

SURFACE CIRCULATION IN THE GULF OF NAPLES DURING THE GELATO 2012 EXPERIMENT

E. Zambianchi^{1*}, P. Poulain², P. Zang³, A. Kalampokis⁴, M. Berta⁵, M. Borghini⁵, B. Buonocore¹, D. Cianelli¹, P. Falco¹, R. Gerin², I. Iermano¹, C. Mantovani⁵, G. Nicolaides⁶, T. Ozhokmen³, S. Sofianos⁷, M. Uttieri¹ and V. Zervakis⁴

¹ DiSAM, Università Parthenope, Napoli, Italy - enrico.zambianchi@uniparthenope.it

² OGS, Trieste, Italy

³ RSMAS, University of Miami, USA

⁴ University of the Aegean, Lesvos, Greece

⁵ ISMAR-CNR, La Spezia, Italy

⁶ TEI, Piraeus, Greece

⁷ IASA, University of Athens, Greece

Abstract

We present selected results of an experiment carried out in the Gulf of Naples (GoN) in the summer of 2012. Different aspects of the surface circulation in the Gulf, a coastal area of the South-Eastern Tyrrhenian Sea were targeted during the experiment. An assessment of the importance of the local wind forcing in the case of summer breeze regime is illustrated, as well as results regarding relative dispersion and the detection of surface transport barriers (Lagrangian Coherent Structures) developing in the area.

Keywords: Currents, Coastal processes, Water transport, Gulf of Napoli, Tyrrhenian Sea

Introduction

In the framework of the MED TOSCA (Tracking Oil Spill and Coastal Awareness network) project, a field experiment was conducted in the summer of 2012 in the Gulf of Naples, organized by DiSAM and ISMAR, with the cooperation of OGS, UAegean, TEI, IASA and RSMAS (see above, authors' list). The goals of the GELaTo (Gulf of Naples Eulerian/Lagrangian TOsca) 2012 experiment carried out between July 27th and August 6th, were: i. The study of the surface circulation in the area, ii. The validation of HF radar data, iii. The assessment of relative dispersion regimes in the area (at submesoscale), iv. The test of novel drifter designs and the intercalibration of different near-surface Lagrangian instruments, v. The identification of connectivity paths within the area, in terms of Lagrangian Coherent Structures.

Materials and methods

The GoN is a very intensively monitored coastal area. In particular, since 2004 a 3-antenna HF radar system has been providing hourly surface current data at 1 km spatial resolution over the entire Gulf area.

Moreover, in the framework of the TOSCA project a circulation model of the GoN was set up, namely a local implementation of the Regional Ocean Modeling System (ROMS) with 300 m horizontal resolution, forced by the SKIRON atmospheric model (0.05°, 1h resolution) and by the Mediterranean ocean Forecasting System (1/16° deg with SLA, SST, T/S profiles assimilation) ocean model at the open boundary conditions.

The GELaTo experiment implied a very intensive drifter deployment, recovery and redeployment activity in the Gulf, as well as continuous HF radar measurement of surface currents. During GELaTo 46 drifters of different designs were deployed in the GoN (divisible into two broad categories, current-following and oil spill-following units), their trajectories resulting in the spaghetti diagram shown in fig. 1.

Radar data were acquired continuously and shared, together with the drifter trajectories, in near-real time among the participants as well as with the MPO Division of the RSMAS - University of Miami, that handled the data processing for Lagrangian Coherent Structure identification on the basis of Finite Time Lyapunov Exponents.

Moreover, during GELaTo the ROMS circulation model was utilized in forecast mode, utilizing the SKIRON forecast data.

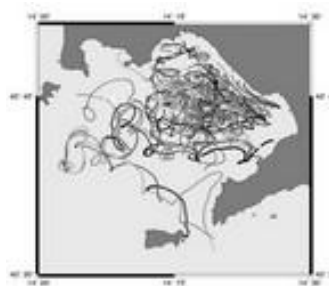


Fig. 1. Trajectories of drifters deployed during the GELaTo 2012 experiment

Results

In this communication we focus on points (i), (iii) and (v) of the main goals of the GELaTo 2012 experiment. Drifter trajectories, HF radar data as well as numerical simulations showed that the typical surface circulation in the GoN is dominated by the oceanic response to the forcing breeze regime. As a consequence, the overall current patterns rotates the entire 360° over the 24 hours, clockwise. Separation of drifter triplets is seen to kick in after a time of the order of 2-3 days. Lagrangian Coherent Structures have proved tricky to sample, mainly for logistical reasons (transmission of HF radar data time delay and ship relocation time necessities); however, a targeted experiment in a specific subarea of the Gulf allowed to point out their presence, which may have important consequences on pollutant retention and water renewal in the GoN.

References

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