

# Monitoring slope current intrusions events into the Gulf of Lion with spaceborne coastal altimetry.



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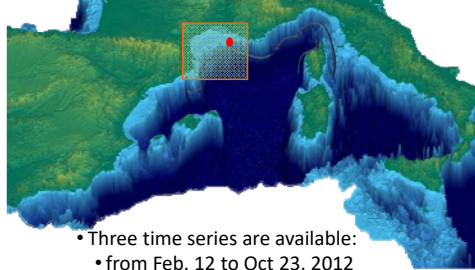


## Motivations and Goal

The Northern Mediterranean Current is the northern branch of the cyclonic circulation of the northwestern Mediterranean Sea. Occasionally the Northern Current can penetrate on the Gulf of Lion shelf, strongly impacting the local biogeochemistry and in turn the primary production. The space-time variability of slope currents plays a key role on the across-shore transport of natural and anthropogenic elements. It is therefore of critical importance to monitor the positions of these hydrodynamical features in a synoptic way. This work proposes to address this issue by **developing a new multi-satellite altimetric-based approach aiming at monitoring the long-term behaviour of the Northern Current.**

## JULIO Current Meter (Judicious Location for Intrusion Observation)

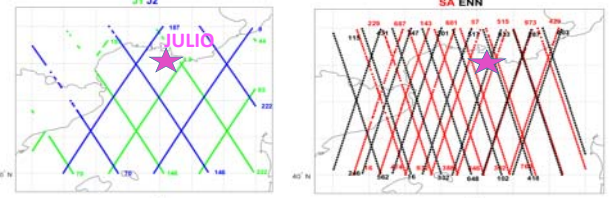
<http://mio.pytheas.univ-amu.fr/~petrenko/julio.htm>



- Situated on the 100 m-deep isobath;
- Measures horizontal currents through the water column, to detect intrusions occurring upstream and on the eastern side of the Gulf of Lion.
- Current time series every ½ hour and every 4m depth throughout the water column.

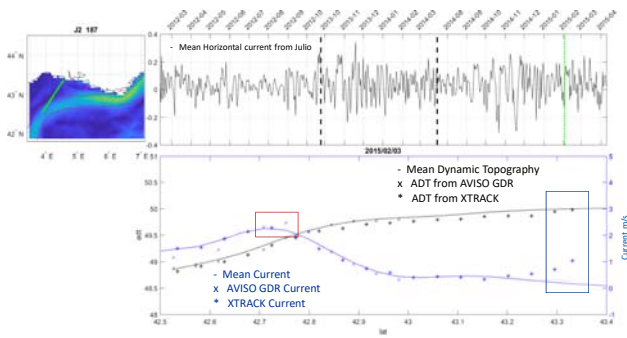
- Three time series are available:
  - from Feb. 12 to Oct 23, 2012
  - from Sep. 26, 2013 to March 28, 2014
  - from July 17, 2014 to April 10, 2015

## JULIO vs Altimetry



- Julio:**
- Average of the profile of horizontal currents
  - Daily time resolution
  - Projected to the direction perpendicular to the Altimeter track
- Altimetry:**
- Several tracks considered with different geometry and distance w.r.t. JULIO location.
  - Coastal specialized altimetry products (XTRACK).

## Comparison Altimetric Currents with Julio

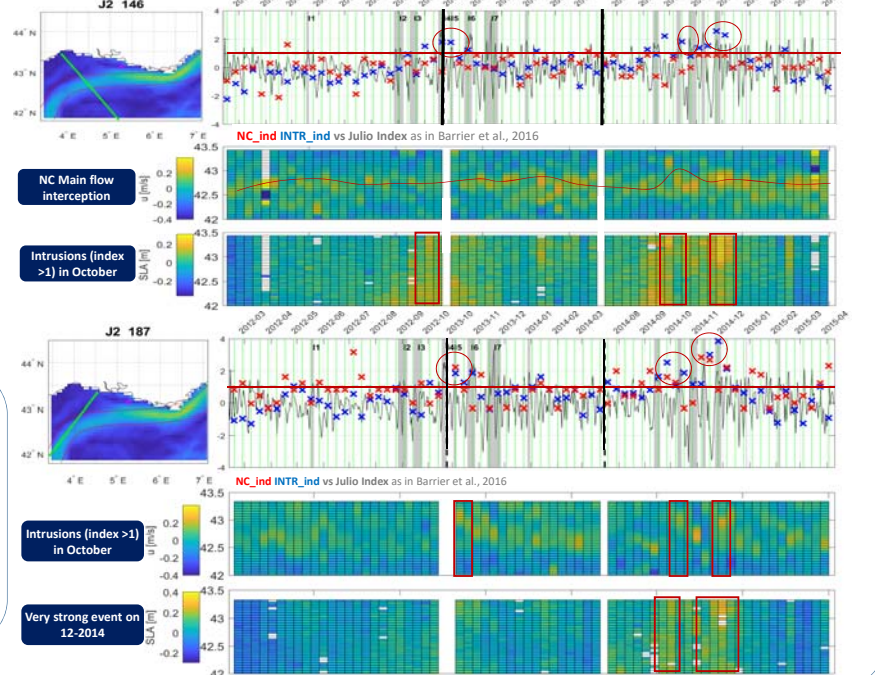


$$NC\_index = \frac{D(U_{max}) - D(U_{mean})}{std(D(U_{max}))}$$

$U_{max}$  is the local maximum of the altimetry derived current (from ADT)  
 $D(U_{max})$  is the distance from coast of  $U_{max}$   
 $U_{mean}$  is the local maximum of the current derived from MDT

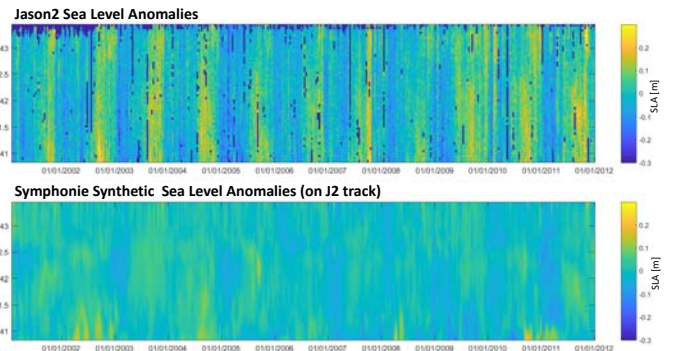
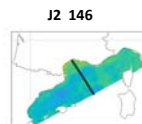
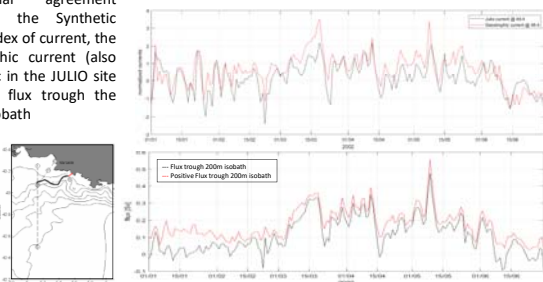
$$INT\_index = \frac{mean(SLA_{nearcoast})}{std(SLA_{nearcoast})}$$

$SLA_{nearcoast}$  is the Sea Level Anomaly up to 21 Km from the coastline



## Synthetic studies with SIMPHONIE model (10 years of simulations)

Substantial agreement between the Synthetic JULIO index of current, the geostrophic current (also synthetic in the JULIO site and the flux trough the 200m isobath



## Further Steps:

- Development of an algorithm for the detection of intrusions (or mega-intrusions) into the Gulf of Lion based on Synthetic measurements
  - Input variable definition on model data (NC\_ind, INT\_ind, ecc.)
  - Input variable selection and algorithm definition (Random Forest approach)
- Test and verification of the algorithm on real altimetric data (Jason 2, Saral/Altika, Cryosat)

## References:

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- Bouffard, J., Roblou, L., Birol, F., Pascual, A., Fenoglio-Marc, L., Cancet, M., ... & Menard, Y. (2011). Introduction and assessment of improved coastal altimetry strategies: case study over the Northwestern Mediterranean Sea. In *Coastal altimetry* (pp. 297-330). Springer, Berlin, Heidelberg.
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## Acknowledge:

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