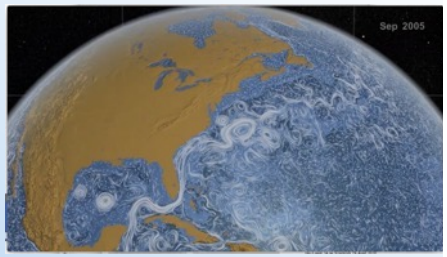
FUMSECK (et un peu plus)
Résultats - Valorisation
Perspectives

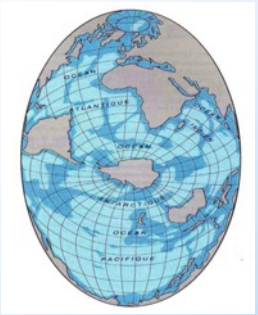
OPLC, MIO, 09/02/2023

Stéphanie Barrillon, Anne Petrenko, Jean-Luc Fuda, Caroline Comby, Andrea Doglioli, Anthony Bosse, Roxane Tzortzis (OPLC)

Robin Fuchs, Christophe Yohia, Nagib Bhairy, Melilotus Thyssen, Gérald Grégori (MIO)

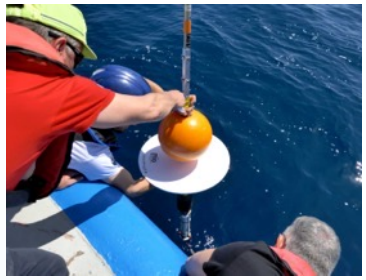
Patrice Le Gal, Patrick Marsaleix, Claude Estournel, Caroline Ulses, Frédéric Cyr, Francesco d'Ovidio

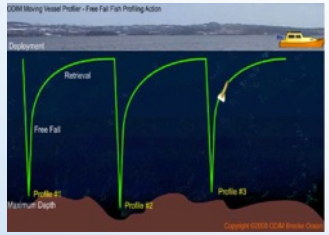


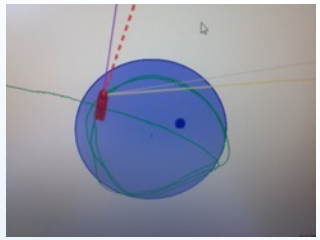


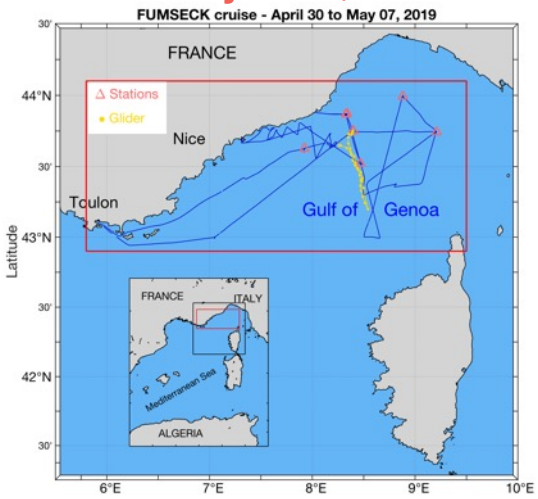
FUMSECK (*Facilities for Updating the Mediterranean Submesocale - Ecosystem Coupling Knowledge), 30 avr - 07 mai 2019, mer Ligure. R/V* Téthys II (S. Barrillon)

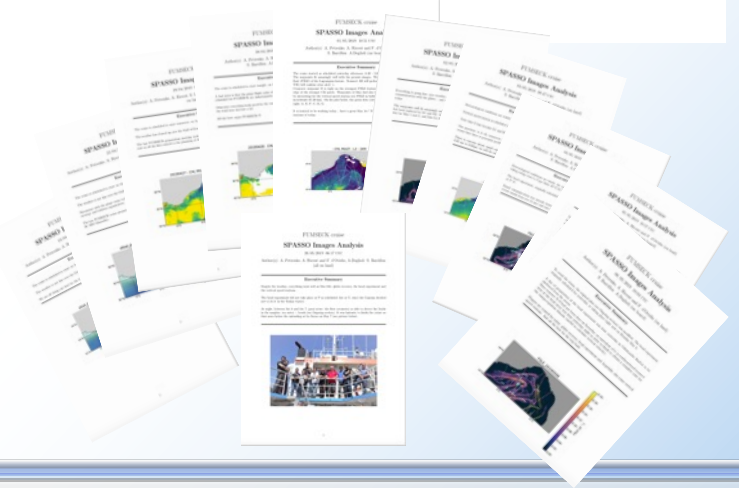
- Préparation SWOT. Mesures couplées phys/bio
- Résultats :
  - **Vitesses verticales**
  - **Effet tempête phys-bio**





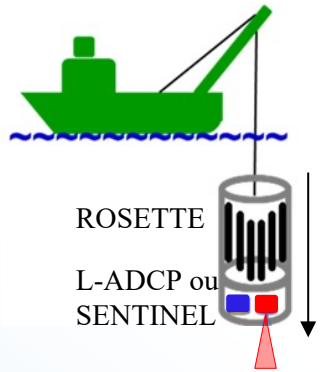


- Stratégie lagrangienne avec SPASSO

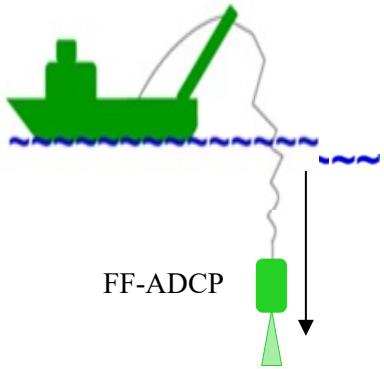
Mesures Vitesses verticales

Directes *in situ* (ADCP)

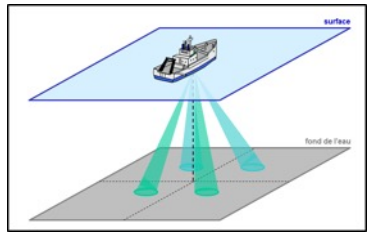
CTD



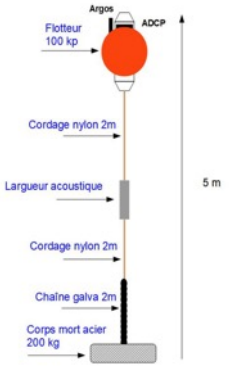
Free-Fall



Coque



Mouillage

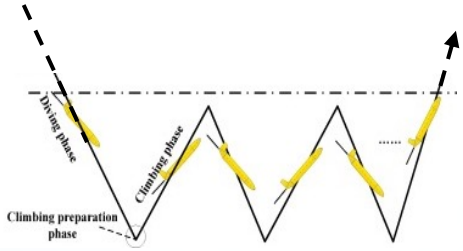


Directes *in situ* avec modèle de vol

VVP

(*Vertical Velocity Profiler*)

Glider



Indirectes :

Équation **ω**

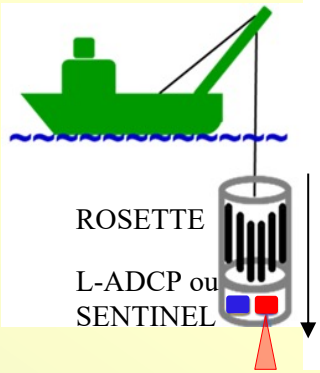
- + *in situ* density/ currents
- + satellite

+ Modélisation (hydrostatique)

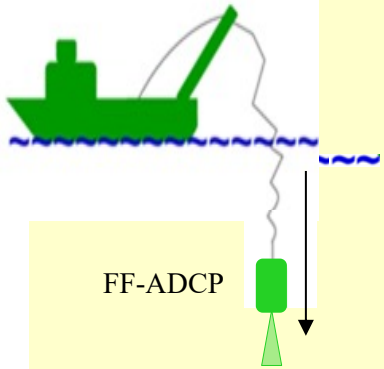
Mesures Vitesses verticales

Directes *in situ* (ADCP)

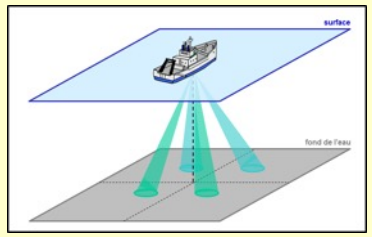
CTD



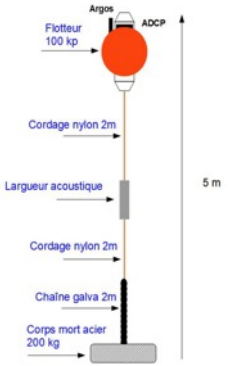
Free-Fall



Coque



Mouillage

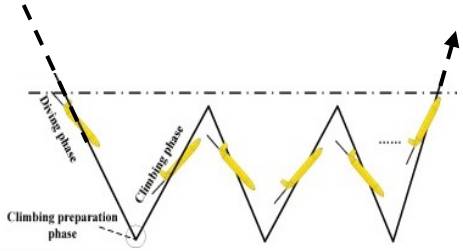


Directes *in situ* avec modèle de vol

VVP

(*Vertical Velocity Profiler*)

Glider



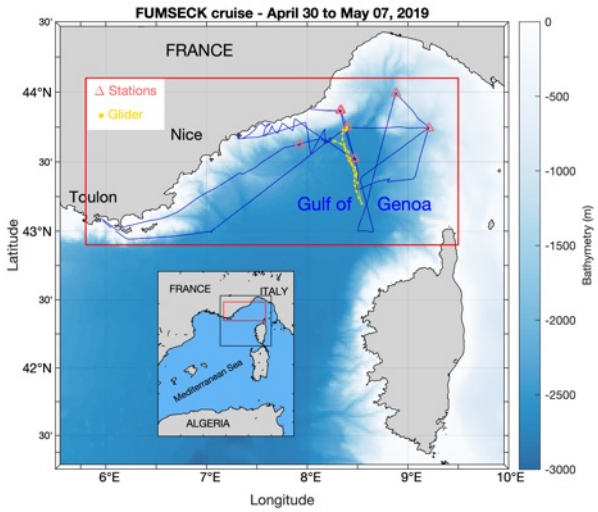
Indirectes :

Équation **ω**

- + *in situ* density/ currents
- + satellite

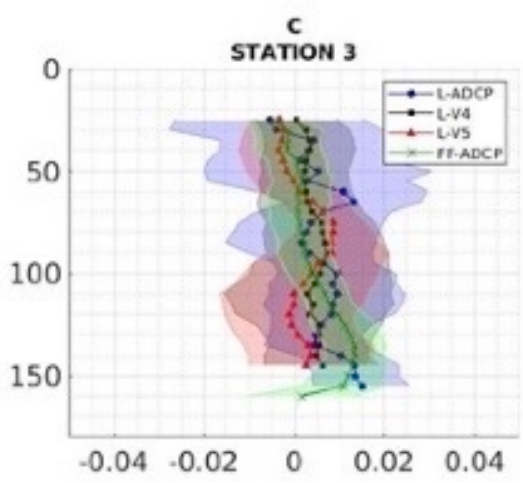
+ Modélisation (hydrostatique)

Vitesses verticales ADCP



Comby *et al.* (2022)

- FUMSECK
- 6 stations
- 4 methodes
  - Lowered-ADCP
  - Lowered-Sentinel
    4 beams + 5th vert.
  - FreeFall-ADCP



Résultats

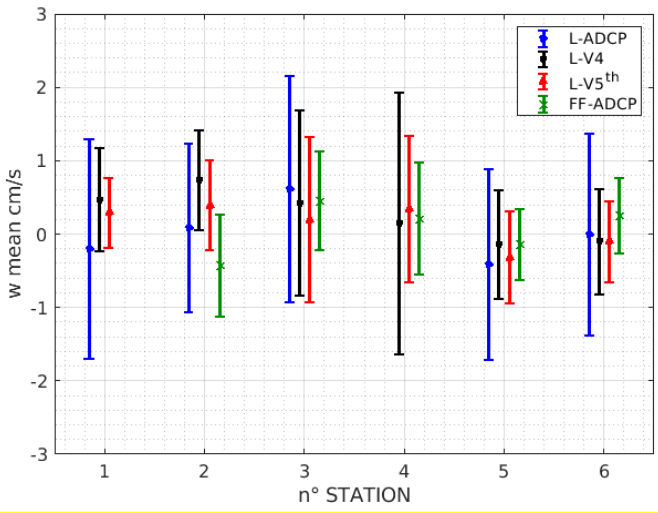
Downcasts data 0 – 150 m

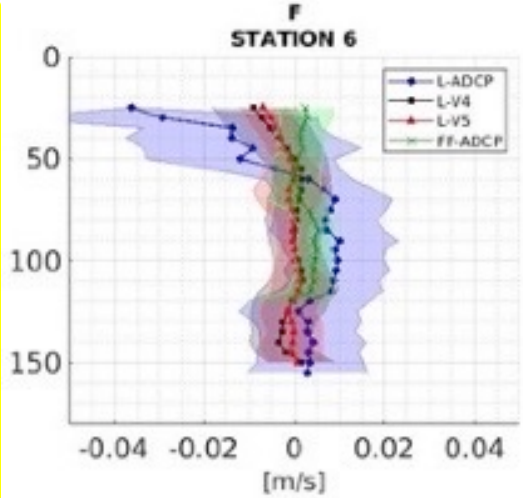
	μ ~ mm/s			
0.02	0.26	0.14	0.6	cm/s

	σ ~ cm/s			
1.3	1.0	0.7	0.6	cm/s

L-ADCP > L-V4 > L-V5 > FF-ADCP

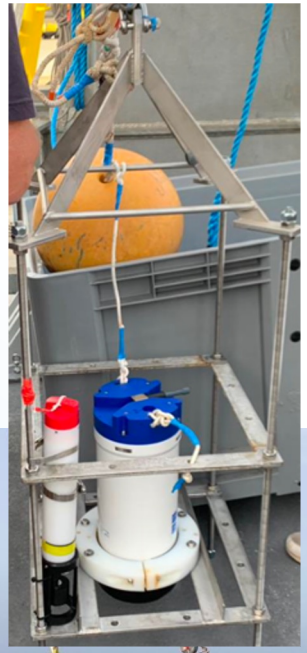
➔ best FF-Sentinel

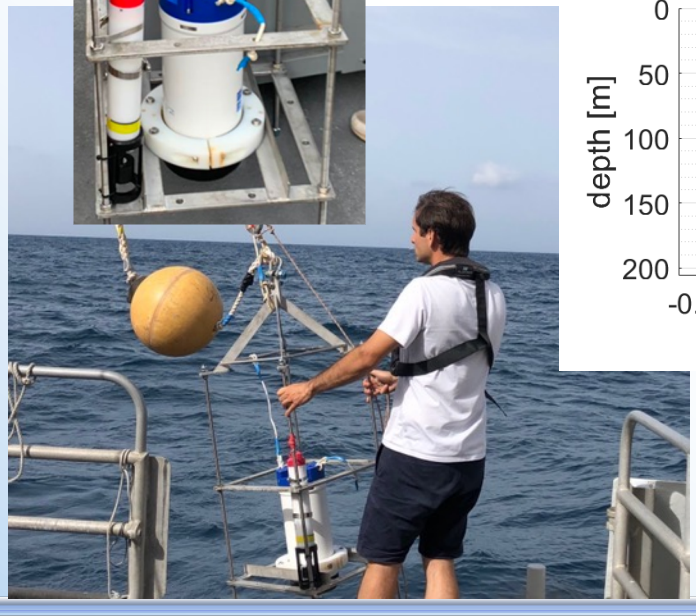


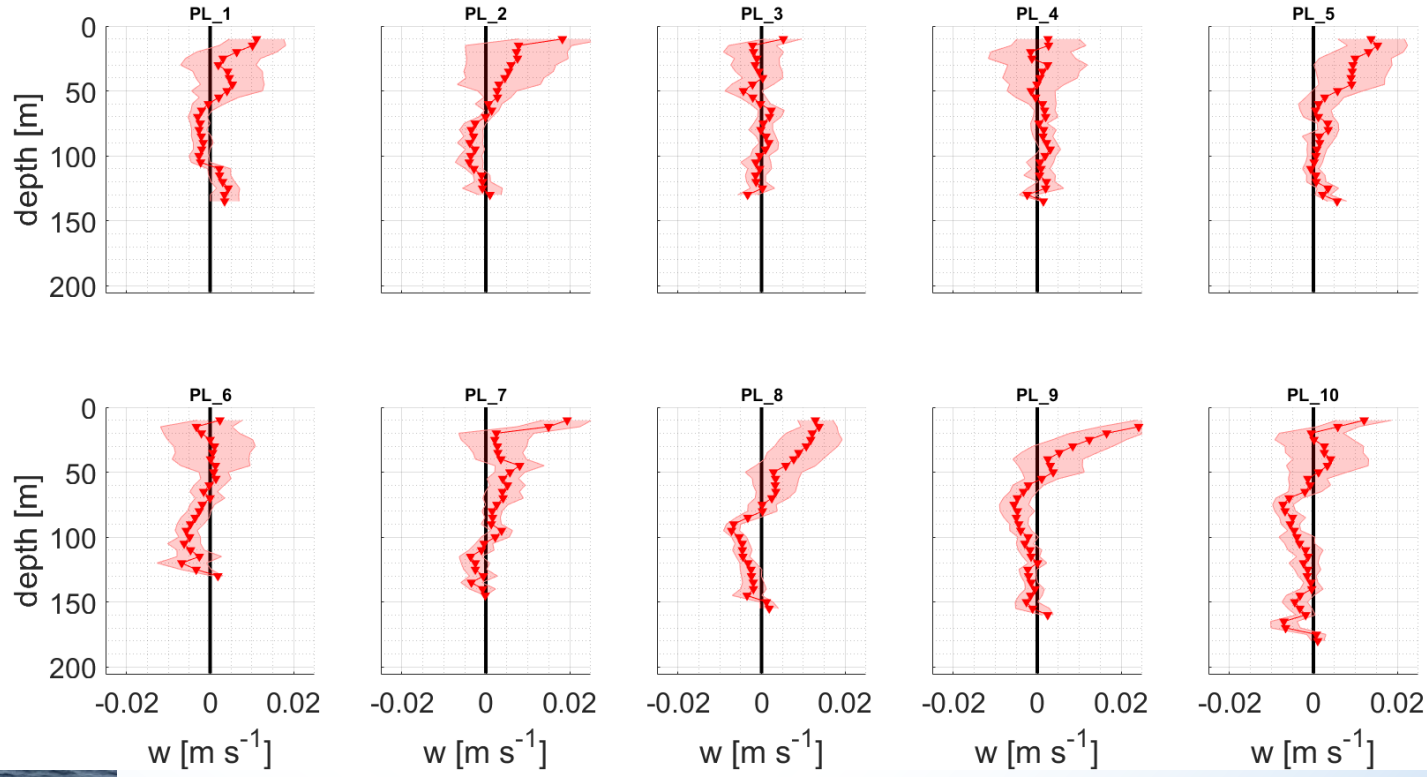


FF-ADCP avec Sentinel

VVPTest 2022 (Med)







Caroline Comby

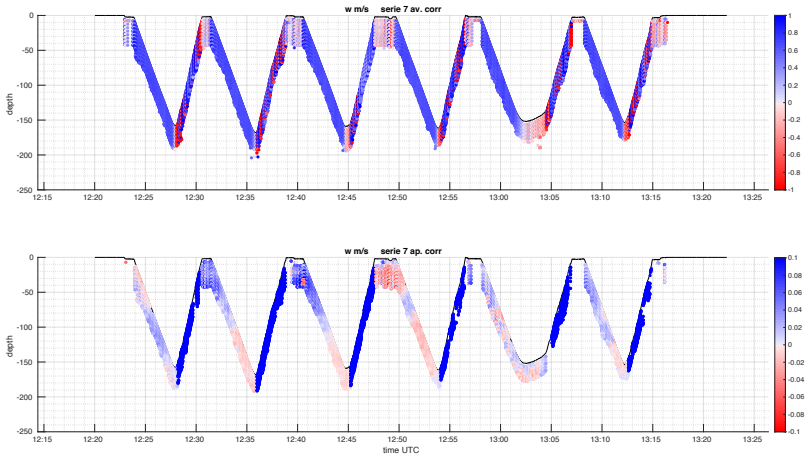
σ ≈ 3 mm/s

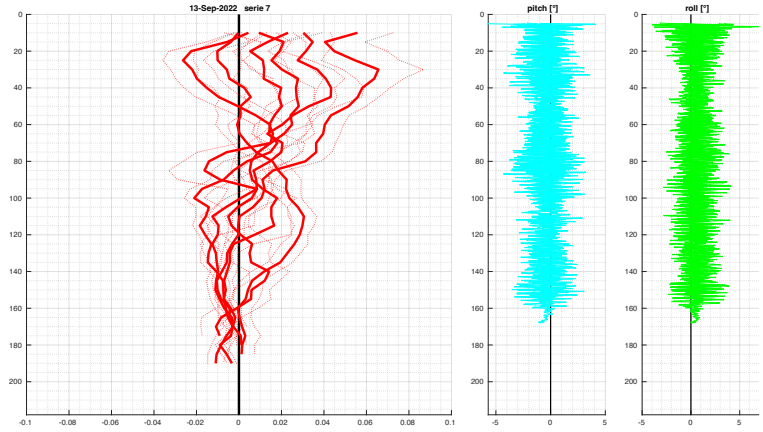
FF-ADCP avec Sentinel

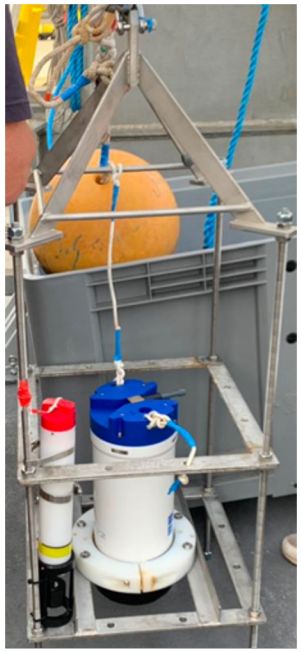
Gascogne 2022, ondes internes

Caroline Comby

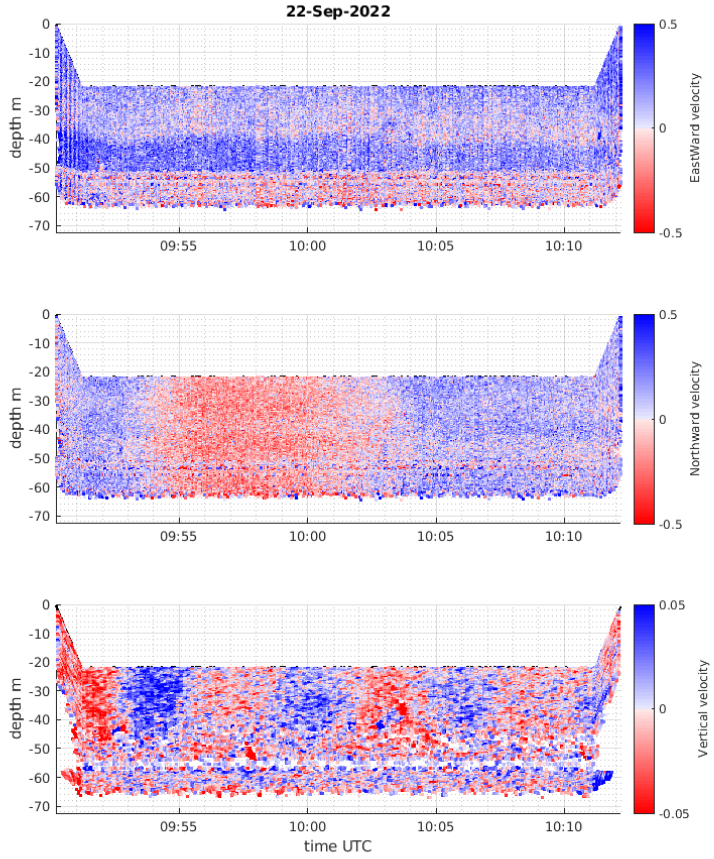
Profils







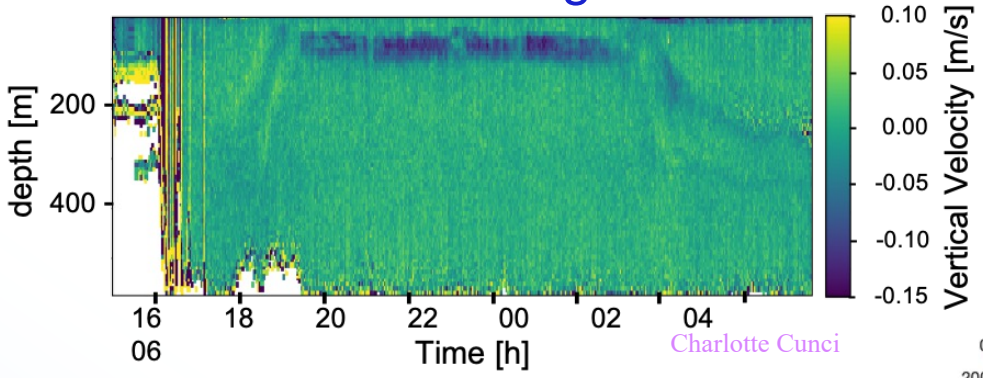
Profondeur fixe



→ Oscillations vitesses verticales ≠ horizontales

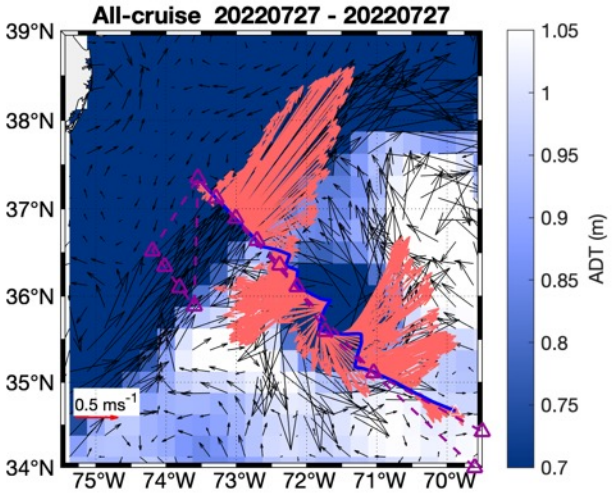
ADCP de coque

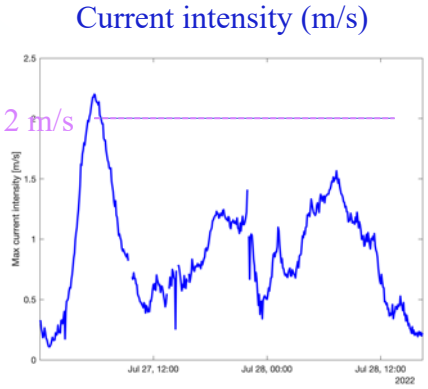
- Simple soustraction du mouvement vertical du bateau
  - FUMSECK: anomalies négatives la nuit → migration nycthémérale du krill

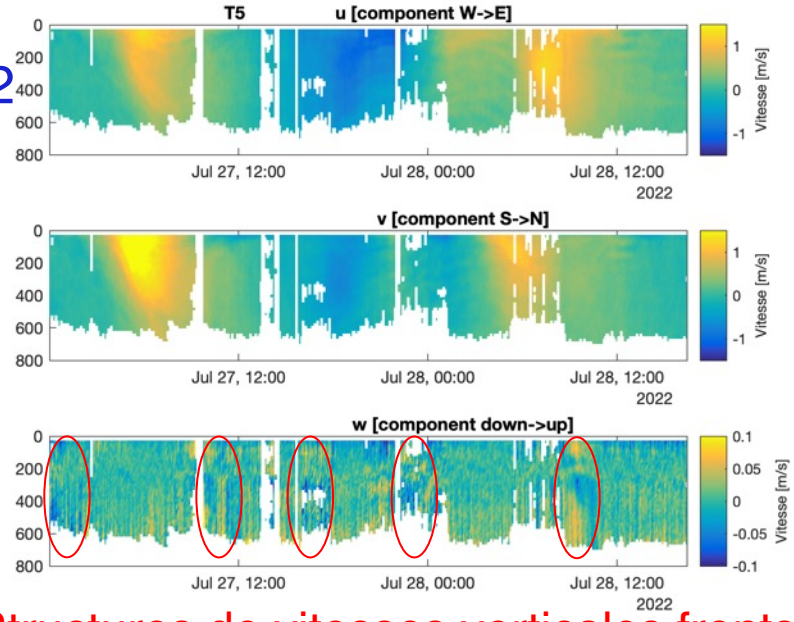


Charlotte Cunci

  - FIGURE (M. Benavides) Gulf Stream 2022







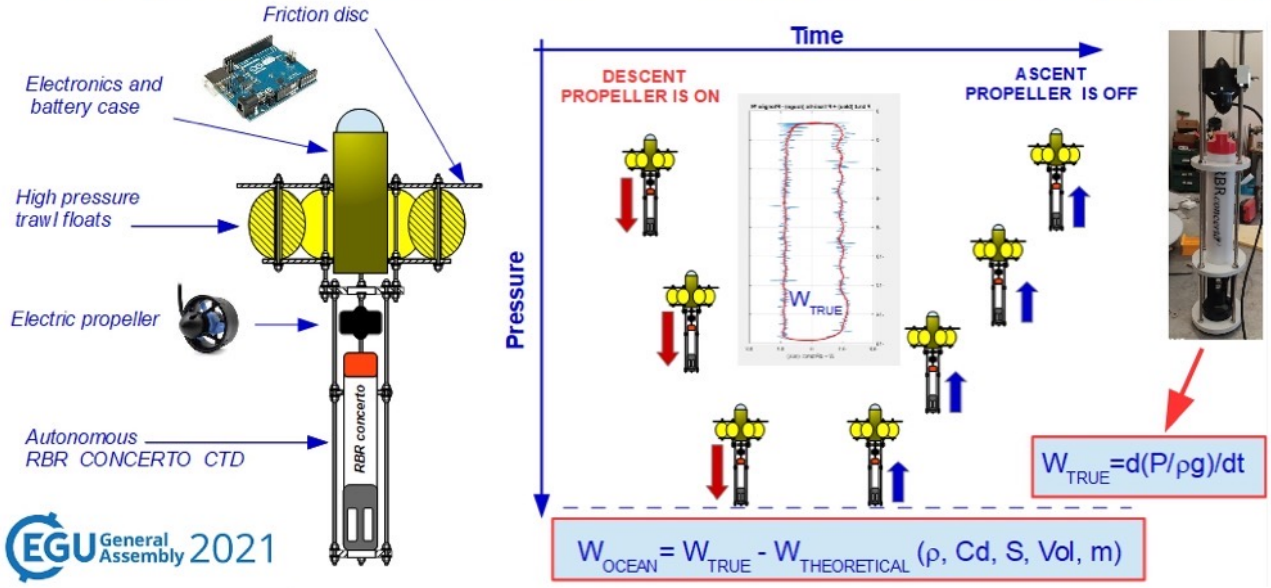
Structures de vitesses verticales fronts

Vertical Velocity Profiler (VVP)

VVP (Fuda *et al.*, EGU 2021): profiler autonome

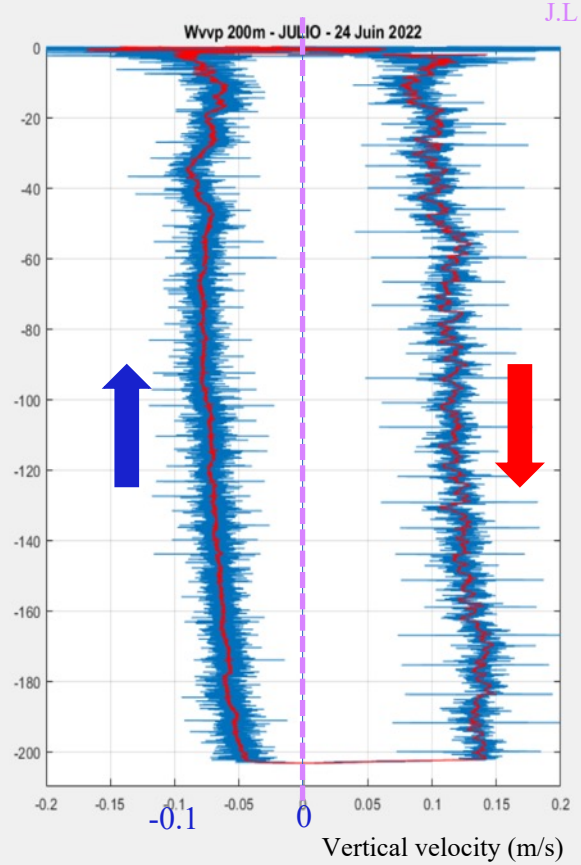
A new approach for measuring ocean vertical velocities

Fuda, J.-L[1]., Barrillon, S.[1], Doglioli, A[2]., Petrenko, A.[2], Gregori, G.[1], Tzortzis, R.[2], Comby, C.[2], Thyssen, M.[1], Lafont, M.[2], Bhairy, N.[1], Malengros, D.[1], Guillemain, D.[1], and Grenz, C.[1]*



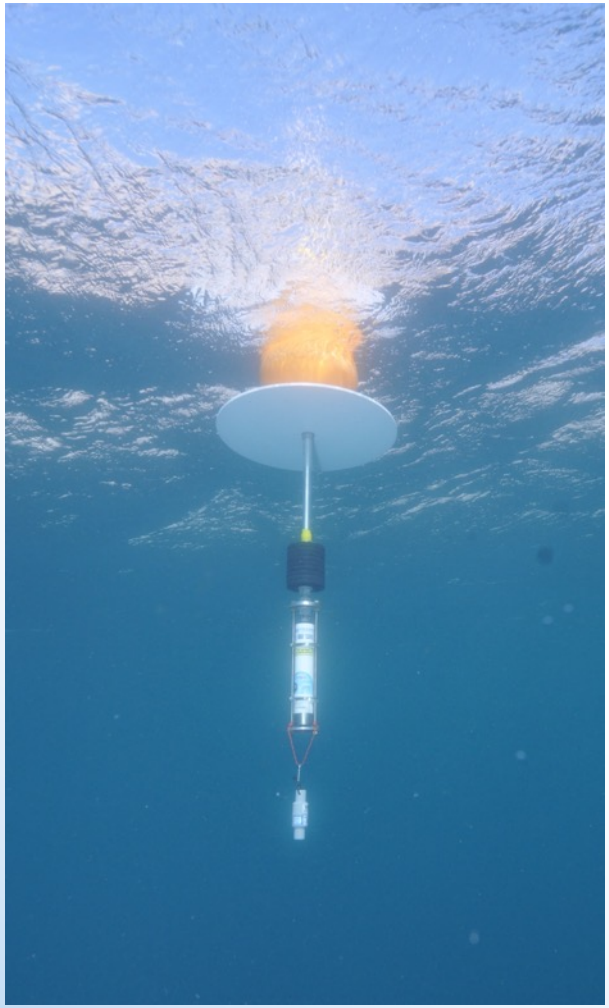
Premier 200 m profil (2022)

J.L Fuda

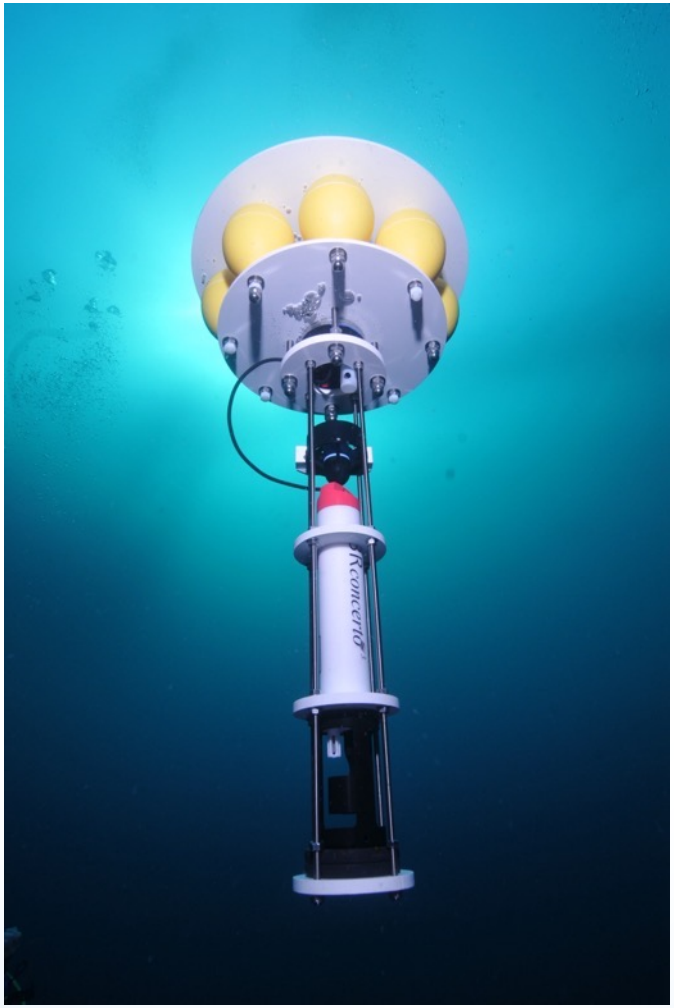


Vertical Velocity Profiler (VVP)

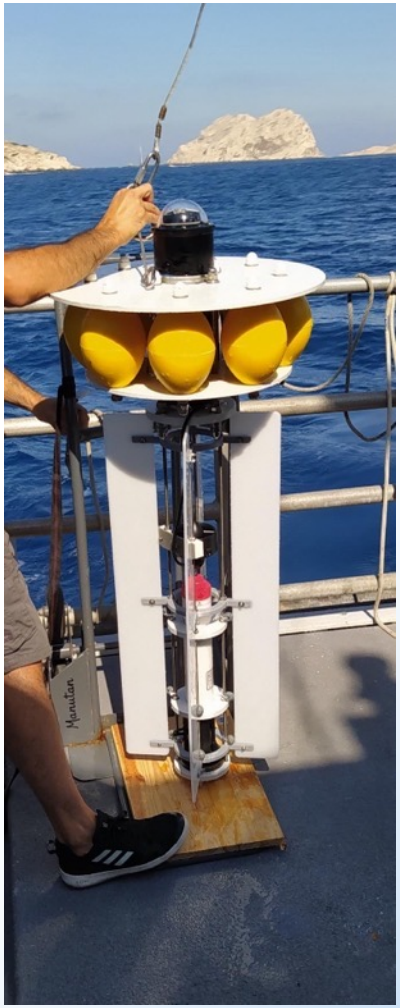
2019



2021



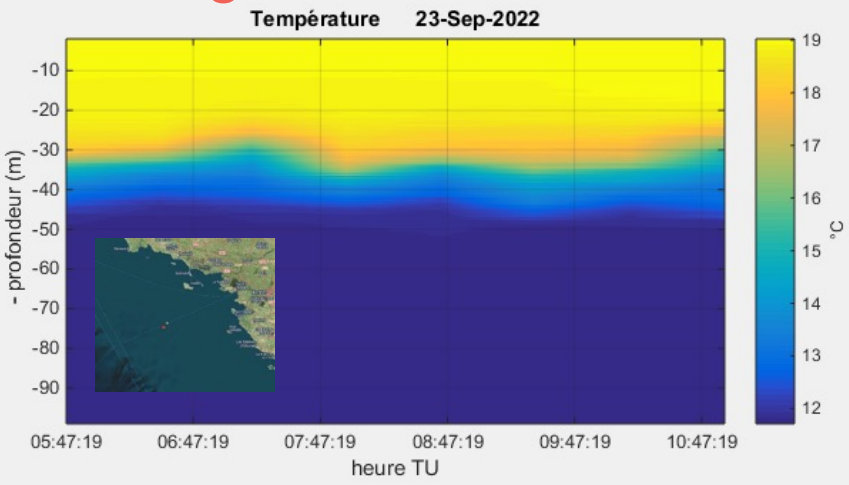
2022

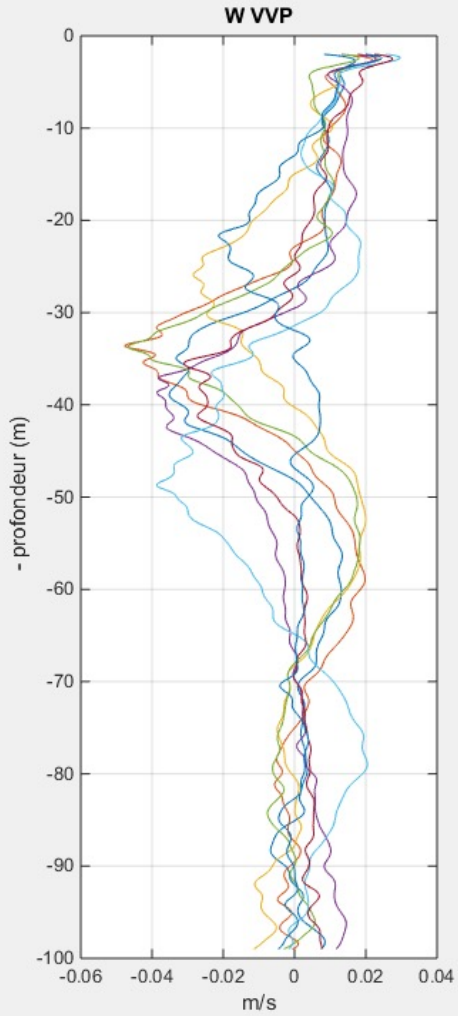


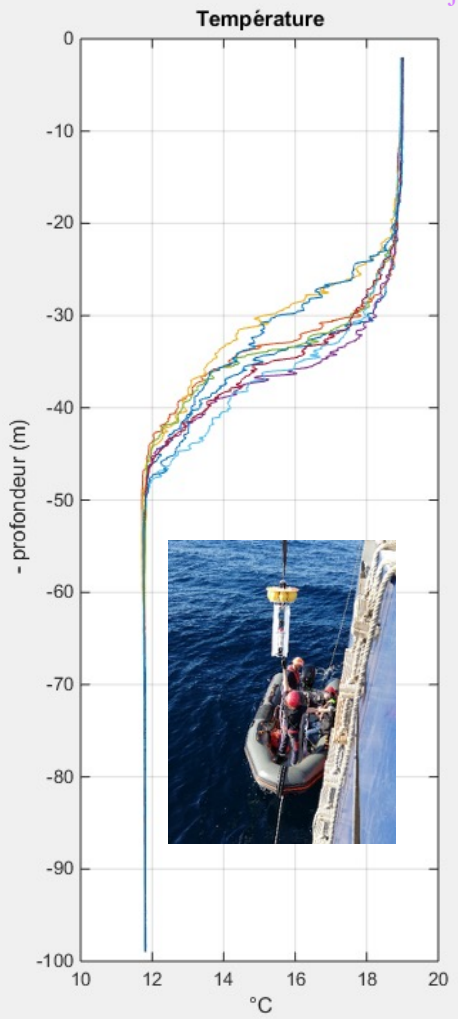
Vertical Velocity Profiler (VVP)

Gascogne 2022, ondes internes

J.L Fuda



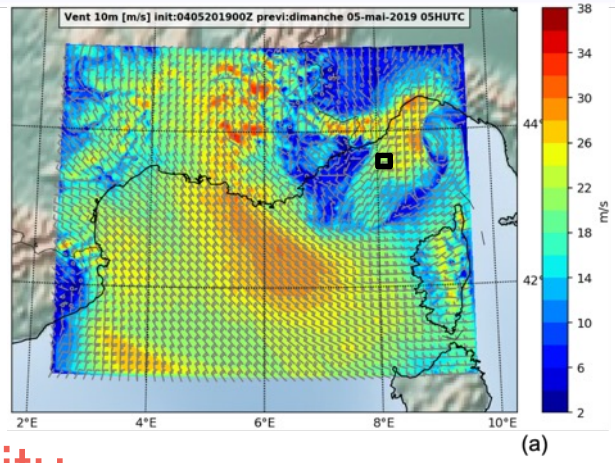


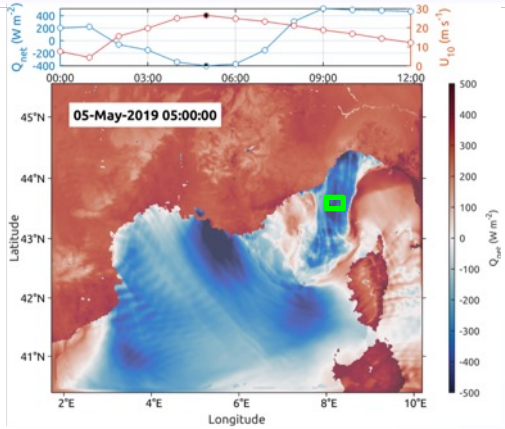


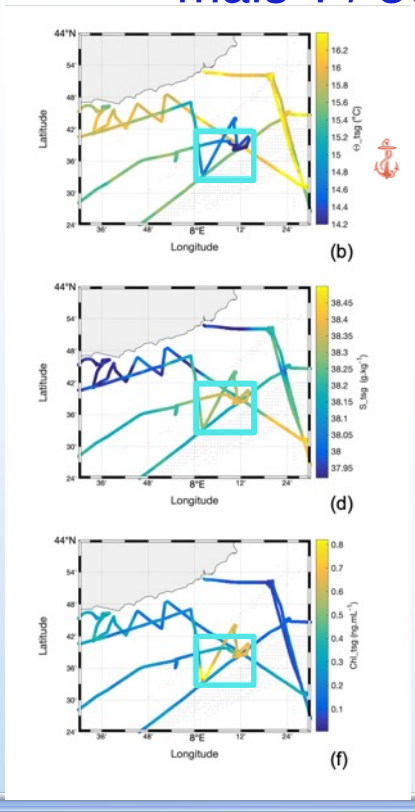
Tempête FUMSECK

Barrillon *et al.* , 2023

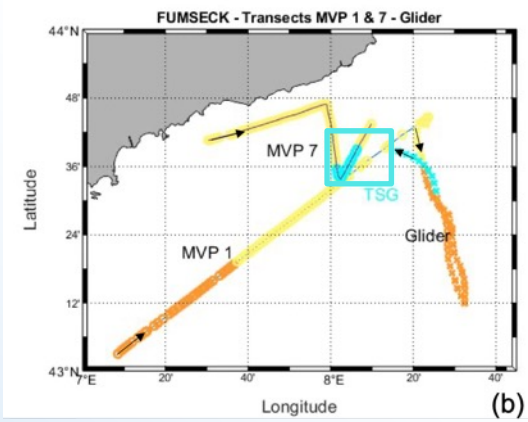
- Tempête intense
  - Vents atteignant 130 km/h
  - @Toulon : 1 / 2 ans
    mais 1 / 30 ans en mai

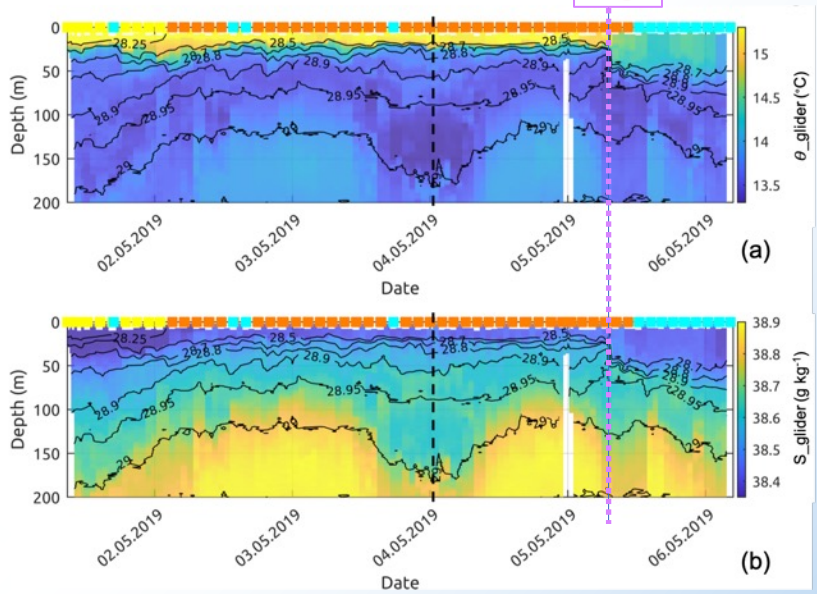






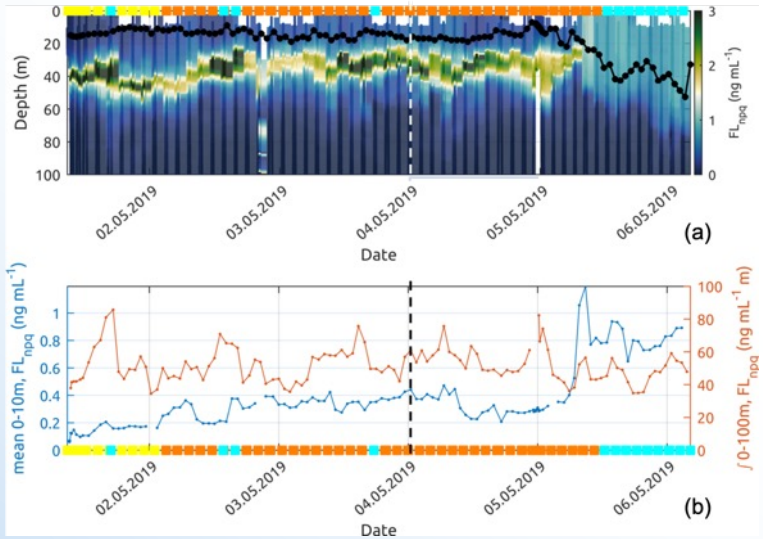
- Mesures in situ
  - masse d'eau froide vue par TSG et Glider

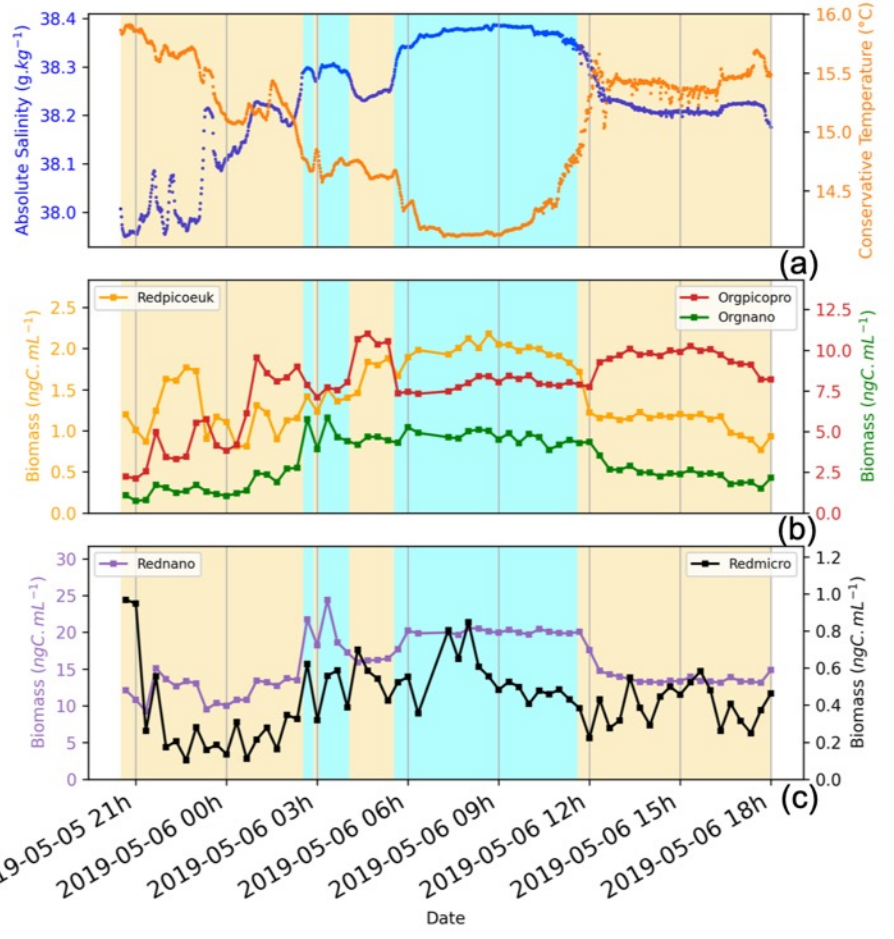




Tempête FUMSECK

- Mesures couplées phys/bio
  - Masse d'eau provenant de 60m
  - Approfondissement couche mélange
  - Dilution DCM par mélange
  - ↗Chla et nutriments surface
  - ↗biomasse (sauf orgpicopro)



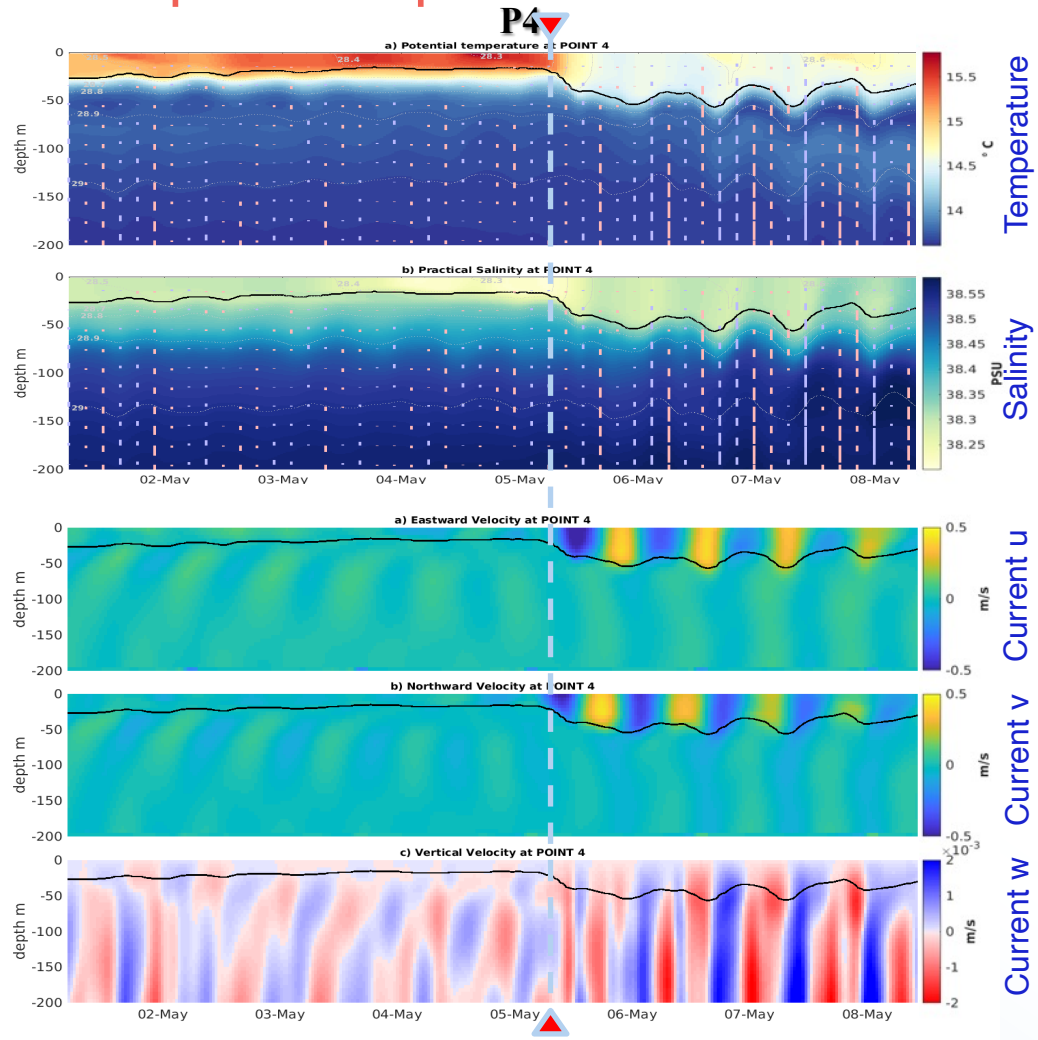


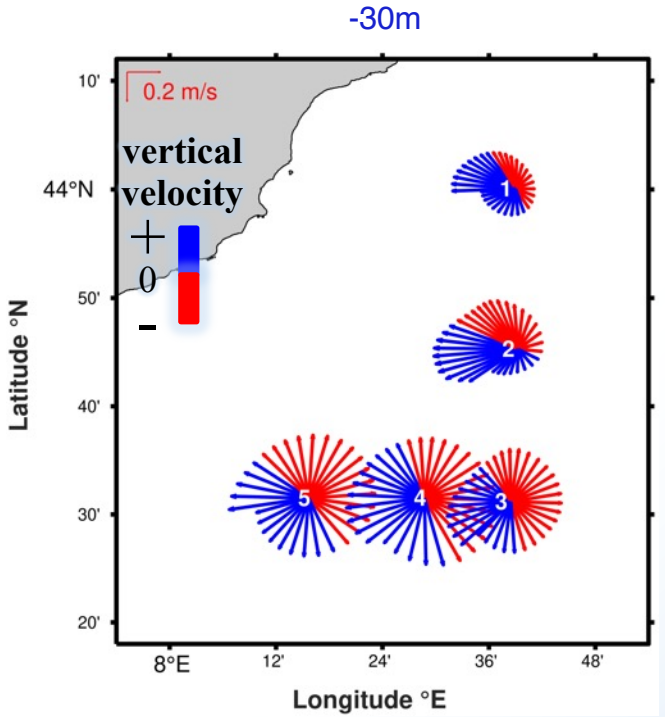
Symphonie Modelisation

Impact tempête FUMSECK

Comby *et al., en préparation*

Caroline Comby

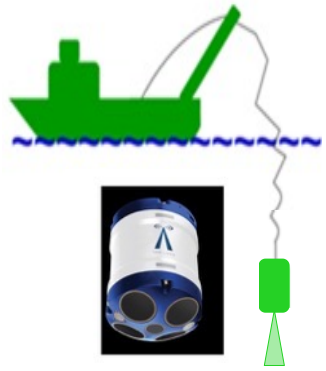




- Approfondissement couche melange
- Intensification courant (horizontal et vertical)
- Ondes quasi-inertielles

Conclusions et perspectives

- Totalité des données FUMSECK exploitées
  - Vitesses verticales → Comby et al. 2022
  - Couplage phys/bio → Barrillon et al. 2023
  - Modélisation → Comby et al. en préparation
  - Conférences, réseaux sociaux, médias …



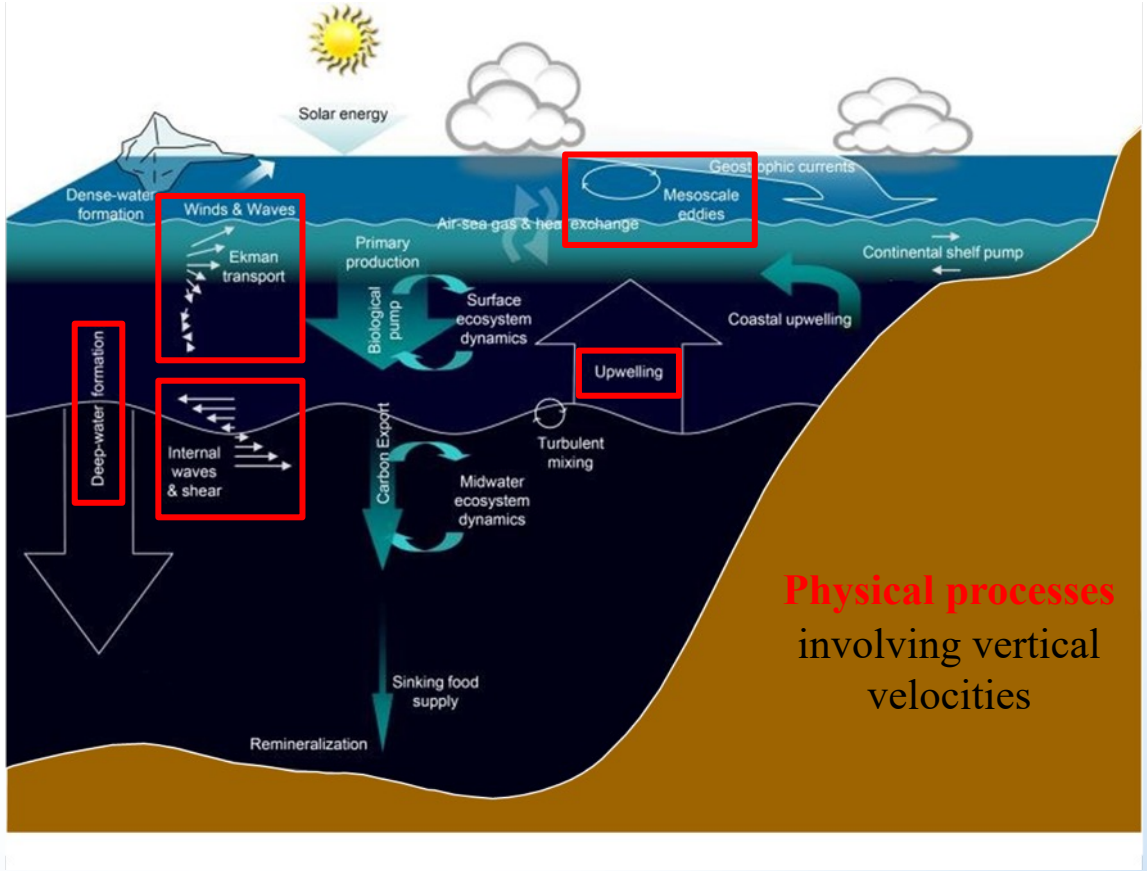
- Vitesses verticales
  - Projet LEFE FUMSECK-vv 2021-2023 *(S. Barrillon, A. Petrenko)*
    → instruments vitesses verticales
  - Campagne BioSWOT-Med *(A. Doglioli, G. Grégori)*
    → vitesses verticales et fines échelles
  - Projet SeaLab AMIDEX 2023 - 2026 *(P. Le Gal)* → labo / in situ
  - Projet HOPE-vv AMIDEX (*A. Petrenko*, en attente)
    → vitesses verticales et pompe à carbone
  - Projet ANR PRME VV-MIMOSA (*S. Barrillon*, en attente phase 2)
    → multi-plateforme


VV-MIMOSA

Oceanic Vertical Velocities

Why ?

- Many oceanic processes: **physical** and **biogeochemical**
- **Key** for fine understanding of
  - **ocean dynamics** (meso and submeso scales)
  - **vertical exchanges** (carbon sequestration, nutrients to surface)
- In situ measurement lacking : **challenge**
  - very low intensities
  - ephemeral nature



Oceanic Vertical Velocities

Why ?

- Many oceanic processes: **physical** and **biogeochemical**
- **Key** for fine understanding of
  - **ocean dynamics** (meso and submeso scales)
  - **vertical exchanges** (carbon sequestration, nutrients to surface)
- In situ measurement lacking : **challenge**
  - very low intensities
  - ephemeral nature