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Observation of Mesoscale Instabilities of the Northern Current in the North Western Mediterranean Sea : a combined study using Gliders, Surface Drifters, Moving Vessel Profiler and Vessel Data in the Ligurian

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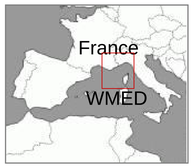
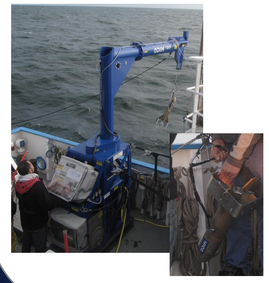
The Northern Current (NC) is a branch of the general North-Western Mediterranean cyclonic circulation extending from the Ligurian to the Catalan Sea (Millot, 1991). In winter and early spring, instabilities of this slope current are intense and can generate eddies, meanders and filaments. These mesoscale structures have a physical and biogeochemical impact on coastal ecosystems. They play a role in water, chemicals and nutrients transport, vertical mixing and possible trapping of biological materials. The IMEDIA cruise was dedicated to study the mesoscale instabilities of the Northern Current using an innovative set of platforms.

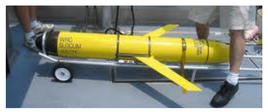
Description of the IMEDIA 2012 cruise



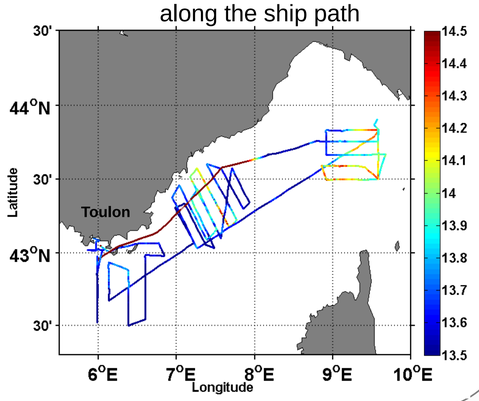


The IMEDIA cruise took place onboard the RV Tethys2 (11-22 March 2012).
A set of physical sensors/plateforms was used including:

- Ship's hull-mounted ADCP and TSG
- Moving Vessel Profiler equipped with a CTD: 710 profiles on 16 sections (0-400m depth)
- Drifting buoys (50m depth)
- Glider equipped with a CTD (0-600m depth) along a radial Nice-Toulon

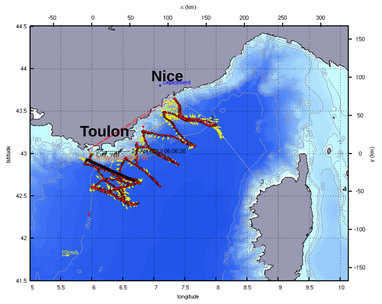


Near surface TSG temperature (°C) along the ship path

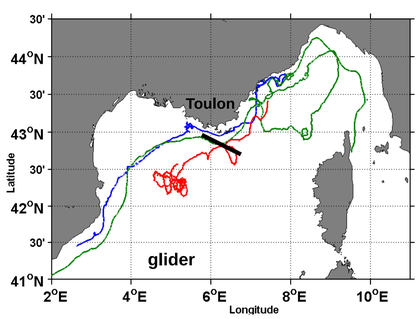


Mesoscale structures of the Northern Current off the French coast

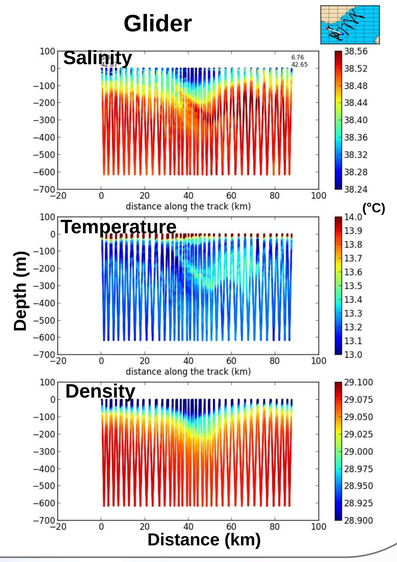
Glider deployment area



Drifting buoys trajectory



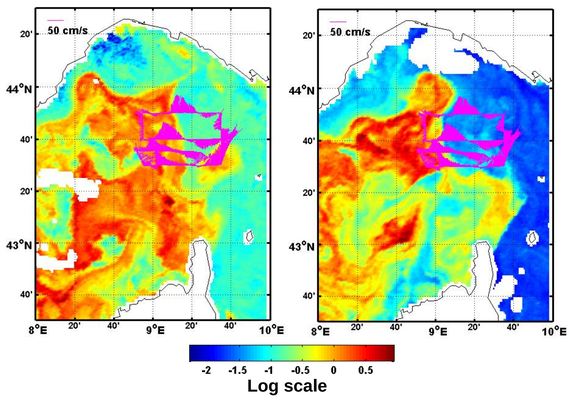
Glider



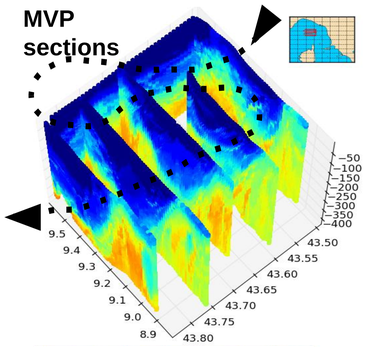
In standard condition, the Northern Current flows along the coastline.
During the IMEDIA cruise, a secondary path of the Northern Current identified using drifting buoys was followed by the glider as inferred by the temperature, salinity and density plots.

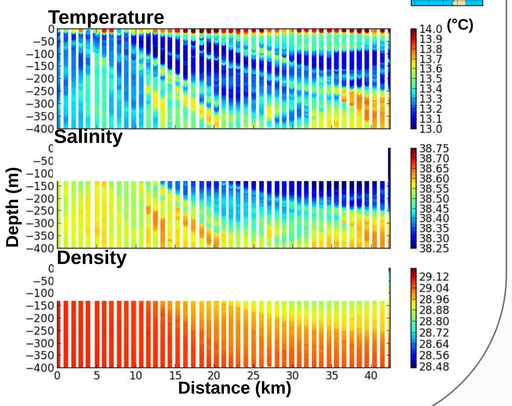
Study of a meander north of Corsica

Surface MERIS Chl-a (µg/L) + ADCP currents (22.5m)



MVP sections





- Anticyclonic meander associated with Northern Current waters: low salinity, low nutrient, high surface temperature
- Layering in temperature and salinity, no signature on the density
  - => submesoscale transport
  - => thermohaline submesoscale intrusions induced by mesoscale turbulence?

Conclusions and future work

The Northern Current flowing in the North Western Mediterranean Sea is strongly constrained by mesoscale and submesoscale processes. Recent observation methods enable to better explore those processes like meandering or submesoscale themohaline intrusions.
However, the complex driving mechanisms remain to be explored. The next step of this work is the use of both quasi-geostrophic models (simplified approach) and 3D oceanic primitive equations models (realistic approach).