

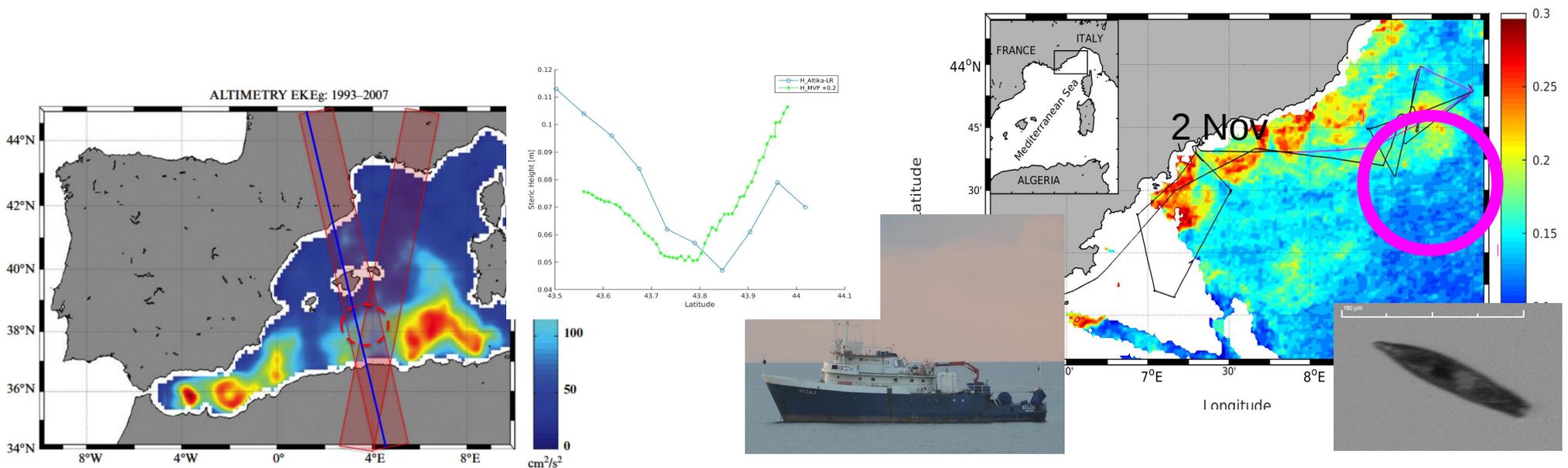
# In situ observations in France related to SWOT Cal/Val

Francesco d'Ovidio LOCEAN-IPSL

1. Federation of experimental capacity in the Mediterranean

2. CalVal site in the SW Mediterranean

3. Performed experiments: the OSCAHR cruise



# Two levels of CalVal



## “Ground truth” CalVal

In situ/airborne measurements that can be related with SWOT science requirements.

### Compare:

- SSH points
- SSH spectra

## “user-level” CalVal

Falsification approach: find **inconsistency** of SWOT-derived physical dynamics in process studies

Identify in situ process studies which can be informative on SWOT performance

# **1. Federation of experimental capacity in the Mediterranean**

# **Federation of in situ capacity in the Mediterranean**

## **France**

LOCEAN/LEGOS (F. Durand): 3-5 Gliders

MIO (A. Doglioli): MVP, underway cytometry  
+ 1 R/V ship

## **Abroad**

Spain (IMEDEA/SOCIB): 2 gliders + R/V ship

Turkey (IMS METU): R/V ship

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## Other French SWOT-ST experimental Cal/Val project:

**South West Pacific** (L. Gourdeau, F. Marin, A. Ganachaud)

Planned for 2021

# MULTI-SUB capacity (e.g., ALBOREX experiment)

A. Pascual (IMEDEA), J. Tintoré (SOCIB)

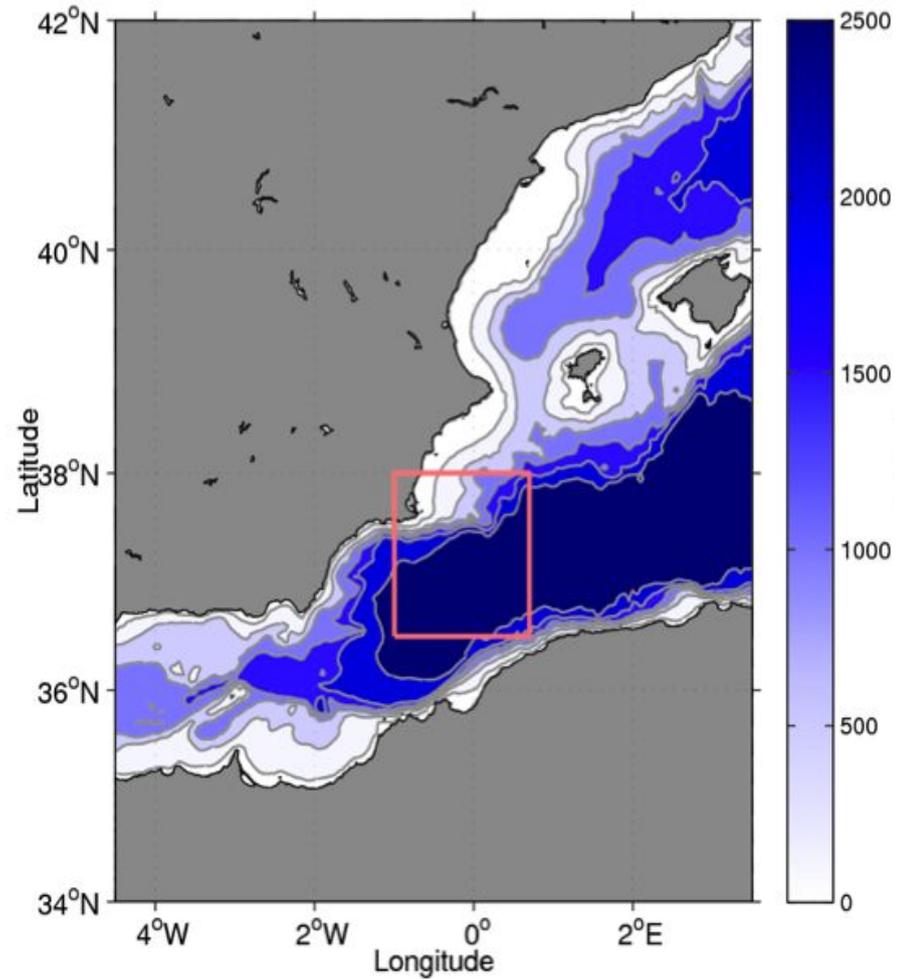
## Submesoscale resolving observations

**Dates: 24 May - 2 June 2014**

**Area: Eastern Alboran Sea**

**Ship: R/V SOCIB**

- 25 drifters
- 2 gliders
- 3 Argo floats
- ADCP
- Thermosalinograph
- 80 CTDs
- Nutrients
- Chlorophyll
- Remote sensing
- Modeling



# Collaboration with IMS-METU

## R/V Bilim 2

- Length Overall, 40 meters,
- Coastal Research Vessel (Turkish Waters and International waters of the Mediterranean and Black Sea)
- 10 knots max cruising speed
- 12 Berths (Scientists)



# Equipment

- **ScanFish** Rocio (EIVA) equipped with CTD, Fluorometer, O<sub>2</sub> sensor, CDOM, Turbidity sensor and Sonar
- **CTD (Seabird)** equipped externally with O<sub>2</sub> sensor, Fluorometer, PAR, Turbidity sensor, Transmissiometer
- **ADCP**
- **Fisheries Acoustics** (30, 120, 200 kHz)
- **On board:** Continuous fluorometer, filtration lab (for 47mm and 25 mm filters), Auto analyser.
- **Lab Space:** 14 m<sup>2</sup> Chemistry Lab (2/5 of this lab is used as wet lab, filtration units), Computer Room 16 m<sup>2</sup>, Biology Lab (Wet Lab) 10 m<sup>2</sup>.
- Local Area Network, GPS via network, Depth Sounding, Surveillance camera system.



# Collaboration with IMS-METU

## R/V Bilim 2

### Possible synergies

1. integration to operations in the W Med
2. In situ experiment over the Eastern Med/Black sea SWOT swath (fast sampling phases)

Funding: Turkey



## **2. CalVal site in the SW Mediterranean**

# CalVal zone: Algerian current

- A very turbulent area (instability of the Algerian Current), density fronts (mostly governed by salinity), with marked filaments embedded

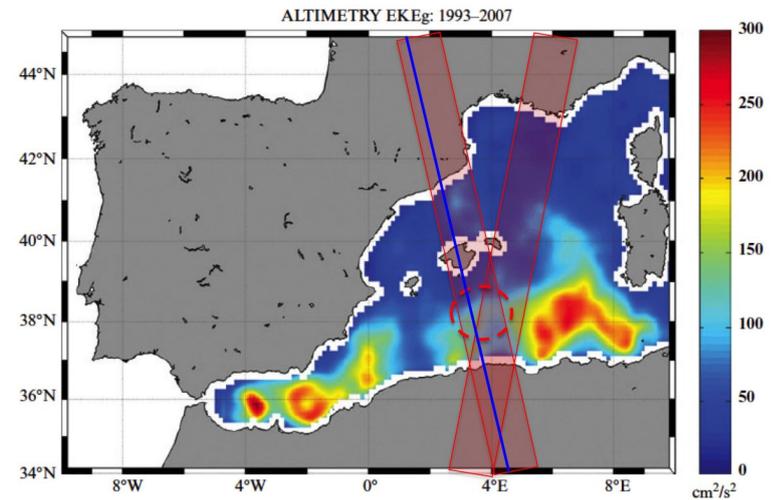
- Associated to strong vertical velocities at mesoscale (1 to 25 m/day) (Ruiz et al 2009)

- Short  $Ro$  ( $\sim 12$  km), resolved by SWOT

- Favourable signal/noise ratio expected from SWOT there (IGW, swell wave length)

- Region adequately documented at these scales (ALBOREX-PERSEUS project)

- Logistics/diplomacy proven tractable (ongoing Franco-Algerian operations based on LOCEAN glider transects off Algiers, SOMBA project)



[Pascual et al., 2014]

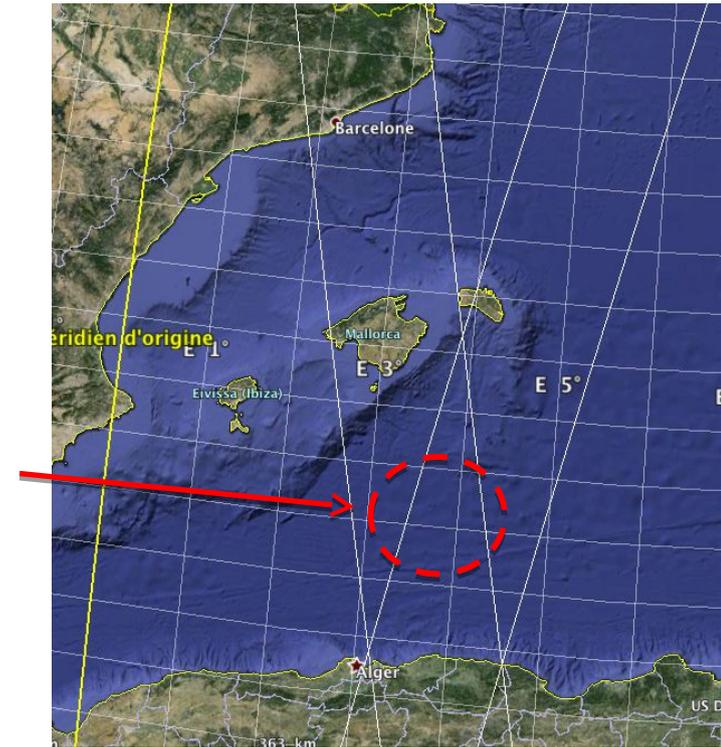
## Type of ClaVal: “Ground truth” + “User level”

- SSH in situ estimation
- Ecobiogeochemical process modulation by (sub)mesoscale

## Calendar (tentative)

2018: check out cruise

2021: fast sampling phase



## Capacity

Spain (MULTI-SUB)+France (BIOSWOT): 2 ships, 3-5 gliders; GPS buoys?  
+ Turkey: 1 ship+UCTD

### 3. Performed experiments: the OSCAHR cruise (previous SeaGoLSWOT in SWOT-SDT)

**A.M.Doglioli**, G.Grégori, M.Thyssen, T. Wagener, P.Marrec,  
G.Rougier, N.Bhairy, J.Fenouil, A.deVerneil, L.Rousselet, F.Cyr, A.A.Petrenko,  
J.-M.André, F.d'Ovidio, A.Pietri, **F.Nencioli**, L.Jullion,  
C.Pinazo, C.Yohia and P.Marsalaix



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#### Non-SWOT funding



# Background

## OSCAHR

*Observing Submesoscale Coupling At High Resolution*

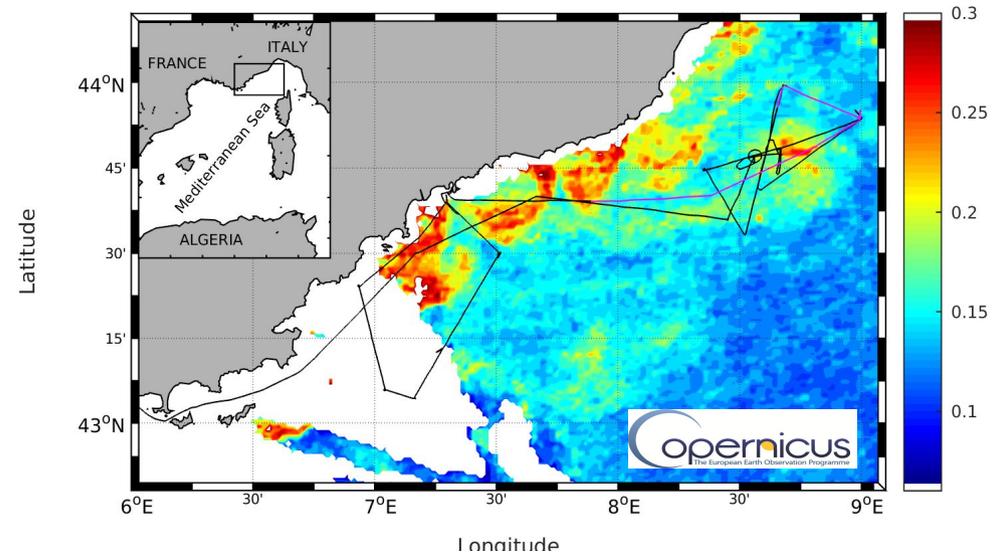
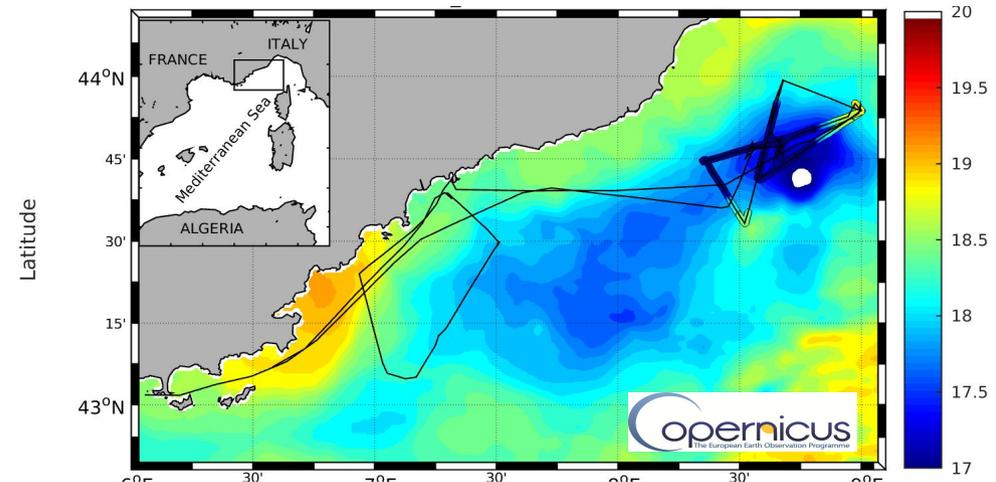
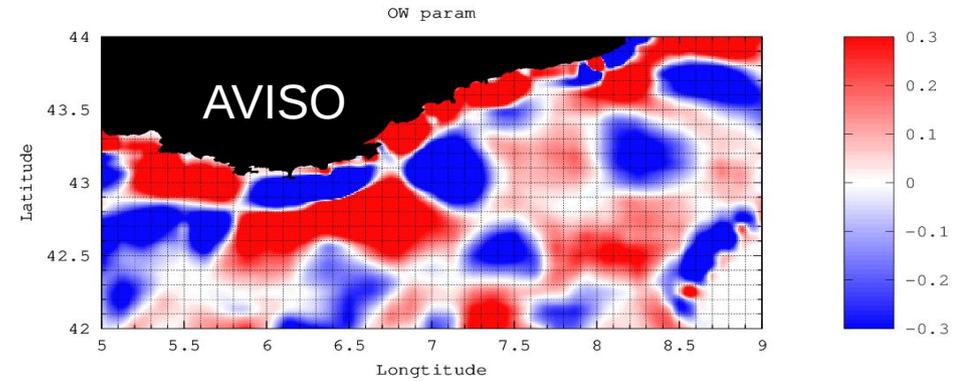
Goals :

1) acquisition of SWOT-grade experimental capabilities

2) Showcase submesoscale biophysical experiment

Cruise :

29 October to 6 November 2015



# Materials and Methods

## Surface Horizontal Mapping

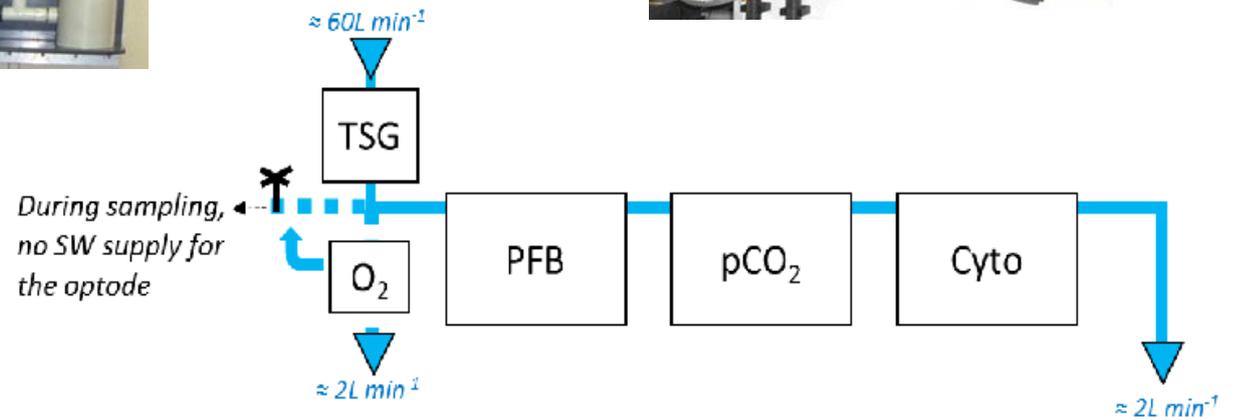
TSG  
ThermoSalinoGraph



Fluorimeter



Onboard surface  
water intake



Thermosalinograph

Fluorimeter

Automated flow cytometer Cytosense

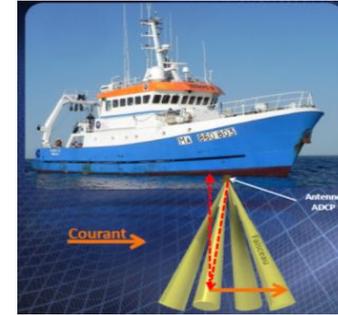
*high-throughput sampling*  
(20' → 3.7 to 2.4 km)

# Materials and Methods

## Horizontal & Vertical Mapping

### Hull-mounted ADCP

*150 Khz (vertical resolution 8 m)*



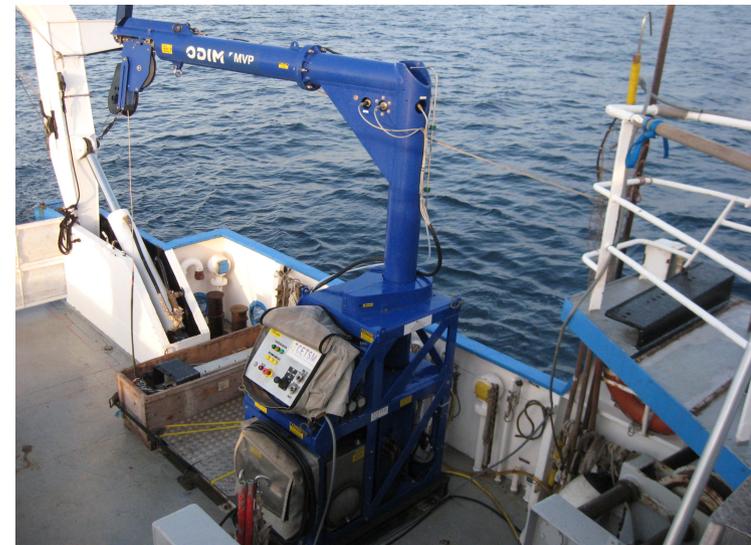
### MVP Moving Vessel Profiler

Multi-Sensor Free-Fall Fish:

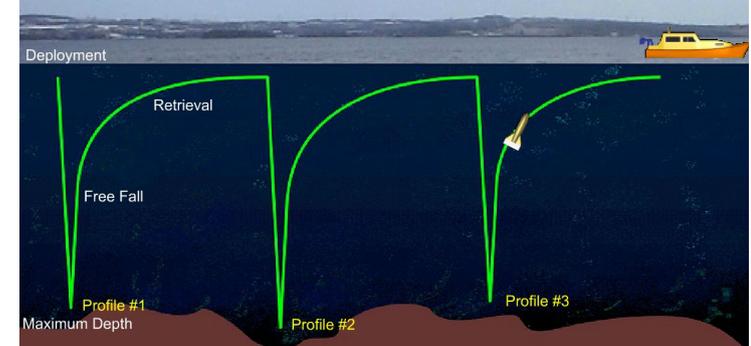
CTD, fluorescence and LOPC  
Laser Optical Particle Counter

*~2 km horizontal resolution*

*~1 m vertical resolution*



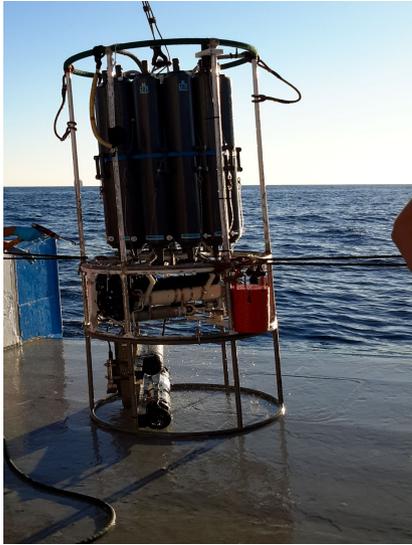
ODIM Moving Vessel Profiler - Free Fall Fish Profiling Action



# Materials and Methods

## High resolution vertical sampling

### CTD carousel



12 niskin bottles

### ECOVSF3

Three-angle, Three-wavelength  
Volume Scattering Function Meter

### CTD SBE32

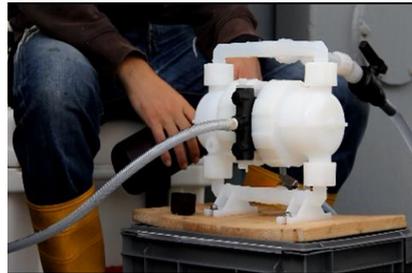
### LOPC and LISST

Laser Optical Particle Counter

Laser In situ scatterometer and  
transmissiometer

### PASTIS

Pumping Advanced System To Investigate Seawater

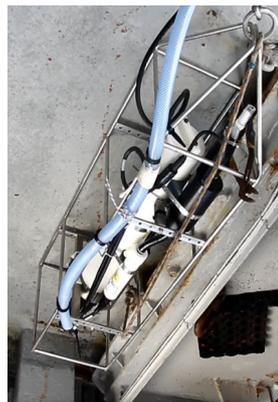


- bellows pump
- 30m PE tube
- CTD SBE19+



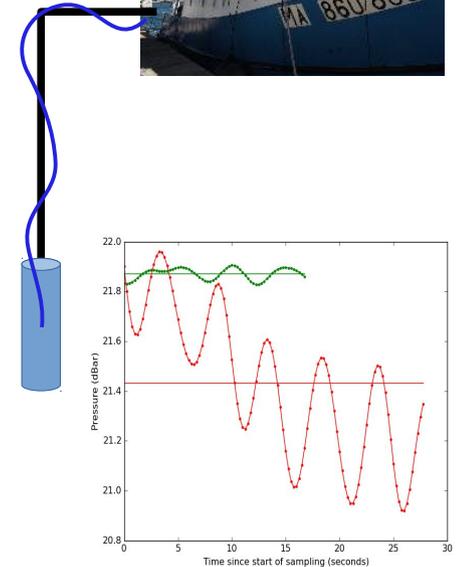
*Discrete  
Sampling*

*vertical  
resolution  
0.1 to 1 m*



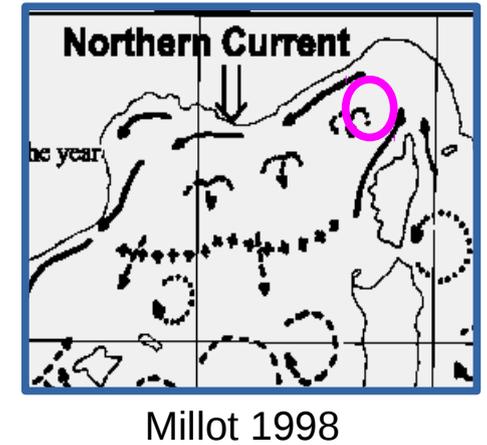
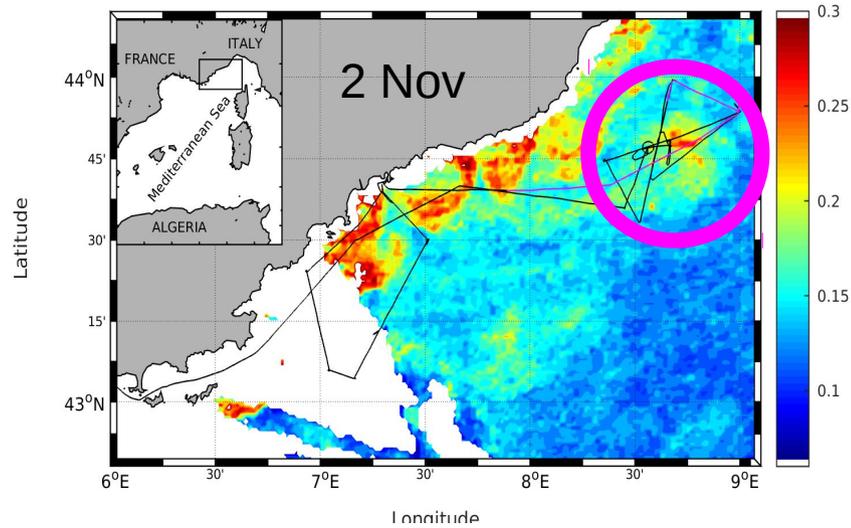
Post-Cruise  
Lab Analysis:

Nutrients and Cytometer FACScalibur

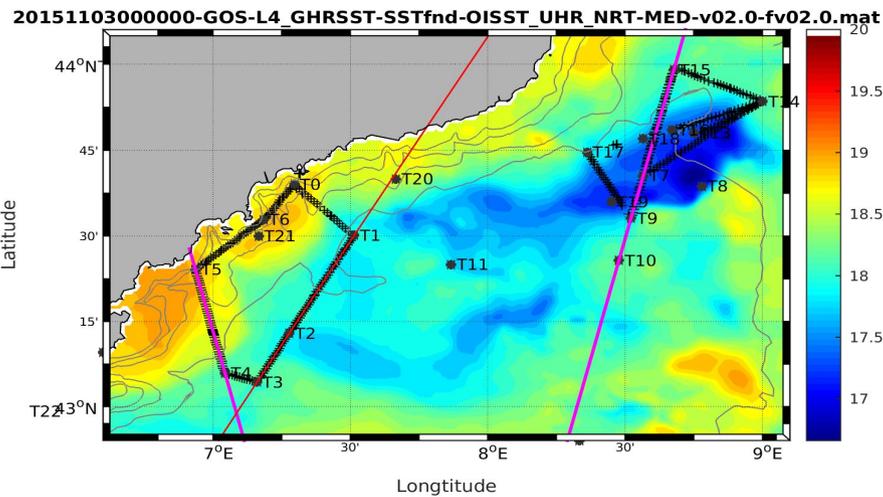


# Materials and Methods

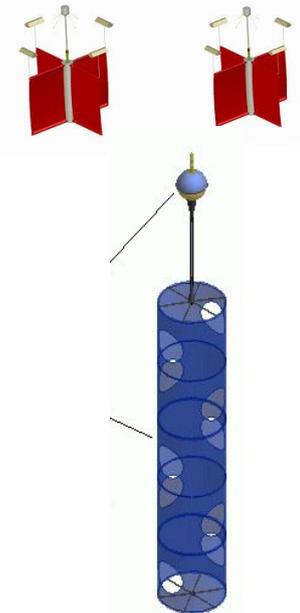
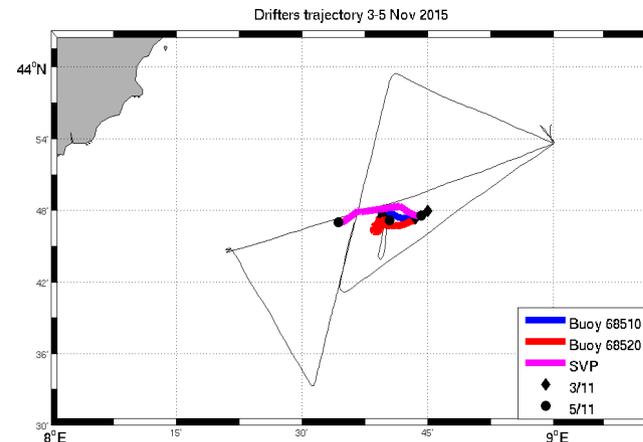
## SWOT-like adaptive Lagrangian sampling strategy (but using Chl instead of HR altimetry)



### CalVal exercise *Saral/AltiKa & Jason2*



### Lagrangian drifters *2 code and 1 SVP*

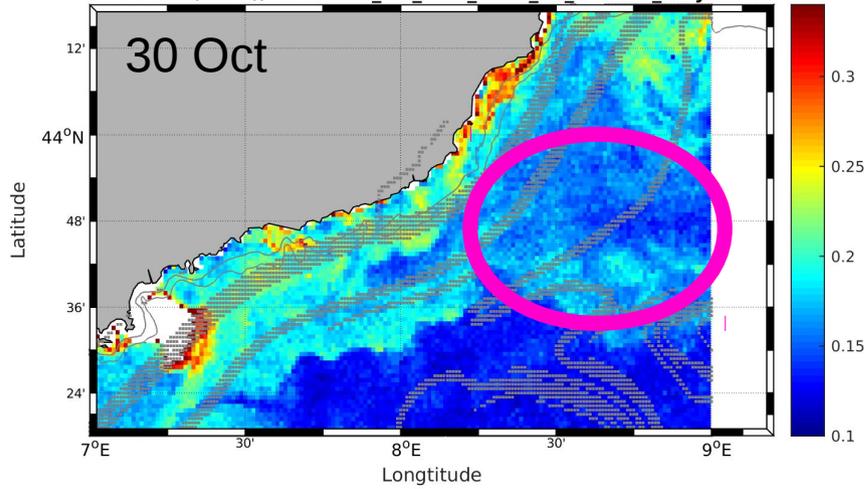


# Results

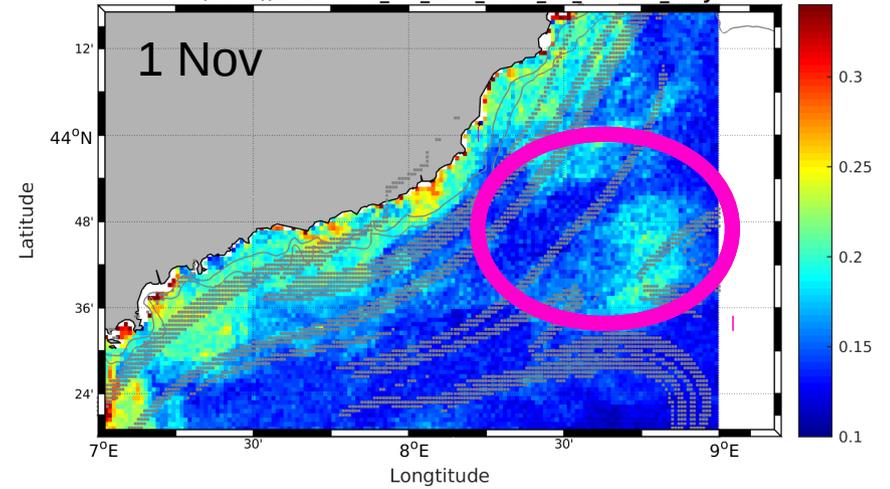
Comparison of AVISO+ADCP+FSLE+CHL:  
Nadir altimetry unreliable – use of Chl anomalies instead

FSLE + CHL

OSCAHR/FSLE//20151030\_nrt\_med\_2014\_d0\_lambda\_only.mat

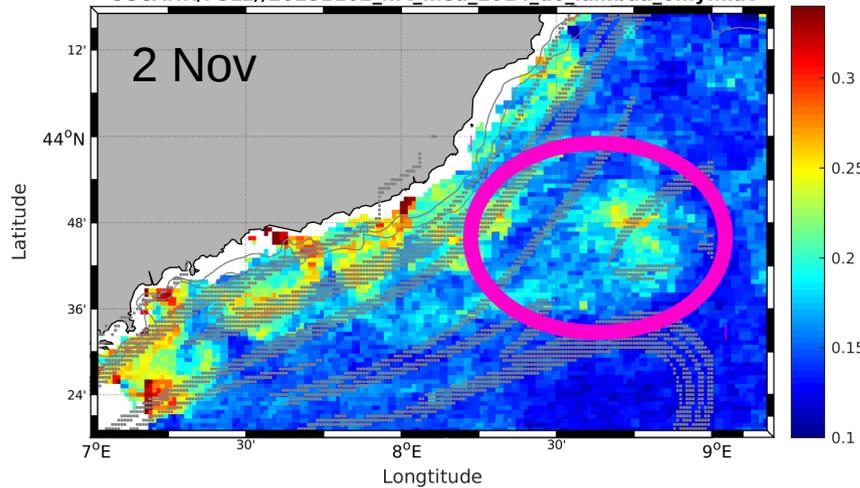


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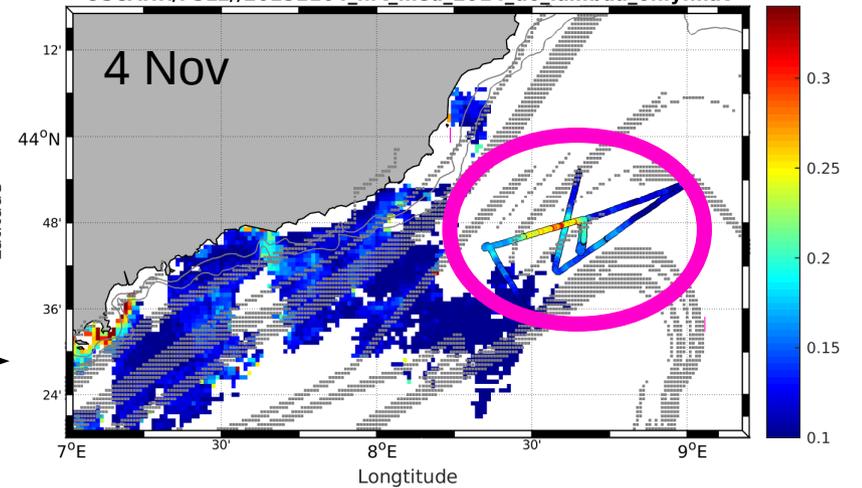


+ CHLtsg

OSCAHR/FSLE//20151102\_nrt\_med\_2014\_d0\_lambda\_only.mat

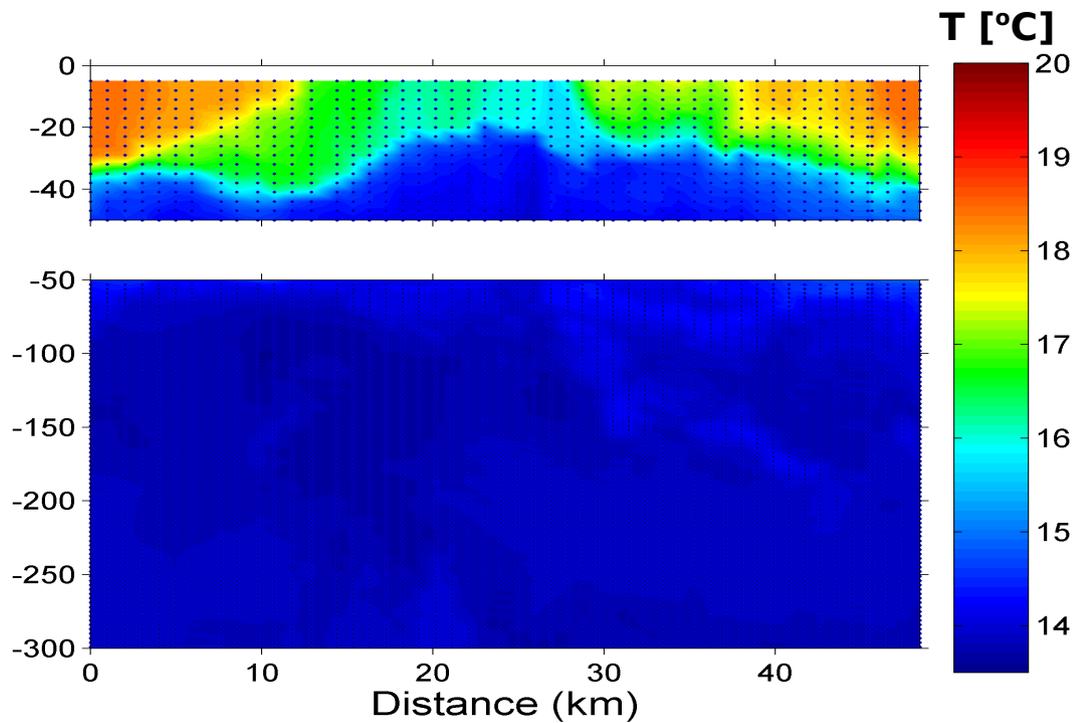
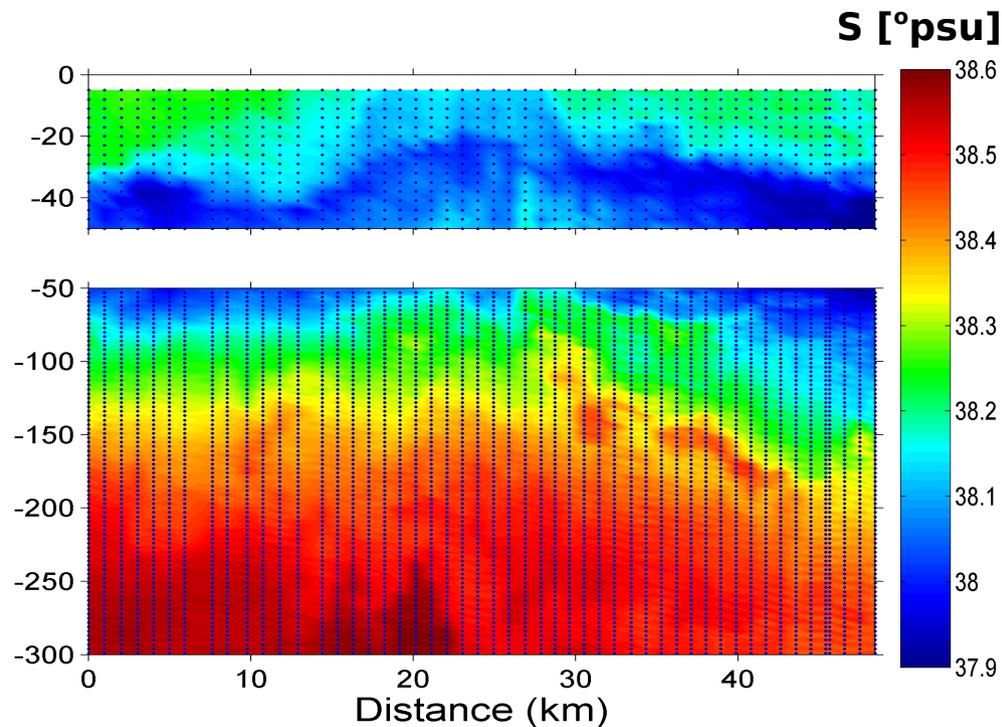
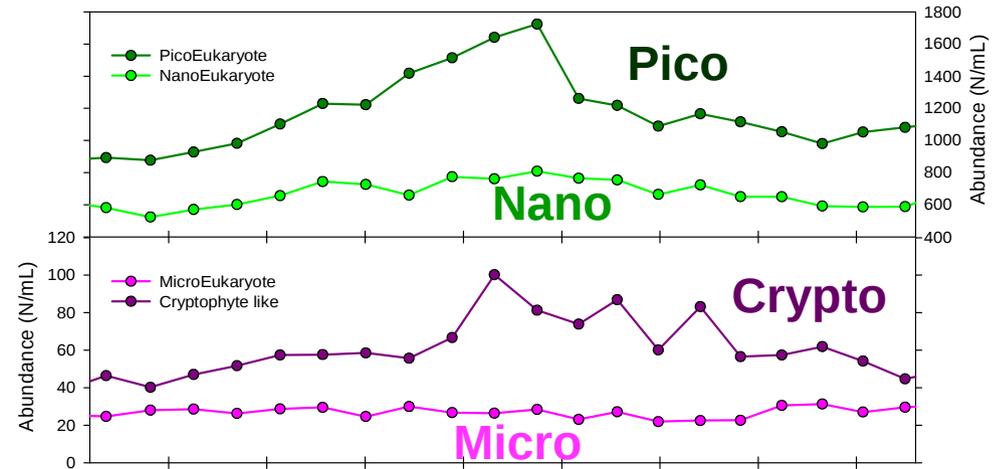
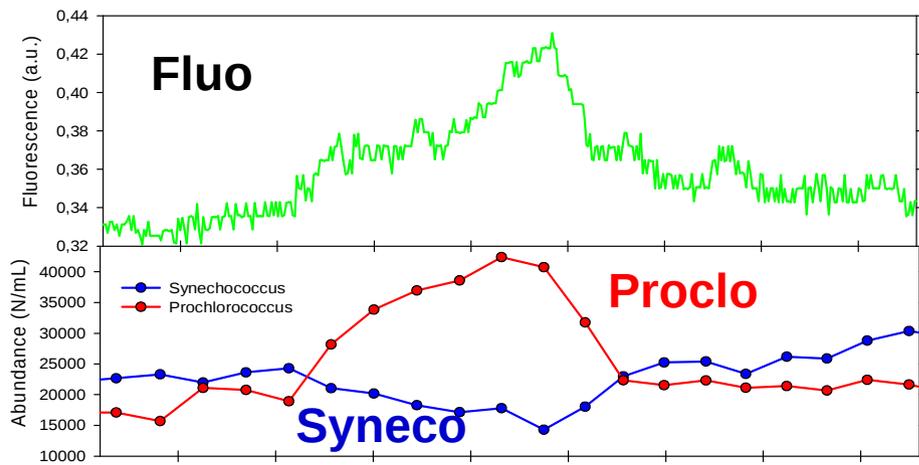


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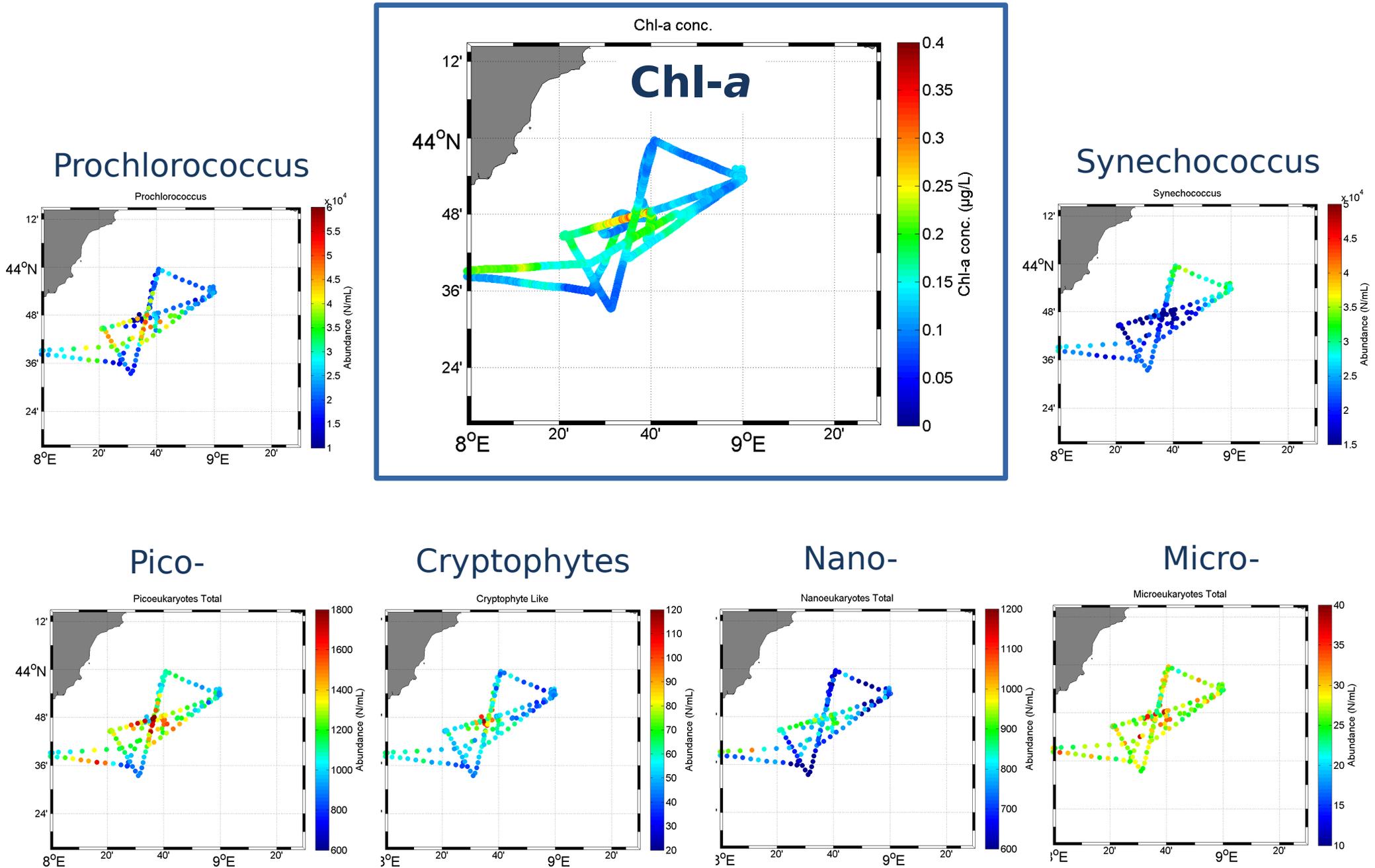
# Results

## MVP vertical section and phytoplankton assemblages



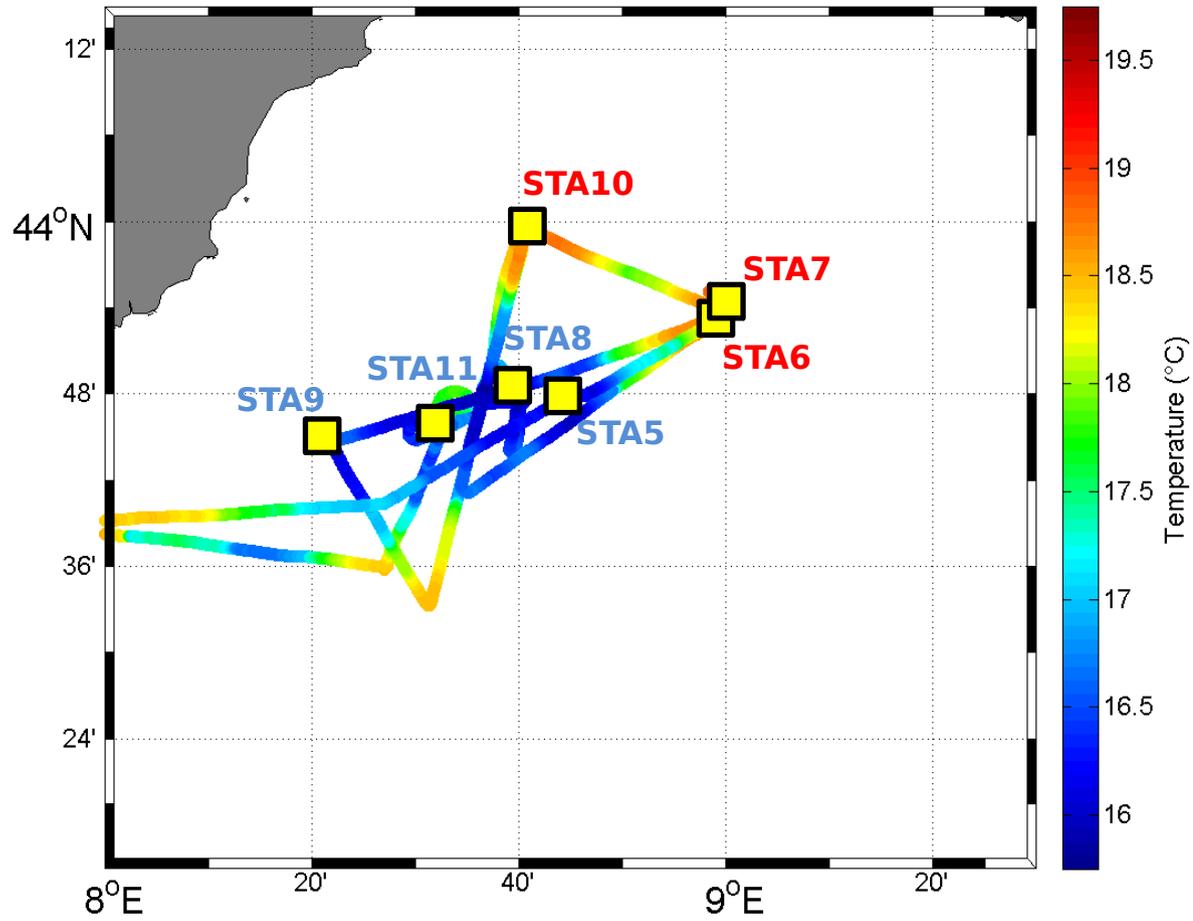
# Results

## Decomposition of the fluorescence measurements at the surface



# Results

## PASTIS measurements at 7 stations

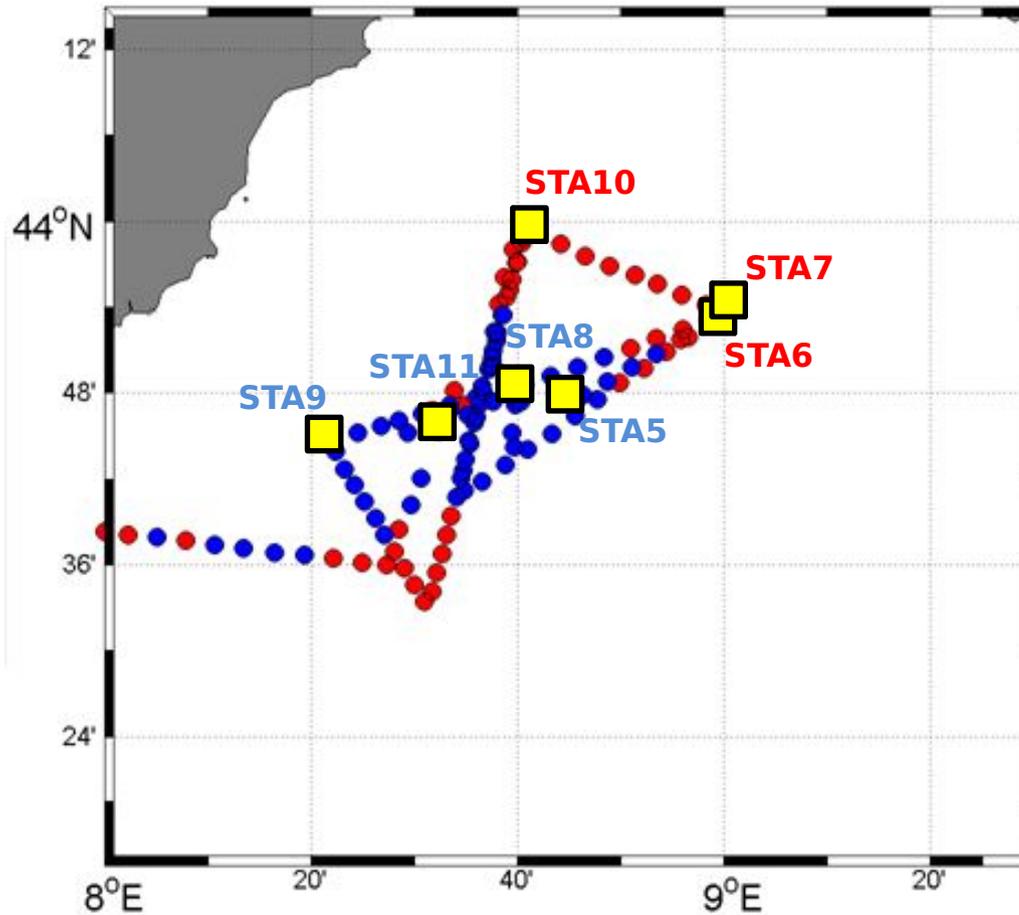


# Results

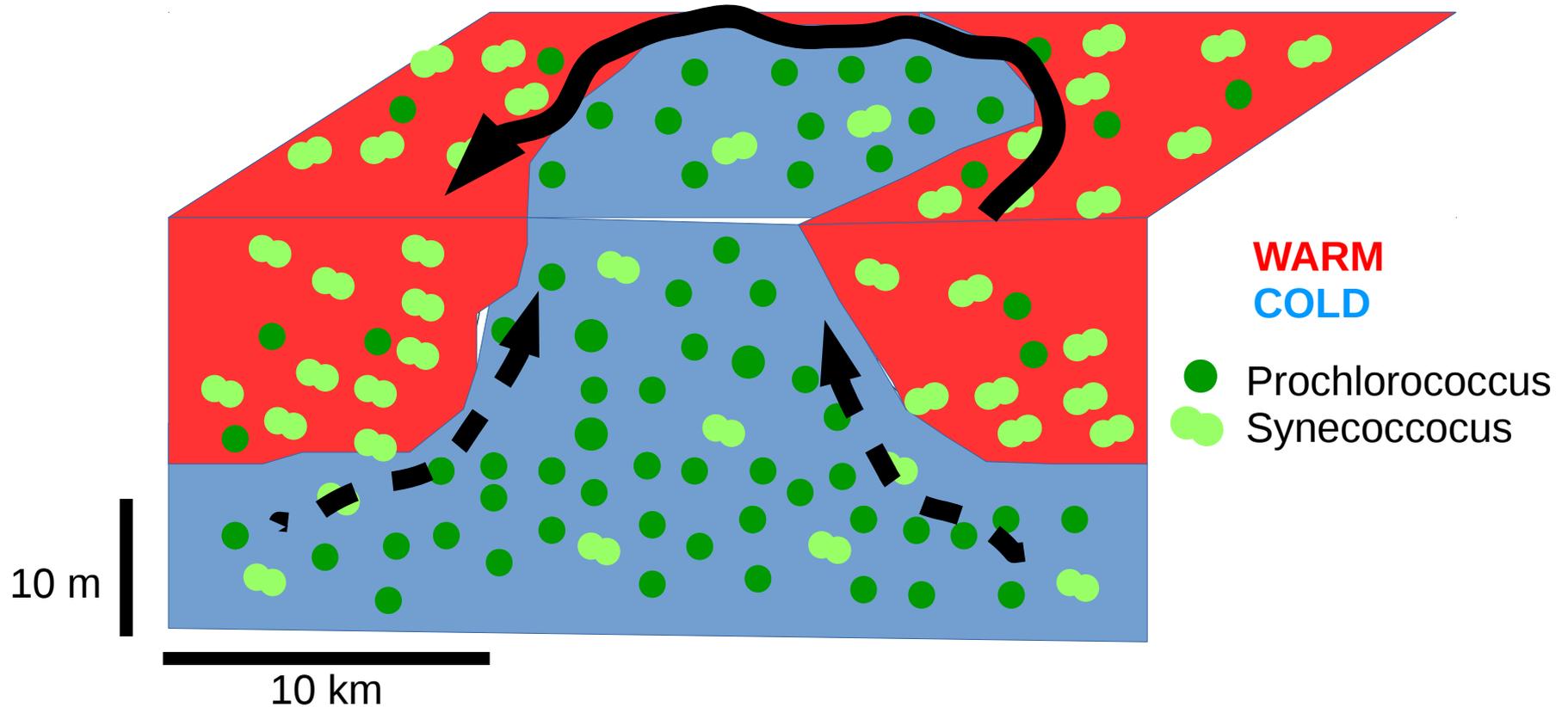
PASTIS measurements  
at 7 stations

**Warm Stations**  
**SST > 17,5°C**  
***“Boundaries”***

**Cold Stations**  
**SST < 17,5°C**  
***“Core”***



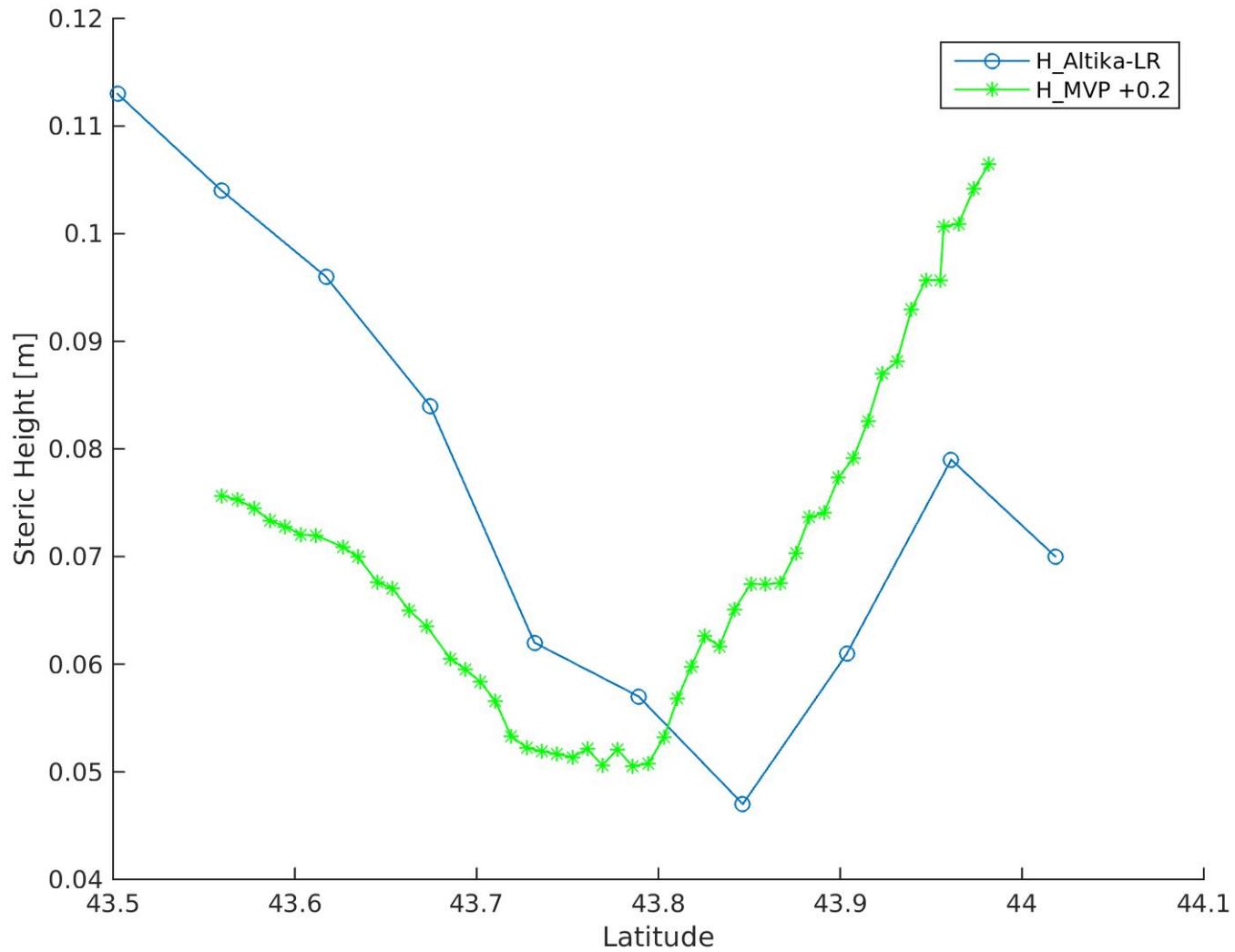
## Summarizing...



### *Preliminary conclusion:*

the fine-scale structure of the physical field drives  
the spatial organization of the plankton functional groups

# SSH reconstruction – preliminary result



Caveats: spatiotemporal mismatch (~1 day)

## **Some questions to discuss:**

- What can be the role of the Turkish group? (East Med, West Med, Black Sea??)
- CalVal approach too much “user level” and not enough “ground truth”?
- Do we need other partners/ships/instruments?
  - SHOM (Seasoar) ?
  - Lidar ?
- Which specific objectives for the 2018 experiments?

# OSCAHR project (still under construction!) webpages

[www.mio.univ-amu.fr/OSCAHR/](http://www.mio.univ-amu.fr/OSCAHR/)



## Thanks for your attention!

