

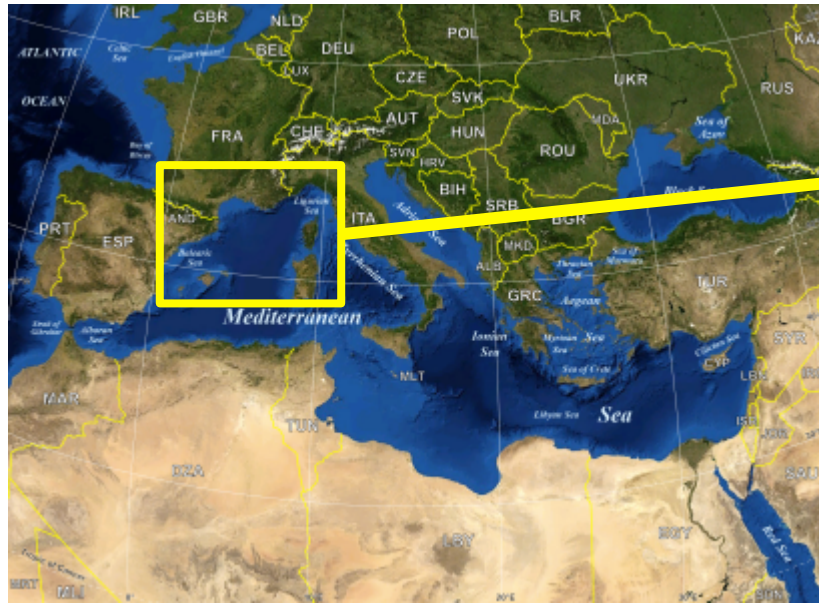


Aspects of the variability of the Northern Current (NW Mediterranean Sea) observed by satellite altimetry - complementarity with a high resolution model

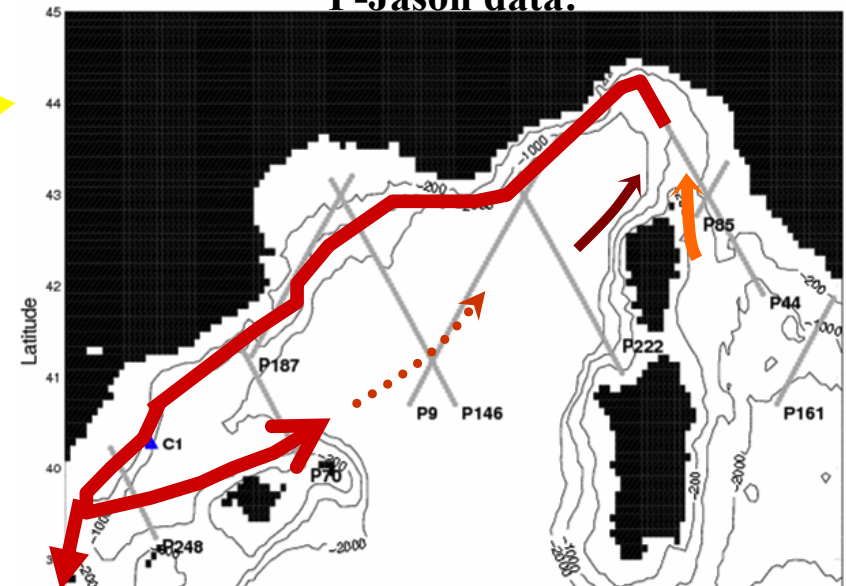
**F. Birol, C. Estournel, M. Hermann, F. Niño, P. Marsaleix,
E. Mignon Le Vaillant, B. Thirion & N. Fuller**

Objectives :

- Document and understand the spatio-temporal structure of the coastal circulation
 - Seasonal & interannual variations
- Forcings and impacts at regional scale



NC schematic view & Distribution of P-Jason data:



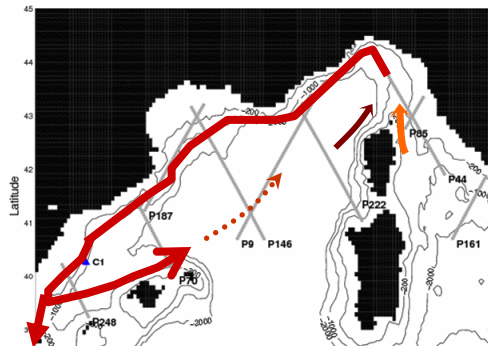
Northern Current (in-situ data, modelling and SST fields):

- Permanent feature of the circulation - width < 50 km
- Marked density front
- Seasonal variability: **Intensification in winter** / **Decrease in summer**

But ... what can we observe and learn with the long time series of altimetry data?

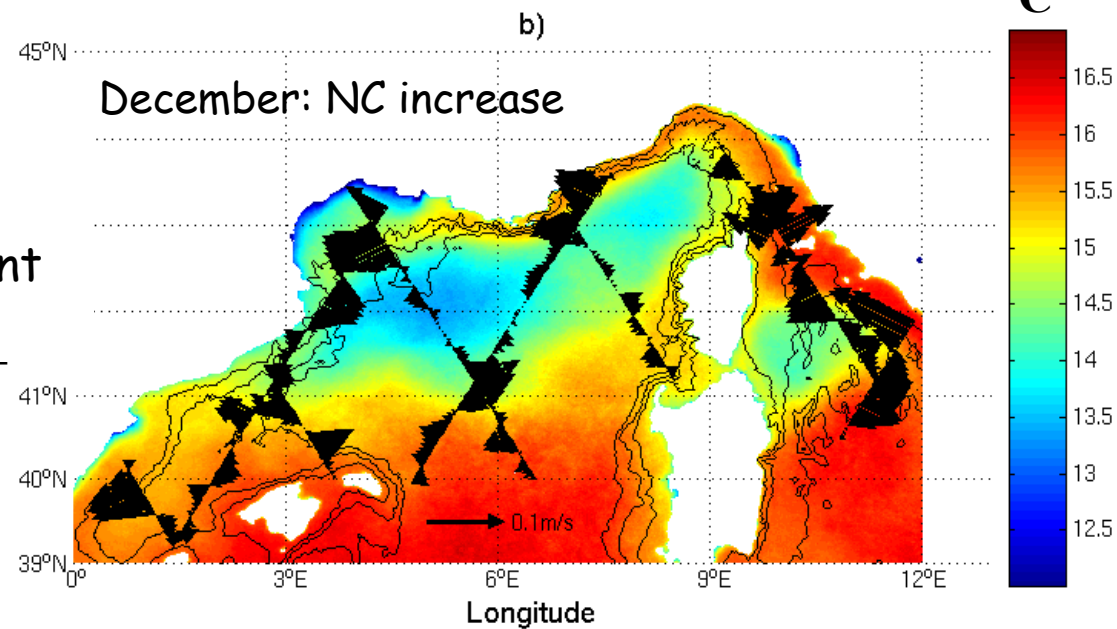
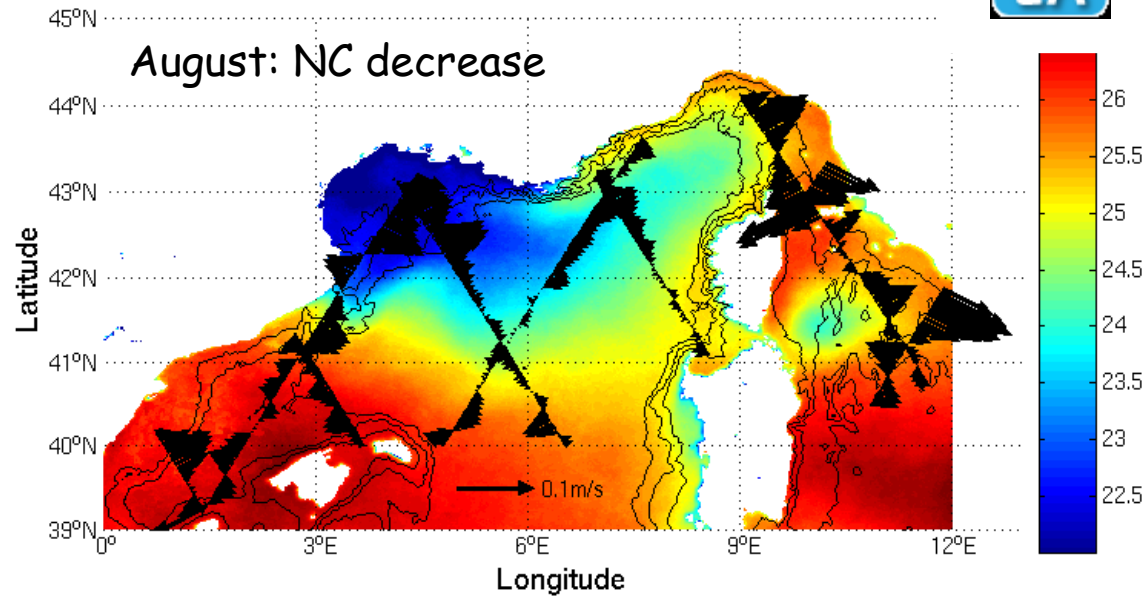
Monthly climatology of:
 - SST (AVHRR)
 - Geostrophic velocity anomalies from 15 years of T/P and Jason-1 data (X-TRACK 1-Hz SLA)

NC circulation

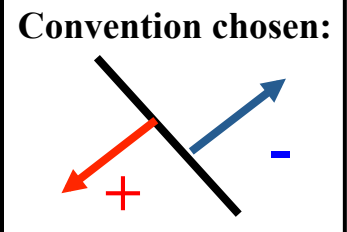
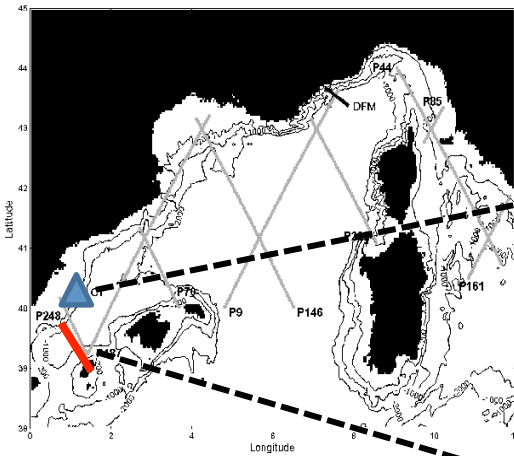


- Warmer waters advected along the shelf
- Seasonal variability in agreement with past studies

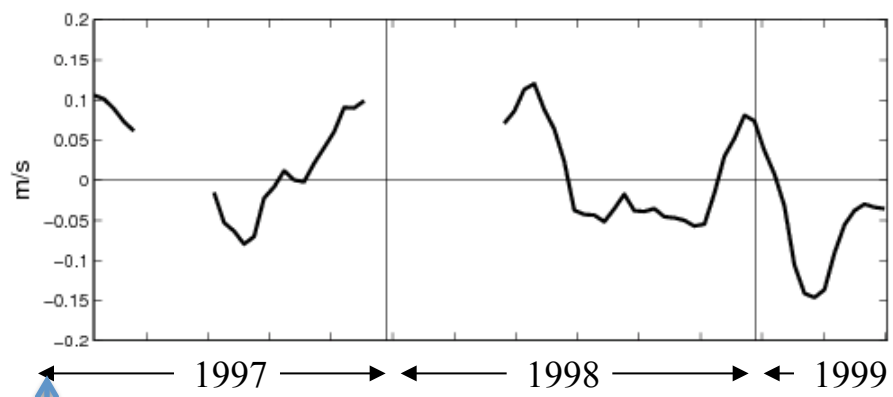
From Birol et al., 2010



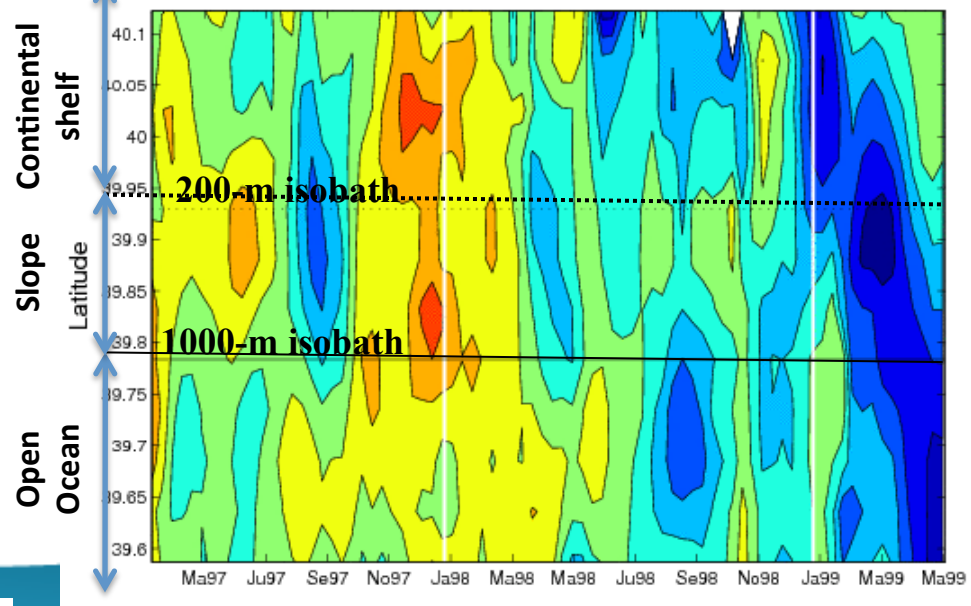
Altimeter-derived velocity anomalies - Comparison to current meter data



→ Strong interannual variability

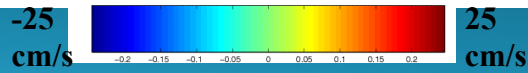


In situ current anomaly - alongshore component



Altimetry - cross-track current anomaly
X-Track
1 Hz data

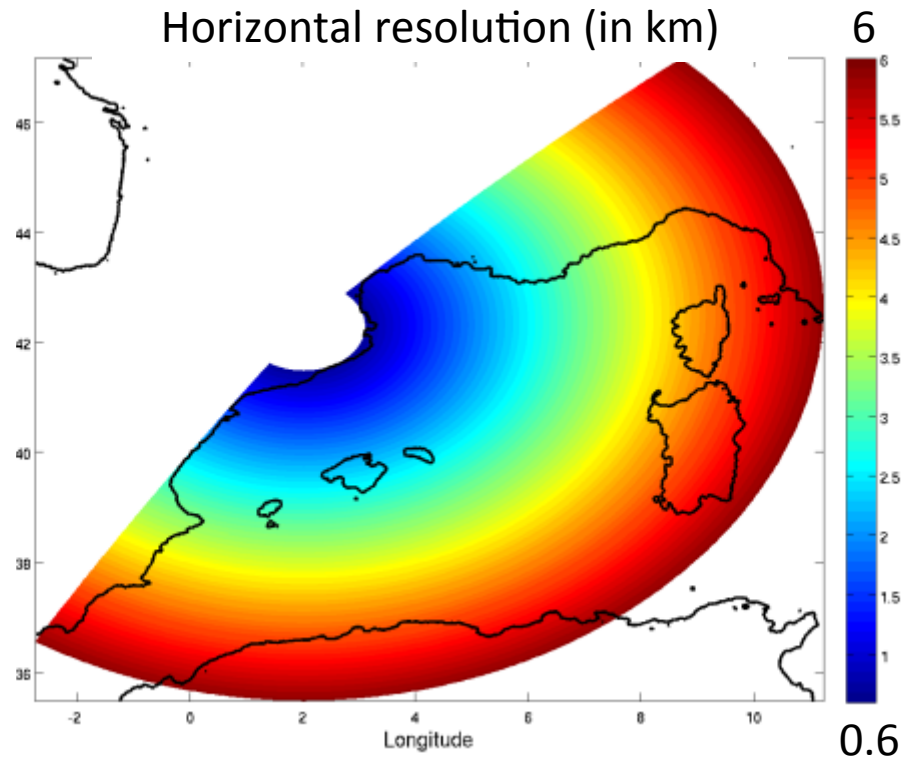
From Birol et al., 2010



3D ocean circulation model continuously developed by the SIROCCO system team (CNRS & Toulouse University).

Marsaleix et al., 2008, 2009, 2010, 2011, 2012

- Physical frame: Boussinesq hydrostatic, free surface
- Vertical grid: sigma coordinate system
- Horizontal Grid: curvilinear, from 0.6 km to 6 km
- Open boundary conditions: MERCATOR
- Run from the 1st January 1991 to the end of 2011



Methodology:

SYMPHONIE 3D ocean model,
ECMWF forcings, run from
1991 to 2011

Interpretation

T/P and Jason-1/2 1Hz
alongtrack SLA, 1993 to 2011

Regional model

→ 3D daily fields over a
long time period
But... realism?

Altimetry

→ Observations
But... alongtrack track and
sea level anomalies only

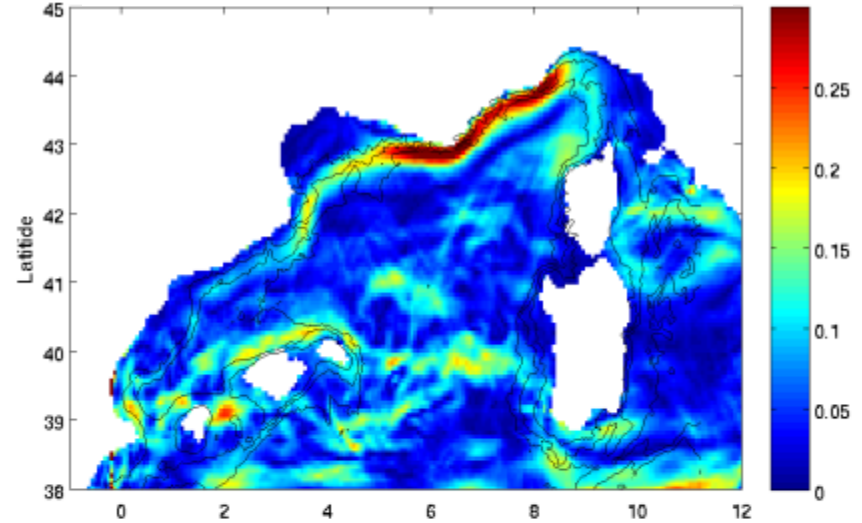
Validation

→ Geostrophic velocity anomalies derived from T/P, J1&2 alongtrack SLA
and from 2D model SLA over the 1993-2011 common period

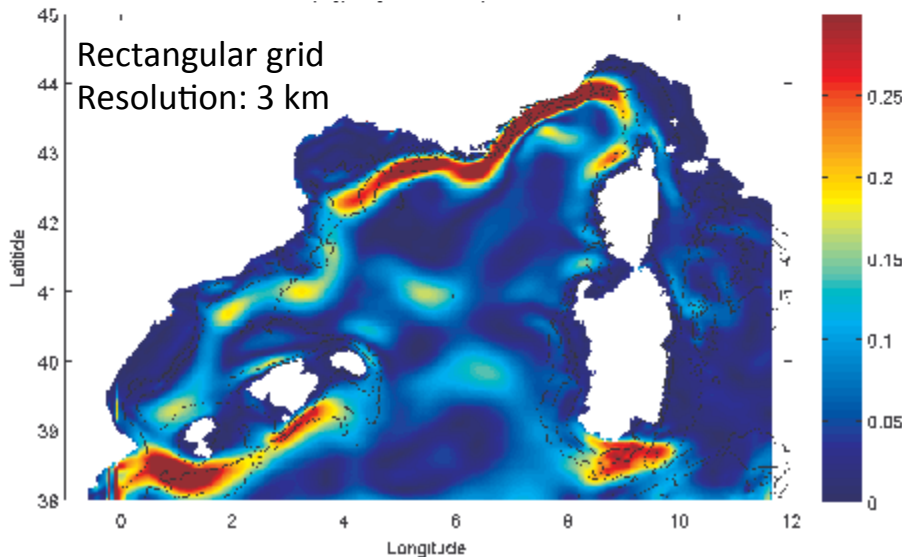
Mean surface geostrophic current amplitude (in m/s)

Model validation:
=> significant improvement

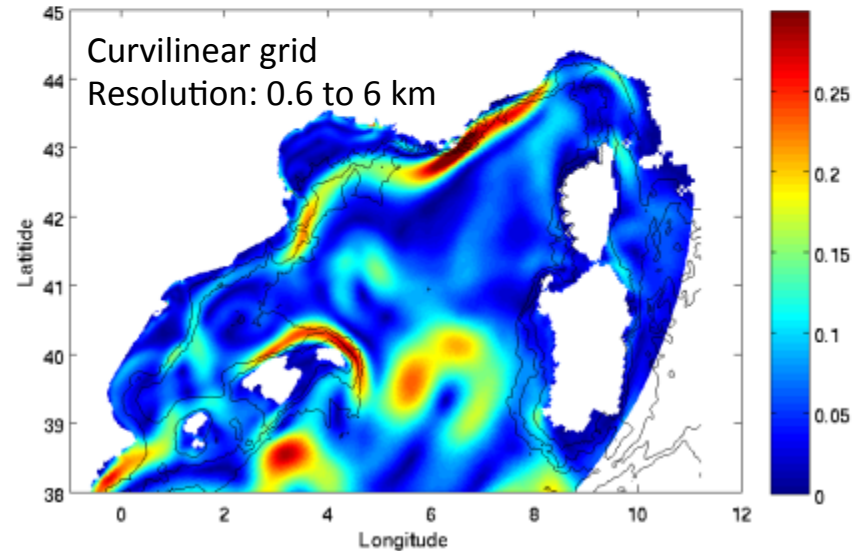
Observations (MDT Rio 2014)



Symphonie (regional config in 2011)



Symphonie (regional config in 2014)



Monthly climatology
1993 - 2011

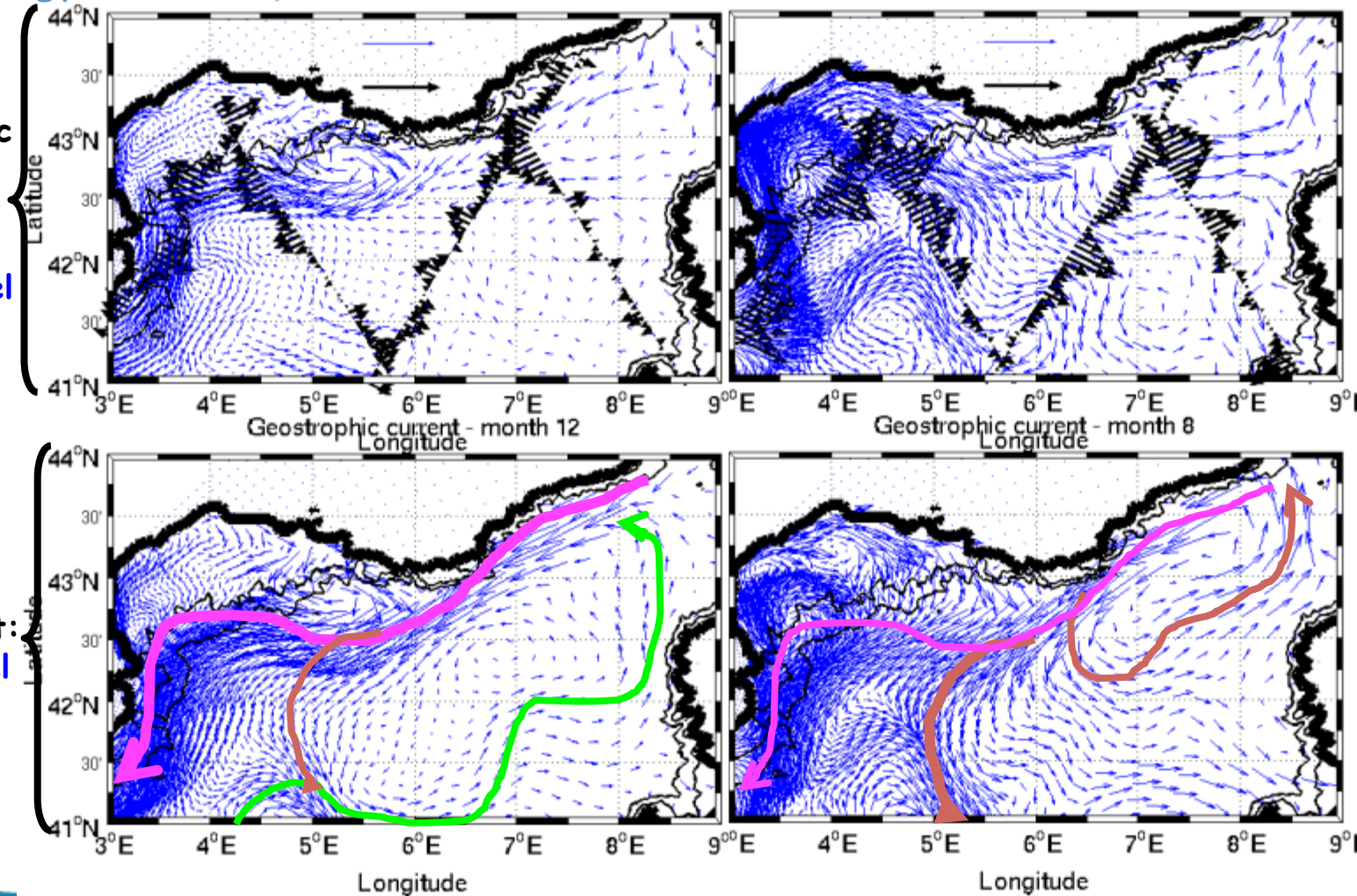
Surface geostrophic current anomalies:
→ Altimetry
(T/P + J1 + J2)
→ **Symphonie model**



Absolute surface geostrophic current:
→ **Symphonie model**

December

August



→ Understand information provided by altimetry in terms of 2D, absolute circulation

Monthly climatology
1993 - 2011

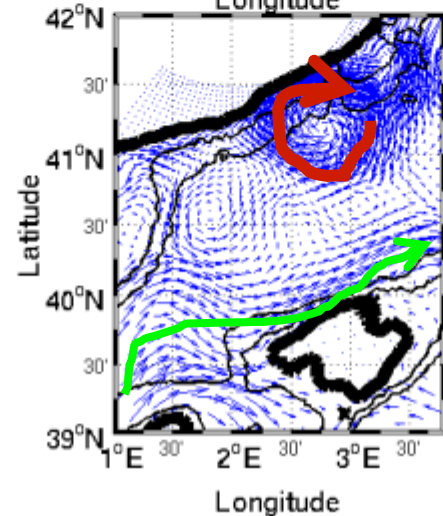
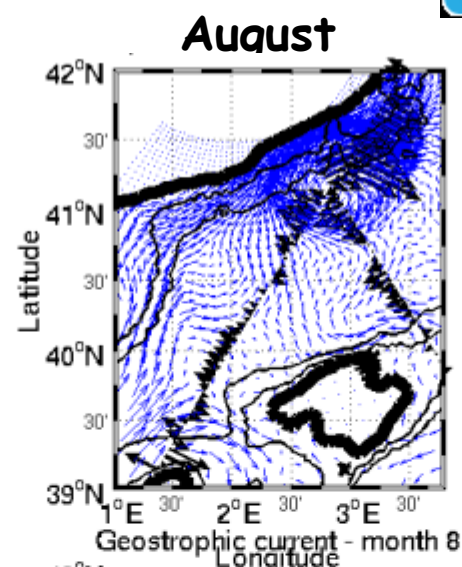
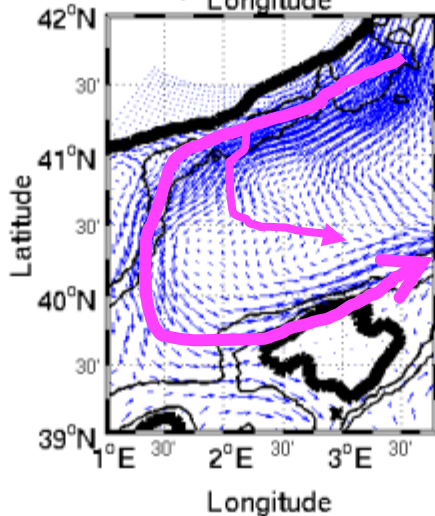
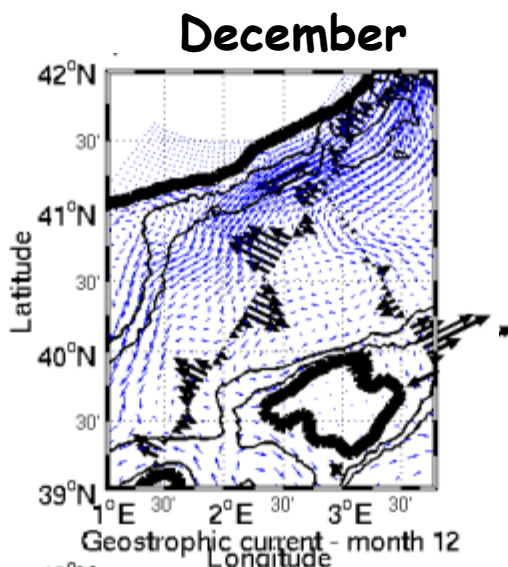
Surface geostrophic current anomalies:

- Altimetry (T/P + J1 + J2)
- **Symphonie model**



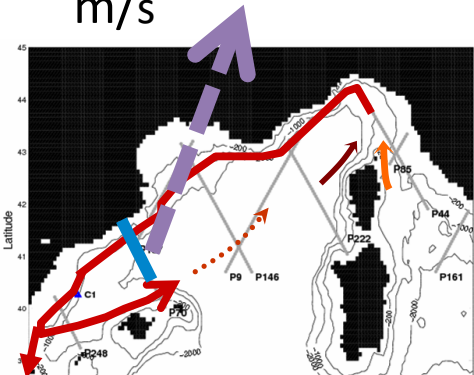
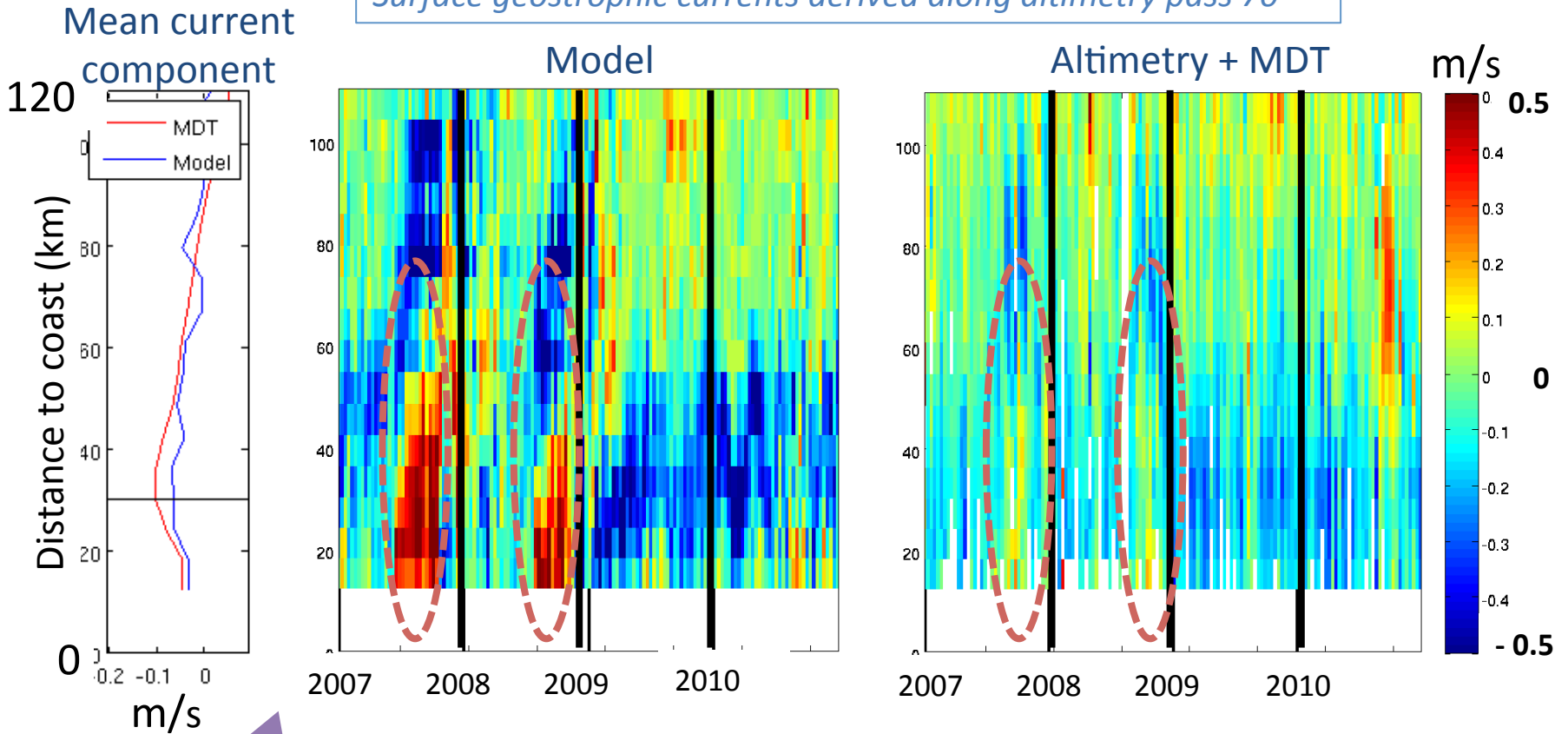
Absolute surface geostrophic current:

- **Symphonie model**



→ Understand information provided by altimetry in terms of 2D, absolute circulation

Surface geostrophic currents derived along altimetry pass 70

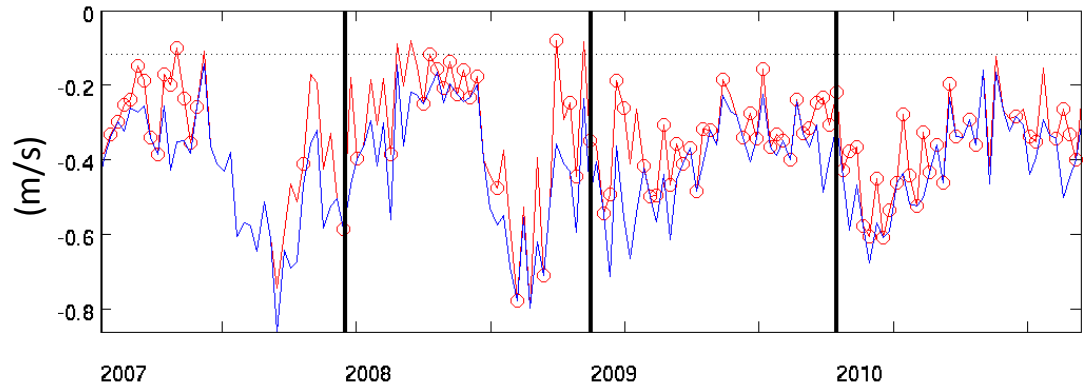


→ The coastal «catalan eddy» is observed by altimetry

Comparison between model and altimetry

NC characteristics observed in the model along pass 70 (2007- 2010)

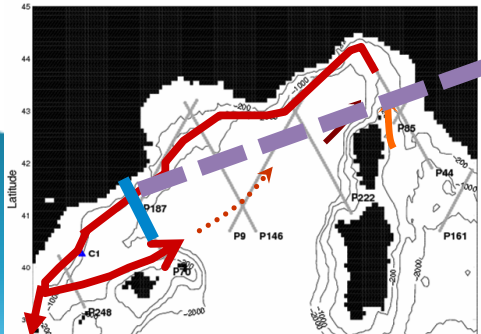
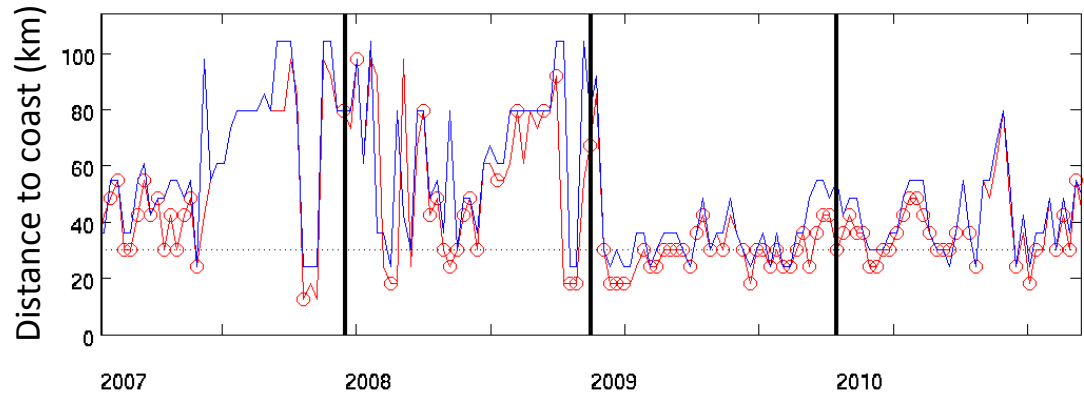
Northern Current core amplitude



NC core detection:

- Method 1 (classical)
- Method 2 (experimental)

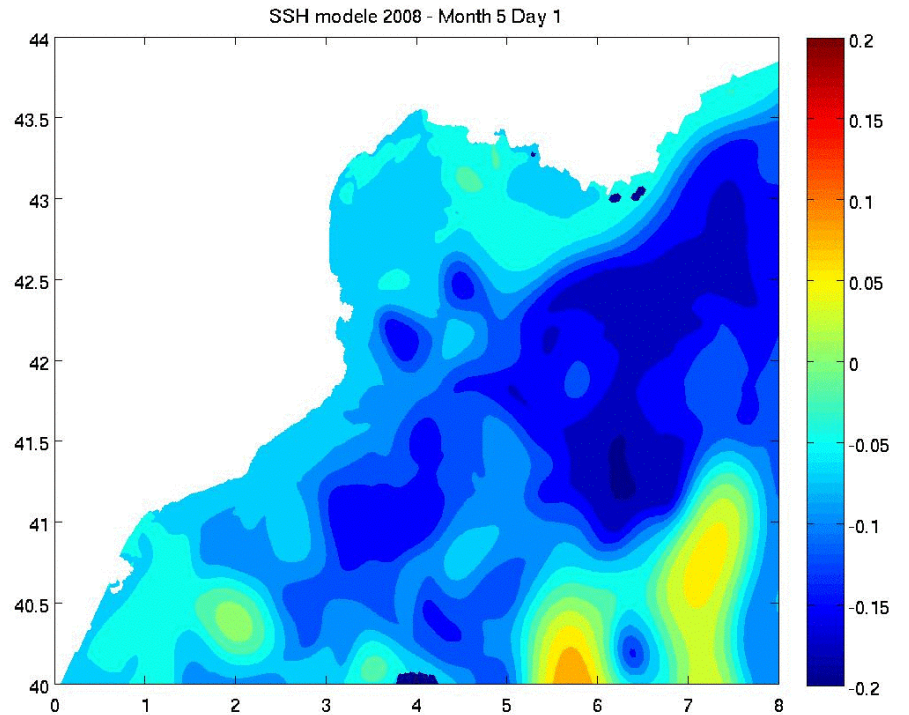
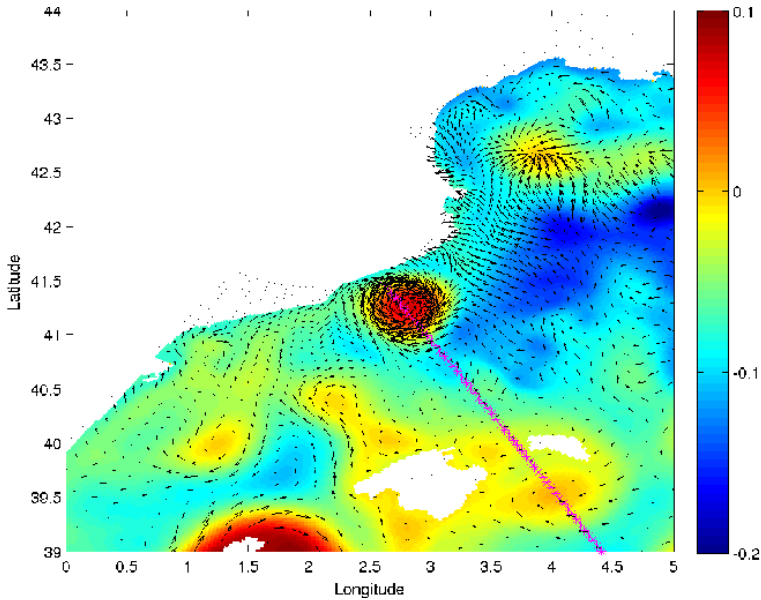
Northern Current core position



→ This eddy induces strong interannual variability in the coastal circulation

Catalan eddy: origin and life

*Model SSH (meters) and surface currents
7 August 2008*



→ Impact at regional scale?



Summary & Perspectives

- ✓ Strong complementarity between altimetry & high-resolution model for coastal studies
 - altimetry significantly helps to improve and validate regional ocean circulation models, even at coastal scales.
 - ocean models allow to understand the information captured in altimetry data.
- ✓ A coastal-resolution, regional model of the NW Mediterranean Sea has been developed to study the spatio-temporal structure of the coastal ocean circulation, the origin of its variability and the impact at regional scale.
 - it is mature enough to be used for other studies: contribution of the new/future altimeter missions for coastal ocean surfaces
- ✓ Analysis of the model and altimetry reveals coherent informations:
 - strong seasonal variability of the coastal circulation
 - important year-to-year modulation of the seasonal cycle
- ✓ This study continues in order to validate/complete/understand the regional circulation system, the origin of the variability & the impact at regional scale.

Summary & Perspectives

The question of continuity between altimetry, model and long-term in-situ observations

Moose - Mediterranean Ocean Observing System on Environment (>2010)

