Cruise Report
F.S. POSEIDON Cruise No. 490

Dates of Cruise: 28. September to 01. October 2015

Projects:
Student course CAU Kiel (MNF-Pher-110b)

Areas of Research: Physical oceanography
Port Call: Warnemünde (29./30. Sept. 2015)
Institute: CAU Kiel & GEOMAR Helmholtz Zentrum für Ozeanforschung Kiel
Chief Scientist & Report responsible: Dr. J. Karstensen (GEOMAR)
Number of Scientists: 12 & 12
Master: Matthias Günther

Chapter 1

Scientific personal

Cruise code: POS 490
Cruise dates: 28.9. – 01.10.2015
Port call: Kiel – Warnemünde – Kiel

Table 1.1: *Scientific personal POS 490: GEOMAR: Helmholtz-Zentrum für Ozeanforschung Kiel, Kiel, Germany; CAU: Christian Albrechts Universität Kiel, Kiel, Germany*

Name	Institute	Function	leg
Johannes Karstensen	GEOMAR	Chief scientist	1, 2
Christian Begler	GEOMAR	PO	1, 2
Inga Koszalka	GEOMAR	PO	1, 2
Jonathan Wiskandt	CAU	student	1
Mareike Koerner	CAU	student	1
Carl Jakob Schmidt	CAU	student	1
Daniel Kaufmann	CAU	student	1
Jennifer Janine Flavia Eschenbach	CAU	student	1
Pia Wiesner	CAU	student	1
Tobias Gereon Schulzki	CAU	student	2
Philip Volker Reinald Kreussler	CAU	student	2
Gabriel Ditzinger	CAU	student	2
Arne Alexander Bendinger	CAU	student	2
Anna Brandis	CAU	student	2
Tanja Anina Timmermann	CAU	student	2

Chapter 2

Objective

The main purpose of the POSEIDON cruise P490 was the training of students in observational methods of physical oceanographers. Undergraduate students in the Bachelor programm ”Physik des Erdsystems” 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” modul. 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. Hydrographic and current sections from the Fehmarn Belt (section C) and along the deepest topography from about 10°40 E to 14°21 E (section L) were done. Moreover, a long time mooring site that monitors the flow through the Fehmarn Belt is serviced.

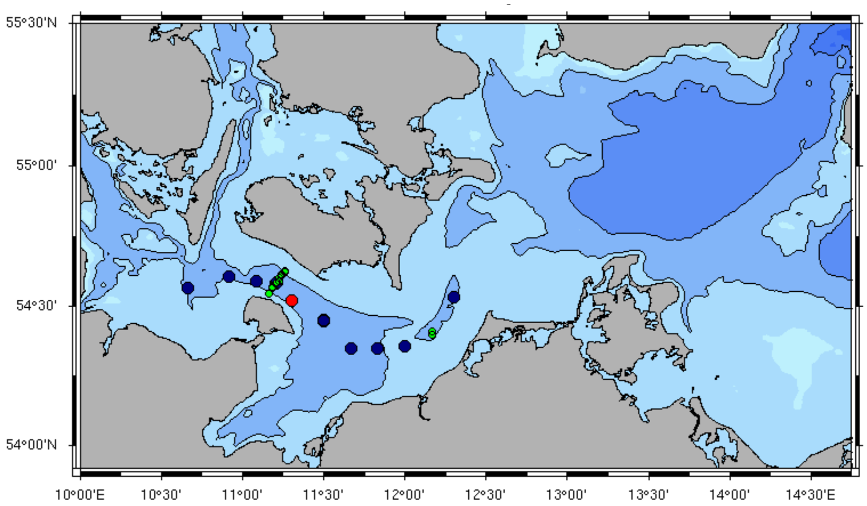

Figure 2.1: *POSEIDON P490 cruise stations. Black (LG section)/ Green (FB section) and Red dot are the CTD stations, red dot is also location of the V431 mooring.*

Chapter 3

Cruise Narrative

Monday 28.09.2015

RV POSEIDON left port on Monday 15.Sept. 2014 at 08:00 LT. We took course to the first working area, the Fehmarn Belt. A safety instruction was given by the 2nd officer (Hero Nannen) at 08:30 in the mess. A test alarm (fire and abondom ship) followed and a trip to the ships facilities. The science crew than met again in the dry lab and an introduction to science program was given. A first CTD station was performed in order to test the system. A Sea-Bird SBE 911 was sued with double C,T and oxygen sensors. Three CTDs of L-section were occupied next, the last one at the mooring position just outside the Sperrgebiet Marienleuchte. The mooring was approached next, and the release command send. The weather was very good, sunny and calm. The upper floation of the shield should have come up, but it didn't. We tried different angles without success. The operation was terminated at 15:00 and we contunied with the CTD stations along the L-section. The last CTD was done at 21:30 and we steamed eastward to start a CTD survey from east to west on the next day.

Tuesday 29.9.2015

The work started at 07:00 LT with CTD (Prak. station 16) and work continued westward with occupation of 4 more CTDs. The program was stopped and we entered Warnemünde and moored at 14:00 (Pier 8). In the harbour we started with the work on the salinometer, measureing the samples taken on Monday. The students for the 2nd leg arrived at 15:00 on board. A seminar talk followed and a safety and familarization followed (2nd officer). The group of students from the 1st leg left the ship (16:00) and headed for the train to Kiel. In the afternoon, further salinometer work was done. We contacted submaris divers regarding recovery of the two moorings and made arrangements for recovery on the following day (30.9.2015).

Wednesday 30.9.2015

We left Warnemünde at 08:00 LT and headed for the Fehmarn Belt in meet with diver team in order to support recovery of lost V431 2014/2015 and search for bottom frame V431 2012/2013.

At station 11:30, communication with diver and further discussion about the strategy. Diver started at 12:30 and search until 14:00, V431 2014/2015 found and robe attached; Device was upside down, reason unknown. POSEIDON recovered mooring Diver team started search for V431 2012/2013 at 14:45 to 16:15 diver returned without finding the frame. Short contact with Wasserschutzpolizei because of misunderstanding in the notification to the Bundeswehrstandort Marienleuchte. Continued CTD program by repeating the C section (C2) and working further eastward along the L section (repeating stations from Day 1/Day 2) through the night. Salinometer work and meteorological observations continued as well.

Thursday 01.10.2015

Early in the morning, at 03:30 the CTD program was stopped (station 17) and an ADCP survey started - heading back to Kiel. At 07:00 labwork was started again (Salinometer). The material was packed and labs cleaned. We moored at Kiel Seefischmarkt at 14:00.

Chapter 4

Preliminary results

4.1 Hydrographic along C and L section

CTD

Fehmarn Belt (C section)

The C section was occupied twice: On the 28.09.2016 and the 30.09.2016 six CTD profiles were taken (see figure 2.1).

The first section from Monday, 28.09.2016 shows a relatively thin mixed layer. To a depth of nearly $10m$ potential temperature, salinity and potential density are constant. The second section shows a deeper mixed layer of approximately $12m$. In a depth of $17m$ is a strong gradient in temperature, salinity and density on the 28.09.2016 (Fig. 4.1, pot.Temperature, Salinity, Sigma0). The potential temperature ranges from $13,5-14,5°C$ (Fig. 4.1, pot. Temperature), the salinity from $20-24,5\ psu$ (Fig. 4.1, Salinity) and the potential density from $14-18kg/m^3$ (Fig. 4.1, Sigma0). During the second section this layer is in a depth of $20m$.

The range of the potential temperature ($13,5-15,5°C$) is significantly smaller than the range of salinity ($12-24,5\ psu$). The resulting potential density ranges between 9 and $18kg/m^3$ and is corresponding to the salinity field. Each field shows a strong layering.

In contrast the oxygen and chlorophyll-a fields show a weaker layering. The values of oxygen range from $1-7ml/l$ (Fig. 4.1, Oxygen). The upper 15m show higher values of more than $5ml/l$ for the 28.09.2016 For the 30.09.2016 this layer reaches nearly $20m$. Below $20m$ the concentration is lower than $3ml/l$. The plot of the 30.09 shows an unexpected oxygen minimum at a depth of $15m$ at a position of 54,57°N. The same anomaly is visible in the chlorophyll-a concentration.
In general the Chlorophyll-a concentration ranges from $0,1-0,9\mu g/l$ (Fig. 4.1, Chlorophyll-A). The characteristic minimum in the layer below $20m$ is visible. The highest concentration is at a depth of $15m$, the surface water shows lower values. The areas of high chlorophyll-c concentration are smaller and fewer on the 30.09 but in both sections the maximum zones are

closer to Fehmarn than to Lolland.

The wind field shows northern winds of $4-5m/s$ (see above at meteorology) for the 28.09.2016, weak winds during the 29.09.2016 ($1m/s$) and stronger easterly and southern winds ($2-3m/s$) during the 30.09.2016. This causes a flow of surface water into the Baltic Sea and a flatter homogenous surface layer (Fig. 4.1). The shift in the wind direction makes the surface water flow back into the Fehmarn Belt during the 29. and 30.09.2016 This deepens the surface layer and pushes the deep water out of the Fehmarn Belt. This movement is visible in the deeper salt, temperature and density patterns. Regarding the characteristic values the deeper layer represents North Sea water. Due to the small gradient in temperature the potential density is mostly influenced by the salinity.

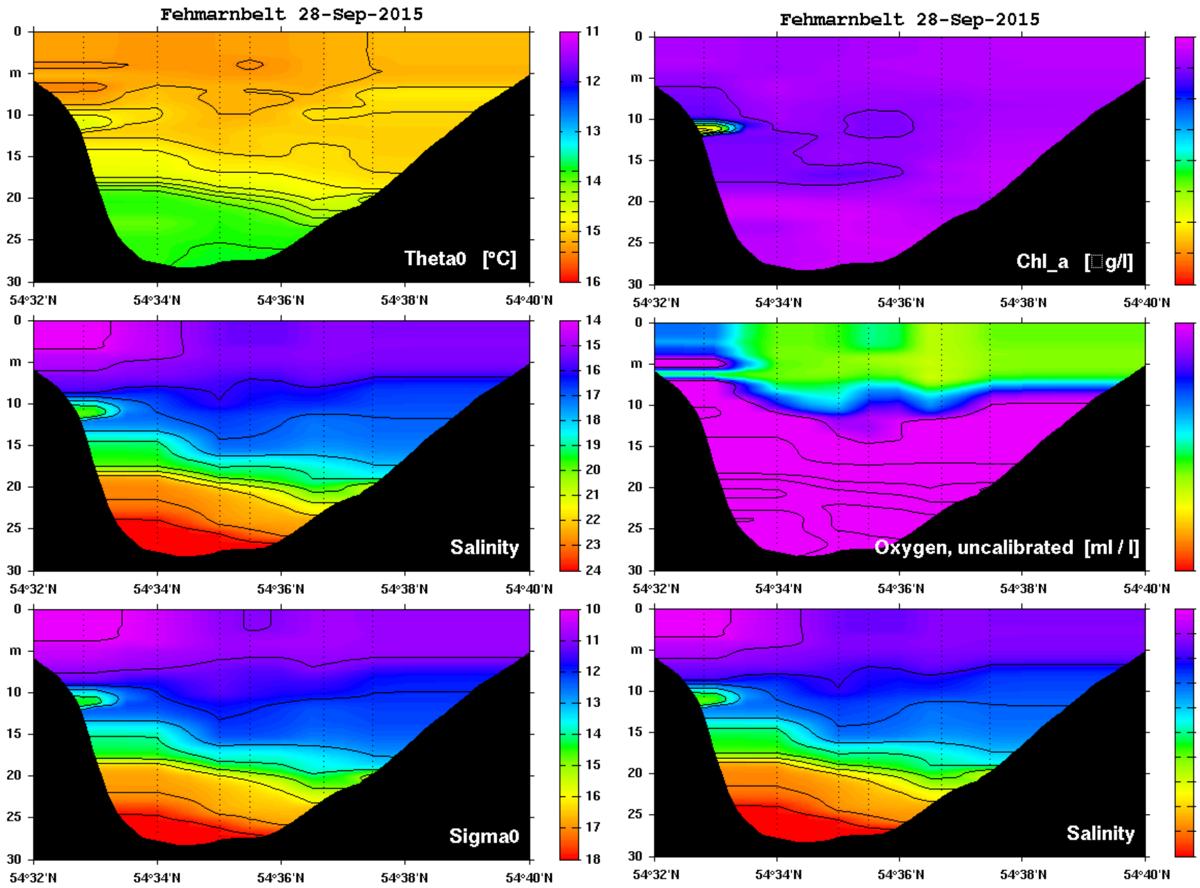

Figure 4.1: *Chlorophyll, oxygen and salinity distribution along Fehmarnbelt on 28. Sept. 2015 derived from CTD data.*

Zonal section (L Section)

The L-Section was measuered twice as well as the C-Section. The first measurement was done on the 28. and on the 29.09. between station 1 ($\phi = 54°$ 34’01 N, $\lambda = 10$ ° 40’02 E) and station

16 ($\phi = 54$ ° 20'94 N, $\lambda = 11$ ° 39'94 E), not including the C-Section from above (Station 4-9). It has to be noted that the measurement was not done chronologically. It started on monday the 28. with station 1-3 plus station 10 and 11 from west to east. On Tuesday the 29. we started the measurement east at station 16 and completed the section westward. In contrast to the first measurment the second has only been done between station 11 ($\phi = 54$ ° 26,02' N, $\lambda = 11$ ° 30,16' E) and station 16. This took place on the 30.09. except for Station 16 which was measured on the 1.10.2016.

The first measurement of the L-Section on monday and tuesday shows a thin mixed layer (Fig. 4.2). Within the upper $3 - 4m$ the water is vertically nearly uniform in properties of potential temperature, salinity, oxygen and fluorescence whereas the mixed layer is deeper in the east than in the west.

The potentiel temperature ranges from $13,5 - 15,5°C$ (Fig. 4.2, pot. Temperature). Below the very thin mixed layer a layer with a stong horizontal gradient is located. In a depth of roughly $16m$ at around 11° E the potential temperature is around $14°C$ at the same depth at 11,8° E the temperature is about $1°C$ higher. (Fig 4.2, pot. Temperature).
The salinity profile shows a matching situation. It ranges from about 12 psu to 24 psu (Fig. 4.2, Salinity). As well as the temperature profile the salinity profile shows a strong horizontal gradient. Here the drifference between 11 ° E and 11,8 ° E comes to roughly 6 psu.
The potential density profile is corresponding to the salinity field with values of $8 - 18kg/m^3$ (Fig. 4.2, Sigma0).
The salinity, the potential temperature and the potential density profile have a strong vertical gradient at 11 ° E in a depth between 15 and 20m. This is where the Fehmarn Belt is located. (Section **??**) Looking at the oxygen profile it becomes obvious that the areas of low oxygen concentration are corresponding to the areas of cold and salty water (Fig. 4.2, Oxygen).
We have a maximum of Chlorophyll-a around 11° E and a depth of 7-16m with values of up to 0.8μg/l. The same values can be found at 11.8° E close to the ground and slightly lower values at 12.2° E between 10 and 15m (Fig. 4.2, Chlorophyll-A). Everywhere else the values are below $0.6\mu g/l$
Regarding the second measurement it is notable, that the colder fresher surface water which was located in the far east of the section has now moved a little to the west. Considering the whole water column one realizes that nearly the whole column has shifted to the west. This becomes distinct looking at the profiles of oxygen and salinity.

Evaluating this section one has to take the topoghraphy into consideration. In the deeper basin between 10,8° E and 11,6° E colder and saltier water comulates. Taking the oxygen profile in account we can also assume that it is relative old water.
From this observations we can conclude that this water is North Sea water. This water came to the Baltic Sea through the Skagerrak during an inflow event. Since it is far saltier than the water from the Baltic sea it sinks down. Due to the topography of the Baltic Sea it mounts in the bottom basins.
Comparing the first and second measurement the westward water shift is noticeable. This shift is explained by a change in wind direction. Which is also the reason for the deepening of the

mixed layer in the Fehmarn Belt section. For further explanation see chapter **??**. Additional comparisons between the measurements are not possible due to a lack of data.

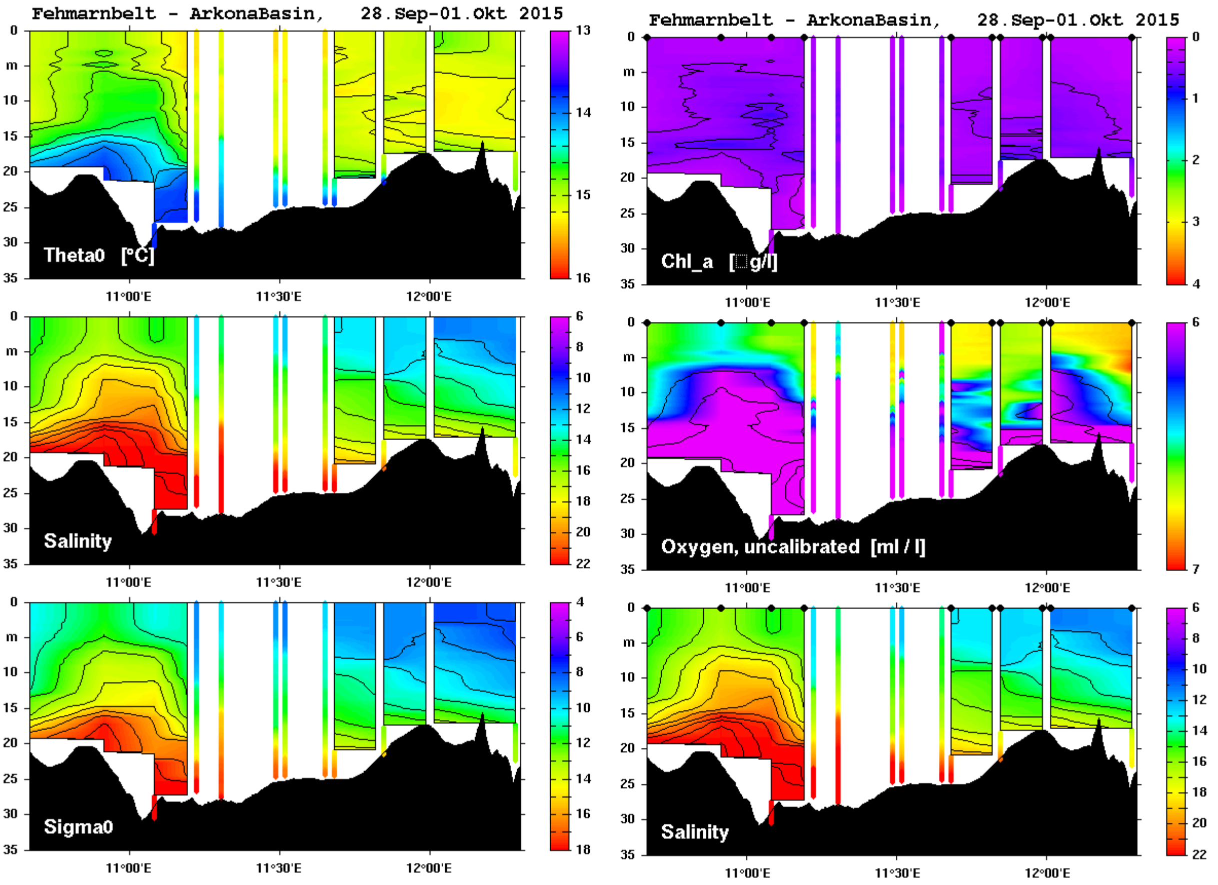

Figure 4.2: *Potential temperature, salinity and potential density distribution along zonal section between 28. and 30. Sept. 2015.*

4.2 Meteorological Observations

Various meterological data has been recorded during the journey. The values were measured by the automatic board weatherstation (ABWSt) of the German weather service (DWD) with the latest data displayed on the DAVIS-SHIP-Display. The following evaluation is based on a combination of this data and a set of data acquired from CTD-station based psychrometric measurements. Tab. 4.1 gives an overview of the available data and the according measuring device.

Table 4.1: *Overview on selscted paramters from the ABWSt and the psychrometer*

	DWD/ship	in-situ observations
air pressure	x	
air temperature	x	x
most temperature		x
sea surface temperature	x	
wind direction and speed	x	
cloud cover		x

The ABWSt data was availble every second or so and was used here in comparison with the 63 measured (and 22 calculated) values from the psychrometric measurements. An Assmann psychrometer was used during the cruise.

The air temperature was measured by a PT-100 resistance thermometer with an accuracy of 0.1 K fig. 4.3 compares the values of the ABWSt. acquired at the CTD-stations with the respective values of the psychrometric measurements.

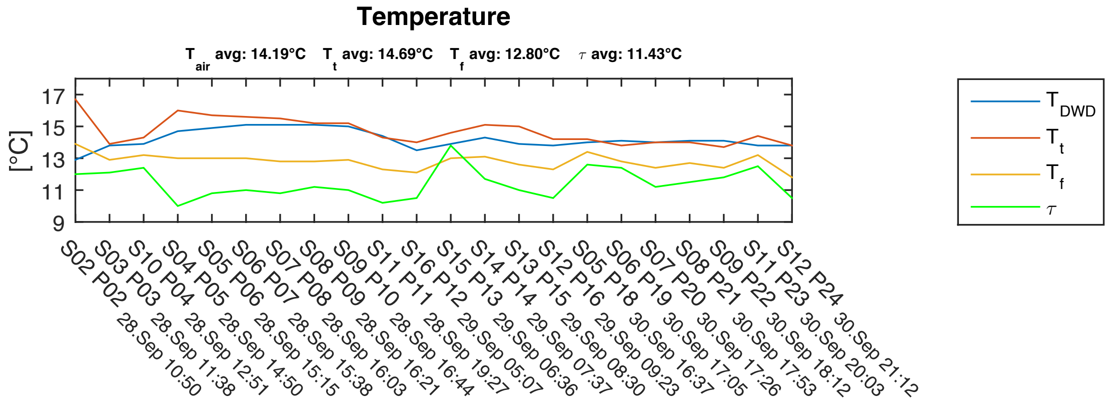

Figure 4.3: Surface temperature.

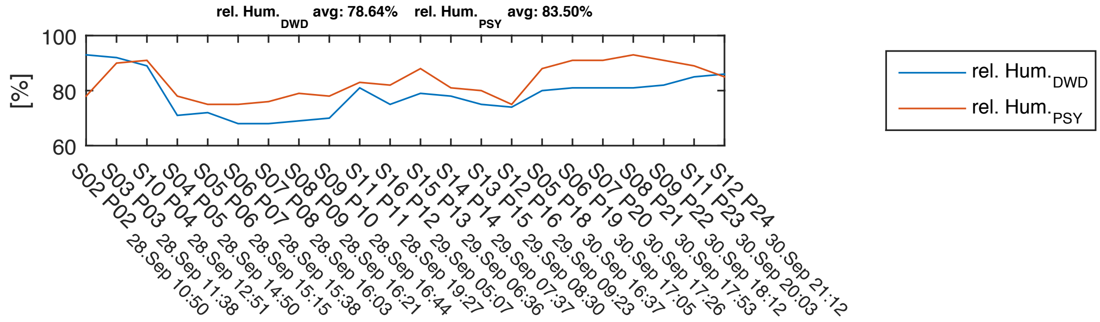

Figure 4.4: Humidity.

Releative humidity was measured using a voltage sensor (ABWSt.) on the one hand and a chart based examination of the dry and moist air temperature aquired from the psychrometer measurments. A comparision of the two available data sets is seen below in fig. 4.4.

The wind direction is measured with a special 8bit gray-code by Thies Clima (producer) in a resolution of 2.5°. The wind speed is measured by a sensor of the same producer. The measurement is based on frequency analyses and allows for absolute values between 0 and $50\,\mathrm{m}^2\,\mathrm{s}^{-1}$. The resolution of the wind speed measurement is $0.3\,\mathrm{m}^2\,\mathrm{s}^{-1}$.

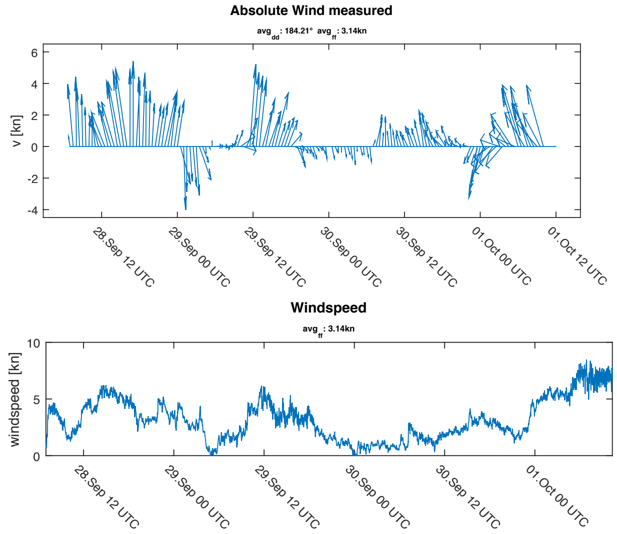

Figure 4.5: (upper) wind vector, (lower) wind speed (knots).

As shown in fig. 4.5, the wind during the cruise was relatively weak (average: 3.14kn), which could be explained by the small pressure gradient displayed in fig. 4.6. The average wind direction ist dominated by a southerly component. A futher description can be found below in pressure chart analysis. As shown in fig. 4.6 , the air pressure during the cruise was rather high, with an average value of 1038.19hPa. The maximum pressure was measured on the 29.09.2015 from 8:55 until 9:42 UTC (1041.4 hPa). Thereafter the air pressure decreased slowly but continually until the end of the cruise (1033 hPa).

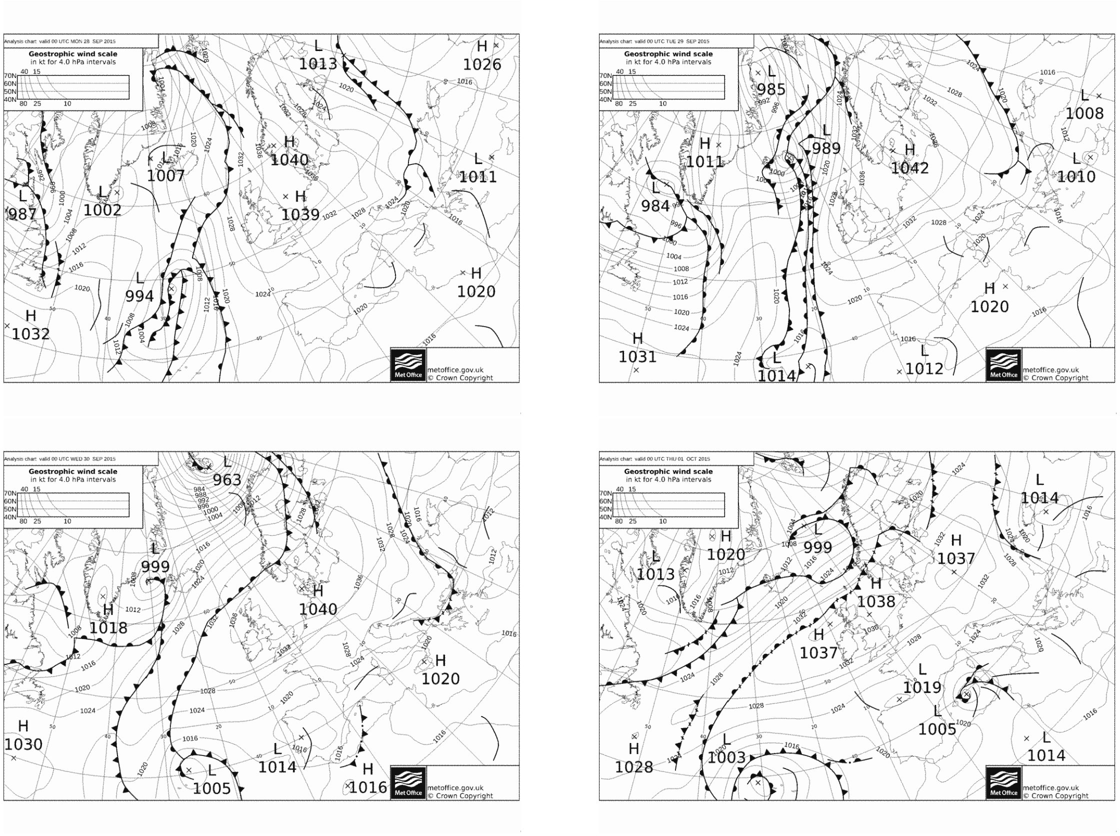

Figure 4.6: Surface pressure analysis charts from Met Office UK for the period September 28^{th} to October 01^{th}, 2015, for 00:00 UTC each.

The described high pressure conditions are confirmed by the surface pressure analysis charts. The centre of the high pressure cell was above southern Norway with a constant central pressure of approximately 1040 hPa. The high pressure cell moved in a south-easterly direction during the cruise. The pressure charts only explain the measured wind directions shown in fig. 4.5 at night time reasonably well.

The predominant wind direction at 00:00 UTC on all days of the cruise was north. According to the pressure chart, the expected (geostrophic) wind direction for the 29.09.2015, 00 UTC, is easterly; for the 30.09.2015, 00 UTC, it is northerly and for the 1.10.2015, 00 UTC, it is north-westerly. The stable high pressure cell should also have resulted in a similar wind direction during the days, however, the measured wind direction had a strong southerly component. This might be due to local effects. The stable high pressure conditions do explain the low cloudiness and high temperatures, though. The weather conditions were not influenced by any low pressure cells (and thus fronts), so the absence of precipitation during the cruise is also in accordance with the pressure charts (4.6).

4.3 Mooring V431 in the Fehramn Belt

For the 30th September the deployment of a mooring was scheduled at Fehmarn Belt ($54.5085°$ N, $11.3113°$ E). Since the mooring probably turned face down the previous group was unable to recover the mooring as planned for the 28th September.

Instead of going eastwards the RV Poseidon had to return to Fehmarn Belt which left the scientists with less time to collect further CTD data. In the morning of 30th September the RV Poseidon reached the spot where the mooring was deployed last year. In order to recover the mooring divers were hired. During the 5 hour stay, the divers were able to first spot the mooring and then succesfully recover it from the sea (fig.: 4.7). The second mooring, however, could not be found by the divers. As suggested the mooring turned face down during deployment.

Since the mounted ADCP faced the ground it was unable to gather reliable data on current velocities.

Figure 4.7: Recovery of the mooring. The buoyancy part had been triggered but could not float to the surface

Instruments

The mooring contained a bottom mount of type Al-200 from Deep Water Buoyancy and a buoyancy part at about 27.3 m depth. A MicroCat was installed at the bottom mount. The model SBE37-IM from Sea-Birds Electronics recorded data for temperature and salinity in a depth of approximately 27 m. The data was taken between 15th September 2014 and 1st October 2015. The sample interval was 900 seconds.

The Aanderaa RDCP600 was mounted in the buoyancy part and gathered data for temperature, salinity, oxygen and current velocities. The data was recorded between 5th December 2012 and 16th December 2013 in intervals of 1 hour. The instrument divided the water column into 18 bins of 2 m height. For each bin there were data recorded in order to create a vertical profile of current velocities.

Data assessment

We chose the time interval for fig.: 4.8 and 4.9 to be from 1st January to 1st October in order to compare the available data. Since the Aanderaa RDCP600 only collected data until 16th September the last 2 weeks are missing (fig.: 4.8 and fig.: 4.9, top). In all other figures the whole dataset was used in order to gain as much information as possible.
The water temperature measured by the Aanderaa RDCP600 shows a seasonal cycle (fig.: 4.8, top). The temperature series starts at about 4 °C in January and drops to a miniumum of 0.6 °C in the end of March. From there on the temperature rises throughout the year until it reaches its maximum of 16 °C in late September. This behaviour is typical to oceans because they react with a certain delay to atmospheric temperature changes. In the MicroCat (fig.: 4.8, bottom) data a seasonal cycle is visible as well. However, the difference between the maximum in September 2015 and the minimum in March 2015 is not as big as in 2013.

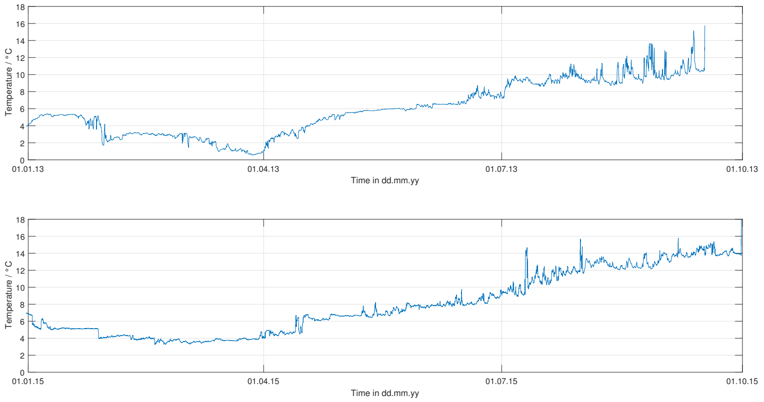

Figure 4.8: Time series of water temperature in 27 m depth. Top: Aanderaa RDCP600 dataBottom: MicroCat data

In the beginning, the water salinity measured by the Aanderaa RDCP600 (fig.: 4.9, top) remains almost constant at around 20 psu for the first 2 months. It then drops to its minimum of 11 psu in the end of March. The value rises up to its maximum of 29 psu in May and remains almost constant with a slight decline to the end of the interval (fig.: 4.9). The MicroCat data (fig.: 4.9, bottom) shows much less varying salinity values. In contrast to the 2013 data the salinity minimum doesn't drop below 15 psu in late March. On the other hand, the maximum doesn't reach more than 24 psu in late May. After that, the salinity remains at a constant value of about

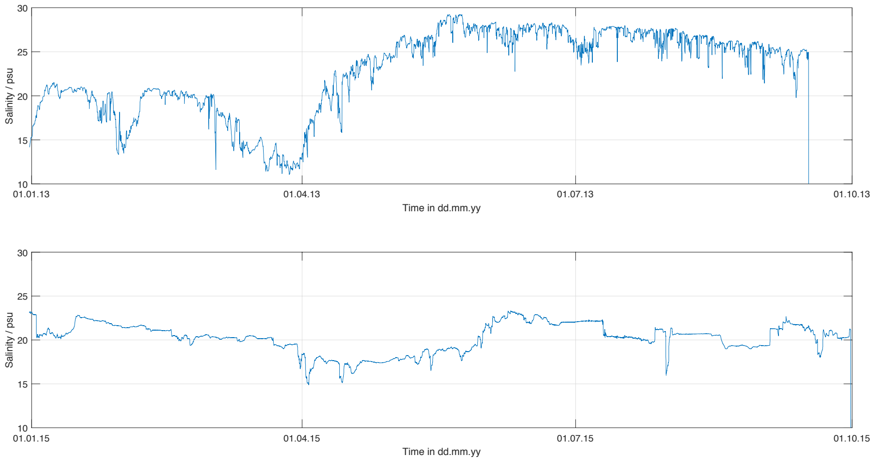

Figure 4.9: Time series of water salinity in 27 m depth.Top: Aanderaa RDCP600 data Bottom: MicroCat data

20 psu.
If you compare both salinity time series one can notice a strong decrease in salinity in late March 2013 (fig.: 4.9). This feature could be due to snow melt and thus increased fresh water inflow after the winter. However, in 2015 there is no significant drop in salinity during this time of the year. This could imply that a strong inflow event took place in which salty water from the North Sea entered the Baltic Sea. Since this inflow event is confirmed and dated for the end of 2014 the data seems reliable. The strong increase in salinity between April and May 2013 supposes another inflow event.

In fig.: 4.10 a rapid change in salinity from 3rd December until 24th December is notable. The increase of about 10 psu in 3 weeks is a clear indicator for the inflow event mentioned above. The salinity minumum of 15 psu in the beginning of April and the subsequent almost constant behaviour are visible.

Fig.: 4.11 shows a historgram of current directions in the 2nd bin. The 2nd bin represents the depth interval between 24.75 m and 23.25 m. According to the histogram the main current direction is 109° which translates to east-southeast.
In fig.: 4.12 one can see that the parallel component is positive in the first 6 bins. Positive means that the averaged current direction for those bins has a component in direction of the main current flow which was defined above. This can be related to an inflow of western Baltic Sea water which most likely originates from the North Sea. Bins 7 to 18 show negative parallel components that can be associated with a flow to the west. Surface near water masses that flow in direction of the North Sea can be identified by this.

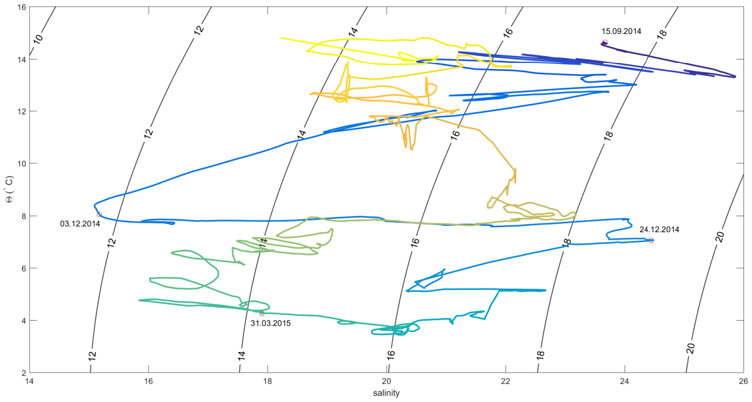

Figure 4.10: TS diagram for the period 2014-2015. Potential density anomaly (σ_θ) shown as isolines. A running mean over 24 h was applied

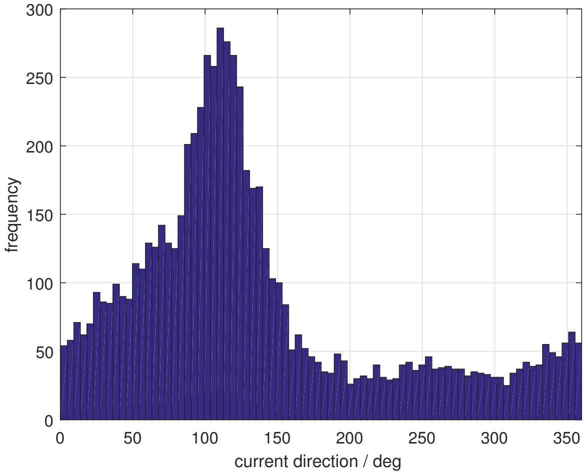

Figure 4.11: Histogram of current directions in 2$^{\text{nd}}$ bin

The interface between inflow and outflow is located at about 17 m depth. As expected the absolute velocity shows a minimum in this area. The highest velocities are reached near surface due to strong influence of wind.

Fig.: 4.13 shows time series of absolute horizontal current velocities near surface (top) and near ground (bottom). The already mentioned higher current velocities near surface are also visible in this figure. The velocities close to the ground don't show a high seasonal variability due to bottom friction and less influence by the wind. The surface near velocities, however, show some seasonal variability. A minimum can be found in March whereas the highest velocities are reached in September.

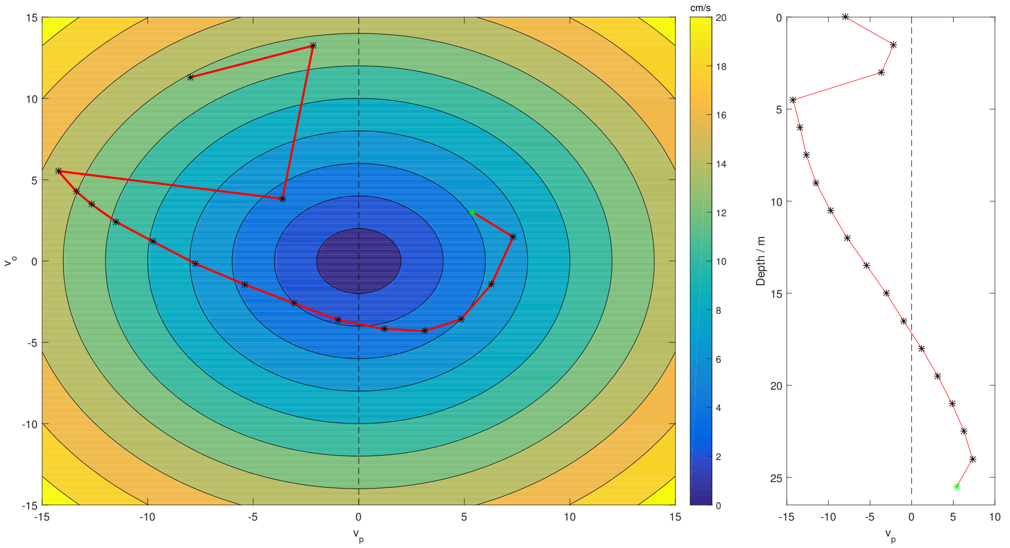

Figure 4.12: **Left:** Averaged (5.12.2012-16.09.2013) current components parallel (v_p) and perpendicular (v_o) to the main flow direction. The deepest bin is highlighted in green. Absloute value of velocity as contour. All values in cms^{-1}. (Right) Averaged parallel component profile

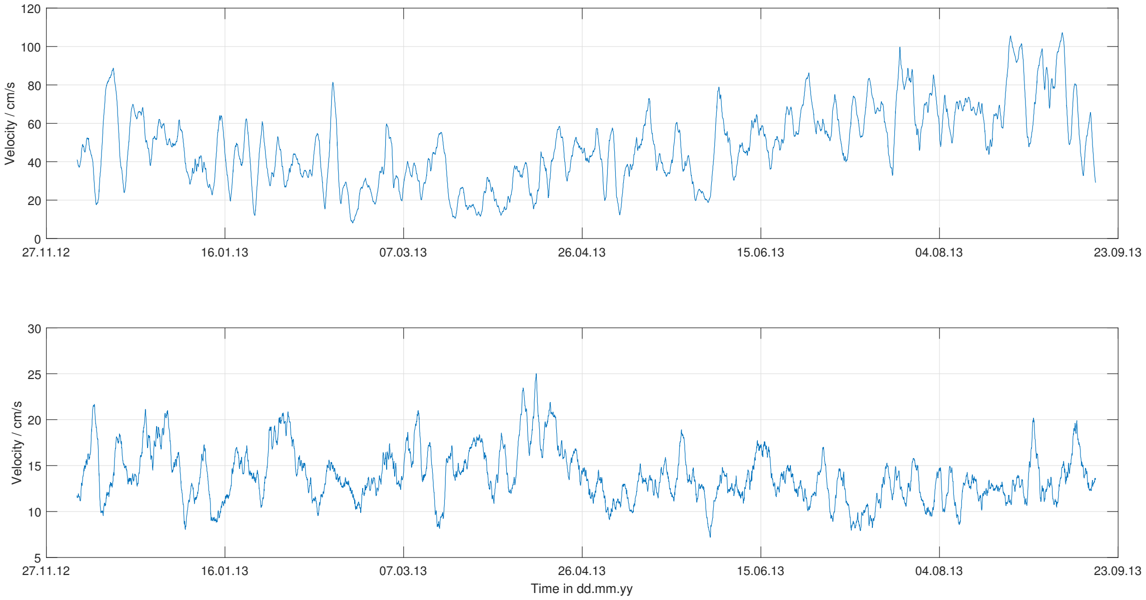

Figure 4.13: Time series of absolute horizontal current velocities (Top) 17th bin (2.25 m - 0.75 m). (Bottom:) 2nd bin (24.75 m - 23.25 m)

Chapter 5

Equipment/instruments

CTD/Rosette und Salinometer

CTD

During the cruise a Hydro Bios CTD was used. It measured the pressure, in-situ temperature, conductivity, oxygen and chlorophyll at each CTD profile. We collected bottle samples for each profile to allow for a calibration of the CTD derived salinity in comparison to a direct estimate using a Beckmann Salinometer.

Beckmann Salinometer

The robust and portable Beckmann Salinometer was used to analyse the water samples. The salinity was measured by an inductive method. To achieve good measurements, the samples were stored for 24 hours in the lab so that the temperature may adjust. As the first measurement, the Beckmann Salinometer was calibrated with IAPSO standard seawater which has a precisely known electrical conductivity ratio. Afterwards, every sample was measured at least two times until the difference of the salinity values was less than 0.01 psu. In between the measurements of two different probes, the salinity of a substandard seawater probe was determined. It is a large volume of Baltic Sea Water taken from a depth close to the ground to ensure the homogeneity of the sample. In an ideal situation the measured salinity of the substandard seawater should remain constant. During the POS490 cruise two different substandard seawater samples were collected and will be analysed independently of each other. A difference between the measurements may indicate a drift of the salinometer but other factors as changements in the room temperature may contribute to a drift as well.

The measurement of the first substandard starts September 29th at 9 am and ends September 30th at 8 pm and is displayed in figure 1. The measurement of the second substandard starts October 1st at 6 am and ends three hours later on October 1st 9 am. The time series is displayed in figure 2. The first substandard features a median salinity of about 17.13 psu with a standard deviation of 0.1 psu. This standard deviation is way bigger than the accuracy of the Beckmann Salinomater

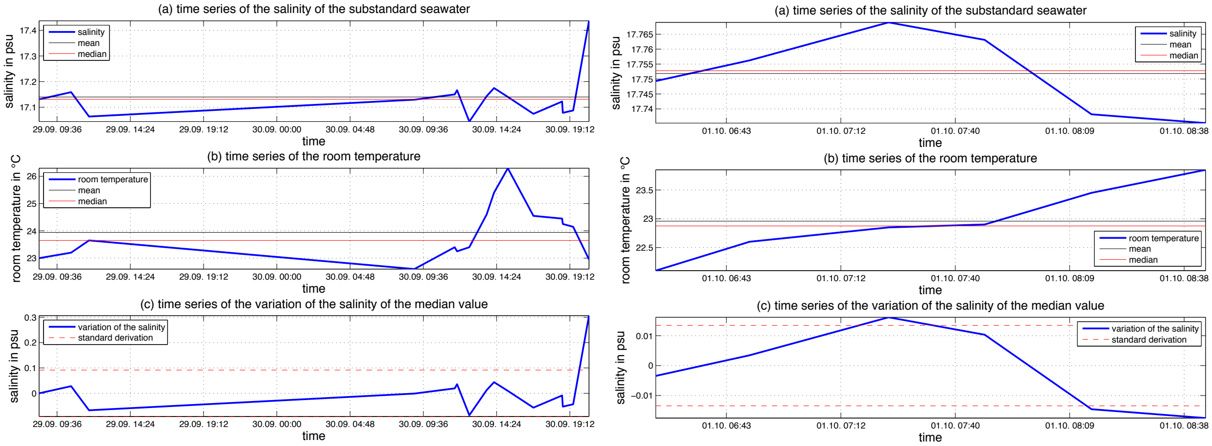

Figure 5.1: (left) Substandard seawater 1: time series from September 29th 9 am until September 30th 8 pm measured with the Beckmann Salinometer: (a) the measured salinity in psu, its mean and its median value, (b) the measured room temperature in Â°C, its mean and its median value, (c) the variation of the measured salinity from its median value as well as its standard deviation, here 0 displays the calculated median value of (a). (right) Substandard seawater 2: time series from October 1st 6 am until October 1st 9 am measured by the Beckmann Salinometer: (a) the measured salinity in psu, its mean and its median value, (b) the measured room temperature in Â°C, its mean and its median value, (c) the variation of the measured salinity from its median value as well as its standard deviation, here 0 displays the calculated median value of (a).

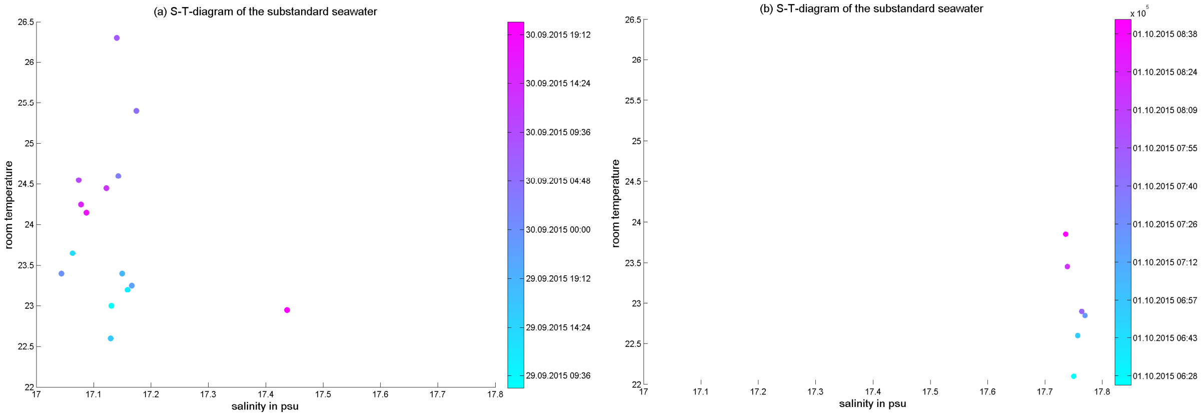

Figure 5.2: salinity-temperature diagram and its developement with time; (a) time series from September 29th 9 am until September 30th 8 pm; (b) time series from October 1st 6 am until October 1st 9 am

should provide. It is remarkable that there is no big difference in between the median and mean salinity. Therefore there are no really big spikes.

The second substandard has a mean and median salinity of about 17.75 psu. There is even a smaller difference in between the mean and the median value than for the first substandard. In comparison, the standard deviation of 0.01 psu is one order of magnitude smaller than the standard deviation of the first substandard. However, it is still about one order of magnitude higher than the nominal accuracy for the Beckmann Salinometer that is given by the manufacturer and has a value of 0.002 psu.

In both cases there is no particular linear trend detectable (time, temperature). Therefore we assume no drift of the salinometer itself. Small deviations in the salinity measurement could be explained by enhanced bubble formation in the conductivity cell of the Beckmann Salinometer. A reliable statement about the relationship of measured salinity and room temperature can not be made.

CTD salinity

From the standard calibration of the conductivity cell an uncalibrated salinity is calculated. This salinity would be later calibrated by the bottle samples measured with the salinometer. The accuracy of the Beckmann Salinometer used on this trip is about 0.04 (for all measurements with the salinometer until September 30th at about 8 pm).

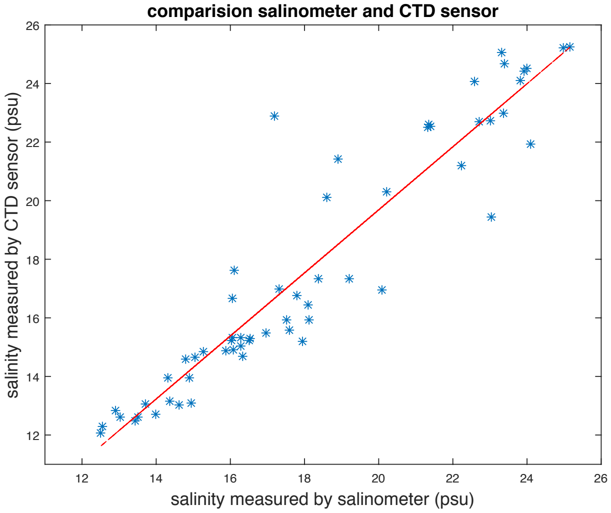

Figure 5.3: comparison of salinity measured by the Beckmann Salinometer and the CTD sensor

The figure shows the salinty values measured by the CTD sensor and those measured by the salinometer. The red regression line is almost a vertically moved bisection line with the linear equation:

$$salinity_{CTD} = 1.0761 * salinity_{salinometer} - 1.8355$$

Therefore, there seems to be no trend (the slope is nearly one), but a constant difference of about 2 psu (salinometer values are about 2 psu higher than CTD values). As the salinometer was calibrated with standard seawater, we assume that its measurement is close to the exact value (+/- 0.04 psu as calculated in the chapter Beckmann Salinometer). Therefore the salinities measured with the CTD have to be corrected with +1.8355 psu.

5.1 Underway Measurements

5.1.1 WERUM

POSEIDON has a central data collection system from WERUM. The system worked well during the cruise and facilitated our work in providing on-line cruise map, a downloadable station book as well as export of relevant data to create underway data files. The data is used by the students for further analysis.

5.1.2 Navigation

POSEIDON has a GPS navigational system as well as a gyro compass available and distributed via WERUM. The WERUM map viewer allowed to follow the cruise track online.

5.1.3 Meteorological Data

POSEIDON is equipped with a so called automatic weather station maintained by the DWD. and acquiring basic meteorological parameters (air temperature, wind speed and direction, wet-temperature, humidity, air-pressure).

5.1.4 Echo sounder

The ELAC navigation Echosounder 30kHz was activated during the cruise. The depth is converted to true depth adding 4.4m to the observed depth scaled by (true sound / 1500).

5.1.5 Thermosalinograph

The thermosalinograph (TSG) on POSEIDON is permanently installed at about 4m depth,takes up about one litre per second.

5.1.6 Vessel mounted ADCP

A 600kHz workhorse ADCP from RD Instruments was mounted in the ships hull. The vmADCP is used with bottom tracking mode. The ADCP acquisition PC from POSIDON was used with the standard navigational data .

Figure 5.4: Stationlist: CTD/RO CTD and rosette; MOOR: mooring

Station	CTD number	Date	Time	Gear	Action	PositionLat	PositionLon	Depth [m]
PO490/0592-1	ctd#1	2015/09/28	09:22:00	CTD/RO	at depth	54° 34.00' N	010° 40.10' E	17.7
PO490/0593-1	ctd#2	2015/09/28	10:35:00	CTD/RO	at depth	54° 36.49' N	010° 55.01' E	19.4
PO490/0594-1	cts#3	2015/09/28	11:29:00	CTD/RO	at depth	54° 35.50' N	011° 05.00' E	28.7
PO490/0595-1	ctd#4	2015/09/28	12:41:00	CTD/RO	at depth	54° 31.29' N	011° 18.33' E	24.6
PO490/0596-1		2015/09/28	13:52:59	MOR	recovery attempt	54° 30.49' N	011° 18.70' E	23.7
PO490/0597-1	ctd#5	2015/09/28	14:38:00	CTD/RO	at depth	54° 32.82' N	011° 09.85' E	7.2
PO490/0598-1	ctd#6	2015/09/28	15:08:00	CTD/RO	at depth	54° 34.01' N	011° 11.09' E	24.7
PO490/0599-1	ctd#7	2015/09/28	15:34:00	CTD/RO	at depth	54° 35.01' N	011° 12.44' E	24.1
PO490/0600-1	ctd#8	2015/09/28	15:54:00	CTD/RO	at depth	54° 35.99' N	011° 13.51' E	24.5
PO490/0601-1	ctd#9	2015/09/28	16:16:00	CTD/RO	at depth	54° 36.68' N	011° 14.57' E	20.2
PO490/0602-1	ctd#10	2015/09/28	16:38:00	CTD/RO	at depth	54° 37.48' N	011° 15.49' E	17.0
PO490/0603-1	ctd#11	2015/09/28	19:17:00	CTD/RO	at depth	54° 27.03' N	011° 30.16' E	22.2
PO490/0604-1	ctd#12	2015/09/29	05:01:00	CTD/RO	at depth	54° 32.02' N	012° 18.00' E	19.6
PO490/0605-1	ctd#13	2015/09/29	06:28:00	CTD/RO	at depth	54° 24.01' N	012° 10.00' E	17.5
PO490/0606-1	ctd#14	2015/09/29	07:32:00	CTD/RO	at depth	54° 21.46' N	011° 59.96' E	14.1
PO490/0607-1	ctd#15	2015/09/29	08:24:00	CTD/RO	at depth	54° 21.06' N	011° 50.02' E	18.2
PO490/0608-1	ctd#16	2015/09/29	09:19:00	CTD/RO	at depth	54° 20.94' N	011° 39.93' E	21.6
PO490/0609-1		2015/09/30	12:17:59	MOR	recovery with diver	54° 30.51' N	011° 18.62' E	23.1
PO490/0610-1	ctd#17	2015/09/30	15:55:00	CTD/RO	at depth	54° 32.83' N	011° 09.82' E	7.6
PO490/0611-1	ctd#18	2015/09/30	16:22:00	CTD/RO	at depth	54° 34.08' N	011° 11.15' E	25.2
PO490/0612-1	ctd#19	2015/09/30	17:00:00	CTD/RO	at depth	54° 35.06' N	011° 12.53' E	23.9
PO490/0613-1	ctd#20	2015/09/30	17:23:00	CTD/RO	at depth	54° 36.06' N	011° 13.55' E	24.0
PO490/0614-1	ctd#21	2015/09/30	17:49:00	CTD/RO	at depth	54° 36.72' N	011° 14.56' E	20.0
PO490/0615-1	ctd#22	2015/09/30	18:11:00	CTD/RO	at depth	54° 37.55' N	011° 15.46' E	16.6
PO490/0616-1	ctd#23	2015/09/30	20:01:00	CTD/RO	at depth	54° 26.91' N	011° 30.17' E	22.0
PO490/0617-1	ctd#24	2015/09/30	21:08:00	CTD/RO	at depth	54° 20.97' N	011° 40.05' E	21.5
PO490/0618-1	ctd#25	2015/09/30	21:57:00	CTD/RO	at depth	54° 21.02' N	011° 50.03' E	18.1
PO490/0619-1	ctd#26	2015/09/30	22:56:00	CTD/RO	at depth	54° 21.51' N	012° 00.02' E	13.9
PO490/0620-1	ctd#27	2015/09/30	23:52:00	CTD/RO	at depth	54° 24.06' N	012° 10.09' E	17.2
PO490/0621-1	ctd#28	2015/10/01	01:03:00	CTD/RO	at depth	54° 32.01' N	012° 18.02' E	19.4

Chapter 6

Acknowledgement

A big thank to Matthias Günther (master), his officers and all crew members of RV POSEIDON for a successful and comfortable cruise.