CNR – NATIONAL RESEARCH COUNCIL OF ITALY
EARTH AND ENVIRONMENT DEPARTMENT

ACQUISITION OF MULTICHANNEL SEISMIC REFLECTION PROFILES IN THE CENTRAL AND SOUTHERN TYRRHENIAN SEA

TIR10: R/V URANIA CRUISE REPORT, 2010-10-19, 2010-10-28

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ISMAR Bologna TECHNICAL REPORT

Bologna, November 2010

Abstract

summary of methodologies, technical details and ship-board results of the TIR2010 geophysical, geological and oceanographical survey in the Central and Southern Tyrrhenian Sea with *R/V Urania* is presented.

Sommario - Vengono presentati le metodologie e l'insieme dei risultati ottenuti durante la campagna TIR2010. E' stata utilizzata la nave da ricerca *R/V Urania* del CNR,

ACRONYM	DESCRIPTION	URL-email
CNR	Consiglio Nazionale Delle Ricerche	www.cnr.it
DTA	Department Earth and Environment	www.dta.cnr.it
IGAG	Institute Environ. Geology and Geoengineering	www.igag.cnr.it
ISMAR	Istituto di Scienze Marine	www.bo.ismar.cnr.it
IAMC	Istituto per l'Ambiente Marino Costiero	http://www.iamc.cnr.it/IAMC/
IGG	Istituto di Geoscience e Georisorse	www.igg.cnr.it
INGV	Istituto naz. geofisica e Vulcanologia	www.ingv.it
UNIROMA1	Universitá di Roma La Sapienza	www.uniroma1.it
UNIBO	Universit'øf Bologna	www.unibo.it
UNIPI	Universitá of Pisa	www.unipi.it
CSIC	Consejo de Superior de Investigations Cientificas	http://www.csic.es
DURHAM	Durham University	http://www.dur.ac.uk
SEG	Soc. of Exploration Geophysicists	www.seg.org
SEG-D	Field data format, SEG, Revision D,	www.seg.org
SEG-Y	Field and archive data format, SEG, Revision Y,	www.seg.org
XTF	Extended Triton Format	www.tritonelics.com
GPS-DGPS-RTK	Global Positioning System	samadhi.jpl.nasa.gov
DTM	Digital Terrain Model	en.wikipedia.org
SRTM	Shuttle Radar Topogr.Mission	www2.jpl.nasa.gov/srtm
MCS	Reflection Multichannel Seismic	
MBES	MULTIBEAM ECHOSOUNDER SYSTEM	
SBP	Sub Bottom Profiling	
PSU	Practical Salinity Scale	ioc.unesco.org
XBT	Expendable BathyTermograph	www.sippican.com
UTM	Universal Transverse Mercator	
UTC	Universal Time Coordinated	
WGS84	World Geodetic System 1984	
NMEA	National Marine Electronics Association	www.nmea.org
SO.PRO.MAR.	Societa' Promozione lavori Marittimi	Fiumicino (Italy)
SBE	Sea Bird Electronics	www.seabird.com
BENTHOS	Teledyne Benthos	www.benthos.com
SIS	Sea Floor Inf. System	www.kongsberg.com
KONGSBERG	Kongsberg Maritime	www.kongsberg.com
SERCEL	Sercel	www.sercel.com
COMM-TECH	Communication Technology	www.comm-tec.com
MB-SYSTEM	MB-SYSTEM	www.ldgo.columbia.edu/MB-System
GMT	Generic Mapping Tool	gmt.soest.hawaii.edu/gmt

Table 1: Acronyms of Organizations, Manufacturers and Products

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1. INTRODUCTION AND BACKGROUNDS

The cruise *R/V Urania* TIR10, has been scheduled for the acquisition of multichannel seismic profiles (MCS), in the framework of the **CROP** (CROsta Profonda) project (Scrocca et al., 2003; Carrara et al., 2007) to study the tectonic setting and the geodynamic evolution of three important structures in the Tyrrhenian Sea backarck basin: (a) the Pontine Islands escarpment, (b) the Messina Strait, that connects the Southern Tyrrhenian Sea to the Ionian Sea, and (3) the volcanic area surrounding the Gulf of Naples (Campi Flegrei). The study of these areas by high resolution reflection seismic can contribute to the definition and prevention of geological, seismic and volcanic hazards, since the Pontine escarpment and Messina Strait are seismogenetic structures with an high tsunamigenic potential, and the Campi Flegrei volcanic risk is enhanced due to the large population and antropic activities involved.

Different topics of interest will be analyzed, among them (1) the characters of the transition from a continental to an oceanic crust, (2) the transfer zone between the Calabrian oceanic and the Sicilian continental subductions, (3) the complex volcanic district characterized by frequent explosive eruptions of Pontine Islands and Gulf of Naples.

Furthermore, TIR10 will includes measurements and data acquisitions in the fields of Oceanography and Seismic Oceanography, taking advantage of the high resolution MCS surveying, as in previous *R/V Urania* cruise ADRIASEIS09 in Southern Adriatic Sea (Carniel et al., 2010).

1.1. GEOLOGICAL SETTING

The Thyrrenian Sea is commonly considered as the back arc basin connected to the west-directed subduction of the Apennines chain. Here the tectonic regime is mainly extensional and trans-extensional and involves both continental and oceanic crust (Malinverno and Ryan, 1986; Doglioni, 1991; Doglioni et al., 1994; Carminati et al., 1998; Gvirtzman and Nur, 2001; Faccenna et al., 2001; Goes et al., 2004).

The Messina Strait is probably where the fault system responsible of the earthquake of 1908 and of the subsequent tsunami is located (Ghisetti, 1984, 1992; Pino et al., 2009). This structure can be described as a semi-graben characterized by a complex kinematics. If is formed by faults trending ENE-WSW in the northern part with a dip slip kinematics and by N-S and NNE-SSW faults in the south, with a trans-extensional direction of movement. This kinematic configuration can be deduced by the relative motion between the Sicilian structures in the west and the Calabrian arc in the east, resulting this latter more advanced due to the southeastward migration of the subduction arc. This two sector have in fact a different geodynamic behaviour: in the east of the strait the subduction hinge is progressively moving away from the upper plate, whereas in the western sector the same hinge approaches it (Devoti et al., 2008). Nevertheless, few evidences are available about the geometry and the position of the fault plane connected to the 1908 Messina earthquake. Growing geometries of Late Pleistocene deposits recognized in the area are not enough to reconstruct the geometry along strike of the main fault plane. A definition of the length of the plane and of its dip, combined with a rheological profile can provide information in order to better define the seismic parameters of the seismogenic source and, also, the role of these fault system in the geodynamic setting of the area.

The Pontine islands escarpment is one of the most relevant morphological structure in the Tyrrhenian Sea, and, likely, of the Mediterranean area. It has a NW-SE direction, and is the boundary between the continental crust to the North-East and the supposed oceanic crust in the South-West. Its nature is almost unknown; is possible to hypothesize the occurrence of a normal fault system that controls the escarpment, which should have a mainly trans-extensional

kinematic. The very well development slope (from -200 to -3000 m meters in less than 10 km) suggests the occurrence of recent tectonic activity. Based on the length of this supposed fault zone (150-200 km) this structure could potentially generate earthquakes with very high magnitude, even if the occurrence of an high heat flow reduce the elastic thickness and the differential stress in the area.

Finally, the volcanic area of the Phlegrean Field , located at the northern boundary of the Campana Plain, is a tectonically depressed area along the Tyrrhenian margin of the Southern Apennines. The tectono-volcanic activity is very important and, consequently, this area has an elevated volcanic risk as it densely populated (Di Vito et al., 2008). A peculiar character of this activity is the bradisism, a periodicity of relative speed uplifting and slow subsidence episodes. The most recent crisis due to bradisism occurred in 1969-1972 [e.g., Corrado et al. (1977)] and in 1982-1984 [e.g. Natale et al. (1999)]. In the last decades the need to better define this processes associated to volcanic risk become progressively higher.

1.2. OCEANOGRAPHIC SETTING

The Tyrrhenian Sea exchanges water with the rest of the Mediterranean Sea through the Sardinia Channel,the Sicily Strait and the Corsica Channel, that represent morphologic constraints for the circulation of the intermediate and deep waters (Millot, 1987; Astraldi and Gasparini, 1994; Sparnocchia et al., 1999; Astraldi et al., 2001). The surface water (0-200 m) entering the Tyrrhenian Sea through the Sardinia Channel is the Modified Atlantic Water (MAW) from the Algerian Current (AC). The MAW is characterized by low salinity (on average less than 38 PSU), and flows cyclonically along the Italian coast. Through the Sicily Strait and deeper than 200 m down to about 700 m, the basin receives the Levantine Intermediate Water (LIW), which is marked by a subsurface temperature maximum and by a higher salinity (on average 38.8 PSU), and mixes with the surface MAW and deeper water masses. From about 700 m to the bottom the Tyrrhenian Deep Water (TDW) is present, being the result of the modification of the West Mediterranean Deep Water (WMDW) that crosses the Sardinia Channel. The circulation pattern in the Tyrrhenian Sea is normally characterized by two cyclonic gyres in the south and in the northern basins, and by the presence of cyclonic and anticyclonic eddies in the central basin. Interesting features in the TDW (Zodiatis and Gasparini, 1996) are the thermoaline 'staircase' formations.

The physical oceanographic objective of this survey was to conduct seismic oceanography [e.g. Buffet et al. (2009)], that is, the method of using multi-channel seismic (MCS) reflection profiling to image thermohaline finestructure in the ocean. In addition to the MCS profiling, a series of strategically located Expendable Bathythermograph (XBT) probes (which consist of a missile-shaped device with a thermocouple located at its nose cone) were launched, capable of measuring vertical resolutions as small as 65 cm and temperature variations as small as $\pm 0.1°C$, (Boyd and Linzell, 1993). Recently, the Mediterranean Occidental (MEDOC) survey (Ranero et al., 2010), found significant thermohaline staircases in the deeper parts of the Tyrrhenian basin (Figure 1)

Thermohaline staircases are regular, well-defined, step-like variations in vertical temperature and salinity gradients that form when temperature and salinity increase with depth and nearly compensate with density, (Kelley, 1984). Turbulent mixing can disrupt the regular step-like structures, so they are typically found in regions where the Prandtl number (the ratio of viscous to thermal diffusion rates) is near unity and turbulent mixing is unusually weak (Merryfield, 2000). Therefore, isopycnal (equal density) stratification is more static than in regions dominated by turbulence.

2. CRUISE SUMMARY

SHIP: *R/V Urania* Flag: Italy [IT] Call Sign: IQSU IMO: 9013220, MMSI: 247498000
START: 2010-10-19 PORT: Napoli
END: 2010-10-28 PORT: Napoli
SEA/OCEAN: Tyrrhenian Sea, Mediterranean Sea
LIMITS: NORTH 41:10.0 SOUTH: 37:50.0 WEST: 12:20.0 EAST: 16:00
OBJECTIVE: Reflection Seismic Multichannel Iacquisition in the Tyrrhennian Sea
COORDINATING BODIES: IGAG ROME ISMAR BOLOGNA (ITALY)
CHIEF OF EXPEDITION: Marco Ligi (ISMAR-CNR)
CONTACT: Marco.Ligi@ismar.cnr.it
DISCIPLINES: MARINE GEOLOGY, MARINE GEOPHYSICS, SEISMIC OCEANOGRA-
PHY, PHYSICAL OCEANOGRAPHY
WORK DONE: 1006 KM MULTICHANNEL REFLECTION SEISMIC, ~100 KM^2 MULTI-
BEAM, ~1000 KM SBP, 1 CTD CASTS, 40 XBT Drops,

LOCALIZATION:
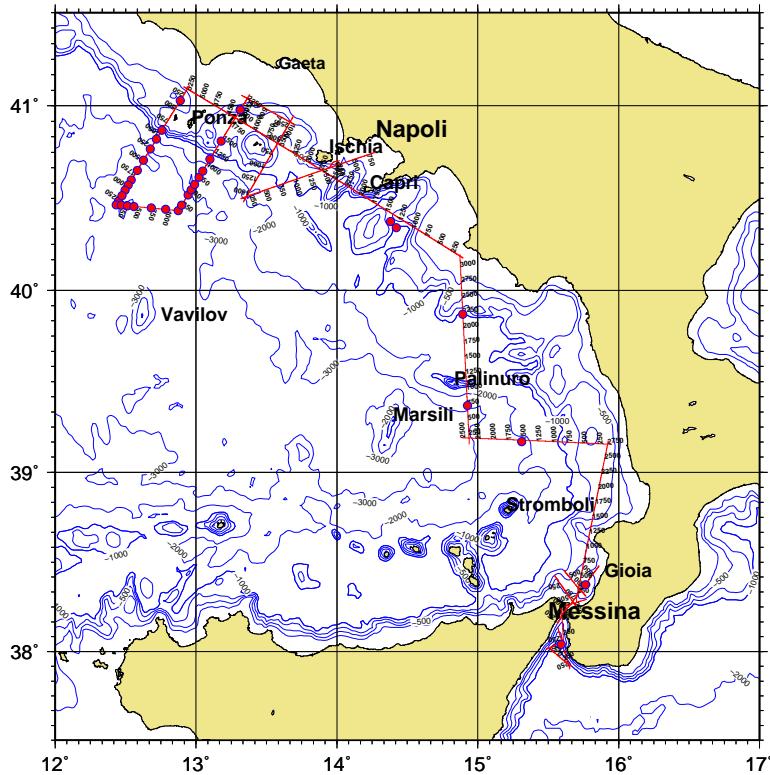
Figure 1: Ship tracks during Cruise TIR10. Red and blue circles are CTD and XBT drops, respectively

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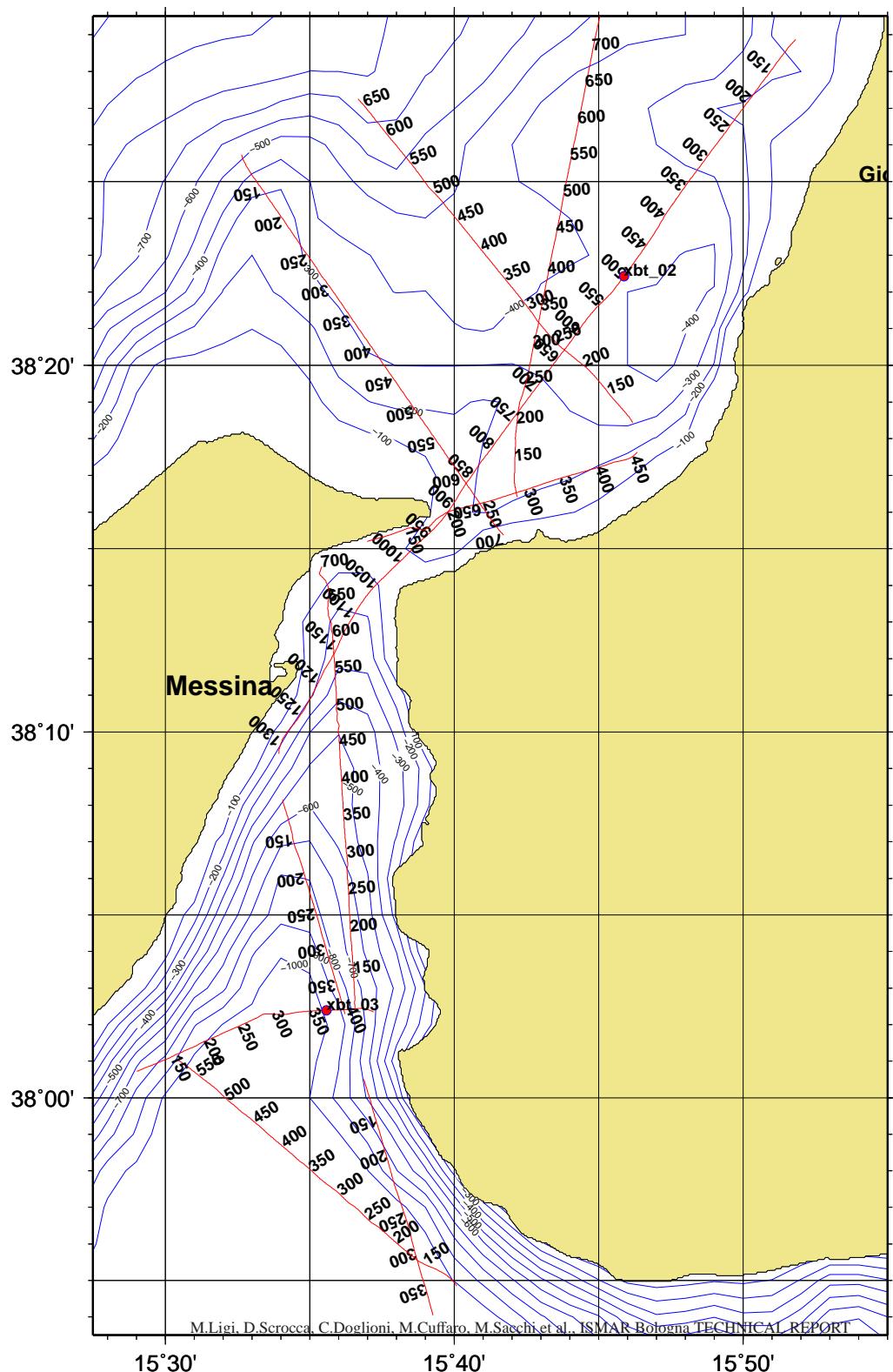
Figure 2: Ship tracks during cruise TIR10 , Strait of Messina Area. Red and blue circles are CTD and XBT drops, respectively.
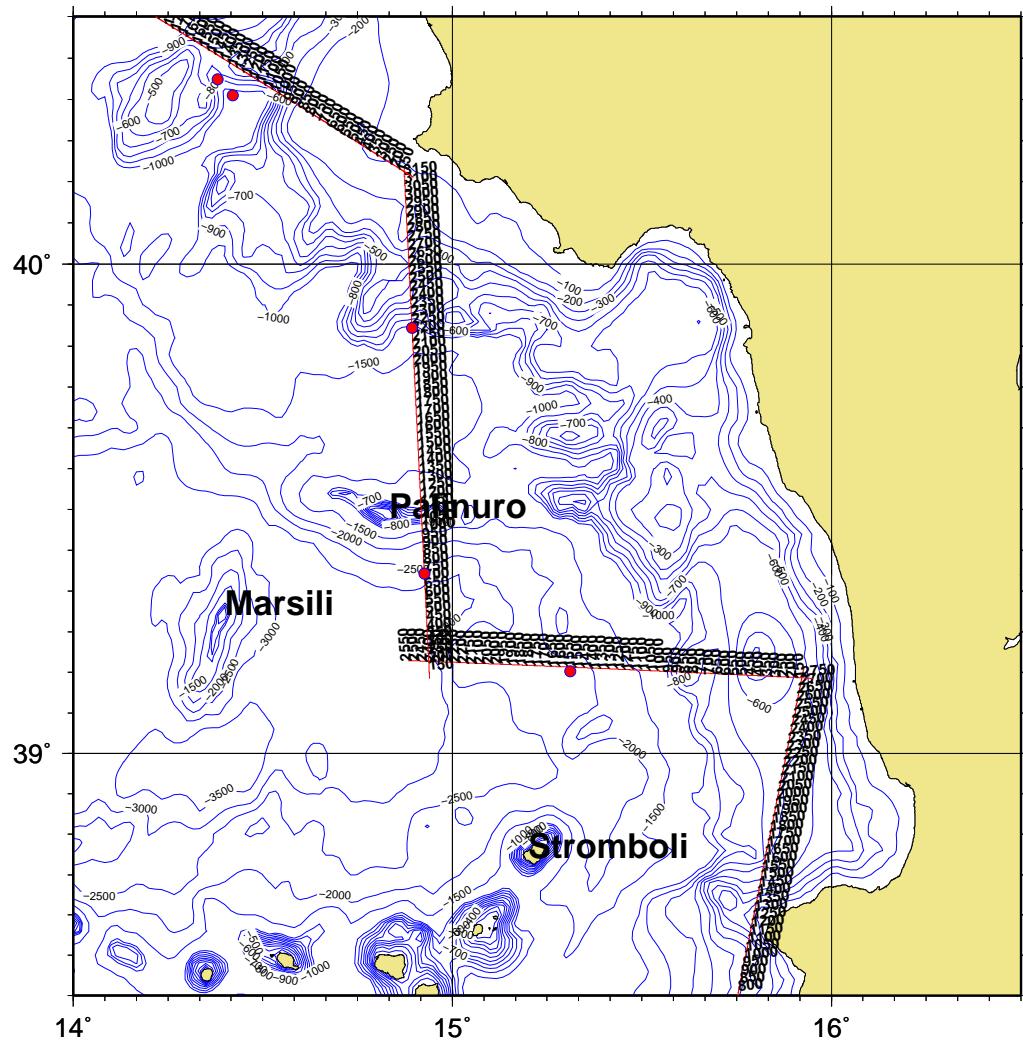
Figure 3: Ship tracks during cruise TIR10 , SE Tyrrhenian Sea. Red and blue circles are CTD and XBT drops, respectively.
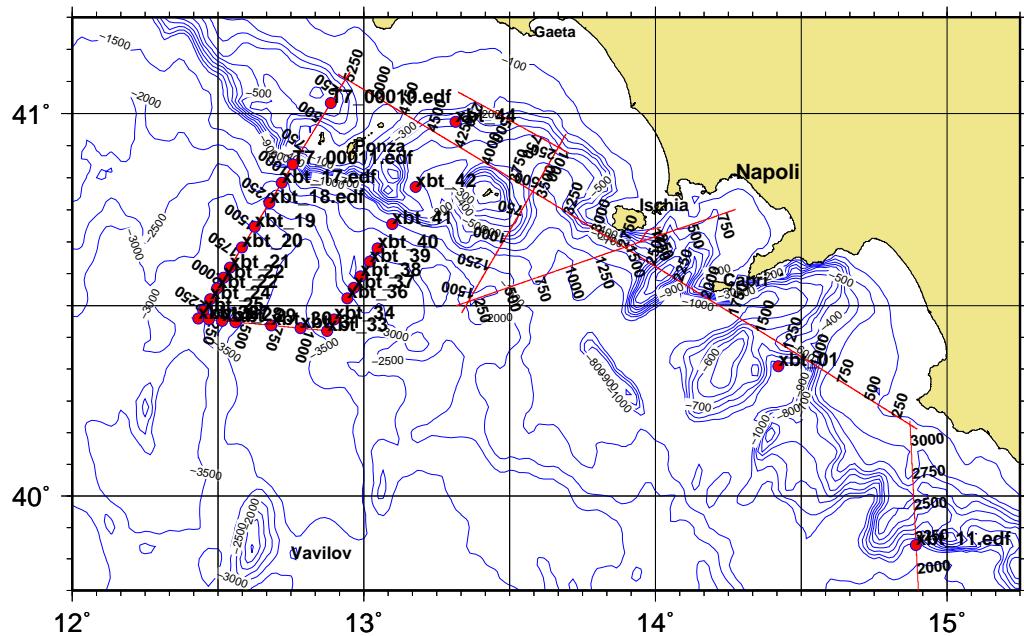
Figure 4: Ship tracks during cruise TIR10 , Pontine I. Area. Red and blue circles are CTD and XBT drops, respectively.

SCIENTIFIC AND TECHNICAL PARTIES

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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. The 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.

R/V Urania is equipped with DGPS and SEAPATH 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.

Figure 5: *R/V Urania.*

3.1. NAVIGATION AND DATA ACQUISITION

The vessel was set-up for data acquisition and navigation with PDS-2000 software by RESON, interfacing by a multiserial and Ethernet link several instruments, among them the DGPS (Fugro), the Atlas-Krupp Deso-25 single-beam echosunder, the MAHRS MRU and the meteorological station.

The position and depth data were also distributed to the CTD data acquisition console. A Kongsberg processor running the SIS software, collected the multibeam data, including a SEAPATH MRU, compass, and DGPS. The MBES was the 70kHz, 400 1x2°, 150°aperture EM-710 (2000 m range) model by Kongsberg, with sonar head positioned on the ship's keel using a V-shaped steel frame. A Sound Velocity probe at the keel 1m above the Sonar Head is interfaced directly to the MBES processor, thus providing the necessary real-time data for the beam-forming. CTD casts were 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.

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 of PDS2000 on Ship Urania (PDS2000). The GPS antenna (primary positioning system) is located on point DGPS.

POSITION	ACROSS	ALONG	HEIGHT
REFERENCE POINT	0.00	0.00	0.00
SEAPATH_GPS	-4.039	0.163	-18.211
MRU	-0.341	-1.342	-1.596
MBEAM_TX	0.0936	10.2964	5.0623
MBEAM_RX	-0.0031	11.0144	5.0600
SEALEVEL	0	0	-0.0875

Table 4: Instrumental Offsets on Ship Urania (EM710). The DGPS antenna (primary positioning system) is located on point SEAPATH_GPS.

3.2. *MULTICHANNEL REFLECTION SEISMIC DATA*

All the relevant information for the acquisition is presented in the Appendix 5.1.

The seismic source was set as a tuned array of three SERCEL's GI-GUN, configured in harmonic mode, two 45+45 and one 75+75 in^3, towed from the starboard and port sites, respectively. The compressed air was delivered at 120-140 Bar by an electrical Mod. I25 Bauer compressor, 2500 L/m.

The array was fired and synchronized by ISMAR's 8 PORTS GUN SYNCHRONIZER (Masini and Ligi, 1995). The RS-232 firing pulse, converted to TTL or Contact Closure by an external circuit, was provided by the PDS-2000 navigation system on programmed distances of 37.5m along the planned routes.

The seismic recording equipment employed (by Sercel) is summarized here: Seal Recording System (Sys 5), NAS drives, Esqc QA, FSK/Digimain bird controller, 96 channel Digital Streamer, 8 actives, 2 head stretches, 50 m tow leader, passive tail buoy, Digicourse cable levelers.

IMPORTANT NOTE: A fixed delay of 10ms was applied to the TB for the gun synchronization, plus 10-11 ms accounting for the opening of valves and shuttles, i.e. actual shot time is espected to appear some 20 ms after TB.

Figure 6: The EEL streamer (Sercel 96 channels digital) and DIGICOURSE Cable Levelers.
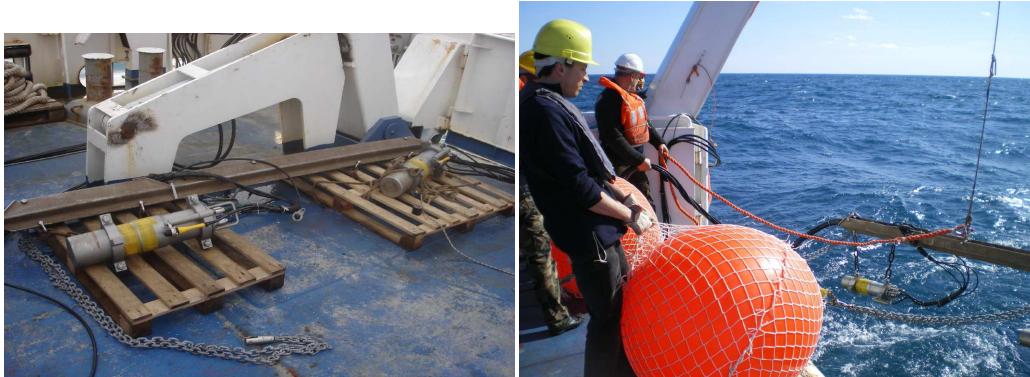
Figure 7: GI-GUN array.

Figure 8: Tail buoy and shot.

Figure 9: Birds and Seismic Recording Acquisition.

3.3. CTD AND XBT DATA

CTD casts were taken throughout the surveyed areas, for sound velocity analysis, and were used for real-time MBES acquisition and post-processing. On the way along seismic profiling, several T7 and T5 XBT launches data were collected by a Sippican Mod. MK21 profiler.

The position of the XBT and CTD stations are reported in Table **??** and can be viewed in Fig.**??**, respectively.

3.4. CHIRP SBP

SBP data was acquired by the 16 transducers, hull mounted BENTHOS (DATASONICS) Mod.CAP-6600 CHIRP-II profiler, with operating frequencies ranging between 2 and 7 kHz. The pulse length was mantained at 20 ms while the trigger rates varied from 0.25 to 1 seconds according to water depth. Digital data acquired by the Communication Technology SWANPRO software were recorded in the XTF format on local disks and transferred on the network upon request. Backups were loaded on HD and DVD. The navigation data was made available to the system as lat/long by NMEA sentences of the DGPS receiver at a rate of aproximately 1 Hz or

by the PDS200's NMEA at 1Hz. The XTF data were then converted to SEG-Y by the Triton-Elics's Xtf2Seg software. This latter data were then input to the ISMAR's SEISPRO software (Gasperini and Stanghellini, 2009) for data processing and display. Since the SEG-Y converted positions were found to be truncated, the accurate position data were recovered from the XTF headers by routines developed at ISMAR, and re-input to SEISPRO. The operation was also useful to check data integrity, other than for producing the navigation map and database.

3.5. *MISCELLANEOUS*

The WGS84 datum, the UTM33N projection and UTC were chosen for navigation and display, and for 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) and Globalmapper. The multibeam data were pre processed on board by the GMT software and ISMAR's routines and scripts, using the package MB-SYSTEM (Caress and Chayes, 2009). Bathymetric data were complemented by the ISMAR's DTM of Tyrrhenian Sea (Marani et al., 2004).

The computing center employed INTEL based PC running the GNU-Linux in addition to portable computer for data acquisition and personal processing. The Linux machines were used as data repositories using the SAMBA software, providing alse network services like WWW, DHCP and NAT.

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

4. PRELIMINARY RESULTS, CONCLUDING REMARKS AND FUTURE WORKS

Main targets of TIR10 cruise have been reached. Post cruise processing will be necessary to provide higher quality seismic images, useful to find geological constrains for tectonic evolution of the central and southern Tyrrhenian domain.

Figure 10 shows a compilation of XBT temperature data in the Pontine Area.

A comparison of the interpretation of the obtained data with the previous CROP–CNR data base, contribuites to collect further areas to be investigated, in order to define the geometry of potential seismogenic zones.

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.
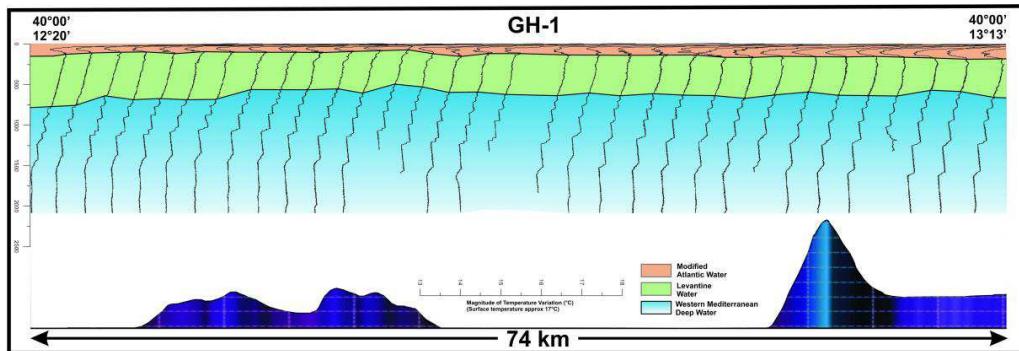
Figure 10: Map of the lateral distribution of XBT profiles in the Tyrrhenian Sea. Three main water masses are identified: a) Modified Atlantic Water (pink), b) Levantine Water (green) and c) Western Mediterranean Deep Water (blue), which is characterized by staircase formation

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5. APPENDIX

5.1. SEISMIC ACQUISITION

Table 5 presents the multichannel lines acquistion parameters and Observer's Log, whereas the figures are plots of each single line (distance vs depth). Section 5.2 shows the EEL Operational Report. Section **??** presents shot-dept-distance graphs and decimated navigation data.

5.2. EEL Project - Operations and Equipment Report

Mobilisation

Mobilisation of the equipment onboard the R/V Urania was carried out on the 19th October 2010 while alongside Napoli. The equipment consisted of a Seal system with a high resolution (HR) 96 channel, 12.5m group length streamer supplied on the NiM winch with integrated hydraulic pack. Additional equipment supplied were dual NAS drives for data storage, FSK/Digicourse (DOS) bird (leveller) controller and Sercel eSQC Pro and iSys V12 plotter for online quality control (QC) of the data. A full complement of spare for all of this equipment was also supplied. The winch was welded (using sacrificial angle iron supplied by the ship) to the frame which normally supports the 20" container. All electronics equipment was setup on bench in the ships dry lab. Birds were stored in the wet lab when the equipment was onboard. Navigation were situated directly behind acquisition station and the gun control was directly to left. The compressor manifold pressure could be observed from a remote display.

Networking and Interconnection

The normal Seal configuration with Seal workstation, CMXL (recorder) and NAS servers on the 150.10.128.x network and just the Seal workstation and eSQC Pro on the 172.27.128.x network was used. In addition the Seal network hub was connected to the ship's network. The connection to the ships network was for two purposes. Firstly it allowed the data to be copied real-time (actually with a short delay since the data transferred once every 5 minutes or so) to the clients central NAS. This was achieved by the client running 'rsync' which just copied any files that had been added or updated since the last time it was run. This was scheduled by adding it to the cron table. The CMXL was triggered from the gun controller by a TTL pulse. Navigation data were provided by an output port from the PDS-2000 navigation system.

Table 5: Cruise CRUISE with *R/V Urania*. MCS OPERATIONS. Fields S and RR are Line sequence and line RE-RUN, respectively.

LINE	S	SOL TIME	EOL TIME	SOL FILE	EOL FILE	SOL FIX	EOL FIX	RR	DATE DATE	COMMENTS COMMENTS
10.1	1	13:28	19:12	99	1323	102	1322	N	21/10/10	Files 99 and 100 noise files at SOL average 5.36μB / Nav sent first fix at 102 not 101/ Gun pressure should be 140 bar
10.1										From shot 975 speed reduced of the vessel , due to air problems. Birds lost control and some went to 20m deep.
10.1										Speed increased to 4.7kn , still struggling with a large tail current , increase speed to 5.2 knots. / EOL NOISE 4.7μB
10.2	2	19:30	20:51	99	399	101	399	N	21/10/10	Files 99 and 100 noise files at SOL average 11.6μB. / Nav crashed for 1m 59 sec. Then when sorted out we were 2 fixes out
10.2										NAS froze at file 352. / Line aborted and seal and NAS re-booted. / EOL NOISE 7.9μB
10.3	3	21:37	23:18	99	396	101	396	N	21/10/10	Files 99 and 100 noise files at SOL average 5.6μB
10.3										Nav froze during handover and navigator not noticed , approx 12minutes lost / EOL NOISE 6.1μB
10.4	4	1:02	3:28	99	590	101	590	N	22/10/10	Files 99 and 100 noise files at SOL average 3.2μB
10.4										GPS CRASH SO STOP LINE EARLY / NO EOL NOISE FILES
10.5	5	4:26	6:14	99	440	101	440	N	22/10/10	Files 99 and 100 noise files at SOL average 8.94 Ub / EOL NOISE 7.4μB
10.6	6	6:55	9:38	99	702	101	702	N	22/10/10	Files 99 and 100 noise files at SOL average 14.88 μB
10.6										FIX 117 190 MISSING HI NOISE FROM FIX 460 TO
10.6										NAS froze at file 618. / EOL NOISE 15.3μB
10.7	7	10:49	12:39	99	465	101	463	N	10/22/10	Files 99 and 100 noise files at SOL average 19.6μB. / NAV lost fixes from 11:09:01 until 11:11:08 and at 11:17:44 until 11:20:37
10.7										and at 11:44:22 until 11:47:11 / EOL NOISE 17.7μB
10.8	8	12:50	15:32	99	668	101	666	N	10/22/10	Files 99 and 100 noise files at SOL average 11.1μB. / Nav lost fixes from 13:40:27 until 13:42:46. / EOL NOISE 6.2μB

10.9	9	16:56	20:04	99	706	101	704	N	22/10/10	Files 99 and 100 noise files at SOL average 4.3μB / NAV lost fixes from 17:38:52 until 17:42:26 and 19:23:05 until 19:24:57
10.9										and at 19:26:10 until 19:27:07. Dropped shot 577. EOL NOISE 16.8μB (late taking noise file , turn started)
10.10	10	20:22	9:40	99	2800	101	2797	N	22/10/10	Files 99 and 100 noise files at SOL average 11.1μB. / Nav lost fixes from 20:58:54 until 21:01:05 and 22:03:28 until 22:05:32
10.10										and 07:34:50 to 07:36:58 and 08:30:52 to 08:31:56 and 09:22:28 to 09:23:17
10.10										noise at EOL 1.87μB
10.11	11	10:48	23:03	99	2573	101	2571	N	23/10/10	Files 99 and 100 noise files at SOL average 3.7μB / 2190 Dropped Shot. /
10.11										average noise at EOL 5.8μB
10.12	12	1:09	16:40	99	3202	101	3200	N	24/10/10	Seal time 2 seconds BEHIND navigation.Files 99 and 100 noise files at SOL average 3.0 μB
10.12										increase in noise from file 1050 to 1100 vessel in area/strong reflection / Higher noise between 2580 - 2615 due to large
10.12										vessel passing by / EOL Noise 4.2μB
10.13	13	18:06	20:21	99	5392	101	5390	N	24/10/10	Files 99 and 100 noise files at SOL average 4.4μB / EOL Noise file average 14.7μB
10.14	14	21:34	9:03	99	2418	101	2420	N	25/10/10	Files 99 and 100 noise files at SOL average 7.83μB / EOL Noise file average 19.7 μB
10.14		:								bird depth lowered to 7.5m at shot 4035 FIX 1688 , 1689, 1815 , 1816 Missing from navigation
10.15	15	10:14	16:07	99	1218	101	1216	N	26/10/10	BIRD DEPTHS LOWERED TO 7.5M OFFSET INCREASED BY 6.25M EXTRA WEIGHT ADDDED TO HESE.
10.15										Files 99 and 100 noise files at SOL average 6.2μB / EOL Noise file average 5.6μB
10.16	16	17:01	4:31	99	2342	101	2340	N	26/10/10	Files 99 and 100 noise files at SOL average11 μB / EOL Noise file average3 μB
10.16										
10.17	17	6:28	11:32	99	1072	101	1085	N	27/10/10	Files 99 and 100 noise files at SOL average 4.98 μB / EOL Noise file average 4.2 μB
10.17										Fixes stop at 666 (09:15) Fixes 667 to 681 Missing 15 shots dropped.

10.18	18	12:55	21:08	99	1720	101	1718	N	27/10/10	Files 99 and 100 noise files at SOL average 16.6 μB / EOL Noise file average 2.5 μB / High SOL noise due to vessel still turning
10.18			:							onto line
10.19	19	21:44	6:22	99	1833	1720	3451	N	27/10/10	Files 99 and 100 noise files at SOL average 18.8 μB / EOL Noise file average 2.2 μB Noise at SOL Hi due to streamer still not straight
10.19										Navigator forgot to reset fix point.
10.19										Tailbuoy snapped off by fishing vessel at shot 1695. Line terminated to recover equipment.
10.20	20	9:47	13:45	99	904	101	902	N	28/10/10	Files 99 and 100 noise files at SOL average 5.6 μB / EOL Noise file average 4.2 μB

Table 6: Cruise TIR10 with *R/V Urania*. MCS Shot Data. SD=Shot Distance, KP=Progressive distance on line.

LON	LAT	HDG	CMG	SD	KP	CDP	FIX	FILE	DATE	LINE
15.863635	38.481095	221	225	39.4	0	199	102	101	2010-10-21T13:28:02	TIR10.01
15.838588	38.455425	215	218	34.9	3596	793	201	200	2010-10-21T13:55:50	TIR10.01
15.813693	38.429127	216	219	36.5	7236	1393	301	300	2010-10-21T14:22:45	TIR10.01
15.789400	38.402647	214	215	37.3	10863	1993	401	400	2010-10-21T14:51:19	TIR10.01
15.766917	38.376162	217	215	37.4	14403	2593	501	500	2010-10-21T15:21:19	TIR10.01
15.740285	38.351178	216	216	34.7	18033	3193	601	600	2010-10-21T15:49:05	TIR10.01
15.715550	38.324808	221	215	37.7	21675	3793	701	700	2010-10-21T16:17:54	TIR10.01
15.690797	38.298497	217	213	35.2	25311	4393	801	800	2010-10-21T16:45:12	TIR10.01
15.667105	38.271568	220	214	35.8	28953	4993	901	900	2010-10-21T17:17:57	TIR10.01
15.638663	38.246688	202	224	36.2	32688	5593	1001	1000	2010-10-21T17:45:54	TIR10.01
15.610227	38.221613	176	210	37.1	36438	6193	1101	1100	2010-10-21T18:12:53	TIR10.01
15.590130	38.191922	220	204	35.9	40180	6793	1201	1200	2010-10-21T18:39:33	TIR10.01
15.567660	38.163355	210	202	36.8	43927	7393	1301	1300	2010-10-21T19:06:29	TIR10.01
15.565625	38.156795	188	180	35.9	44683	7513	1321	1320	2010-10-21T19:12:26	TIR10.01
15.567697	38.135758	174	162	35.8	0	199	101	101	2010-10-21T19:30:17	TIR10.02
15.580098	38.102428	153	164	35.9	3866	793	198	200	2010-10-21T20:03:35	TIR10.02
15.592050	38.070040	170	165	37.6	7613	1393	298	300	2010-10-21T20:34:39	TIR10.02
15.603733	38.038287	165	164	38.1	11285	1981	396	398	2010-10-21T21:07:04	TIR10.02
15.614602	38.008435	159	164	40.3	0	199	101	101	2010-10-21T21:37:00	TIR10.03
15.626547	37.976378	162	164	39.3	3711	793	200	200	2010-10-21T22:08:38	TIR10.03
15.643350	37.931610	161	166	35.7	8899	1393	301	300	2010-10-21T22:50:53	TIR10.03
15.654448	37.900763	163	166	39.1	12460	1963	396	395	2010-10-21T23:18:00	TIR10.03
15.668065	37.914062	326	330	39.9	0	199	101	101	2010-10-22T01:02:44	TIR10.04
15.634147	37.933238	308	312	36.6	3710	793	200	200	2010-10-22T01:33:55	TIR10.04
15.601858	37.955160	311	316	37.6	7460	1393	300	300	2010-10-22T02:02:46	TIR10.04
15.569248	37.976842	308	309	37.6	11208	1993	400	400	2010-10-22T02:29:17	TIR10.04
15.536643	37.998533	322	313	37.4	14952	2593	500	500	2010-10-22T02:59:53	TIR10.04
15.507132	38.017382	324	306	19.1	18289	3127	589	589	2010-10-22T03:27:53	TIR10.04
15.483673	38.012047	65	68	38.6	0	199	101	101	2010-10-22T04:26:19	TIR10.05
15.522220	38.025578	64	64	36.2	3707	793	200	200	2010-10-22T04:55:54	TIR10.05
15.561297	38.038222	95	86	37.4	7445	1393	300	300	2010-10-22T05:28:30	TIR10.05
15.603915	38.040168	92	86	38.0	11202	1993	400	400	2010-10-22T05:58:29	TIR10.05
15.620097	38.039185	139	124	37.8	12654	2227	439	439	2010-10-22T06:13:30	TIR10.05
15.609393	38.039958	353	1	35.4	0	199	101	101	2010-10-22T06:55:43	TIR10.06
15.606865	38.075748	360	1	37.1	3983	793	202	200	2010-10-22T07:27:41	TIR10.06
15.604998	38.109388	340	354	36.2	7728	1393	302	300	2010-10-22T07:57:39	TIR10.06
15.601853	38.143048	345	357	39.9	11477	1993	402	400	2010-10-22T08:27:05	TIR10.06
15.598893	38.176418	352	352	38.9	15222	2593	502	500	2010-10-22T08:58:58	TIR10.06
15.596552	38.210017	354	7	38.9	18971	3193	602	600	2010-10-22T09:32:23	TIR10.06
15.590195	38.241602	35	16	37.0	22704	3793	702	700	2010-10-22T10:17:26	TIR10.06
15.590308	38.241923	35	13	35.8	22741	3799	703	701	2010-10-22T10:17:48	TIR10.06
15.616427	38.253295	71	72	41.1	0	199	101	101	2010-10-22T10:49:22	TIR10.07
15.662553	38.266493	55	65	36.3	4464	793	200	200	2010-10-22T11:22:12	TIR10.07
15.707028	38.276542	70	74	36.4	8518	1393	300	300	2010-10-22T11:54:14	TIR10.07
15.747895	38.286530	70	75	36.7	12263	1993	400	400	2010-10-22T12:22:03	TIR10.07
15.772172	38.293925	29	31	38.5	14578	2365	462	462	2010-10-22T12:38:57	TIR10.07

15.769628	38.307245	339	339	38.5	0	199	101	101	2010-10-22T12:50:05	TIR10.08
15.742378	38.332608	314	310	38.0	3698	793	200	200	2010-10-22T13:20:45	TIR10.08
15.710052	38.358702	321	323	36.0	7769	1393	300	300	2010-10-22T13:48:50	TIR10.08
15.683192	38.384942	311	320	37.8	11511	1993	400	400	2010-10-22T14:16:05	TIR10.08
15.655920	38.411018	308	317	38.8	15261	2593	500	500	2010-10-22T14:45:26	TIR10.08
15.628902	38.437227	313	321	35.5	19012	3193	600	600	2010-10-22T15:13:54	TIR10.08
15.611293	38.454180	308	320	41.0	21443	3583	665	665	2010-10-22T15:32:29	TIR10.08
15.544067	38.428908	170	164	38.8	0	199	101	101	2010-10-22T16:56:48	TIR10.09
15.566788	38.400837	150	142	35.4	3710	793	200	200	2010-10-22T17:27:04	TIR10.09
15.593988	38.369993	146	143	36.2	7882	1393	300	300	2010-10-22T17:59:42	TIR10.09
15.618423	38.342292	148	144	39.1	11627	1993	400	400	2010-10-22T18:30:34	TIR10.09
15.642838	38.314597	144	146	38.8	15371	2593	500	500	2010-10-22T19:01:28	TIR10.09
15.669425	38.284382	137	145	38.5	19453	3193	601	600	2010-10-22T19:33:37	TIR10.09
15.694315	38.256930	123	137	38.2	23202	3793	701	700	2010-10-22T20:02:15	TIR10.09
15.695255	38.256248	105	118	36.6	23314	3811	704	703	2010-10-22T20:03:06	TIR10.09
15.703023	38.273515	355	348	38.9	0	199	101	101	2010-10-22T20:22:52	TIR10.10
15.702827	38.306772	14	7	38.6	3710	793	200	200	2010-10-22T20:55:52	TIR10.10
15.712295	38.341583	12	13	38.7	7673	1393	300	300	2010-10-22T21:27:55	TIR10.10
15.720847	38.374672	4	10	38.4	11422	1993	400	400	2010-10-22T21:54:38	TIR10.10
15.729698	38.409977	360	9	36.9	15418	2593	500	500	2010-10-22T22:24:20	TIR10.10
15.738247	38.443032	8	12	37.5	19163	3193	600	600	2010-10-22T22:53:04	TIR10.10
15.746535	38.476135	10	11	36.2	22909	3793	700	700	2010-10-22T23:23:51	TIR10.10
15.755120	38.509167	11	11	39.4	26652	4393	800	800	2010-10-22T23:53:55	TIR10.10
15.763567	38.542197	14	13	38.8	30393	4993	900	900	2010-10-23T00:23:15	TIR10.10
15.772043	38.575248	14	14	38.0	34136	5593	1000	1000	2010-10-23T00:51:48	TIR10.10
15.780462	38.608302	18	13	37.7	37880	6193	1100	1100	2010-10-23T01:22:12	TIR10.10
15.788372	38.641470	22	12	38.9	41627	6793	1200	1200	2010-10-23T01:52:45	TIR10.10
15.797582	38.674422	14	12	37.5	45373	7393	1300	1300	2010-10-23T02:22:38	TIR10.10
15.806115	38.707527	7	11	37.1	49123	7993	1400	1400	2010-10-23T02:50:36	TIR10.10
15.814613	38.740592	4	11	38.5	52868	8593	1500	1500	2010-10-23T03:17:28	TIR10.10
15.823102	38.773558	11	11	37.8	56608	9193	1600	1600	2010-10-23T03:47:55	TIR10.10
15.831113	38.806610	33	19	38.4	60350	9793	1700	1700	2010-10-23T04:17:27	TIR10.10
15.840033	38.839605	23	12	37.5	64098	10393	1800	1800	2010-10-23T04:46:26	TIR10.10
15.848822	38.873465	21	10	34.4	67934	10993	522	1900	2010-10-23T05:15:47	TIR10.10
15.856998	38.906497	18	12	39.3	71671	11593	622	2000	2010-10-23T05:44:14	TIR10.10
15.865878	38.939438	17	12	38.2	75412	12193	722	2100	2010-10-23T06:12:32	TIR10.10
15.874458	38.972472	10	13	37.3	79155	12793	822	2200	2010-10-23T06:40:33	TIR10.10
15.882972	39.005525	10	11	37.1	82898	13393	922	2300	2010-10-23T07:09:19	TIR10.10
15.892267	39.041045	12	12	35.2	86924	13993	1022	2400	2010-10-23T07:41:39	TIR10.10
15.900817	39.074105	12	12	37.7	90669	14593	1122	2500	2010-10-23T08:11:43	TIR10.10
15.910285	39.107517	358	12	38.9	94503	15193	1222	2600	2010-10-23T08:43:36	TIR10.10
15.918187	39.140688	354	9	35.4	98250	15793	1322	2700	2010-10-23T09:11:43	TIR10.10
15.926587	39.173018	355	12	34.3	101912	16369	1418	2796	2010-10-23T09:40:08	TIR10.10
15.951833	39.154042	264	270	38.9	0	199	101	101	2010-10-23T10:48:38	TIR10.11
15.909090	39.156082	262	272	36.5	3705	793	200	200	2010-10-23T11:17:18	TIR10.11
15.865820	39.157688	260	272	37.6	7450	1393	300	300	2010-10-23T11:45:57	TIR10.11
15.822568	39.159390	257	273	37.2	11195	1993	400	400	2010-10-23T12:14:40	TIR10.11
15.779278	39.160782	257	274	35.8	14942	2593	500	500	2010-10-23T12:45:18	TIR10.11
15.735943	39.162297	257	269	38.6	18692	3193	600	600	2010-10-23T13:15:33	TIR10.11
15.692618	39.164032	264	272	37.7	22443	3793	700	700	2010-10-23T13:43:30	TIR10.11

15.649330	39.165662	267	274	37.5	26190	4393	800	800	2010-10-23T14:14:02	TIR10.11
15.606052	39.167250	266	272	37.5	29936	4993	900	900	2010-10-23T14:42:08	TIR10.11
15.562792	39.168775	271	272	36.7	33679	5593	1000	1000	2010-10-23T15:10:48	TIR10.11
15.519488	39.170273	268	271	37.2	37426	6193	1100	1100	2010-10-23T15:40:19	TIR10.11
15.476188	39.171858	270	271	38.0	41173	6793	1200	1200	2010-10-23T16:08:28	TIR10.11
15.432882	39.173278	274	275	38.1	44920	7393	1300	1300	2010-10-23T16:35:55	TIR10.11
15.389560	39.174860	268	272	38.2	48669	7993	1400	1400	2010-10-23T17:05:41	TIR10.11
15.346215	39.176302	264	270	38.2	52419	8593	1500	1500	2010-10-23T17:34:08	TIR10.11
15.302973	39.177820	270	274	38.1	56161	9193	1600	1600	2010-10-23T18:06:45	TIR10.11
15.259728	39.179045	274	277	38.4	59901	9793	1700	1700	2010-10-23T18:39:08	TIR10.11
15.216390	39.180553	271	275	36.7	63651	10393	1800	1800	2010-10-23T19:11:22	TIR10.11
15.173048	39.181983	269	273	37.2	67400	10993	1900	1900	2010-10-23T19:43:58	TIR10.11
15.129713	39.183312	268	272	38.9	71148	11593	2000	2000	2010-10-23T20:16:14	TIR10.11
15.086365	39.184725	271	273	37.0	74898	12193	2100	2100	2010-10-23T20:48:07	TIR10.11
15.042598	39.186055	272	272	37.9	78684	12793	2201	2200	2010-10-23T21:17:33	TIR10.11
14.999320	39.187438	272	272	36.9	82428	13393	2301	2300	2010-10-23T21:44:49	TIR10.11
14.956020	39.188785	272	273	36.6	86174	13993	2401	2400	2010-10-23T22:12:34	TIR10.11
14.912703	39.190097	268	271	37.6	89921	14593	2501	2500	2010-10-23T22:42:00	TIR10.11
14.882400	39.190950	273	274	36.5	92541	15013	2571	2570	2010-10-23T23:03:28	TIR10.11
14.939898	39.154015	353	356	38.9	0	199	101	101	2010-10-24T01:09:31	TIR10.12
14.938028	39.187425	352	356	36.5	3713	793	200	200	2010-10-24T01:38:34	TIR10.12
14.935780	39.221062	355	359	36.2	7454	1393	300	300	2010-10-24T02:08:59	TIR10.12
14.933530	39.254753	354	357	38.3	11201	1993	400	400	2010-10-24T02:39:06	TIR10.12
14.931338	39.288452	352	356	37.9	14948	2593	500	500	2010-10-24T03:07:38	TIR10.12
14.929208	39.322123	354	356	37.8	18691	3193	600	600	2010-10-24T03:36:34	TIR10.12
14.927105	39.355798	353	356	36.4	22436	3793	700	700	2010-10-24T04:05:46	TIR10.12
14.924968	39.389503	356	360	36.9	26183	4393	800	800	2010-10-24T04:34:50	TIR10.12
14.922652	39.423155	355	357	37.6	29927	4993	900	900	2010-10-24T05:04:18	TIR10.12
14.920677	39.456837	356	358	38.9	33672	5593	1000	1000	2010-10-24T05:33:42	TIR10.12
14.918355	39.490497	351	354	38.8	37415	6193	1100	1100	2010-10-24T06:02:32	TIR10.12
14.916330	39.524103	355	359	36.9	41152	6793	1200	1200	2010-10-24T06:31:43	TIR10.12
14.914047	39.557742	356	357	38.4	44892	7393	1300	1300	2010-10-24T07:07:13	TIR10.12
14.911938	39.591463	0	357	37.7	48641	7993	1400	1400	2010-10-24T07:42:04	TIR10.12
14.909793	39.625153	358	358	38.2	52387	8593	1500	1500	2010-10-24T08:17:39	TIR10.12
14.907680	39.658825	356	355	36.8	56131	9193	1600	1600	2010-10-24T08:50:58	TIR10.12
14.905418	39.692523	1	359	37.1	59879	9793	1700	1700	2010-10-24T09:21:36	TIR10.12
14.903203	39.726193	359	357	39.3	63622	10393	1800	1800	2010-10-24T09:50:54	TIR10.12
14.901055	39.759887	360	0	37.5	67369	10993	1900	1900	2010-10-24T10:19:01	TIR10.12
14.898943	39.793583	357	358	36.6	71115	11593	2000	2000	2010-10-24T10:47:34	TIR10.12
14.896610	39.827168	355	359	38.3	74851	12193	2100	2100	2010-10-24T11:19:21	TIR10.12
14.894412	39.860827	358	357	37.3	78593	12793	2200	2200	2010-10-24T11:48:53	TIR10.12
14.892247	39.894498	357	357	38.0	82337	13393	2300	2300	2010-10-24T12:16:36	TIR10.12
14.890113	39.928103	357	357	75.2	86074	13993	2400	2400	2010-10-24T12:44:10	TIR10.12
14.887910	39.961792	355	356	37.4	89820	14593	2500	2500	2010-10-24T13:11:52	TIR10.12
14.885680	39.995477	358	358	36.8	93565	15193	2600	2600	2010-10-24T13:41:13	TIR10.12
14.883607	40.029148	359	357	37.3	97309	15793	2700	2700	2010-10-24T14:11:37	TIR10.12
14.881327	40.062805	2	357	35.8	101052	16393	2800	2800	2010-10-24T14:41:48	TIR10.12
14.879128	40.096490	3	357	37.0	104798	16993	2900	2900	2010-10-24T15:11:12	TIR10.12
14.877137	40.130163	3	355	37.3	108541	17593	3000	3000	2010-10-24T15:39:25	TIR10.12
14.874737	40.163790	11	359	37.4	112282	18193	3100	3100	2010-10-24T16:07:43	TIR10.12

14.872645	40.197140	18	5	37.3	115990	18787	3199	3199	2010-10-24T16:35:38	TIR10.12
14.897278	40.175930	288	294	39.5	0	199	101	101	2010-10-24T18:06:36	TIR10.13
14.860427	40.193565	298	301	37.3	3701	793	200	200	2010-10-24T18:36:22	TIR10.13
14.823135	40.211460	299	302	38.2	7447	1393	300	300	2010-10-24T19:06:14	TIR10.13
14.785938	40.229425	299	303	38.7	11191	1993	400	400	2010-10-24T19:35:27	TIR10.13
14.748585	40.247323	297	302	36.7	14940	2593	500	500	2010-10-24T20:04:19	TIR10.13
14.711268	40.265245	299	302	37.1	18688	3193	600	600	2010-10-24T20:33:18	TIR10.13
14.673985	40.283232	293	301	37.2	22436	3793	700	700	2010-10-24T21:02:29	TIR10.13
14.636535	40.300957	293	301	37.2	26180	4393	800	800	2010-10-24T21:32:33	TIR10.13
14.599292	40.318937	290	301	38.3	29923	4993	900	900	2010-10-24T22:02:53	TIR10.13
14.561825	40.336653	291	301	37.9	33666	5593	1000	1000	2010-10-24T22:34:04	TIR10.13
14.524418	40.354535	289	300	37.7	37414	6193	1100	1100	2010-10-24T23:05:34	TIR10.13
14.486943	40.372253	293	302	36.5	41157	6793	1200	1200	2010-10-24T23:37:10	TIR10.13
14.449590	40.390197	294	300	37.4	44904	7393	1300	1300	2010-10-25T00:06:57	TIR10.13
14.412075	40.407952	295	302	37.8	48650	7993	1400	1400	2010-10-25T00:35:10	TIR10.13
14.374630	40.425780	301	302	37.5	52396	8593	1500	1500	2010-10-25T01:03:48	TIR10.13
14.337037	40.443467	305	301	38.2	56142	9193	1600	1600	2010-10-25T01:31:55	TIR10.13
14.299475	40.461212	309	302	37.3	59890	9793	1700	1700	2010-10-25T02:00:50	TIR10.13
14.261890	40.478937	313	304	36.8	63637	10393	1800	1800	2010-10-25T02:30:38	TIR10.13
14.224472	40.496722	311	303	37.3	67379	10993	1900	1900	2010-10-25T03:02:38	TIR10.13
14.186917	40.514487	307	301	38.9	71125	11593	2000	2000	2010-10-25T03:32:46	TIR10.13
14.149352	40.532248	303	302	37.8	74871	12193	2100	2100	2010-10-25T04:02:53	TIR10.13
14.111597	40.549790	300	301	37.0	78616	12793	2200	2200	2010-10-25T04:32:22	TIR10.13
14.074145	40.567700	300	300	36.8	82362	13393	2300	2300	2010-10-25T05:01:11	TIR10.13
14.036412	40.585218	298	301	37.2	86106	13993	2400	2400	2010-10-25T05:30:10	TIR10.13
13.998693	40.602837	298	301	36.8	89852	14593	2500	2500	2010-10-25T05:58:28	TIR10.13
13.961065	40.620522	299	302	38.9	93594	15193	2600	2600	2010-10-25T06:27:50	TIR10.13
13.923423	40.638108	297	301	36.3	97330	15793	2700	2700	2010-10-25T06:56:53	TIR10.13
13.885932	40.655620	298	301	37.4	101050	16393	2800	2800	2010-10-25T07:25:34	TIR10.13
13.848510	40.673188	297	302	39.1	104770	16993	2900	2900	2010-10-25T07:53:46	TIR10.13
13.811012	40.690550	290	304	35.7	108483	17593	3000	3000	2010-10-25T08:20:13	TIR10.13
13.773450	40.707943	286	301	35.8	112202	18193	3100	3100	2010-10-25T08:51:29	TIR10.13
13.736078	40.725357	290	306	37.4	115907	18793	3200	3200	2010-10-25T09:22:24	TIR10.13
13.699498	40.743398	294	307	35.0	119598	19393	3300	3300	2010-10-25T09:52:00	TIR10.13
13.661208	40.759642	292	301	36.9	123306	19993	3400	3400	2010-10-25T10:22:29	TIR10.13
13.623975	40.777262	292	301	37.6	127010	20593	3500	3500	2010-10-25T10:51:23	TIR10.13
13.586623	40.794655	292	302	36.9	130709	21193	3600	3600	2010-10-25T11:20:54	TIR10.13
13.549095	40.811832	295	305	35.5	134407	21793	3700	3700	2010-10-25T11:50:08	TIR10.13
13.511600	40.829167	293	301	35.3	138111	22393	3800	3800	2010-10-25T12:18:58	TIR10.13
13.474010	40.846537	295	301	37.5	141823	22993	3900	3900	2010-10-25T12:48:33	TIR10.13
13.436213	40.863723	294	301	38.9	145540	23593	4000	4000	2010-10-25T13:19:12	TIR10.13
13.398695	40.881157	300	300	37.6	149250	24193	4100	4100	2010-10-25T13:49:12	TIR10.13
13.361068	40.898398	301	300	37.2	152955	24793	4200	4200	2010-10-25T14:18:07	TIR10.13
13.323217	40.915670	300	302	36.5	156677	25393	4300	4300	2010-10-25T14:47:26	TIR10.13
13.285620	40.932972	302	299	37.0	160384	25993	4400	4400	2010-10-25T15:19:07	TIR10.13
13.247780	40.950282	305	303	36.6	164108	26593	4500	4500	2010-10-25T15:48:36	TIR10.13
13.210005	40.967508	305	302	36.8	167822	27193	4600	4600	2010-10-25T16:17:49	TIR10.13
13.172175	40.984762	303	301	38.1	171541	27793	4700	4700	2010-10-25T16:46:31	TIR10.13
13.134312	41.002013	305	302	37.8	175261	28393	4800	4800	2010-10-25T17:15:58	TIR10.13
13.096437	41.019188	305	300	37.4	178977	28993	4900	4900	2010-10-25T17:45:39	TIR10.13
13.058608	41.036418	303	300	36.4	182695	29593	5000	5000	2010-10-25T18:16:31	TIR10.13

13.020823	41.053642	307	303	38.8	186409	30193	5100	5100	2010-10-25T18:48:43	TIR10.13
12.983007	41.070797	303	301	37.4	190119	30793	5200	5200	2010-10-25T19:19:39	TIR10.13
12.945302	41.087853	304	301	39.1	193816	31393	5300	5300	2010-10-25T19:51:55	TIR10.13
12.911882	41.102910	306	300	38.5	197088	31927	5389	5389	2010-10-25T20:19:57	TIR10.13
12.952690	41.108412	214	220	37.7	0	199	101	101	2010-10-25T21:34:13	TIR10.14
12.930323	41.080997	208	213	35.8	3581	793	200	200	2010-10-25T22:05:31	TIR10.14
12.908000	41.053253	211	214	35.7	7193	1393	300	300	2010-10-25T22:34:13	TIR10.14
12.885023	41.025460	211	212	36.4	10836	1993	400	400	2010-10-25T23:03:05	TIR10.14
12.862270	40.997587	212	213	35.5	14477	2593	500	500	2010-10-25T23:31:47	TIR10.14
12.839317	40.969477	213	215	36.4	18149	3193	600	600	2010-10-25T23:59:46	TIR10.14
12.816475	40.941208	212	212	36.5	21831	3793	700	700	2010-10-26T00:27:48	TIR10.14
12.793767	40.913327	215	215	38.4	25472	4393	800	800	2010-10-26T00:57:09	TIR10.14
12.770957	40.885112	213	210	37.2	29151	4993	900	900	2010-10-26T01:27:14	TIR10.14
12.748030	40.857097	212	210	37.9	32815	5593	1000	1000	2010-10-26T01:57:37	TIR10.14
12.725272	40.828960	212	212	36.5	36483	6193	1100	1100	2010-10-26T02:28:27	TIR10.14
12.702747	40.800740	208	209	35.3	40149	6793	1200	1200	2010-10-26T02:57:51	TIR10.14
12.679970	40.772617	211	213	34.8	43819	7393	1300	1300	2010-10-26T03:28:08	TIR10.14
12.657078	40.744355	211	212	36.7	47506	7993	1400	1400	2010-10-26T03:56:45	TIR10.14
12.633962	40.716062	206	211	38.0	51206	8593	1500	1500	2010-10-26T04:25:16	TIR10.14
12.611140	40.687623	208	210	37.3	54909	9193	1600	1600	2010-10-26T04:54:50	TIR10.14
12.588323	40.659182	209	206	34.1	58611	9793	1702	1700	2010-10-26T05:25:24	TIR10.14
12.565173	40.630937	207	207	36.1	62314	10393	1802	1800	2010-10-26T05:55:15	TIR10.14
12.542595	40.602522	210	211	37.4	66007	10993	1904	1900	2010-10-26T06:25:32	TIR10.14
12.519752	40.574018	212	214	38.0	69718	11593	2004	2000	2010-10-26T06:56:32	TIR10.14
12.496797	40.545562	213	212	37.3	73429	12193	2104	2100	2010-10-26T07:28:27	TIR10.14
12.473970	40.516975	213	212	37.5	77149	12793	2204	2200	2010-10-26T07:57:35	TIR10.14
12.451023	40.488410	212	211	36.8	80871	13393	2304	2300	2010-10-26T08:26:43	TIR10.14
12.428055	40.459842	213	215	36.6	84597	13993	2404	2400	2010-10-26T08:58:20	TIR10.14
12.424542	40.455570	210	211	36.2	85157	14083	2419	2415	2010-10-26T09:02:52	TIR10.14
12.409387	40.468068	108	105	35.6	0	199	101	101	2010-10-26T10:15:03	TIR10.15
12.451968	40.464527	101	95	34.7	3638	793	200	200	2010-10-26T10:45:12	TIR10.15
12.495103	40.461308	96	94	38.2	7315	1393	300	300	2010-10-26T11:15:39	TIR10.15
12.538333	40.458393	100	98	36.8	10997	1993	400	400	2010-10-26T11:45:54	TIR10.15
12.581505	40.455175	100	98	50.1	14679	2593	500	500	2010-10-26T12:16:37	TIR10.15
12.624980	40.452250	96	96	37.1	18382	3193	600	600	2010-10-26T12:48:27	TIR10.15
12.668018	40.448955	93	96	37.4	22053	3793	700	700	2010-10-26T13:21:09	TIR10.15
12.711372	40.445943	95	94	35.6	25747	4393	800	800	2010-10-26T13:54:19	TIR10.15
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12.798110	40.439700	96	97	38.2	33143	5593	1000	1000	2010-10-26T15:00:00	TIR10.15
12.841482	40.436392	90	95	38.3	36843	6193	1100	1100	2010-10-26T15:30:33	TIR10.15
12.884822	40.432972	87	96	36.7	40543	6793	1200	1200	2010-10-26T16:01:37	TIR10.15
12.891348	40.432702	83	92	38.1	41098	6883	1215	1215	2010-10-26T16:06:14	TIR10.15
12.864008	40.420540	37	34	39.8	0	199	101	101	2010-10-26T17:02:22	TIR10.16
12.886675	40.448827	32	27	36.3	3687	793	200	200	2010-10-26T17:33:39	TIR10.16
12.909673	40.477420	38	34	37.0	7415	1393	300	300	2010-10-26T18:04:43	TIR10.16
12.932613	40.506138	38	30	38.1	11152	1993	400	400	2010-10-26T18:36:11	TIR10.16
12.955530	40.534878	37	33	36.6	14889	2593	500	500	2010-10-26T19:08:04	TIR10.16
12.978452	40.563582	39	33	36.6	18622	3193	600	600	2010-10-26T19:35:27	TIR10.16
13.001455	40.592197	38	29	36.5	22351	3793	700	700	2010-10-26T20:03:56	TIR10.16
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13.047570	40.649578	38	32	37.5	29825	4993	900	900	2010-10-26T21:01:43	TIR10.16

13.070670	40.678202	42	35	37.9	33559	5593	1000	1000	2010-10-26T21:33:03	TIR10.16
13.093617	40.706882	41	31	37.8	37290	6193	1100	1100	2010-10-26T22:03:33	TIR10.16
13.116750	40.735543	45	33	37.5	41026	6793	1200	1200	2010-10-26T22:36:39	TIR10.16
13.140067	40.764103	41	31	36.1	44762	7393	1300	1300	2010-10-26T23:10:26	TIR10.16
13.163177	40.792768	39	31	37.7	48499	7993	1400	1400	2010-10-26T23:42:33	TIR10.16
13.186277	40.821498	38	31	37.9	52239	8593	1500	1500	2010-10-27T00:13:33	TIR10.16
13.209797	40.850052	36	33	36.7	55980	9193	1600	1600	2010-10-27T00:44:04	TIR10.16
13.232907	40.878795	31	31	35.8	59721	9793	1700	1700	2010-10-27T01:13:30	TIR10.16
13.255963	40.907520	30	29	37.4	63457	10393	1800	1800	2010-10-27T01:42:47	TIR10.16
13.279307	40.936120	30	31	37.9	67194	10993	1900	1900	2010-10-27T02:12:50	TIR10.16
13.302615	40.964767	36	30	37.4	70934	11593	2000	2000	2010-10-27T02:43:33	TIR10.16
13.325978	40.993393	38	33	37.2	74674	12193	2100	2100	2010-10-27T03:15:33	TIR10.16
13.349195	41.022055	34	30	37.8	78410	12793	2200	2200	2010-10-27T03:46:51	TIR10.16
13.372433	41.050695	35	31	37.1	82149	13393	2300	2300	2010-10-27T04:18:24	TIR10.16
13.381592	41.061812	37	33	38.5	83605	13627	2339	2339	2010-10-27T04:30:51	TIR10.16
13.322202	41.057043	116	120	37.5	0	199	101	101	2010-10-27T06:28:42	TIR10.17
13.360617	41.041063	114	119	38.6	3686	793	200	200	2010-10-27T06:57:01	TIR10.17
13.399440	41.024873	114	119	37.0	7414	1393	300	300	2010-10-27T07:25:44	TIR10.17
13.438712	41.009302	114	118	37.5	11145	1993	400	400	2010-10-27T07:54:11	TIR10.17
13.477062	40.992477	114	120	37.5	14877	2593	500	500	2010-10-27T08:23:03	TIR10.17
13.515885	40.976338	112	120	36.5	18607	3193	600	600	2010-10-27T08:53:04	TIR10.17
13.560342	40.957707	118	120	37.5	22886	3793	715	700	2010-10-27T09:33:32	TIR10.17
13.598977	40.941493	118	118	37.0	26605	4393	815	800	2010-10-27T10:05:42	TIR10.17
13.637670	40.925285	120	119	36.2	30329	4993	915	900	2010-10-27T10:36:35	TIR10.17
13.676190	40.908958	118	122	37.0	34048	5593	1015	1000	2010-10-27T11:08:02	TIR10.17
13.702897	40.897790	111	120	36.4	36620	6007	1084	1069	2010-10-27T11:30:57	TIR10.17
13.693855	40.948292	193	203	36.2	0	199	101	101	2010-10-27T12:57:19	TIR10.18
13.672385	40.919307	196	211	37.6	3694	793	200	200	2010-10-27T13:28:03	TIR10.18
13.650203	40.890207	198	210	34.4	7428	1393	300	300	2010-10-27T13:59:55	TIR10.18
13.627805	40.861282	200	209	37.8	11155	1993	400	400	2010-10-27T14:30:14	TIR10.18
13.605373	40.832405	202	211	38.0	14880	2593	500	500	2010-10-27T14:59:35	TIR10.18
13.583148	40.803620	206	211	36.9	18589	3193	600	600	2010-10-27T15:32:19	TIR10.18
13.561025	40.774708	204	210	38.8	22306	3793	700	700	2010-10-27T16:02:55	TIR10.18
13.538612	40.745757	204	211	38.0	26038	4393	800	800	2010-10-27T16:32:52	TIR10.18
13.494163	40.687893	202	209	36.5	33486	5593	1000	1000	2010-10-27T17:36:47	TIR10.18
13.471947	40.658988	205	211	38.3	37206	6193	1100	1100	2010-10-27T18:06:47	TIR10.18
13.449710	40.630032	205	210	35.7	40934	6793	1200	1200	2010-10-27T18:36:14	TIR10.18
13.427563	40.601107	207	211	34.7	44654	7393	1300	1300	2010-10-27T19:05:54	TIR10.18
13.405382	40.572153	204	210	36.1	48379	7993	1400	1400	2010-10-27T19:36:27	TIR10.18
13.383288	40.543173	206	211	37.0	52102	8593	1500	1500	2010-10-27T20:07:21	TIR10.18
13.361025	40.514257	208	213	38.1	55828	9193	1600	1600	2010-10-27T20:35:51	TIR10.18
13.339127	40.485368	206	209	37.0	59543	9793	1700	1700	2010-10-27T21:03:49	TIR10.18
13.335382	40.480445	209	211	37.1	60175	9895	1717	1717	2010-10-27T21:08:39	TIR10.18
13.315888	40.499080	72	72	37.3	0	199	1720	101	2010-10-27T21:44:03	TIR10.19
13.356970	40.510107	71	71	37.3	3692	793	1819	200	2010-10-27T22:14:03	TIR10.19
13.398422	40.521120	71	72	36.7	7413	1393	1919	300	2010-10-27T22:44:12	TIR10.19
13.439863	40.532277	72	71	37.0	11139	1993	2019	400	2010-10-27T23:14:33	TIR10.19
13.481437	40.543223	70	70	37.8	14866	2593	2119	500	2010-10-27T23:45:18	TIR10.19
13.522958	40.554275	72	71	36.1	18594	3193	2219	600	2010-10-28T00:15:51	TIR10.19
13.564415	40.565365	70	70	37.3	22316	3793	2319	700	2010-10-28T00:46:05	TIR10.19
13.605982	40.576337	71	70	36.5	26042	4393	2419	800	2010-10-28T01:16:18	TIR10.19

13.647567	40.587377	72	69	36.8	29772	4993	2519	900	2010-10-28T01:46:56	TIR10.19
13.689263	40.598323	73	70	36.3	33506	5593	2619	1000	2010-10-28T02:18:01	TIR10.19
13.730808	40.609378	73	68	37.8	37234	6193	2719	1100	2010-10-28T02:49:03	TIR10.19
13.772460	40.620205	73	70	37.3	40959	6793	2819	1200	2010-10-28T03:21:33	TIR10.19
13.814058	40.631235	69	69	37.1	44688	7393	2919	1300	2010-10-28T03:53:52	TIR10.19
13.855660	40.642113	70	72	73.9	48412	7993	3019	1400	2010-10-28T04:24:50	TIR10.19
13.897348	40.652893	61	70	37.2	52138	8593	3119	1500	2010-10-28T04:54:38	TIR10.19
13.938908	40.664102	65	70	36.6	55871	9193	3219	1600	2010-10-28T05:24:12	TIR10.19
13.966428	40.689748	39	39	38.0	59650	9793	3320	1700	2010-10-28T05:50:50	TIR10.19
14.005945	40.702388	74	75	37.4	63390	10393	3420	1800	2010-10-28T06:15:05	TIR10.19
14.018888	40.704710	75	76	38.0	64514	10573	3450	1830	2010-10-28T06:22:36	TIR10.19
13.940902	40.664313	70	72	40.4	0	199	101	101	2010-10-28T09:48:27	TIR10.20
13.982285	40.675293	70	69	37.0	3707	793	200	200	2010-10-28T10:17:06	TIR10.20
14.024153	40.686047	72	72	37.8	7443	1393	300	300	2010-10-28T10:46:59	TIR10.20
14.065953	40.697072	75	73	37.4	11184	1993	400	400	2010-10-28T11:15:13	TIR10.20
14.107898	40.707708	66	68	38.2	14922	2593	500	500	2010-10-28T11:43:33	TIR10.20
14.149677	40.718830	71	72	38.1	18663	3193	600	600	2010-10-28T12:14:21	TIR10.20
14.192033	40.728810	67	71	37.2	22411	3793	700	700	2010-10-28T12:44:45	TIR10.20
14.233673	40.740270	63	71	37.4	26153	4393	800	800	2010-10-28T13:15:08	TIR10.20
14.275590	40.751232	64	72	37.4	29898	4993	900	900	2010-10-28T13:44:33	TIR10.20
14.276012	40.751335	69	77	36.9	29935	4999	901	901	2010-10-28T13:44:50	TIR10.20