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Distribution and circulation of water masses in the outer region of the Gulf of Cadiz and associated wind-induced variability

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A study on the distribution and circulation of water masses in the Gulf of Cadiz in spring of 2001 and its associated meteorologically forced variability was carried out from the data collected in the GOLFO 2001 survey (divided into three legs: mesoscale 1, macroscale and mesoscale 2). The CTD data were used to perform the geostrophic study of the outer region of the Gulf of Cadiz whereas the ADCP data were used in the continental shelf. Meteorological conditions changed from Westerlies in mesoscale 1 and most macroscale to Easterlies in mesoscale 2. This variability has allowed to study the response of hydrological and hydrodynamics features to the meteorological forcing.

The general surface circulation in the Gulf of Cadiz in spring-summer is anticyclonic with short term variations. Under Westerlies, the currents flow closer to Cape Sta. Maria and under Easterlies they move away from the Cape, probably forced by the coastal countercurrent that flows westwards in the northern area under this regime. Geostrophic computations are referred to 300 meters, which maximizes the inflow to the Strait of Gibraltar.

North Atlantic Central Water (NACW) is the most important water mass in the first thousand meters of the water column. At sigma-t=27, its salinity and temperature are rather steady. Besides this homogeneity, the thermohaline and circulation patterns are rather different in the upper and lower limits. The lower layers of NACW (sigma-t=27,3) are advected by the Mediterranean Water (MW) in the northern part towards the open North Atlantic whereas the upper layers of NACW (sigma-t=26,6) conform the main core of the anticyclonic surface circulation in the Gulf of Cadiz. The inter-

mediate layers of the outer region, main reservoir of NACW (thickness over 300 m), have reduced movement.

The main upwelling areas of the Gulf of Cadiz are Cape St. Vincent and Cape Sta. Maria. Upwelling off Cape St. Vincent is an open sea process linked to the almost permanent upwelling system off the western Portugal coasts during spring-summer. Upwelling in Cape Sta. Maria is a coastal feature that changes quickly under different wind regimes: Westerlies enhance it and Easterlies weaken and even make it dissapear. NACW upwelled in Cape St. Vincent move eastwards following the main flow until about 7,5 W, where part of them are advected towards the south or southeast and form the Cape Sta. Maria filament, with highest thermohaline signature at about 40-50 m.

Surface mixture studies show that changes in the wind regime induce variations in some surface features (upwelling in Cape Sta. Maria, surface signature of the Huelva Front, surface coastal countercurrent,...) in a relatively shallow layer (about 25 meters).