SURFACE CIRCULATION AND FLUXES INSIDE THE CENTRAL MEDITERRANEAN SEA

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Abstract

A composite data set of hydrographic measurements, SST and current data was used to describe the Atlantic Water circulation in the Central Mediterranean Region during different seasonal periods. While the mean current features were estimated applying to the region an inverse box model, the shorter variability was investigated using the remote sensing SST and currentmeter measurements. A special attention was devoted to understand the role played by the wind field in determining the main features and their variability.

Keywords: Sicily Strait, Sardinia Channel, Inverse box model, surface circulation

Introduction

The Central Mediterranean connects the Ionian basin with two main basins of the Western Mediterranean: the Tyrrhenian and the Algerian Seas. The principal water masses forming the circulation of the Mediterranean Sea are forced to flow through the region, which then become essential for the assessment of water budget of the whole basin. For these reasons, the area has been extensively investigated since the '70s (1; 2; 3). Recently (4) have qualitatively described the general circulation of the area while (5) have provided a quantitative estimates of seasonal water fluxes. This present work is devoted to improve the resolution of the surface mesoscale structures and to explore the main forcing of the region.

Seasonal hydrographic surveys were conducted in the Central Mediterranean between November 1993 to June 2000 (Fig. 1). The data-set includes CTD measurements along several sections, long-term current measurements and several VM-ADCP data. The data-set has been integrated with the ECMWF data at 10 m, used to define the wind stress curl field with a spatial resolution of a half degree. Moreover, several remote sensing SST images have been retrieved during a period including the CTD cruise spanning-time. This was done in order to follow the time evolution of the mesoscale structures pointed out through hydrographic measurements (usually extending over a period of about 20 days).

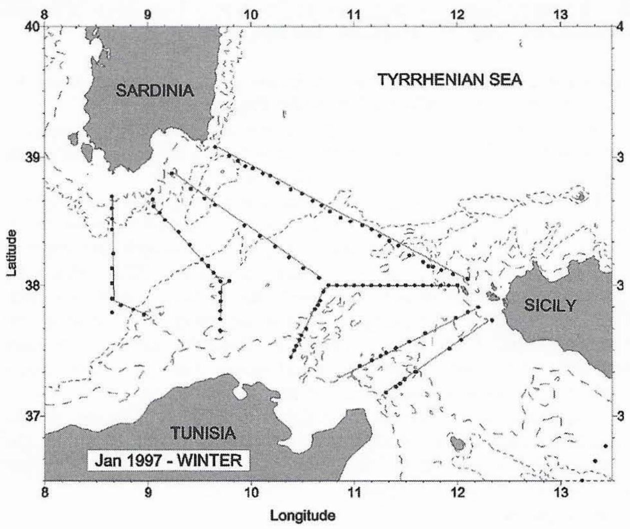

Fig. 1. Measurement sites in the Central Mediterranean Sea during January 1997.

Results

The result of the model is a mean circulation over the region. The reference velocity, obtained as the system solution by SVD inversion method (6), is applied to the initial geostrophic velocity field, to obtain the absolute geostrophic flow. The surface flux patterns shows a main vein of Atlantic Water flowing from the Algerian Basin ranging from 2.24 to 0.97 Sv. The major part enters into the eastern Mediterranean basin. This vein is subject to important mesoscale phenomenon inside the Sicily strait region, where the recirculation may have the same relevance of the mean flow. Similar recirculation also occurs inside the Sardinian Channel, and it was estimated to be about half of that occurring at the sill strait region. The vein entering the Tyrrhenian Sea varies from 0.1 to 1.2 Sv. It recirculates cyclonically into the basin and exits along the Sardinia cost. This outflow varies between 0.38 and 0.82 Sv.

The main structures estimated by the model are in good relation to the remote sensing SST and current-meter data relative to the measurements period. Two relevant features can be observed: a cold and salt cyclonic circulation subsists to the northwestern side of the region, whereas a warmer and fresher anticyclonic structure prevails to the south. The wind stress curl was calculated from ECMWF and related to the circulation and SST fields. The analysis confirms that both structures are wind-driven and may have a significant role in modulating the mean flow through the region.

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