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ISTITUTO DI SCIENZE MARINE**

REPORT ON THE OCEANOGRAPHIC, MORPHOBATHYMETRIC, GEOLOGICAL AND GEOPHYSICAL ACTIVITIES DURING CRUISE ADR0208 (17-28 october 2008, R/V *URANIA*, ADRICOSM-STAR PROJECT)

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ISMAR-ISAC-CNR Interim Technical Cruise Report

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REPORT ON THE OCEANOGRAPHIC, MORPHOBATHYMETRIC, GEOLOGICAL AND GEOPHYSICAL ACTIVITIES DURING CRUISE ADR0208 (R/V R/V *Urania* , ADRICOSM-STAR PROJECT) , by

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Abstract - We present the shipboard activities and results of Cruise ADR0208 on R/V *Urania* (17-28 october 2008) on Southern Adriatic Sea. Oceanographical, geological and geophysical works were performed on italian, montenegrinian and albanian margins, other than in the central basin. The cruise was scheduled to (a) acquire classic hydrological and bio-geochemical data and hyperspectral radiation profiles on the water column, (b) initiate the systematic mapping of the montenegrinian and albanian shelf areas by Multibeam and CHIRP SBP, and (c) recover, service and redeploy an instrumented mooring in the center of the South Adriatic Sea. Most of the proposed work have been performed, and some results are presented hereinafter, alongwith tecnical details on procedures and instrumentation.

Sommario - Vengono presentate le attivita' ed i risultati preliminari della crociera ADR0208 con R/V *Urania* , (17-28 ottobre 2008) in Adriatico Meridionale. La campagna era stata progettata per (a) la raccolta di dati oceanografici, biogeochimici e di profili di radiazione iperspettrali nella colonna d'acqua, (b) l'inizio di rilievi sistematici di batimetria e sottofondo con 'multibeam' e CHIRP, e (c) recuperare e reinstallare una catena strumentale profonda. La quasi totalita' del lavoro previsto e' stato effettuato, e di seguito vengono presentati alcuni dei risultati ottenuti, assieme alle metodologie e alle strumentazioni impiegate.

ACRONYMS

ACRONYM	DESCRIPTION	URL-email
CNR	Consiglio Nazionale Delle Ricerche	www.cnr.it
GNOO	Gruppo Naz.Oceanografia Operativa	gnoo.bo.ingv.it
ADRICOSM	ADRIatic sea integrated COastal areaS	gnoo.bo.ingv.it/adricosm
ADRICOSM-STAR	ADRICOSM integrated river basin an coastal zone management system: Montenegro coastal area and Bojana river catchment	gnoo.bo.ingv.it/adricosm-star
MEDPOL	Programme for the Assessment and Control of Pollution in the Mediterranean region	http://195.97.36.231/medpol
ISAC	Institute of Atmospheric Sciences and Climate	www.isac.cnr.it
ISMAR	Istituto di Scienze Marine	www.ismar.cnr.it
UNITUS	Universita' della Tuscia, Viterbo	www.unitus.it
INOGS	Ist.Naz.Oceanografia e Geofisica Speriment.	www.ogs.trieste.it
CMCC	Centro Euro-Mediterraneo per i Cambiamenti Climatici	CMCChttp://www.cmcc.it
PDS-2000	RESON	www.reson.com/sw1738.asp
SBE	Sea Bird Electronics	www.seabird.com
SIPPICAN	Sippican Corp.	www.sippican.com
BENTHOS	Teledyne Benthos	www.benthos.com
SWAN-PRO	Communication Technology	www.comm-tec.com
GMT	Generic Mapping Tool	gmt.soest.hawaii.edu/gmt
CDOM	Colored Dissolved Organic Matter	
TSM	Total Suspended Matter	
MBES	Multibeam Echosounder System	
SBP	Sub Bottom Profiling	
SVP	Sound Velocity Profile	
CTD	Conductivity/Temperature/Depth	
ADW	Adriatic Deep Water	
LIW	Levantine Intermediate Water	
GPS-DGPS-RTK	Global Positioning System	samadhi.jpl.nasa.gov
DTM	Digital Terrain Model	en.wikipedia.org

Table 1: Acronyms of Organizations, Manufacturers and Products

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1 INTRODUCTION

Cruise ADR02_08, coordinated by ISAC-CNR, is dedicated to the ADRICOSM-STAR project (co-ordinating Institution CMCC, scientific Coordinator Prof. Nadia Pinardi) and this year's MED-POL project phase. ADRICOSM-STAR "... aims at the development and partial implementation of an integrated coastal area and river and urban waters management system that considers both observational and modelling components." The research area is the Montenegro and Albanian coastal and marginal zone, inclusive of Kotor Bay (Boka Kotorska). The project involves 19 public and private partners from Italy, Montenegro, Serbia and Albania and has a duration of 3 years starting from March 2007.

MEDPOL objectives are (citing the MEDPOL website):

- to present periodical assessments of the state of the environment in hot spots and coastal areas (needed to provide information for decision makers on the basic environmental status of the areas which are under anthropogenic pressures);

- to determine temporal trends of some selected contaminants in order to assess the effectiveness of actions and policy measures, and

- to enhance the control of pollution by means of compliance to national/international regulatory limits.

Participating countries are: Albania, Algeria, Croatia, Cyprus, Greece, Israel, Morocco, Slovenia, Syria, Tunisia and Turkey.

The cruise objectives is:

- To acquire classic hydrological data of the area

- To acquire geochemical data of the water column in the area

- To acquire marine biological data of the area

- To acquire hyperspectral radiation profile data of the area

- To initiate the systematic mapping of the study zone sea bottom and sub-bottom with Multibeam and CHIRP technology

- To collect sediment data in selected stations for pollutant analysis

- To recover, service and redeploy an instrumented mooring in the center of the South Adriatic Sea.

The cruise hydrological data will be used to generally characterize water masses and to map the extension of coastal waters into the open sea and to assess their mixing. Also, the data will be used in the ADRICOSM-STAR data assimilation effort in circulation modelling.

The cruise hydrological, geochemical (colored dissolved organic matter, total suspended matter, hereafter CDOM and TSM, respectively), biological (chlorophyll) and hyperspectral radiation data will be analysed to implement a regional algorithm for the estimation of chlorophyll via remote sensing ocean color imagery of the coastal zone (Case II waters, CDOM and generally TSM rich which modulate remotely sensed reflectances in the visible bands, thus masking the chlorophyll radiometric signal).

Multibeam and CHIRP data will be used to assess the geological and surficial and subsurficial morphological setting, other than help to update bathymetric maps. Among the settings we may cite sediment transport pathways, such as accumulation and erosion areas, and risk and hazard studies. In addition, high resolution bathymetric data will be used to construct digital terrain models useful for regional modelling of wave and current dynamics. As a result of this investigation the owners of the data will also be able to produce environmental and geological maps at variuos scales. In particular, Kotor Bay data, along with pollution data from sediment samples, will be used to optimize the wastewater disposal effort in environmentally safe conditions.

The data relative to the mooring chain will extend the existing hydrological and current multi-year dataset dedicated to the understanding of the Adriatic Sea circulation dynamics, particularly in relation to the interannual variability of winter convection events.

This paper reports the shipboard activities during the cruise, including description of the ship, equipment and their usage, along with details of the general settings, performances and some scientific and technical results.

Data Sampling And Acquisition

The study area has been sampled along the transects shown in the map (see below). Such transects cover the Montenegrin and Albanian coastal zone as well as two coast-to-coast open Adriatic Sea transects. Bio-optical and hydrological sampling was performed during the daylight hours, while Multibeam/CHIRP sampling was carried out at night.

Hydrological measurements include:

- CTD vertical profiles (pressure, temperature, conductivity, dissolved oxygen, light transmission, fluorimetry)

- Rosette water samples (nutrients, pigments, phytoplankton species, CDOM, TSM, dissolved O2 and salinity, the latter two to calibrate CTD sensors)

Bio-optical measurements include:

- SATLANTIC hyperspectral profiles of upwelling radiance and downward irradiance (350-700 nm range);

- T-FLAP expendable probe fluorescence profiles

Surface measurements include:

- Continuous meteorological standard observations (p, T, humidity, wind speed and direction);

- continuous surface T and S recording.

Biological and biogeochemical measurements include:

- Inorganic nutrients and total nitrogen and phosphorus concentrations;

- Oxygen concentration;

- Chlorophyll concentration;

- Phytoplankton pigment composition;

- Particulate organic matter concentration and composition;

- Incubation experiments to determine primary production;

Water samples were prepared and stored on board following standard protocols and procedures Some analysis would be performed on board, among them salinity and oxygen determination on bottle samples, DOM, Clorophyll.

In addition to the above, CHIRP SBP and Multibeam bathymetric data were acquired allover planned routes or during transits, and the seafloor was sampled by grab in predetermined stations or according to findings on the way.

1.1 Geological and Oceanographical Setting

Geological setting

The Montenegrinian and Northern Albanian margins and coastal areas are part of the seismically active W-verging Dinaride/Albanide fold-and-thrust belt along the eastern Adriatic basin boundary (see Fig.1). The margins have relict shelf edge, with sediment stored on the albanian coastline, and evidence of large-scale mass wasting [Argnani et al.(2006)], [Roure et al.(2004)]. The continental shelf is very narrow from N in Croatia to C. Patamuni S of the Bay of Kotor, near Budva, where it develops offshore down to C.Rodonit.

The seismic activity is present in the study area as moderate to strong intensity events. In particular, it must be cited the M6.9 destructive event of 1979-04-15 and aftershock in the Bar region [Console and Favali(1981)], [Boore et al.(1981)], whose epicenter was located offshore 5-10 NM, at the most external thrust. The area south of the mouth of Bujana River to W and SW of Cape Rodonit is also seismically active, being interested by a WNE pure-compression thrust and by ENE trending strikeslip faults [Aliaj et al. (2004)], [Aliaj (2008)]. According to [Tiberti et al.(2008)] and therein cited authors, the events have large potential for generating tsunamis.

Because of karst environment in the Dinaric range, especially in N Montenegro, coastal aquifers may also develop at sea with submarine syphons, springs and resurgences, within a geological and hydrogeological setting strongly related to tectonics and to past and future climate and sea level fluctuations [Fleury et al.(2007)]

Oceanographical Setting

The dynamics of the Southern Adriatic is dominated by the presence of a quasi-permanent cyclonic gyre that in the winter season creates the conditions for the open-ocean convection and the production of dense and oxygenated waters. Studies show that two types of dense water formation processes occur during winter within the Adriatic Sea: the major portion of the Adriatic Deep Water (ADW) is formed through open ocean convection inside the Southern Adriatic Pit (SAP) within the cyclonic gyre, while the remaining dense water is formed on the continental shelf of the Northern and Middle Adriatic that moves southward and ultimately sinks to the bottom of the SAP ([Ovchinnikov et al. (1985)][Bignami et al. (1990)] [Malanotte-Rizzoli (1991)]). The eastern margin is characterized by the influence of the incoming water of Ionian origin which flow northward being restricted mainly to the continental slope. This area is interested by the Levantine Intermediate water (LIW) that occupies the layer between 150 and 600m.

The coastal zone of Albanian and Montenegro in the eastern margin consists of a narrow shelf area North of the Strait of Otranto, with smooth bathymetry and with circulation features presumably determinate by inflowing Ionian waters, by local winds, and by relatively large amounts of the riverine inflow. The latest provide a strong contribution to the Adriatic freshwater budget, in a way that their influence in feeding the freshwater coastal zone is sometimes felt far downstream along the Croatian coast . The current state of knowledge of oceanographic characteristics of the Albanian shelf is very limited due to very small number of in-situ oceanographic studies that have been undertaken in the area. Numerical simulations and satellite infrared images indicates that the circulation on the Albanian shelf responds strongly to the local wind forcing [Bergamasco and Gačič (1996)]. More specifically, the northeasterly wind generates very intense coastal upwelling along the Albanian shoreline due to the sudden change of the coastline orientation in that area. Bora wind induces an undercurrent at intermediate depths near the Albanian shelf break, which is directed in the opposite direction of the Levantine Intermediate Water (LIW) inflow from the Ionian. Therefore, in addition to coastal upwelling, Bora in the Strait of Otranto weakens and occasionally blocks completely the LIW inflow.
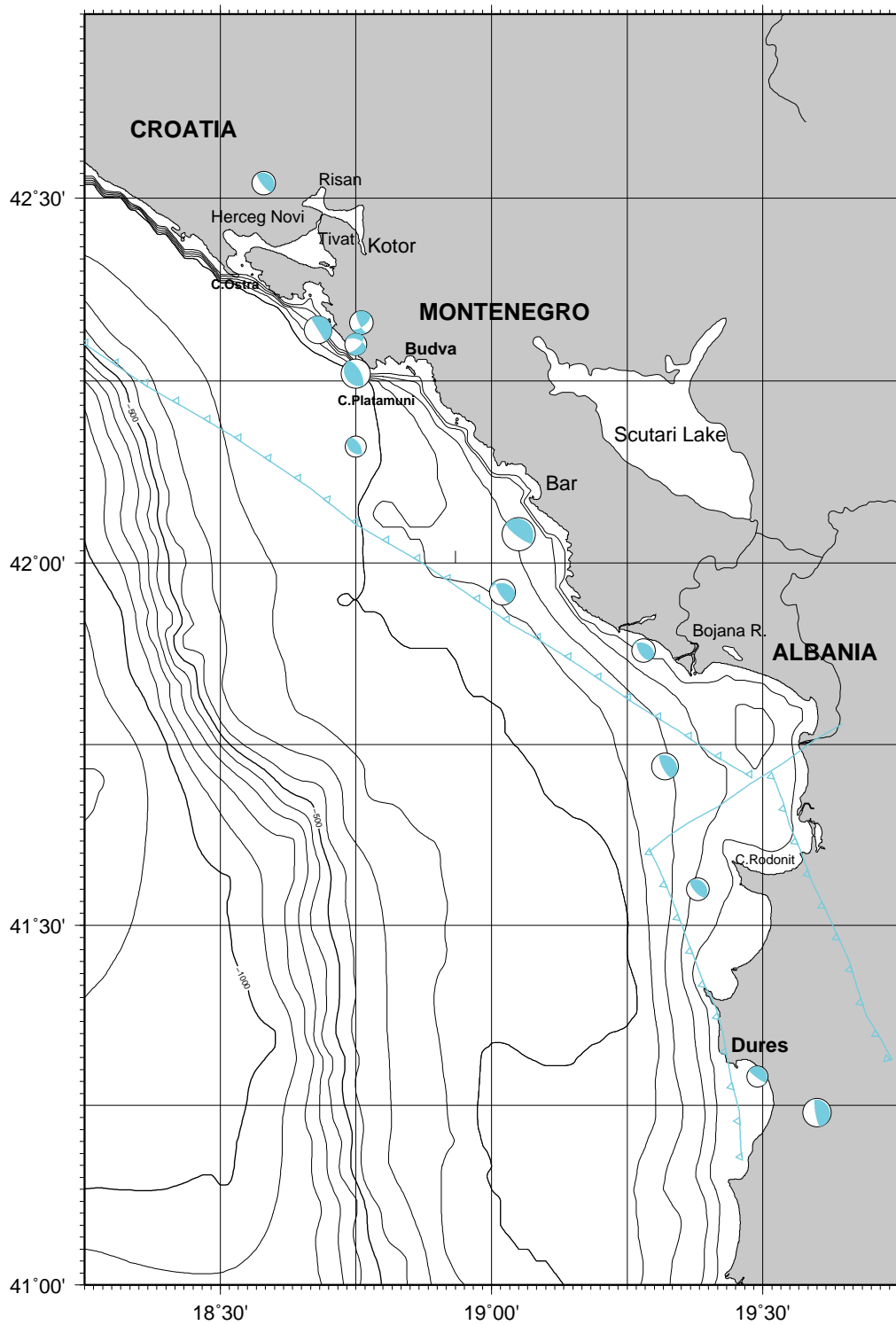
Figure 1: Geological setting of Montenegro-Albania. Structural lineaments, left and rigth fronts, strike-slip transform fault from [Aliaj et al. (2004)] and [Aliaj (2008)]. Centroid moment tensor solutions by [Pondrelli et al.(2006)]. Bathymetry by GEBCO.

2   CRUISE SUMMARY

SHIP: R/V *Urania*
START: 2008-10-17 PORT: Bari
END: 2008-10-29 PORT: Bari
SEA/OCEAN: Southern Adriatic Sea, Mediterranean Sea
LIMITS: NORTH 43 SOUTH: 40:30 WEST: 17:00 EAST: 19:00
OBJECTIVE: HYDROGRAHIC AND GEOLOGICAL SURVEY
COORDINATING BODIES: ISAC-CNR
CHIEF OF EXPEDITION: Dr. Francesco Bignami
CONTACT: F.Bignami@isac.cnr.it
DISCIPLINES: PHYSICAL AND BIO-GEOCHEMICAL OCEANOGRAPHY, SWATH BATHYMETRY, GEOPHYSICS
WORK DONE: 77 WATER SAMPLING AND CTD STATIONS, 7 FLAP-XBT LAUNCHES, 26 Hyperspectral Profiles
11 GRABS, 2600 KM SBP, about 200 KM^2 Of SWATH MULTIBEAM.

LOCALIZATION:
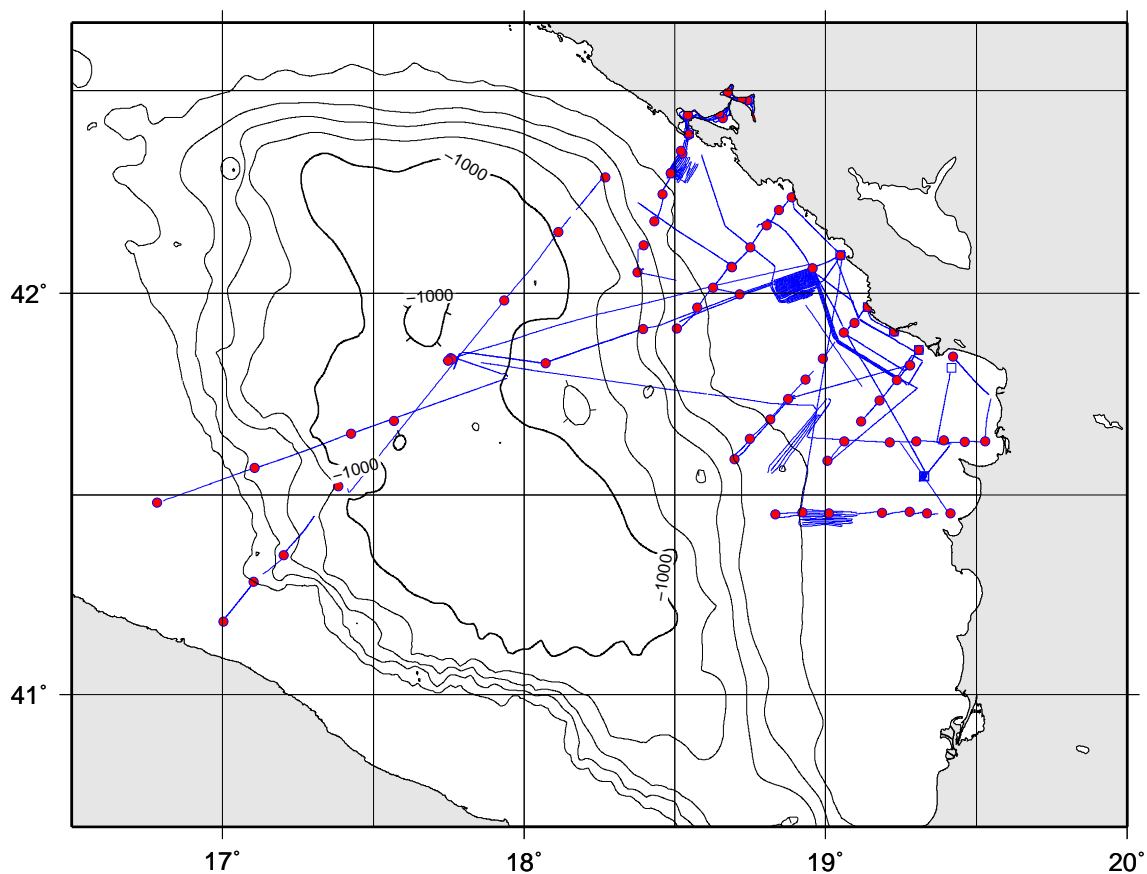
Figure 2: Whole ship track during Cruise ADR0208 in the Southern Adriatic Sea. Blue circles are CTD stations. Red squares are Grab Stations.
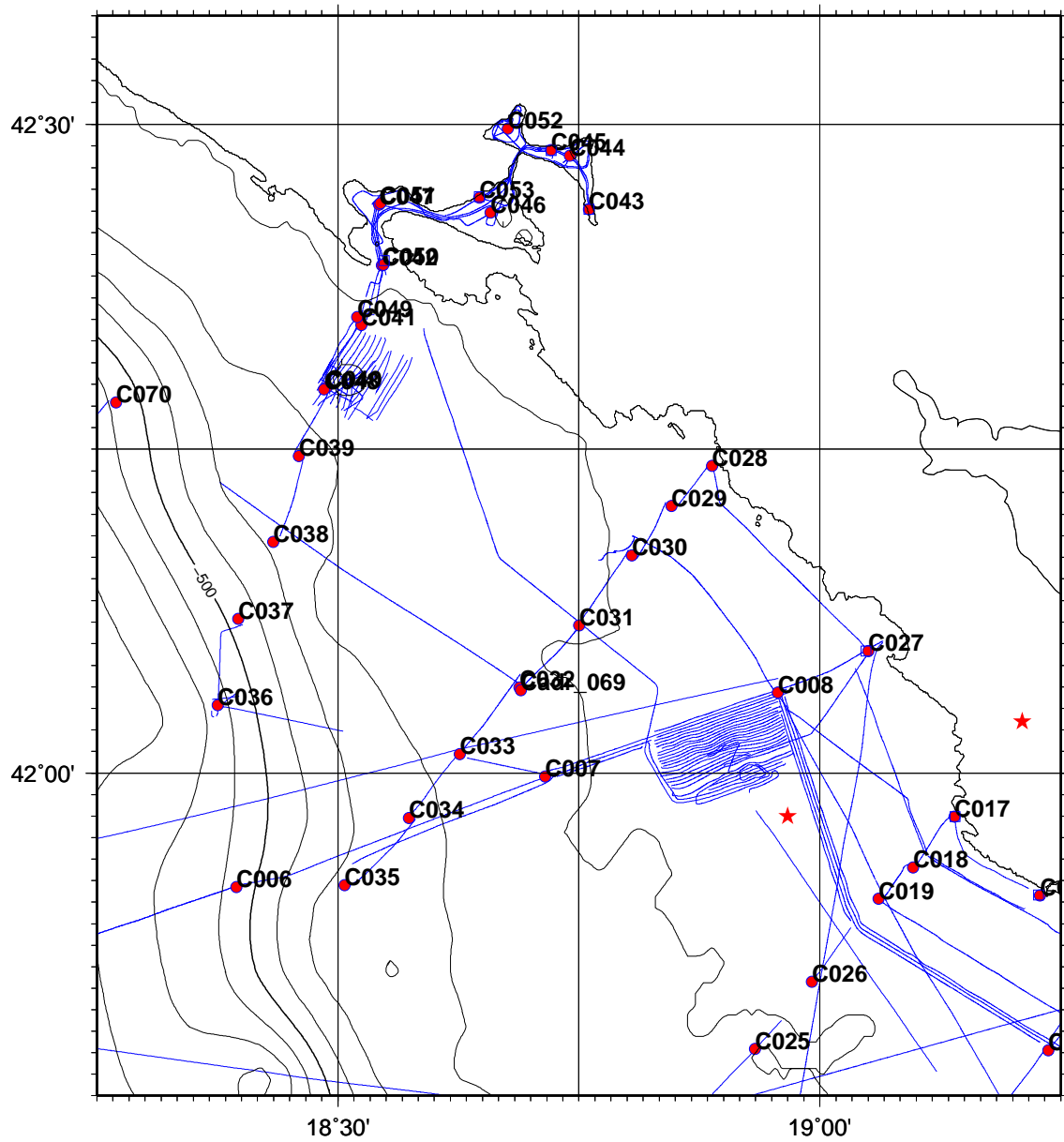
Figure 3: Whole ship track during Cruise ADR0208 in the Montenegro Area. Blue circles are CTD stations. Red squares are Grab Stations.
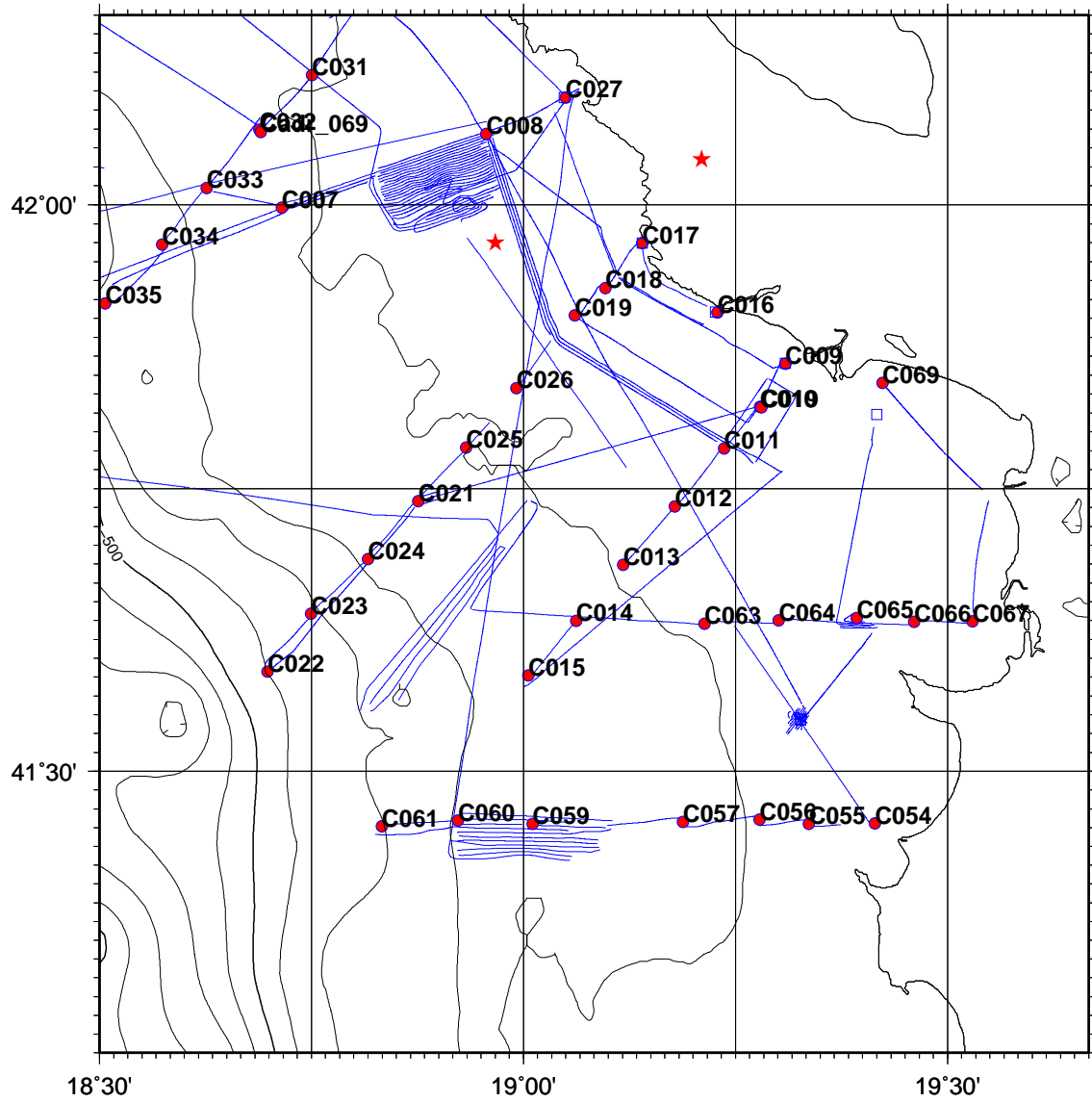
Figure 4: Whole ship track during Cruise ADR0208 in the Albania-Montenegro Area. Blue circles are CTD stations. Red squares are Grab Stations.

SCIENTIFIC AND TECHNICAL PARTIES

PARTICIPANTS	ORGANIZATION	EXPERTISE	tel & email & www
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Radomi Zujovic	IMB, Kotor		
Alexandar Jovičić	IMB, Kotor		jovicic.alexandar@gmail.com

Table 2: Scientific and technical parties

3   MATERIALS AND METHODS

The research cruise was carried out with the 61 meter R/V *Urania* (Fig. 5), owned and operated by SO.PRO.MAR. and on long-term lease to CNR. Ship is normally used for geological, geophysical and oceanographical work in the Mediterranean Sea and adjoining waters, including but not limited to, the Atlantic Ocean, the Red Sea, and the Black Sea.

Figure 5: R/V *Urania* .

R/V *Urania* is equipped with DGPS positioning system (satellite link by FUGRO), single-beam and multibeam bathymetry and integrated geophysical and oceanographical data acquisition systems, including ADCP, CHIRP SBP and other Sonar Equipment, other than water and sediment sampling. Additional equipment can be accommodated on the keel or towed, e.g. Side Scan Sonars.

3.1 NAVIGATION, SWATH BATHYMETRY, CHIRP SBP DATA ACQUISITION

The vessel was set-up for multibeam data acquisition and navigation with PDS-2000 software by RESON.

One workstations was used for the acquisition of multibeam data, interfacing by a multiserial and Ethernet link a RESON 8160 P1 processor, an TSS MAHRS MRU and FOG compass, DGPS receiver (Fugro Omnistar), by a MOXA Multi/serial I/O, TC/P and UDP network sockets. The MBES was the 50kHz, 126 0.5°, 150°aperture RESON 8160 (5000 m range). The sonar head is positioned on the ship's keel using a V-shaped steel frame. A Sound Velocity probe at the Sonar Head is interfaced directly to the MBES processor, thus providing the necessary real-time data for the beam-forming. XBT and CTD casts are normally used for input of the sound velocity profile to the system. An Anderaa Meteorological Station was also made available, at a rate of one measurement every 5 minutes.

The PDS-2000 project was built using the UTM projection, Zone 33. The instrumental offsets (PDS-2000) are presented in Fig. 6 and in Tab. 3

POSITION	ACROSS	ALONG	HEIGHT
REFERENCE POINT	0.00	0.00	0.00
DGPS	1.64	14.30	14.18
MBEAM	0.00	14.36	-4.96
MAHRS	0.00	0.0	-3.40
ECHO SOUNDER 33	5.50	-1.85	-3.80
CHIRP	-1.0	11.80	-4.00
A-FRAME	6.5	-6.70	0.0
STERN	0.00	-30.60	0.00

Table 3: Instrumental Offsets on Ship Urania (PDS2000). The GPS antenna (primary positioning system) is located on point DGPS.
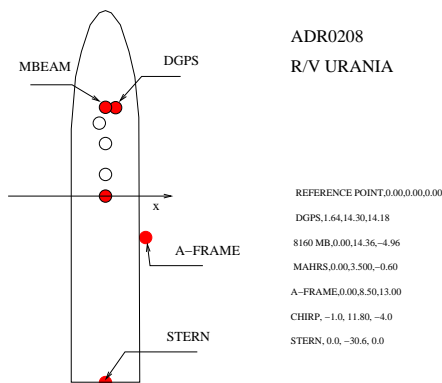
Figure 6: Cruise ADR0208. Instrumental Offsets (PDS-2000) on R/V *Urania*

MULTIBEAM BATHYMETRY

The PDS-2000 was able to build real-time DTM at the resolution of 20, 5 and 2.5 during the acquisition of the entire surveyed areas. The multibeam datasets will therefore be used for an up-to-date regional and local bathymetric compilation.

CALIBRATION

Some lines were acquired for testing calibration of the multibeam. Heading and pitch values will be easily found, whereas roll values will be difficult to achieve due to the extremely rough

bottom morphology. However, we are confident that any misalignement will be found and, possibly, recovered, using the entire data set of lines.

CHIRP SBP

A Teledyne Benthos CHIRP SBP system (16 hull-mounted transducers) was used. The data were acquired by the SWANPRO software by Communication Technology, with direct interfacing to the DGPS, therefore actual positioning data have to be converted according to the offsets of Tab.3. The system setting (multiping mode) was: power full, length 20ms, trigger rate variyng from 0.5 to 0.687 s,gain 9dbm preamp gain ranging from 1.5 to 3 db. The data were recorded in the XTF format and converted also into the SEG-Y format for processing with ISMAR's SEISPRHO package [Gasperini and Stanghellini(2008)].

3.2 OVERVIEW OF OCEANOGRAPHICAL SAMPLING STRATEGY, SAMPLE TREATMENT AND ONBOARD ANALYSIS

3.1 CTD CASTS AND WATER SAMPLING

CTD and rosette sampling casts were taken on surveyed area. Conductivity (SBE-4,$3x10^{-4}$ S/m initial accuracy), temperature (SBE-3/F, $1.0x10^{-3}$ °C) and oxygen (SBE-13, $4.3x10\mu\lambda l^{-1}$), PAR (depth < 1000m), light transmission and fluorimetry data were collected by a Seabird SBE 11 PLUS using the SEASAVE V5.33 software. The pressure data were measured by a ParoScientific Digiquartz (0-6000m, accuracy 0.1%). Data were acquired at 24Hz and the descent rate was aproximately 1 m/s, much less when close to bottom or on interesting interfaces.

The conversion from pressure to depth on the SEA-SAVE software was done at latitude 41N. The WHOI-UNESCO package was also used for converting to the 42N for comparison. A General Oceanics rosette sampler with 24 10l capacity Niskin bottles was employed for water sampling. DGPS NMEA Position data were interfaced directly to the CTD acquisition systems.

The position of the CTD stations together with some relevant data are reported in Tables 5, and can be viewed in Fig. 2, 3 and 4.

The recorded data were converted to the CNV and ASCIIOUT (for CTD) formats and further plotted with the ODV software [Schlitzer(2004)]. The Sound Velocity data from the acquired profiles were made available for import into the PDS-2000 software for multibeam data corrections.

Oxygen data on the water samples were verified by Winkler titration method.

The slow-descending, free fall Profiler II Ocean profiler by SATLANTIC was used for hyperspectral investigation on upper water column.

UNITUS's T-FLAP, a new launchable probe developed to perform temperature and fluorescence profiles was tested diring the cruise. Five of them were launched in order to study sensors response, at different trophic conditions.

Two special T-FLAP were launched to verify the hydrodynamic behavior in the water column: these probes were equipped with three-axial-accelerometers, pressure transducer, gyroscope. Table 6 shows the launch data. Chlorophyll a, TSM and CDOM samples were taken from the CTD bottles at different depths, in order to calibrate probe measures.

During the launch communication problems occurred to the 2 special T-FLAP: we acquired data till 13m depth.

Table 4 shows the oceanographic instrumentation used, recovered and deployed during the Cruise.

Instrument	Property of	Serial number	Calibration Date
Rosette Water Sampler 24 bottles	Urania		
CTD SBE 911 plus	Urania		
AANDERAA weather pack	Urania		
Primary temperature	OGS	1717	2008-07-01
Primary conductivity	OGS	3442	2008-07-01
Secondary temperature	R/V URANIA	4440	2008-02-02
Secondary conductivity	R/V URANIA	3172	2008-02-02
SPAR	R/V URANIA	6279	2008-06-27
fluorometer Chelsea Aquatracka III	R/V URANIA	065600-001	2007-10-12
Transmiss. Chelsea/Seatech/Wetlab CStar	R/V URANIA	954DR	2006-03-30
Oxygen SBE43	R/V URANIA	1029	2008-02-23
Oxygen SBE43	R/V URANIA	0078	2005-12-23
Datasonics Altimeter	R/V URANIA	43697	
DOSIMAT 665 METROHM	CNR-ISMAR Ancona	4M7/388	
716 DMS TITRINO METROHM	CNR-ISMAR Ancona		
760 Sampler METROHM	CNR-ISMAR Ancona		
CDOM Perkin Elmer Spectrophotometer	CNR-ISMAR Ancona		
CDOM filtration apparatus	CNR-ISMAR Ancona		
TSM filtration apparatus	CNR-ISMAR Ancona		
Chlorophyll-a filtration apparatus	UNITUS		
T-FLAP expendable probes	UNITUS		
Chlorophyll-a filtration apparatus	St.Zool."A.Dohrn" Napoli		
HPLC filtration apparatus	St.Zool."A.Dohrn" Napoli		
SATLANTIC optical profiler	St.Zool."A.Dohrn" Napoli		
Sediment traps	CNR-ISMAR Bologna		
MOORING INSTRUMENTATION	OGS		

Table 4: Oceanographic instrumentation on Cruise ADR02_08 .

Basically, three types of CTD-casting were defined: SW) Sea-water column measurement, BT) Sea-water column measurement and sampling, OM) optical measurements with CTD PAR, SAT-LANTIC hyperspectral profiler and T-FLAP expendable probes.

Different tasks were accomplished on board by any group and specific sample-collection procedures were established according to widely accepted schemes.

Water samples were filtrated immediately upon collection, and some analysis were performed onboard, i.e. O_2 and CDOM. The samples were stored in refrigerator at 4 and -20 ℃for analysis at the labs (among them TSM, Clorophyll and many others, see Chapter 3.4).

Table 5 shows the CTD and water sampling stations.

Table 5: CTD data from SBE files (asciiout program).

LON	LAT	STATION	DATE TIME	PRES(db)	DEPTH(m)
1646.9500	4128.7900	C001	2008-10-17T19:42:10	107.0	106.1
1706.3400	4134.0100	C002	2008-10-17T21:49:56	452.0	448.0
1725.5700	4139.1500	C003	2008-10-18T00:08:53	1142.0	1130.0
1745.3600	4150.3500	C004	2008-10-18T07:39:48	1206.0	1193.1
1804.2600	4149.5900	C005	2008-10-18T14:54:26	1218.0	1204.9
1823.6800	4154.7000	C006	2008-10-18T18:10:11	728.0	721.0
1842.9000	4159.8400	C007	2008-10-18T20:33:30	129.0	127.9
1857.3800	4203.7300	C008	2008-10-18T22:32:33	63.0	62.5
1918.5200	4151.6100	C009	2008-10-19T10:46:16	13.0	12.9
1916.7300	4149.3300	C010	2008-10-19T12:27:16	46.0	45.6
1914.2100	4147.1100	C011	2008-10-19T13:42:19	67.0	66.5
1910.7200	4144.0500	C012	2008-10-19T14:50:29	79.0	78.4

1907.0600	4140.9700	C013	2008-10-19T15:47:03	91.0	90.3
1903.7300	4137.9900	C014	2008-10-19T17:08:54	124.0	123.0
1900.3500	4135.1000	C015	2008-10-19T18:34:01	151.0	149.8
1913.7100	4154.3100	C016	2008-10-20T06:28:03	9.0	8.9
1908.3900	4157.9700	C017	2008-10-20T07:28:08	15.0	14.9
1905.8000	4155.6100	C018	2008-10-20T08:28:00	62.0	61.5
1903.6400	4154.1700	C019	2008-10-20T10:03:34	75.0	74.4
1916.8400	4149.3100	C019	2008-10-20T11:43:17	46.0	45.6
1852.5700	4144.3300	C021	2008-10-20T14:41:48	124.0	123.0
1841.8900	4135.2800	C022	2008-10-20T16:54:44	461.0	456.9
1844.9600	4138.3600	C023	2008-10-20T19:43:06	320.0	317.3
1848.9900	4141.2500	C024	2008-10-20T20:39:53	191.0	189.4
1855.9500	4147.1700	C025	2008-10-20T21:58:42	100.0	99.2
1859.5000	4150.3100	C026	2008-10-20T22:50:36	89.0	88.3
1903.0000	4205.6600	C027	2008-10-21T05:51:17	44.0	43.6
1853.2900	4214.2400	C028	2008-10-21T07:29:58	31.0	30.8
1850.7600	4212.3700	C029	2008-10-21T08:41:05	74.0	73.4
1848.3000	4210.0900	C030	2008-10-21T09:41:49	89.0	88.3
1845.0200	4206.8500	C031	2008-10-21T10:41:23	103.0	102.2
1841.3100	4203.9700	C032	2008-10-21T11:35:59	130.0	128.9
1837.5900	4200.8900	C033	2008-10-21T13:09:17	170.0	168.6
1834.4200	4157.9100	C034	2008-10-21T14:22:32	202.0	200.3
1830.4200	4154.7900	C035	2008-10-21T15:44:23	304.0	301.4
1822.5300	4203.1500	C036	2008-10-22T06:09:19	517.0	512.3
1823.8000	4207.1500	C037	2008-10-22T07:40:36	391.0	387.6
1825.9700	4210.7100	C038	2008-10-22T08:46:01	274.0	271.7
1827.5600	4214.6900	C039	2008-10-22T09:53:09	200.0	198.3
1829.2800	4217.8500	C040	2008-10-22T11:06:58	144.0	142.8
1831.4700	4220.7500	C041	2008-10-22T12:22:14	120.0	119.0
1832.7300	4223.5000	C042	2008-10-22T13:23:43	57.0	56.5
1845.6200	4226.0700	C043	2008-10-22T15:52:21	20.0	19.8
1844.4300	4228.5500	C044	2008-10-22T16:48:23	30.0	29.8
1843.2800	4228.8000	C045	2008-10-22T17:43:20	60.0	59.5
1839.5000	4225.9300	C046	2008-10-22T19:21:53	36.0	35.7
1832.5700	4226.2900	C047	2008-10-22T20:15:02	38.0	37.7
1829.1300	4217.7600	C048	2008-10-23T07:47:40	167.0	165.6
1831.1900	4221.1000	C049	2008-10-23T09:02:50	120.0	119.0
1832.8200	4223.5200	C050	2008-10-23T10:18:30	58.0	57.5
1832.6400	4226.3500	C051	2008-10-23T11:53:58	38.0	37.7
1840.5600	4229.7900	C052	2008-10-23T14:48:42	855.0	846.5
1838.8100	4226.6100	C053	2008-10-23T19:29:59	29.0	28.8
1924.8800	4127.2300	C054	2008-10-24T07:45:27	9.0	8.9
1920.1900	4127.2100	C055	2008-10-24T08:40:36	44.0	43.7
1916.7100	4127.4200	C056	2008-10-24T09:47:39	84.0	83.3
1911.2800	4127.2900	C057	2008-10-24T11:00:06	123.0	122.0
1900.6600	4127.2100	C059	2008-10-24T12:53:20	122.0	121.0
1855.3800	4127.3700	C060	2008-10-24T13:57:30	191.0	189.4
1849.9800	4127.0700	C061	2008-10-24T15:15:48	322.0	319.2
1745.7400	4150.2000	C062	2008-10-25T16:31:03	1210.0	1197.0
1912.8000	4137.8400	C063	2008-10-26T07:50:54	84.0	83.3
1918.0400	4138.0000	C064	2008-10-26T09:08:53	62.0	61.5
1923.5700	4138.1300	C065	2008-10-26T10:18:44	38.0	37.7
1927.6500	4137.9300	C066	2008-10-26T11:59:07	29.0	28.8
1931.7800	4137.9600	C067	2008-10-26T12:53:23	20.0	19.8
1925.4100	4150.6000	C069	2008-10-26T15:30:42	1.0	1.0

T-FLAP	STATION	COMMENT
651	ADR02_004	(Special T-FLAP)
652	ADR02_004	(Special T-FLAP)
613	ADR02_069	(ADRICOSM 1-5)
625	ADR02_070	(AM9)
611	ADR02_072	(AM7)
621	ADR02_075	(AM5)
628	ADR02_078	(AM2)

Table 6: T-FLAP launches during Cruise ADR02_08 R/V *Urania* along Dubrovnik-Bari transect.

3.3 BOTTOM SAMPLING

Bottom samples were taken by a 50L Modified VanVeen Grab, and were split between ISMAR and IBMK. Some samples were washed and sieved on board. Table 7 shows the positioning data of the stations.

LON LAT DEPTH	STA	DATE TIME	LITHOLOGY	COMMENT
1918.5276 4151.6303 17.0	GR01	19-10-2008 11:27:19	sand, sandy clay	rare clasts
1913.6030 4154.3320 11.0	GR02	20-10-2008 06:43:49	silty clay, sandy clay	compact
1908.4100 4157.9680 18.0	GR03	20-10-2008 07:48:24	sandy clay	sandy
1902.8804 4205.6673 48.0	GR04	21-10-2008 06:05:55	clay, clay	plastic
1832.8799 4223.7210 56.0	GR05	22-10-2008 13:58:46	clay, silty clay	
1845.6229 4226.0791 22.0	GR06	22-10-2008 16:05:16	mud, mud	rare clasts, olive, hydrated, bioturbated
1843.2706 4228.7953 67.0	GR07	22-10-2008 18:00:24	sandy clay, sandy clay	hydrated, well preserved corals, briozoa, shell fragments
1838.7905 4226.6545 53.0	GR08	23-10-2008 19:47:16	uniform sandy mud	grey-olive gray, plastic, rare coarse fragments, benna eu11 bijela
1925.0152 4148.9307 30.0	GR09	26-10-2008 16:59:57	uniform olive clay	anoxic on surface, bioturbated
1919.6193 4132.7755 82.0	GR10	27-10-2008 00:10:14	plastic olive dark green	more compact clay
1919.6216 4132.7317 50.0	GR11	27-10-2008 00:27:46	olive gray hydrated sandy mud	gray to dark gray sandy mud

Table 7: Grab Stations positions. Lat/lon data expressed as DDMM.xxxx. Time is UTC. POS=TRUE, position true on bottom, POS=DGPS, position on DGPS, with heading.

3.4 DATA PROCESSING SEQUENCES

CTD data (at OGS, Trieste and ISAC-CNR Roma)

CTD data will undergo the following post-processing steps:

- application of pressure, fluorimeter, transmissometer offsets measured on board via dry casts on deck (CTD only)

- de-spiking and eventual linear interpolation of missing data in profiles; Winkler - CTD O2 regression coefficient calculation and correction of oxygen sensors (CTD only)

- production of final 1 dbar and 1 m averaged CTD downcast database

Meteo-marine data time series (at ISAC-CNR Roma)

Meteorological and sea surface temperature and conductivity recordings will undergo the following processing:

- Extraction of binary data into ASCII format

- de-spiking and linear interpolation of missing data in time series

- production of final low-pass filtered meteo-marine (bandpass to be decided on the basis of international standards and/or scientific requirements).

Bio-optical data

Bio-optical data will be processed to obtain inherent and apparent optical properties.

- Apparent Optical Properties;
  - Sub-surface remote sensing reflectance

  - Normalized water leaving radiance

  - Sub-surface Irradiance reflectance
- Inherent Optical Properties:
  - 1-meter binned profiles of absorption, scattering and total attenuation

  - 1-meter binned profiles of backscattering
- Biological and biogeochemical data
  - Inorganic nutrients are determined with a colorimetric method (Auto-analyzer);
  - Total N and P are determined with a colorimetric method (Auto-analyzer);;
  - Chlorophyll content is measured with spectrofluorimetric method;
  - Pigments are separated and quantyfied by HPLC analysis;
  - Particulate N and C is quantified with CHN elemental analyzer;
  - Primary production is obtained from ^{13}C assimilation estimates;
  - Microzooplankton abundance is estimated from individual count;
  - Nanoflagellates concentration is obtained via epifluorescence;
  - Grazing and cannibalism of ciliates is estimated performing analyses on phytoplankton, nanoflagellates and microzooplankton on samples from different degrees of dilution;
  - Isotopic composition is measured by means of a mass spectrometer.

Multibeam and CHIRP data

Multibeam data will be processed by using the PDS-2000 and other industry-standard software, in addition to the O.S. MB-System package. DTM data will be produced, further analyzed and mapped by the O.S. GMT package [Wessel and Smith (1995)]. The CHIRP data will be processed by the ISMAR's O.S. SEISPHRO package [Gasperini and Stanghellini(2008)], to produce enhanced images of the subsurface seafloor, strata geometry, isopachs etc.

Sediment analysis

The sediments will be analyzed for:

- physical properties (granulometry, density, mineralogy)

- chemical properties (N,C by CHN) and stable isotopes delta ^{13}C and ^{15}N, radionuclides $_{210}$Pb and $_{137}$Cs, heavy metals

3.5   MAPPING AND MISCELLANEOUS

During the cruise we have used the 1Km resolution bathymetric data of the SRTM30-PREDICTED dataset by [Becker et al.(2008)]. The lat-lon data were used to produce GMT Netcdf grids, and, after conversion to the UTM33 Projection, for input to the PDS-2000 software. Therefore, we have been able to use them for navigation and planning.

The datum was set to WGS84 and the UTM (zone33) was chosen for navigation, display, and data acquisition. The time zone was set to the UTC for the instrumental data acquisition.

The positioning maps and bathymetric images were produced with GMT [Wessel and Smith (1995)]. The multibeam data were pre processed on board by the PDS2000 and GMT software and ISMAR's routines and scripts, using the PDS-2000 production DTMS or XYZ ASCII converted data.

Photographs and video were taken by digital cameras and video-camera.

4 INITIAL RESULTS

Some initial results are presented, in order to address the importance of the preliminary findings and processing sequence of the data acquired.

4.1 OCEANOGRAPHICAL PROFILING

4.1 SATELLITE IMAGERY

Surface chlorophyll fields, remotely sensed by MODIS platforms AQUA and TERRA, were received on board after processing at CNR-ISAC in Rome (6 images in all, files in hdf format). This allowed the visualization of the biological situation of the study area. Figure 7 shows the AQUA image of 22 october 2008 11:15 UTC. It can be seen that most of the study area is essentially oligotrophic, a typical Fall situation, save for the Bojana River plume (center right of the image) and the coatal Albanian waters. Most probably, the high chlorophyll signal in the image is due to a mix of primary production and riverine sediment, CDOM loads (Case II waters) contribution to surface radiance variability. In situ data (e.g. chlorophyll, geochemical and bio-optical data) will be analyzed in order to determine the percentages of the signal due to these two components in order to set up a chlorophyll algorithm for such waters, in which the signal due to phytoplankton is masked/confused by suspended and dissolved matter.
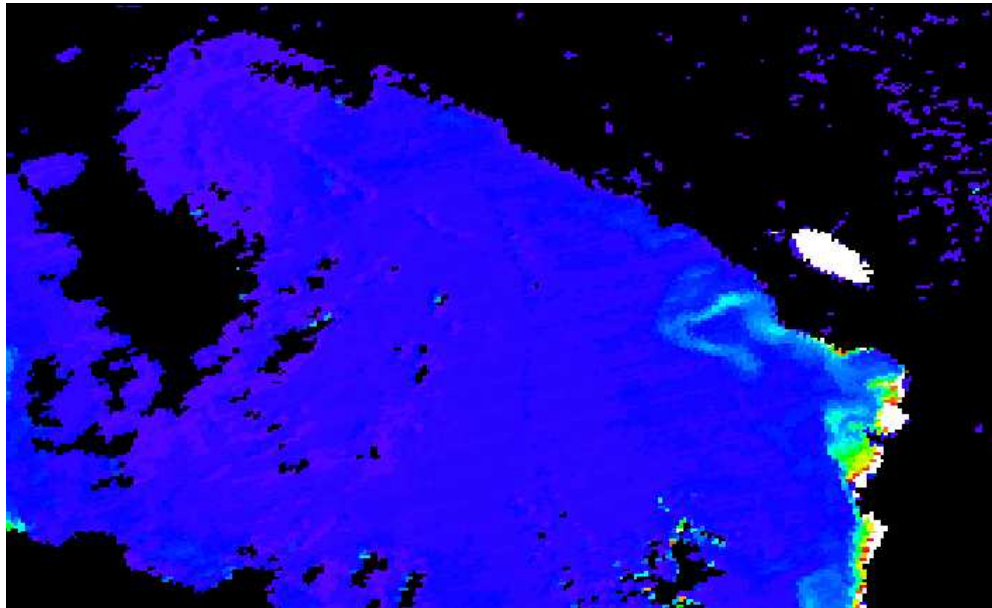
Figure 7: Surface chlorophyll field, remotely sensed by MODIS AQUA, Oct. 22 2008, 11:15 UTC.

4.2 CTD

Figure 8 shows the CTD data of all the samples collected.

CRUISE ADR0208 R/V URANIA

CTD DATA SBE911 Plus

DATE START: 2008–10–17

DATE END: 2008–10–29

Figure 8: Cruise ADR0208. CTD data.

For the sake of showing data quality we present some examples of the oceanographical data collected along transect 2 of ADRICOSM project (stations 63 to 67, Fig.9), i.e. salinity, temperature, O_2,

Figure 9: Cruise ADR0208. CTD data, transect ADRICOSM 2. From top to bottom: O_2, transmissometer, temperature, salinity.

4.3 T-FLAP

Figure 10 shows the calibrated Temperature profile from one of the launches.
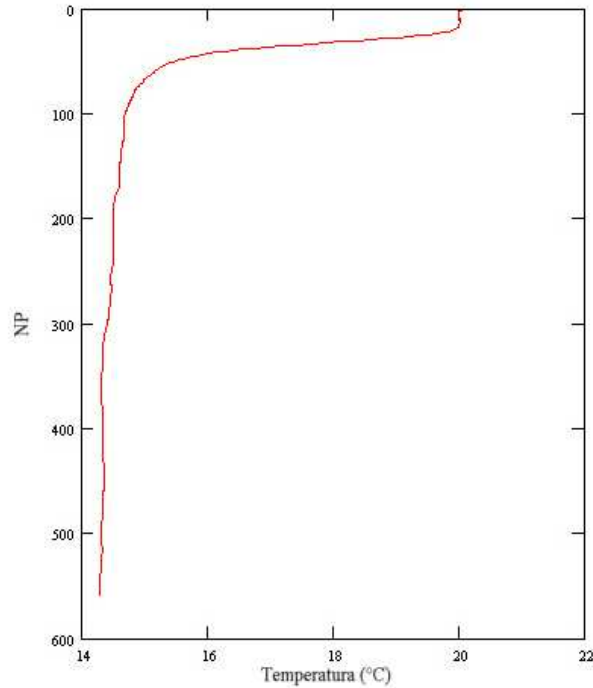
Figure 10: Cruise ADR0208. Calibrated Temperature profile of T-FLAP 625.
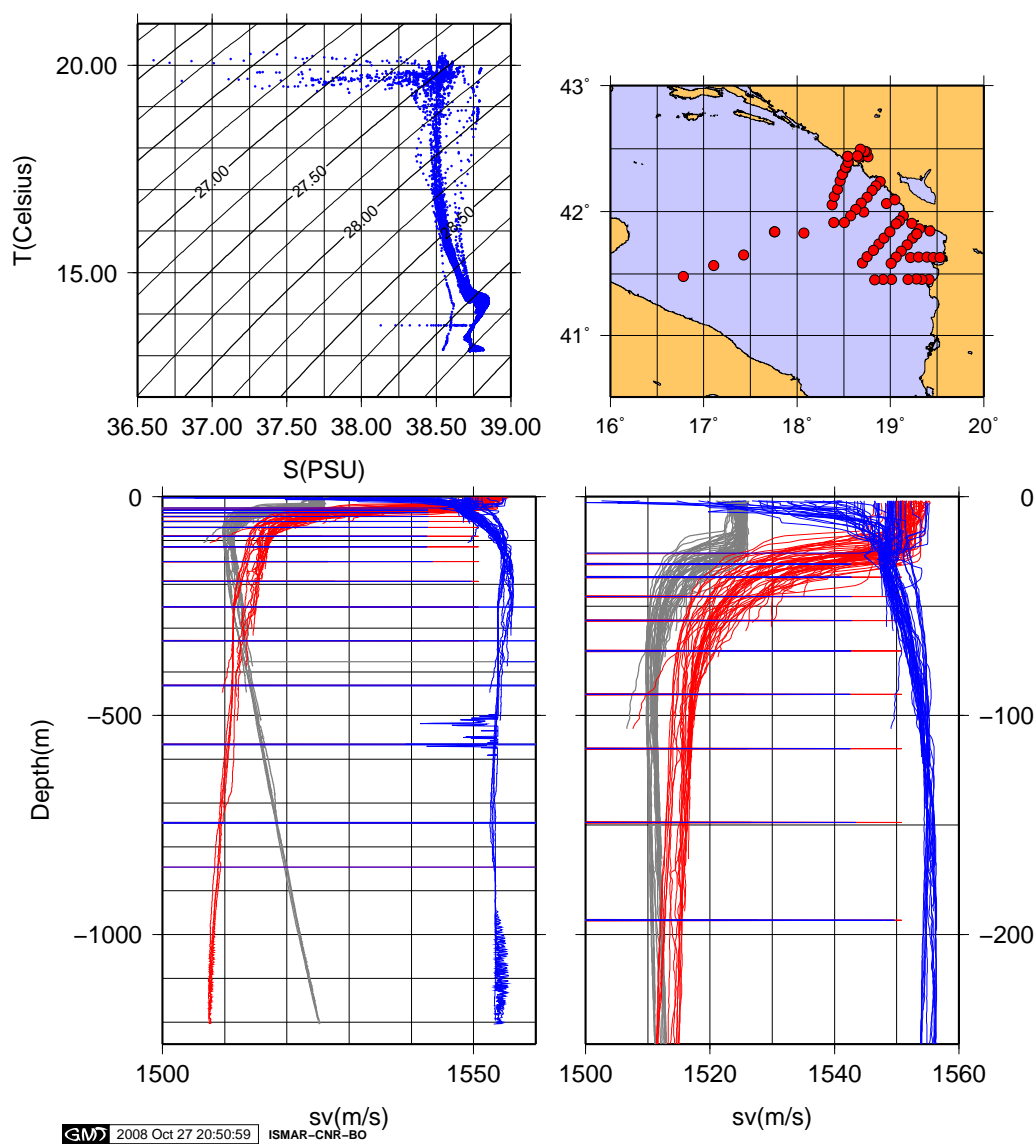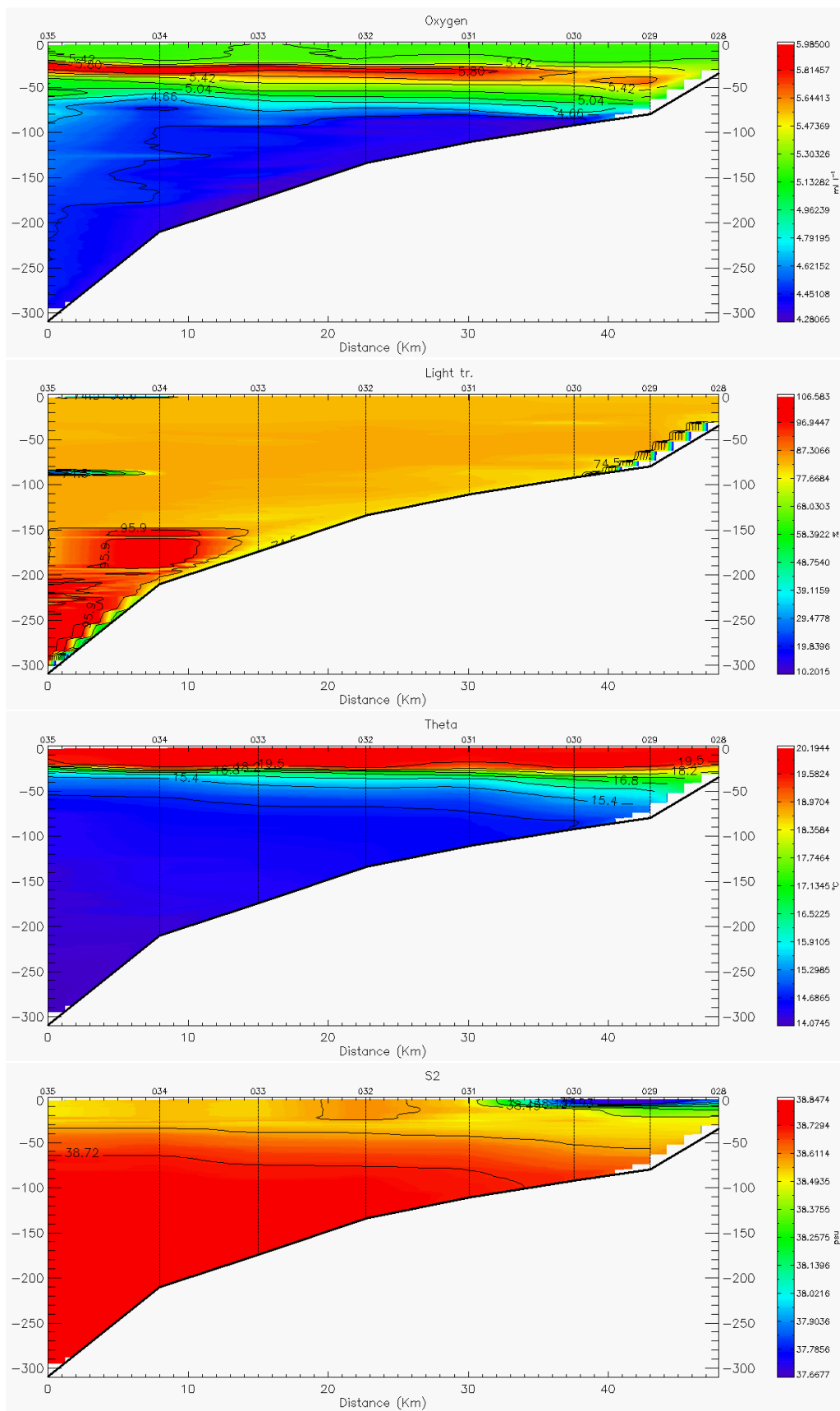
4.2 MOORING MAINTENANCE AND REDEPLOYMENT

On day 2008-10-19 the VAM1 OGS-ISMAR VECTOR mooring was recovered. Figure 12 shows the mapping data of the operation. Two sediment traps were removed and the sampled stored at -10°. On day 2008-10-25 the mooring was reconfigured (see Fig.11) and redeployed.

Figure 13 shows the work done, including instrument positioning by trilateration (see Table 8) with the following procedure:

- setting of water depth at deployment area, by CTD pressure data (1210.284dB, 1197.325m, 7.448m above sea bottom, e.g. 1204.7m) and map comparison.

- setting of average sound velocity at deployment area (1520m/s) by CTD data analysis and DESO25 data comparison

- setting of navigation offsets relative to POS0 on point A-FRAME for the three measurement sites, according to ship's position and heading

- Sound Velocity correction of measured ranges by the ratio of 1497 m/s of the OCEANO's TT300 Acoustic Telecommand against the actual 1520 m/s

- plotting and graphical solution

Mooring VAM1

ADCP Buoy 40'' **s/n 1750**

ARGOS transmitters **s/n 71633** (8535/1)

- 265 m

Snodo

359 m Kevlar Rope

CT - SBE37 **s/n 4593** - 350 m

CT - SBE37 **s/n 4513** - 550 m

CT - SBE37 **s/n 4514** - 750 m

361 m Kevlar Rope

CT - SBE37 **s/n 5097** - 1000 m

100 m Kevlar Rope

50 m Kevlar Rope

Vitrovex buoys - 632 m

CT - SBE37 **s/n 4596** - 1170 m   15 m Kevlar Rope

Aanderaa Current meter **RCM11 s/n 591** -1182 m

5 m Kevlar Rope

Vitrovex buoys - 1187 m

5 m Kevlar Rope

Acoustic Releasers **s/n 433 - s/n 398** - 1192 m

5 m Wire Rope

7 m Iron Chain

Ballast - 1204.6 m
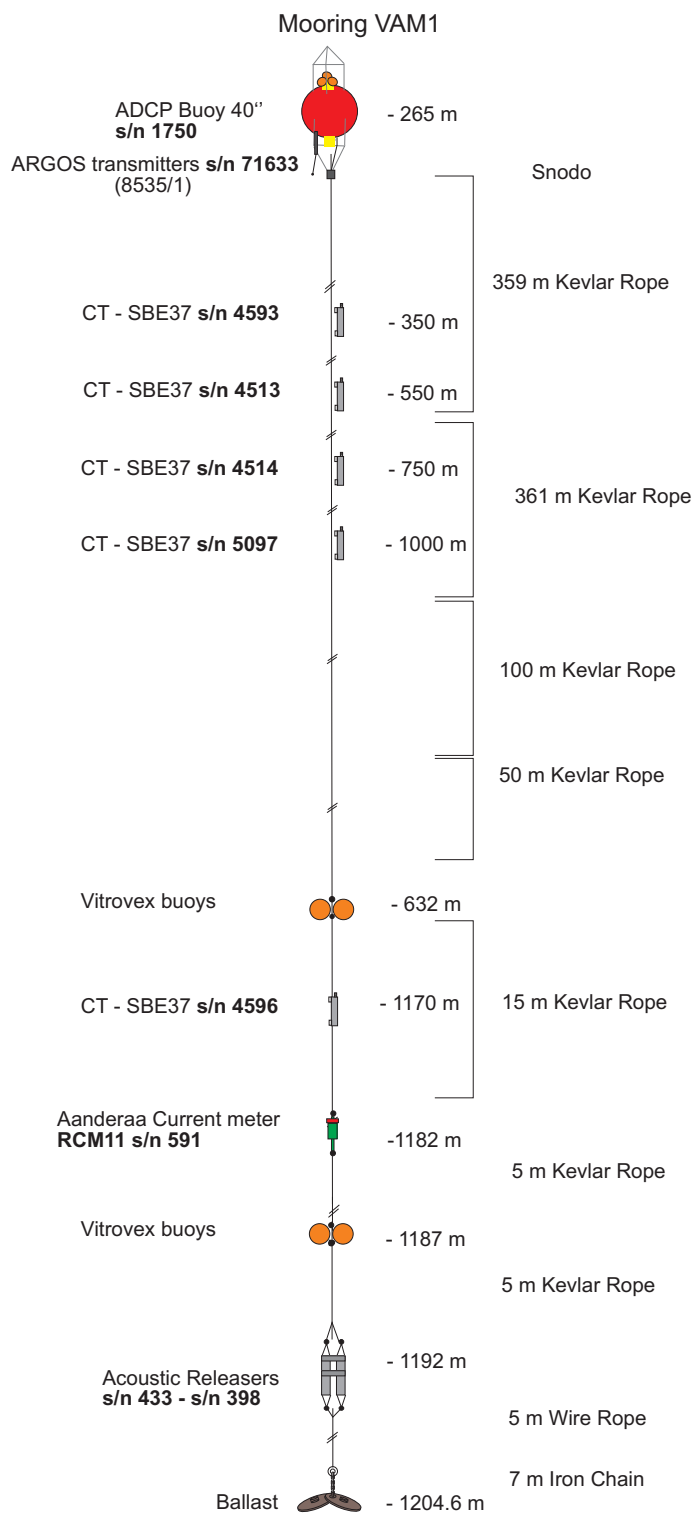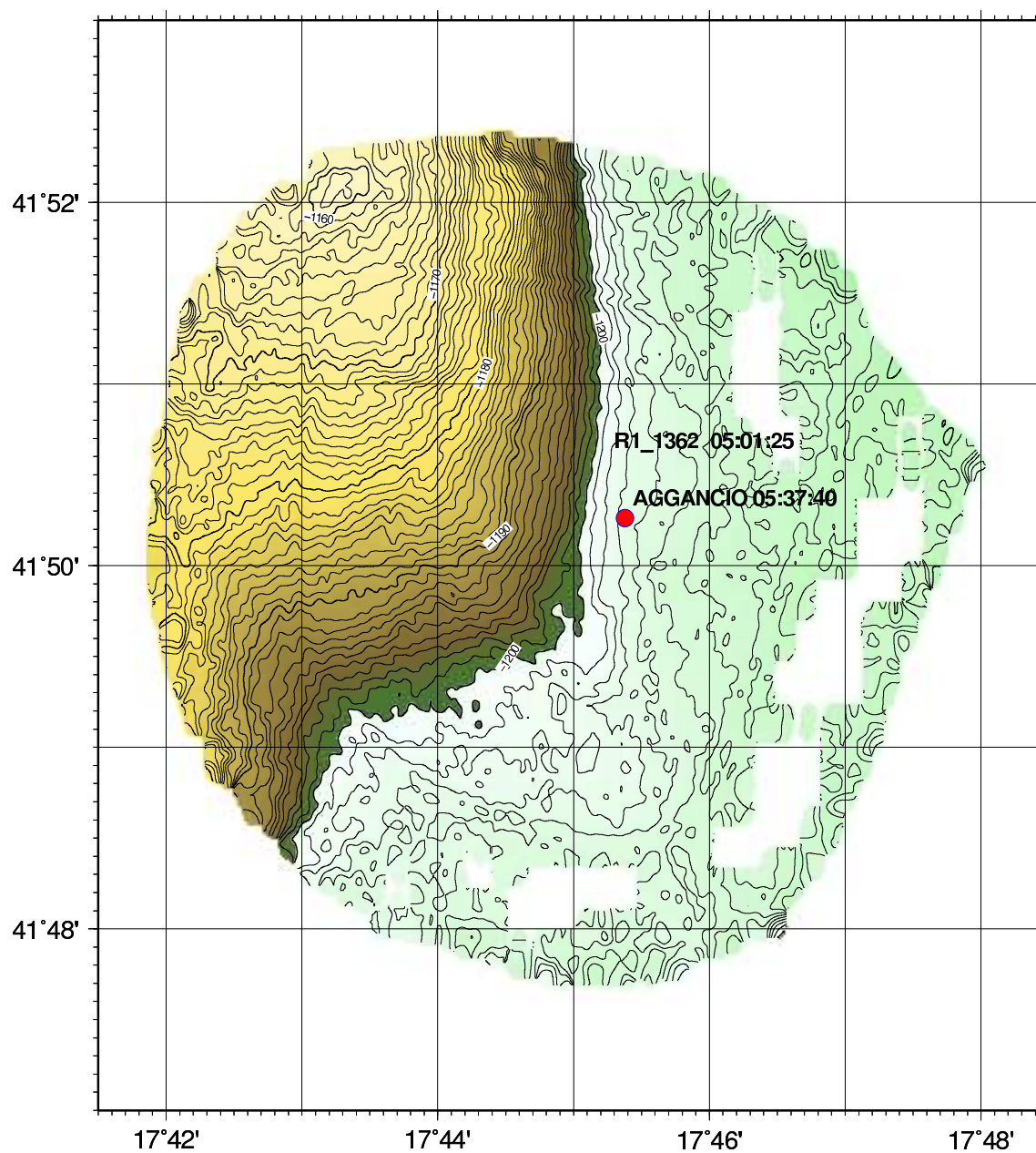
Figure 11: Mooring VAM1.

Figure 12: Mooring VAM-1 Recovery 2008-10-18. Work done. Bathymetry by multibeam, this survey
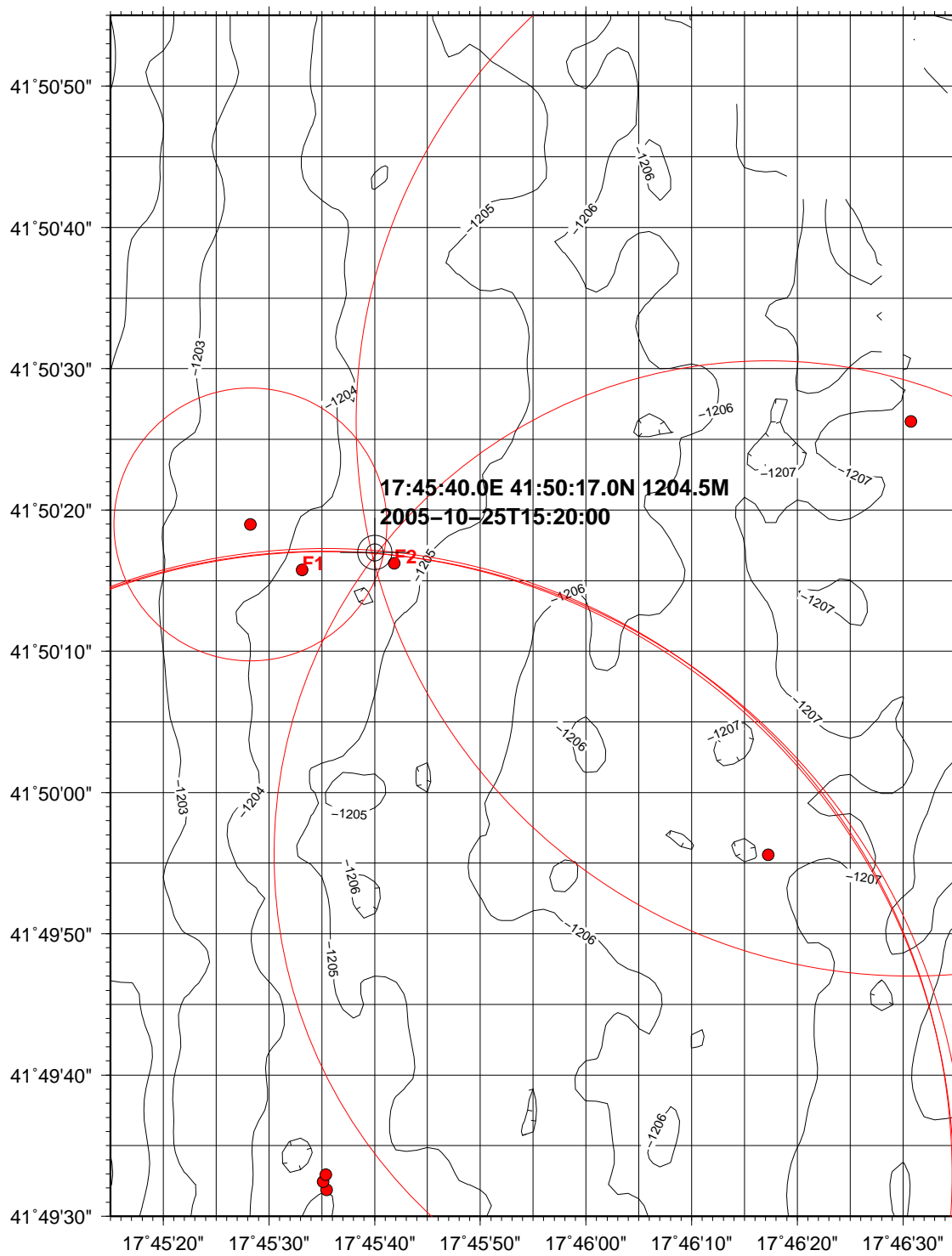
Figure 13: Mooring redeployment 2008-10-25. Work done. Points F1,F2 show the ship positions during transit to deployment (F2 is the dead-weight drop point). Other red points are site of range measurement for trilateration. Bathymetry by multibeam, this survey

LON LAT DDMM.xxx	PLANAR ANGLE S.V.CORRECTED	EAST NORTH UTM33	MEASURED OFFSET	TIME UTC	FIX FIX
1745.552 4150.263	0.0 0.0 0.0	729100.5 4635438.6	0 0	15:10:43	F1_PLAN_085N
1745.697 4150.270	0.0 0.0 0.0	729300.7 4635459.6	0 0	15:14:37	F2_DROP_090N
1745.471 4150.316	297.1 14.2 1213.0	728984.5 4635534.7	1192 5	15:28:20	R1a_1192_013N
1745.591 4149.531	1390.3 49.8 1821.0	729197.3 4634086.6	1794 3	15:48:12	R2a_1794_295N
1745.585 4149.541	1373.0 49.4 1807.8	729189.2 4634104.0	1780 4	15:50:02	R2b_1780_324N
1745.590 4149.549	1363.6 49.2 1800.7	729194.7 4634119.6	1772 5	15:51:27	R2c_1772_354N
1746.512 4150.438	1208.4 45.8 1686.2	730418.5 4635805.6	1659 5	16:05:50	R3a_1659_198N
1746.287 4149.926	1076.0 42.5 1594.0	730137.8 4634849.2	1570 3	16:17:03	R4a_1570_252N

Table 8: Deployment navigation data 2008-10-25. Range measurements and angle reduced to 1176m (14m Acoustic Release above sea bottom at 1204m, 14m draught of transducer, positioned on point A-Frame ,see 3). Lat/lon data expressed as DDMM.xxxx. Time is UTC.

4.3 SWATH BATHYMETRY, CHIRP PROFILING AND BOTTOM SAMPLING

During nights and on every opportunity during the day, e.g. transits to stations, multibeam and chirp runlines were performed, with the aim to map interesting features on the sea bottom, that could be representative of the different geological settings. Bathymetric data were collected mainly on three areas, (a) the Bay of Kotor and shelf, (b) the shelf in front of Bar, and (c) the area between the Bojana River (border between Montenegro and Albania) and Cape Rodonit in Albania. Other data were collected on the Montenegrinian and Albanian slope and shelf during transits.

Bay of Kotor and northern Montenegrinian shelf

The Bay of Kotor, considered to be the southernmost fjord of Europe, is composed by three embayments, with average depths ranging from 20 to 40m, connected by shallower and narrow straits (e.g. the Verige S., 350m wide), and dominated by mountains of the Dynarides Range as high as 2000m (Mt.Orjen, that dominates to the NW the Bay of Risan, 1894m), with well expressed karst entirety and aquifers discharging on the coast and also below the sea level.

For example, on the northern bay, with the cities of Kotor to the SE and Risan to the NW, several authors reported springs and siphons well studied and explored by divers even at depth of -170m, among them the Sopot just SE of Risan, which also springs at sea at a depth of 25-30m [Milanovic(2007)], [Eusebio et al.(2005)], [Bordin(2007)]. Another spring was reported east of the Gospa od Skrpjela Islet, on the northern coast of the Kotor bay, between Perast and C.Drazin by Montenegrinian colleagues on board.

We therefore payed a special attention on mapping by multibeam the nearshore area, in spite of the little time available, resulting with some intersting findings on the Kotor and Risan bays (Fig. 14) which may resemble submarine karst springs morphologies, e.g. circular, sub-circular or elliptical depressions or pits, with maximum measured depths of 35m from a rather flat seafloor of 30m depth.Figure 15 presents a CHIRP image of these morphologies, evidencing also a possible stage of formation by deeper aquifer fluxes and sediment dissolution. The deepest and largest of these pits was investigated by CTD and sampled by grab, reporting anoxic, seawater conditions on bottom.

The investigations on the western Bays of Risan and Morinj, altough not able to map in detail the submarine spring of Sopot, close to the village of Vitoglav, were able to evidence morphological features similar to the ones found on Kotor Bay. These features, lying on seabottoms 25-30m deep, may also have been formed by karstic resurgences, especially the ones found NE of the Island close to the city of Perast and on the S, in front of the village of D.Kostanjica, east of D.Morin. These last locality is interested by nearshore resurgences, which experience salting on low-discharge conditions.

The Verige Strait, connecting the Central Bay of Tivat to the Bay of Kotor, shows very steep flanks that continue into the embayment, being stopped by a steep, narrow ridge, parallel to the S

coastline, which elevates above surface with the man-made Island of Gospa od Skrpjela

The Bay of Tivat was mapped mostly on the northern (city of Bijela) and Southern flanks, whereas the Herceg-Novi area was mostly investigated on its borders and on the main entrance from C.Ostra to the Mamula I., including the Ploča shoal.

Chirp data showed extremely interesting subbottom geometries, among them compressional structures on the Verige strait (16), 20-30m thick sedimentary sequences in the Bays of Tivat (Fig.17) and Herzeg-Novi (Fig.18).

The shelf and shelf break area south of the Bay of Kotor was mapped, from the limit of croatian waters to the E. Figure 19 shows and example of the CHIRP records.
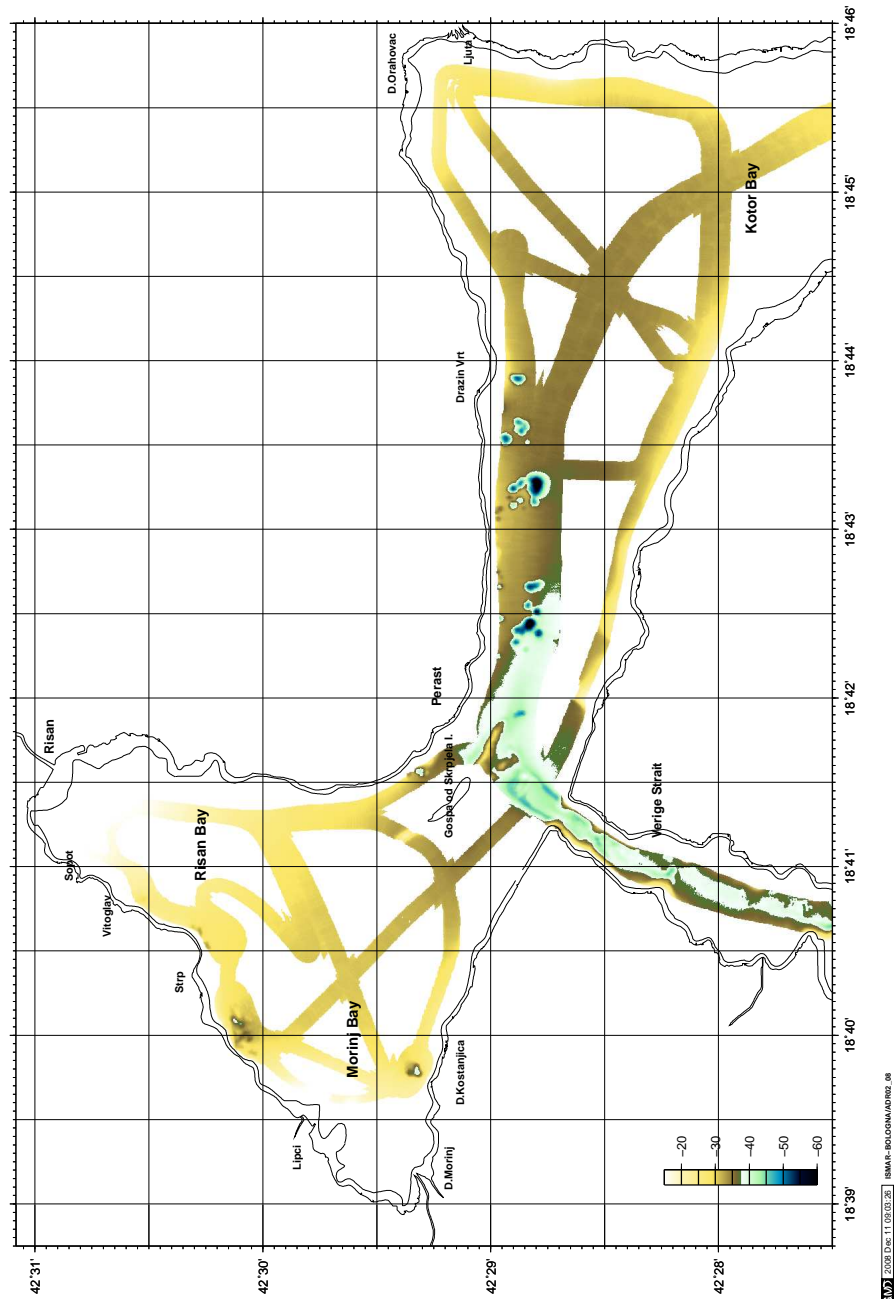

Figure 14: Bays of Kotor and Risan. Bathymetry by multibeam, this survey
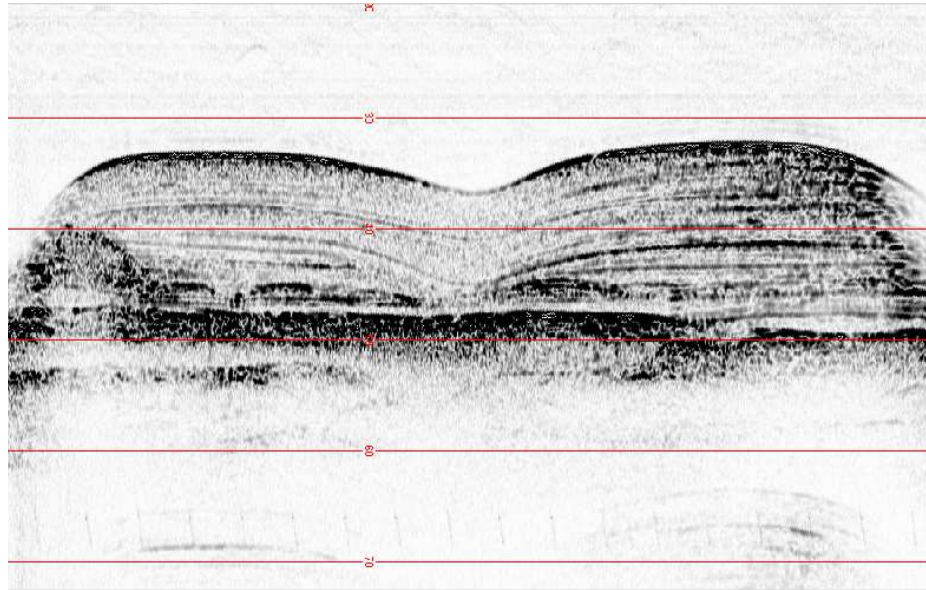
Figure 15: Bay of Kotor, CHIRP image of karstic depressions.
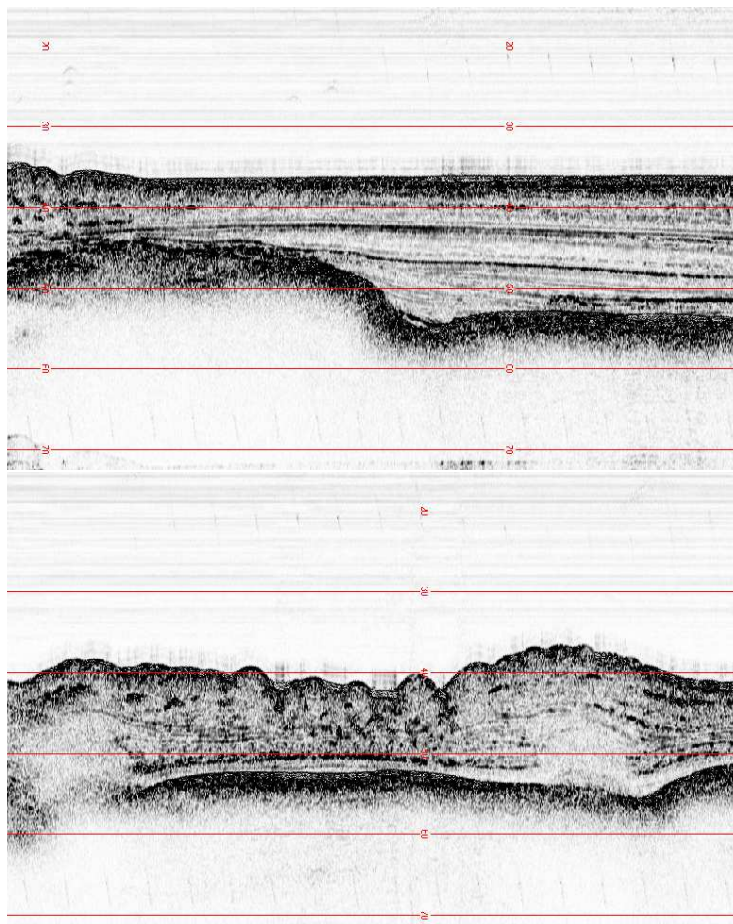
Figure 16: Verige Strais, CHIRP images.
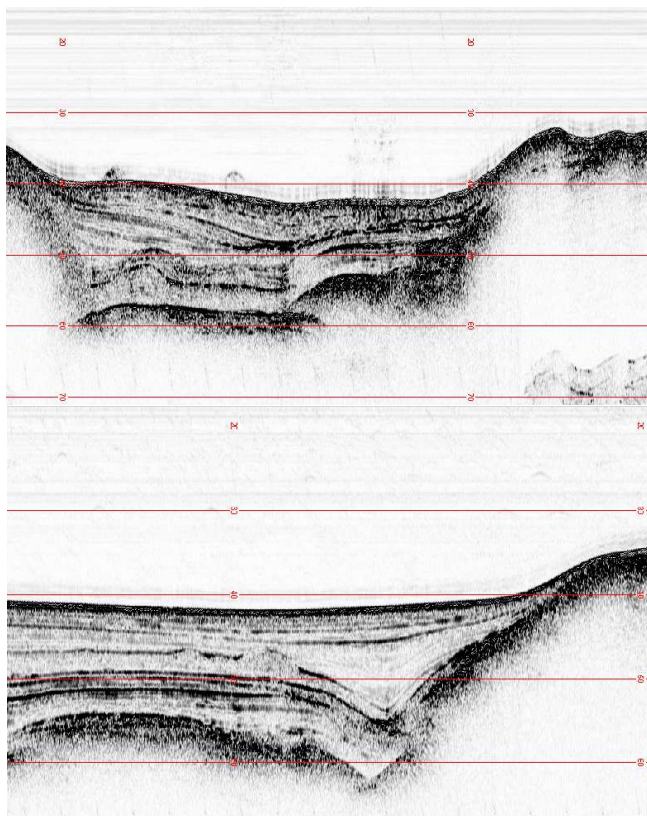
Figure 17: Tivat Bay, CHIRP images.
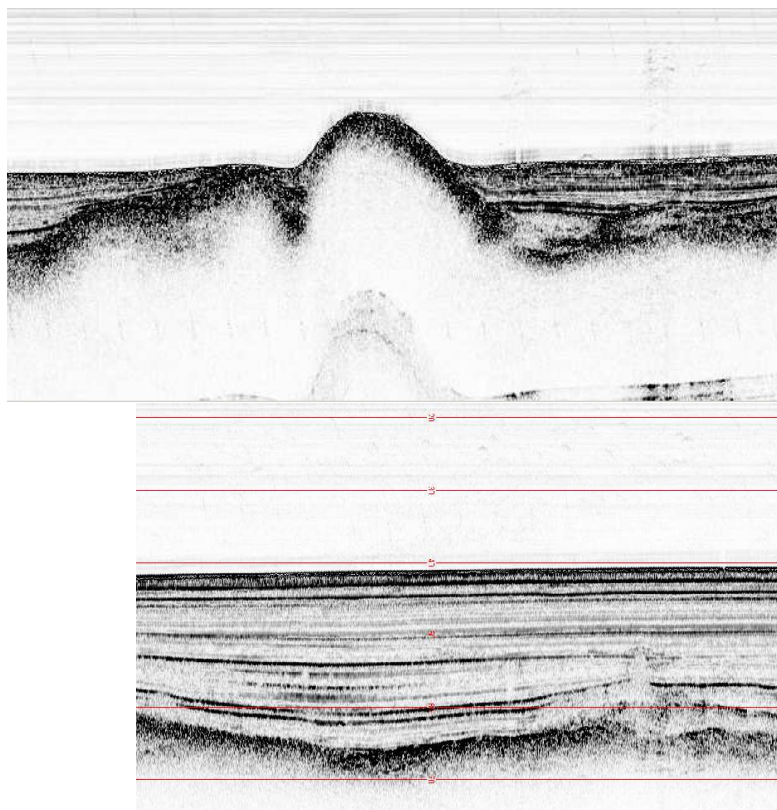
Figure 18: Herzeg-novi Bay, CHIRP images.
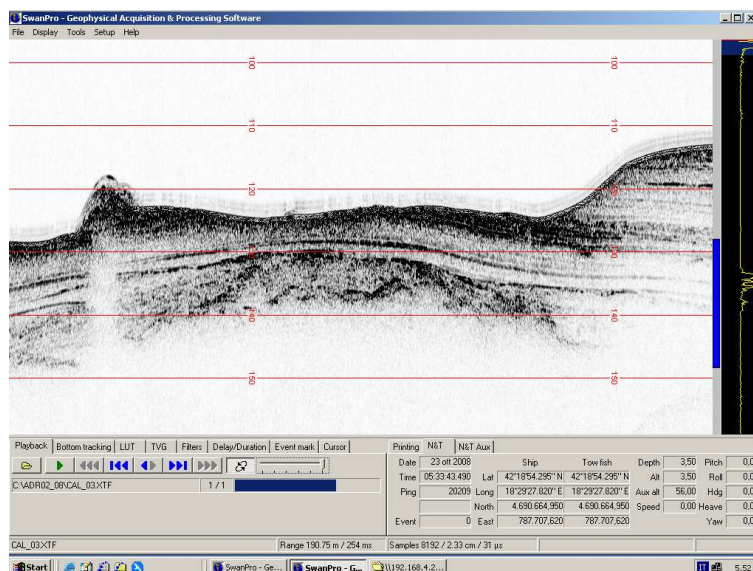
Figure 19: Outcrops, northern montenegrinian offshore..

Bar region and southern Montenegro shelf and slope

The area in front of Bar is dominated by an elliptical morphological high, with an intriguing, funnel-like feature on the west, and bordered to the SW by dune and sand-bar morphologies (Fig.20). Figure 21 shows and example of CHIRP records at the edge of southern montenegrinian shelf, with gassy sediments that hamper a sedimentary sequence penetrated up to 40-50m below the seabottom.
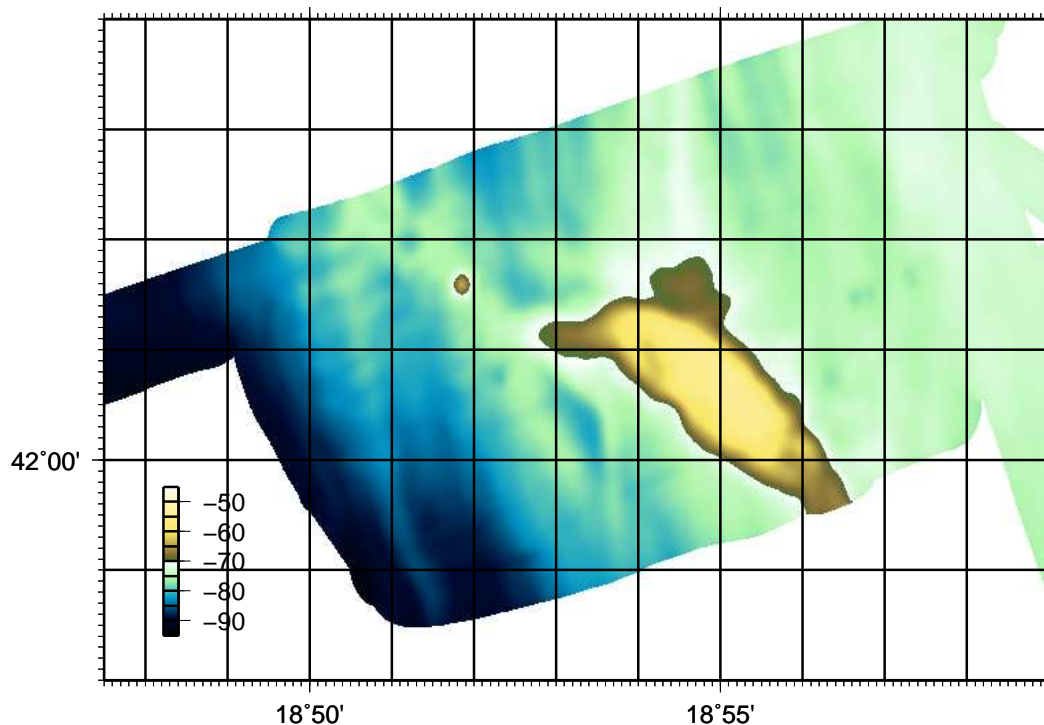
Figure 20: Bar offshore area.
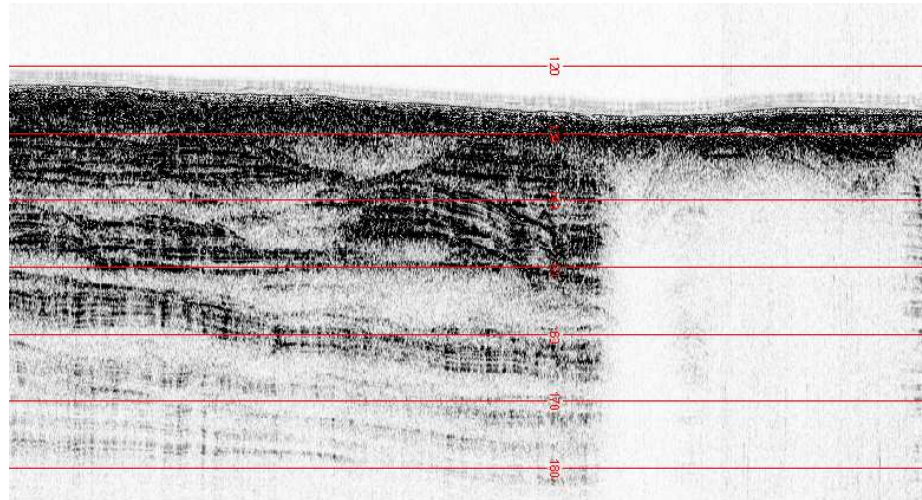
Figure 21: Southern Montenegrinian shelf, gassy sediments.

Cape Rodonit region and Albanian slope

When reached the Albanian shelf, the area offshore Cape Rodonit was mapped. An example of subbottom morphologies of the area is shown by Fig.22).

The shelf-break and slope area SW of Cape Rodonit was also investigated. Figures 23, 24, 25 present some examples of the subbottom morphologies in the area.
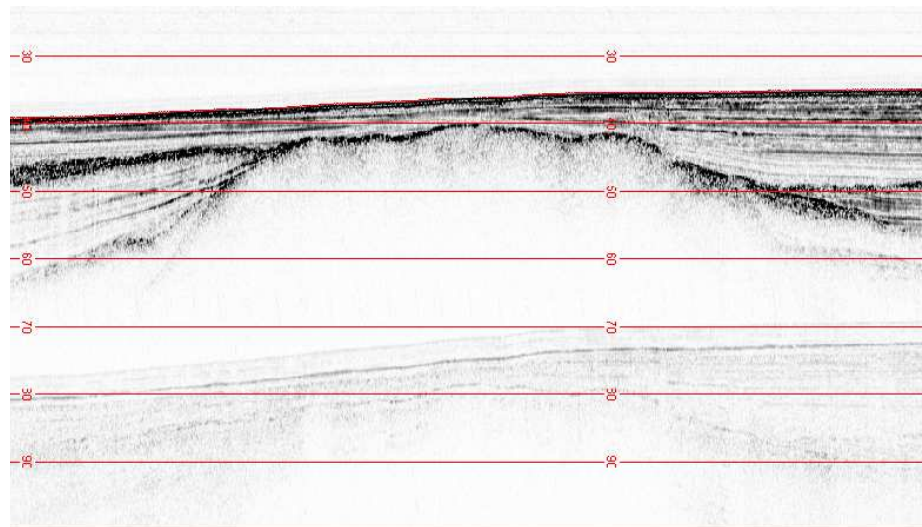
Figure 22: Hard acoustic basement draped by holocene sediments, Cape Rodonit, Albania.

Figure 23: Compressions, montenegrinian offshore.

Figure 24: Compressions, montenegrinian-albanian offshore.
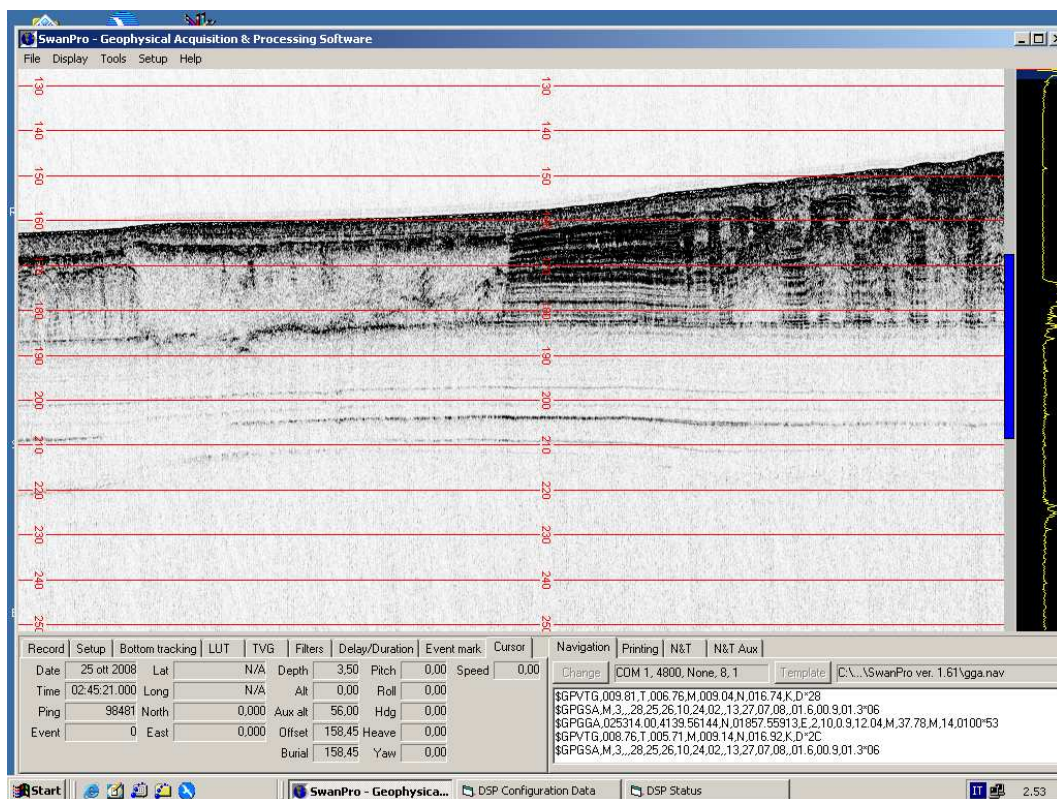
Figure 25: Chaotic, gassy sediments, albanian-montenegrinian offshore.

5   CONCLUSIONS

During the 12 days of cruise ADR0808, including transits and port calls, we obtained:

- measurements of the water column on 77 CTD stations,

- sampling of seawater on a great percentage of the CTD stations

- 26 Hyperspectral profiles and launches of experimental XBT.

- sampling of the sea bottom on 11 stations

- aproximately 200KM^2 of swath bathymetry, 2600 KM of high resolution SBP profiles and of single beam bathymetry

The collected physical, bio-geochemical and optical oceanographic data will be useful to studying and modelling of the Adriatic circulation, also by mean of the in-situ calibration of satellite-borne instrumentation data.

Several morphological features were revealed by the swath bathymetry and Chirp SBP mapping, providing good chances to further explore, finalize and better detail a very interesting marine area.

Analysis of the data collected during the expedition is under process, and will continue during the forthcoming several months.

No problems were encountered regarding neither the people nor the environment during the cruise.

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6 APPENDIX

6.1 DIARY OF OPERATIONS

- 17/10/2008
  - 05:30h - 17:00h UTC: In Bari harbour; customs operations, equipment loading, laboratory and instrumentation setup.
  - 17:00h UTC: Leave Bari harbour, steam towards Station 001, located SE of the Gargano promomtory. Gargano - Bar transect.
  - 19:31h UTC: Sta. 1, CTD adr02_001, 41°28.76' N, 16°46.90' E, bottom 112 m. Gargano - Bar transect. Samples: UNITUS: chl. ISMAR: O2, nuts.
  - 21:45h UTC: Sta. 2, CTD adr02_002, 41°34.16' N, 17°06.36' E, bottom 460 m. Gargano - Bar transect. Samples: UNITUS: chl. ISMAR: O2, nuts.

- 18/10/2008
  - 00:05h UTC: Sta. 3, CTD adr02_006, 41°39.14' N, 17°25.60' E, bottom 1140 m. Gargano - Bar transect. Samples: O2, nuts ISMAR.
  - 04:30h UTC: sta. 4, OGS MOORING RECOVERY - start operations. 41°50.265' N 17°45.373' E, bottom 1204.6 m.
  - 07:00h UTC: sta. 4, OGS MOORING RECOVERY - end operations. 41°50.265' N 17°45.373' E.
  - 07:36h UTC: Sta. 4, CTD adr02_004, 41°50.36' N, 17°45.34' E, bottom 1204.6 m. Gargano - Bar transect. Samples: UNITUS: chl, TSM and TFLAP 651 and 652 launched but launch failed in that data transmission was interrupted sortly after launch. ISMAR: O2, nuts, CDOM; OGS: salinity.
  - 14:50h UTC: Sta. 5, CTD adr02_005, 41°49.61' N, 18°04.26' E, bottom 1217 m. Gargano - Bar transect. Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM ; OGS: salinity.
  - 18:08h UTC: Sta. 6, CTD adr02_006, 41°54.72' N, 18°23.67' E, bottom 705 m. Gargano - Bar transect. Samples: UNITUS: chl ISMAR: O2, nuts.
  - 20:33h UTC: Sta. 7, CTD adr02_007, 41°59.84' N, 18°42.90' E, bottom 140 m. Gargano - Bar transect. Samples: UNITUS: chl.; ISMAR: O2, nuts.
  - 22:30h UTC: Sta. 8, CTD adr02_008, 42°03.71' N, 18°57.37' E, bottom 72 m. End Gargano - Bar transect. Samples: UNITUS: chl. ISMAR: O2, nuts.

- 19/10/2008
  - 07:10h UTC: weigh anchor outside Bar port. Montenegrin colleagues boarding and Dr. Miserocchi disembarking, using maritime agent's pilot launch.
  - 08:35h UTC: leave Bar to station adr02_009 (Bojana River transect).
  - 09:33h UTC: DRY CTD adr02_p_tr_fl_off, 41°54.57' N, 19°10.27' E, bottom 57.8 m. CTD for pressure, transmissometer and fluorimeter offsets and other coefficients determination.
  - 10:41h UTC: Sta. 9, CTD adr02_009, 41°51.60' N, 19°18.50' E, bottom 17.8 m. (Bojana River transect, sta. 4-1 on ADRICOSM maps). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM; IMBK: nuts, sfc nuts sonde, sed. Rosette, bacteriology, phytoplankton OGS, phytoplankton.
  - 11:27h UTC: Sta. 9, GRAB GR01 (sta. ADRICOSM 4-1), 41°51.62' N, 19°18.54' E, bottom 17 m (Bojana River transect, ADRICOSM sta. 4-1). Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.
  - 12:51h UTC: AFTER CTD adr02_009, we dismount secondary O2 (ISAC sensor s/n 0078) to mount PAR (Urania sensor s/n), because SATLANTIC pressure sensor continues not to work. NEW .CON FILE: ADR2_PAR_SPAR.CON, starting next CTD (adr02_011).
  - 12:26h UTC: Sta. 10, CTD adr02_010, 41°49.36' N, 19°16.76' E, bottom 51 m. (Bojana River transect, ADRICOSM sta. 4-2). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM. NOTE: THIS CTD WITH NEW .CON FILE ADR2_PAR_SPAR.CON.
  - 13:45h UTC: Sta. 11, CTD adr02_011, 41°47.12' N, 19°14.17' E, bottom 75 m. (Bojana River transect, ADRICOSM sta. 4-3). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.

- 14:50h UTC: Sta. 12, CTD adr02_012, 41°44.06' N, 19°10.72' E, bottom 86 m. (ADRICOSM sta. 4-4). Samples: UNITUS: chl; ISMAR: nuts; IMBK: phytoplankton OGS, phytoplankton IMBK.

- 15:45h UTC: Sta. 13, CTD adr02_013, 41°40.97' N, 19°07.08' E, bottom 98.7 m. (ADRICOSM sta. 4-5). Samples: UNITUS: chl; ISMAR: O2, nuts.

- 17:05h UTC: Sta. 14, CTD adr02_014, 41°37.96' N, 19°03.75' E, bottom 132 m. (ADRICOSM sta. 4-6). Samples: UNITUS: chl; ISMAR: nuts.

- 18:25h UTC: Sta. 15, CTD adr02_015, 41°35.12' N, 19°00.45' E, bottom 159 m. (ADRICOSM sta. 4-7). Samples: UNITUS: chl; ISMAR: O2, nuts. IMBK: phytoplankton OGS, phytoplankton; OGS: salinity.

- 19:00h UTC: Multibeam/chirp until next station in the morning.

- 20/10/2008

  - 06:25h UTC: Sta. 16, CTD adr02_016, 41°54.31' N, 19°13.74' E, bottom 10 m. (MEDPOL sta. new EU9). Samples: ISMAR: nuts; IMBK: nuts, sfc nuts sonde, sed. Rosette, bacteriology, phytoplankton OGS, phytoplankton IMBK, PAH, total hydrocarbons, heavy metals.

  - 06:44h UTC: Sta. 16, GRAB GR02, 41°54.34' N, 19°13.60' E, bottom 10 m (MEDPOL sta. EU9). Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.

  - 07:25h UTC: Sta. 17, CTD adr02_017, 41°57.93' N, 19°08.40' E, bottom 19 m. (ADRICOSM sta. 3-1). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM; IMBK: nuts, sfc nuts sonde, sed. Rosette, bacteriology, phytoplankton OGS, phytoplankton IMBK.

  - 07:49h UTC: Sta. 17, GRAB GR03, 41°57.97' N, 19°08.41' E, bottom 19 m (ADRICOSM sta. 3-1). Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.

  - 08:24h UTC: Sta. 18, CTD adr02_018, 41°55.61' N, 19°05.79' E, bottom 67.2 m. (ADRICOSM sta. 3-2). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.

  - 09:00h UTC: Sta. 18, SATLANTIC ADR02_2008_10-20_S018, 41°55.76' N, 19°05.57' E, bottom 60 m. (ADRICOSM sta. 3-2). Profile taken to approx. 20 m, counting time during descent (p sensor not working). 1 min free fall.

  - 09:58h UTC: Sta. 19, CTD adr02_019, 41°54.19' N, 19°03.67' E, bottom 79 m. (ADRICOSM sta. 3-3). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM.

  - 10::03h UTC: Sta. 19, SATLANTIC ADR02_2008_10-20_S019, 41°54.06' N, 19°03.80' E, bottom 79.5 m. (ADRICOSM sta. 3-3). 1 min free fall.

  - 11:38h UTC: Sta. 20, CTD adr02_020, 41°49.32' N, 19°16.84' E, bottom 51 m. (ADRICOSM sta. 4-2). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM. NOTE: this station is repeated today so to have CTD and SATLANTIC off Bojana river mouth. We do not repeat sta. 4-1 because too shallow to be safe with "pressure blind" SATLANTIC.

  - 11:54h UTC: Sta. 20, SATLANTIC ADR02_2008_10-20_S020, 41°49.32' N, 19°16.77' E, bottom 51 m. (ADRICOSM sta. 4-2). 1 min free fall.

  - 14:08h UTC: Sta. 21, SATLANTIC ADR02_2008_10-20_S021, 41°44.29' N, 18°52.43' E, bottom 129 m. (ADRICOSM sta. 3-6). 1 min free fall. NOTE: Dr. E. Vellucci of Obs. Oceanologie of Villefranche-sur-mer (France) suggested from now on to carry out one free-fall profile and one surface acquisition (probe mounting float), which is what we'll do.

  - 14:25h UTC: Sta. 21, SATLANTIC ADR02_2008_10-20_S021_sup, 41°44.33' N, 18°52.42' E, bottom 129 m. (ADRICOSM sta. 3-6). 2 min acquisition with probe floating on sfc.

  - 14:37h UTC: Sta. 21, CTD adr02_021, 41°44.33' N, 18°52.54' E, bottom 129 m. (ADRICOSM sta. 3-6). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM.

  - Transit to station 22 (ADRICOSM sta. 3-9, offshore end of ADRICOSM transect 3) with MULTIBEAM/CHIRP track.

  - 16:51h UTC: Sta. 22, CTD adr02_022, 41°35.28' N, 18°41.87' E, bottom 467 m. (ADRICOSM sta. 3-9). Samples: UNITUS: chl; ISMAR: O2, nuts; OGS: salinity. NOTE: spike in primary T and C sensors at 440 m during down cast. T and C values now at 99. °CC or S/m. Spike also on O2 sensor which settles around 2 ml/l incorrect value. Sensors do not recover during upcast. Techs work on CTD. C sensor cable changed. Trial OK; OGS: salinity.

  - 19:43h UTC: Sta. 23, CTD adr02_023, 41°38.37' N, 18°44.97' E, bottom 322.4 m. (ADRICOSM sta. 3-8). Samples: ISMAR: nuts.

- 20:37h UTC: Sta. 24, CTD adr02_024, 41°41.25' N, 18°48.98' E, bottom 193 m. (ADRICOSM sta. 3-7). Samples: ISMAR: nuts.

- 20:37h UTC: we opened SATLANTIC lower external casing so to expose pressure sensor (Druck PMP 4010 s/n 2248481) and wiring. Checked wiring, no damage encountered. Cleaned contacts and reassembled lower casing. We will try pressure sensor functionality tomorrow morning. Servicing operation above was authorized via e-mail by Dr. Maurizio Ribera D'Alcala' who is in charge of instrument owned by SZN Naples.

- 21:51h UTC: Sta. 25, CTD adr02_025, 41°47.21' N, 18°56.01' E, bottom 102 m. (ADRICOSM sta. 3-5. Sta. 3-6 was done earlier this afternoon). Samples: ISMAR: nuts.

- 22:48h UTC: Sta. 26, CTD adr02_026, 41°50.31' N, 18°59.57' E, bottom 93 m. (ADRICOSM sta. 3-4). No samples.

- 22:48h UTC: start MULTIBEAM/CHIRP operations for the night. Next station planned: MEDPOL station EU4 to be started out at 0530 UTC.

- 21/10/2008

  * 05:48h UTC: Sta. 27, CTD adr02_027, 42°05.64' N, 19°03.01' E, bottom 47 m. (MEDPOL station EU4). Samples: ISMAR: nuts; IMBK: nuts, sfc nuts sonde, sed. Rosette, bacteriology, phytoplankton OGS, phytoplankton.

  * 06:04h UTC: Sta. 27, GRAB GR04, 42°05.64' N, 19°03.01' E, bottom 47 m (MEDPOL station EU4). Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.

  * 07:26h UTC: Sta. 28, CTD adr02_028, 42°14.16' N, 18°53.33' E, bottom 35 m. (ADRICOSM station 2-1). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM; IMBK: phytoplankton OGS, phytoplankton.

  * 07:45h UTC: Sta. 28, SATLANTIC ADR02_2008-10-20_S028, 42°14.33' N, 18°53.20' E, bottom 36.8 m. (ADRICOSM sta. 2-1). 1:36 min free fall. NOTE: forgot to compile station header in SATVIEW.

  * 08:29h UTC: Sta. 29, SATLANTIC ADR02_2008-10-20_S029, 42°12.25' N, 18°50.92' E, bottom 80 m. (ADRICOSM sta. 2-2). 2 min free fall. NOTE: colleagues in ISAC Rome suggest tot o one SATLANTIC profile, 1 CTD, 1 SATLANTIC profile from now on in each optical station. We proceed this way.

  * 08:38h UTC: Sta. 29, CTD adr02_029, 42°12.36' N, 18°50.78' E, bottom 80.9 m. (ADRICOSM station 2-2). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM.

  * 08:54h UTC: Sta. 29, SATLANTIC ADR02_2008-10-20_S029b (second profile), 42°12.45' N, 18°50.69' E, bottom 80.7 m. (ADRICOSM sta. 2-2). 2 min free fall.

  * 09:30h UTC: Sta. 30, SATLANTIC ADR02_2008-10-20_S030, 42°09.96' N, 18°48.55' E, bottom 91 m. (ADRICOSM sta. 2-3). 2 min free fall. NOTE: we activated SATVIEW SATLANTIC PAR vs. T profile display so as to be able to estimate max depth reached by SATLANTIC via CTD T vs. P profile. Deepest SATLANTIC T = 17.48 °CC.

  * 09:40h UTC: Sta. 30, CTD adr02_030, 42°10.09' N, 18°48.37' E, bottom 92.2 m. (ADRICOSM station 2-3). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.

  * 09:58h UTC: Sta. 30, SATLANTIC ADR02_2008-10-20_S030b (second profile), 42°10.12' N, 18°48.29' E, bottom 92.5 m. (ADRICOSM sta. 2-3). 2 min free fall. Deepest SATLANTIC T = 17.54 °CC.

  * 10:40h UTC: Sta. 31, CTD adr02_031, 42°06.86' N, 18°45.02' E, bottom 111.5 m. (ADRICOSM station 2-4). Samples: UNITUS: chl, TSM; ISMAR: nuts.

  * 11:27h UTC: Sta. 32, SATLANTIC ADR02_2008-10-20_S032, 42°03.87' N, 18°41.36' E, bottom 134 m. (ADRICOSM sta. 2-5). 2 min free fall. Deepest SATLANTIC T = 19.79 °CC.

  * 11:34h UTC: Sta. 32, CTD adr02_032, 42°03.95' N, 18°41.31' E, bottom 134.7 m. (ADRICOSM station 2-5). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM; IMBK: phytoplankton OGS.

  * 11:59h UTC: Sta. 32, SATLANTIC ADR02_2008-10-20_S032b, 42°04.00' N, 18°41.39' E, bottom 134 m. (ADRICOSM sta. 2-5). 2 min free fall. Deepest SATLANTIC T = 19.78 °CC.

  * 13:09h UTC: Sta. 33, CTD adr02_033, 42°00.89' N, 18°37.59' E, bottom 174.2 m. (ADRICOSM station 2-6). Samples: UNITUS: chl; ISMAR: nuts.

- ∗ 14:13h UTC: Sta. 34, SATLANTIC ADR02_2008_10-20_S034, 41°57.76' N, 18°34.10' E, bottom 211.7 m. (ADRICOSM sta. 2-7). 2 min free fall. Deepest SATLANTIC T = 16.86 ℃C.
  - ∗ 14:18h UTC: Sta. 34, CTD adr02_034, 41°57.97' N, 18°34.28' E, bottom 210 m. (ADRICOSM station 2-7). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.
  - ∗ 14:48h UTC: Sta. 34, SATLANTIC ADR02_2008_10-20_S034b, 41°57.85' N, 18°34.57' E, bottom 208 m. (ADRICOSM sta. 2-7). 2 min free fall. Deepest SATLANTIC T = 16.70 ℃C.
  - ∗ 15:45h UTC: Sta. 35, CTD adr02_035, 41°54.79' N, 18°30.43' E, bottom 309 m. (ADRICOSM station 2-8). Samples: UNITUS: chl; ISMAR: nuts; IMBK: phytoplankton OGS; OGS: salinity.
- 22/10/2008
- 06:34h UTC: Sta. 36, CTD adr02_036, 42°03.16' N, 18°22.54' E, bottom 517 m. (ADRICOSM station 1-7). Samples: UNITUS: chl; ISMAR: nuts; IMBK: phytoplankton OGS; OGS: salinity.
- 07:30h UTC: Sta. 37, SATLANTIC ADR02_2008_10-20_S037, 42°06.89' N, 18°24.13' E, bottom 395 m. (ADRICOSM sta. 1-6).
- 07:37h UTC: Sta. 37, CTD adr02_037, 42°07.13' N, 18°23.82' E, bottom 397 m. (ADRICOSM station 1-6). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.
- 08:05h UTC: Sta. 37, SATLANTIC ADR02_2008_10-20_S037b, 42°07.21' N, 18°23.85' E, bottom 396 m. (ADRICOSM sta. 1-6).
- 08:46h UTC: Sta. 38, CTD adr02_038, 42°10.67' N, 18°25.97' E, bottom 280 m. (ADRICOSM station 1-5). Samples: UNITUS: chl; ISMAR: nuts..
- 09:35h UTC: Sta. 39, SATLANTIC ADR02_2008_10-20_S039, 42°14.50' N, 18°27.77' E, bottom 205 m. (ADRICOSM sta. 1-4).
- 09:50h UTC: Sta. 39, CTD adr02_039, 42°14.70' N, 18°27.61' E, bottom 205 m. (ADRICOSM station 1-4). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM; IMBK: phytoplankton OGS.
- 10:13h UTC: Sta. 39, SATLANTIC ADR02_2008_10-20_S039b, 42°14.77' N, 18°27.45' E, bottom 206 m. (ADRICOSM sta. 1-4).
- 10:52h UTC: Sta. 40, SATLANTIC ADR02_2008_10-20_S040, 42°17.71' N, 18°29.38' E, bottom 164 m. (ADRICOSM sta. 1-3).
- 11:04h UTC: Sta. 40, CTD adr02_040, 42°17.85' N, 18°29.26' E, bottom 154 m. (ADRICOSM station 1-3). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM.
- 11:22h UTC: Sta. 40, SATLANTIC ADR02_2008_10-20_S040b, 42°17.93' N, 18°29.26' E, bottom 142 m. (ADRICOSM sta. 1-3).
- 12:10h UTC: Sta. 41, SATLANTIC ADR02_2008_10-20_S041, 42°20.64' N, 18°31.16' E, bottom 128 m. (ADRICOSM sta. 1-2).
- 12:21h UTC: Sta. 41, CTD adr02_041, 42°20.75' N, 18°31.48' E, bottom 128.5 m. (ADRICOSM station 1-2). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM.
- 12:38h UTC: Sta. 41, SATLANTIC ADR02_2008_10-20_S041b, 42°20.79' N, 18°31.55' E, bottom 126 m. (ADRICOSM sta. 1-2).
- 13:10h UTC: Sta. 42, SATLANTIC ADR02_2008_10-20_S042, 42°23.39' N, 18°32.64' E, bottom 68.8 m. (ADRICOSM sta. 1-1).
- 13:241h UTC: Sta. 42, CTD adr02_042, 42°23.51' N, 18°32.72' E, bottom 63.8 m. (ADRICOSM station 1-1). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM; IMBK: nuts, sfc nuts sonde, sed. Rosette, bacteriology, phytoplankton OGS, phytoplankton.
- 13:37h UTC: Sta. 42, SATLANTIC ADR02_2008_10-20_S042b, 42°23.49' N, 18°32.81' E, bottom 63.2 m. (ADRICOSM sta. 1-1).
- 13:58h UTC: Sta. 42, GRAB GR05, 42°23.72' N, 18°32.88' E, bottom 63 m (ADRICOSM station 1-1). Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.
- 15:51h UTC: Sta. 43, CTD adr02_043, 42°26.11' N, 18°45.62' E, bottom 22.5 m. (MEDPOL EU 11 inner Kotor bay, in front of Kotor). Samples: ISMAR: nuts; IMBK: phytoplankton OGS.

- 16:05h UTC: Sta. 43, GRAB GR06, 42°26.08' N, 18°45.62' E, bottom 22 m (MEDPOL station EU11). Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.

- 16:43h UTC: Sta. 44, CTD adr02_044, 42°28.55' N, 18°44.45' E, bottom 34.5 m. (ADRICOSM KO, inner Kotor bay). Samples: UNITUS: chl; ISMAR: nuts; IMBK: phytoplankton OGS.

- 17:43h UTC: Sta. 45, CTD adr02_045, 42°28.80' N, 18°43.28' E, bottom 63 m. (extra station, in FWS in karst spring, 60 m deep in 30 m bottom surounding, 50 m diameter seen in multibeam/chirp data). Samples: UNITUS: chl; ISMAR: O2, nuts.

- 18:00h UTC: Sta. 45, GRAB GR07, 42°28.79' N, 18°43.27' E, bottom 63 m (extra FWS). Samples: Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.

- 19:19h UTC: Sta. 46, CTD adr02_046, 42°25.92' N, 18°39.49' E, bottom 39.7 m. (ADRICOSM sta. TV, i.e. off Tivat). Samples: UNITUS: chl; ISMAR: nuts; IMBK: phytoplankton OGS.

- 20:15h UTC: Sta. 47, CTD adr02_047, 42°26.28' N, 18°32.65' E, bottom 43.1 m. (ADRICOSM sta. HN, i.e. off Herceg Novi). Samples: UNITUS: chl; ISMAR: nuts; IMBK: phytoplankton OGS.

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  - 07:34h UTC: Sta. 48, SATLANTIC ADR02_2008_10-23_S048, 42°17.65' N, 18°29.39' E, bottom 170 m. (ADRICOSM sta. 1-3, repetition of previously done station).

  - 07:46h UTC: Sta. 48, CTD adr02_048, 42°17.76' N, 18°29.15' E, bottom 171.7 m. (ADRICOSM station 1-3). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM.

  - 08:07h UTC: Sta. 48, SATLANTIC ADR02_2008_10-23_S048b, 42°17.81' N, 18°28.97' E, bottom 174.5 m. (ADRICOSM sta. 1-3).NOTE: wrong date in filename and file header?need to change them.

  - 08:50h UTC: Sta. 49, SATLANTIC ADR02_2008_10-23_S049, 42°20.89' N, 18°31.25' E, bottom 129 m. (ADRICOSM sta. 1-2).

  - 08:57h UTC: Sta. 49, CTD adr02_049, 42°21.05' N, 18°31.21' E, bottom 127 m. (ADRICOSM station 1-2). Samples: UNITUS: chl; ISMAR: O2, nuts.

  - 09:16h UTC: Sta. 49, SATLANTIC ADR02_2008_10-23_S049b, 42°21.17' N, 18°31.14' E, bottom 128 m. (ADRICOSM sta. 1-2).

  - 10:01h UTC: Sta. 50, SATLANTIC ADR02_2008_10-23_S050, 42°23.40' N, 18°32.70' E, bottom 68.5 m. (ADRICOSM sta. 1-1).

  - 10:20h UTC: Sta. 50, CTD adr02_050, 42°23.52' N, 18°32.81' E, bottom 62 m. (ADRICOSM station 1-1). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.

  - 10:33h UTC: Sta. 50, SATLANTIC ADR02_2008_10-23_S050b, 42°23.50' N, 18°32.83' E, bottom 63 m. (ADRICOSM sta. 1-1).

  - 11:44h UTC: Sta. 51, SATLANTIC ADR02_2008_10-23_S051, 42°26.29' N, 18°32.63' E, bottom 41.5 m. (ADRICOSM sta. HN, off Herceg Novi, Kotor Bay).

  - 11:50h UTC: Sta. 51, CTD adr02_051, 42°26.35' N, 18°32.64' E, bottom 42 m. (ADRICOSM station HN). Samples: UNITUS: chl; ISMAR: nuts; IBMK: phytoplankton, phytoplankon OGS.

  - 12:03h UTC: Sta. 51, SATLANTIC ADR02_2008_10-23_S051b, 42°26.28' N, 18°32.61' E, bottom 42.8 m. (ADRICOSM sta. HN).

  - 14:41h UTC: Sta. 52, SATLANTIC ADR02_2008_10-23_S052, 42°29.78' N, 18°40.51' E, bottom 30 m. (ADRICOSM sta. RI, Risan Bay, NW branch of inner Kotor Bay).

  - 14:45h UTC: Sta. 52, CTD adr02_052, 42°29.79' N, 18°40.57' E, bottom 30 m. (ADRICOSM station RI). Samples: UNITUS: chl; ISMAR: O2, nuts.

  - 14:56h UTC: Sta. 52, SATLANTIC ADR02_2008_10-23_S052b, 42°29.80' N, 18°40.59' E, bottom 30 m. (ADRICOSM sta. RI).

  - 15:00h UTC: start Multibeam/CHIRP survey of Kotor Bay, starting from Risan Bay. We alternate with Kotor Bay stations

  - 19:27h UTC: Sta. 53, CTD adr02_053, 42°26.61' N, 18°38.42' E, bottom 33 m. (extra ADRICOSM station EU10N off Bijela shipyard). Samples: UNITUS: chl; ISMAR: nuts; IMBK: nuts, sfc nuts sonde, sed. Rosette, bacteriology, phytoplankton OGS, phytoplankton.

- 19:47h UTC: Sta. 53, GRAB GR08, 42°26.65' N, 18°38.69' E, bottom 33 m (MEDPOL station EU11N). Samples: ISMAR: granulometry, pollutants; IMBK: heavy metals, PAH, sedimentology.

- 24/10/2008
  - 07:35h UTC: Sta. 54, SATLANTIC ADR02_2008_10-24_S054, 41°27.12' N, 19°24.94' E, bottom 10.5 m. (ADRICOSM sta. 7-1, Albanian waters).
  - 07:40h UTC: Sta. 54, CTD adr02_054, 41°27.20' N, 19°24.88' E, bottom 11.1 m. (ADRICOSM station 7-1). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM; IBMK: phytoplankton OGS.
  - 07:52h UTC: Sta. 54, SATLANTIC ADR02_2008_10-24_S054b, 41°27.25' N, 19°24.86' E, bottom 11.5 m. (ADRICOSM sta. 7-1).
  - 08:28h UTC: Sta. 55, SATLANTIC ADR02_2008_10-24_S055, 41°27.10' N, 19°20.43' E, bottom 45 m. (ADRICOSM sta. 7-2).
  - 08:40h UTC: Sta. 55, CTD adr02_055, 41°27.14' N, 19°20.29' E, bottom 49 m. (ADRICOSM station 7-2). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.
  - 08:53h UTC: Sta. 55, SATLANTIC ADR02_2008_10-24_S055b, 41°27.25' N, 19°19.17' E, bottom 49 m. (ADRICOSM sta. 7-2).
  - 09:29h UTC: Sta. 56, SATLANTIC ADR02_2008_10-24_S056, 41°27.17' N, 19°16.63' E, bottom 89.8 m. (ADRICOSM sta. 7-3).
  - 09:46h UTC: Sta. 56, CTD adr02_056, 41°27.42' N, 19°16.71' E, bottom 88.5 m. (ADRICOSM station 7-3). Samples: UNITUS: chl, TSM; ISMAR: nuts, CDOM.
  - 09:58h UTC: Sta. 56, SATLANTIC ADR02_2008_10-24_S056b, 41°27.42' N, 19°16.72' E, bottom 88.4 m. (ADRICOSM sta. 7-3).
  - 10:45h UTC: Sta. 57, SATLANTIC ADR02_2008_10-24_S057, 41°27.18' N, 19°11.23' E, bottom 124.4 m. (ADRICOSM sta. 7-4).
  - 10:55h UTC: Sta. 57, CTD adr02_057, 41°27.29' N, 19°11.27' E, bottom 124.6 m. (ADRICOSM station 7-4). Samples: UNITUS: chl; ISMAR: O2, nuts; IBMK: phytoplankton OGS.
  - 11:15h UTC: Sta. 57, SATLANTIC ADR02_2008_10-24_S057b, 41°27.29' N, 19°11.29' E, bottom 124.6 m. (ADRICOSM sta. 7-4).
  - 12:00h UTC: Sta. 58, CTD adr02_058, 41°27.16' N, 19°05.89' E, bottom 125.6 m. (ADRICOSM station 7-5). Samples: UNITUS: chl; ISMAR: nuts.
  - 12:51h UTC: Sta. 59, CTD adr02_059, 41°27.21' N, 19°00.66' E, bottom 125.1 m. (ADRICOSM station 7-6). Samples: UNITUS: chl; ISMAR: O2, nuts.
  - 13:45h UTC: Sta. 60, SATLANTIC ADR02_2008_10-24_S060, 41°27.22' N, 18°55.30' E, bottom 196 m. (ADRICOSM sta. 7-7).
  - 13:54h UTC: Sta. 60, CTD adr02_060, 41°27.36' N, 18°55.35' E, bottom 195 m. (ADRICOSM station 7-7). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts.
  - 13:47h UTC: Sta. 60, SATLANTIC ADR02_2008_10-24_S060b, 41°27.35' N, 18°55.55' E, bottom 192 m. (ADRICOSM sta. 7-7).
  - 15:12h UTC: Sta. 61, CTD adr02_061, 41°27.10' N, 18°49.99' E, bottom 326 m. (ADRICOSM station 7-8). Samples: UNITUS: chl; ISMAR: nuts; IBMK: phytoplankton OGS.
  - 15:30h UTC: start Multibeam and CHIRP tracks on Albanian margin.

- 25/10/2008
  - 06:00h UTC: weigh anchor in Bar Bay. Waiting for agent and pilot boat to disembark Montenegrin colleagues.
  - 08:00h UTC: Leave Bar after disembarking Montenegrin colleagues.
  - 04:10h UTC circa: start operations - OGS mooring redeployment. 41°50.06' N, 17°44.17' E, bottom 1192 m circa.
  - 15:14h UTC: OGS mooring deployed. 41°50.269' N, 17°45.725' E. Bottom: 1207.6
  - 15:21h UTC: 41°50.264' N, 17°45.564' E. Estimate of mooring position.
  - 15:29h UTC: first acoustic triangulation of mooring. 41°50.295' N, 17°45.456' E. Distance 1192 m, i.e. ship on top of mooring.

- 16:27h UTC: Sta. 62, CTD adr02_062, 41°50.222' N, 17°45.758' E, bottom 1215 m. (ADRI-COSM, after OGS mooring deployment). OGS: salinity.
- 17:45h UTC: triangulation fix on mooring. 41°50.283' N, 17°45.667' E. Bottom: 1204.5 m, i.e. depth of mooring.
- 18:00h UTC circa: steam to Albanian margin area to start Multibeam and CHIRP tracks. NOTE: time change tonight from daylight savings to solar local.

- 26/10/2008
  - 07:37h UTC: Sta. 63, SATLANTIC ADR02_2008_10-26_S063, 41°37.78' N, 19°13.15' E, bottom 88 m. (ADRICOSM sta. 6-5).
  - 07:51h UTC: Sta. 63, CTD adr02_063, 41°37.83' N, 19°12.85' E, bottom 89 m. (ADRICOSM station 6-5). Samples: UNITUS: chl; ISMAR: O2, nuts.
  - 08:10h UTC: Sta. 63, SATLANTIC ADR02_2008_10-26_S063b, 41°37.88' N, 19°18.30' E, bottom 67.5 m. (ADRICOSM sta. 6-5).
  - 08:54h UTC: Sta. 64, SATLANTIC ADR02_2008_10-26_S064, 41°37.78' N, 19°13.15' E, bottom 88 m. (ADRICOSM sta. 6-4).
  - 08:08h UTC: Sta. 64, CTD adr02_064, 41°37.96' N, 19°18.18' E, bottom 68.8 m. (ADRICOSM station 6-4). Samples: UNITUS: chl; ISMAR: nuts.
  - 09:20h UTC: Sta. 64, SATLANTIC ADR02_2008_10-26_S064b, 41°38.01' N, 19°17.92' E, bottom 69 m. (ADRICOSM sta. 6-4).
  - 10:10h UTC: Sta. 65, SATLANTIC ADR02_2008_10-26_S065, 41°37.98' N, 19°23.74' E, bottom 40 m. (ADRICOSM sta. 6-3).
  - 10:20h UTC: Sta. 65, CTD adr02_065, 41°38.09' N, 19°23.60' E, bottom 41 m. (ADRICOSM station 6-3). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.
  - 10:31h UTC: Sta. 65, SATLANTIC ADR02_2008_10-26_S065b, 41°38.25' N, 19°23.49' E, bottom 41 m. (ADRICOSM sta. 6-3).
  - 11:48h UTC: Sta. 66, SATLANTIC ADR02_2008_10-26_S066, 41°37.83' N, 19°27.67' E, bottom 33 m. (ADRICOSM sta. 6-2).
  - 12:03h UTC: Sta. 66, CTD adr02_066, 41°37.96' N, 19°27.64' E, bottom 33 m. (ADRICOSM station 6-2). Samples: UNITUS: chl; ISMAR: nuts.
  - 12:10h UTC: Sta. 66, SATLANTIC ADR02_2008_10-26_S066b, 41°37.91' N, 19°27.62' E, bottom 33 m. (ADRICOSM sta. 6-2). 12:46h UTC: Sta. 67, SATLANTIC ADR02_2008_10-26_S067, 41°37.87' N, 19°31.73' E, bottom 22 m. (ADRICOSM sta. 6-1).
  - 12:57h UTC: Sta. 67, CTD adr02_067, 41°37.99' N, 19°31.77' E, bottom 21.9 m. (ADRICOSM station 6-1). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.
  - 13:01h UTC: Sta. 67, SATLANTIC ADR02_2008_10-26_S067b, 41°37.95' N, 19°31.85' E, bottom 21.3 m. (ADRICOSM sta. 6-1).
  - 14:01h UTC: Sta. 68, SATLANTIC ADR02_2008_10-26_S068, 41°44.43' N, 19°32.96' E, bottom 18.2 m. (ADRICOSM sta. 5-3).
  - 14:10h UTC: Sta. 68, CTD adr02_068, 41°44.55' N, 19°32.99' E, bottom 17 m. (ADRICOSM station 5-3). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.
  - 14:21h UTC: Sta. 68, SATLANTIC ADR02_2008_10-26_S068b, 41°44.56' N, 19°32.87' E, bottom 18 m. (ADRICOSM sta. 5-3). NOTE: this CTD profile OK during acquisition but replay reveals pressure at -180000 circa. Examined LED display on deck unit for pressure frequency and it results to be 0, as if pressure data stream were silent. We decide to continue CTD utilizing mark scans: while lowering click mark scans every 10 m using winch readout. Then click last mark scan at bottom depth, record altimeter value and number of downcast marks, so as to be able to reconstruct depth for CTD profile.
  - 14:21h UTC circa: start Multibeam/CHIRP operations on Albanian margin.

- 27/10/2008
  - 10:30h UTC: Sta. 69, SATLANTIC ADR02_2008_10-27_S069, 42°03.89' N, 18°41.26' E, bottom 135.5 m. (ADRICOSM sta. 1-5, repeated today to launch T-FLAP 613). Launched T-FLAP 613 after CTD. Last winch depth: 15 m; no. of downcast marks (starting from 0 m): 23. Mark every 5 m.

- 10:51h UTC: Sta. 69, CTD adr02_069, 42°03.85' N, 18°41.39' E, bottom 134.6 m. (ADRICOSM station 1-5). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM.

- 11:21h UTC: Sta. 69, SATLANTIC ADR02_2008_10-27_S069b, 42°03.97' N, 18°41.58' E, bottom 132 m. (ADRICOSM sta. 1-5).

- 14:40h UTC: Sta. 70, SATLANTIC ADR02_2008_10-27_S070, 42°17.00' N, 18°16.06' E, bottom 132 m. (Bari - Dubrovnik transect sta. AM9).

- 14:47h UTC: Sta. 70, CTD adr02_070, 42°17.18' N, 18°15.87' E, bottom 498 m. (Bari - Dubrovnik transect sta. AM9). Samples: UNITUS: chl, TSM; ISMAR: O2, nuts, CDOM. Launched T-FLAP 625 after CTD. Last winch depth: 570 m (???) m; no. of downcast marks (starting from 0 m): 56. Mark every 10 m.

- 15:35h UTC: Sta. 70, SATLANTIC ADR02_2008_10-27_S070b, 42°17.13' N, 18°15.93' E, bottom 515 m. (Bari - Dubrovnik transect sta. AM9). Launched T-FLAP 625.

- 16:57h UTC: Sta. 71, CTD adr02_071, 42°09.10' N, 18°06.83' E, bottom 1146.7 m. (Bari - Dubrovnik transect sta. AM8). Samples: ISMAR: nuts. Last winch depth: 1136 m; no. of downcast marks (starting from 0 m): 115; altimeter from bottom: 16.801 m. Mark every 10 m.

- 19:16h UTC: Sta. 72, CTD adr02_072, 41°59.00' N, 17°56.03' E, bottom 1219.1 m. (Bari - Dubrovnik transect sta. AM7). Samples: UNITUS: chl; ISMAR: nuts. Last winch depth: 1200 m; no. of downcast marks (starting from 0 m): 121; altimeter from bottom: 19.4 m (with winch at 1202 m). Mark every 10 m.

- 21:55h UTC: Sta. 73, CTD adr02_073, 41°50.00' N, 17°44.90' E, bottom 1201 m. (Bari - Dubrovnik transect sta. AM1). No Samples. Last winch depth: 1180 m; no. of downcast marks (starting from 0 m): 119; altimeter from bottom: 23.150 m. Mark every 10 m.

• 28/10/2008

- 01:01h UTC: Sta. 74, CTD adr02_074, 41°41.04' N, 17°34.12' E, bottom 1113 m. (Bari - Dubrovnik transect sta. AM6). Samples: ISMAR: nuts. Last winch depth: 1100 m; no. of downcast marks (starting from 0 m): 112; altimeter from bottom: 17.949 m. Mark every 10 m. NOTE: scan gap at 600 sec circa.

- 07:51h UTC: Sta. 75, SATLANTIC ADR02_2008_10-28_S075, 41°31.00' N, 17°23.10' E, bottom 962 m. (Bari - Dubrovnik transect sta. AM5).

- 08:00h UTC: Sta. 75, CTD adr02_075, 41°31.25' N, 17°23.07' E, bottom 952 m. (Bari - Dubrovnik transect sta. AM5). Samples: UNITUS: chl; ISMAR: nuts. Launch T-FLAP 621. Last winch depth: 960 m; no. of downcast marks (starting from 0 m): 95; altimeter from bottom: 19.680 m. Mark every 10 m.

- 09:11h UTC: Sta. 75, SATLANTIC ADR02_2008_10-27_S075b, 41°31.34' N, 17°23.00' E, bottom 949 m. (Bari - Dubrovnik transect sta. AM5).

- 10:58h UTC: Sta. 76, CTD adr02_076, 41°20.94' N, 17°12.11' E, bottom 568 m. (Bari - Dubrovnik transect sta. AM4). Samples: ISMAR: nuts. Last winch depth: 560 m; no. of downcast marks (starting from 0 m): 57; altimeter from bottom: 19.072 m. Mark every 10 m.

- 12:30h UTC: Sta. 77, CTD adr02_077, 41°16.97' N, 17°06.21' E, bottom 155 m. (Bari - Dubrovnik transect sta. AM3). Samples: ISMAR: nuts.Last winch depth: 140 m; no. of downcast marks (starting from 0 m): 15; altimeter from bottom: 8.4 m. Mark every 10 m.

- 13:40h UTC: Sta. 78, CTD adr02_078, 41°10.96' N, 17°00.12' E, bottom 114.5 m. (Bari - Dubrovnik transect sta. AM2). Samples: UNITUS: chl, TSM; Samples: ISMAR: nuts. Last winch depth: 100 m; no. of downcast marks (starting from 0 m): 11; altimeter from bottom: 8.2 m (with 101 m winch). Mark every 10 m.

- 13:50h UTC: Steam to Bari.

- 14:00h UTC: enter Bari harbor. End of operations.