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Long-term fluctuations (1979–2008) of the phytoplankton dynamics in the Bay of Calvi (Corsica, NW Mediterranean): response to climate change

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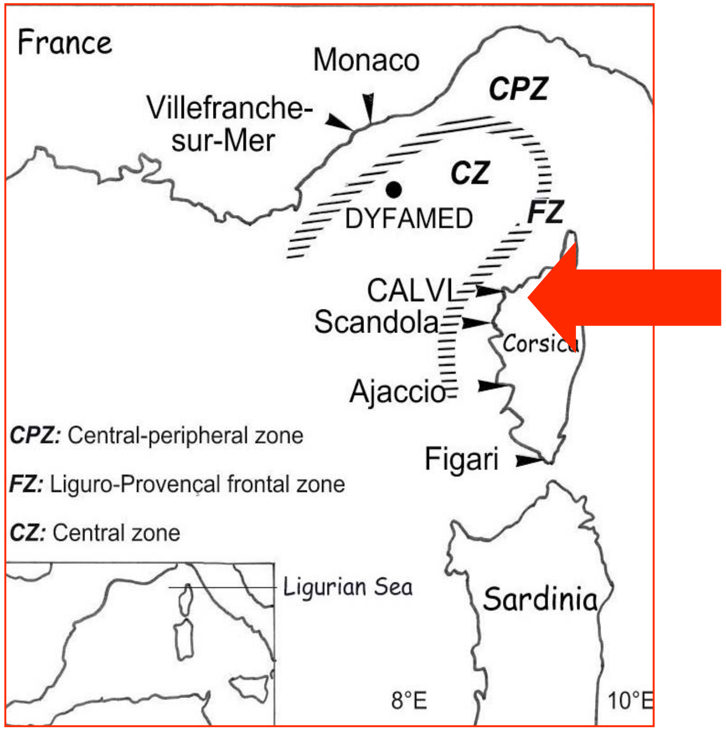
Long-term fluctuations (1979–2008) of the phytoplankton dynamics in the Bay of Calvi (Corsica, NW Mediterranean): response to climate change



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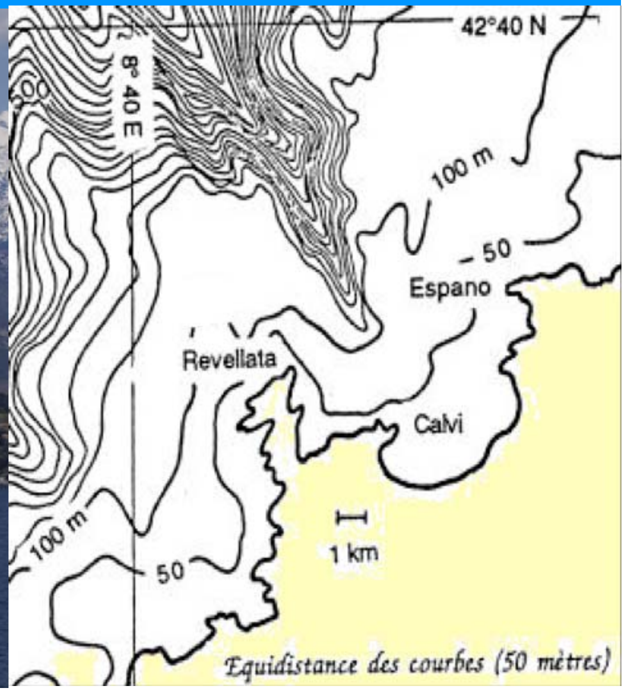
The characteristics of the Bay of Calvi

- Open bay
- Narrow shelf
- Oligotrophic characteristics
- Few anthropogenic forcing
- Reference area for the EU Water Framework Directive



ULg's marine and oceanographic research station

- Basic sampling
- Long-term series (since 1979)

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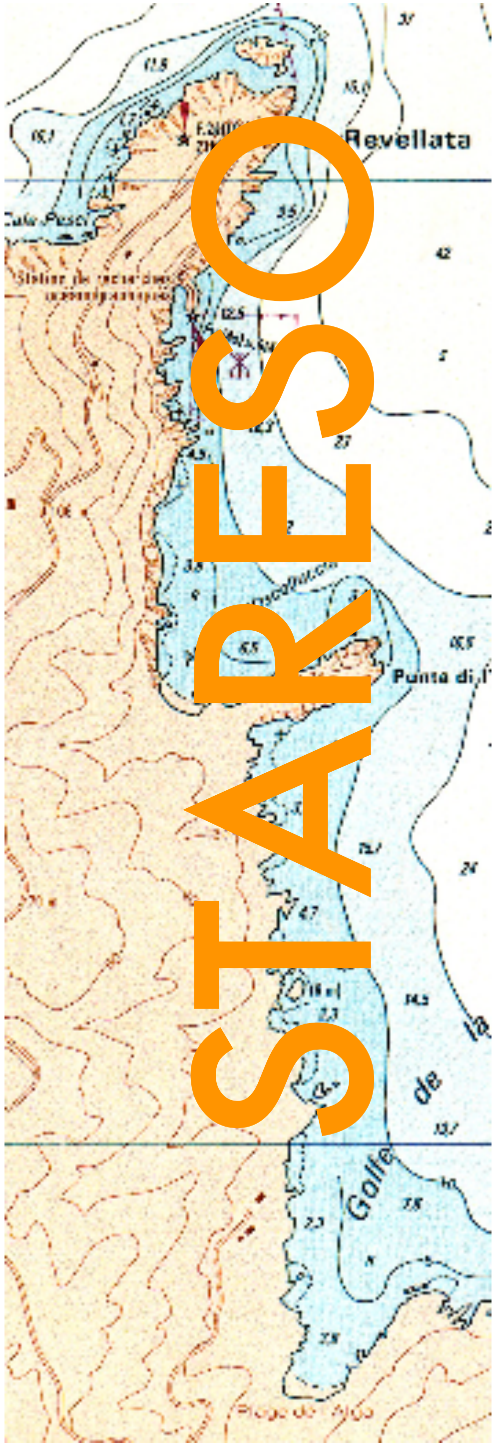

Time-series data

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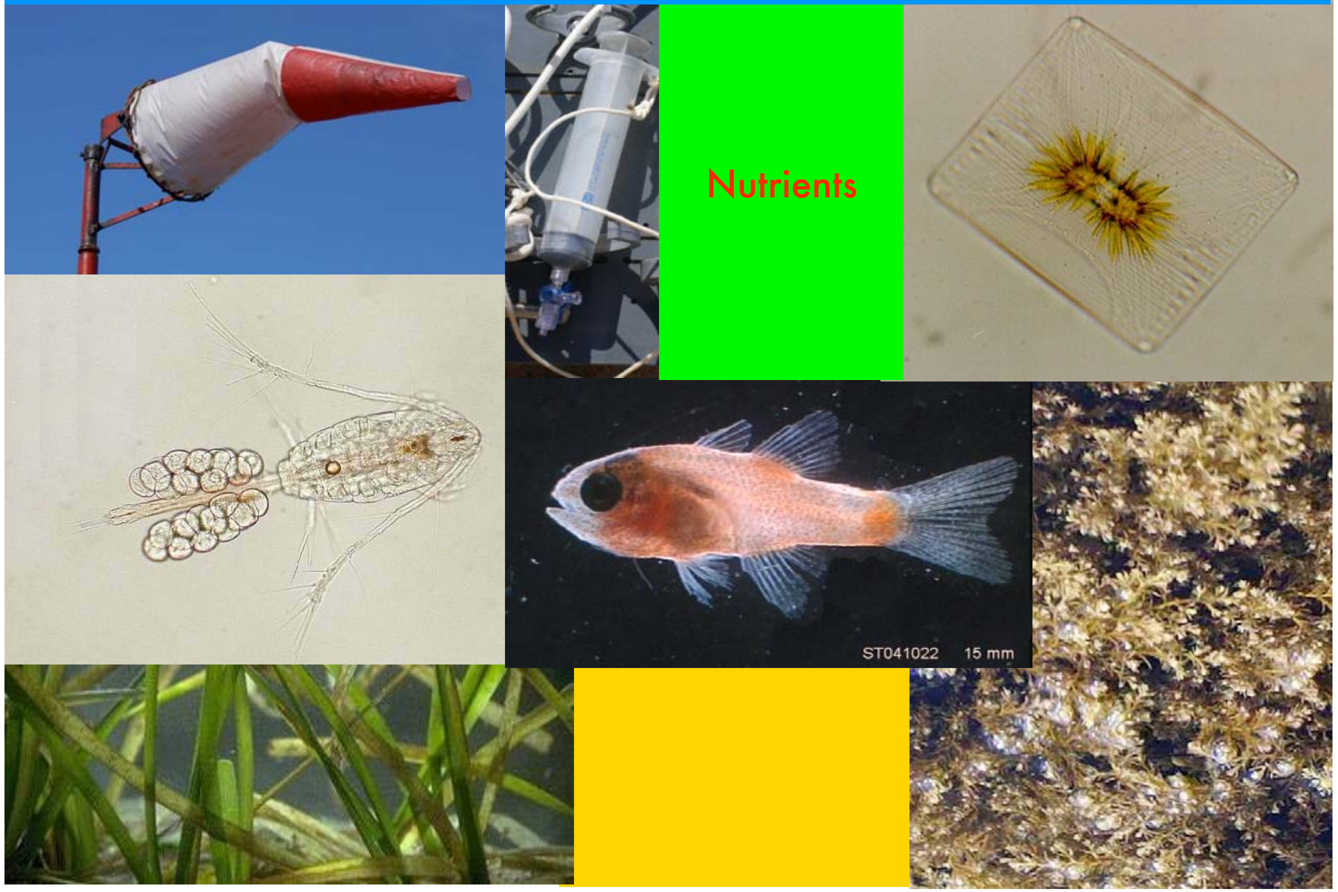

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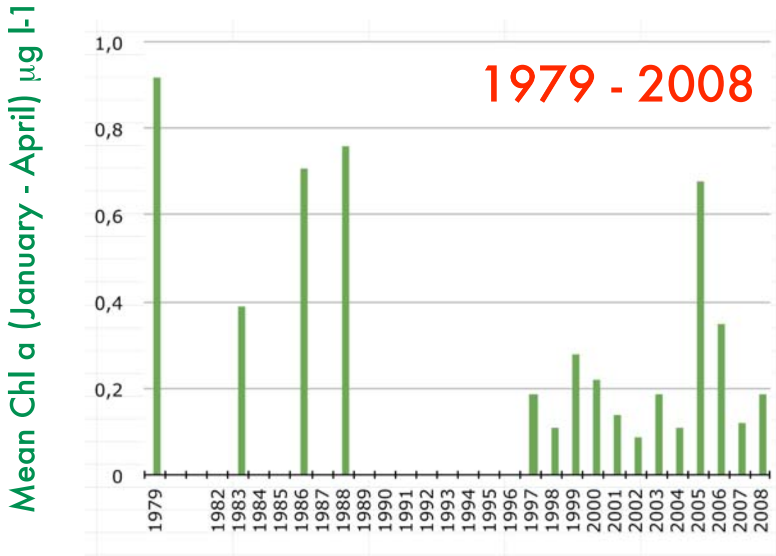
Objective

The aim is to examine the interannual variability of the winter-spring phytoplankton bloom in the Bay of Calvi and its control by physical forcing and climate variation

Mean interannual variations of the winter - spring Chl a concentration in the Bay of Calvi (January - April, subsurface, 1979 - 2008)



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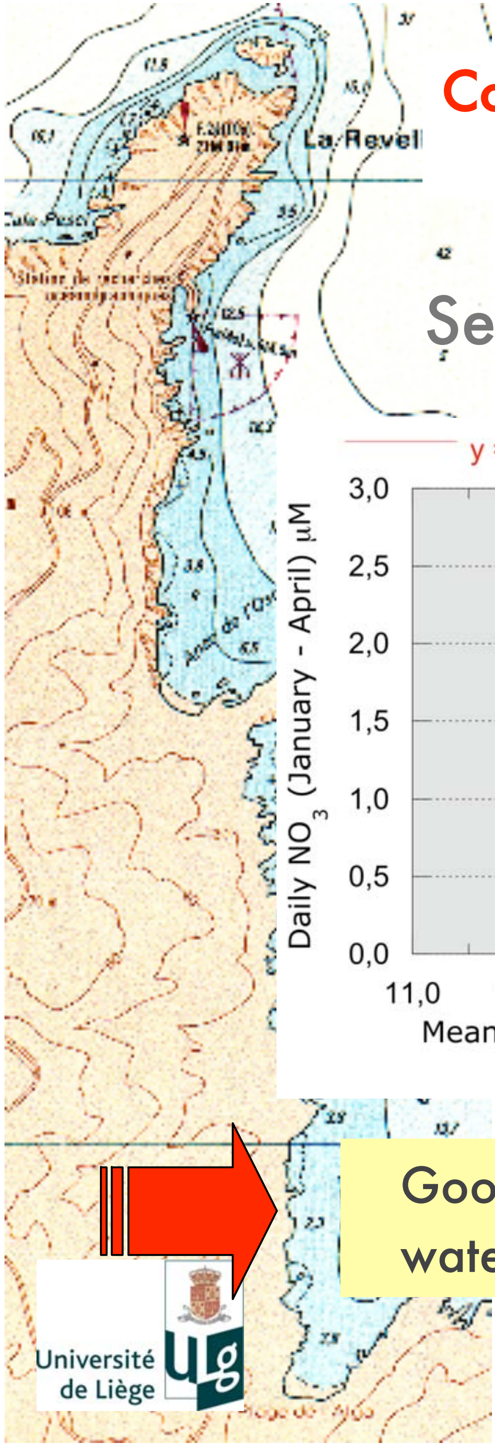
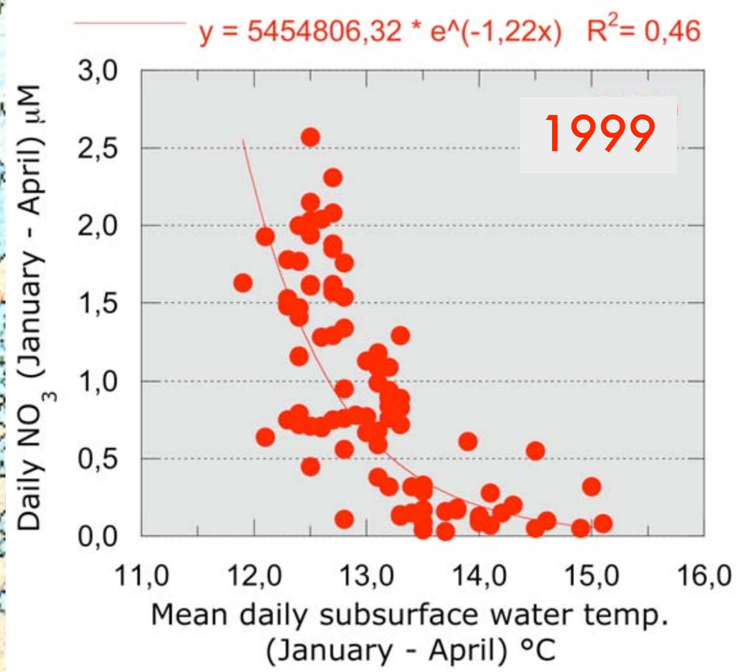
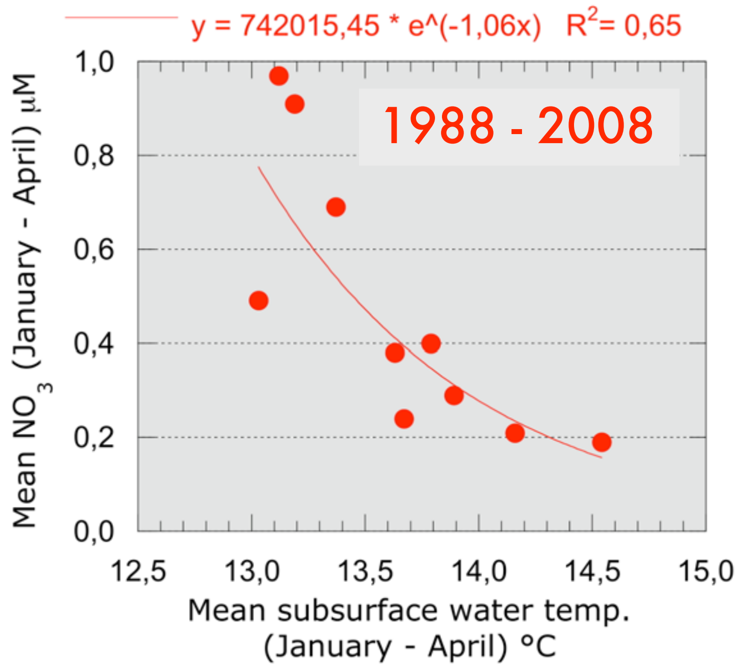


Correlation between upwelling of nutrient-rich water and subsurface temperature

Seasonal evolution



Interannual evolution



Good correlation between nutrient concentrations and subsurface water temperature for the winter-spring period

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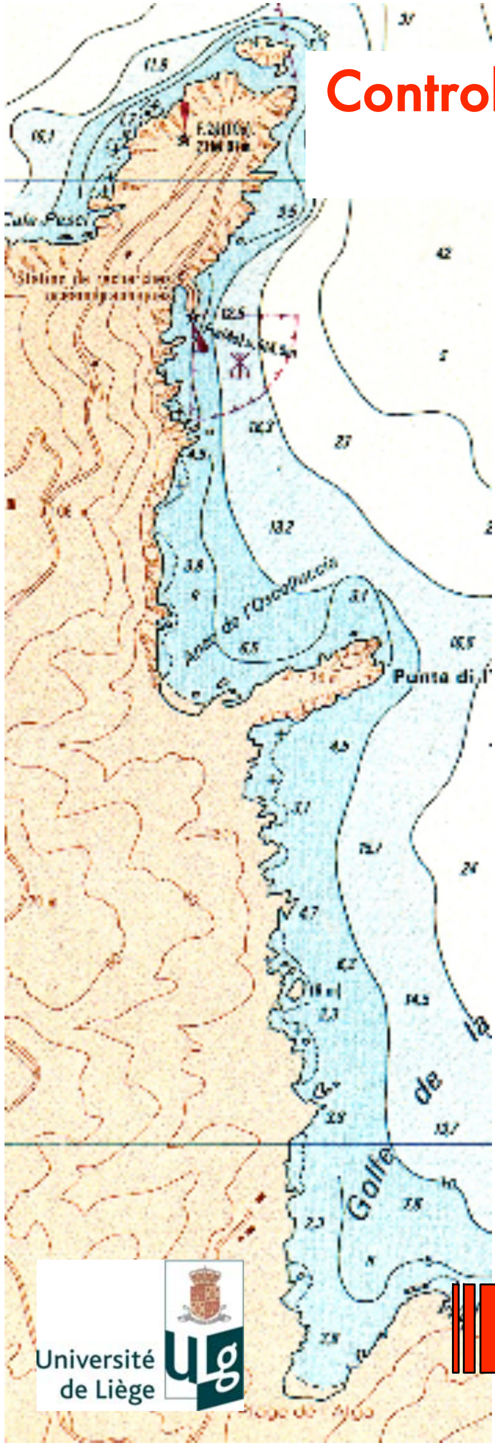
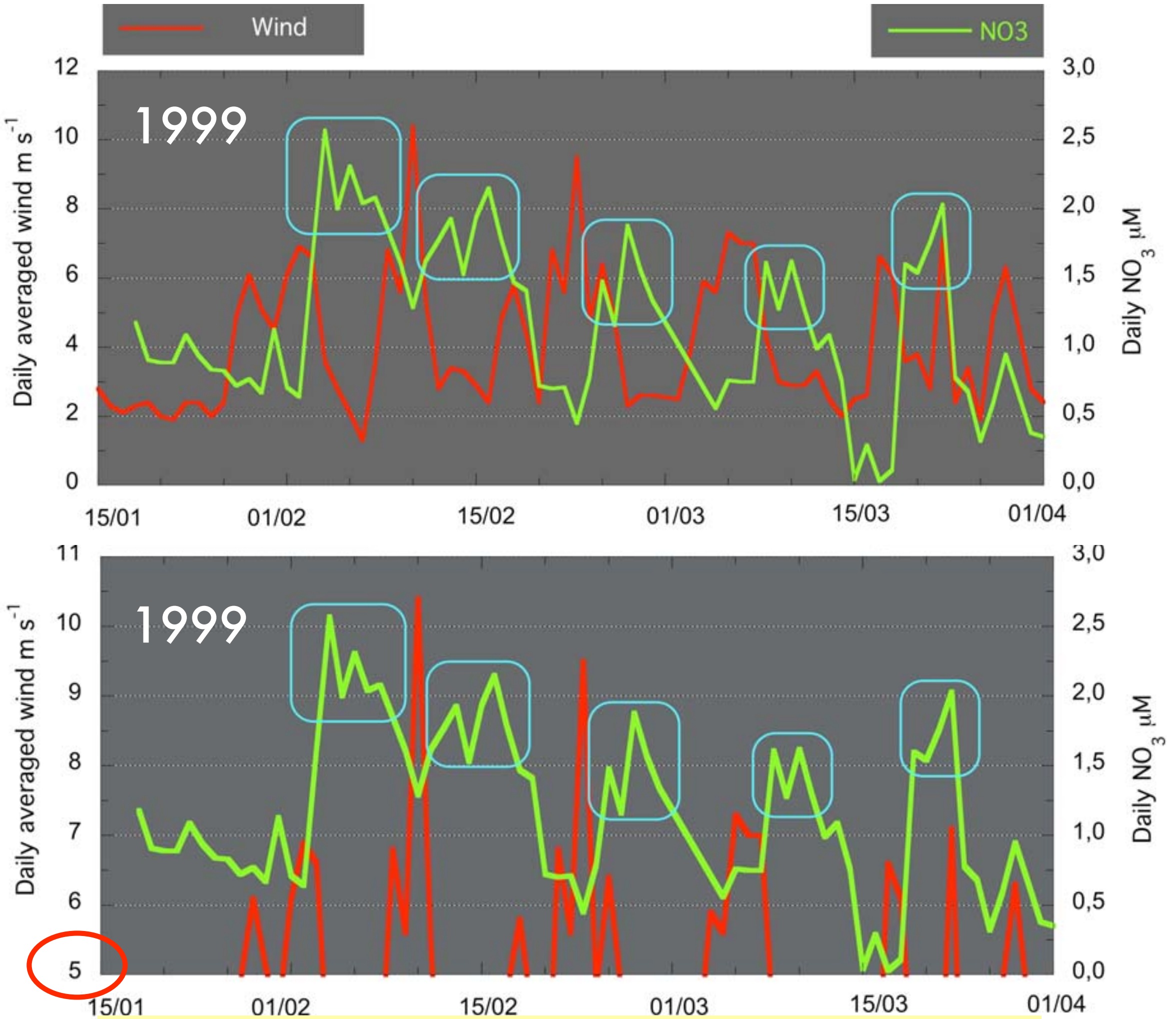
Control of surface nutrient enrichment by winter vertical mixing due to wind stress





Strong control of surface nutrient enrichment by wind > 5 m s^{-1}

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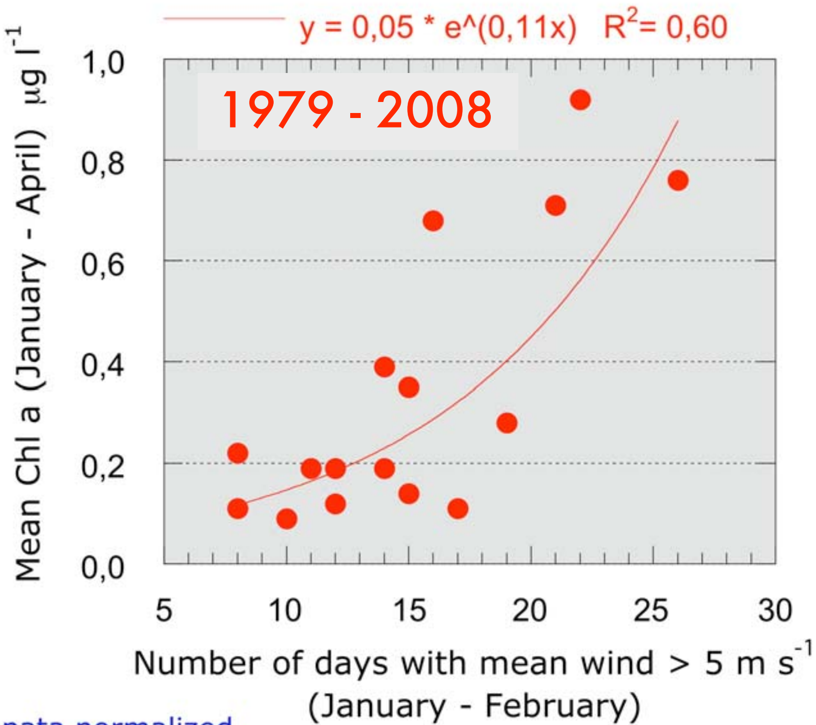
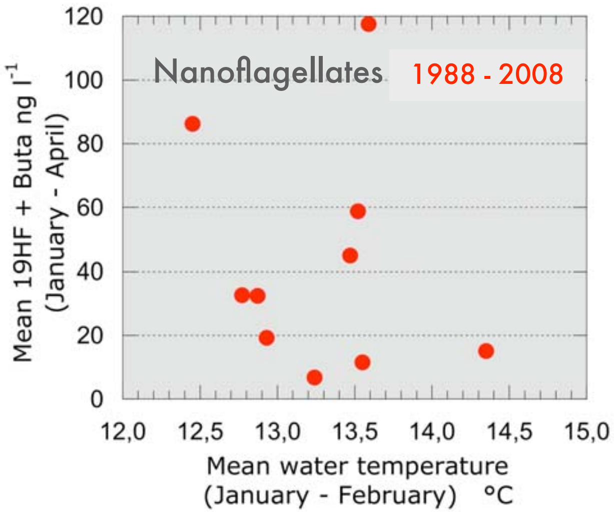
Mechanisms responsible for phytoplankton biomass changes ?



Zapata normalized

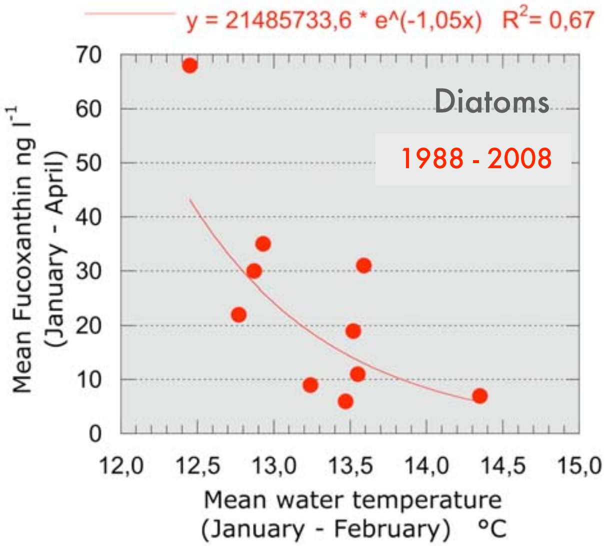
Control of phytoplankton production by wind forcing and subsequent nutrient enrichment

Shift in the winter-spring phytoplankton composition ?

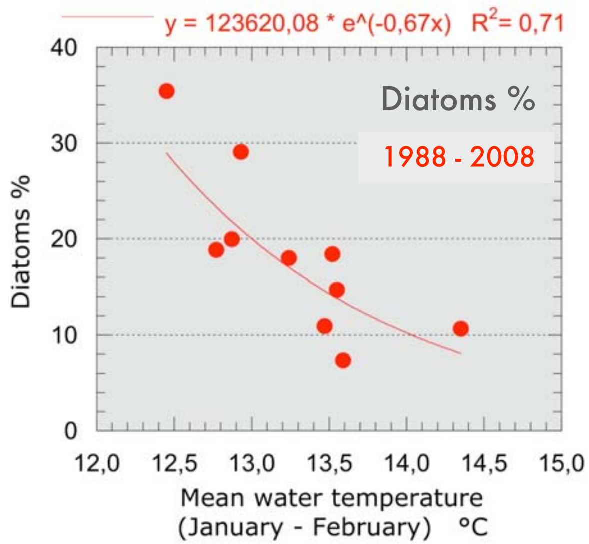


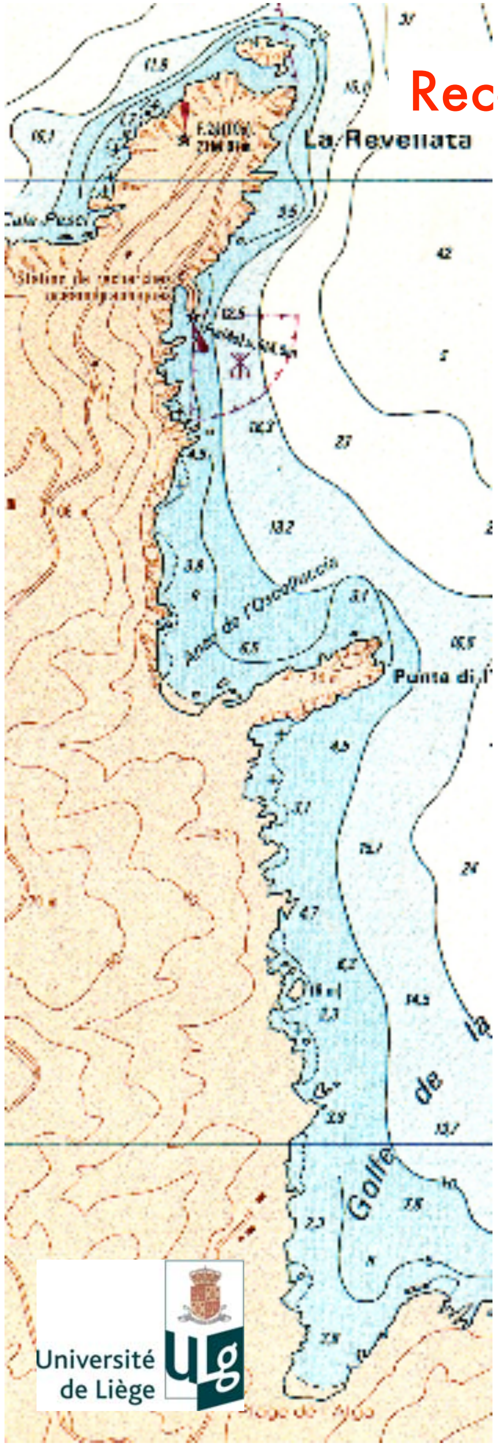
Zapata normalized

Control of diatom abundance by water temperature



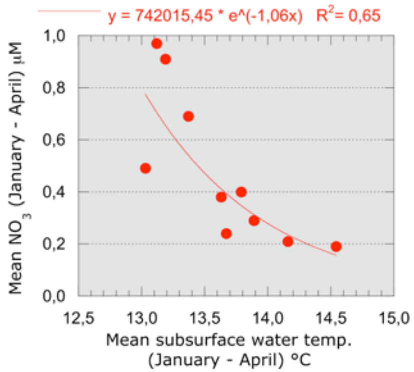
Zapata normalized

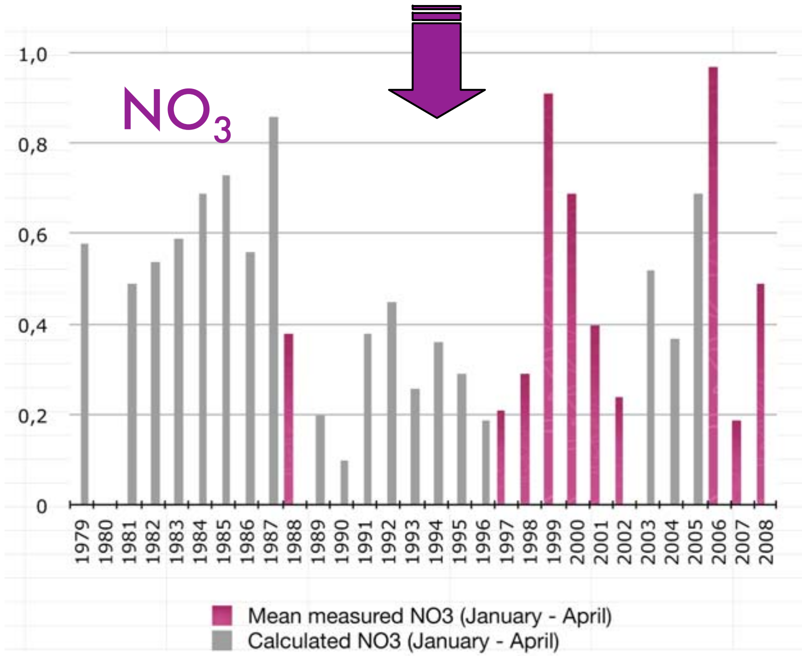


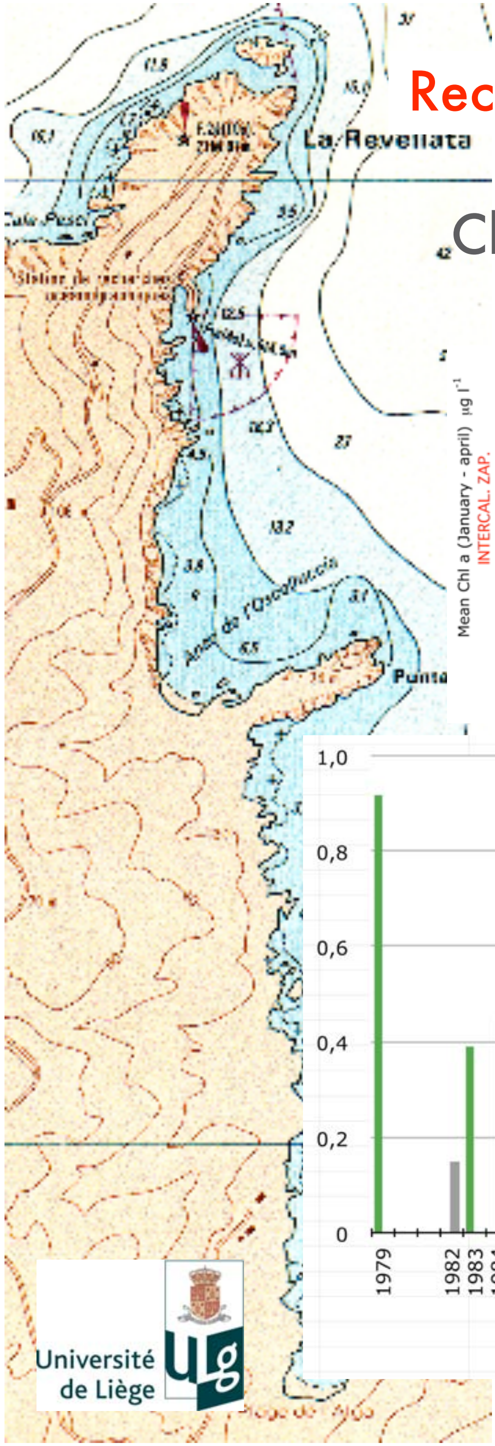


Reconstruction of missing nutrient and phytoplankton data

NO_3 / Water temperature

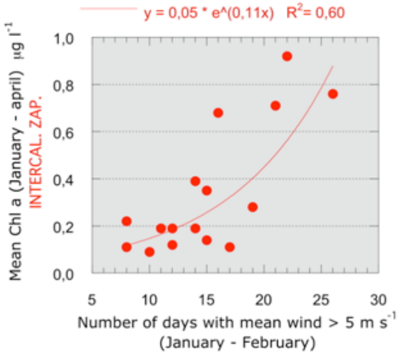




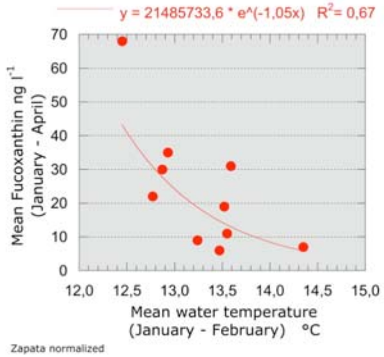


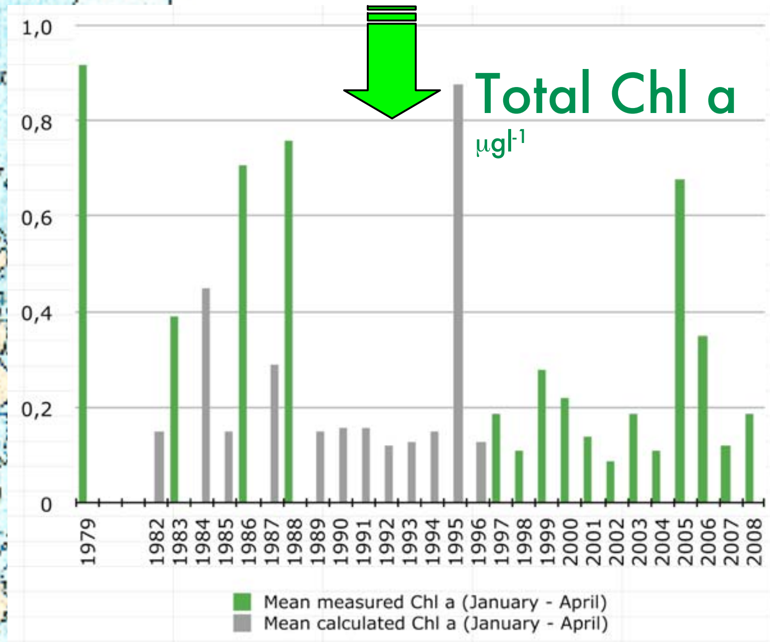
Reconstruction of missing nutrient and phytoplankton data

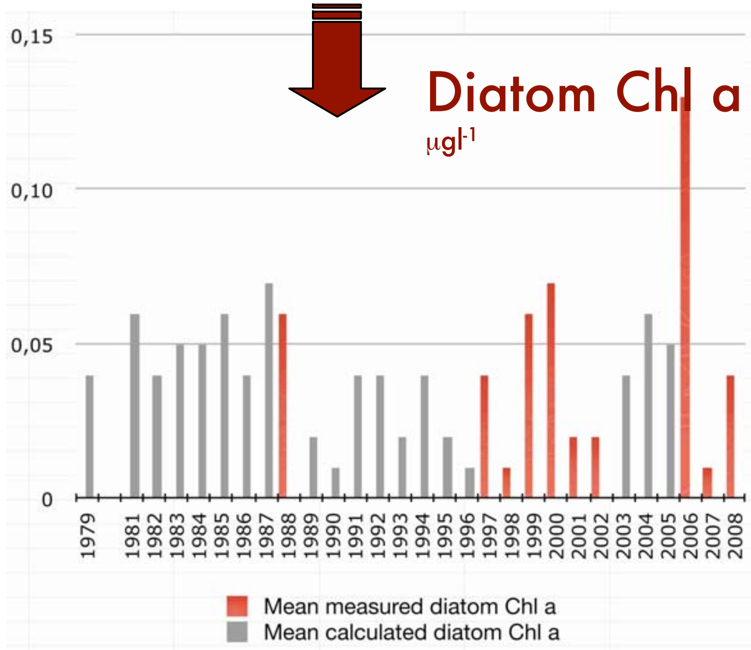
Chl a / Wind stress



Fucoxanthin / Water temp.







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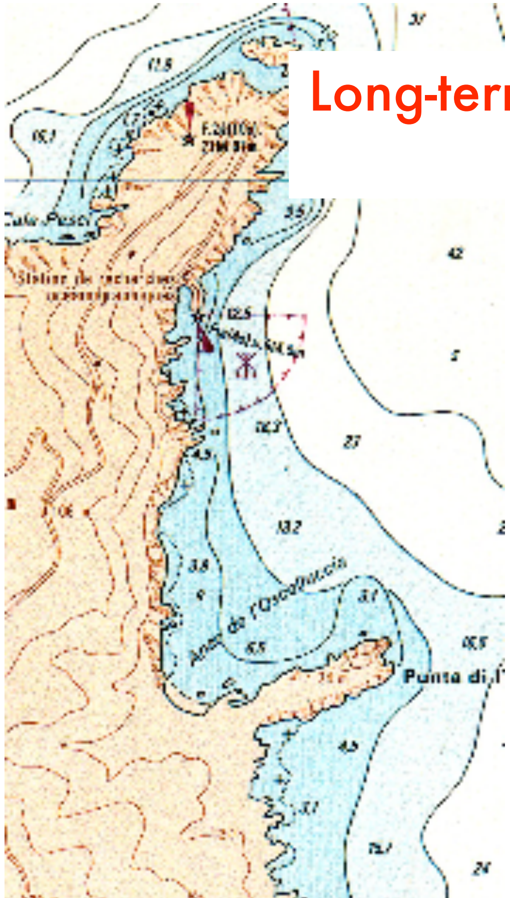
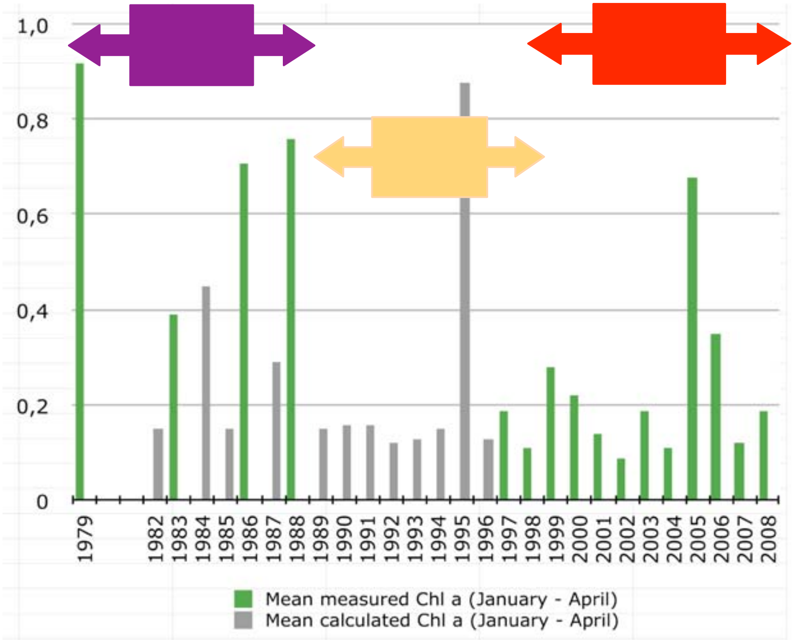
Long-term evolution of nutrient and phytoplankton parameters (January - April)





Total Chl a

$\mu g l^{-1}$

1979-1988: high nutrients, high Chl a, moderate diatom contribution, herbivorous food web

1989-1998: low nutrients, generally low Chl a, very low diatom abundance, changes in the zooplankton communities, increase of thermophilic species, ...

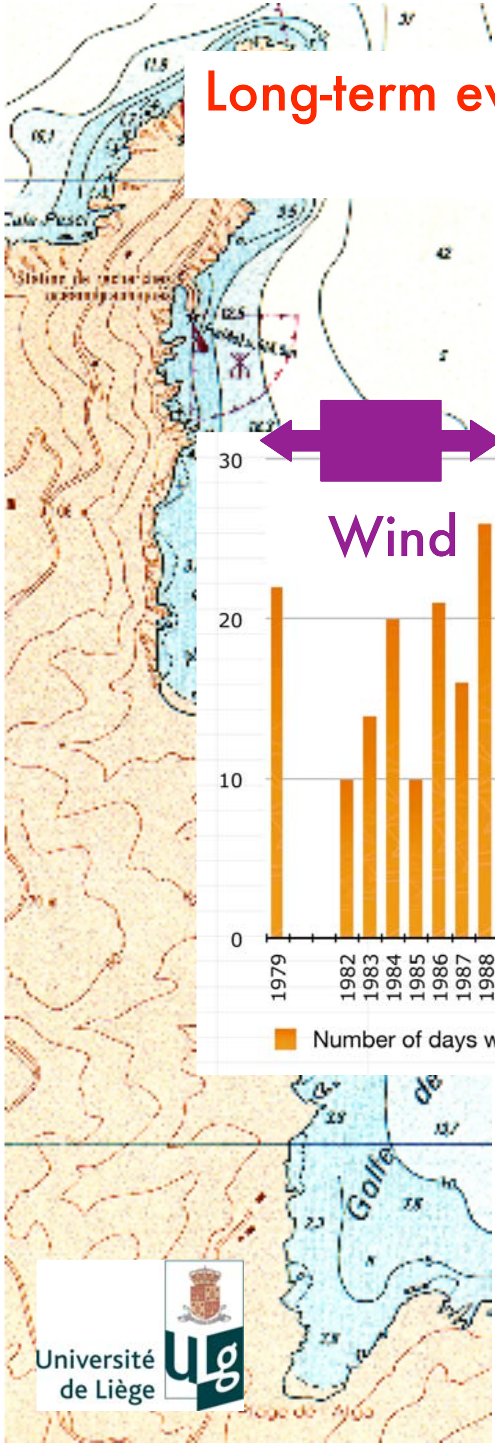
1999-2008: variable nutrients, Chl a and diatom contribution, invasion of *Pelagia noctiluca* and salps

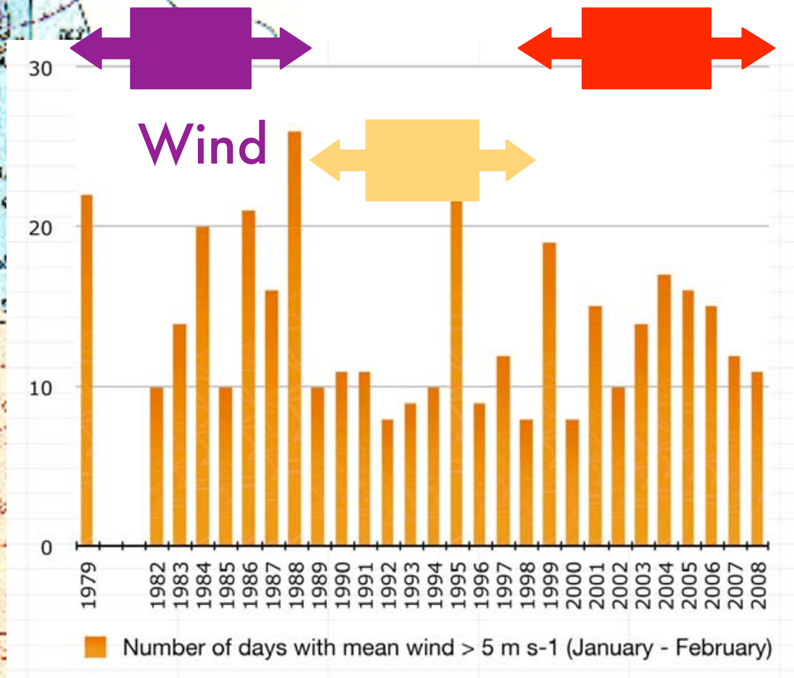
Bottom - up control, stable system

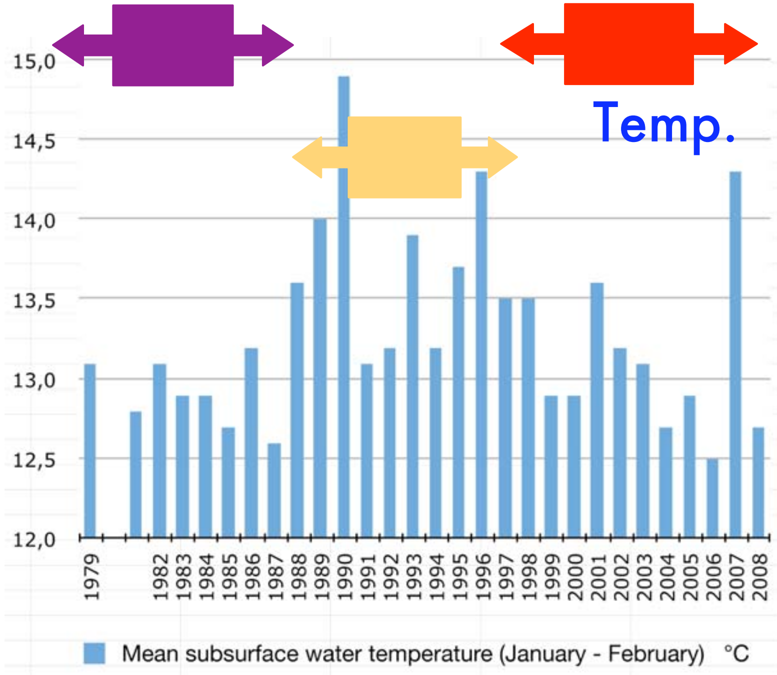
Large-scale climate variation & alteration of the plankton dynamics

Increase of the top - down control? Unstable system?

Long-term evolution of wind stress and subsurface water temperature (January - February)







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In all cases, control of phytoplankton dynamics by physical constraints

Conclusions & perpectives

- The Bay of Calvi is one of the few areas where very specific characteristics can be used to study the responses of marine ecosystems to physical forcing and changing climate

- Large-scale climate variation observed in the nineties has altered the pelagic food-web dynamics through changes in biological interactions

- Major changes in plankton dynamics occurred during the last 3 decades, suggesting a shift in the functioning of the pelagic ecosystem

- There is a need to explore the shift in the pelagic communities as well as changes in the abundance of specific taxonomic groups

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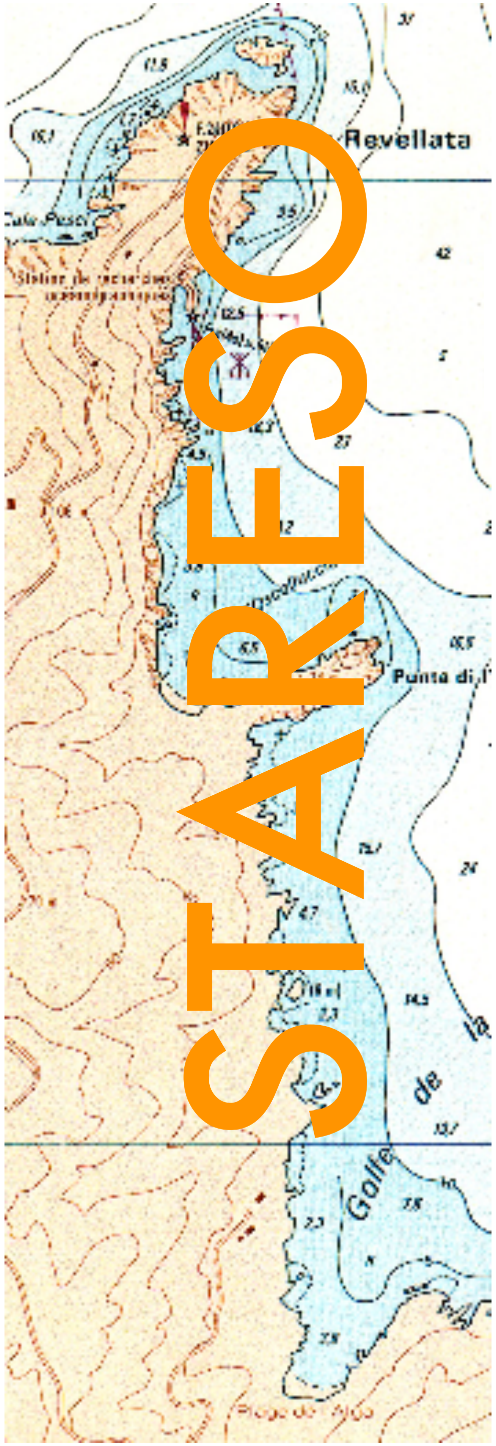

Thank you for your attention !

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