



# **AEGEAN AND TYRRHENIAN DRIFTER DATABASES**

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Approved by: .....

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## 1. Introduction:

The delayed mode processing procedures followed for the preparation of an e-database, as described in Borrione et al. (2008), have been carried out also on the drifter data collected for the Tyrrhenian and the Aegean Sea.

Although the data processing methods (editing and interpolation) are often similar among research institutes, the two cases required more time and attention, as they were collected and organized by different research centers. This made it necessary to go through several additional elaborations, in order to reorganize the obtained data and process them with our Matlab scripts. This guarantees consistency with the data available in the other e-databases.

The following report describes the procedures followed to prepare and process the data for the two e-databases which are now available on line and can be reached from the main MedSVP (Mediterranean Surface Velocity Program) page.

Chapter 2 gives a brief introduction on the methods followed for the construction of the database. Chapter 3 focuses on how the data gathered in the Aegean Sea have been dealt with, while Chapter 4 describes the procedures followed for those available for the Tyrrhenian Sea. Both chapters start with a brief description of the two projects. Final conclusions can be found in Chapter 5.

## 2. Standard procedures

All the MatLab scripts that have been written to visualize and process the Tyrrhenian and Aegean Sea database have been positioned in the Poseidon terminal, under the *'/home\_sire/drifter/Ines'* folder which also contains the two folders (*Database\_Tirreno* and *Database\_Egeo*) where data series are located.

The following table shows the 'protocol' with which each MedSVP database has been created and which could be followed if another similar database is planned. Each script starts with the letters XX, which are replaced with the initials of the user who has created each specific database (RG or IB). A detailed description of steps 1 to 5 is found in Borrione et al. (2008).

STEP	MatLab script name or intermediate procedure	Brief description of script results
i.	Create a subfolder named <i>raw_mmm_yyyy</i> under the <i>raw</i> directory.	
1.	XX_mat2raw_mmm_yyyy.m: 1.1 : Change date and month of DUD (Database Updating Date) 1.2 : Change path of input and output folders 1.3 : Run script	Reorganizes data from a binary Matlab file (*.mat), to an ASCII format (*.arg). Saves the results in the subfolder indicated in step i.
ii	Create a folder named <i>edi_mmm_yyyy</i> under the main <i>edi</i> folder	
2.	XX_mainedit.m: 2.1 : Change date and month of DUD 2.2 : Rename path of input and output files 2.3 : Run script	Automatic editing of position and temperature spikes. Saves the results in the subfolder indicated in step ii.
iii.	Create a <i>deploy_mmm_yyyy.dat</i> document.	
3.	XX_edit_pos_manual.m 3.1 : change month and date of DUD 3.2 : Rename path of input and output files 3.3 : Run the script	Allows manual editing of remaining position spikes. If edited, the files are saved after adding '_p' to the filename.
4.	XX_edit_temp_manual: 4.1. Change month and date of DUD 4.2. Change month and date of DUD in XX_spike_temp.m 4.3. Rename path of input and output files then run the script	Allows manual editing of remaining temperature spikes. If edited, the files are saved after adding '_t' to the filename
5.	XX_metti_NaN_su_drogue_e_volt.m 5.1. : Change month and date of DUD 5.2. : Rename path of input and output files then run script	Places the NaN value to the drogue and volt values corresponding to manually edited temperature spikes. This is done only on those files with the '_t.ed' extension. There is no change in the filename.
iv.	Create a folder named <i>finaledited</i> in <i>edi_mmm_yyyy</i> where all the final-edited files must be moved. The '_p' or '_t' part of the name, must be removed from the filename first. Create a folder named <i>html</i>	
v.	Create folder named <i>kri_mmm_yyyy</i> under the <i>kri</i> folder	

6.	XX_mainkri.m: 6.1. : change date of DUD 6.2. : Rename path of input and output files then run script	Interpolates, filters and subsamples edited data. Creates a <i>dati_deploy_mmm_yyyy.txt</i> document in the <i>html</i> folder. Saves the kriging results in the subfolder indicated in step v.												
vi.	Create a folder named <i>plots</i> , the latter containing 2 subfolders: <i>kritimeseries</i> and <i>kritracks</i> .													
7.	XX_plot_fig_kri.m 7.1. : change DUD 7.2. : Rename path of input and output files then run script	Creates timeseries and trajectories of drifters with the kriged data. Figures are located in the <i>plots</i> ' subfolders ( <i>*.ppm</i> extension)												
8.	XX_ppm2gif 8.1. : Change DUD, rename paths and run script from Poseidon terminal (control writing-reading-executing file permissions)	Converts format of previously created plots into <i>*.gif</i> format												
vi.	Modify <i>dati_deploy_mmm_yyyy.txt</i> (using a spreadsheet software): check text alignment, add a 10 <sup>th</sup> column with the drifter status, save as <i>Master_table.txt</i>													
vii.	Create a space on the web for the created database with the following folders and sub folders:													
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="border: none;">1st level</th> <th style="border: none;">2nd level</th> <th style="border: none;">3rd level</th> </tr> </thead> <tbody> <tr> <td style="border: none;">/www/.../database_name/</td> <td style="border: none;">data/</td> <td style="border: none;">kriged edited</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">plots/</td> <td style="border: none;">kritracks kritimeseries</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">html/</td> <td style="border: none;"></td> </tr> </tbody> </table>		1st level	2nd level	3rd level	/www/.../database_name/	data/	kriged edited		plots/	kritracks kritimeseries		html/	
1st level	2nd level	3rd level												
/www/.../database_name/	data/	kriged edited												
	plots/	kritracks kritimeseries												
	html/													
viii.	Move the <i>Master_table.txt</i> document in the web's folder named <i>data</i> Move the <i>*.gif</i> created images in the corresponding web <i>plots</i> subfolders.													
9.	XX_crea_master_table.m 9.1 change name of input and output folders then run script	Creates the html code for the drifter's main master table located in the web <i>data</i> folder												
ix.	Create folder <i>mmm_yyyy</i> under the web <i>html</i> folder													
10.	XX_html_search.m 10.1. : change DUD then run script	Creates the html file ( <i>search.html</i> ) in the <i>html</i> folder needed for the drifter search page.												
11.	XX_html_singoli_drifter.m 11.1 : change path of output and input folders 11.2 : run script	Creates the html file ( <i>difterID.html</i> ) with the graphs summarizing the drifter timeseries and trajectories plots.												
xi.	Move a copy of the newly created <i>*.html</i> files ( <i>difterID.html</i> ) in the web <i>html</i> folder.													
xii.	Move a copy of the final-edited (and kriged) files in the web <i>edited (kriged)</i> subfolder.													
12.	XX_aggiusta_ed_in_database.m 12.1. : Change path of input and output folders 12.2. : Run scripts	Removes for each file in the web edited folder columns corresponding to drogue presence and battery level.												
13.	XX_aggiusta_kri_in_database.m 13.1. : Change path of input and output folders 13.2. : Run script	Removes for each file in the web kriged folder columns corresponding to drogue presence and battery level. Rewrites values in new variables (e.g. time,lat, lon, u, v, sst)												

Table I. Schematic diagram of the procedures followed for the construction of an e-database.

The main steps, listed in Table 1 (where DUD stand for Database Updating Date) have been followed chronologically for the creation of the Tyrrhenian and Aegean Databases. To convert the available data into the required standard format, further specific scripts have been created. The following sections, describe in detail the procedures followed for each database, together with the problems encountered and the adopted solutions.

### 3. Aegean Sea Database

In the northern and central Aegean Sea, 38 standard GPS (Global Positioning System) SVP (Surface Velocity Program) drifters were launched from March 2002 to February 2003 in 4 separate deployments: March 2002, June 2002, September 2002 and February 2003. Figure 1 shows where these drifters were deployed. Colors and shapes indicate their deployment dates: March 2002 (asterisk), June 2003 (triangle), September 2002 (circle), February 2003 (cross). The goal of the project was to study the circulation in the north and central Aegean Sea (Olson et al., 2007). Deployments were carried out from the HCMR R/V *Aegaeo* by the Hellenic National Center for Marine Research (HCMR) with help from the University of Athens.

Further information on the acquired data and the drifter trajectories can be found in the Aegean sea drifter database at the following link:

[http://doga.ogs.trieste.it/sire/drifter/database\\_egeo/index.html](http://doga.ogs.trieste.it/sire/drifter/database_egeo/index.html)

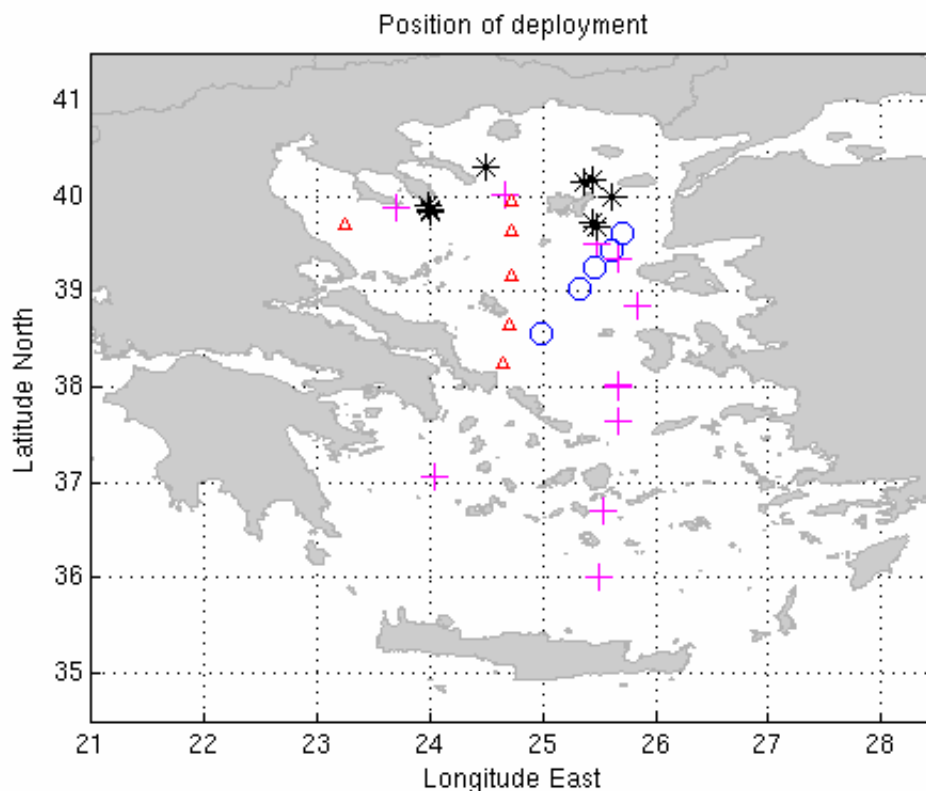


Figure 1. Deployment positions of the 45 drifters released in the Aegean Sea: March 2002 (asterisk), June 2003 (triangle), September 2002 (circle), February 2003 (cross).

### 3.1. Data preparation

The data that were made available for the organization of the e-database webpage were located in an 'edi' folder, as it was assumed that the time series had already been edited for temperature and position. Each file name had been named after the drifters Argos ID number followed by the \*.dat extension (18979.dat).

An example of the first few lines of data retrieved from the 18979.dat file, as given in the original format, is shown in Figure 2.

```
18979,08/03/2002,18:00:00, 25.3804, 40.1524, 13.90, 90.47
18979,08/03/2002,20:00:00, 25.3941, 40.1557, 13.81, 82.70
18979,08/03/2002,21:00:00, 25.4007, 40.1564, 13.72, 69.93
18979,08/03/2002,22:00:00, 25.4059, 40.1566, 13.68, 69.93
18979,08/03/2002,23:00:00, 25.4076, 40.1565, 13.51, 69.93
18979,09/03/2002,00:00:00, 25.4068, 40.1572, 13.42, 90.47
18979,09/03/2002,01:00:00, 25.4042, 40.1584, 7.88, 89.91
```

Figure 2. Example of the data gathered by drifter 18979 as in *edi/18979.dat*.

As in the example in Figure 2, the following information can be found:

- Drifter Argos ID number
- Date (dd/mm/yyyy)
- Time (GMT)
- Longitude East
- Latitude North
- Measured temperature (°C)
- Quality index

At the moment, no information has been forwarded from HCMR to interpret the quality index value.

The first step that had to be undertaken, was to create a script that could convert the available data, in a format that was compatible with our MatLab scripts. For this reason, the *IB\_egeoEDIfORMAT2egittoEDIfORMAT.m* matlab script was run.

All the variables missing in the Aegean data series (sensor time, drogue presence and battery level value), and needed to work with our scripts, were replaced by NaN values. The new file names started with the 'a' character (since no trajectory had been split) followed by the Argos



ID number; for example, the '18979.dat' file was rewritten in its new format in the file named 'a18979.ed'.

The new files were located in two different folders: 'new\_edi' and 'new\_edi\_NA' under the '.../Ines/Database\_Egeo/' main folder. In the second, also the quality index value was recorded in the last column. Only the files in the 'new\_edi' folder were processed with the procedure explained below.

Before proceeding, each drifter trajectory and recorded temperatures were plotted to have a quick view on the data quality. It appeared obvious that both position and temperature had not been thoroughly edited, as it can be seen in Figures 3 and 4.

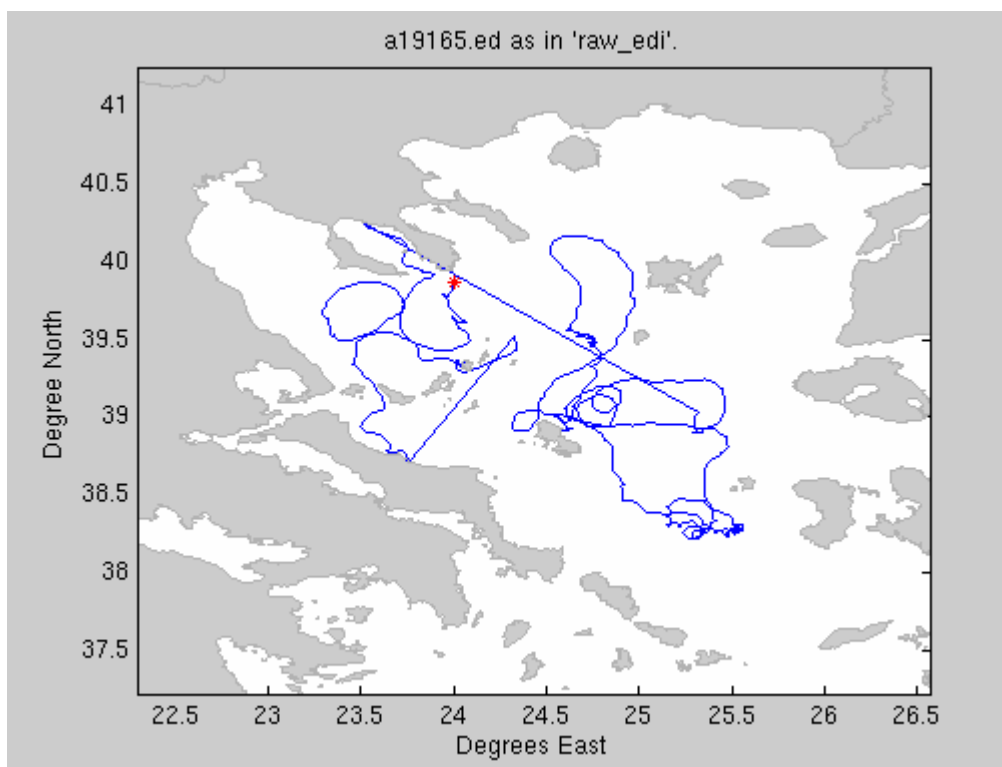


Figure 3. Trajectory of drifter a19165 as in the 'raw\_edi' folder. The plot shows how improbable rectilinear segments have not been removed from the data series or data series were not split in several trajectories. The red asterisk indicates position of deployment.

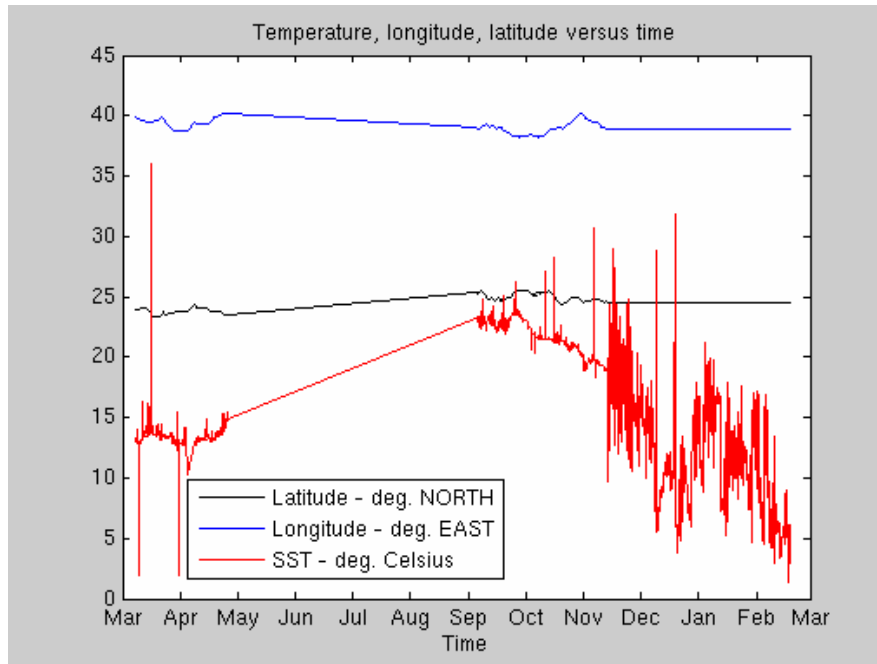


Figure 4. Time series of longitude, latitude and temperature of drifter a19165 as in the ‘*raw\_edi*’ folder. Temperature recordings show a four month lack of data (from May to September), while the noisy temperature recordings (from November to March) correspond to the stranded status of the drifter.

As can be seen in Figure 3, trajectories still included artificial segments, those corresponding to when drifters were stranded or were carried on vessels before and/or after deployment - starlike and improbable linear trajectories - while in Figure 4, obvious temperature spikes can be seen (drawn in red). It is interesting to note, that stranded positions (easily recognizable, as latitude and longitude maintain an approximately constant value) are confirmed by very disrupted temperature recordings (Figure 4).

Before the kriging interpolation could be carried out (step 6), the data had to be edited both for temperature and position. For this reason, two MatLab scripts (*RG\_manual\_pos\_edit.m* and *RG\_manual\_temp\_edit.m*) were modified to read the recorded values.

The first script was modified into *IB\_EGEO\_manual\_pos\_edit\_nines.m*. It allowed to easily identify – in the data file - points where the drifter was stranded. Similarly to the original script, it asks the user to click on points that need to be removed. The script replaces, in the *edi* file, all values corresponding to the suspected point with the 999 value and returns the line number where the replacement has occurred. The modified data is then saved in a different file, with the same name, but with a ‘*\_p.ed*’ extension. All the data after the drifter was stranded were removed from the ‘*\_p.ed*’ file and copied into a new file renamed with the consecutive

deployment letter (e.g. file a18979.ed was split in 2 parts: a18979\_p.ed and b18979.ed). The script was then run again on the newly created file ('b18979.ed) to remove further position spikes, if present. Once all drifters were corrected for the position, similarly, the data were edited for temperature (edited files were renamed with the '\_t.ed' extension)

In the second step (numbered 4 in Table 1), the *IB\_EGEO\_edit\_temp\_manual.m* was run. As temperatures had not been automatically edited for less obvious temperature spikes (as is normally done in step 2 of Table 1, and described in Borrione et al., 2008), the script was modified to call the *IB\_EGEO\_temp\_edit.m* and the *IB\_spike\_temp.m*; these two scripts automatically edited the temperature values and saved the edited data series in the 'new\_edited\_temp' folder. These newly created files were then opened for manual editing.

The data that were ready for the kriging procedure, were then manually copied into the 'Database\_Egeo/new\_edited\_temp/finaledited' folder.

As the drifters hosted a GPS transmitter, a recording was saved every hour. For this reason, the *IB\_EGEO\_mainkrig.m* (modified from *RG\_mainkrig.m*) performed interpolation every 30 minutes. Subsampling, on the other hand, was undertaken at two different intervals: every 6 hours to maintain consistency with the data available in the other e-databases (resulting data series were saved in the '.../Database\_Egeo/kri\_30min\_6hr\_subs' folder), and every 2 hours (saved in the '.../Database\_Egeo/kri\_30min\_2hr\_subs' folder).

The edited data saved in the '.../new\_edited\_temp/finaledited' folder and the kriged data saved in the '.../Database\_Egeo/kri\_30min\_6hr\_subs' folder or the '.../Database\_Egeo/kri\_30min\_2hr\_subs' folder were the ones made available, after authorized authentication, through the e-database.

### **3.2. Database construction:**

Step 7, in Table 1, was run on all interpolated and subsampled data. The script, *RG\_plot\_fig\_kri.m* had to be modified into *IB\_EGEO\_plot\_fig\_kri\_CODE.m* for two main reasons:

- As had already been done for the Tyrrhenian Sea database, all components of the plots referred to the drogue presence readings had to be removed.
- The resolution of the maps used for the other databases was not appropriate for the Aegean Sea, which has a much higher distribution of islands. By using the original

maps, the drawn trajectories of many drifters seemed crossing land although there was no other information supporting stranding. For this reason, the map resulting from the *RG\_mappa\_med\_hi.m* MatLab script, with a higher resolution and based on georeferenced data, was used instead.

The following spaghetti diagram, shows the trajectories of all the drifters deployed in the Aegean Sea. The red asterisks correspond to the positions of deployments.

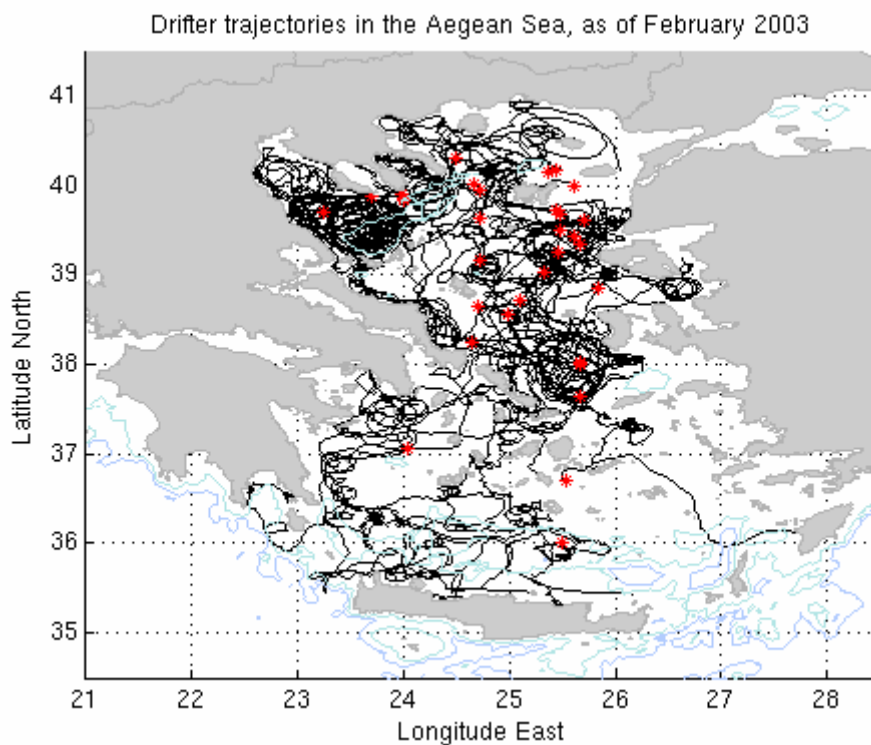


Figure 5. Spaghetti diagram of all the drifters deployed in the Aegean sea. Red asterisks indicate the positions of deployments. Drifters were deployed from March 2002 to February 2003.

Finally, steps 7 through 13 were carried out to construct the web page, which can be reached through the following link:

[http://doga.ogs.trieste.it/sire/drifter/database\\_egeo/index.html](http://doga.ogs.trieste.it/sire/drifter/database_egeo/index.html)

#### 4. Tyrrhenian Sea database

In total, 72 CODE drifters were deployed in the Tyrrhenian sea to study seasonal variations and the surface circulation of the basin. They were deployed from ships of opportunity and research vessels along 5 different transects (Napoli–Palermo in December 2001, January and August 2003, Napoli–Cagliari in January 2003, Civitavecchia–Bonifacio Strait in April 2003 ) and in the area close to Isola d’Elba (Figure 6). The institutes involved in the area of study were OGS (with 9 drifters), the NATO Undersea Research Centre (NURC) of La Spezia (with 11 drifters), and IUN - University of Naples (with 52 drifters). Further information on the surface circulation patterns found in the Tyrrhenian Sea as inferred from the drifters deployed in 2003 can be found in Menna (2003).

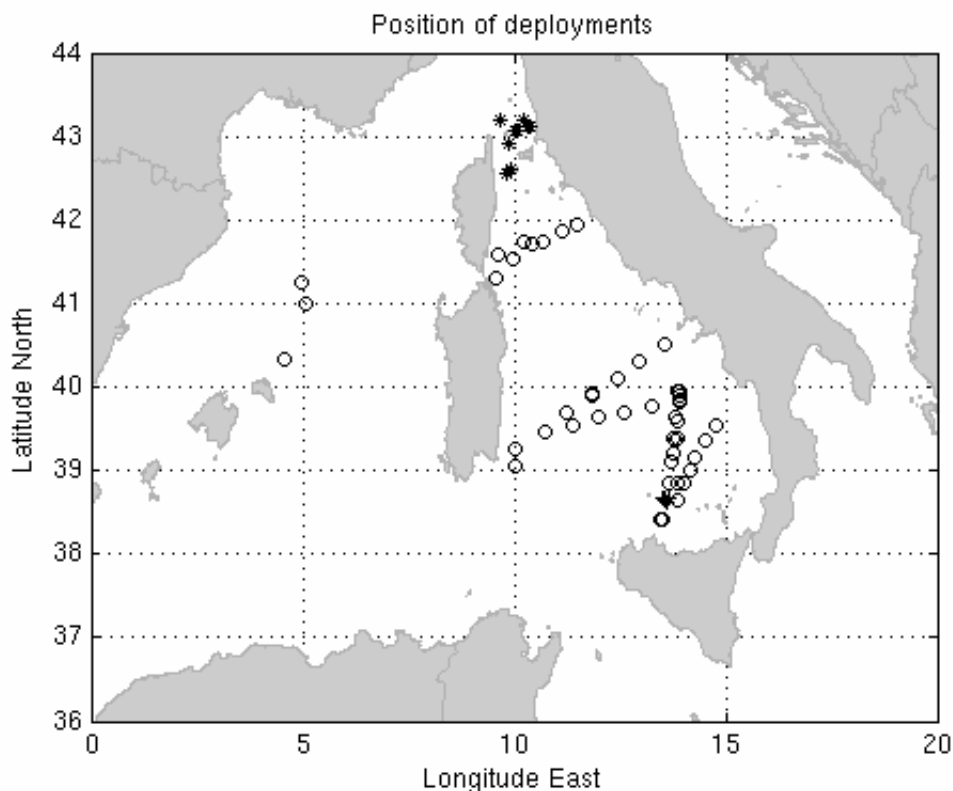


Figure 6. Deployment positions of the CODE drifters released in the Tyrrhenian sea. Circles locate drifters deployed by IUN, asterisks those by NURC and the crosses those by OGS.

## 4.1. IUN and OGS drifters

### 4.1.2. Initial structure:

For all the drifters deployed by IUN and OGS, processed data were obtained from Dr. Laura Ursella. These were already separated in three main folders according to their level of elaboration. The data series converted into engineering units (similarly to what is done with step 1 in Table I) were located in the *raw* folder. Files were in ASCII format and with the *\*.arg* extension. The files (ASCII format, *\*.ed* extension) in which position and temperatures were edited and trajectories split – where necessary – were located in the *edi* folder. The final interpolated (every 30 minutes) and filtered time series were stored in the *kri* folder; the kriged data series were located in 3 different subfolders according to the drifter positioning system: ‘*argos*’ for all the Argos readings, ‘*gps*’ for drifters 33254 and 33253 which were equipped with a GPS receiver, and the ‘*argos\_gps*’ folder, where Argos and GPS position recordings were combined.

The following table summarizes the names and meaning of the variables found in each of these subfolders; these variables are always present, except for *ssti*, *sste*, *sstim*, which may be absent in the *argos* folder if the drifter has a corresponding file under the *gps* folder.

Variable name:	Corresponding to:
Tig (tia)	Time (MatLab serial)
Lonig (lonia)	Kriged longitude (every 30 minutes)
Latig (latia)	Kriged latitude (every 30 minutes)
Loneg (lonea)	Error resulting from interpolation of longitude
Lateg (latea)	Error resulting from interpolation of latitude
Lonimg (lonima)	Filtered longitude
Latimg (latima)	Filtered latitude
Uig (uia)	Zonal component of interpolated velocity (cm/sec) (every 30 minutes)
Vig (via)	Meridional component of interpolated velocity (cm/sec) (every 30 minutes)
Uimg (uima)	Zonal component of filtered velocity (cm/sec)
Vimg (vima)	Meridional component of filtered velocity (cm/sec)
Ssti	Interpolated temperature. Not available in the <i>argos</i> folder
Sste	Error resulting from interpolation of temperature – not available in the <i>argos</i> folder
Sstim	Temperature corresponding to filtered coordinates. Not available in the <i>argos</i> folder

Table II. Table summarizing the list of variables that can be found in each of the original ‘*kri*’ subfolders obtained for the IUN and OGS drifters. The final letter, ‘*a*’ or ‘*g*’, depends on the origin of the data: ‘*a*’ for Argos, ‘*g*’ for GPS, In *argos\_gps* all variables start with ‘*g*’. Each variable is a column vector of values, its length depends on the number of recordings. Filtering has been carried out with a 36 hour low-pass filter.

The file *Database\_Tirreno/Tirreno\_deploy\_pos\_and\_coefficients.txt* summarizes all the information that has been collected (corrected and joined from different sources) regarding each drifter (Argos ID number, Argos project ID number, position and time of drifter deployment, institute, bfile.dat format – 0 for hexadecimal, 1 for decimal -, calibration coefficients of the temperature sensors).

Before proceeding with the steps 7 to 13, previously processed *kri* files were plotted on the corresponding *bfiles.dat* to have a quick look at the available data series and on how they were split. The script used was *IB\_compare\_plots.m*. The resulting plots showed that not all the data were correctly processed and the trajectories split (see examples in Figures 7, 8, 9). This is the reason why they needed further elaboration before they could be used for the e-database.

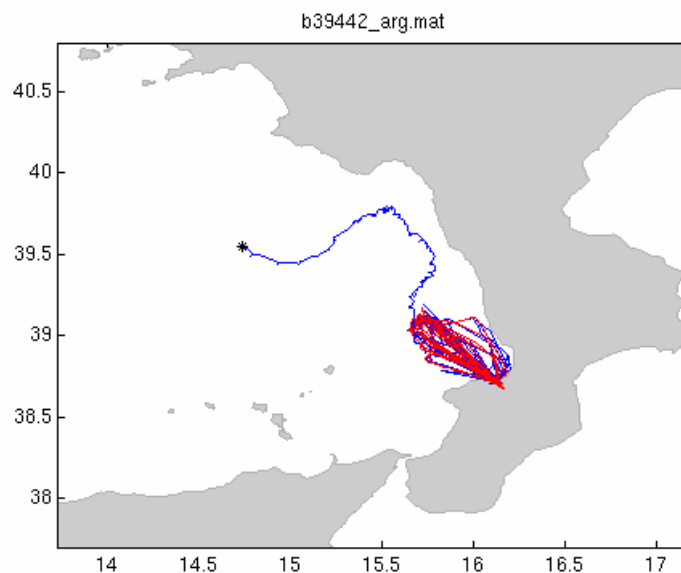


Figure 7. Trajectory of drifter b39444 (in blue) as in *bfiles.dat* and its 'trajectory' (red) as in the *kri* folder. The Figure demonstrates how only the part corresponding to the 'virtual' trajectory of the drifter had been processed. Coordinates are in Latitude North and Longitude East.

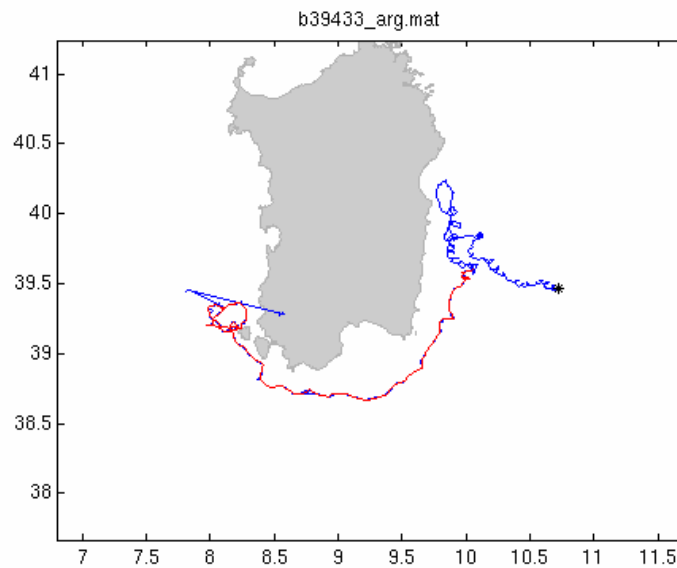


Figure 8. Trajectory of drifter b39433 (in blue) as in *bfiles.dat* and its 'trajectory' (red) as in the *kri* folder. In this case, a part of the trajectory (after deployment) had been neglected. Coordinates are in Latitude North and Longitude East.

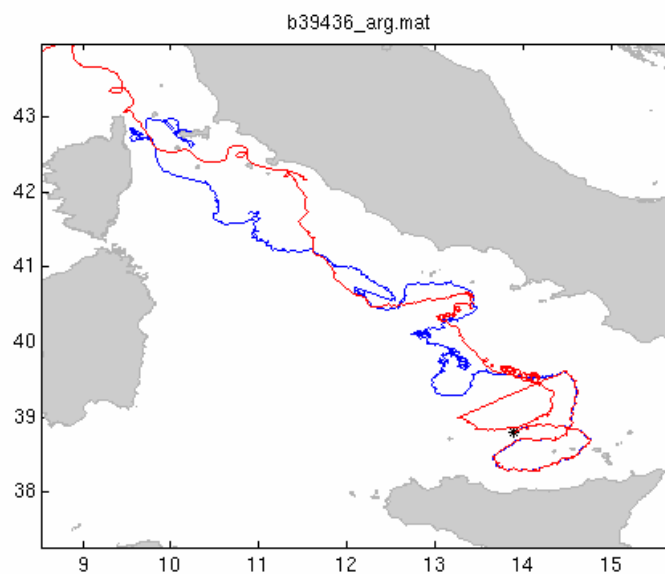


Figure 9. Trajectory of drifter b39436 (in blue) as in *bfiles.dat* and its 'trajectory' (red) as in the *kri* folder. The overall kriged trajectory was the sum of the trajectories of two different drifters (b39436 and b39435). Coordinates are in Latitude North and Longitude East.

In cases similar to those of drifter b39433, a portion of the trajectory had been ignored during the editing and kriging procedure. This was then found out to be due to a mistake in reporting the date of the specific drifter deployments (e.g. in 39445, 39444, 39443, 39442, 39441, 39440



files, the deployment date was recorded as beginning of September 2003 instead of beginning August 2003, thus resulting in the loss of one month measurements). Drifter 39436 is a unique case: the kriged data series included the kriged data recorded by drifter 39435 (most probably while the MatLab script was executed, variables were not cleared appropriately).

Once drifter data series were checked individually, it was decided to repeat the processing procedures (starting with step 2) only on the following ones: b34447, b39433, b39436, b39441, b39442, b39444.

#### **4.1.2. Editing and interpolation**

As the format of the *raw* files was not compatible with the Matlab programs planned to be used, (e.g. the column corresponding to the drogue presence reading was missing since all drifters used were of the CODE type), before step 2 could be run, the *IB\_tirrenofomat2egittoformat.m* was used to insert a 10<sup>th</sup> column. The script, which was run on all the *raw* drifter files, copied the new modified versions in the '*Database\_Tirreno/raw/final\_raw\_egittoformat*' folder.

At this point step 2 (editing) could be carried out on the drifters containing errors. Although the script was executed correctly, the created plots (e.g., Figure 10) demonstrated that the incorrect splitting procedures had been carried out before the *\*.mat* files (found in *bfiles\_mat*) were converted in the corresponding *\*.arg* files (found in '*raw*' folder).

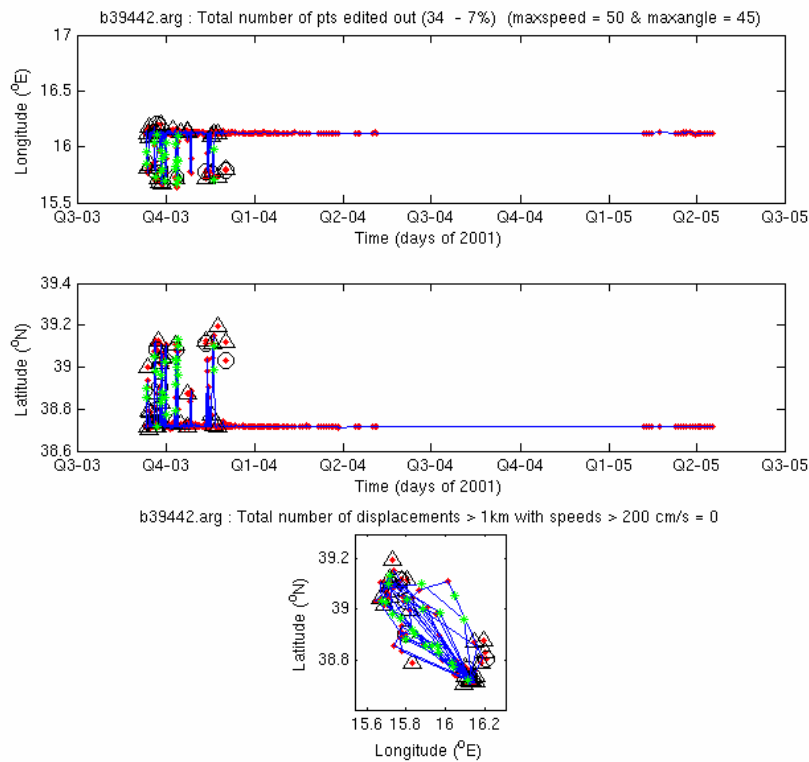


Figure 10. Plot generated during the main editing procedure of drifter b39442. This figure shows how the script was editing position records only on the trajectory corresponding to the stranded status of the drifter (compare with Figure 7).

Knowing this, the script *IB\_compare\_plots.m* was once again used to compare the time series of each \*.arg file (as in the 'raw' folder) with the corresponding ones as in the bfiles.dat (found in the 'home\_sire/drifter/data'). Figures 11 and 12 show the plots obtained which confirmed the first hypothesis.

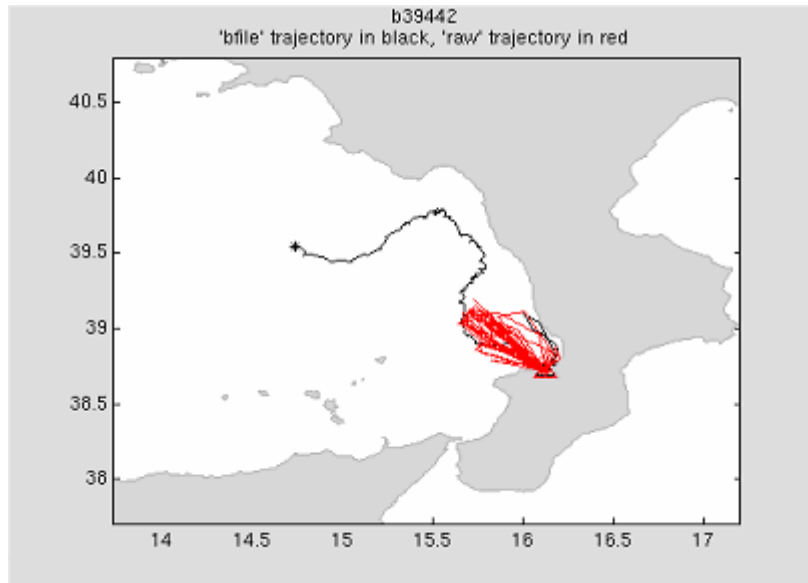


Figure 11. The following plot was generated by plotting the trajectories of drifter b39442 as in the \*.arg (in red) and \*.dat (in black) files. Erroneously, only the positions (and environmental measurements) corresponding to the stranded status of the drifter had been saved and processed (in red).

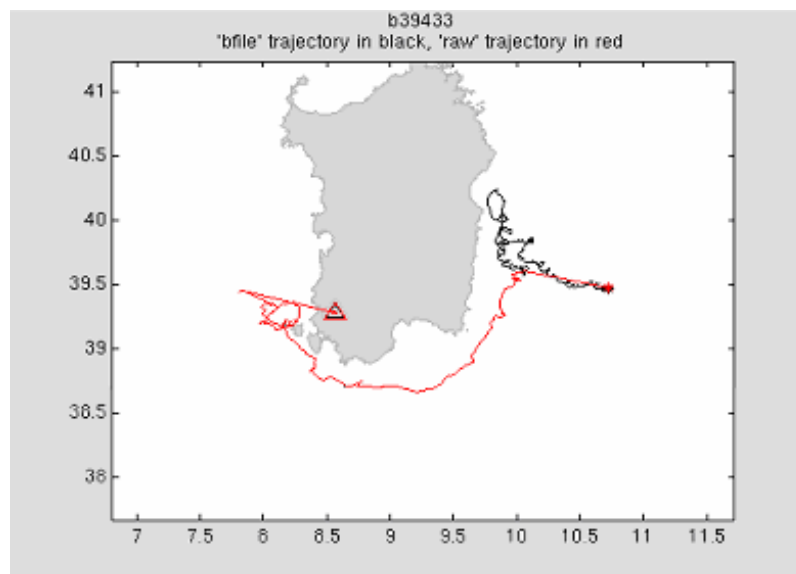


Figure 12. The image was generated by plotting the trajectories of drifter b39443 as in the \*.arg (in red) and \*.dat (in black) files. Erroneously, part of the initial trajectory (and the related environmental measurements) had been cut from the data serie.

The above mentioned problems determined the need to reprocess the data of the drifters b34447, b39433, b39436, b39441, b39442, b39444, starting from step 1 in Table 1.

As the *XX\_dat2mat.m* script needs information on the date and position of deployment for each drifter, a table (similar to *drifter\_info.txt*) was prepared; missing or incorrect values of deployment dates were filled in with values retrieved directly from the recordings (first accepted Argos time, latitude, and longitude). This step was important, since for the previously listed drifters a whole month of measurements had been cut off.

The *bfiles.dat* files need drifter specific conversion scripts which take into account the instrument output format – decimal or hexadecimal – and the structure of the message (number of bytes per measured variable), for this reason, drifters with errors were kindly reprocessed by L. Ursella who then provided us new corrected *raw edi kri* files (placed in the *raw\_edi\_kri\_LU* folder). A copy of these replaced the incorrect ones in the ‘*raw*’, ‘*edi*’ and ‘*kri*’ folder.

Before continuing the processing procedures with step 7, *IB\_subsample\_KRI.m* was run to subsample time series every six hours. The same script, automatically converted the original files into binary MatLab files similar to the ones found in other MedSVP projects. Finally, (part of) *IB\_KRI\_tirrenoformat2egittoformat.m* was used to create the ‘*dati\_deploy\_mmm\_yyyy.txt*’ ASCII document. Originally, this text file is created by the *XX\_mainkri.m* script which was skipped here.

Final interpolated, filtered and sub-sampled data had been moved into the ‘*Database\_Tirreno/kriged\_for\_web/kri\_egitto\_format*’ folder. For drifters b33253 and b33254 – which had both GPS and Argos systems – only the files present in the ‘*Database\_Tirreno/kri/gps\_argos*’ folder have been used. After this last step, all the ‘*kri*’ files were compatible with our scripts (steps 7 to 12).

The *RG\_plot\_fig\_kri.m* was also modified into the *IB\_plot\_fig\_kri\_CODE\_Tirr.m* so that the created figures (saved in the ‘*plots/kritracks*’ and ‘*plots/kritimeseries*’) were consistent with the type of drifters used: all aspects referring to the drogoue component - specific of the SVP drifters - had to be removed or replaced. This was also done for the script *RG\_crea\_master\_table.m* which was modified and replaced with *IB\_crea\_master\_table\_tirreno.m*.

Steps 7 through 12 (using the appropriate scripts, *IB\_html\_search\_tirreno.m* and *IB\_html\_singoli\_drifter\_tirreno.m*) were then carried out in chronological order.

Figure 13 shows the resulting (interpolated and filtered) trajectories of the drifters deployed in the Tyrrhenian Sea.

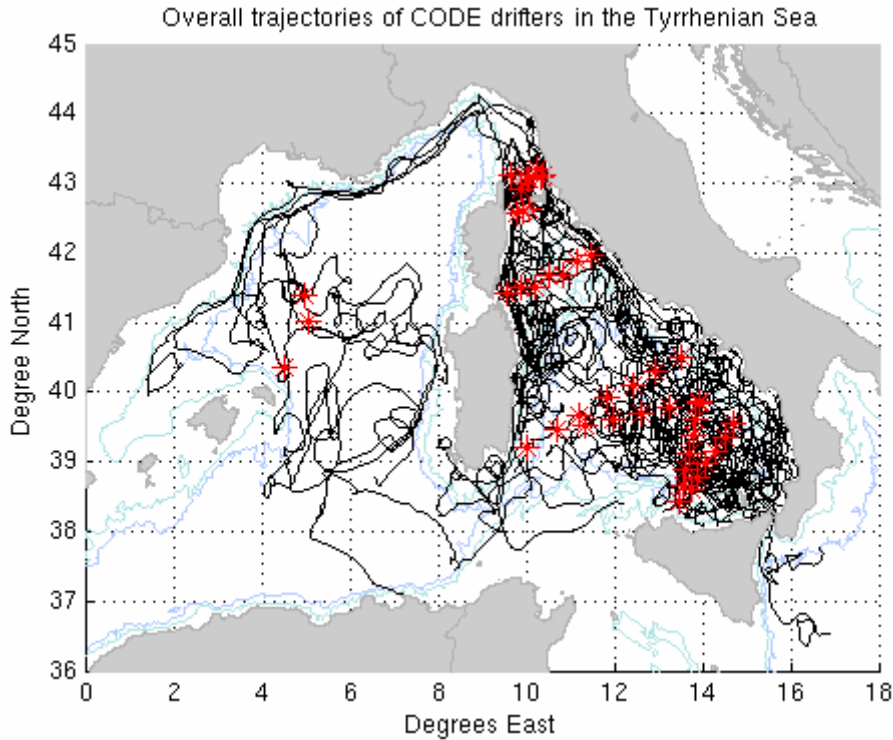


Figure 13. Spaghetti diagram of the drifters deployed in the Tyrrhenian Sea. Red asterisks show the deployment locations. Trajectories are those after interpolation and 36 hour low-pass filtering.

## 4.2. NURC drifters

Eleven CODE drifters were deployed by NURC in the Tyrrhenian Sea. This was done in two separate missions: MREA03 (drifters: 14635, 14636, 14638, 14639) and ASCO02 (drifters: 2461, 6939, 14649, 14654, 14695, 14710, 14711). For each of these drifters (except 14638, 14639, 14695) OGS had only the corresponding *bfiles.dat*. For this reason, contacts were made with NURC and Dr. Pietro Zanasca kindly sent us the data converted into engineering units for each of these drifters.

### 4.2.1. Initial structure

For each project, a single file was given (*mrea02\_drifter.raw* and *asco02.raw*). Each of these contained in sequence all the data recorded within each project. The available data series found for MREA03 had already been edited for position and temperature, while data pertaining to ASCO02 still had to be processed.

Figure 14 shows the structure of the data in the two files (the example is referred to MREA03, but is also valid for ASCO02).

<b>14635</b>	<b>2003</b>	<b>149.208</b>	<b>43.107</b>	<b>10.394</b>	<b>99</b>	<b>9</b>	<b>19.260</b>	<b>99.999</b>
14635	2003	149.240	43.106	10.390	15	1	9.565	10.306
14635	2003	149.310	43.091	10.394	15	3	9.546	10.306
14635	2003	149.384	43.078	10.389	2	3	9.546	10.306
14635	2003	149.785	43.028	10.376	15	3	9.370	10.306
14635	2003	150.024	43.005	10.385	16	3	9.292	10.306
14635	2003	150.093	42.993	10.390	16	2	9.253	10.306

Figure 14. Example of data as can be found in *mrea03\_drifter.raw*. The file, in ASCII format, contains all the data collected within the project. Drifter data are appended in the same file. The first line, in bold, contains drifter deployment information.

Each column, in order, contains the following information:

- Drifter ID number
- Year
- Day of 2003
- Latitude
- Longitude
- Satellite ID number
- Satellite quality
- Temperature (°C)
- Battery level (Volts)

The first line of each section pertaining to a drifter contains deployment information ( e.g. date, latitude and longitude, bold line in Figure 14). This line is easily recognized, as the satellite ID number, class and temperature values are fixed to false readings: 99, 9, 999.99 respectively.

The satellite quality number (the greater, the better accuracy), also indicates the positioning system used: 1-2-3 pertain to Argos, 4 and 5 to the GPS system (only for drifters 2461 and 6939 where positions were combined).

Before any processing script could be run, the format of the available files had to be converted into a structure compatible with the EGITTO files (used as reference), and each file split into drifter specific \*.ed files.

For this reason, two conversion scripts were used:

*IB\_TIRRsac\_EDIfORMAT2egittoEDIfORMAT.m* was run on the *mrea03\_drifter.raw* file. It created the corresponding *bfiles.ed* in the *edi\_mrea03* folder. On the other hand the *IB\_TIRRsac\_RAWformat2egittoRAWformat.m* was run on the *asco02.raw* file. In this case the generated drifter specific files (\*.arg) were saved in the *raw\_asco02* folder, as the data still had to undergo all the editing procedures. Both scripts converted the available Julian dates into the corresponding MatLab serial time with *IB\_julian2datenum.m*.

#### 4.2.2. Editing and interpolation

The automatic and manual editing procedures carried out on the drifters deployed within ASCO02 were very similar to the ones used for the Aegean drifters. Trajectories were split and values corresponding to the stranded status of the drifter were removed with *IB\_TIRRsac\_manual\_edit\_nines.m*. Recordings of drifter 14695 and 14654 were not edited: only one position was available for drifter 14695 and drifter 14654 was always stranded.

Files resulting from temperature and position editing were then copied into the '*edi\_asco02*' folder. All the edited files, were then placed in a single folder, named '*ALL\_nurc\_finaledited*'; these were then interpolated, low-pass filtered and sub-sampled with *IB\_TIRRsac\_mainkri.m*.

Interpolation was done differently according to the mean drifter specific transmission period: data acquired by the two drifters with Argos and GPS receivers were interpolated every 30 minutes while all the rest were interpolated every 2 hours. Subsampling was carried out in both cases every 6 hours. Results of the two kriging procedures are saved in the '*Database\_Tirreno/sac/kri\_30min\_6hr\_subs*' and '*Database\_Tirreno/sac/kri\_2hr\_6hr\_subs*' respectively.

Figure 15 shows the trajectories (interpolated and filtered) of the drifters deployed by NURC.

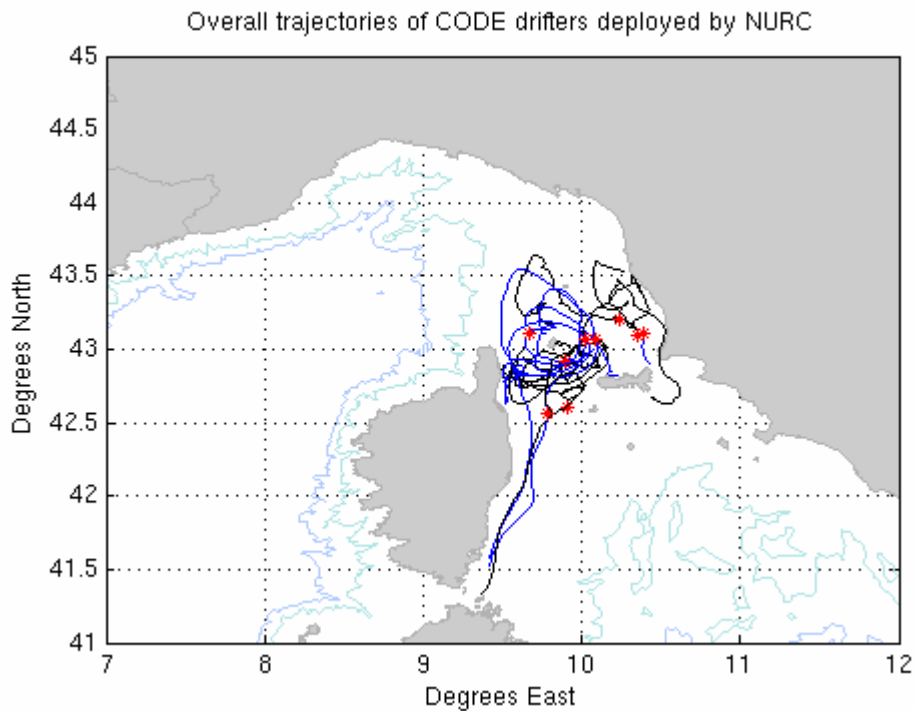


Figure 15. Overall trajectories (interpolated and filtered) of drifters deployed between May 2002 and June 2003. In blue ASCO2 drifters, while in black MREA03 drifters. Red asterisks locate deployment positions.

Once all the data available for the Tyrrhenian sea had been kriged, and placed in the common '*Database\_Tirreno/kriged\_for\_web/kri\_egitto\_format*' folder, the procedures listed in Table 1 (steps 7 to 13) were carried out as explained above and in detail in Borrione et al. (2008).

The following link redirects to the Tyrrhenian Sea e-database.

[http://doga.ogs.trieste.it/sire/drifter/database\\_tirreno/index.html](http://doga.ogs.trieste.it/sire/drifter/database_tirreno/index.html)



## 5. Conclusions

Following Borrione et. al (2008), which described the procedures that are generally carried out in delayed mode for the construction of an e-database, this report explained in detail what was done to prepare an e-database for two projects carried out in the Mediterranean: the one obtained from the CODE drifters deployed in the Tyrrhenian Sea by the OGS, NURC and University of Naples, Parthenope from December 2001 to August 2003, and the one deriving from the SVP drifters deployed in the Aegean Sea from March 2002 to February 2003.

The report explains how the original scripts, that are usually used for such purpose, have been modified accordingly, to cope with the different ways each data series were organized.

The time and work needed to accomplish the initial goal, demonstrated how important it is to have a common way of collecting and processing data. This not only to reduce the effort needed to elaborate the data (spent requesting and receiving further clarifying information or preparing appropriate conversion programs), but also to reduce the information loss that can occur when data are processed with a different methodology.

## 6. References

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