

# THE ALGERIAN GYRES

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## Abstract

In the framework of the MATER programme, currents measurements have been collected in the Algerian basin from July 1997 until August 2002 with eulerian and lagrangian (isobaric and profiling) currentmeters. They have given evidence of two large scale, permanent and barotropic cyclonic circulations that we named the Algerian Gyres. These gyres seemingly follow closed  $f/H$  isolines and are forced by the alongslope circulation.

*Key-words: general circulation, Algerian basin, potential vorticity conservation, lagrangian and eulerian currentmeters.*

## Introduction

The MATER Programme (MTP2/MAST3) involved several field experiments. In this framework, 12 RAFOS (isobaric) floats were deployed in the eastern Algerian basin from July 1997 to July 1998. They were designed to sample the LIW (they were slightly overballasted and drifted at ~600 m instead of 300-400 m). Simultaneously, a 9-mooring array was deployed, equipped with 5 current meters at 100, 350, 1000, 1800 and 2800 m to document the circulation of the surface, intermediate and deep layers. They were complemented in fall 1997 by 17 profiling floats, deployed to sample the TDW (7 floats drifting at ~1200 m) and the WMDW (10 floats drifting at ~2000 m) layers.

## Results

The first dominant pattern showed by the current measurements, was a large scale cyclonic circulation that we call the Eastern Algerian Gyre [1]. This gyre has an elliptical shape and is characterized by a west-east extension of ~250 km and a north-south extension of 150-200 km. Typical velocities are ~5-10 cm/s at the periphery of the gyre and the corresponding rotational period is ~3-4 months. From July 1997 to July 1998, both the eulerian and the lagrangian measurements exhibit roughly the same large scale cyclonic circulation, at least at 350 m and below although such a cyclonic circulation cannot be evidenced in the surface layer due to the large intensity of the mesoscale, we suppose it occurs over the whole depth and can thus be qualified as barotropic.

From December 1999 and during 2.5 years, floats at 1200 and 2000 m showed another unexpected large scale cyclonic circulation located west of the Eastern Algerian Gyre (Fig. 1). This gyre, called the Western Algerian Gyre, has an elliptical shape extending over ~300 km from west to east and over ~150 km from north to south. Typical velocities associated with this gyre are ~5 cm/s at the periphery and the rotational period is ~4-5 months.

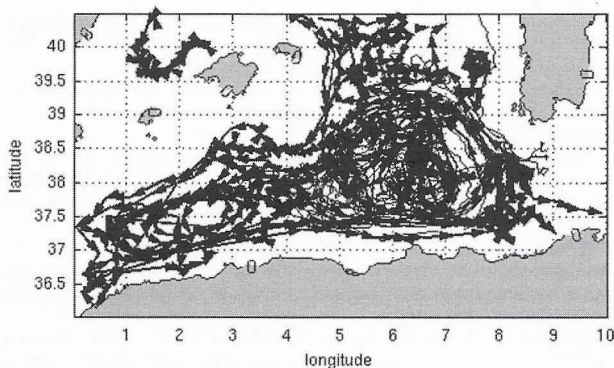


Fig. 1 Trajectories of floats from July 1997 to August 2002.

$f/H$  isolines (combined effects of topography and planetary vorticity for barotropic motions) are closed in the whole basin (Fig. 2) in the eastern and western parts respectively. These contours correspond pretty well to both gyres.

First, this may confirm that the Eastern Algerian gyre is barotropic too and that both gyres are dynamically similar. The important role of

topography is also confirmed by [2] since these general circulation patterns are better represented in numerical models with high resolution and the use of "partial cells" taking into account the bottom topography in a better way.

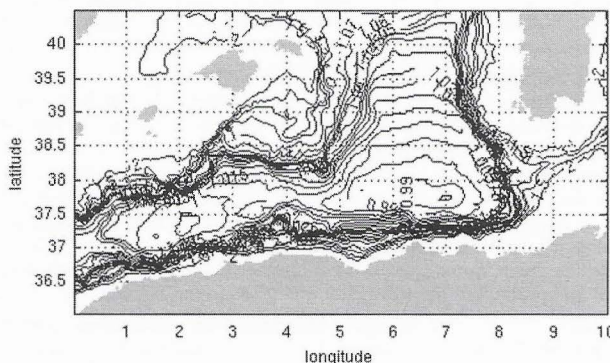


Fig. 2 contours of potential vorticity  $f/H$  normalized by  $f$  taken at  $37^{\circ}45$  N and  $H = 2800$  m.

## Conclusion

These barotropic gyres, which correspond to a mean recirculation of ~4 Sv each, reveal new aspects of the general circulation of the western Mediterranean Sea.

They might be mainly forced, through diffusion/advection processes, by the boundary currents [3] which flow cyclonically along the continental slope.

## References

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