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Canary Islands, Azores, Gibraltar Observations (CANIGO), Volume I: northern Canary Islands basin

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Canary Islands Azores Gibraltar Observations (CANIGO) is an European research project that was carried out as a target study in the European Union's Marine Science and Technology (MAST) III programme from 1996 to 1999. Its general objective was to gain a better understanding of the physics, biogeochemistry and paleoceanography of the eastern subtropical North Atlantic. The study region of CANIGO encompassed the subtropical frontal system of the Azores, the Gibraltar exchange, the northern Canary Islands region and the transition zone of the NW African upwelling margin. CANIGO included scientists of 45 institutions from several European countries (Austria, France, Germany, Italy, Ireland, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom). The disciplines of physics, chemistry, biology and geology were included in a combined observational and modeling program.

The specific goals of CANIGO were: (1) to obtain an improved knowledge of physical processes controlling the North Atlantic subtropical gyre and the related mesoscale circulation through observations and nested circulation models; (2) to study the carbon cycle in the pelagic system in nutrient limited (oligotrophic) and nutrient-rich (productive) waters and to estimate the carbon flow through and from the pelagic system to deep waters; (3) to determine, quantitatively, the influence of coastal upwelling and Saharan dust on the magnitude and composition of particle flux in the Canary region, and to investigate how this influence changed through the last glacial and interglacial period; and (4) to quantify, understand and model the water mass exchange system through the Strait of Gibraltar, the processes of formation, evolution and fate of the Mediterranean Outflow, including the associated submesoscale eddies, and to measure the biogeochemical fluxes (in terms of carbon, nitrogen, trace metals and metalloids) accompanying these water exchanges.

The work program consisted of observations with ships, moored instrumentation, drifters, floats and acoustic tomography, laboratory experiments, the use of satellite data, numerical modeling and the processing and joint analysis of data.

Larger-scale processes in the northern Canary Basin were observed with CTD, ADCP, drifters and floats. XBT measurements on ships of opportunity supplemented these observations. Current-meter moorings were deployed south of the Azores, and along a quasi 29°N transect north of the Canary Islands ranging from north of La Palma to east of Lanzarote / Fuerteventura. The 29°N transect also included the Spanish/German time-series station ESTOC (European Station for Time-series in the Ocean, Canary Islands) 100 km north of Gran Canaria. This volume provide unique observations of the Canary Current, the poleward undercurrent and transport of AAIW, and the biogeochemistry of the region: the seasonal pattern and composition of dust inputs from the Sahara and the multispectral radiometric analysis of this aerosol, the primary productivity along the 29°N transect during a 19-month period using a bio-optical model to SeaWiFS-derived chlorophyll data, the distribution of induced fluorescence of natural waters in the region and the optical characterization of the water masses. A study on the effect of different parameterizations of PAR on primary production and phytoplankton distribution at ESTOC was discussed with respect to the validation of remotely sensed ocean-colour data. The importance of environmental and zooplankton loss factors on the dynamics of the deep chlorophyll maximum in the Canary Islands region was modelled. Particle flux and composition determined with sediment traps along the 29°N transect were exhibit a close coupling with surface water properties but also the far-reaching coastal margin influence in the deep water. Coccolithophorids were identified as major contributors to the carbonate flux along the entire productivity transect. To obtain insights into the climate history of the region, sediments were collected with multi-corers and gravity corers north of the Canary Islands and along the NW African upwelling margin. The distribution of planktonic organisms in the water column and surface sediment was synthesized and used for the climate reconstruction of the region. How well surface sediments mimic upper water-column processes especially with respect to upwelling features along the coast was investigated using geochemical and microfossil evidence. The glacial–interglacial variability of coastal upwelling and associated filaments, particle deposition and trade wind intensity along the NW African margin was reconstructed, illustrating both the climate-related changes in upwelling intensity and effects of lower sea level during glacial times on location and strength of coastal upwelling.

The observations in the Azores frontal and the Gibraltar/Gulf of Cadiz regions are included in Volume 2 of this special issue that extend and complement the observations conducted in the northern Canary Island basin. Both volumes in concert provide an integrated understanding of the oceanography of the Canary-Azores-Gibraltar region.

The CANIGO data are publicly available at the Irish Marine Data Center (mailto: datacentre@marine.ie; http://www.marine.ie/datacentre/projects/CANIGO/).

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