

Title : Adaptive observing strategies for fine scale biophysical interactions

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Abbreviated abstract: Numerical simulations and satellite observations highlight the role played by finescale on structuring the phytoplankton community. Physical and biological in situ measurements are necessary, although they remain challenging due to the high spatio-temporal frequency.

Satellite-based adaptive and Lagrangian strategies coupled with a high-resolution physical-biological sampling help in identifying, following and sampling finescale structures of interest.

Results from past cruises highlight the physical and biological coupling at finescale and pave the way to the future BIOSWOT-Med cruise planned for 2023 in the southwestern Mediterranean Sea under the future SWOT satellite tracks.

Related publications:

Comby et al. (2022). [10.1175/JTECH-D-21-0180.1](https://doi.org/10.1175/JTECH-D-21-0180.1)

Tzortzis et al (2021). [10.5194/bg-18-6455-2021](https://doi.org/10.5194/bg-18-6455-2021)

Messié et al (2020). [10.1029/2019GL085282](https://doi.org/10.1029/2019GL085282).

Rousselet et al (2019). [10.1029/2018JC014392](https://doi.org/10.1029/2018JC014392).

The **“Paradox of the Plankton”** (Hutchinson 1961):

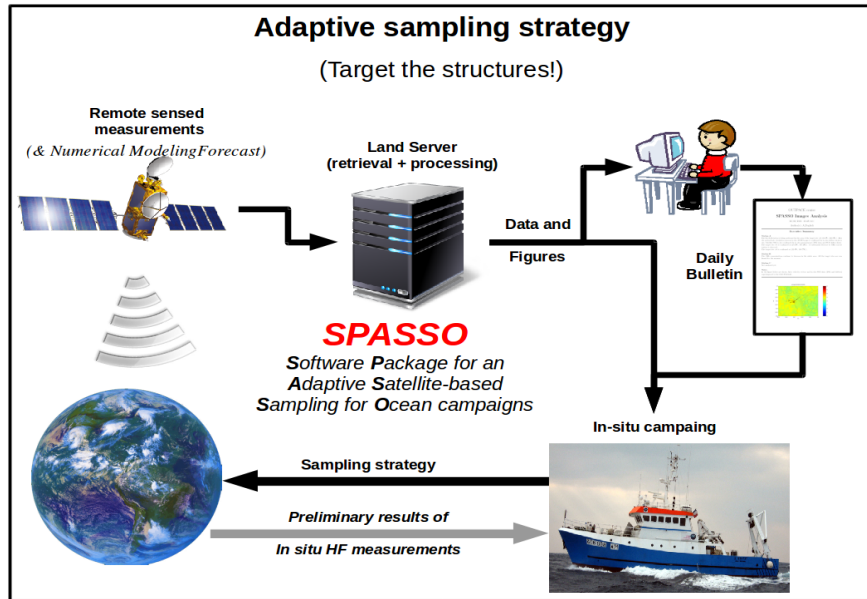
How a limited range of resources can support an unexpectedly wide range of plankton species ?

A possible explanation :

the fine-scale dynamics generate a constantly changing environmental conditions.

In situ measurements at submesoscale : a big challenge due to the ephemeral character of these structures

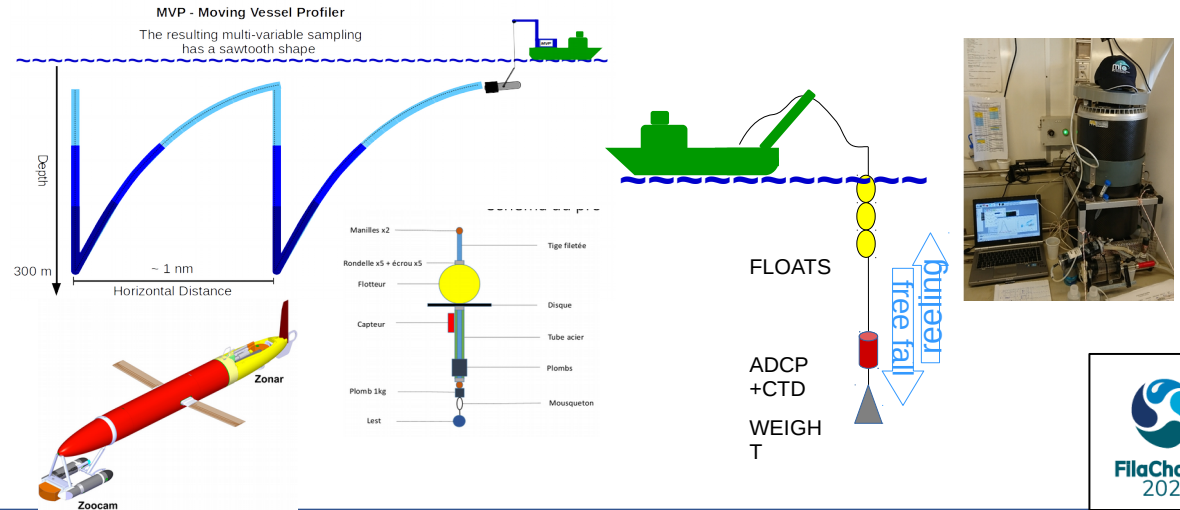
Exploit the satellite NRT data to guide the in-situ sampling



Our approach :

Innovative multidisciplinary instrumentation :

Towed vehicles, gliders, AUV, drifters & floats, FFADCP, VVP, Cytometry, zooplankton and omics



Results from previous campaigns OSCAHR'15, OUTPACE '15, PROTEVSMED_SWOT'18, FUMSECK'19

Satellite-based adaptive and Lagrangian strategies proved to be successful to target and follow fine-scale structures in situ.

When paired with *in situ* high-frequency biological measurements (e.g. automated cytometry) these strategies highlight the important role of the fine scales in structuring the phytoplankton community by acting as fluid dynamical barriers and biodiversity hot-spots.

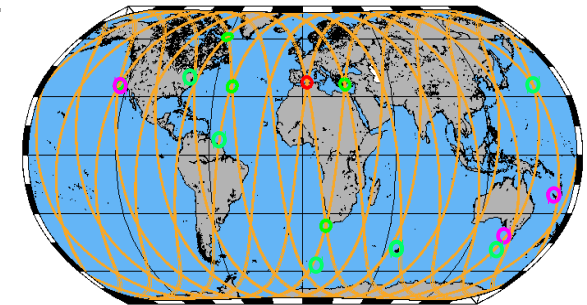
Innovative methodologies are in development to directly measure in situ the vertical velocity and to increase the geochemical and biological sampling.

Outlook for the next campaign BIOSWOT-Med 2023



To perform a cruise in the oligotrophic and moderately energetic SW Med :

- i) sampling fine-scale dynamics,
- ii) measuring nutrient concentrations at nanomolar-precision,
- iii) performing high-resolution cytometry,
- iv) estimating accurately the zooplankton grazing.



Suggestions for the discussion

main recent key advancements :

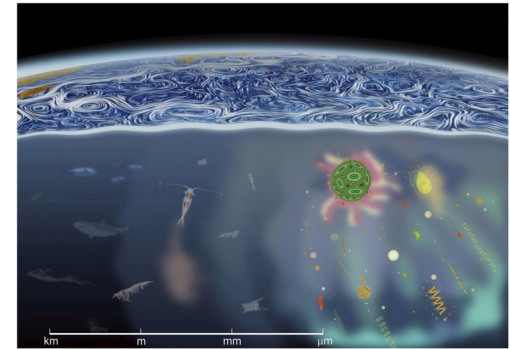
Lagrangian multidisciplinary strategies, high-frequency biological sampling.

incoming opportunities :

SWOT mission providing altimetry-derived high-resolution surface currents.

future possible outstanding knowledge locks :

Climate-scale variability of the physical-biological coupled dynamics at the fine-scale



From Basterretxea et al., 2020

