North Atlantic

Coupling between the Canary Current and the upwelling system off northwestern Africa

J. L. Pelegri, Departamento de Fisica, Facultad de Ciencias del Mar, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain, joseluis.pelegri@fisica.ulpgc.es, A. Antoranz, J. Cisneros-Aguirre, C. Gordo, L. Garcia-Weil, D. Grisolia, A. Hernandez-Guerra, I. Lais, A. Marrero

Thursday  N Atlantic  NAt-04ak

Deep ocean studies of the Canary Current suggest the existence of an eastern branch of this current which recirculates southward along the African continental slope and platform. During the last three years the Physical Oceanography Group at the Universidad de Las Palmas de Gran Canaria (Canary Islands, Spain) has undertaken several efforts to corroborate the existence of this branch and to investigate its characteristics, in particular its interaction with the upwelling current system off northwest Africa. These studies include XBT measurements, hydrographic cruises, drifters and modeling. Three XBT lines have been maintained with a quarterly periodicity between the Canary Islands and the southern tip of the Iberian Peninsula, and between the Canary Islands, Madeira and the western part of the Iberian Peninsula. These lines, together with standard T-S algorithms developed for the region, allow us to appreciate the clockwise recirculation pattern of the Canary Current and its seasonal variability, and have confirmed the presence of significant onshore flow between the Straits of Gibraltar and Cape Ghir. Two hydrographic cruises between the Iberian Peninsula and the Canary Islands, with special emphasis on the region of the Cape Ghir filament, have been done to investigate how the eastern branch onshore flow recirculates along the African slope and flows back into the deep ocean. The results show the presence of both vertical and horizontal circulation cells at several levels, and confirm the importance of the filament as a mechanism for intermittently returning eastern branch water into the deep ocean. Preliminary numerical studies point at the importance of an adequate representation of this region by showing the potential influence of different boundary conditions on the circulation in the subtropical northeastern Atlantic Ocean. These studies have been carried out through funding from the Spanish government (project Frentes) and the European Union (project Canigo).
COUPLING BETWEEN THE CANARY CURRENT AND THE UPWELLING SYSTEM OFF NORTHWEST AFRICA


Departamento de Fisica, Facultad de Ciencias, Universidad de Las Palmas de Gran Canaria, Spain
E-mail: jordi@ull.es

During the last three years the Physical Oceanography Group at the Universidad de Las Palmas de Gran Canaria (Canary Islands, Spain) has undertaken several efforts to investigate the existence and variability of the eastern branch of the Canary Current, which recirculates southward along the African continental slope and platform. These efforts include the maintenance of periodic XBT lines, hydrographic cruises, launching of drifters, analysis of historical data and modeling. Here we present some of our results, which confirm the presence of significant recirculation flow between the Strait of Gibraltar and the Canary Islands.

Figure 1: The study area and the approximate XBT section. Typical distance between stations 27 km.

Figure 2: NOAA NCEP-NCAR reanalysis data at the Strait of Gibraltar. The X axis shows time and the Y axis shows depth.

Figure 3: The XBT data (CTD) were obtained at a density of 40 stations in the eastern branch of the Canary Current. The graph shows the horizontal distribution of all 41 XBT and 41 CTD transects.

Figure 4: XBT data were obtained by a ship that travelled along the African coast. The ship was equipped with a hydrographic package.

Figure 5: A hydrographic cruise was done over the region with the purpose of investigating the structure of the Canary Current. The map shows the locations of all 8 XBT and 8 CTD transects.

Figure 6: Temperature and salinity data from the XBT surveys. The data were obtained along the African coast and through the Canary Archipelago, clearly linked to the coastal upwelling jet. The results confirm the ubiquity of this horizontal recirculation cell, and point at the intimate coupling between the interior and coastal ocean basins through this horizontal cell and the vertical upwelling cell. Filaments in the upwelling jet probably act to accommodate the excess inflow, by returning it to the interior ocean. One main conclusion is the very important role played by the coastal upwelling system in controlling a significant fraction of the interior flow. This needs to be taken into consideration for proper modeling of large-scale ocean circulation.

CONCLUSIONS

The analysis of 22 XBT lines and two hydrographic cruises indicates that a significant fraction of the Canary Current recirculates southward along the African coast and through the Canary Archipelago, clearly linked to the coastal upwelling jet. The results confirm the ubiquity of this horizontal recirculation cell, and point at the intimate coupling between the interior and coastal ocean basins through this horizontal cell and the vertical upwelling cell. Filaments in the upwelling jet probably act to accommodate the excess inflow, by returning it to the interior ocean. One main conclusion is the very important role played by the coastal upwelling system in controlling a significant fraction of the interior flow. This needs to be taken into consideration for proper modeling of large-scale ocean circulation.

This work has been funded through project FRENTES (NMB95-0731) of the Spanish government, and project CAN300/MAR01/960060 of the European Union.

Figure 7: The XBT data (CTD) were obtained by a ship that travelled along the African coast. The ship was equipped with a hydrographic package.

Figure 8: The XBT data (CTD) were obtained by a ship that travelled along the African coast. The ship was equipped with a hydrographic package.