(Sub-)Mesoscale in North-Western Mediterranean Sea : Observations and Modelling

AUTHORS

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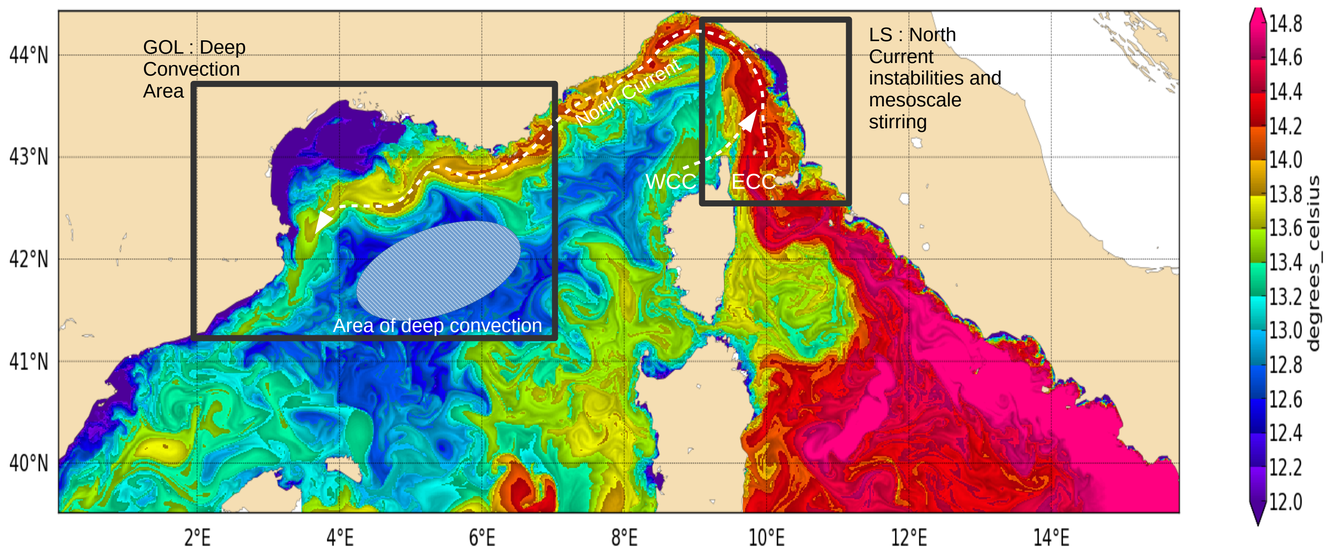
INTRODUCTION

The Northern Current (NC) is a branch of the general North-Western Mediterranean cyclonic circulation extending from the Ligurian to the Catalan Sea. In winter and early spring, **instabilities of this slope current are intense** and generate eddies, meanders and filaments.

The mesoscale activity is also enhanced just after a **deep convection event** during winter in the Gulf of Lions. The study of mesoscale structures is thus crucial, because of their physical and biogeochemical impact on ecosystems.

High resolution modelling has been performed using two on-line zooming facilities - AGRIF : Gulf of Lion (GOL) and Ligurian Sea (LS) of 400m resolution - imbedded in a regional model of the NW Mediterranean Sea of 1200 m resolution (figure a)

Figure (a) : Geographical situation , winter sea surface temperature on modelled area (resolution 1200m).
Black domains describe the two way zoom areas (resolution 400m)



Observations and Modelling of an eddy in Ligurian Sea

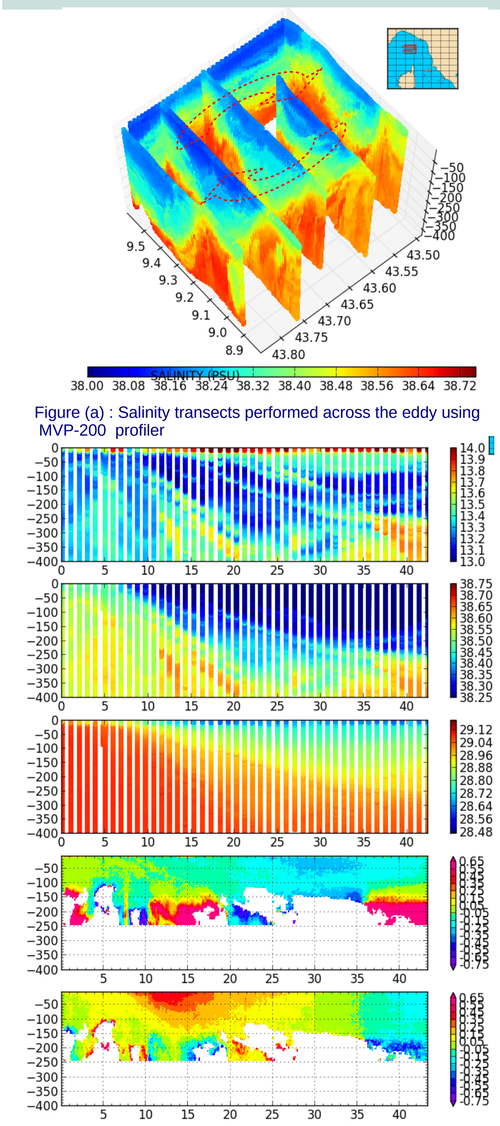


Figure (a) : Salinity transects performed across the eddy using MVP-200 profiler

Figure (b) : Observed potential temperature, salinity, density, zonal and meridional current Recorded during IMEDIA cruise along a transect across the eddy

During the IMEDIA cruise (March 2012), an eddy was detected in remote sensing data (SST and Chla). It has been intensively investigated using the Moving Vessel profiler and hull mounted ADCP. Horizontal resolution is about 0.5 nautical miles. 6 transects has been performed (fig. a).

This area is an outflow area. The East Corsica Current (ECC : warmer and saltier) meets the West Corsica Current (WCC : colder and fresher) in the Ligurian Sea (LS).

Potential temperature and salinity transects in the eddy exhibit **fine layering, vertically compensated in density,** suggesting a passive tracer 'like' behaviours of this fines scales anomalies (fig.b)

High resolution (dx = 400m) numerical modelling of this area is able to reproduce the meandering of the slope density current in the Ligurian Sea (fig. c). Cross section A-B reveals the fresh and cold core of the eddy and an **"onion peel" like structure** in salinity and temperature. The potential density profile is undisturbed.

An horizontal cross section of temperature (fig.d) exhibits the role played by meso-scale eddies through stirring in the mixing of both WCC and ECC.

Figure (c) : Modelled eddy Salinity, temperature density cross-section A-B
Sea surface temperature.

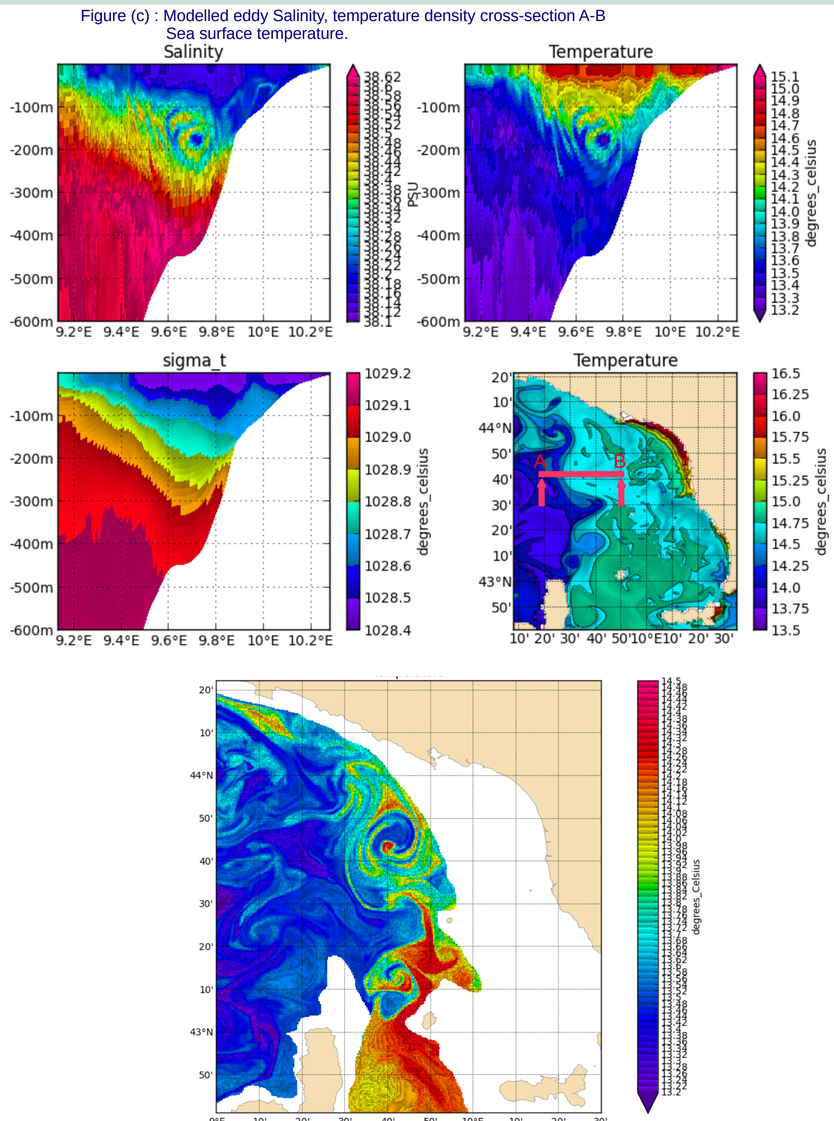


Figure (d) : Modelled potential temperature at 200m deep

High Resolution Modeling of Deep Convection

Figure (a) :Hovmoller of modelled variable at "Lion buoy" : 42°N;5°E from February to March 2013

Figure (b) : Relative vorticity at depth 400m 2 days after strong convection event (Feb 26st)

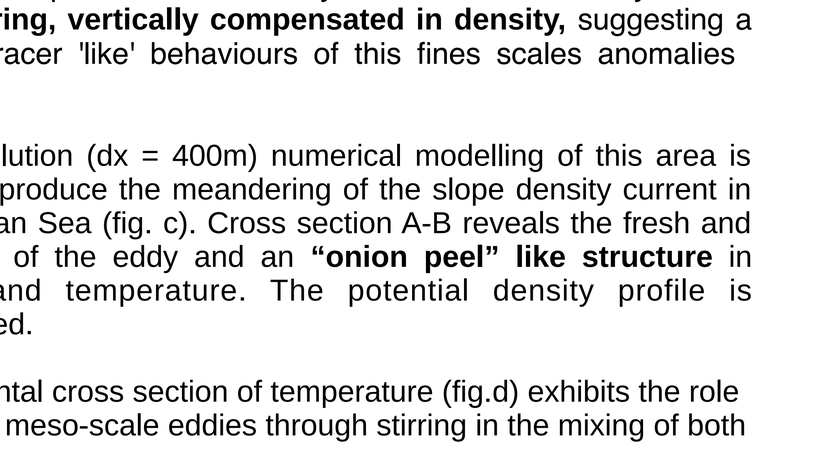


Figure (c) : Vertical velocity (m/s) at depth 400m 2 days after strong convection event (Feb 26st)

A numerical modelling of a period of strong deep convection (February-March 2013 ; HYMEX-SOP2) has been performed using a regional model (Mars3d)

- Even in hydrostastic modelling assumption, the convection events are simulated by both vertical mixing and vertical velocities (fig. a)
- Few days after those strong events of deep convection, the concerned area is characterized by small intense vortices (fig. b)
- An important vertical motion persists after the convection and contributes to the horizontal extension of the mixed patch (fig. c) - 0.01m/s corresponds to 864 m/day -

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