



# NUTRIENT AND PHYTOPLANKTON RESPONSES TO EXTERNAL FORCING IN A MEDITERRANEAN COASTAL AREA UNBIASED BY TERRESTRIAL INPUTS AND LOCAL ACTIVITIES (CALVI, CORSICA)

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## Objectives

- To synthesize a long-term high-resolution study of nutrient and phytoplankton bloom dynamics performed between 1979 and 2011 at a permanent station in the Bay of Calvi (Corsica, northwestern Mediterranean)
- To understand mechanisms controlling the interannual variability of phytoplankton bloom in a context of climate change



Impossible d'afficher l'image. Votre ordinateur manque peut-être de mémoire pour ouvrir l'image ou l'image est endommagée. Redémarrez l'ordinateur, puis ouvrez à nouveau le fichier. Si le x rouge est toujours affiché, vous devrez peut-être supprimer l'image avant de la réinsérer.

## The studied area : the Bay of Calvi, Corsica, Western Mediterranean



- Open bay and narrow shelf
- Oligotrophic characteristics
- Few anthropogenic pressures
- High control by climate forcing
- Reference for the WFD



## Time-series : subsurface data

- Water temperature, wind, phytoplankton and zooplankton from 1979
- Nutrients from 1988



High sampling frequency during phyto- and zooplankton blooms (1 - 7 times per week)



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**STARESO**

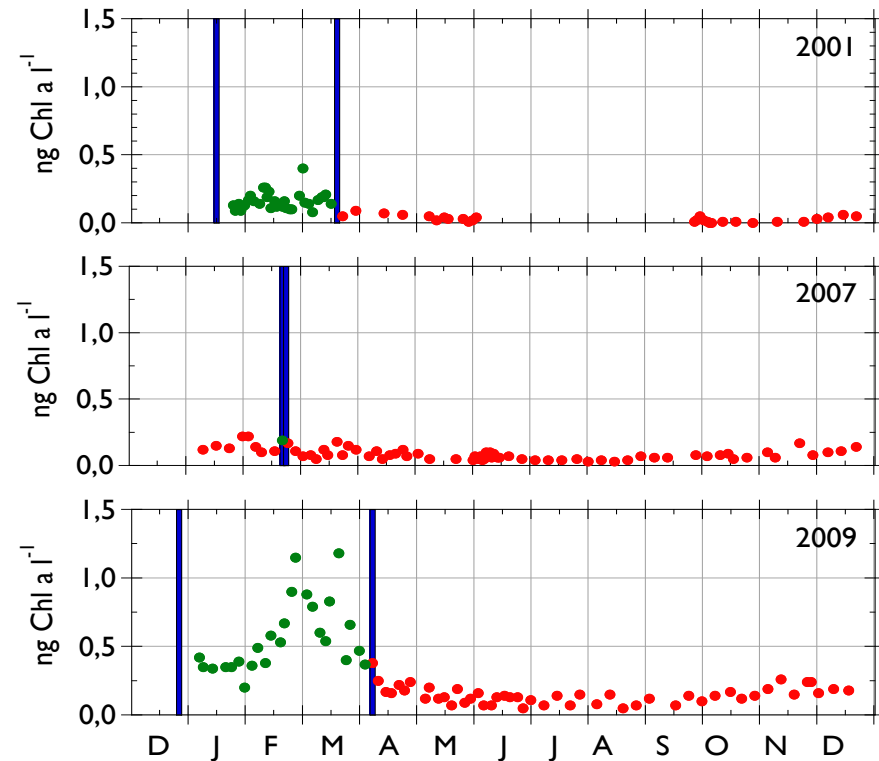
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## Time-series : results

- The winter-spring phytoplankton bloom of the Bay of Calvi is characterized by a very large interannual variability reaching one order of magnitude from one year to another

What factors and/or processes control this variability ?

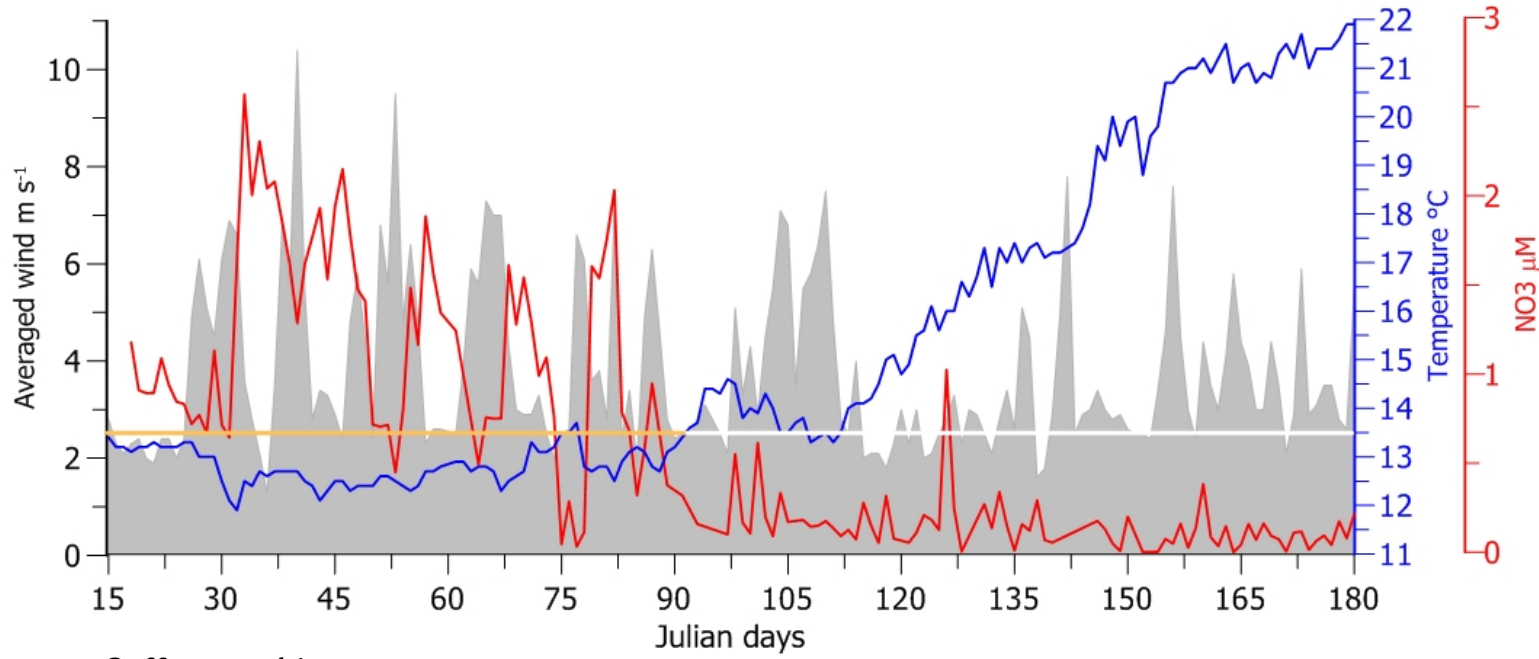
- Water temperature
- Wind intensity
- Nutrient availability
- Zooplankton grazing



The blue bars indicate the limits of the period of cold water (< 13,5 °C)

# Control of nutrient availability by wind stress

In unstratified water column (surface temperature < 13,5 °C), surface nutrient enrichment is strongly controlled by wind stress - annual example : 1999



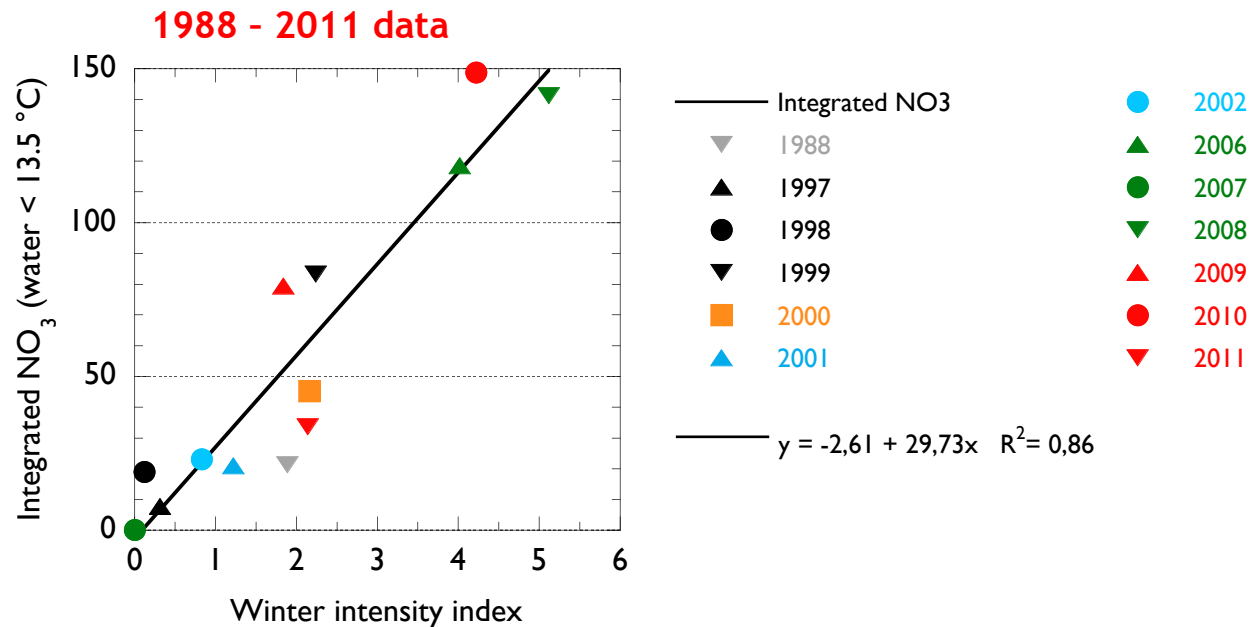
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## Definition of a winter index intensity : WII

WII takes into account the duration of the period of cold water and the frequency of windy days during the period of cold water

## Control of nutrient availability by WII : time-series results

Winter surface nutrient enrichment is strongly and linearly controlled by WII ( $R^2 = 0,86$ )

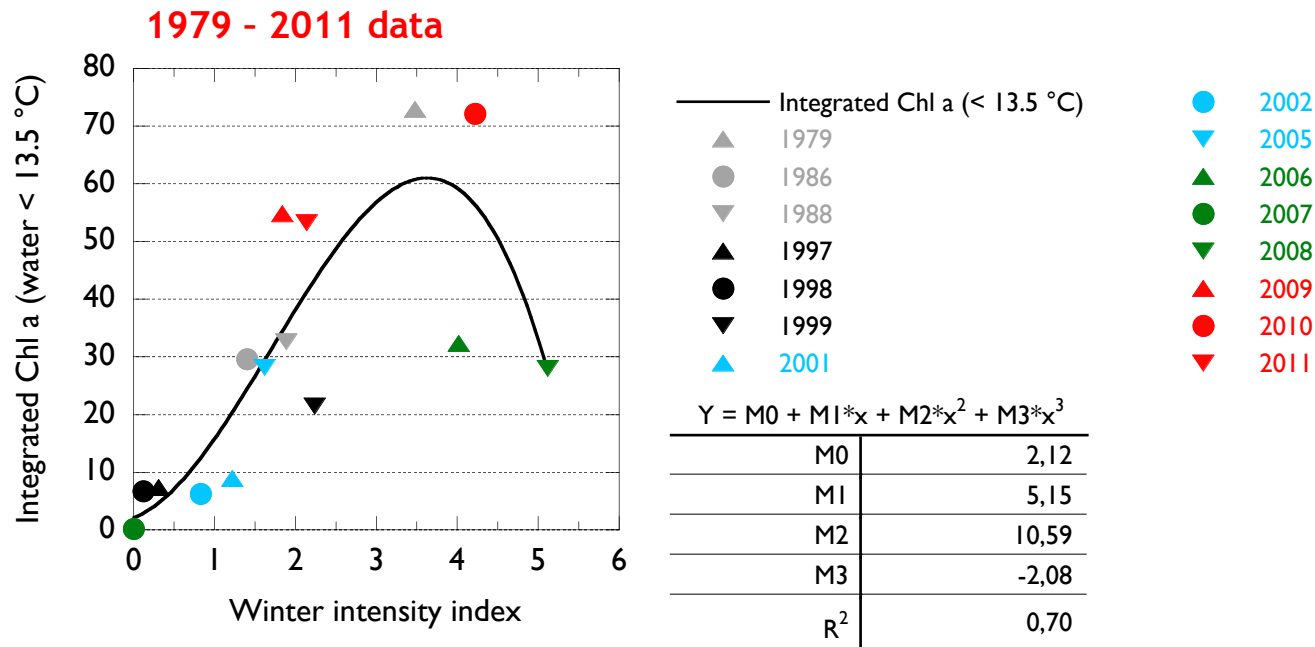


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## Control of phytoplankton by WII : time-series results

Phytoplankton biomass is strongly controlled by WII : increasing phytoplankton concentrations are observed for low and intermediate WII, while high WII are associated with lower phytoplankton biomasses (polynomial regression :  $R^2 = 0,70$ )



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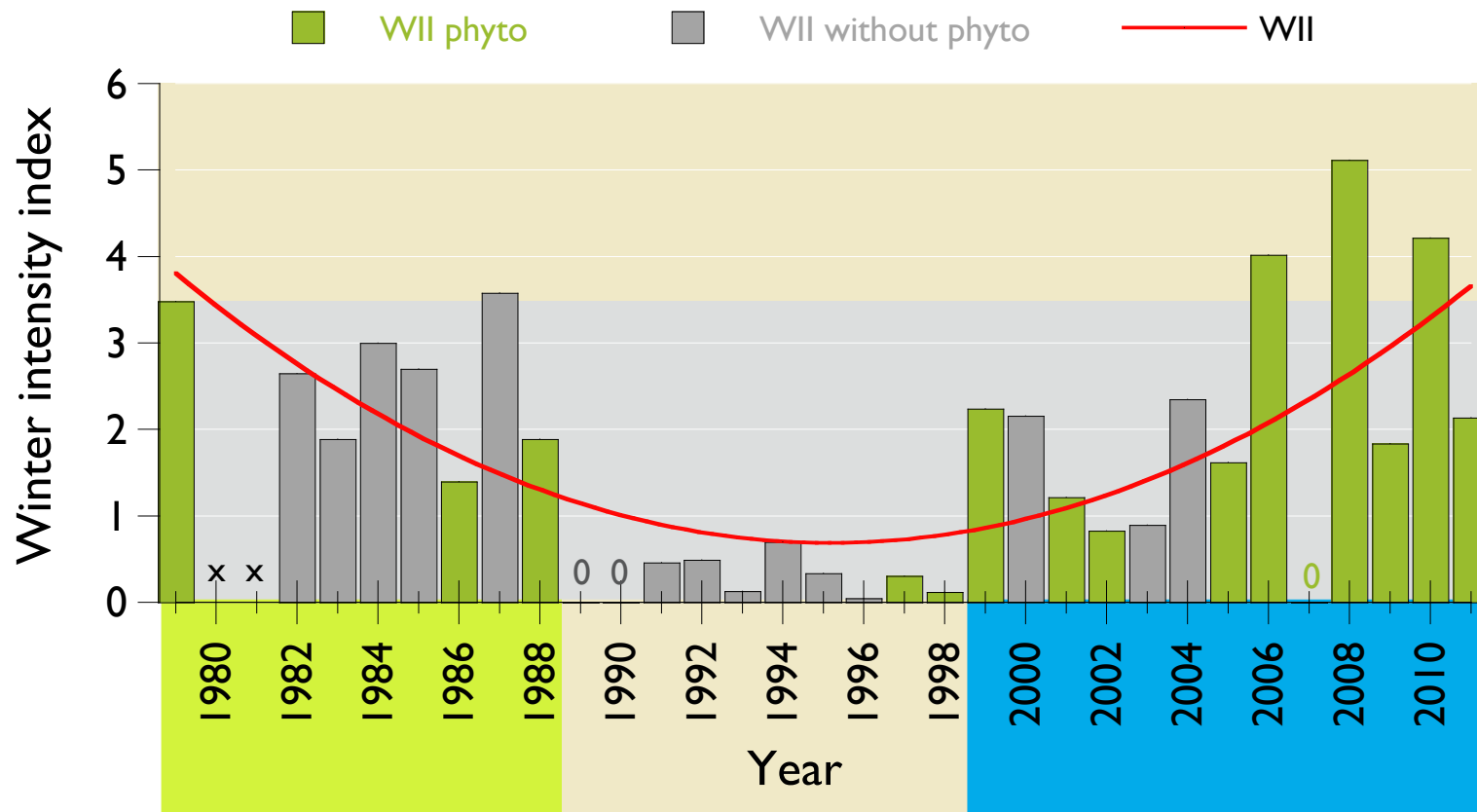
## Is zooplankton grazing responsible for lower phytoplankton biomasses associated with high WII ?

Phyto- and zooplankton biomasses increase concomitantly (linear regression :  $R^2 = 0,70$ ). This implies that lower phytoplankton concentrations observed at high WII are not due to enhanced zooplankton grazing.



Lower phytoplankton biomasses observed at high WII are probably due limitation of phytoplankton growth by reduced exposition to light in a highly mixed water column

# Trends in WII over the 1979 – 2011 period



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## Conclusions

This study, built from three decades of observation acquired in an oligotrophic Mediterranean coastal area,

- shows the combined effects of 2 key natural forcings (wind intensity and water temperature) on nutrient refueling of surface water,
- detects consistent patterns in terms of relationships between environmental drivers and response of winter-spring phytoplankton bloom,
- does not evidence any continuous change in phytoplankton biomass from 1979 but shows a year to year response to climate variation.





Thank you for your attention !