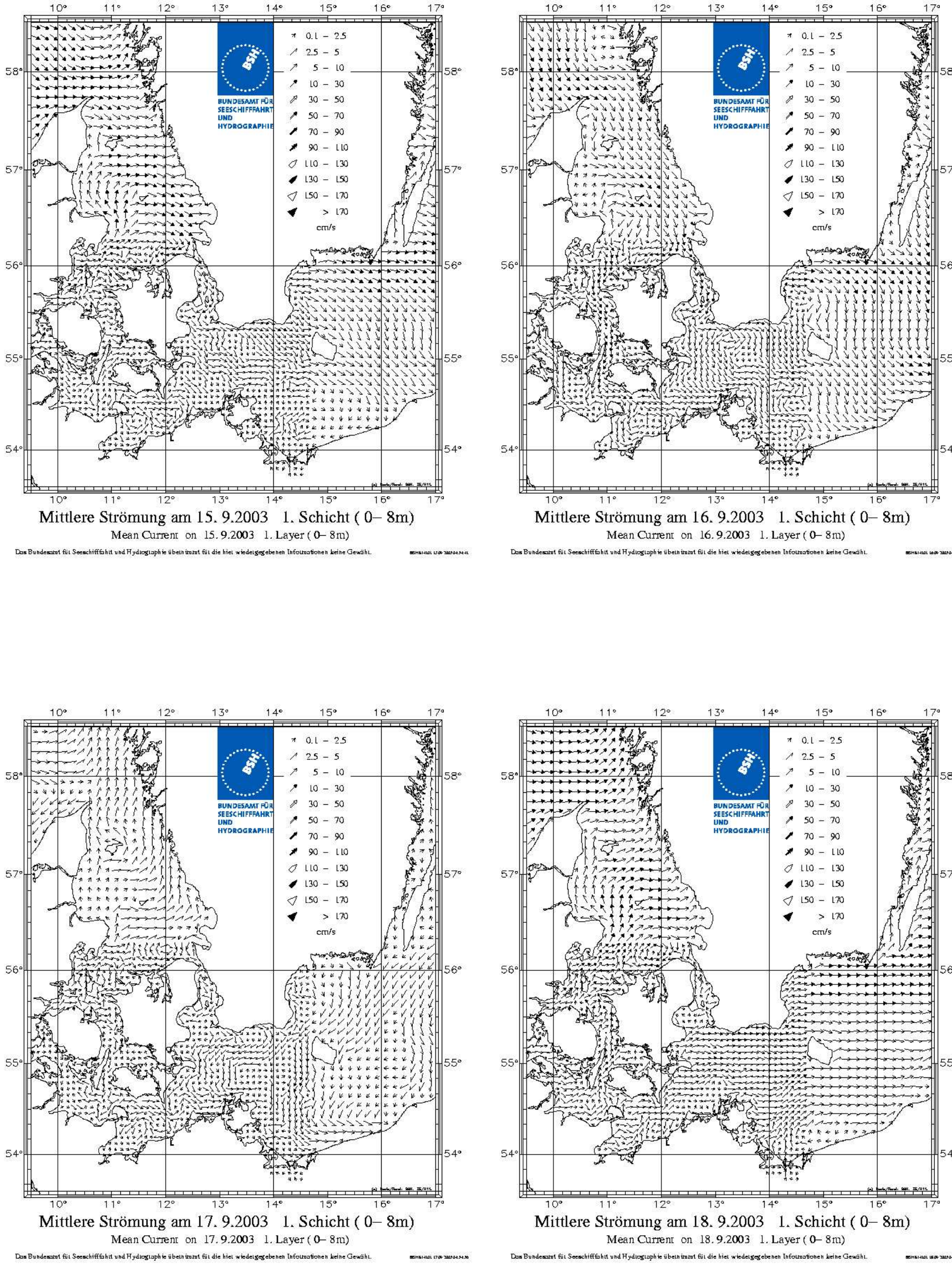

Figure 4.11: *Currents (0-8m) in the western Baltic as predicted from the BSH (Bundesamt für Seeschifffahrt und Hydrographie). Material provided through their web site http://www.bsh.de .*

Chapter 5

Equipment/instruments

Mooring deployment site V431 is located in the military zone of Marienleuchte at the southeastern opening of the Fehmarnbelt. Water depth is about 29m. V431 consists of a Workhorse ADCP (300kHz) and a self containing T/S recorder of type SBE-MicroCat.

Table 5.1: V431: Summary on 5th recovery and 6th launch of trawl resistant bottom mooring V431.

year; time (UTC)	latitude	longitude	depth	comment
15.09.2003; 13:34	54°31.31'N	11°18.23'E	29 m	recovery, after several release commands have been send. The mooring appeared only after release command 10m apart from nominal position.
18.09.2003; 06:34	54°31.32'N	11°18.22'E	28.0 m	deployed, no comments

During the maintenance days (16.09. and 17.09.) data has been uploaded from the mooring instruments (MicroCat, ADCP). maintenance include checking for possible cracked etc., cleaning of instruments and sensors, change of batteries, anti-fouling cylinder. Finally the shield is assembled again and made ready for the next deployment (Figure 5.1).

Figure 5.1: Assembling the shielded mooring V431 (left). Shield just before launching from ALKOR (right)

5.1 CTD/Rosette and Salinometer

During AL223 an OTS-Multisonde was used with dissolved oxygen and chlorophyll (fluorometer) senors attached. The frame of the sonde allow to mount 12 sampling bottles. As the bottle samples are used for salinity calibration only (oxygen was not calibrated) we used/attached on most stations only two bottles. An electronic thermometer and a pressure sensor have been mounted on these two bottles to verify the release depths.

Temperature and pressure have been lab calibrated in 2001 and these coefficients are used during AL229. From the standard calibration of the conductivity cell a preliminary (uncalibrated) salinity is calculated. The salinity is later calibrated using the bottle samples salinities measure with a Beckman type salinometer. Accuracy of the Beckman salinometer is estimated from duplicate samples, the 'substandard'. 'Substandard' is a mixture of what is left from the first few stations bottles. The substandard is then calibrated with the salinometer and its salinity determined several times during the cruise. The intention is to detect possible temporal trends in the measurements. Besides some outliers the overall average of the substandard is 18.66 with a standard deviation of 0.02 (figure 5.2).

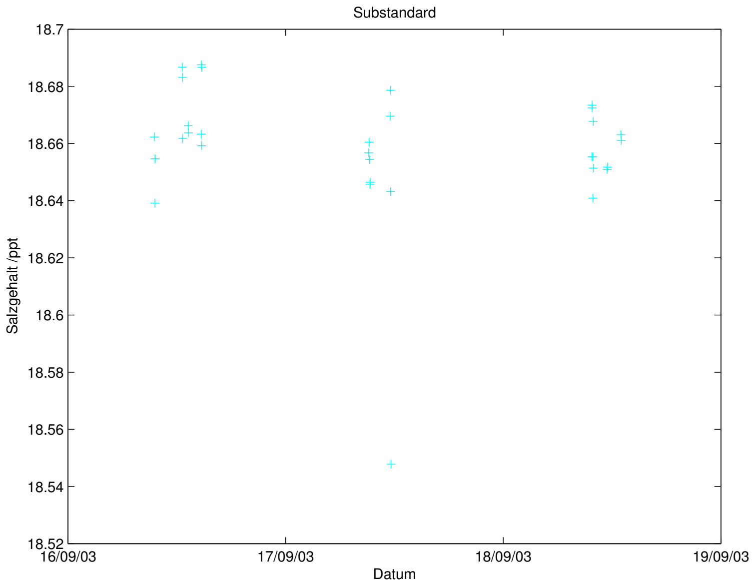

Figure 5.2: Salinity values of repeated substandard measurements.

We took samples from the thermosalinograph (TSG) and measured them with the salinometer (figure 5.3, left). Average difference is order 0.1808 too low in salinity compared with the salinometer and the TSG values have to be corrected by adding the bias.

Scatter is quite large comparing OTS sonde and bottle salinities (figure 5.3, right). Some of the scatter can be attributed to the large vertical salinity gradients in the water column and the sampling footprint of a bottle in comparison to the conductivity cell. However, most differences are close to zero and not correction is applied to the OTS measurements.

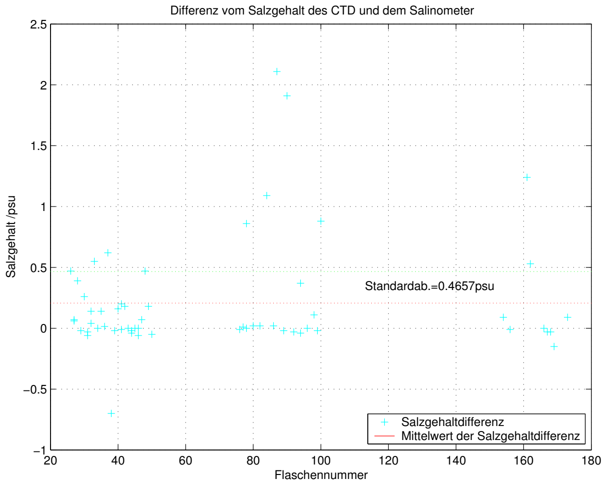

Figure 5.3: (left) Difference between OTS salinity and salinometer values from bottle samples. (right) Difference between TSG observations and bottle samples from TSG.

5.2 Underway Measurements

5.2.1 Datadis

A central system, called DATADIS, is installed on board ALKOR that gathers all navigation, depth, data from meteorological sensors, as well as the thermosalinograph data and write them into a file as well as distributing them for display in the individual labs. In addition all data is available in the main lab for further usage at a RS232 port. A desktop computer was installed that recorded the data.

5.2.2 Navigation

ALKOR has a GPS navigational system as well as a gyro compass available. Data is fed into DATADIS and from their available for other devices.

5.2.3 Meteorological Data

ALKOR is well equipped with meteorological sensors measuring air temperature, wind (speed and direction), wet-temperature, air-pressure, long and shortwave radiation. Radiation sensors are cleaned at the beginning of the cruise. The general maintenance of the radiation sensor is in the responsibility of IfM (Dr. K. Uhlig).

5.2.4 Echo sounder

During AL 229 the ELAC echo sounder was for determination. The data on display (DATADIS) is already corrected for the mounting depth and the depth is calculated with a fixed sound velocity of 1500 m/s. This has to be considered for further usage of the data.

The just recently installed SIMRAD echo sounder was, at least the beginning of the cruise, not available - the controlling computer was robbed during a port call in Riga, Lettland, a few weeks ago. RF felt responsible for the robbing and bought a new laptop computer to control the SIMRAD two day before the cruise (on 13.09.2003). C. Smarz, who is experienced with setting up the system, installed the software and was able to reactivate the SIMRAD. However, as the laptop did not even had one serial port it was not possible to add navigational information to the data as well as putting the data on display at the two screens (on is on the bridge and the other in the main lab). In addition, the TFT screen in the main lab was out of order and was send back to the manufacturer after the end of the cruise. Besides the ports, an additional problem with the new control-laptop is maybe related to the temperature during recording. As the system is getting very warm the external screen is switched off after 2 hours of working and all external monitors fail.

5.2.5 Thermosalinograph

The thermosalinograph (TSG) on ALKOR is permanently installed at about 4m depth and a SeaBird type. Data is directly fed into the DATADIS. Calibration was done during the cruise through bottle samples.

5.2.6 Vessel mounted ADCP

A 300 kHz workhorse ADCP from RD Instruments was mounted for AL 229. A number of problems reported in the past have been dimished due to a more sophisticated mounting. However, still the measurements have obviously erroneus velocities during steaming period of the ship (see discussion of vmADCP vs. tADCP measurements). The vmADCP is used with bottom tracking mode. Navigational data comes from the DATADIS system of ALKOR, hence GPS and gyro compass. Absolute (eath coordinate) velocities are calculated using the vmDAS software provided through RD Instruments.

Chapter 6

Acknowledgment

Herzlichen Dank an Kapitän Detelv Korte und 1. Offizier Jan Lass sowie der gesamten Besatzung der ALKOR für ihre professionelle Unterstützung und die nette Atmosphäre an Bord. BASEWECS is a BMBF project and pasrt of DEKLIM, grant number 01LD0025.

Chapter 7

Appendix

```
ALKOR cruise 229: Station and sample log
Kiel-Warnemünde-Warnemünde-Kiel, 15-Sep-2003 to 18-Sep-2003

St. year mm dd hr mm latitude longitude depth park.-no.
                      deg min  deg min
-----------------------------------------------------------------
Day 1
001 2003 09 15 09 01 54 33.93 10 40.04 17 001
002 2003 09 15 10 06 54 36.49 10 54.95 19 002
003 2003 09 15 10 55 54 35.49 11 04.96 28 003
004 2003 09 15 11 29 54 32.81 11 09.83 12 004
005 2003 09 15 11 49 54 34.05 11 11.05 24 005
006 2003 09 15 12 08 54 35.00 11 12.47 24 006
007 2003 09 15 12 27 54 36.01 11 13.56 24 007
008 2003 09 15 12 45 54 36.68 11 14.47 20 008
009 2003 09 15 13 03 54 37.47 11 15.42 17 009
010 2003 09 15 14 36 54 31.25 11 18.22 28 010
011 2003 09 16 06 55 54 11.37 11 59.71 13 022
012 2003 09 16 07 24 54 13.33 11 58.83 16 023
013 2003 09 16 07 53 54 15.76 11 57.63 18 024
014 2003 09 16 08 22 54 18.22 11 56.59 19 025
015 2003 09 16 08 48 54 20.64 11 55.48 19 026
016 2003 09 16 09 16 54 23.09 11 54.42 19 027
017 2003 09 16 09 42 54 25.50 11 53.34 21 028
018 2003 09 16 10 07 54 27.87 11 52.20 21 029
019 2003 09 16 10 36 54 30.28 11 51.02 11 030
020 2003 09 17 07 49 54 24.00 12 09.99 21 015
021 2003 09 17 08 51 54 32.01 12 17.96 23 016
022 2003 09 17 09 54 54 38.04 12 29.90 18 017
023 2003 09 17 11 44 54 48.45 12 54.93 22 018
024 2003 09 17 12 24 54 49.99 13 03.06 37 018a
025 2003 09 17 14 02 54 54.94 13 29.97 58 019
026 2003 09 17 15 52 54 47.00 14 00.04 39 020
027 2003 09 17 17 30 54 38.08 14 20.88 32 021
028 2003 09 18 02 59 54 21.52 12 00.08 18 014
029 2003 09 18 03 42 54 20.95 11 50.01 22 013
030 2003 09 18 04 25 54 20.98 11 40.01 28 012
031 2003 09 18 05 23 54 26.99 11 30.05 29 011
032 2003 09 18 06 21 54 31.35 11 18.24 28 010
033 2003 09 18 07 15 54 32.78 11 09.85 10 004
034 2003 09 18 07 33 54 34.02 11 11.19 28 005
035 2003 09 18 07 51 54 34.97 11 12.56 27 006
036 2003 09 18 08 08 54 36.02 11 13.56 28 007
037 2003 09 18 08 24 54 36.72 11 14.49 24 008
038 2003 09 18 08 39 54 37.53 11 15.57 20 009
```