SeaGoLSWOT: an oceanographic campaign in support of the AirSWOT mission in the Northwestern Mediterranean

Francesco Nencioli[(1)], Francesco d'Ovidio[(2)], Andrea M. Doglioli[(1)], Anne A. Petrenko[(1)] and Jérôme Bouffard[(1)]

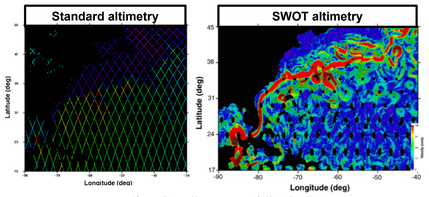
[(1)] Aix-Marseille University, Mediterranean Institute of Oceanography (MIO), 13288 Marseille, Cedex 9, France; Université du Sud Toulon-Var; CNRS-INSU/IRD UM 110
[(2)] Laboratoire d'Océanographie et du Climat : Experimentation et Approches Numeriques (LOCEAN), IPSL, Paris, France

OSTST 2013
Science Results from Satellite Altimetry

SWOT: Surface Water and Ocean Topography

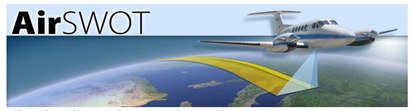
(from http://swot.jpl.nasa.gov/mission/)

- Wide-swath US/French satellite altimetry mission (launch scheduled for Fall 2020)
- Oceanography mission: SSH observations at a resolution of few km (meso- and submeso-scale regimes) over a 100 km swath
- Particularly important for transport analysis in coastal regions where traditional altimetry is inaccurate

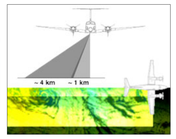


(from http://smsc.cnes.fr/SWOT/)

AirSWOT

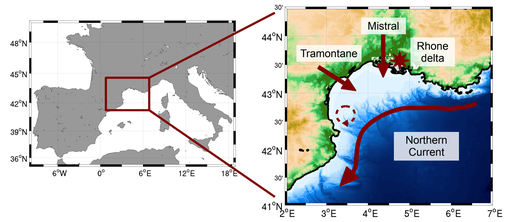


(from http://swot.jpl.nasa.gov/airswot/)



- Before satellite launch, SWOT calibration/validation through the AirSWOT program:
  - ➔ Airborne version of SWOT over key ocean regions
  - ➔ Each flight associated with an accompanying oceanographic campaign

The Gulf of Lion (GoL; North-western Mediterranean)

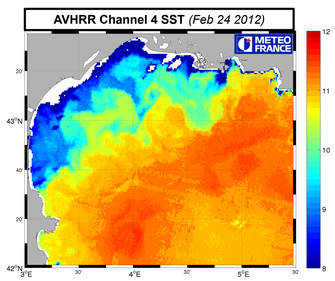


- Regional ocean dynamics influenced by three main forcings:
  1. Mistral & Tramontane – wind induced coastal upwelling;
  2. Northern Current (NC) – strong dynamical barrier between the GoL continental shelf and the open Mediterranean basin;
  3. Rhone delta – river plume and freshwater inputs

Why an AirSWOT campaign in the GoL

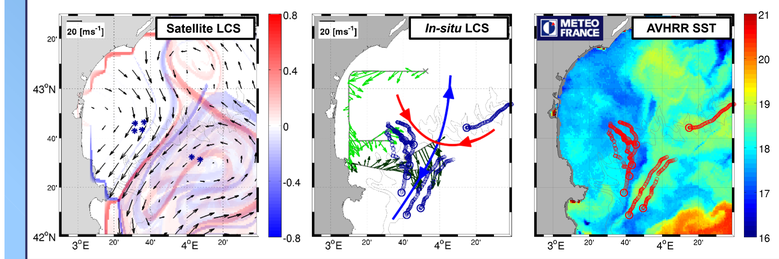
GoL presents favorable characteristics for the development of an AirSWOT mission:

- Weak tidal regime – focus on the interpretation of the AirSWOT altimetry signal associated with (sub)mesoscale structures
- Intense (sub)mesoscale activity due to NC instabilities and strong wind forcing
- Marked contrast between coastal waters (colder) and open Mediterranean waters (warmer) – (sub)mesoscale structures detectable from remote sensed imagery
- Experience from the Latex10 experiment (*see below*)



The Latex10 campaign (1-24 September 2010):

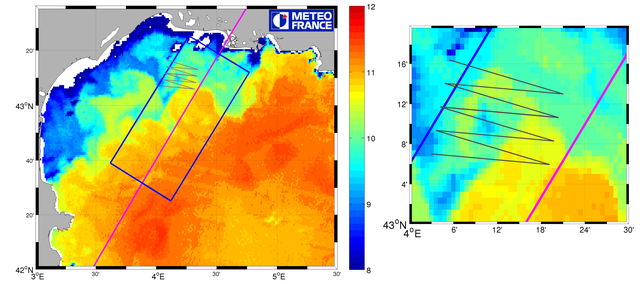
In-situ Detection of Lagrangian Coherent Structures (LCS)



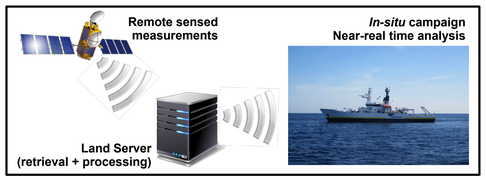
- LCS identified from AVISO velocities using Finite-Size Lyapunov Exponents (FSLE; d'Ovidio et al., 2004).
- Adaptive sampling strategy combining satellite data, Lagrangian drifter releases and ship-based ADCP measurements to localize *in-situ* LCS (Nencioli et al., 2011).
- Evidenced limitations of standard altimetry over the continental shelf.

The SeaGoLSWOT campaign (29 October – 10 Novembeer, 2014)

- SeaGoLSWOT is a Cnes supported field campaign associated with the AirSWOT mission over the GoL
- The AirSWOT flight will cover an area of approximately 50 x 100 km (blue rectangle) across one of Jason's track over the GoL (in magenta the track 187)
- Main goal of the campaign is to collect a series of three-dimensional mappings of physical and biological variables across identified (sub)mesoscale features (zoomed figure to the right)



Adaptive sampling strategy



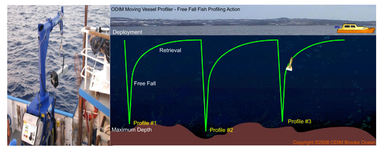
- Focus on small-scale,rapidly-evolving (sub)mesoscale structures, thus *in-situ* sampling based on further refinement of the adaptive strategy developed during the Laetx10 campaign.
- Pattern of each mapping designed/optimized according to the structures identified from the near-real time analysis of satellite imagery (AVHRR, Ocean color etc.) and previous mappings

In-situ measurements

1. Lagrangian drifters

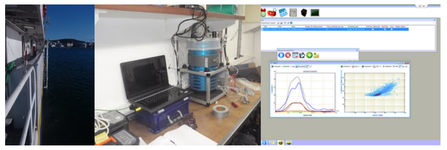
- Drifter arrays released every 3 days
- Larger scale circulation
- Lagrangian Coherent Structures
- Integrated with ADCP velocities

2. Moving Vessel Profiler (MVP)



- Vertical sections: CTD (hydrography), Flurometer, LOPC (zooplankton PSD)
- Quasi-synoptic three-dimensional mappings every 10-12 hours

3. Bench-top flow cytometer



- Surface phytoplankton assemblages
- Horizontal distribution of different phytoplankton groups
- Impact of (sub)mesoscale dynamics on ecological communities

Key objectives within AirSWOT program

(1) Provide AirSWOT measurements with a ground truth of the physics at ~1 km horizontal resolution in the upper 100 m of the water column;

(2) Test and tune novel in-situ sampling strategies and instrument configurations to be used during future AirSWOT flights;

(3) Investigate the link between the ~10 km horizontal surface structures and the dynamics/biogeochemical processes within the upper layer of the water column;

Perspectives: follow-up campaign on Spring 2015

- A second SeaGoLSWOT campaign in late February-early March 2015 is likely to occur.
- We aim at including a fleet of gliders and possibly a second R/V for a more complete biogeochemical characterization.
- The campaign will provide the opportunity to directly investigate the impact of (sub)mesoscale induced restratification in regulating the onset of the spring bloom (e.g. Mahadevan et al., 2012)

Acknowledgments

F.N. acknowledges support from the FP7 Marie Curie Actions of the European Commission, via the Intra-European Fellowship (FP7-PEOPLE-IEF-2011), project "*Lyapunov Analysis in the COaSTal Environment*" (LACOSTE-299834). F. d'O. acknowledges support from the CNES via the project "*GoLSWOT, A working group for the flight of AirSWOT over the Gulf of Lion*". AVHRR data were provided by Météo-France. Many thanks to M. Thyssen and G. Gregori for sharing the flow cytometer images, to the crew of the *R/V Tethys II*, and to all participants of the Latex10 experiment.

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LAgrangian Transport EXperiment (LATEX) website: *http://mio.pytheas.univ-amu.fr/?Programme-LATEX*