HIGH RESOLUTION GLIDER MEASUREMENTS AROUND THE VERCELLI SEAMOUNT (TYRRHENIAN SEA) IN MAY 2009

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Abstract

Physical and bio-chemical characteristics of the upper water column in the vicinity of the Vercelli Seamount were studied from the 23rd to the 30th of May 2009 using a Slocum shallow battery-powered glider. In addition to mesoscale and sub-mesoscale structures crossed by the glider, the near-surface water properties changed abruptly on the 27th of May under the influence of a cold near-surface plume originating from the Strait of Bonifacio and triggered by Mistral winds.

Keywords: Tyrrhenian Se, Surface Waters

Introduction

The “Tyrrhenian Seamounts Ecosystems: an Integrated Study” (TySEc) experiment took place in the Tyrrhenian Sea in late Spring 2009 with the aim of studying the geomorphologic characteristics and the hydrodynamics of the area over and around a seamount. Seamounts are sites of high productivity with coexisting biocenosis in a relative limited space, moreover they represent ‘stopping stations’ in the benthonic dispersion processes. Their importance on the ecology of the marine environment and of their high level of vulnerability to the global climate change represents an interesting subject in different international projects.

As part of the TySEc experiment, the "Trieste-1" glider was operated in an area of roughly 750 km^2 over the Vercelli Seamount (Figure 1) for a period of about 8 days (from the 23rd to the 31st of May). The seamount is located in the northern Tyrrhenian Sea, (41°05' N / 10°53' E), and its summit reaches 55 m below the sea surface. The glider was configured to provide oceanographic data during the ascending phase of the saw-tooth path, every 0.75 km. During the entire campaign 300 profiles between 4 and 180 m depth were acquired, providing temperature, salinity, oxygen, fluorescence, and turbidity data.

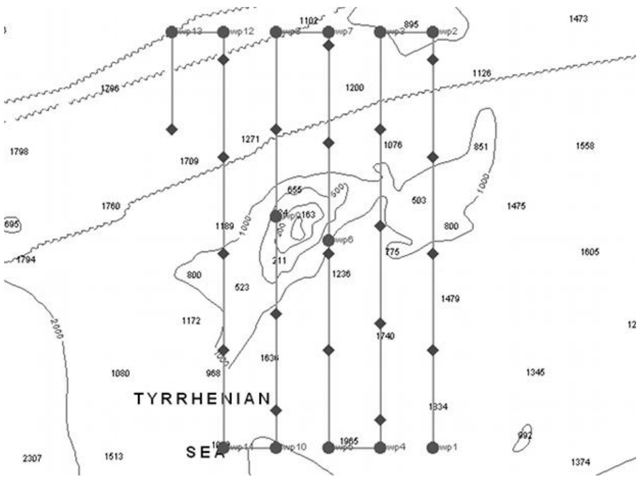

Fig. 1. Details of the glider track overlaid on the bathymetry showing the Vercelli Sea mount.

Results

A shallow (5-10 m deep) mixed-layer with maximum temperature of 23°C was present until the 27th of May, when the temperature at the surface abruptly decreased to 21°C and the mixed layer deepened to over 15 m (Figure 2). Satellite sea surface temperature images and sea level anomaly maps reveal that this change corresponds to the expansion/intrusion of a relatively cold near-surface plume originating from the Strait of Bonifacio (between Corsica and Sardinia). Due to sustained Mistral winds, there is an increase of the double gyre structure associated with the plume. In particular, the southern anticyclonic gyre strengthen on the 27th of May, advecting cold water which reaches the study area.

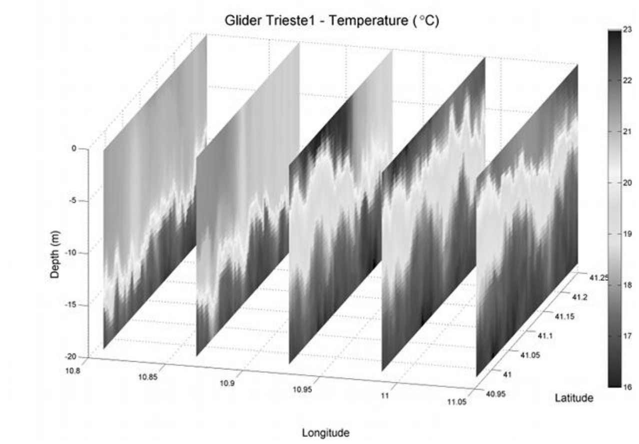

Fig. 2. Contour plot of the temperature (°C) along the glider track between 4 and 20 m.

The salinity which was essentially minimal (around 37.7) near the surface before the 27th of May, increases to 38.0-38.1 in the surface mixed layer, while a layer with minimum salinity develops near the base of the mixed layer (10-20 m). Contemporarily the dissolved oxygen maximum deepens from the surface to the base of the mixed layer (10-20 m). In addition to the above evolution of the water mass properties, high frequency (with periods of 0.5 day or less) variations are ubiquitous and are mostly apparent near the base of the mixed layer. They correspond to mesoscale and sub-mesoscale structures crossed by the glider and to tidal/internal waves. Below the mixed layer, the salinity and oxygen distributions show correlated structures (high salinity corresponding to low oxygen) all the way down to 180 m. A sub-surface maximum in chlorophyll concentration and turbidity is also seen between 60 and 80 m. Apparently the Vercelli Seamount has little effect on the water properties measured by the glider.

The “Trieste-1” glider is involved in the DORII project (Development of Remote Instrumentation Infrastructure) whose objective is the integration of observations and model simulations in the Grid. DORII e-Infrastructure is based on the concept of instrument element, that virtualized an instrument within the Grid. More generally, a computational Grid is a hardware and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities [1].

References

1 - Foster I. and Kesselman C., 1998. The Grid: Blueprint for a New Computing Infrastructure, Edited by Ian Foster and Carl Kesselman, Morgan Kaufmann Publishers,1998, San Francisco,CA, 675 pp.