Circulation in the Southeastern Mediterranean Sea (EGITTO-NICOP)

Pierre-Marie Poulain
Istituto Nazionale di Oceanografia e di Geofisica Sperimentale
Borgo Grotta Gigante, 42/c
34010 Sgonico (Trieste), Italy
Phone: +39 040 2140322 Fax: +39 040 2140266 Email: ppoulain@ogs.trieste.it

Award #: N000140610391
http://poseidon.ogs.trieste.it/sire/drifter/egitto_main.html

LONG-TERM GOALS

To improve the understanding of marine environmental evolution, with particular emphasis on the eddy dynamics in marginal seas where the effect of bottom morphology, the forcing by sheared winds and fresh water inflow can be significant factors.

OBJECTIVES

The main objective of the EGITTO-NICOP project is to study the circulation in the Tunisian and Egyptian coastal waters. It is an extension of the EGITTO project to describe the surface circulation eddy and seasonal variability in the southeastern Mediterranean waters using low-cost satellite-tracked drifters in concert with satellite observations of sea surface temperature and near-surface chlorophyll pigment concentration.

APPROACH

With the help of Tunisian and Egyptian colleagues, it is planned to deploy surface drifters in the southern flank of the Strait of Sicily and off the Egyptian coast. All drifters are Global Drifter Program (GDP) drifters drogued with a holey sock to 15-m depth, that is, the same drifters utilized in the EGITTO project.

The management of drifter data and satellite images follows the one of the EGITTO project. In particular:

- The drifter data are downloaded from the Service Argos server everyday. Near-real-time (NRT) data reduction and editing are done and graphical summaries (spaghetti diagrams, time series, etc.) are produced. Every three months, the drifter data are processed (editing, interpolation, filtering) and are archived in a database reachable interactively via internet.

- NOAA AVHRR data are downloaded with the OGS TeraScan receiving station. These satellite data are processed (navigation, calibration and registration) and SST images of the Eastern Mediterranean are produced in near-real time.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 2007	**Annual**	**00-00-2007 to 00-00-2007**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Circulation In The Southeastern Mediterranean Sea (EGITTO-NICOP)	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Istituto Nazionale di Oceanografia e di Geofisica Sperimentale,Borgo Grotta Gigante, 42/c,34010 Sgonico (Trieste), Italy, ,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
code 1 only

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**6**	

Most of the above near-real time products are posted on a dedicated web page. The EGITTO and the EGITTO-NICOP drifter data are combined to:

- compute Eulerian and Lagrangian surface circulation statistics,
- compare the drifter-inferred currents to thermal structures obtained from satellite data. Images and animations with color-coded SST fields overlaid with drifter tracks are produced.

WORK COMPLETED

A total of 20 GDP SVP drifters were ordered and were deployed in the Eastern Mediterannean. With the help of our Tunisian colleagues, deployments from ships-of-opportunity (ferries) were conducted in the Strait of Sicily in January and March 2007 (Fig. 1). Drifter were also deployed in March 2007 in the Cretan Passage with the French R/V Le Suroit. Drifter deployments off the Egyptian coast were not carried out due to political reasons.

The data of these drifters were processed in NRT and posted on the web. They were combined with the EGITTO data to update our general EGITTO/EGITTO-NICOP drifter database in the Eastern Mediterranean (http://doga.ogs.trieste.it/doga/sire/egitto/database_egitto/). Eulerian statistics were computed for the areas of the Strait of Sicily, and adjacent Tunisian shelf, and off the Egyptian coast. Drifter tracks were overlaid over selected SST images to describe the near-surface circulation in the above mentioned regions.

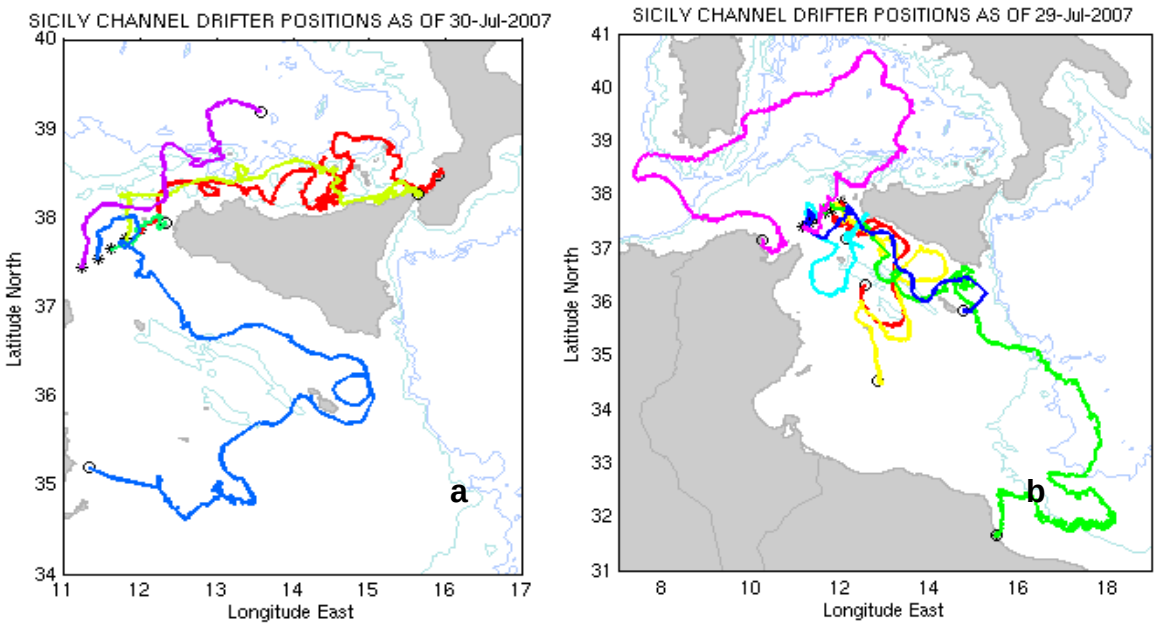

Fig. 1. Trajectories of surface drifters deployed in the Strait of Sicily in January (a) and March (b) 2007. Tracks are shown between the drifter deployments on 27 January or 17 March (star symbols) and their last position at the end of July 2007 (circle symbols).

An EGYPT-EGITTO observational meeting was organized at OGS (Trieste, Italy) on 9-10 October 2006 to discuss the first results of the EGYPT and EGITTO projects and to plan future measurements in the southeastern Mediterranean Sea. The Tunisian and Egyptian colleagues have been invited to participate in this meeting.

RESULTS

The Eulerian statistical results (Fig. 2) computed in the Strait of Sicily and contiguous areas (southern Tyrrhenian, Tunisian shelf, eastern Ionian) reveal the main pathways of the near-surface Atlantic Water (AW) generally proceeding eastward. There is a first branching east of Sicily, into currents entering the Tyrrhenian and the Strait proper. Farther downstream, the flow splits into a branch headed to the south on the Tunisian shelf, another one penetrating zonally into the central Ionian, and a last component veering to the north in the northern Ionian. In the southern Ionian, off the Libyan coast east of 14°E, mean currents are westward, before heading to the north and joining the eastward currents near 35°N. Most of these major pathways have speeds ranging in 10-20 cm/s. The variability around the mean currents, represented with ellipses in Fig. 2, is large downstream of the Strait, south of Sicily, where it can actually be of the same order of magnitude as the mean.

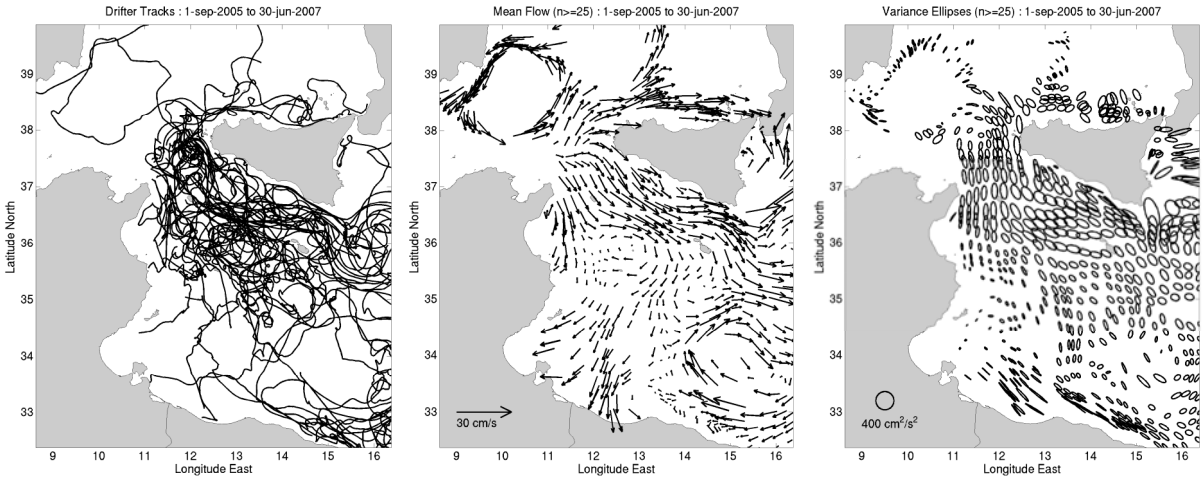

Fig. 2. Low-pass filtered interpolated trajectories (left), mean circulation (middle) and variance ellipses (right) in the Strait of Sicily and adjacent areas. These Eulerian statistics were computed using the EGITTO/EGITTO-NICOP drifter database spanning 5 September 2005 to 30 June 2007. Bins of 0.5° x 0.5° on a grid with mesh size of 0.25° were used.

The surface circulation off Egypt (Fig. 3) is composed of a main eastward flow located approximately on the African continental shelf break. Upon reaching the coast of Israel, this flow turns to the north and intensifies very close to the coast. Major anticyclonic circulation features appear in the open southern Levantine Sea near 29°E (referred to as the Mersa Matruh Eddy) and near 33°E (often called the Shikmona Eddy). Mean speeds in the near-coast currents and in the above-mentioned structures can reach 20 cm/s and the velocity fluctuations (see variance ellipses in the right panels) can be of comparable amplitude.

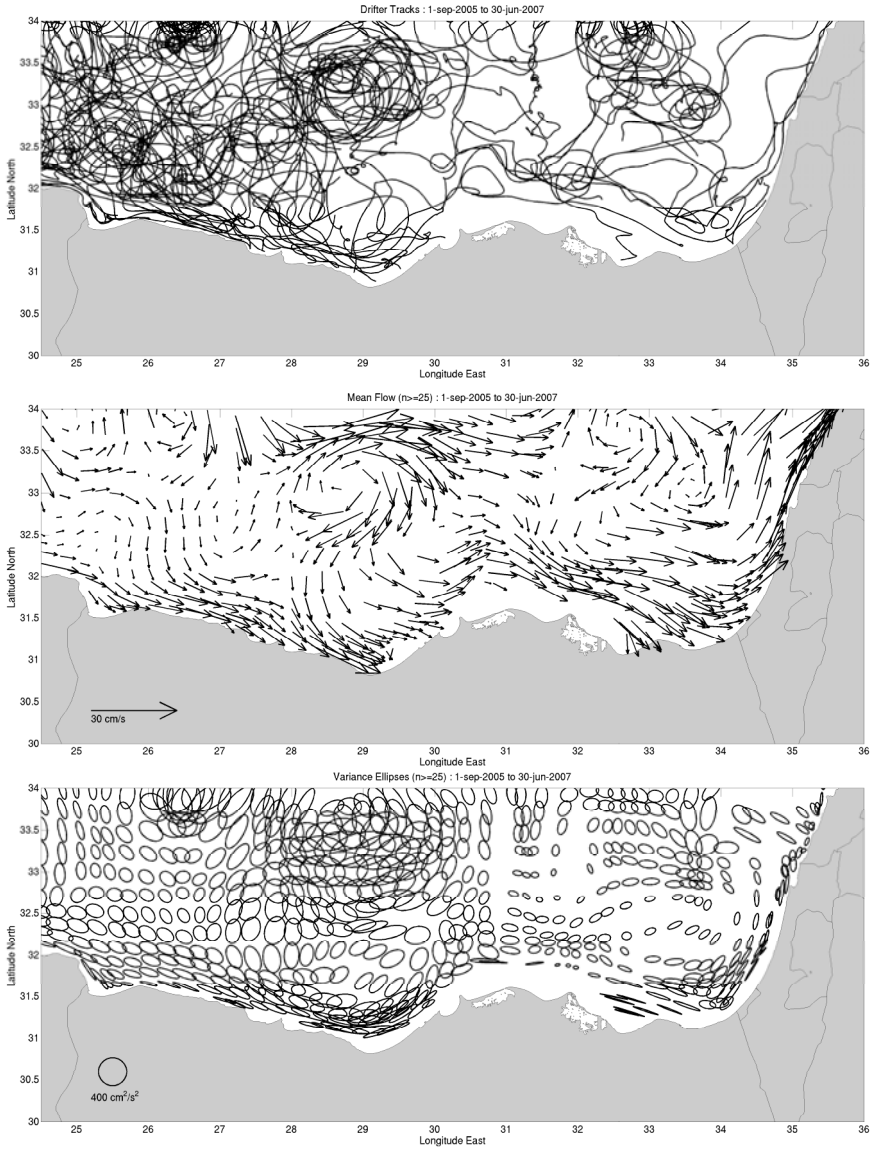

Fig. 3. Same as in Fig. 2 but for area off the Egyptian coast.

An example of SST image for the Strait of Sicily and Tunisian Shelf areas is depicted in Fig. 4 for 16 March 2007. The superimposed 5-day-long drifter trajectory segments indicated reduced transport of the relatively cold AW in the Strait. Farther downstream, the cold waters mix with the warm waters of the southern Ionian, and there is a good agreement between the SST structures and the drifter movements.

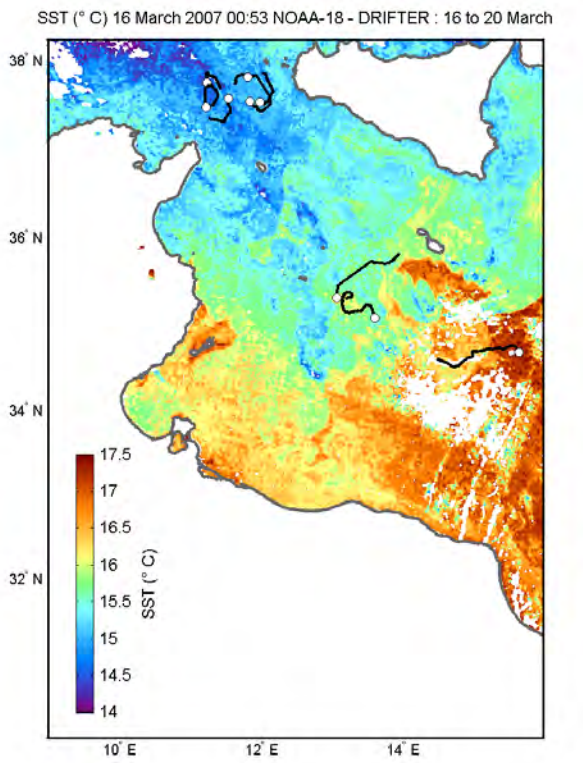

Fig. 4. Color-coded SST image of the Strait of Sicily on 16 March 2007, with superimposed drifter tracks spanning from 16 to 20 March. The white dots represent the drifter locations on 16 March (or 17 March for those just deployed in the Strait).

IMPACT/APPLICATION

The scientific impact of this project is to increase our understanding of the southeastern Mediterranean Sea dynamics and of its major forcing mechanisms. Future application could be the validation of diagnostic numerical models and the assimilation of the drifter data into prognostic numerical models in the framework of operational oceanography projects as part of MOON (Mediterranean Operational Oceanography Network).

RELATED PROJECTS

The EGITTO-NICOP project is strongly related to, and fully integrated in, several other projects sponsored by ONR, the European Commission and national funding agencies. These programs include:

- THE EGITTO project (http://poseidon.ogs.trieste.it/sire/drifter/egitto_main.html).
- The EGYPT program (http://www.ifremer.fr/lobtln/EGYPT), including drifter and profiling floats, hydrographic surveys, moorings, remote sensing.
- The National Tunisian Oceanographic Program, including drifters and hydrographic surveys.
- The MFSTEP (http://www.bo.ingv.it/mfstep) and MOON (http://www.moon-oceanforecasting.eu/) operational oceanography projects, including XBT transects, profiling floats, prognostic numerical models.