



SECOND TOSCA DRIFTER EXPERIMENT IN THE GULF OF TRIESTE (OCTOBER 2012)

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1. Introduction

As part of the TOSCA project, a second experiment was carried out in the Gulf of Trieste in order to study the surface circulation and the dispersion. The experiment was conducted on 18-25 October 2012 using drifters, HF radars and models. The experiment also involved the Istituto Tecnico Nautico (ITN) "Tomaso di Savoia Duca di Genova" of Trieste that made its ship available for the entire period of the experiment (Fig. 1). The report provides details on the deployments and recoveries of the drifters and illustrates the drifter trajectories during the week of the experiment.



Fig. 1. The R/V Umberto D'Ancona of the ITN used during most of the experiment.

2. The planned experiment

Supported by the results obtained during the first drifter experiment performed in the Gulf of Trieste in April 2012 (Gerin et al., 2012), the deployment locations of the drifters were maintained unaltered. This time, the area was seeded with drifters equipped with

Iridium communication, while the GPS/GPRS drifters were used during the dispersion experiment in concert with other types of drifters. As for the first experiment, the operability of the HF radar network and the numerical model simulations were checked a few days in advance with respect to the beginning of the drifter deployments.

The six deployments within the yellow area of Fig. 2 were carried out by the colleagues of the Marine Biology Station of Piran (Slovenia), while the deployments in the other two areas (green and red areas) were conducted by OGS in collaboration with the ITN. Dispersion studies were performed in several locations near Miramare and Trieste (orange circles in Fig. 2). Several drifters were recovered during the experiment (because they came too close to the coast or almost exited the Gulf) and were redeployed at convenient locations (mainly within new dispersion experiments).

A Waverider buoy and an Arvor C profiling float were also deployed approximately in correspondence to station 17. They recorded wave parameters and collected CTD casts almost for the entire period of the experiment.

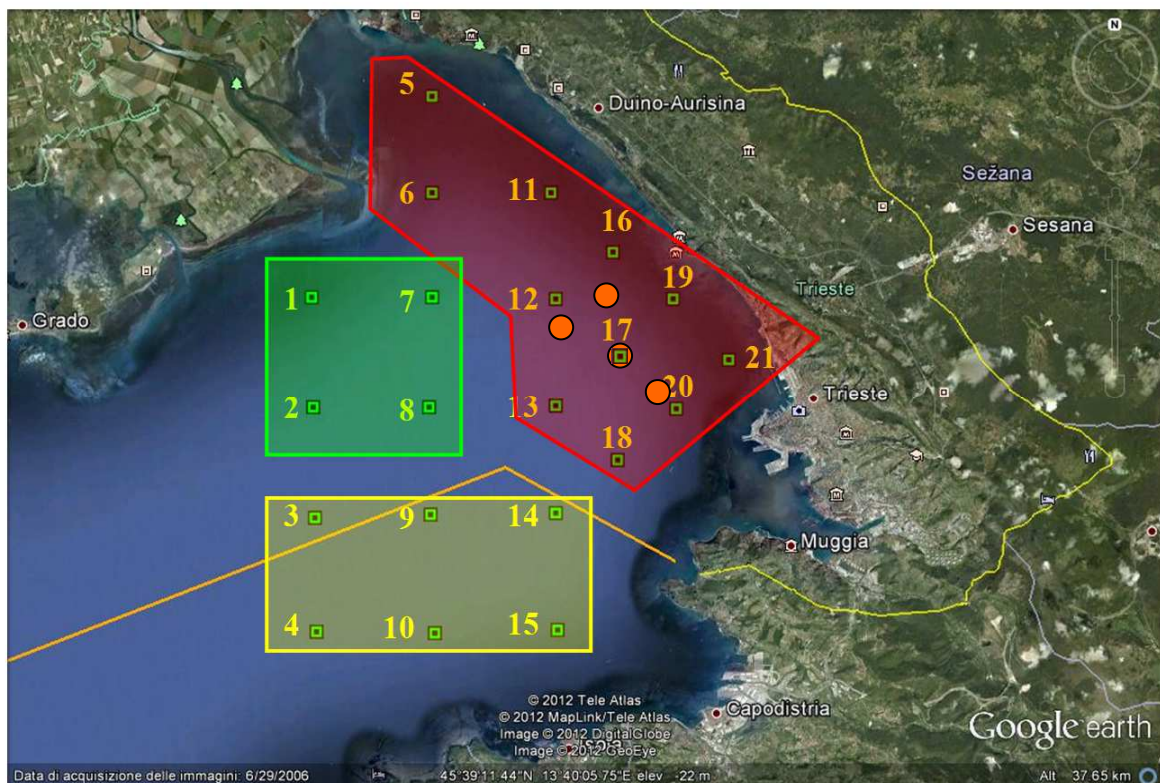


Fig. 2. Drifter deployment schema in the Gulf of Trieste. The green squares represent the drifter deployment positions and the orange circles indicate the deployment locations of the dispersion experiments.

3. The different type of drifters used

As for the first experiment, several types of drifters were used. They are summarized in Table 1.

Type	Quantity	Institute	Telemetry	Deployed	Recovered	Lost
CODE/Elcon	6	OGS	GSM	6	6	0
CODE	19	OGS	Iridium	19	18	1
CODE/ADCP	1	OGS	GSM	1	1	0
CODE/OGS	2	OGS	GSM	2	2	0
CODE/OGS	1	UNINAP	GSM	1	1	0
I-SPHERE/Metocean	4	UNINAP	Iridium	4	4	0
CODE/UAEAGEAN	2	UAEAGEAN	GSM	2	1	1
OILSPILL	7	TEI PIRAEUS	GSM/Iridium	7	6	1
PROTOTYPE	2	ICM	Globalstar	2	2	0
PROTOTYPE	4	MBS	?	4	4	0
TOTAL	47			47	44	3

Table 1: Quantities and types of drifters used during the experiment.

4. The drifter experiment

4.1. Thursday 18/10/2012

Six drifters were deployed early in the morning by the colleagues of the Marine Biology Station (MBS) of Piran at the 6 positions inside the yellow area of Fig. 2 (Table 2) together with 4 prototypes manufactured by them. Then, OGS deployed all the other instruments in the red and green areas of Fig. 2.

In the afternoon, OGS carried out the deployments of the dispersion experiment with several drifters released in very close clusters. The trajectories of these drifters during the days after the releases can be seen in Fig. 3.

drifter type	drifter id	drifter file name	depl lat	depl lon	depl time (GMT)
CODE		b300234011281570	45,66885	13,745	18/10/2012 08:15
CODE		e300234011285570	45,64875	13,71482	18/10/2012 08:36
CODE	e389	d300234011313890	45,63118	13,69345	18/10/2012 08:48
CODE	e089	d300234011310890	45,65008	13,65468	18/10/2012 09:05
CODE		f300234010470090	45,64998	13,58972	18/10/2012 09:27
PROTOTYPE	UTC_563	aUTC_563	45,57485	13,53666	18/10/2012 09:35
CODE	OGS-Slo1	c300234011283610	45,579	13,5477	18/10/2012 09:35
CODE	e988	e300234011319880	45,64983	13,53483	18/10/2012 09:46
CODE	OGS-Slo2	d300234011285560	45,615	13,5199	18/10/2012 09:55
Oil spill	STI-18	aSTI-18	45,67298	13,68252	18/10/2012 09:57
CODE	e989	c300234011319890	45,68538	13,535	18/10/2012 10:08
CODE	OGS-Slo6	a300234011283560	45,6114	13,5912	18/10/2012 10:13
CODE	e287	c300234011312870	45,68578	13,59035	18/10/2012 10:30
CODE	OGS-Slo4	a300234011281520	45,5708	13,5992	18/10/2012 10:35
PROTOTYPE	UTC_734	aUTC_734	45,57435	13,59591	18/10/2012 10:46
CODE	e289	e300234011312890	45,68562	13,65207	18/10/2012 10:52
CODE	OGS-Slo5	a300234011282560	45,6093	13,6555	18/10/2012 10:59
CODE	OGS-Slo3	a300234011284560	45,5795	13,6592	18/10/2012 11:15
PROTOTYPE	UTC_559	aUTC_559	45,5753	13,6537	18/10/2012 11:19
PROTOTYPE	UTC_447	aUTC_447	45,56658	13,71559	18/10/2012 11:51
CODE-OGS	SN00014	d393290608548	45,67043	13,68132	18/10/2012 13:02
CODE-OGS	SN00004	g393356699978	45,67047	13,68132	18/10/2012 13:12
Oil spill	STII-03	aSTII-03	45,66697	13,68028	18/10/2012 13:27
Oil spill	STII03-Iridium	aSTII03-Iridium	45,67347	13,68222	18/10/2012 13:27
Isphere	ISPHERE-3	c300034012578040	45,67308	13,68125	18/10/2012 13:29
CODE UAEGEAN	UA-15	aUA-15	45,67247	13,68158	18/10/2012 13:32
Oil spill	STI-05	aSTI-05	45,67068	13,67735	18/10/2012 13:40
Isphere	ISPHERE-1	c300034012489470	45,67067	13,6772	18/10/2012 13:41
CODE UAEGEAN	UA-17	aUA-17	45,66777	13,68102	18/10/2012 13:52
Oil spill	STII04-Iridium	aSTII04-Iridium	45,66723	13,68105	18/10/2012 13:54
Oil spill	STII-04	aSTII-04	45,66697	13,68028	18/10/2012 13:59
Oil spill	STI-01	aSTI-01	45,66697	13,68028	18/10/2012 13:59
Isphere	ISPHERE-2	c300034012480560	45,66707	13,68005	18/10/2012 13:59
CODE-OGS	SN00016	b393356498829	45,67052	13,66858	18/10/2012 14:07
Oil spill	STI-19	aSTI-19	45,67087	13,686	18/10/2012 14:10
Isphere	ISPHERE-4	c300034012659810	45,67105	13,6692	18/10/2012 14:10
CODE	e788	c300234011317880	45,72	13,58997	18/10/2012 14:54
CODE		f300034013313360	45,75353	13,59033	18/10/2012 15:10
CODE	e488	c300234011314880	45,71985	13,65302	18/10/2012 15:39
CODE	e689	d300234011316890	45,7036	13,68375	18/10/2012 15:53
CODE	e789	c300234011317890	45,68658	13,70767	18/10/2012 16:04

Table 2. Drifter deployment information of the first day (18 October 2012).

In case of drifters displaying data transmission with gap in time larger than 3 hours, the trajectory was split in two. The cases were handled as a drifter recovery and re-deployment with a new (subsequent) drifter file name and the information are included in Table 3 and successive (blue).

drifter type	drifter id	drifter file name	recovery time (GMT)	information
CODE UAEGEAN	UA-15	aUA-15	18/10/2012 17:52	split
Oil spill	STI-05	aSTI-05	18/10/2012 18:00	split
Oil spill	STI-18	aSTI-18	18/10/2012 18:02	split
Oil spill	STI-01	aSTI-01	18/10/2012 18:07	split
Oil spill	STI-19	aSTI-19	18/10/2012 18:07	split

Table 3. Drifter recovered during the first day (18 October 2012).

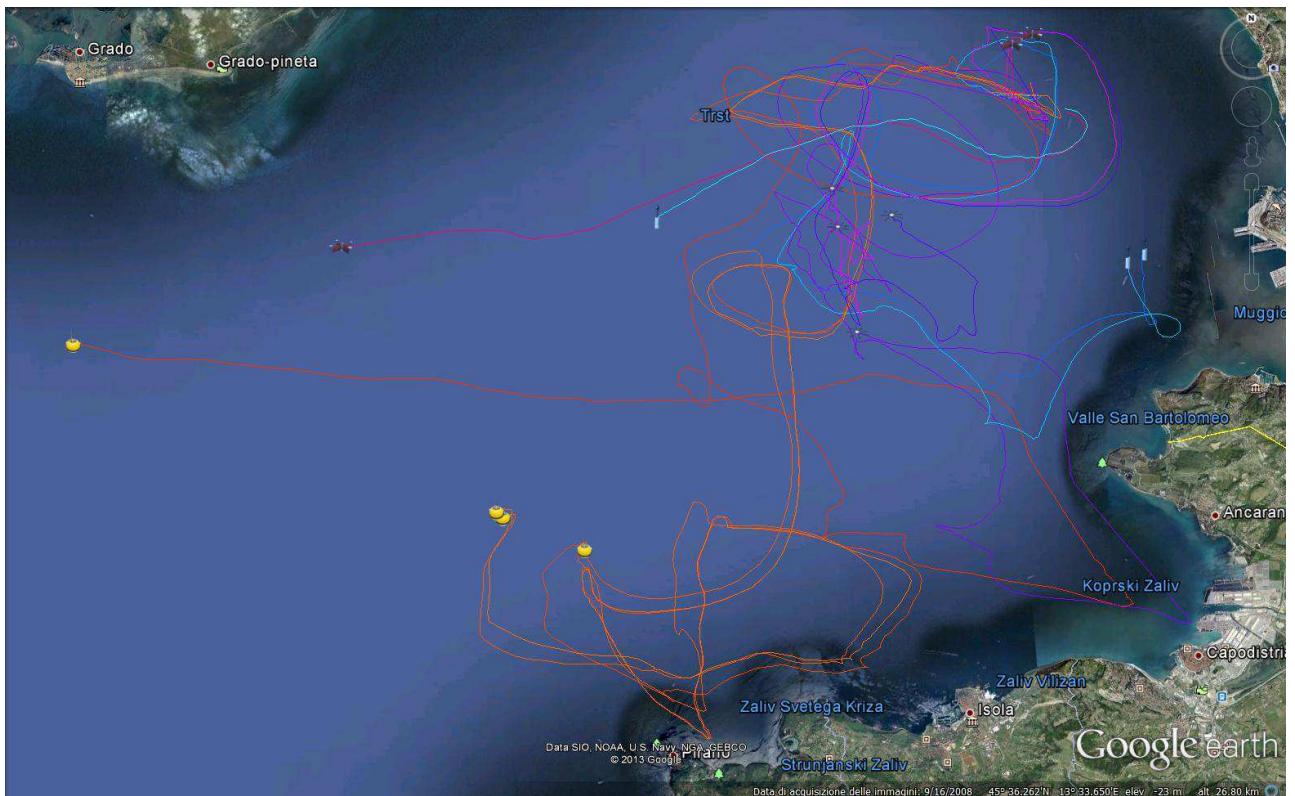


Fig. 3. Trajectories of all the drifters deployed for the dispersion experiment during the first day (18 October 2012).

4.2. Friday 19/10/2012

On Friday, several drifters were deployed during four dispersion experiments (Table 4 and Figs. 4 to 7).

drifter type	drifter id	drifter file name	depl lat	depl lon	depl time (GMT)
Oil spill	STI-01	bSTI-01	45,6842	13,66948	19/10/2012 07:36
Oil spill	STI-19	bSTI-19	45,6762	13,6326	19/10/2012 07:44
Oil spill	STI-18	bSTI-18	45,67634	13,63216	19/10/2012 07:49
CODE UAEGEAN	UA-15	bUA-15	45,6822	13,675	19/10/2012 07:51
Oil spill	STI-05	bSTI-05	45,6786	13,644	19/10/2012 07:53
CODE	e788	d300234011317880	45,69377	13,53628	19/10/2012 11:42
CODE	e989	d300234011319890	45,72217	13,5944	19/10/2012 12:12
CODE	e988	f300234011319880	45,68728	13,59482	19/10/2012 12:32
Prot-ICM	Tosca9	aTosca9	45,67702	13,63228	19/10/2012 12:54
CODE-Elcon	00001271	a393667772687	45,67692	13,6323	19/10/2012 12:55
CODE-Elcon	00001272	a393667772675	45,67582	13,63373	19/10/2012 12:58
CODE-Elcon	00001273	a393667772682	45,67608	13,63483	19/10/2012 13:02
CODE-OGS	SN00013	c393356498840	45,68273	13,68637	19/10/2012 14:11
CODE-OGS	SN00001	a393667772685	45,68273	13,68637	19/10/2012 14:13
Prot-ICM	Tosca2	aTosca2	45,6829	13,6851	19/10/2012 14:18
CODE-Elcon	00001274	c393356986714	45,65787	13,6851	19/10/2012 14:37
CODE-Elcon	00001275	c393356986728	45,65752	13,70407	19/10/2012 14:38
CODE-Elcon	00001276	b393351513355	45,6573	13,70522	19/10/2012 14:40
CODE	OGS-Slo1	d300234011283610	45,5635	13,5976	19/10/2012 15:30
CODE	e389	e300234011313890	45,65005	13,71107	19/10/2012 15:56
CODE		f300234011285570	45,65032	13,70952	19/10/2012 15:58
CODE		c300234011281570	45,64935	13,7097	19/10/2012 16:01

Table 4. Drifter deployment information of the second day (19 October 2012).

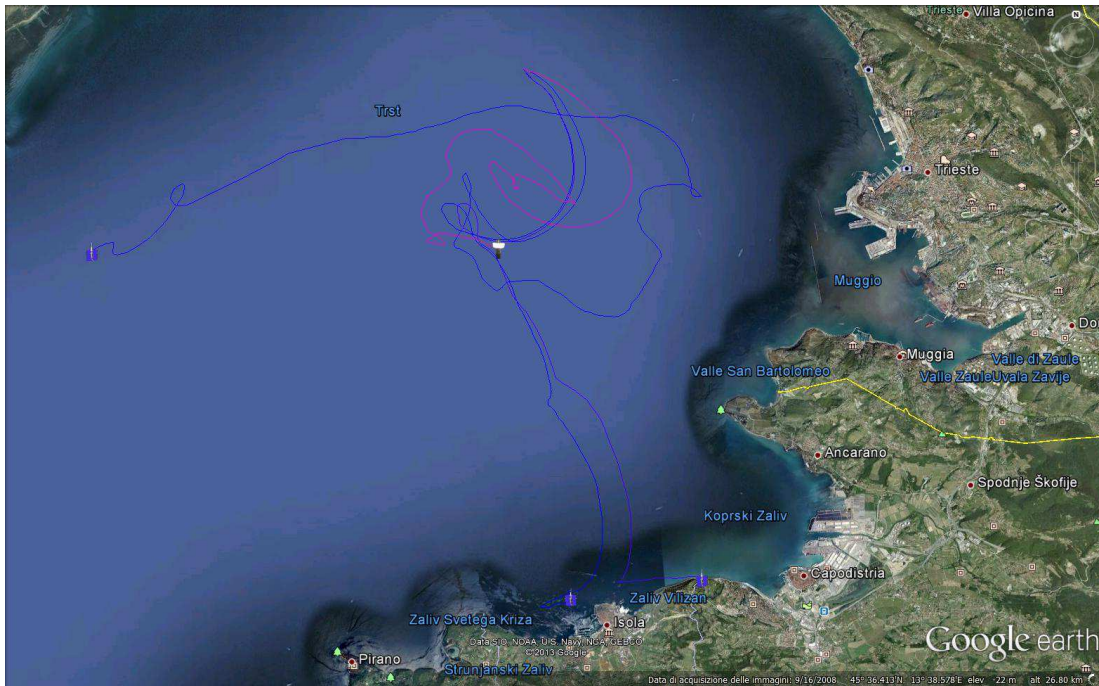


Fig. 4. Trajectories of all the drifters deployed for the first dispersion experiment during the second day (19 October 2012).

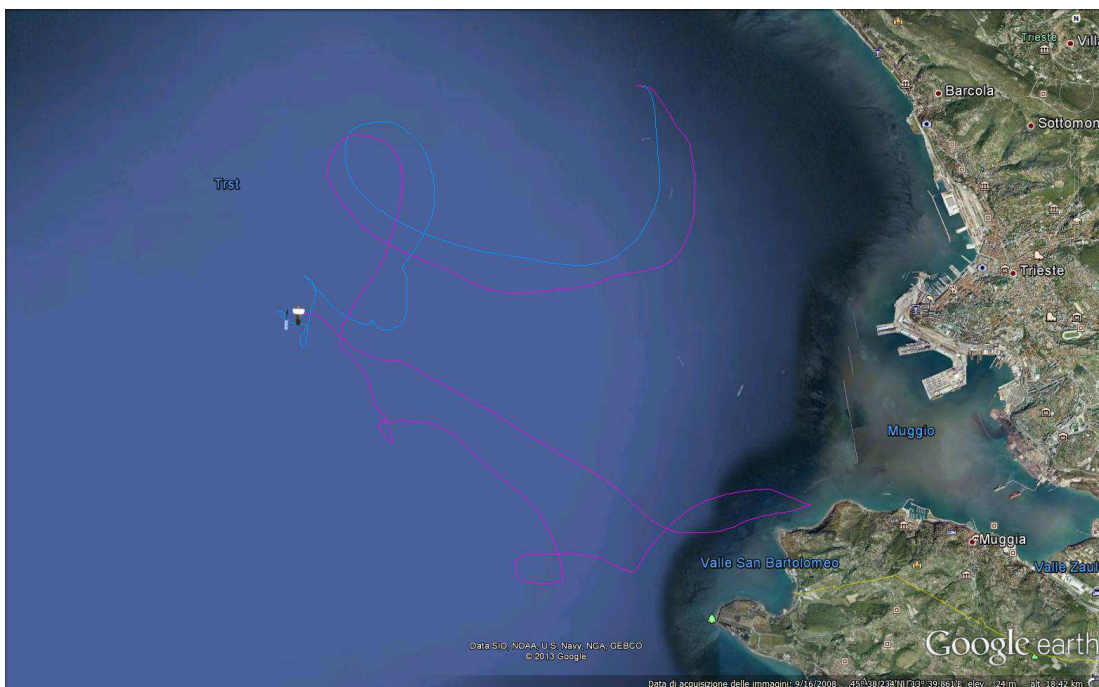


Fig. 5. Trajectories of all the drifters deployed for the second dispersion experiment during the second day (19 October 2012).

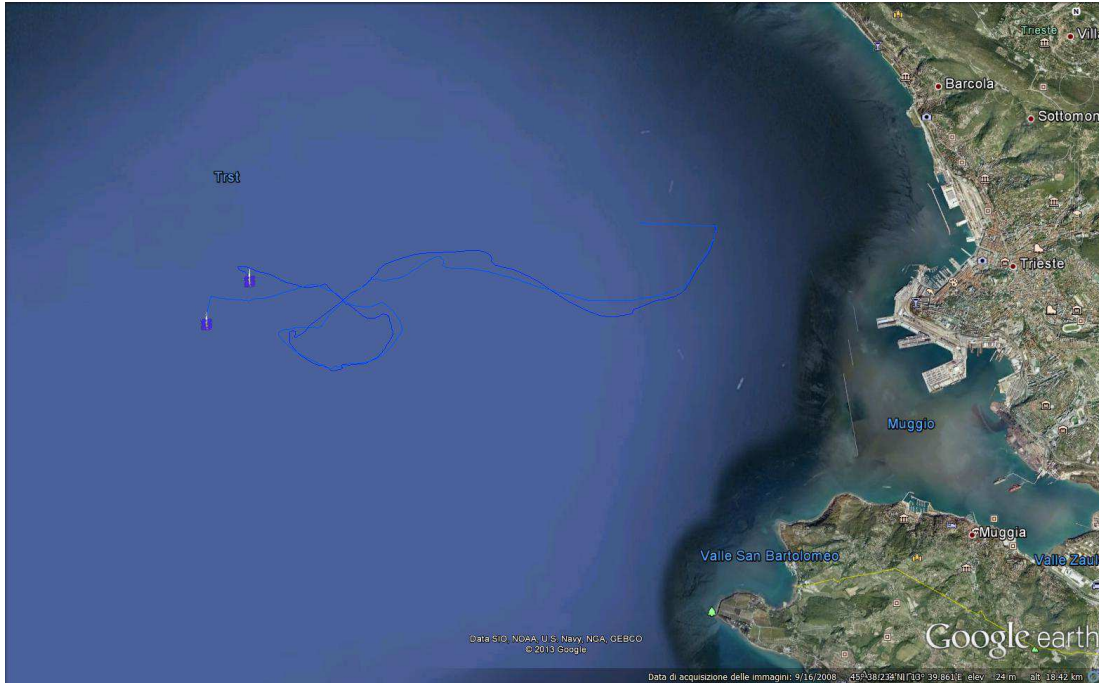


Fig. 6. Trajectories of all the drifters deployed for the third dispersion experiment during the second day (19 October 2012).

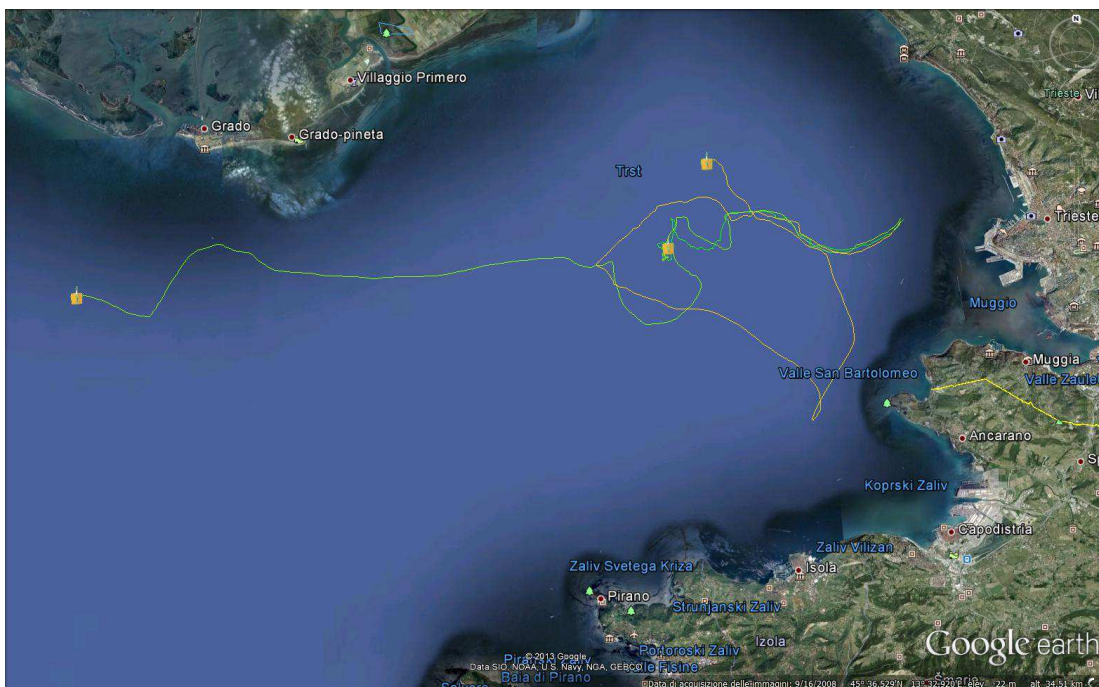


Fig. 7. Trajectories of all the drifters deployed for the fourth dispersion experiment during the second day (19 October 2012).

Some of the drifters were recovered during the day, they are indicated in Table 5. Some of them were redeployed during the same day (see Table 4). The two CODE/UAEGEAN drifters stopped transmitting the position data and they were located by chance. It was found that they had lost some of the floating elements and the antenna was completely submerged (Fig. 8). Unfortunately, one of the CODE/UAEGEAN drifters was hit by the ship during the recovery phase and sank.

drifter type	drifter id	drifter file name	recovery time (GMT)	information
CODE GPS	e988	e300234011319880	19/10/2012 09:57	
CODE GPS	e989	c300234011319890	19/10/2012 10:30	
CODE	OGS-Slo1	c300234011283610	19/10/2013 10:45	split
CODE GPS	e788	c300234011317880	19/10/2012 11:16	
CODE UAEGEAN	UA-17	aUA-17	19/10/2012 13:21	
CODE UAEGEAN	UA-15	bUA-15	19/10/2012 13:21	sunk
CODE GPS		b300234011281570	19/10/2012 15:01	
CODE GPS	e389	d300234011313890	19/10/2012 15:23	
CODE GPS		e300234011285570	19/10/2012 15:44	

Table 5. Drifter recovered during the second day (19 October 2012).

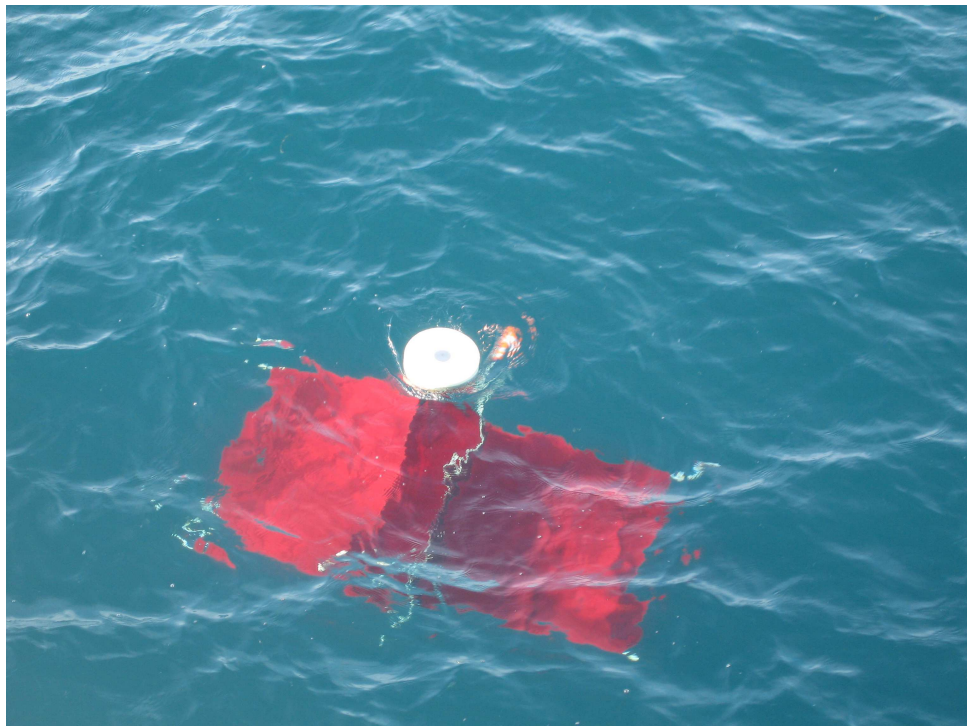


Fig. 8. CODE/UAEGEAN drifter staying afloat with only one floating element.

4.3. Saturday 20/10/12 and Sunday 21/10/2012

During Saturday and Sunday the R/V Umberto D'Ancona could not be operated. One drifter trajectory was split due to a gap in the transmission (Tables 6 and 7).

drifter type	drifter id	drifter file name	recovery time (GMT)	information
Oil spill	STII-04	aSTII-04	20/10/2012 12:50	split

Table 6. Drifter split on Saturday (20 October 2012).

drifter type	drifter id	drifter file name	depl lat	depl lon	depl time (GMT)
Oil spill	STII-04	bSTII-04	45,6395	13,6217	20/10/2012 16:28

Table 7. Split drifter deployment information.

4.4. Monday 22/10/2012

During the fifth day of the experiment, we recovered several drifters in the morning (Table 8) and redeployed some of them in two new dispersion experiments (Table 9 and Figs. 9 and 10).

drifter type	drifter id	drifter file name	recovery time (GMT)	information
CODE-Elcon	00001271	a393667772687	22/10/2012 05:31	
Oil spill	STI-01	bSTI-01	22/10/2012 08:08	
Oil spill	STI-19	bSTI-19	22/10/2012 08:48	
Oil spill	STI-18	bSTI-18	22/10/2012 08:54	
Oil spill	STII-04	bSTII-04	22/10/2012 09:00	
CODE-Elcon	00001272	a393667772675	22/10/2012 09:07	
CODE-Elcon	00001275	c393356986728	22/10/2012 09:32	
CODE-Elcon	00001276	b393351513355	22/10/2012 09:53	
CODE-Elcon	00001274	c393356986714	22/10/2012 09:55	
CODE-OGS	SN00001	a393667772685	22/10/2012 10:13	
CODE-OGS	SN00013	c393356498840	22/10/2012 10:14	
CODE	e389	e300234011313890	22/10/2012 10:26	
Prot-ICM	Tosca9	aTosca9	22/10/2012 10:43	
CODE	e689	d300234011316890	22/10/2012 11:00	
CODE-OGS	SN00014	d393290608548	22/10/2012 12:00	
Oil spill	STI-05	bSTI-05	22/10/2012 16:17	split

Table 8. Drifter recovery information of the fifth day (22 October 2012).

drifter type	drifter id	drifter file name	depl lat	depl lon	depl time (GMT)
CODE	e689	e300234011316890	45,68757	13,65278	22/10/2012 11:37
CODE	e389	f300234011313890	45,68757	13,65397	22/10/2012 11:39
CODE-Elcon	00001274	d393356986714	45,68812	13,65397	22/10/2012 11:42
CODE-Elcon	00001275	d393356986728	45,66737	13,69133	22/10/2012 11:59
Prot-ICM	Tosca9	bTosca9	45,66683	13,6925	22/10/2012 12:01
Oil spill	STI-02	aSTI-02	45,66683	13,6925	22/10/2012 12:01
CODE-OGS	SN00013	d393356498840	45,66642	13,69322	22/10/2012 12:02
CODE UAEGEAN	UA-17	bUA-17	45,66662	13,79177	22/10/2012 12:07
CODE-OGS	SN00014	e393290608548	45,66723	13,69177	22/10/2012 12:10

Table 9. Drifter deployment information of the fifth day (22 October 2012).

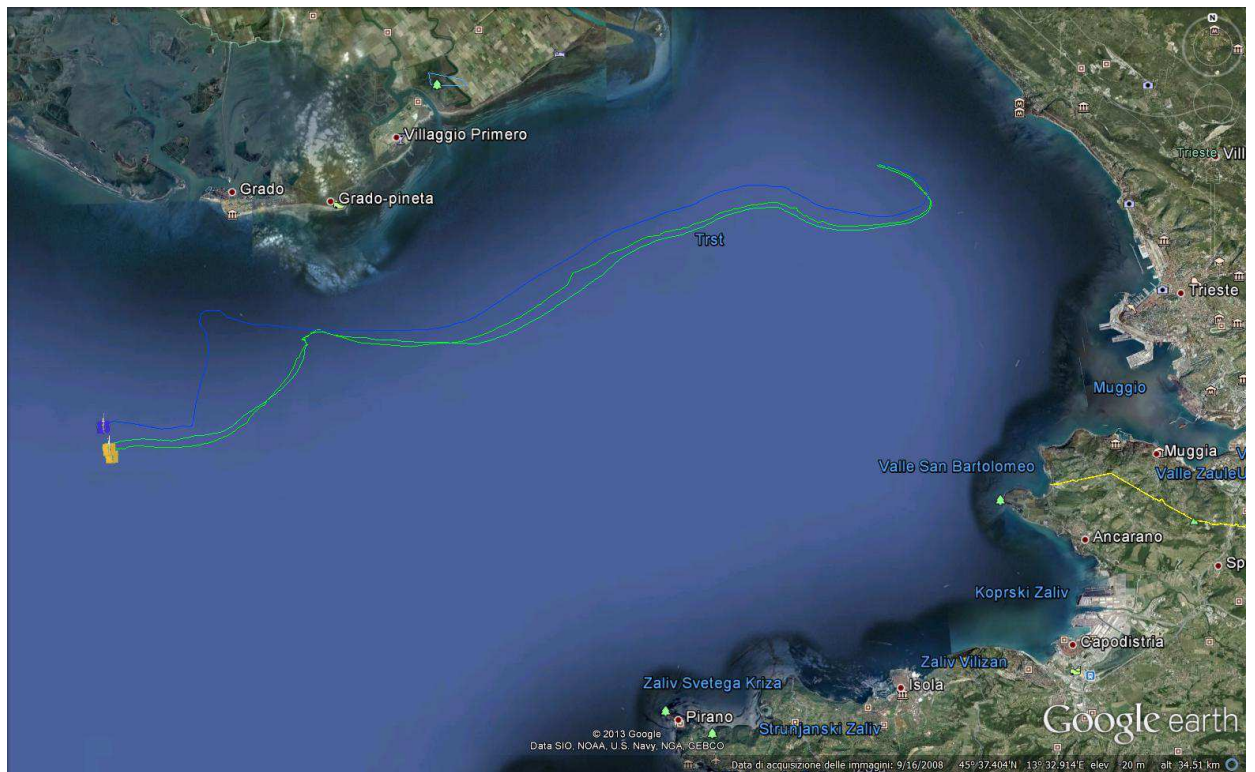


Fig. 9. Trajectories of all the drifters of the first dispersion experiment during the fifth day (22 October 2012).

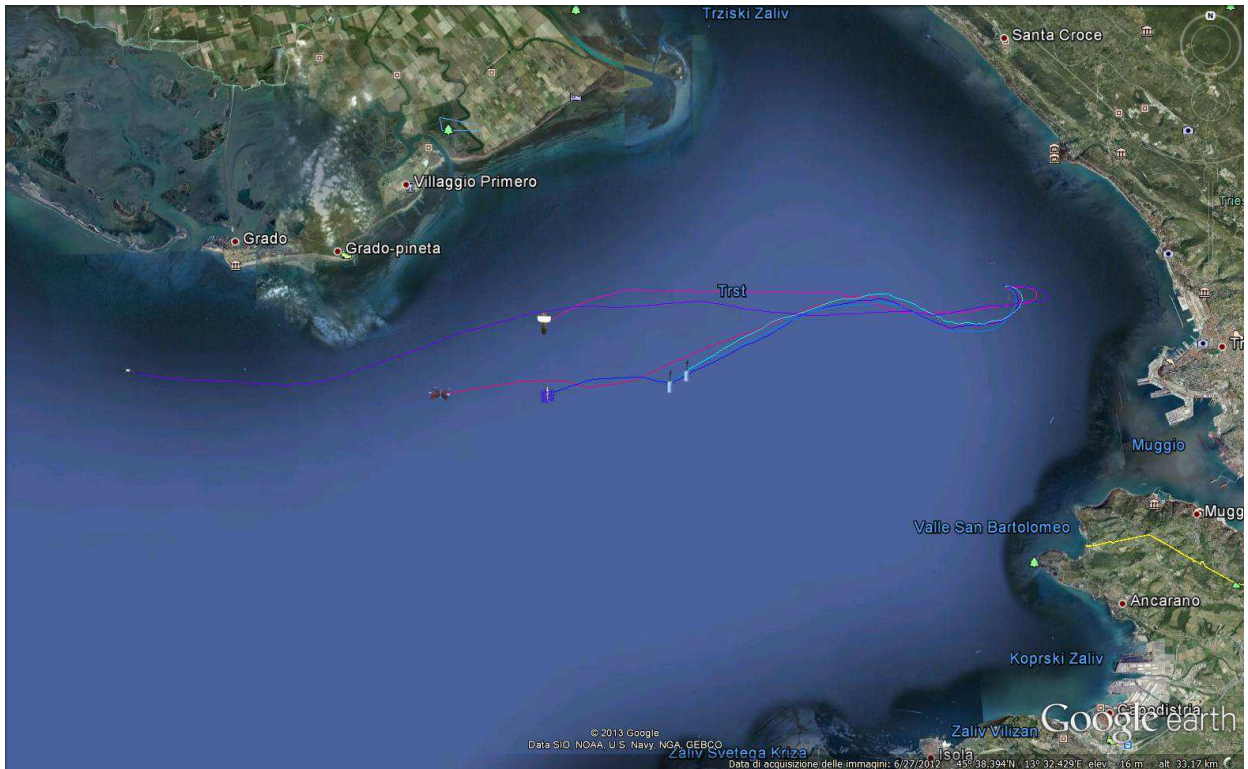


Fig. 10. Tracks of the drifters of the second dispersion experiment during the fifth day (22 October 2012).

4.5. Tuesday 23/10/2012

During this day we recovered part of the remaining drifters at sea and performed one last dispersion experiment (Tables 10 and 11 and Fig. 11).

drifter type	drifter id	drifter file name	recovery time (GMT)
CODE-OGS	SN00016	b393356498829	23/10/2012 07:58
CODE-OGS	SN00004	g393356699978	23/10/2012 08:09
Oil spill	STI-05	cSTI-05	23/10/2012 10:35
Prot-ICM	Tosca2	aTosca2	23/10/2012 10:56
Prot-ICM	Tosca9	bTosca9	23/10/2012 11:35
Oil spill	STI-02	aSTI-02	23/10/2012 12:39
CODE	e989	d300234011319890	23/10/2012 13:12
CODE	e788	d300234011317880	23/10/2012 13:46
CODE	OGS-Slo2	d300234011285560	23/10/2012 15:01
CODE	e988	f300234011319880	23/10/2012 15:16
CODE	e289	e300234011312890	23/10/2012 15:45
CODE	OGS-Slo4	a300234011281520	23/10/2012 16:06
CODE	OGS-Slo1	c300234011283610	23/10/2012 16:25
CODE	e287	c300234011312870	23/10/2012 16:25

Table 10. Drifter recovery information of the sixth day (23 October 2012).

drifter type	drifter id	drifter file name	depl lat	depl lon	depl time (GMT)
Oil spill	STI-05	cSTI-05	45,5860	13,6934	23/10/2012 01:35
CODE-OGS	SN00016	c393356498829	45,6500	13,7111	23/10/2012 09:57
Oil spill	STII-04	cSTII-04	45,6500	13,7111	23/10/2012 11:57
Oil spill	STI-18 - 961	a393667769961	45,6500	13,7111	23/10/2012 11:57
Oil spill	STI-18	cSTI-18	45,6500	13,7111	23/10/2012 11:57

Table 11. Drifter deployment information of the sixth day (23 October 2012).

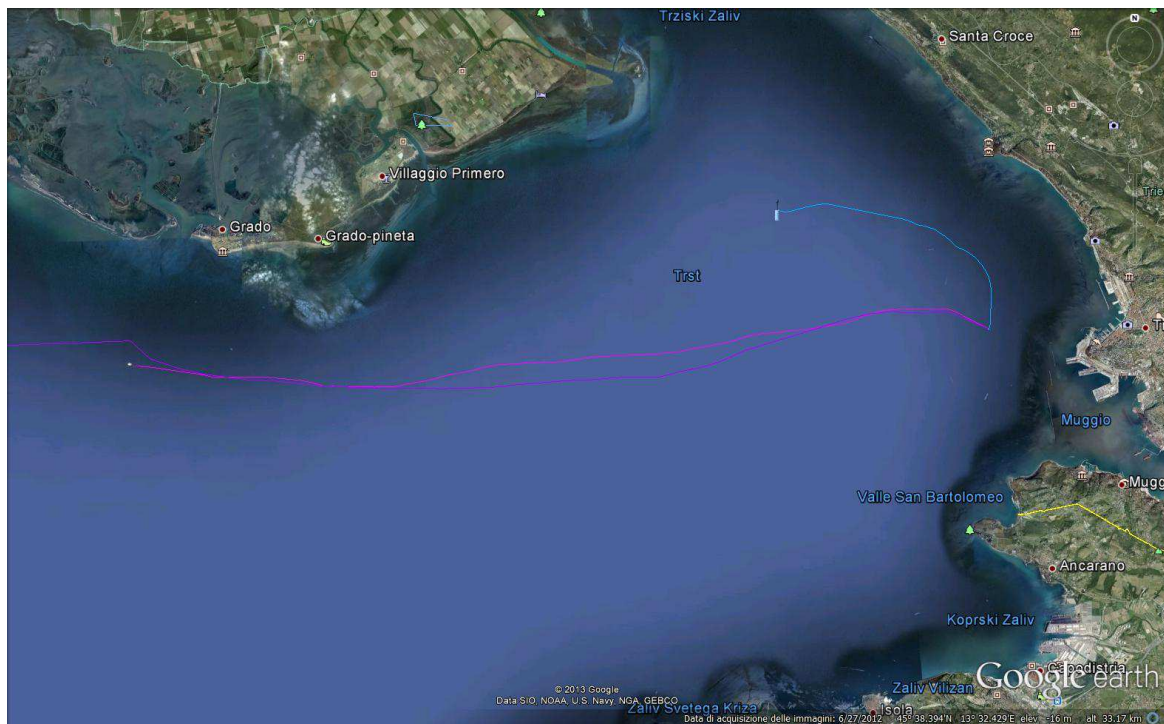


Fig. 11. Tracks of the drifters of the dispersion experiment during the sixth day (23 October 2012).

4.6. Wednesday 24/10/2012

During this day we recovered other drifters at sea and deployed one last oil spill drifter (Tables 12 and 13).

drifter type	drifter id	drifter file name	recovery time (GMT)
Isphere	ISPHERE-1	c300034012489470	24/10/2012 07:35
Isphere	ISPHERE-3	c300034012578040	24/10/2012 07:40
Isphere	ISPHERE-4	c300034012659810	24/10/2012 07:40
CODE-OGS	SN00014	e393290608548	24/10/2012 08:16
CODE UAEGEAN	UA-17	bUA-17	24/10/2012 08:51
Isphere	ISPHERE-2	c300034012480560	24/10/2012 09:22
CODE-Elcon	00001275	d393356986728	24/10/2012 09:31
CODE-OGS	SN00013	d393356498840	24/10/2012 09:41
CODE	e789	c300234011317890	24/10/2012 09:50
CODE	OGS-Slo3	a300234011284560	24/10/2012 10:12
CODE	OGS-Slo5	a300234011282560	24/10/2012 10:42
CODE		c300234011281570	24/10/2012 10:42
CODE-OGS	SN00016	c393356498829	24/10/2012 10:56
CODE	e488	c300234011314880	24/10/2012 10:59

Table 12. Drifter recovery information of the seventh day (24 October 2012).

drifter type	drifter id	drifter file name	depl lat	depl lon	depl time (GMT)
Oil spill	STI-04 - 989	a393667769989	45,6427	13,3424	24/10/2012 09:50

Table 13. Drifter deployment information of the seventh day (24 October 2012).

4.7. Thursday 25/10/2012

On this day, almost all the remaining drifters were recovered with the help of Nino Caressa from Grado (Table 14).

drifter type	drifter id	drifter file name	recovery time (GMT)
CODE GPS	e389	f300234011313890	25/10/2012 07:40
CODE GPS	e689	e300234011316890	25/10/2012 07:43
CODE-Elcon	00001274	d393356986714	25/10/2012 07:49
CODE GPS		f300234011285570	25/10/2012 07:56
CODE GPS	e089	d300234011310890	25/10/2012 07:58
CODE GPS		f300234010470090	25/10/2012 08:04
Oil spill	STII-04	cSTII-04	25/10/2012 08:58
Oil spill	STI-04 - 989	a393667769989	25/10/2012 08:58
Oil spill	STI-18 - 961	a393667769961	25/10/2012 09:00
Oil spill	STI-18	cSTI-18	25/10/2012 09:00
CODE-Elcon	00001273	a393667772682	25/10/2012 09:44

Table 14. Drifter recovery information of other days.

Only two drifter were not recovered. One oil-spill drifter equipped with Iridium transmission was lost at sea (no more transmission after the first day) and one old CODE drifter was not found offshore Grado and provided useful data till the end of November 2012 in the Adriatic Sea. The file of this drifter was also split because of a gap in the transmission data (Tables 15 and 16).

drifter type	drifter id	drifter file name	recovery time (GMT)	information
CODE GPS		f300034013313360	04/11/2012 07:00	split

Table 15. CODE drifter split.

drifter type	drifter id	drifter file name	depl lat	depl lon	depl time (GMT)
CODE		g300034013313360	44,4202	12,8022	06/11/2012 06:59

Table 16. CODE split drifter deployment information.

5. Float and waverider buoy

The Arvor C profiling float and the waverider buoy were deployed during the morning of the first day (Table 17 and Figs. 12 and 13).

The Arvor C provided useful data until the first hours of the 22 October 2012 when the instrument where accidentally caught by a fisherman and carried to Grado. During the time in water, the Arvor C collected 29 profiles. The trajectory color coded by time and the preliminary plots (after a first editing) are displayed in Figs. 14 to 17.

The waverider buoy was operated for 6 days. It recorded the displacements in the three directions (north, west, vertical) from which significant wave height, peak period, direction of the peak wave, and wave spectra can be computed.



Fig. 12. Deployment of the Arvor C.

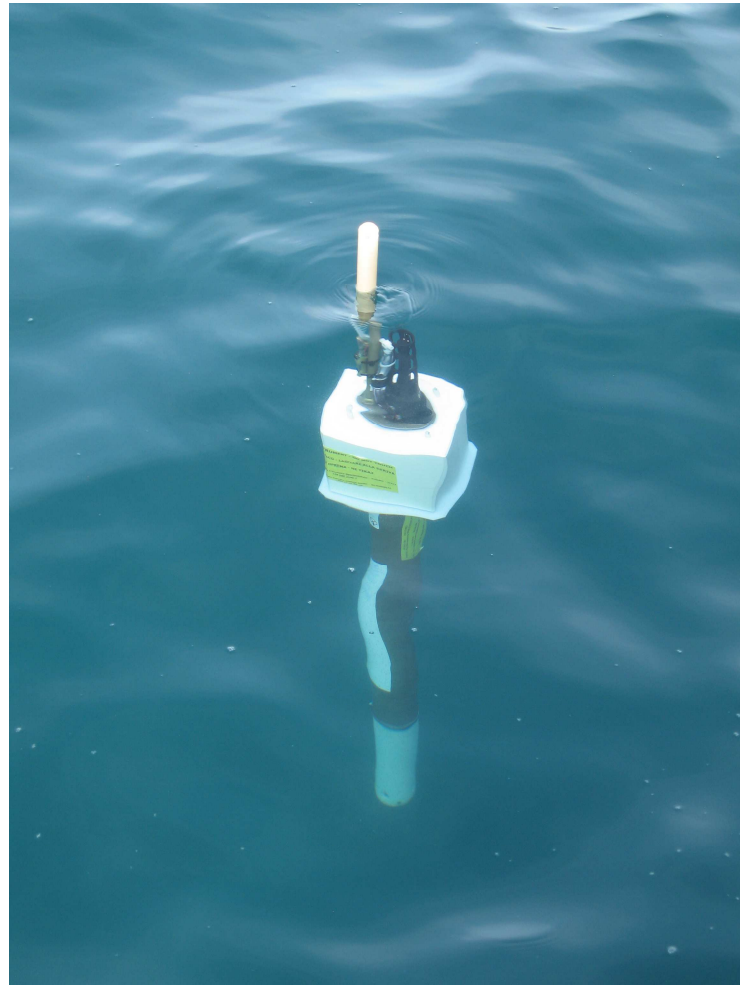


Fig. 13. Arvor C in water just before performing the first profile about 20 minutes after the deployment.

instrument	information	lat	lon	time (GMT)
Arvor C	deployment	45,673	13,681	18-Oct-2012 11:25
waverider	deployment	45,671	13,681	18-Oct-2012 12:39
Arvor C	Last useful profile	45,672	13,663	22-Oct-2012 00:13
waverider	recovery	45,671	13,681	24-Oct-2012 11:28

Table 17. Arvor C and waverider buoy deployment information.

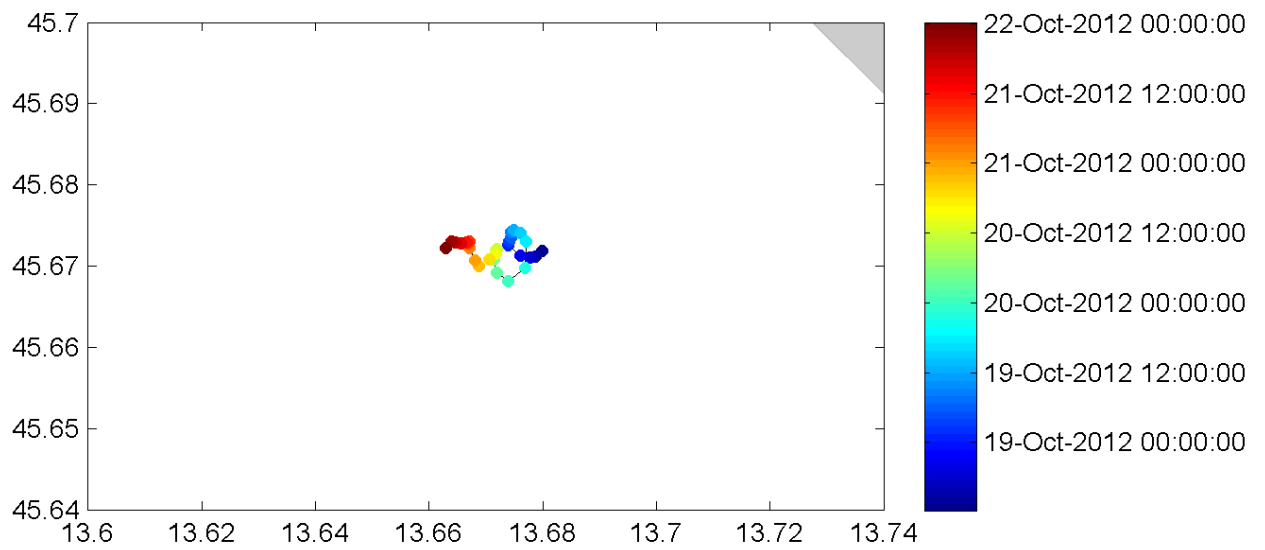


Fig. 14. Trajectory of the Arvor C color coded by time.

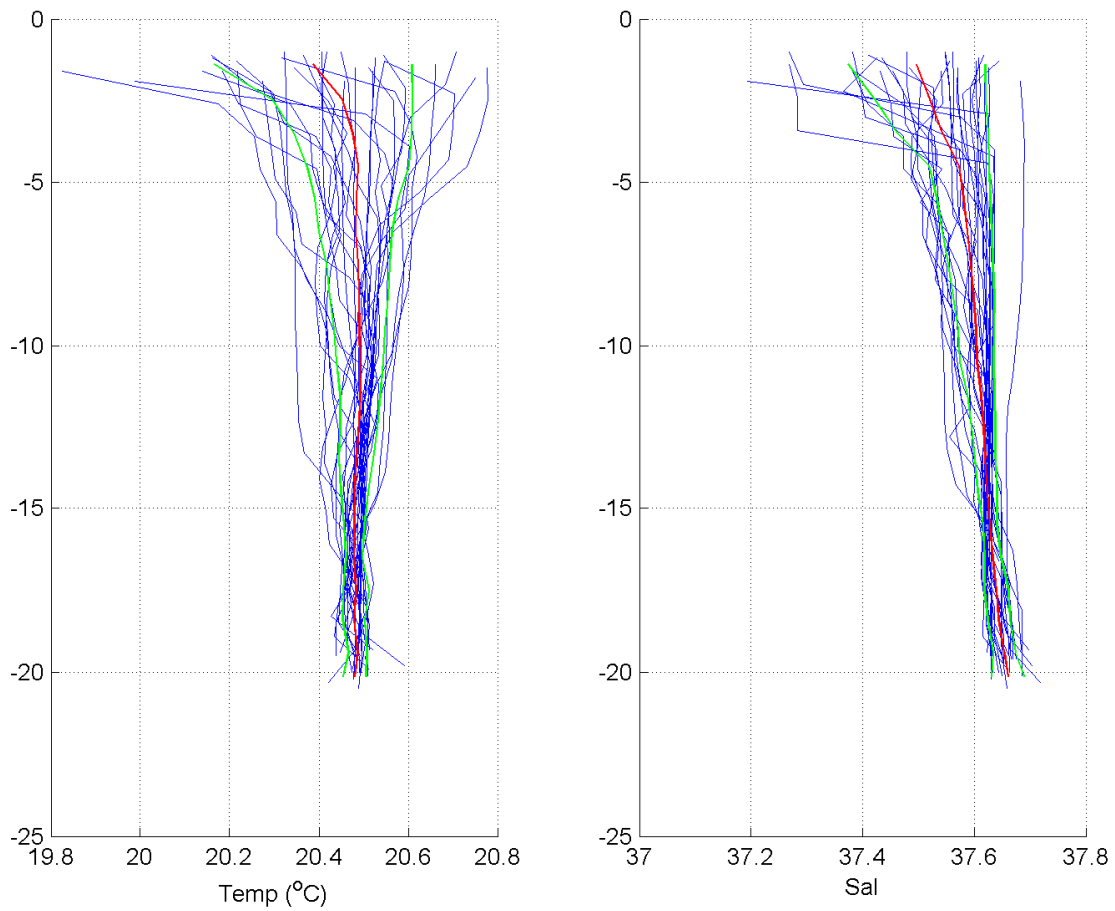


Fig. 15. Temperature and salinity profiles of the Arvor C (blue lines). The red and green lines represent the mean and the mean ± 1 standard deviation, respectively.

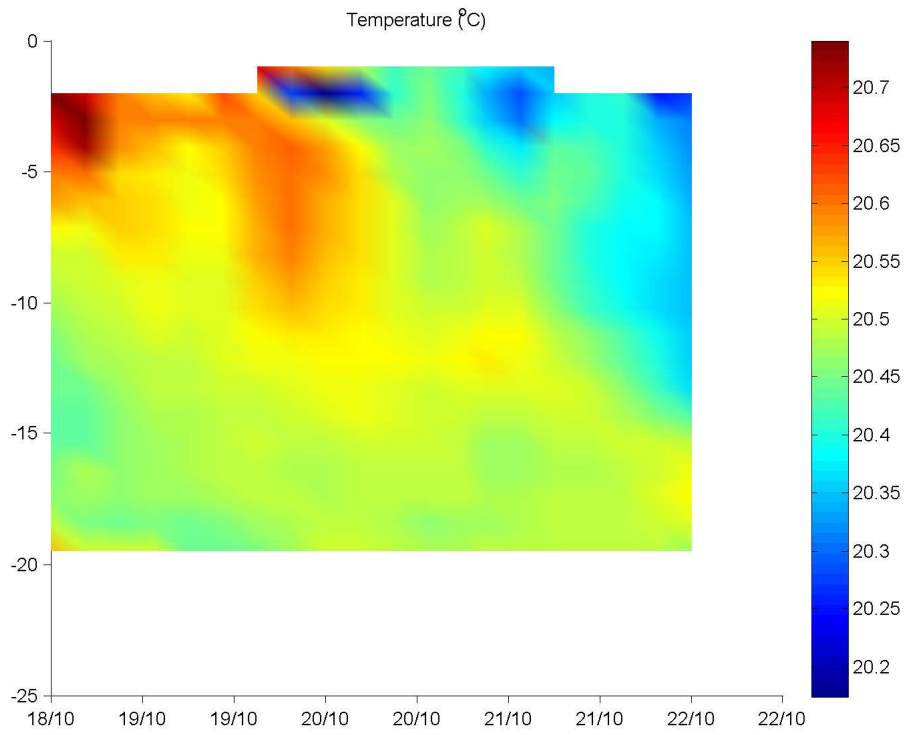


Fig. 16. Temperature contour plot of the Arvor C.

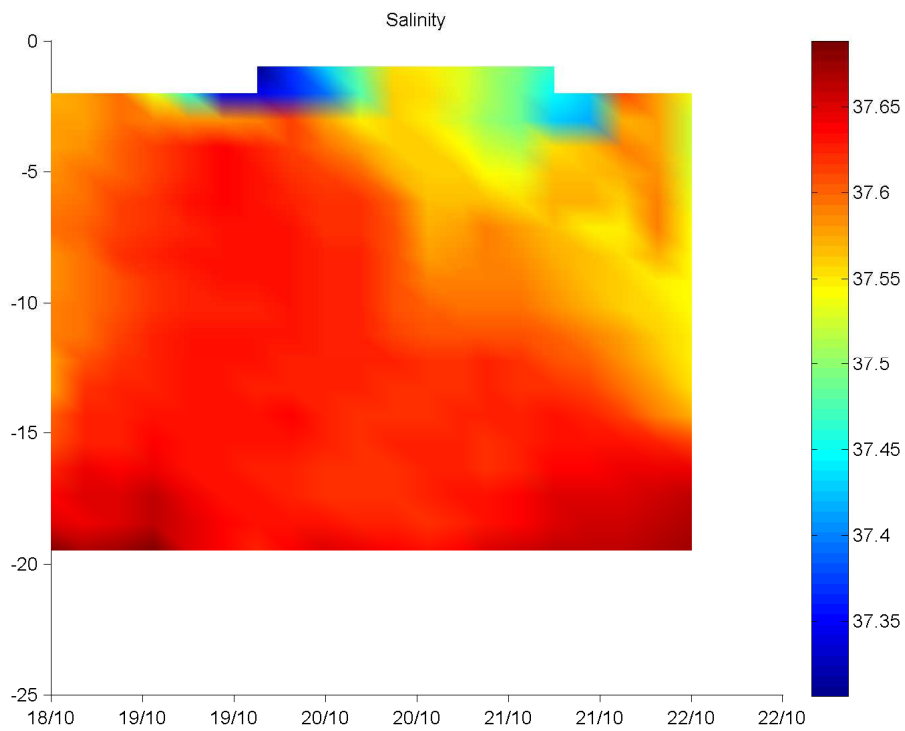


Fig. 17. Salinity contour plot of the Arvor C.

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7. References

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