SURFACE CURRENTS IN THE MACARONESIAN REGION, THIRTEEN YEARS OF DRIFTING DATA.

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Abstract- More than 500 drifting buoys were deployed during the period of 1998 – 2010 in the Macaronesian region. The study of their trajectories has provided a good knowledge about the surface current system in this area. All this information has been implemented into a model intended to cover marine emergency situations in the Macaronesian archipelagos, such as search and rescue operations and pollutant dispersal. The aim is to develop an Operational System, based in the combination of observations and analyses of oceanographic data with numerical simulation, in order to predict the drifting objects trajectories.

Keywords: drifters, surface current, model, Operational System

INTRODUCTION

This development took place under the Surface Velocity Program (SVP) of the Tropical Ocean Global Atmosphere (TOGA) experiment and the World Ocean Circulation Experiment (WOCE). Initial funding was provided by the US Office of Naval Research, with subsequent support from NOAA and the National Science Foundation. Competing designs were submitted by NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), MIT's Draper Laboratory, and Scripps Institution of Oceanography (SIO).

Currently all the data collected with these buoys are being processed to establish the patterns of subsurface currents, studying their seasonality and variability in the environment of the Macaronesian archipelagos (Canaries, Madeira, Azores and CapeVerde), this took place under the MacSIMAR Projects (Incorporation of the Integrated Meteorological and Oceanographic Monitoring System in the Macaronesia, within the strategy of the integrated European marine/ maritime research). These data can be integrated into predictive models of drifting objects, in order to provide assessment in the possible events of human or material loss due to maritime accidents.

In the eastern Atlantic, the circulatory flow of the subtropical gyres recirculates a considerable amount of waters that enters this eastern basin across the central Atlantic ridge, mostly to the south and, to a lesser extent, to the north of the Azores. The main transport is concentrated in the Azores current and continues towards the east following the zonal currents of the Azores Front, where the anticyclonic flow turns and braches into three currents in the Canary Basin. The firs branch flows very close to the eastern flank of the central Atlantic ridge; the second is located in the central Canary Basin; and the third circulates around Madeira and constitutes the Canary Current.

DRIFTING BUOY

Since the 1970s, many drifting buoys have been deployed as part of a wide range of scientific studies. This drifter consists of a surface buoy and a subsurface drogue (sea anchor), attached by a long, thin tether. The buoy measures temperature and other properties, and has a transmitter to send the data to passing satellites. The drogue dominates the total area of the instrument and is centered at a depth of 15 meters beneath the sea surface. Each drifting buoy can be fitted with a range of sensors to measure the surface temperature of the sea, barometric pressure, salinity, wind speed and direction, etc. The buoy also carries sensors testing for submersion and tension on the tether, to prove that the drogue is still attached. Drifter locations are estimated from Argos, a satellite-based system for collecting, processing and distributing data, which is operated by Collecte Localisation Satellites in Toulouse, France.

The Drifter Data Assembly Centre run by NOAA/AOML is based in Miami, Florida. The mission of the centre is to collect the data, verify their quality, interpolate them at six hours intervals and keep them in the database which can then be consulted online. The database currently contains the data from 13.876 SVP drifting buoys deployed since 1979. The data collected from this array of buoys comes from many countries participating in the Global Drifting program.

RESULTS

The results of the annual surface circulation in the Macaronesian archipelagos obtained from drifting buoys have provided a good knowledge of the surface current system in this area. It also confirms the variability in current direction as an indicator of the tendency for gyres to appear in the current. This information has allowed us to compare the structures observed from satellites with drifting buoys deployed in the area.

An Operational Oceanography System is being implemented, based in the combination of observations and analyses of oceanographic data with numerical simulation, in order to try predicting the drifting object trajectories. It is intended to cover marine emergency situations in the Canaries Archipelago waters, like research and rescue operation. The buoys trajectories are used for the calibration of the results obtained by the models. The development of the model is by means of the hydrodynamic equation and the most probable trajectory is obtained for the initial conditions.

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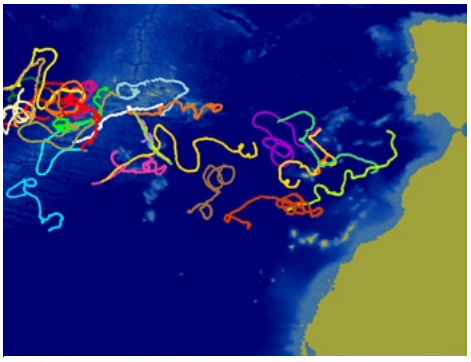

Fig1. The trajectories of a buoy deployed in Azores

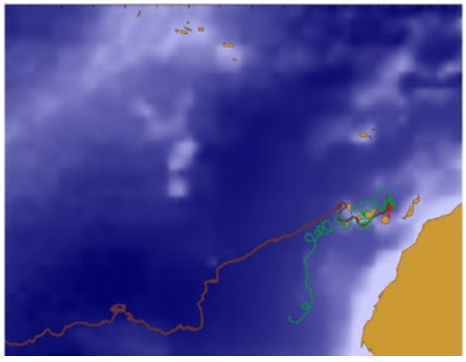

Fig2. The trajectories of a buoy deployed in Canaries