Dagmar Hainbucher
Institut für Meereskunde
ZMAW
Universität Hamburg
Bundesstr. 53
D-20146 Hamburg

Tel.: +49 40 42838 5745
Fax: +49 40 42838 4644

Cruise Report
RV POSEIDON Cruise P414

Genoa – Messina
31. May – 13. June 2011
Chief Scientist: Dagmar Hainbucher
Captain: Klaus Ricke

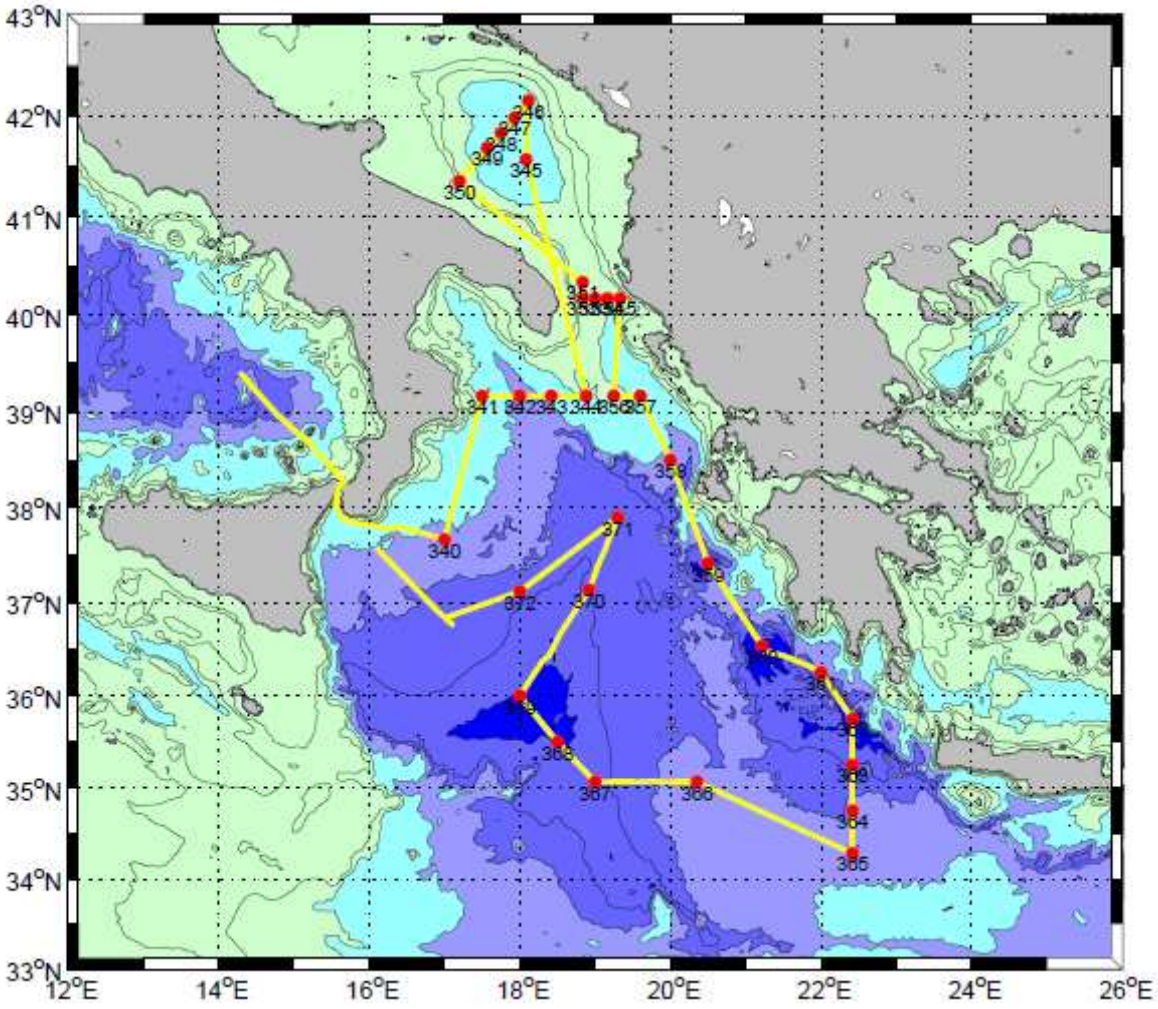

Fig. 1: Ship track of RV POSEIDON cruise P414 from Genoa to Messina. Red dots are CTD stations.

1. Objectives

Until the eighties the main source of deep water masses in the Ionian Basin was the southern Adriatic Sea. During the nineties a dramatic climatic change took place in the eastern Mediterranean (Eastern Mediterranean Transient); deep water was formed of water originating from the Aegean Sea since then. This change in the deep water had extensive consequences for the whole circulation of the eastern Mediterranean Sea. Expeditions carried out in this region during the last years indicate now that the process of deep water formation might reverse again. The process of this re-reversing deep water formation is a long-term one. Therefore, the characteristics of the today's deep water masses in the Ionian Basin, to which extent these characteristics differ from the deep water masses before the EMT and in which state the re-reversed Eastern Mediterranean deep water circulation is now, must be investigated continuously. The Adriatic deep water finds its way to the Ionian Basin on several routes with different entrainments rates. The entrainment rates might be a deciding factor for the Deep Ionian Waters and the resulting density might influence the role of the Aegean Deep Water for the Ionian Deep Waters as well. Therefore, it is crucial to identify and quantify the routes and entrainment rates of the Adriatic Deep Water. The cruise carried out is a continuation of the work carried out during the cruises POS298, M71/3, MSM13/2, MSM15/4 and M84/3. The objective is to investigate the spatial and temporal variability of dispersion and mixing of the Ionian Deep Water.
During the cruise CTD stations were carried out and samples for nutrient, oxygen and oxygen isotopes were taken. Continously measurements were made with the vessel mounted ADCP and thermosalinograph. Additionally, on the cruise students were trained on the use of oceanographic equipment.

2. Cruise participants

Dagmar Hainbucher	Chief Scientist	IfM-ZMAW
Giuseppe Civitarese	Scientist	OGS
Katharina Esser	Student	IfM-ZMAW
Sebastian Essink	Student	IfM-ZMAW
Bernhard Mayer	Scientist	IfM-ZMAW
Angelo Rubino	Scientist	UVE
Norbert Verch	Scientist	IfM-ZMAW
Christina Walter	Student	IfM-ZMAW
Davide Zanchettin	Scientist	MPI-ZMAW

Institut für Meereskunde (IFM-ZMAW)
Zentrum für Marine und Atmosphärische Wissenschaften
Universität Hamburg
Bundesstr. 53
20146 Hamburg / Germany
e-mail: domke-sommer@zmaw.de
www: //www.ifm.zmaw.de

Max-Planck-Institut für Meteorolgie (MPI-ZMAW)
Zentrum für Marine und Atmosphärische Wissenschaften
Bundesstr. 53
20146 Hamburg / Germany
e-mail: annette.kirk@zmaw.de
www: //www.mpimet.mpg.de/en/home.html

Cà Foscari University of Venice (UVE)
Department of Environmental Sciences
Calle Larga S. Marta 2137
30123 Venice / Italy
e-mail: rubino@unive.it
www: //www.unive.it/nqcontent.cfm?a_id=50266

Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS)
Dipartimento Oceanografia
Borgo Grotta Gigante 42/C
34010 Sgonico (TS) /Italy
e-mail: sedoga@inogs.it
www: // www.ogs.trieste.it

3. Narrative

Monday, 30th May
In the early evening the German scientific crew arrived on board of FS Poseidon. After supper we got a safety instruction by the second mate. In the course of the evening also our Italian colleagues arrived on the ship. At around 22:00 POSEIDON left the harbour of Genoa in order to carry out necessary adjustments at the engines. For this reason two technicians were on board who conducted their tests at full speed during night. We started to equip the laboratories and to establish the instruments after the safty instruction.

Tuesday, 31th May
Noon position: 43° 45.30' N, 009° 13.62' E, T_{air} = 20.5 °C, T_{sea} = 20.4 °C, 1016 hPa, 3 Bft, ESE, very cloudy
At 8:00 in the morning the two technicians left POSEIDON with a pilot boat and cruise P414 started. We began steaming to our first station in the Ionian Sea. During day we were still busy in getting our instruments running. Students' education started with a lecture about the Mediterranean Sea.

Wednesday, 1st June
Noon position: 40° 41.70' N, 012° 16.90' E, T_{air} = 20.1 °C, T_{sea} = 21.4 °C, 1014 hPa, 4 Bft, NW, overcast
All instruments were installed and we started to test their operativeness. It was not yet clear if the lADCP would work properly, but, however, a new firmware was installed. The students had to write exams in regional oceanography despite sea- and homesickness. In the afternoon the second mate gave a lecture for the students in navigation and how to control a vessel, followed by the second part of the students' seminar focussing on the Strait of Messina and the Adriatic Sea.

Thursday, 2nd June
Noon position: 38° 02.31' N, 015° 33.90' E, T_{air} = 22.0 °C, T_{sea} = 17.6 °C, 1016 hPa, 2 Bft, variable, cloudy
Right after breakfast we had a quite foggy view on Stromboli and could observe two sources of smoke on the northern side. At 10 a.m.we had a meeting to discuss shift's schedule and additional work. Within the Strait of Messina we had the opportunity of observing surface manifestations of internal waves. After passing the Strait of Messina we reached our area of interest and started with our continuous measurements with the vessel mounted ADCP and thermosalinograph. The boatswain taught the students how to tie the most useful kinds of

knots. At 10 p.m. we finally arrived at the position of the 1st CTD station. The station was finished without any problems at around 10:45 p.m.

Friday, 3rd June
Noon position: 39° 09.90' N, 17° 49.10' E, T_{air} = 23.1°C, T_{sea} = 21.6°C, 1016 hPa, 3.5 Bft, N, blue sky
Today we were busy with CTD station work. Everybody tried to get some routine and to make sure things run smoothly. In the afternoon two dolphins were sighted.

Saturday, 4th June
Noon position: 41° 11.78' N, 018° 12.51' E, T_{air} = 22.2 °C, T_{sea} = 21.7 °C, 1017 hPa, 2 Bft, E, cloudy
As an addition to the safety instruction some days earlier the first mate demonstrated in the morning how to use a survival suit and a fire extinguisher. We reached our first station of the Adria section, the most northern section of our journey. CTD work continued without any problems. In the evening a school of dolphins accompanied our ship swimming right in front of the bow.

Sunday, 5th June
Noon position: 40° 59.20' N, 017° 56.60' E, T_{air} = 22.0 °C, T_{sea} = 21.1 °C, 1014 hPa, 2 Bft, SE, cloudy
Today we reached the Strait of Otranto in the afternoon. CTD work was continuing fine. After eliminating some software bugs, the lADCP showed also reliable preliminary results. For resolving some hardware problems with the vessel mounted ADCP we had to stop steaming for about an hour. After this interference also the ADCP worked well.

Monday, 6th June
Noon position: 39° 10.05' N, 019° 31.85' E, T_{air} = 23.7 °C, T_{sea} = 23.3 °C, 1012 hPa, 5 Bft, ESE, misty
Right in time for our next station we got the permit from Greek to continue our measurements in Greek waters. Altogether, we could enjoy a rather calm day. From now on, the distance between stations became longer and depth deeper. The students still continued with their seminar and they prepared two posters, one dealing with the functioning of a thermosalinograph and one about the circulation in the Strait of Otranto. In between stations we already started to post-process the data.

Tuesday, 7th June
Noon position: 36° 45.30' N, 021° 01.90' E, T_{air} = 23.5 °C, T_{sea} = 22.0 °C, 1012 hPa, 2 Bft, E, overcast
We were continuing our section along the Greek coast to monitor the inflow of Levatine Intermediate water into the Adriatic Sea. Stations were very deep here (exceeding 4000m). In the morning the first mate gathered us to a meeting announcing that our consumption of internet transfer volume is by far too large. In the evening we changed ship's course a bit so that television reception was possible. Unfortunately, the channel with the soccer game transmission Germany against Azerbaijan did not work. This was a big disappointment for all the soccer fans on board.

Wednesday, 8th June
Noon position: 35° 15.00' N, 022° 25.00' E, T_{air} = 24.3 °C, T_{sea} = 22.6 °C, 1012 hPa, 5 Bft, SE, overcast

Today we approached the most eastern section on which we want to quantify the inflow of Aegean water into the Ionian basin. The whole day was occupied with CTD stations of this section. This was a calm day, everything worked satisfying.

Thursday, 9th June
Noon position: 34° 59.70' N, 020° 32.40' E, T_{air} = 22.3 °C, T_{sea} = 22.0 °C, 1013 hPa, 4-5 Bft, N, cloudy
During night we had to bridge a long steaming distance to reach the next station in the central Ionian Sea. This station started in the early afternoon. During the station a technical problem with the winch emerged and we all were afraid that this might be the end of our cruise. But after around 3 hours the problem with a broken part of the table-track of the winch was solved and station work could be continued. Thanks to all of the ship's crew!

Friday, 10th June
Noon position: 35° 00.00' N, 018° 00.00' E, T_{air} = 21.9 °C, T_{sea} = 22.3 °C, 1014 hPa, 4 Bft, NW, blue sky
Our CTD work now focussed on the central Ionian Sea. Work continued without any problems. We had to skip one station in this region in order to approach the harbour of Messina on schedule. In the morning the 2nd engineer gave a tour through the engine rooms.

Saturday, 11th June
Noon position: 37° 00.00' N, 019° 00.00' E, T_{air} = 22.3 °C, T_{sea} = 21.9 °C, 1012 hPa, 2 Bft, NW, blue sky, partly clouded
We were still busy with CTD stations in the central Ionian Sea. Meanwhile, we did also a lot of post-processing of our CTD, lADCP and ADCP data. Work is routine now and everything was working fine.

Sunday, 12th June
Noon position: 36° 46.10' N, 017° 06.20' E, T_{air} = 22.6 °C, T_{sea} = 22.8 °C, 1016 hPa, 5 Bft, cloudy
This was the last day of our measurement campaign. We finished our last station early in the morning. During this station we got severe problems with the winch. It was planned to have another station, but because of the time which was needed for the repair of the winch, this was impossible and we set course to the port of Messina. In the afternoon we were busy with cleaning the labs and cabins. Fortunately, we did not have to remove and to pack any instruments as the scientific crew of the next cruise will use all of our equipment. In the evening we celebrated the end of our cruise with some beer.

Monday, 13th June
FS POSEIDON reached the port of Messina as scheduled early in the morning. Our cruise ended here.

4. Technical Information and Methods

CTD/Rosette and hydrographical samples

Altogether 33 full depth standard hydrographic stations were occupied during the cruise, employing a SeaBird SBE911 plus CTD-O_2 sonde, attached to a SeaBird carousel 12 bottle water sampler. All sensors except of pressure are sent to the factory once a year for calibration. The pressure sensor is sent to calibration as often as required. The serial numbers of the CTD are:

Instrument/Sensor	Serial Number
SBE 11plus	09P9013-0313
Temperature 1: SBE-3-02/F	1526
Conductivity 1: SBE-4-02/2	1222
Pressure 410K-105	53573
Temperature 2: SBE 3-02/F	1540
Conductivity 2: SBE4-02/2	1232
Altimeter PSA 916D	1118
Oxygen SBE 43	1171

At all stations water samples were taken from 12 depth levels within the water column. From all depth levels samples were taken for oxygen and nutrient analysis, from 6 depth levels samples were taken for isotope analysis and always from three depth levels samples were taken for salinity analysis. The salinity samples were analysed on board using a Guildline Autosal Salinometer. The batch–no. of the standard seawater samples is 38H11 which have a K15-factor of 1.07631 (24°C). Two of the water bottles were also equipped with reversing digital thermometers, providing temperature and pressure check values for the CTD sensors. The oxygen samples were analysed on board by the Winkler method with an automatic endpoint detection burette. Nutrient samples were frozen for later analysis and also the samples for oxygen isotopes will be analysed later in a laboratory.

Current measurements

Vertical profiles of horizontal currents were made with a lADCP-2 system attached to the rosette water sampler. The system consists of two ADCPs of the Workhorse type (WHM300) manufactured by RD instruments and operating at a frequency of 300 kHz. The serial numbers of the lADCPs are S/N 141909 and S/N 14411. Unfortunately, we still have some problems with the operation of the instruments even they were sent to factory for repair after one of the last cruises. Both instruments are not pinging synchronously although they were told by command file structure. We do not know if this is a hardware or software problem. However, a draft analysis of the data showed reliable results.

Underway measurements

Underway temperature and salinity measurements were made with a SeaBird thermosalinograph installed in the ship's port well. We took additional water samples and measured the temperature at the instrument's mouth for calibration purposes.

Underway current measurements were taken with a vessel-mounted 75 kHz Ocean Surveyor (ADCP) from RDI, covering approximately the top 500-700m of the water column. The bin size was set to 8 m, the ADCP run in narrowband mode. The instrument was controlled by computers using the conventional VMDAS software under a MS Windows system. Pinging was set to 2 s. No interferences with other used acoustical instruments were observed. Additional navigational data was available from the ship's DAVIS system. The ADCP data was afterwards post-processed with the software package ossi14 (ocean surveyor sputum interpreter), developed by the Leibniz Institute of Marine Sciences, Kiel, which also

corrects for the misalignment angle (Tim Fischer, pers. communication). The misalignment angle was calculated at approximately 10 degrees.

5. Preliminary results

Figure 2 shows the distribution of water masses in the Ionian and Adriatic Sea. The densest water is situated in the Adriatic Sea on our northern most section (black dots). This water is, in opposite to other cruises, which we carried out in recent years, much saltier. This is presumably caused by a higher amount of intruding Levantine Intermediate water in the southern Adriatic Sea. The other flank of the TS-diagram is built by the waters of our eastern most section which represents the inflowing water of Aegean origin (yellow dots). The bottom water of the central Ionian basin (cyan dots) seems to be somewhat heavier than that of Aegean origin which let us conjecture that Adriatic deep water is the main source of the abyssal water masses in the Ionian basin.

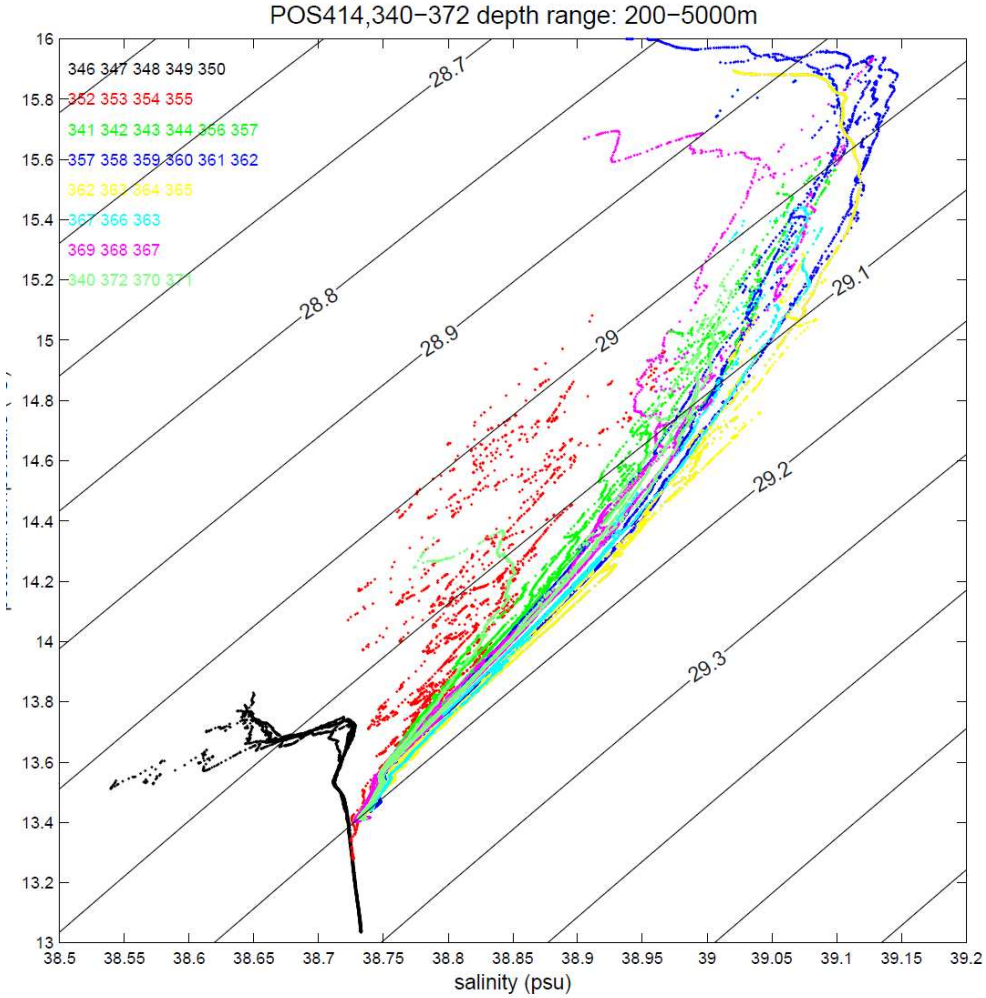

Fig. 2: TS-diagram of all stations of POSEIDON cruise P414. Black dots: Stations in the Adriatic Sea. Red dots: Stations in the Strait of Otranto. Green dots: Stations on 39°10'N in the northern Ionian Sea. Blue dots: Stations along the Greek coast, Yellow dots: Eastern most section of the cruise indicating the Aegean inflow. Cyan dots: Stations in the central Ionian Sea.

The result of our students' seminar and of their discussion about the circulation and hydrography in the Strait of Otranto is shown in figure 3. The seminar was supervised by Angelo Rubino. Authors of the poster are the students: Christina Walter and Sebastian Essink.

Current system in the Strait of Otranto

POSEIDON 414
(Genoa ⟷ Messina)
30th May – 13th June 2011

Sebastian Essink, Christina Walter
Institut für Meereskunde, Universität Hamburg

Description of the main features

The Strait of Otranto forms the connection between the Adriatic Sea and the Ionian Basin. Its width is about 70km and its maximum depth exceeds 800m. This strait shows complex dynamics.

In a near-surface layer (approximately 200 m thickness) Adriatic surface water (AdSW) flows southward along the Italian shelf and MAW flows northward along the Greek shelf. In a near-bottom layer (200- 300m thickness) Adriatic Deep Water (AdDW) flows southward along the Italian shelf and Levantine Intermediate Water (LIW) enters the Adriatic Sea northward.

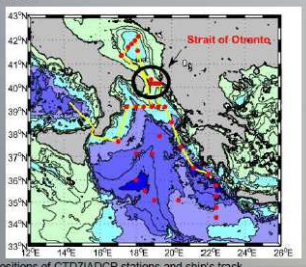

Fig.1: Positions of CTD?/ADCP stations and ship's track

The inflow of MAW at the surface is the most energetic flow in this system. Velocities up to 30 cm/s can be reached. On the contrary, there is a southward flow on the Italian shelf extending to the whole water column. Here, flow velocities of about 15 cm/s have been observed (Ferentinos and Kastanos, 1987).

Between these two layers an intermediate layer of variable thickness can be found. In this layer vertical shear as well as cyclonic eddies may be present in the flow field. Observed instabilities can be explained in terms of near-inertial waves and mesoscale eddies. Especially the formation of eddies is essential for horizontal and vertical mixing of water masses (Ursella et al., 2011).

Data acquisition

We mainly worked using two different kinds of data which we could collect during our cruise POSEIDON 414 through the Strait of Otranto.

The vessel-mounted Acoustic Doppler Current Profiler (ADCP) gathered data continuously along the ship's track. The signals of the emitted beams are not resolved adequately for depths larger than 650m. This is due to acoustic attenuation and lower scatterer concentrations in the deep water. Processing the data, the influence of the ship's course and its speed are removed. Also the velocities were cleaned from interfering spectra and further occuring noise.

The lowered ADCP (lADCP) was deployed together with the CTD sensor. Four profiling measurements of the whole water column in the Strait of Otranto were taken. The exact position of the stations and the ship's track can be found in the enclosed map (Fig. 1).

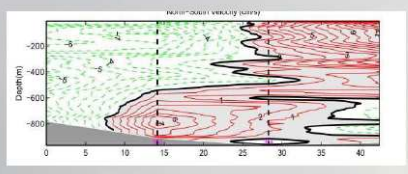

Fig. 2: Section through the Strait of Otranto showing the velocity field yielded by lADCP data; negative values represent southward flow, positive northward flow

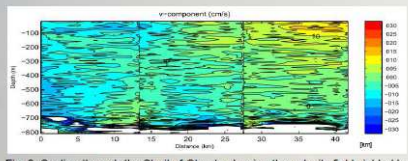

Fig. 3: Section through the Strait of Otranto showing the velocity field yielded by ADCP data

Results

In the following, we will attempt a comparison between ADCP and lADCP data collected during the Poseidon cruise 414.

The lADCP data (Fig. 2) demonstrate that, along the Italian shelf, the velocities point towards the Ionian Sea throughout the whole water column. Along the Greek shelf, instead, in the near-surface layer a strong northward flow can be observed. This flow loses intensity in larger depths and turns into a weak southward flow in the near-botton layer.

In the middle part of the Strait, however, the near-surface layer shows velocities toward south, whilst the bottom layer shows velocities towards north. Note also the presence of the moderate zonal velocity fields in the surface flow on the Italian shelf and in an intermediate flow attached to the Greek shelf.

The ADCP data (Fig. 3) confirm the presence of a flow of water moving southward in a near surface layer on the Italian shelf, but they cannot capture the bottom counterflow, which is too deep to be adequately resolved. It captures also the southwestward flows in the near-surface layer on the Greek shelf. The weakening of the water flow in the near-bottom layer is confirmed. Furthermore, an anticyclonic curl of this current decreasing with depth is visible. There are no ADCP data to validate the flow fields on the Italian shelf.

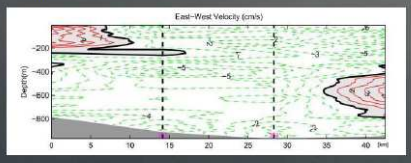

Fig. 4: Section through the Strait of Otranto showing the velocity field yielded by lADCP data; negative values represent westward flow, positive values eastward flow

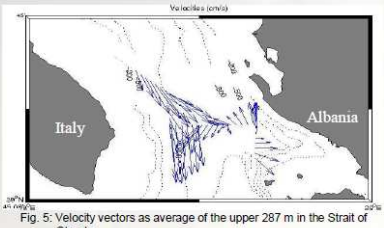

Fig. 5: Velocity vectors as average of the upper 287 m in the Strait of Otranto

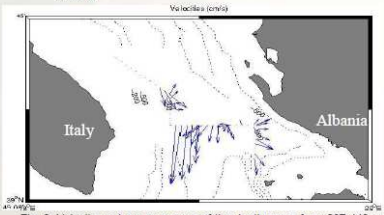

Fig. 6: Velocity vectors as average of the depth range from 287-449 m in the Strait of Otranto

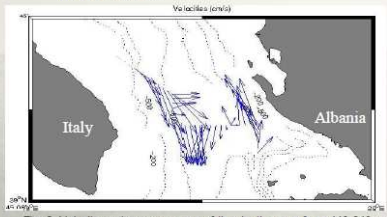

Fig. 6: Velocity vectors as average of the depth range from 449-649 m in the Strait of Otranto

Conclusion

In general, we find a good agreement between the two data sets. Most of the flow patterns can be recognized in both measurements.

The data produced by the ADCP, however, adequately resolve the flow features only in the upper and intermediate part of the water column. As punctual measurements, our observations reflect the instantaneous state of the ocean circulation. A much longer measurement period is required to fully assess mean state and long-term variability of the water masses circulation in the Strait of Otranto (see, e.g., Ursella et al., 2011).

References:
Ferentinos G. and N. Kastanos (1988): Water circulation patterns in the Otranto Straits, eastern Mediterranean. *Cont. Shelf Res.*, 8(9), 1025-1041.
Ursella L., V. Kovacevic, M. Gacic (2011): Footprints of mesoscale eddy passages in the Strait of Otranto (Adriatic Sea), *J. Geophys. Res.*, **116**, C04005

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Fig. 3: Poster draft developed by the students Sebastian Essink and Christina Walter about the circulation in the Strait of Otranto using lADCP and ADCP data gained on cruise P414.

Acknowledgements

We would like to thank Captain Klaus Ricke, his officers and the crew of RV POSEIDON for the support of our scientific programme, for their unending competent and friendly help. We like to express our special thanks to Stefan Gerlach, 2nd mate, Frank Tobolowski, 2nd engineer and Joachim Mischker, boatswain for training our students in navigation, for a guided tour through the engine rooms and for training in making knots.

The ship time of RV POSEIDON and the financial support for the journey of scientists and transport of equipment was provided by the University of Hamburg and by the excellence cluster CLISAP. We gratefully acknowledge this support.

List of Stations

CTD Conductivity-Temperature-Depth sonde
BE Begin of station
BO Near bottom reached on station
EN End of station

EXPO-CODE	Stat. No.	Cast. No.	Type	Date	Time UTC	Code	POSITION Latitude		POSITION Longitude		Bottom depth	Max. press.	Bottom dist.	Comments
POS_414	340	1	CTD	02.06.11	19:10	BE	37° 40.006'	N	16° 59.99'	E	2226			altimeter too high above
					19:51	BO	37° 39.995'	N	17° 00.002'	E	2226	2245	-	real bottom to work properly
					20:44	EN	37° 40.002'	N	17° 00.005'	E	2224			
POS_414	341	1	CTD	03.06.11	07:11	BE	39° 09.998'	N	17° 30.013'	E	1132			-
					07:34	EN	39° 10.001'	N	17° 30.004'	E	1124	1147	8	
					08:11	EN	39° 09.993'	N	17° 30.006'	E	1125			
POS_414	342	1	CTD	03.06.11	11:08	BE	39° 10.000'	N	17° 59.970'	E	2481			bottle 3 was leaking
					11:57	BO	39° 09.990'	N	18° 00.000'	E	2473	2545,6	8	
					12:58	EN	39° 10.000'	N	17° 59.990'	E	2475			
POS_414	343	1	CTD	03.06.11	15:18	BE	39° 10.002'	N	18° 24.998'	E	1540			-
					15:50	BO	39° 09.996'	N	18° 25.006'	E	1538	1575,6	14	
					16:33	EN	39° 10.010'	N	18° 25.019'	E	1540			
POS_414	344	1	CTD	03.06.11	19:02	BE	39° 10.006'	N	18° 52.992'	E	1145			forgotten to close
					19:27	BO	39° 09.998'	N	18° 53.000'	E	1145	1167,4	8	air valves of numbers 8+9
					19:59	EN	39° 09.996'	N	18° 53.004'	E	1144			
POS_414	345	1	CTD	03.06.11	12:25	BE	41° 34.010'	N	18° 05.011'	E	1174			bottle 3 was leaking
					12:50	BO	41° 33.998'	N	18° 04.994'	E	1173	1195,4	8,4	
					13:20	EN	41° 34.002'	N	18° 04.007'	E	1173			
POS_414	346	1	CTD	04.06.11	17:16	BE	42° 09.010'	N	18° 06.985'	E	1123			-
					17:39	BO	42° 08.990'	N	18° 06.995'	E	1124	1133	15,6	
					18:12	EN	42° 09.007'	N	18° 06.995'	E	1125			
POS_414	347	1	CTD	04.06.11	19:52	BE	41° 59.008'	N	17° 55.970'	E	1199			-
					20:16	BO	41° 59.000'	N	17° 55.996'	E	1199	1223,0	8	
					20:47	EN	41° 58.999'	N	17° 55.994'	E	1199			
POS_414	348	1	CTD	04.06.11	22:26	BE	41° 49.997'	N	17° 45.011'	E	1180			bottles 3+6 didn't close properly
					22:50	BO	41° 49.999'	N	17° 44.990'	E	1180	1204,8	8,8	

					23:19	EN	41° 50.005'	N	17° 45.006'	E	1180			
POS_414	349	1	CTD	05.06.11	00:55	BE	41° 41.003'	N	17° 34.004'	E	1094			-
					01:19	BO	41° 40.992'	N	17° 34.002'	E	1095	1114,3	9.7	
					01:51	EN	41° 41.004'	N	17° 34.004'	E	1094			
POS_414	350	1	CTD	05.06.11	04:49	BE	41° 20.994'	N	17° 12.013'	E	548			-
					05:04	BO	41° 20.999'	N	17° 12.004'	E	547	553,7	14	
					05:23	EN	41° 21.004'	N	17° 12.002'	E	548			
POS_414	351	1	CTD	05.06.11	16:07	BE	40° 20.010'	N	18° 50.004'	E	814			-
					16:26	BO	40° 19.996'	N	18° 50.000'	E	815	827,05	11,7	
					16:52	EN	40° 20.005'	N	18° 49.997'	E	814			
POS_414	352	1	CTD	05.06.11	18:10	BE	40° 09.996'	N	18° 50.023'	E	769			-
					18:26	BO	40° 09.997'	N	18° 50.002'	E	768	783,9	8	
					18:48	EN	40° 09.992'	N	18° 49.999'	E	768			
POS_414	353	1	CTD	05.06.11	20:02	BE	40° 10.001'	N	18° 59.992'	E	915			-
					20:20	BO	40° 10.000'	N	19° 00.002'	E	900	919,5	8	
					20:44	EN	40° 09.997'	N	19° 00.010'	E	900			
POS_414	354	1	CTD	05.06.11	22:03	BE	40° 10.001'	N	19° 09.987'	E	953			-
					22:24	BO	40° 10.003'	N	19° 10.001'	E	953	972,3	8,4	
					22:49	EN	40° 09.998'	N	19° 09.998'	E	954			
POS_414	355	1	CTD	05.06.11	23:56	BE	40° 10.009'	N	19° 19.990'	E	916			bottle 3 didn't close and
					00:18	BO	40° 10.010'	N	19° 20.000'	E	916	925,8	8,1	no samples could be taken
					00:43	EN	40° 09.996'	N	19° 19.997'	E	916			
POS_414	356	1	CTD	06.06.11	07:42	BE	39° 10.008'	N	19° 14.987'	E	844			-
					08:01	BO	39° 10.000'	N	19° 14.993'	E	845	863,8	8	
					08:24	EN	39° 10.008'	N	19° 14.996'	E	844			
POS_414	357	1	CTD	06.06.11	10:37	BE	39° 10.010'	N	19° 36.020'	E	1372			-
					11:05	BO	39° 10.000'	N	19° 36.020'	E	1372	1408	8,6	
					11:42	EN	39° 10.010'	N	19° 35.990'	E	1372			
POS_414	358	1	CTD	06.06.11	16:50	BE	38° 30.004'	N	20° 00.001'	E	2252			-

					17:34	BO	38° 30.004'	N	19° 59.996'	E	2249	2313,8	9.7	
					18:22	EN	38° 30.010'	N	20° 00.001'	E	2250			
POS_414	359	1	CTD	07.06.11	02:28	BE	37° 25.009'	N	20° 29.978'	E	3483			bottle 2 was leaking
					03:30	BO	37° 24.991'	N	20° 29.999'	E	3483	3623,3	16,6	air valve of bottle 10 hadn't
					04:37	EN	37° 25.005'	N	20° 30.004'	E	3481			been closed
POS_414	360	1	CTD	07.06.11	12:10	BE	36° 32.020'	N	21° 13.041'	E	4381			-
					13:32	BO	36° 32.003'	N	21° 13.003	E	4391	4620,8	12,6	
					15:03	EN	36° 32.018'	N	21° 13.012'	E	4370			
POS_414	361	1	CTD	07.06.11	20:29	BE	36° 15.000'	N	21° 59.984'	E	2986			-
					21:24	BO	36° 14.992'	N	21° 59.983'	E	2986	3094,7	8	
					22:30	EN	36° 15.001'	N	22° 00.002'	E	2986			
POS_414	362	1	CTD	08.06.11	03:04	BE	35° 44.996'	N	22° 24.986'	E	4477			winch stopped when 100 m
					04:26	BO	35° 45.004'	N	22° 24.988'	E	4478	4632,6	-	beneath echo-sounder depth
					06:06	EN	35° 44.994'	N	22° 24.988'	E	-			
POS_414	363	1	CTD	08.06.11	09:47	BE	35° 15.004'	N	22° 24.999'	E	3779			-
					10:55	BO	35° 14.994'	N	22° 24.988'	E	3784	3934,2	15,2	
					12:12	EN	35° 15.010'	N	22° 24.993'	E	3779			
POS_414	364	1	CTD	08.06.11	16:06	BE	34° 45.004'	N	22° 24.997'	E	2895			-
					17:01	BO	34° 44.998'	N	22° 24.998'	E	2940	3002,1	12,3	
					18:03	EN	34° 44.996'	N	22° 24.988'	E	2897			
POS_414	365	1	CTD	08.06.11	21:25	BE	34° 17.003'	N	22° 24.995'	E	2131			-
					22:04	BO	34° 16.995'	N	22° 25.015'	E	2089	2142,5	36,9	
					22:47	EN	34° 16.991'	N	22° 25.009'	E	2098			
POS_414	366	3	CTD	09.06.11	14:46	BE	35° 03.992'	N	20° 21.005'	E	2903			down profile interupted
					15:03	BO	35° 04.003'	N	20° 21.002'	E	2903	3004,5	10,8	at 1900-2140 dbar, because
					16:09	EN	35° 03.998'	N	20° 21.001'	E	2903			winch had to be repaired
POS_414	367	1	CTD	10.06.11	00:11	BE	35° 03.932'	N	19° 00.109'	E	3522			-
					01:17	BO	35° 03.935'	N	19° 00.087'	E	3514	3647,6	19,2	
					02:30	EN	35° 03.934'	N	19° 00.091'	E	3515			

POS_414	368	1	CTD	10.06.11	06:55	BE	35° 30.002'	N	18° 29.990'	E	3921			-
					08:06	BO	35° 30.000'	N	18° 30.005'	E	3922	4089	12	
					09:21	EN	35° 29.997'	N	18° 30.014'	E	3924			
POS_414	369	1	CTD	10.06.11	14:16	BE	35° 00.008'	N	18° 00.008'	E	3961			-
					15:31	BO	35° 59.999'	N	18° 00.005'	E	3956	4125	12	
					16:51	EN	35° 00.004'	N	18° 00.012'	E	3952			
POS_414	370	1	CTD	11.06.11	02:02	BE	37° 07.994'	N	18° 55.001'	E	3298			-
					03:03	BO	37° 07.994'	N	18° 55.003'	E	3294	3426	10	
					04:16	EN	37° 08.000'	N	18° 55.000'	E	3293			
POS_414	371	1	CTD	11.06.11	10:51	BE	37° 54.017'	N	19° 18.001'	E	3223			-
					11:53	BO	37° 53.997'	N	19° 18.007'	E	3222	3346	8,2	
					13:10	EN	37° 54.027'	N	19° 17.985'	E	3228			
POS_414	372	1	CTD	12.06.11	22:26	BE	37° 06.992'	N	18° 00.002'	E	3256			bottle 3 leaked a bit
					23:27	BO	37° 07.000'	N	17° 59.998'	E	3257	3378	8,4	
					00:37	EN	37° 07.000'	N	17° 59.998'	E	3252			