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Contrôle de la variabilité interannuelle de la composition du phytoplancton de la Baie de Calvi (Corse) par les facteurs environnementaux

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Université de Liège

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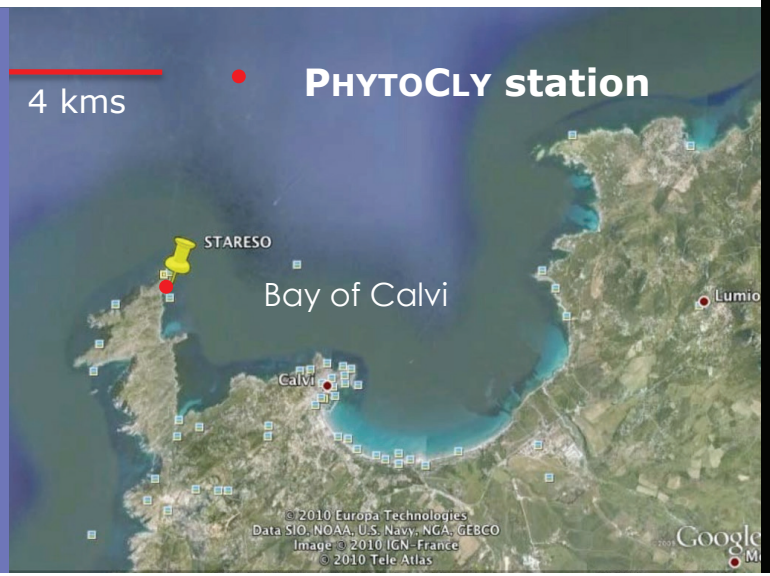
Objectifs

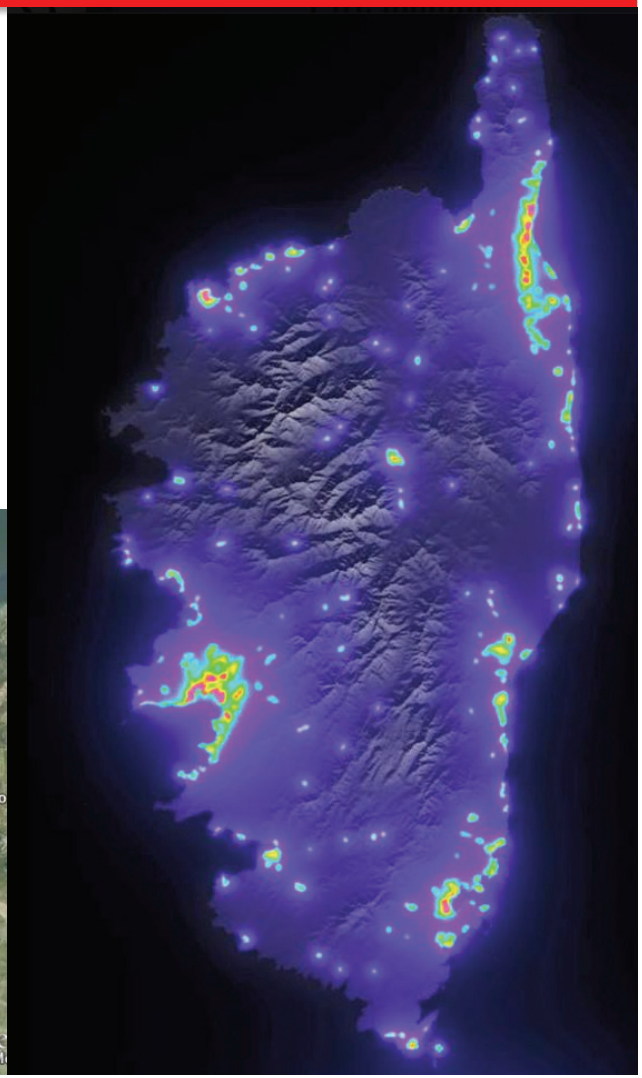
Synthétiser les connaissances sur le contrôle de la variabilité interannuelle du phytoplancton par les facteurs environnementaux dans un site côtier méditerranéen peu impacté par l'activité anthropique locale dans le but :

- **de définir les préférences environnementales et les niches écologiques des principaux groupes phytoplanctoniques,**
- **d'acquérir la connaissance nécessaire au développement d'indices de qualité basés sur le phytoplancton (e.g. indice de composition IC MEDIT).**

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

- **Open bay and narrow shelf**
- **Presence of a deep canyon in front of the city of Calvi**
- **Few anthropogenic pressures**
- **Low-runoff system**
- **Reference for the WFD**





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Long-term time series (surface data, 1979-2014)

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Long-term time series (surface data, 1979-2014)

From 1979 :

- water temperature and wind (34 years)
- phytoplankton (chl *a*, 18 years; pigments, 15 years, continuous data from **2006**)
- zooplankton (16 years, continuous data from 2003)

From 1988 :

- nutrients (16 years, continuous data from **2006**)

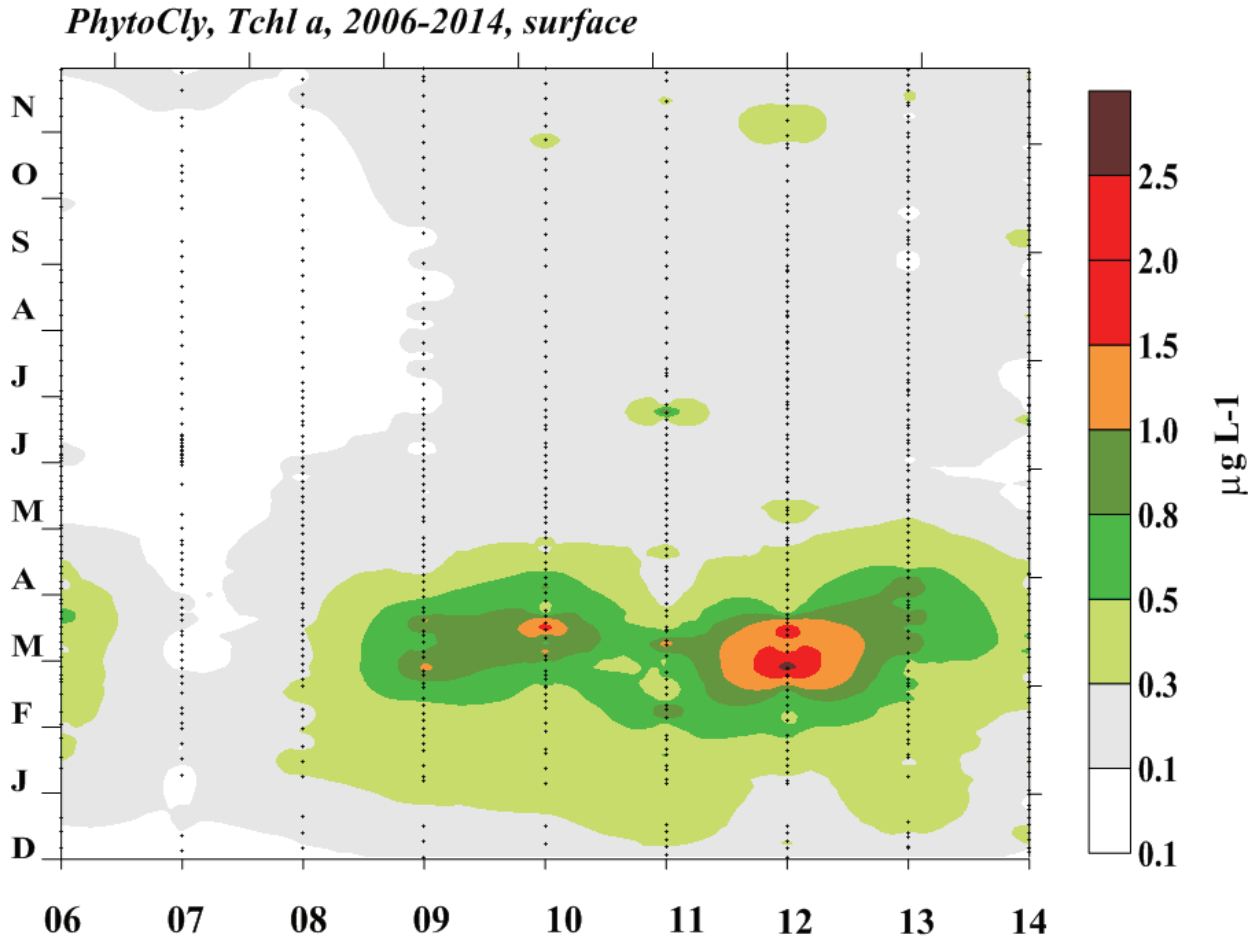
From 2006 :

- **WFD monitoring, including pigment survey (HPLC)**

High sampling frequency during the winter-spring period :

- Phytoplankton and nutrients : daily to biweekly
- Zooplankton : weekly.

High seasonal and interannual variability in phytoplankton biomass



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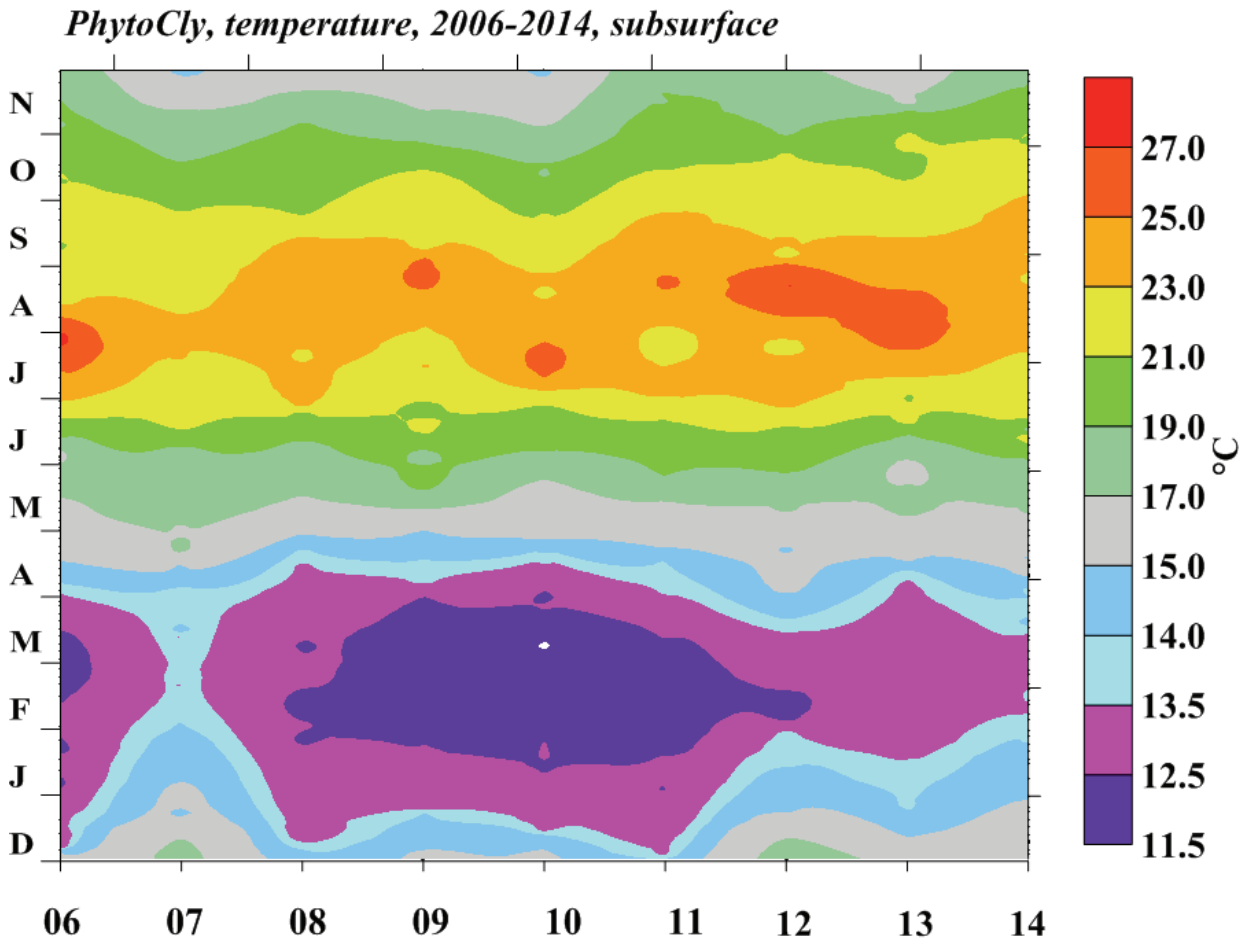
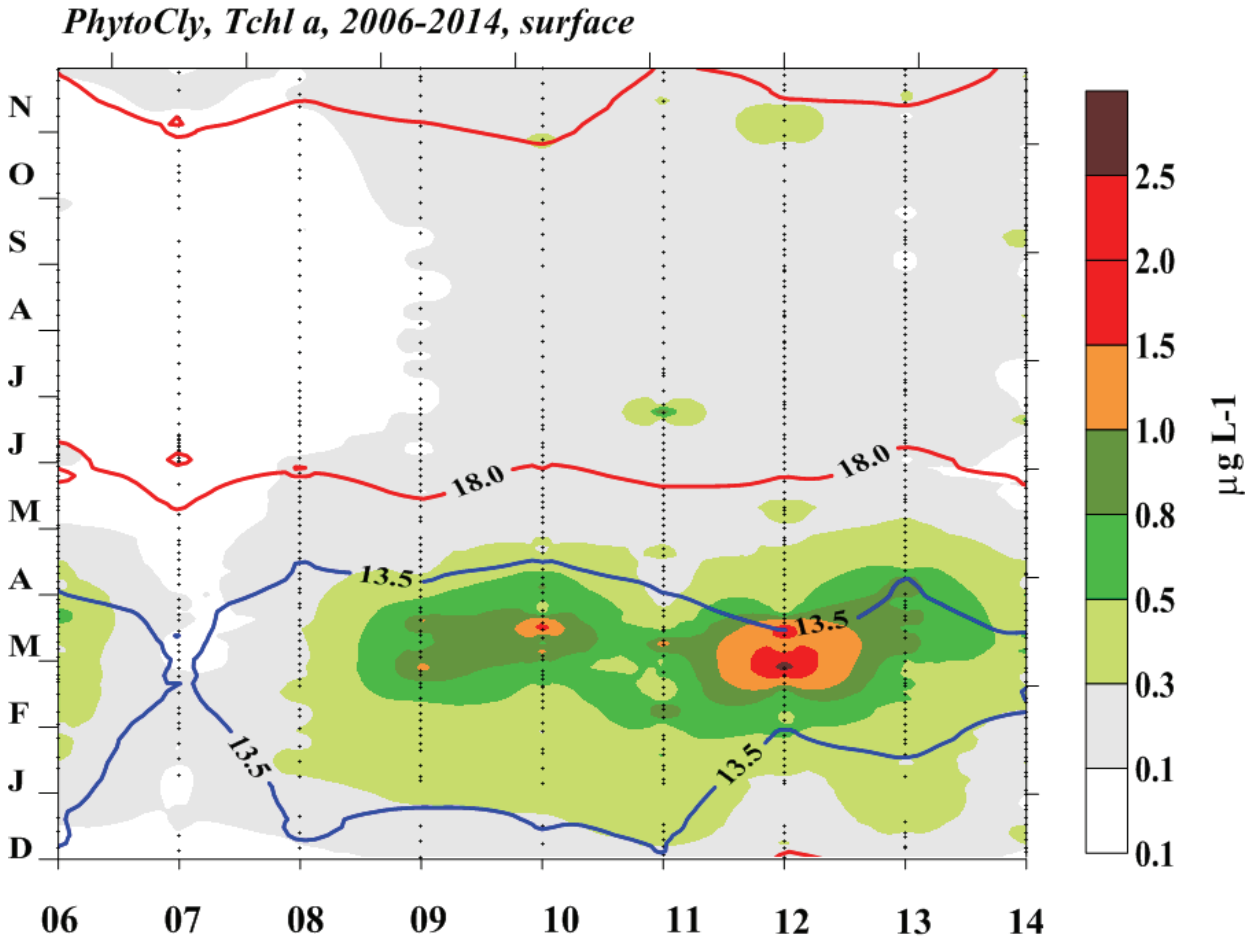
High seasonal and interannual variability in water temperature



High seasonal and interannual variability in phytoplankton biomass



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Winter intensity index (WII)

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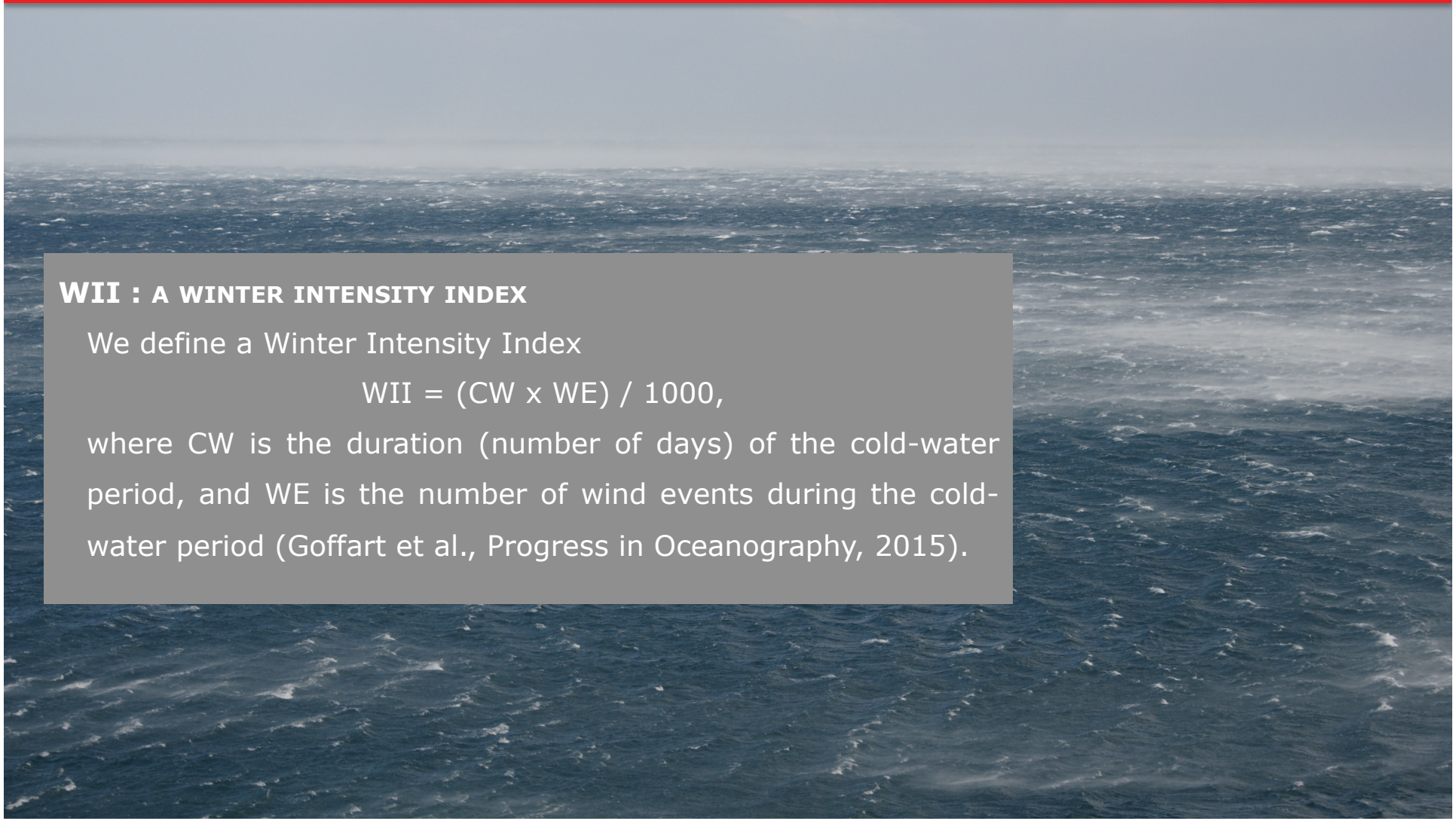


WII : A WINTER INTENSITY INDEX

We define a Winter Intensity Index

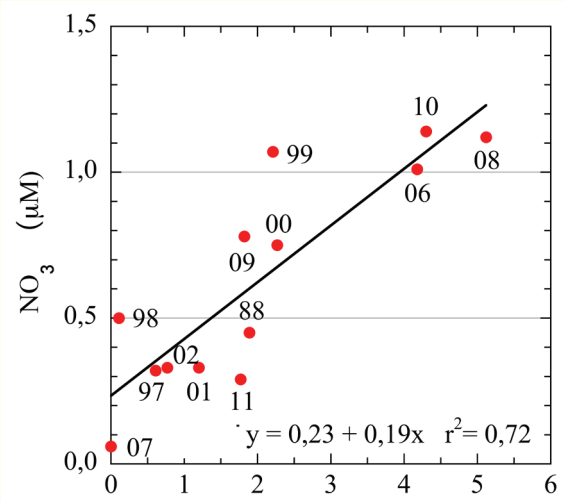
$$WII = (CW \times WE) / 1000,$$

where CW is the duration (number of days) of the cold-water period, and WE is the number of wind events during the cold-water period (Goffart et al., Progress in Oceanography, 2015).

Winter intensity index (WII)

NUTRIENTS AND TCHL *a* VS WII DURING THE COLD-WATER PERIOD

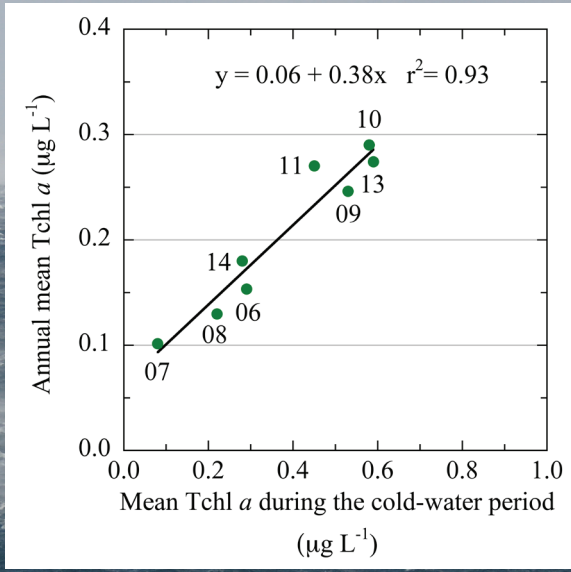
The plots of nitrate and Tchl *a* averaged over the cold-water periods as function of WII show highly significant relationships (Goffart et al., 2015, Progress in Oceanography).



Winter intensity index (WII)

RELATIONSHIPS BETWEEN COLD-WATER PERIOD AND ANNUAL MEAN CONCENTRATIONS

When nutrient and phytoplankton were sampled over the entire year, strong positive correlations are observed between cold-water period and annual mean concentrations.



WINTER INTENSITY IS A KEY DRIVER OF PHYTOPLANKTON BIOMASS OVER THE YEAR

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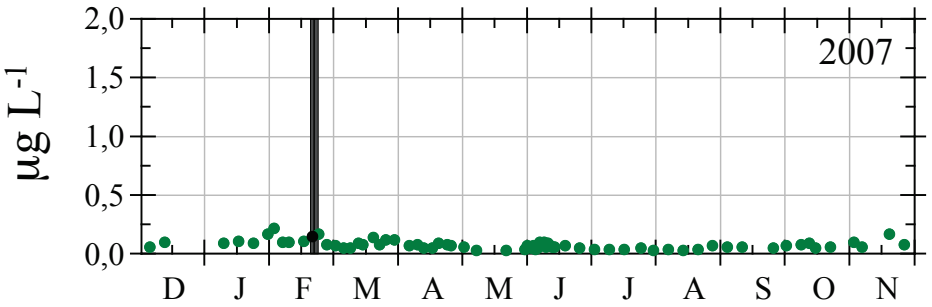
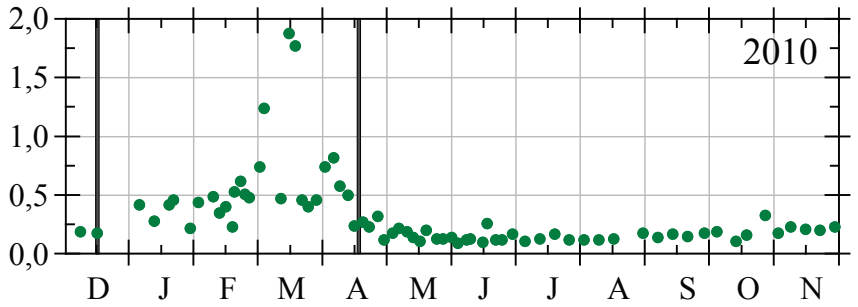
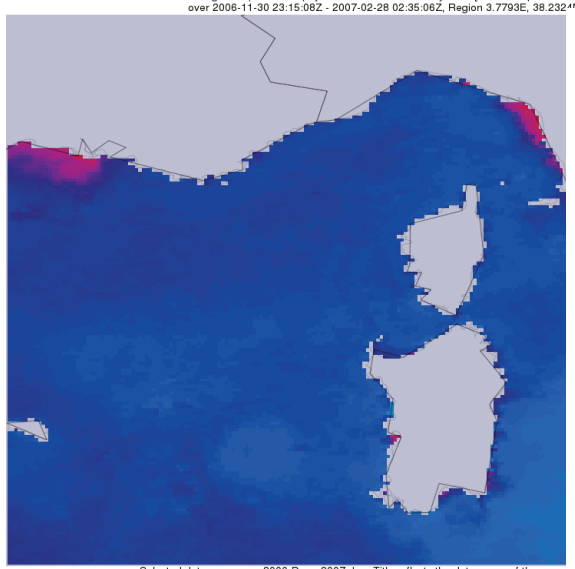
High seasonal and interannual variability in phytoplankton biomass



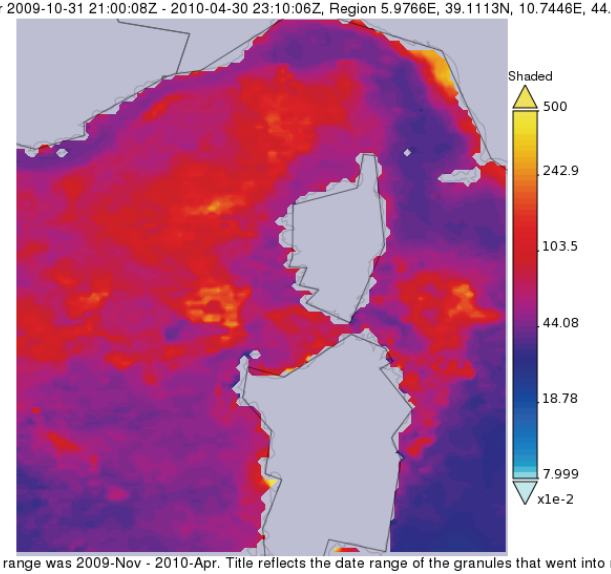


Time Averaged Map of Chlorophyll a concentration monthly 4 km [MODIS-Aqua MODISA_L3m_CHL v2014] mg m-3
over 2006-11-30 23:15:08Z - 2007-02-28 02:35:06Z, Region 3.7793E, 38.232[illegible]



- Selected date range was 2006-Dec - 2007-Jan. Title reflects the date range of the granu

Time Averaged Map of Chlorophyll a concentration monthly 4 km [MODIS-Aqua MODISA_L3m_CHL v2014] mg m-3
over 2009-10-31 21:00:08Z - 2010-04-30 23:10:06Z, Region 5.9766E, 39.1113N, 10.7446E, 44.3188N



- Selected date range was 2009-Nov - 2010-Apr. Title reflects the date range of the granules that went into making this resul

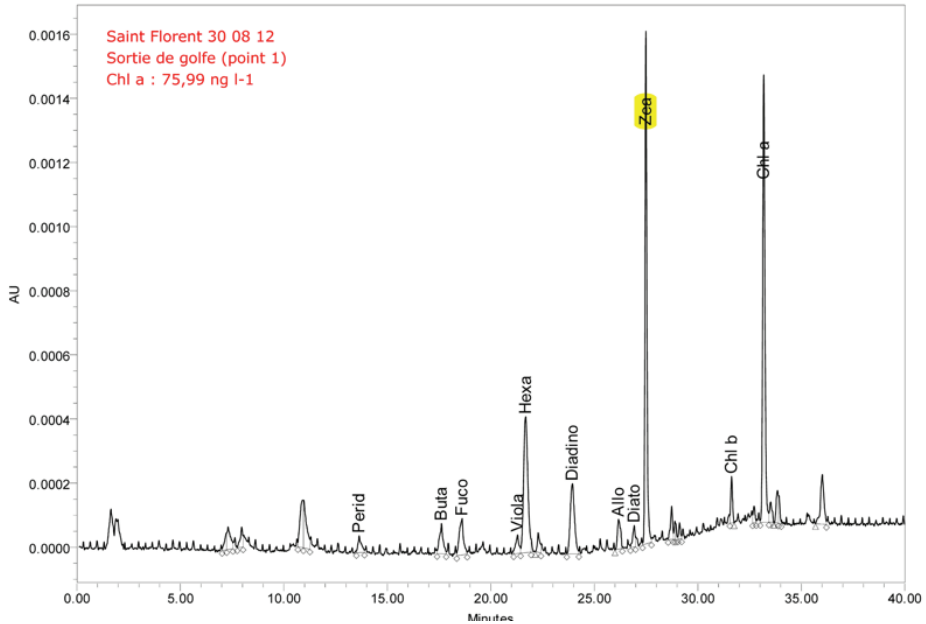
Control of phytoplankton composition by environmental factors

- **Comptages de flore totale (microphytoplancton, données Quadrige, *données Ifremer/Quadrige/Rephy*)**

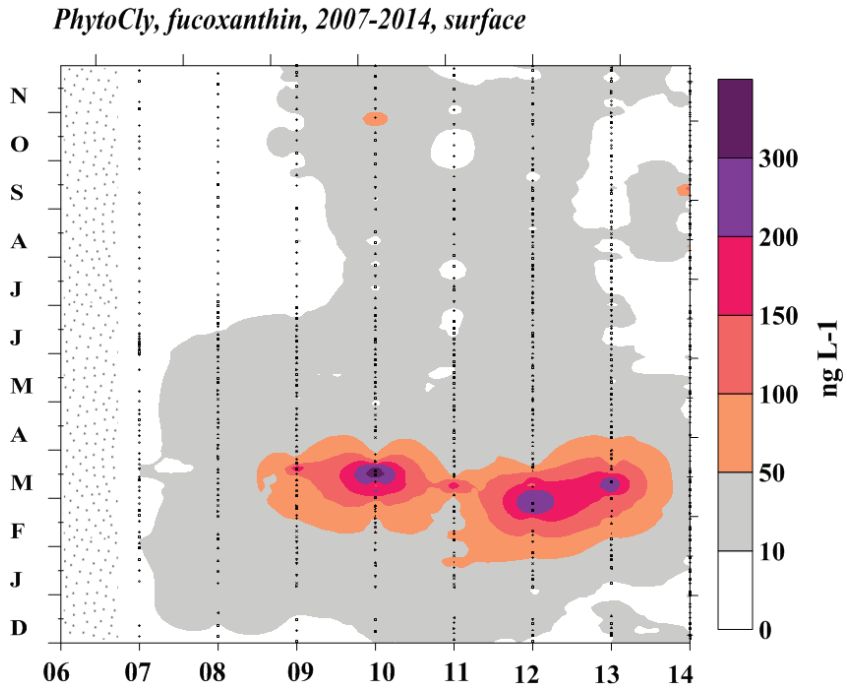
- **Etude de la signature pigmentaire du phytoplancton (chémotaxonomie) : mesures des concentrations en pigments et application de CHEMTAX**

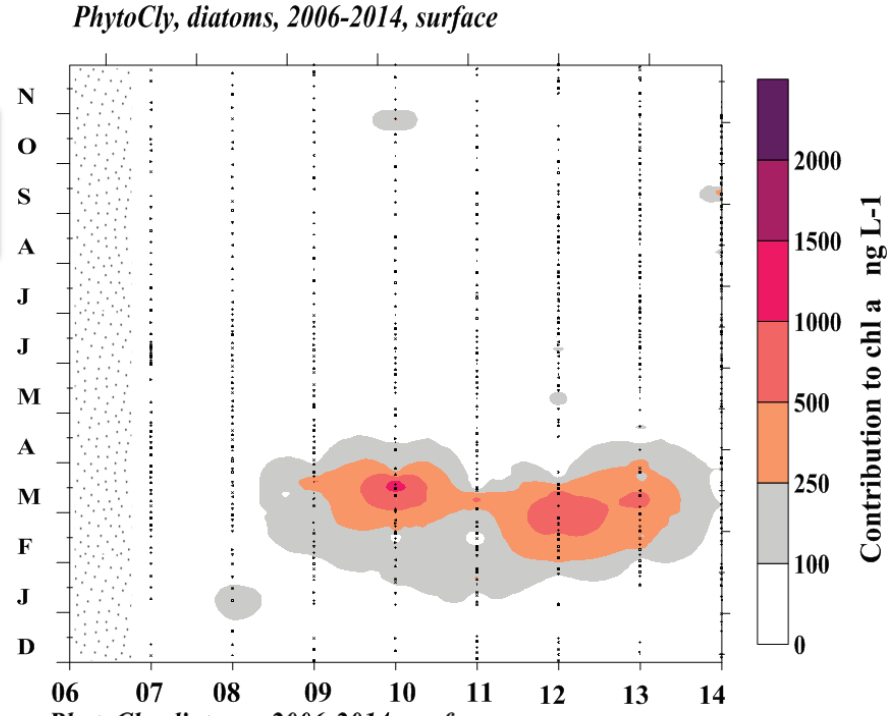
Avantages :

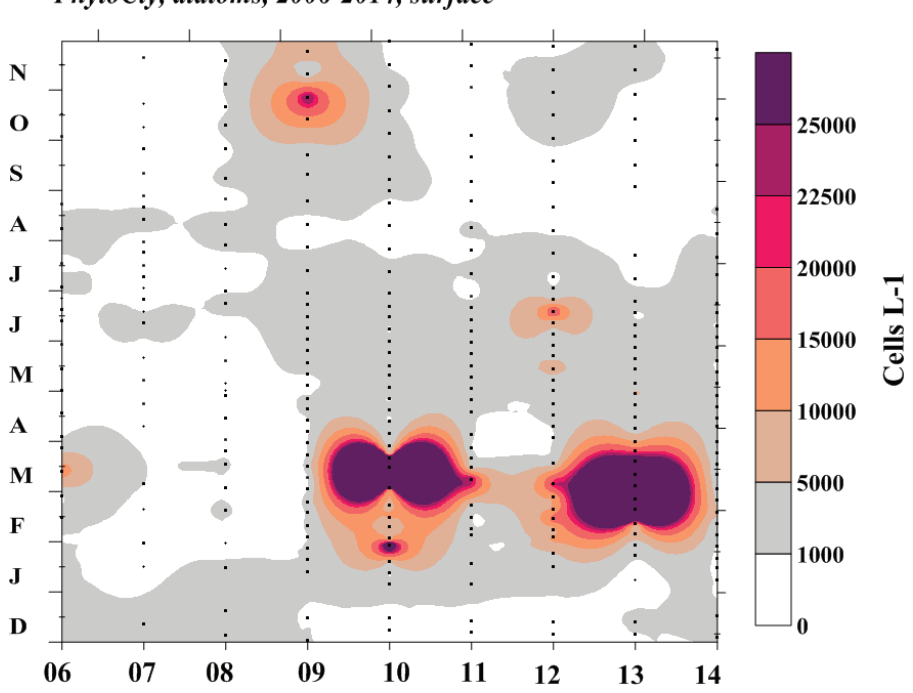
- **informations sur toutes les classes de taille**
- **biomasse totale et composition**
- **rapidité des analyses (40 min / éch)**
- **niveau d'information taxonomique suffisant pour la DCE**



Microphytoplankton : diatoms

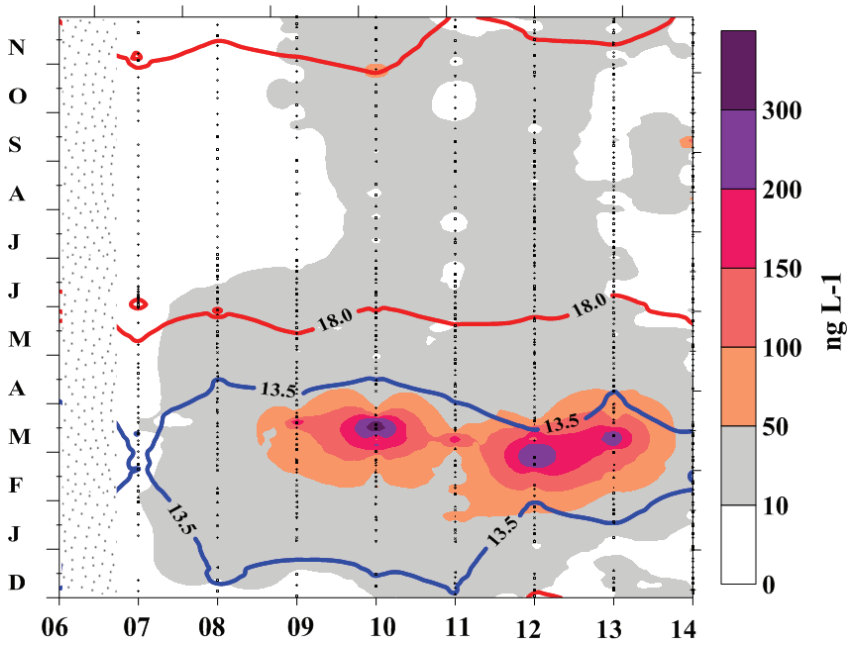




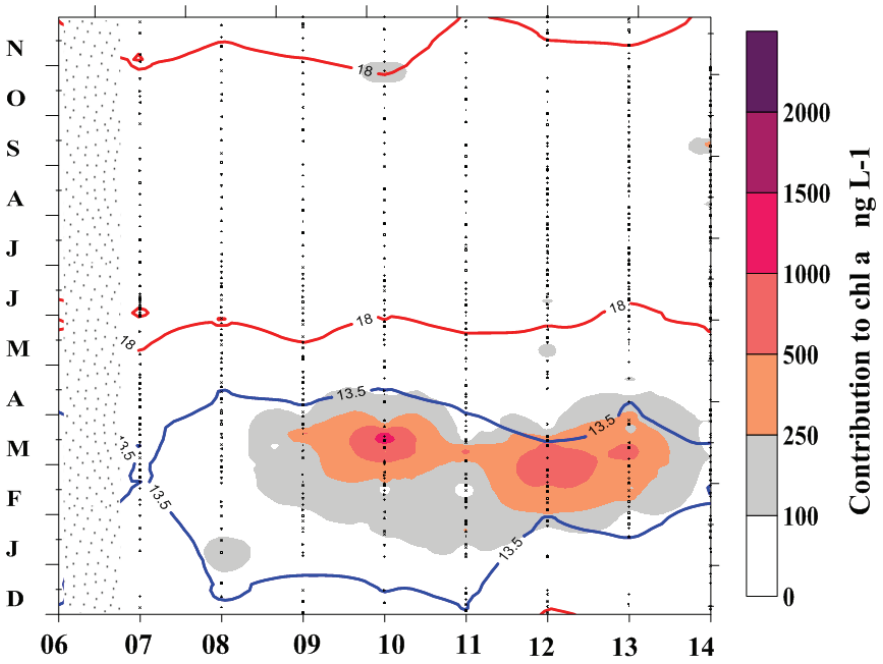


Microphytoplankton : diatoms

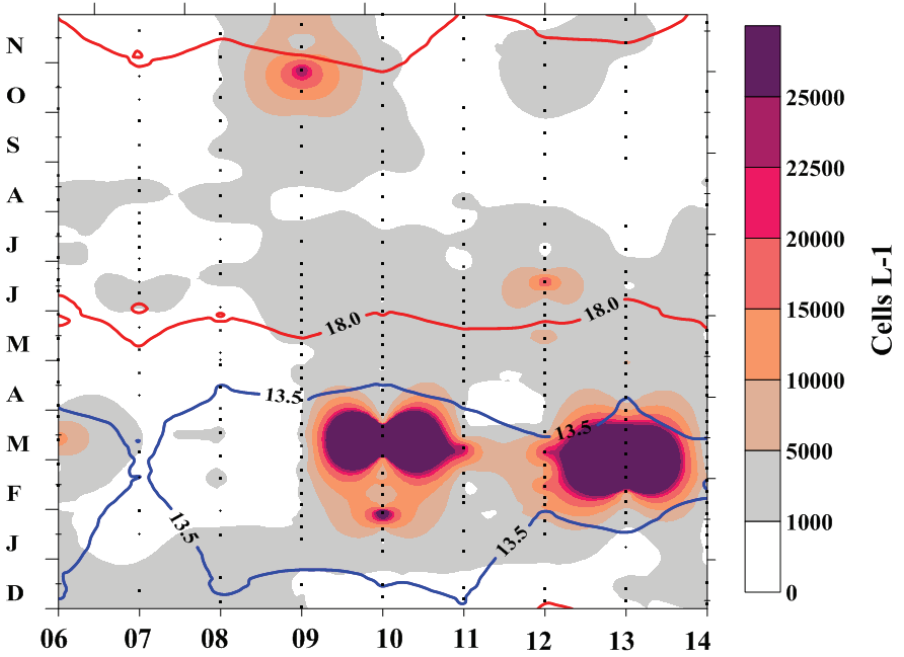
PhytoCly, fucoxanthin, 2007-2014, surface



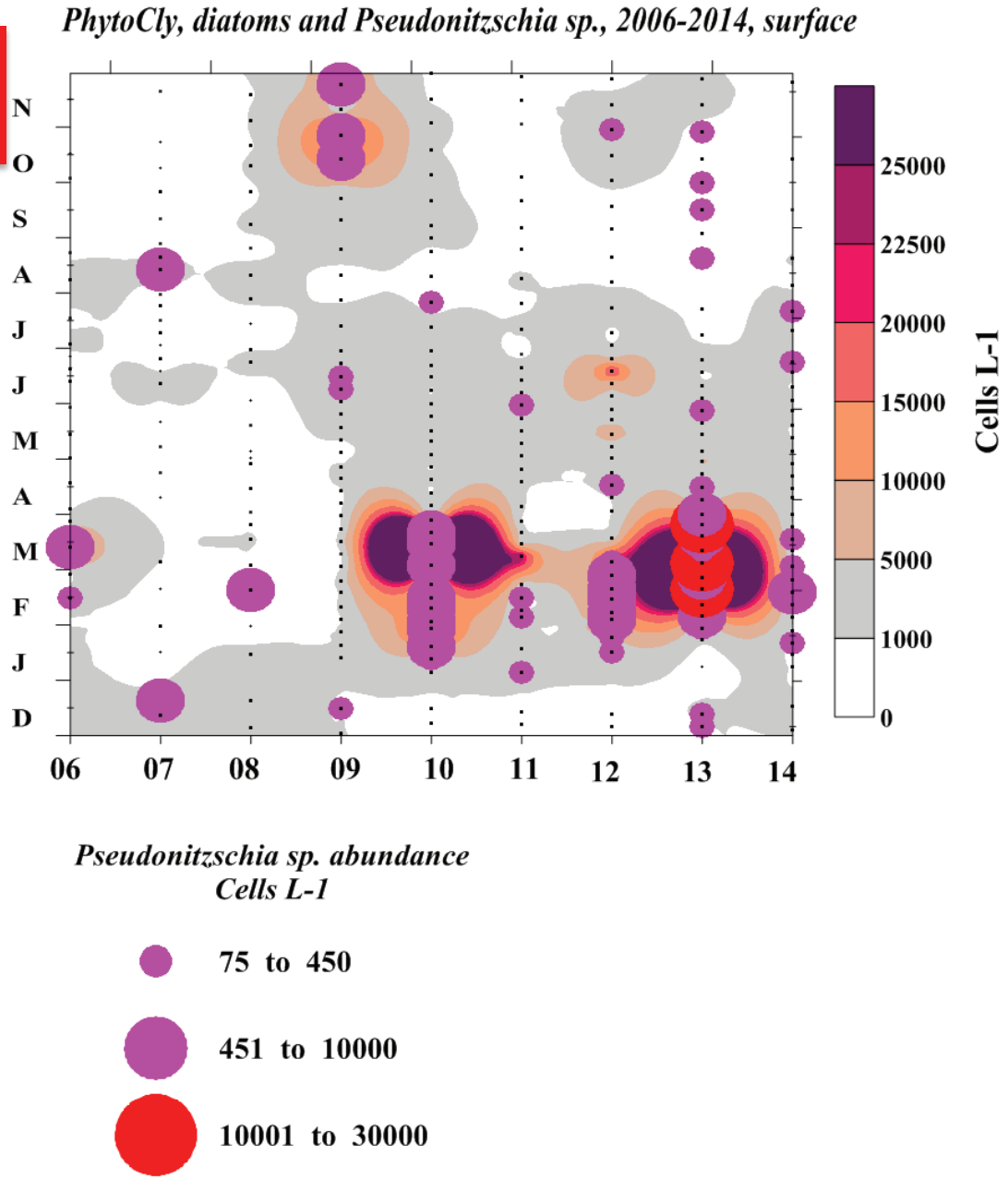
PhytoCly, diatoms, 2006-2014, surface



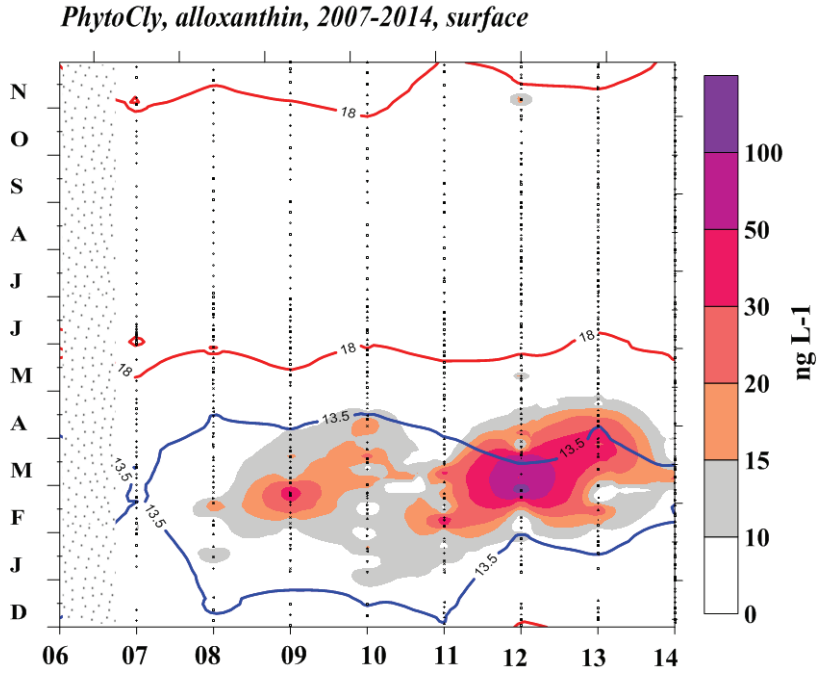
PhytoCly, diatoms, 2006-2014, surface

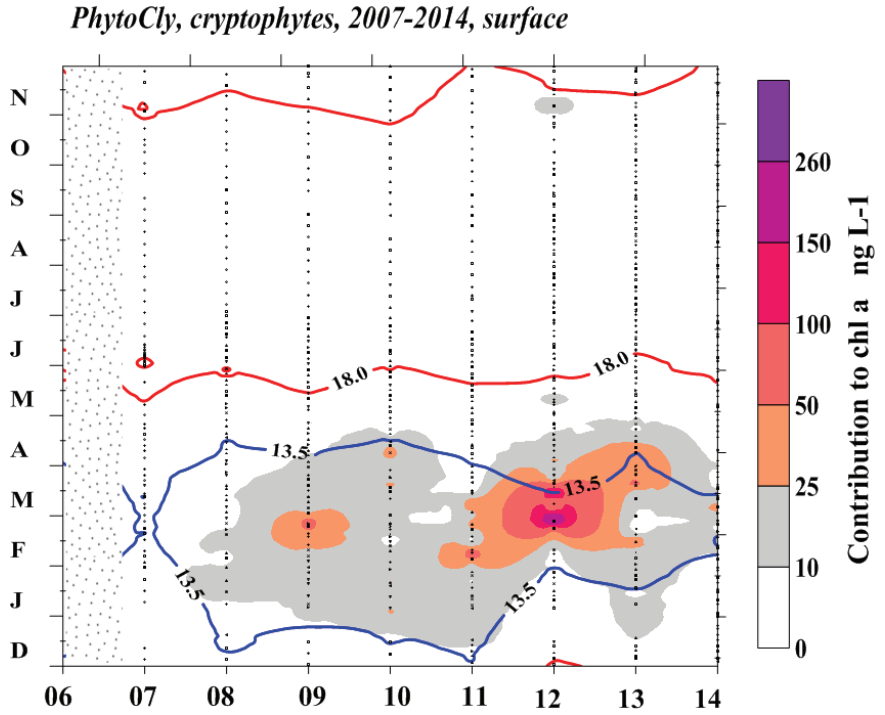


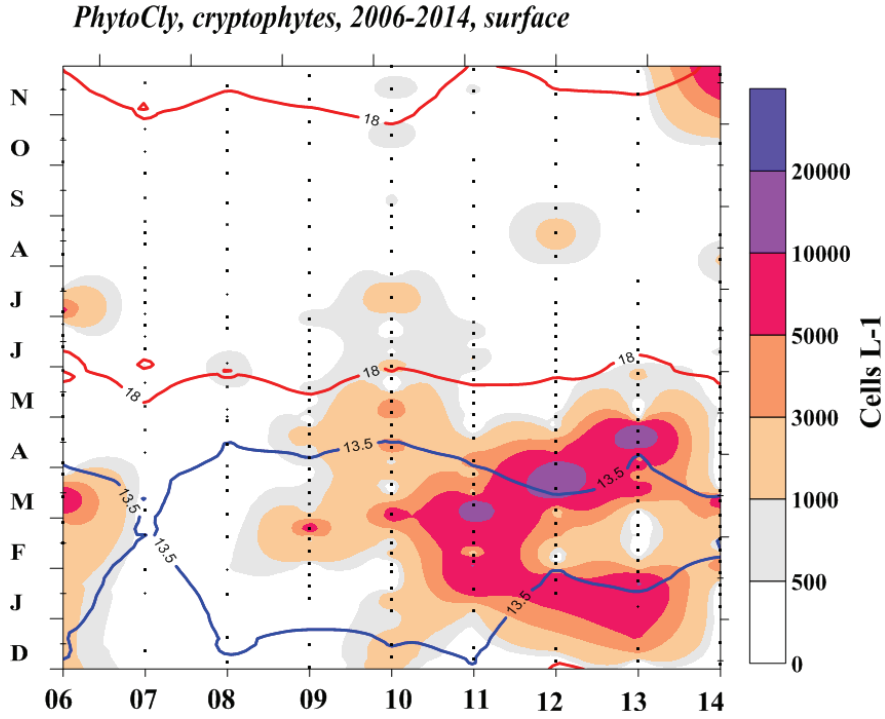
Pseudonitzchia sp.



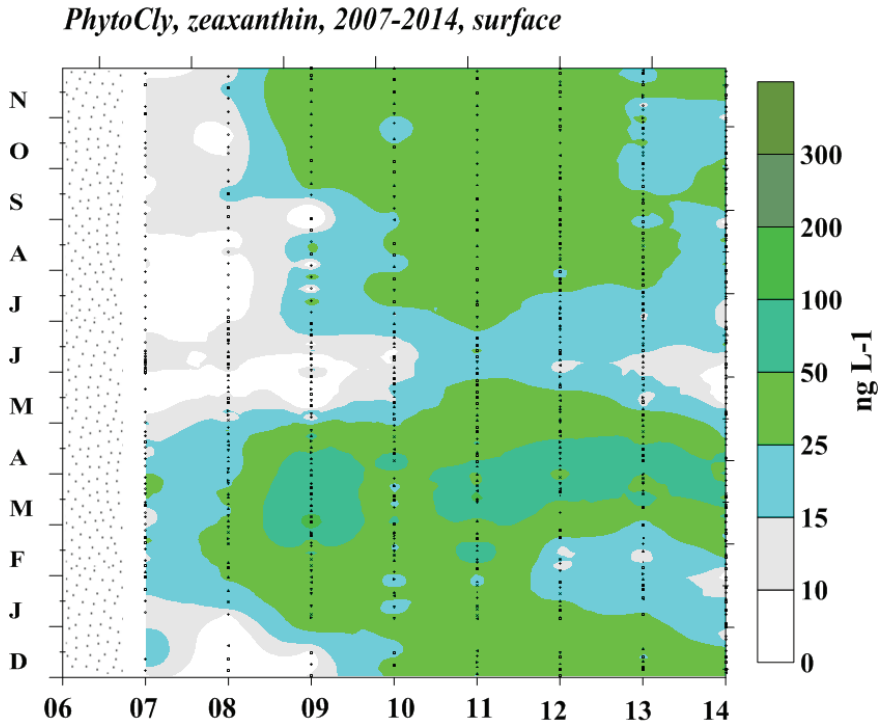
Micro- and nanophytoplankton : cryptophytes

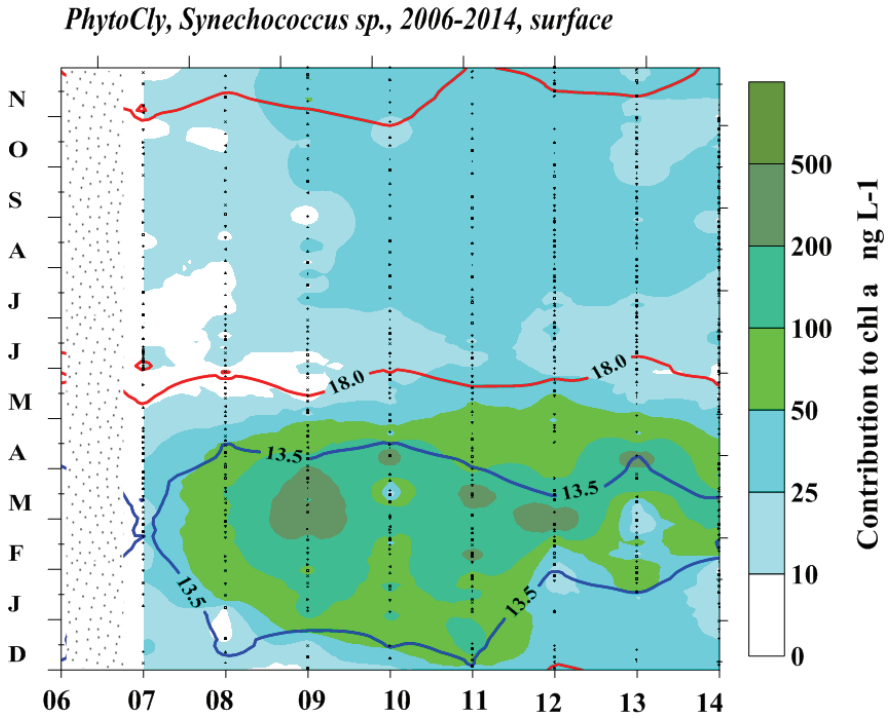






Picophytoplankton : cyanobacteria





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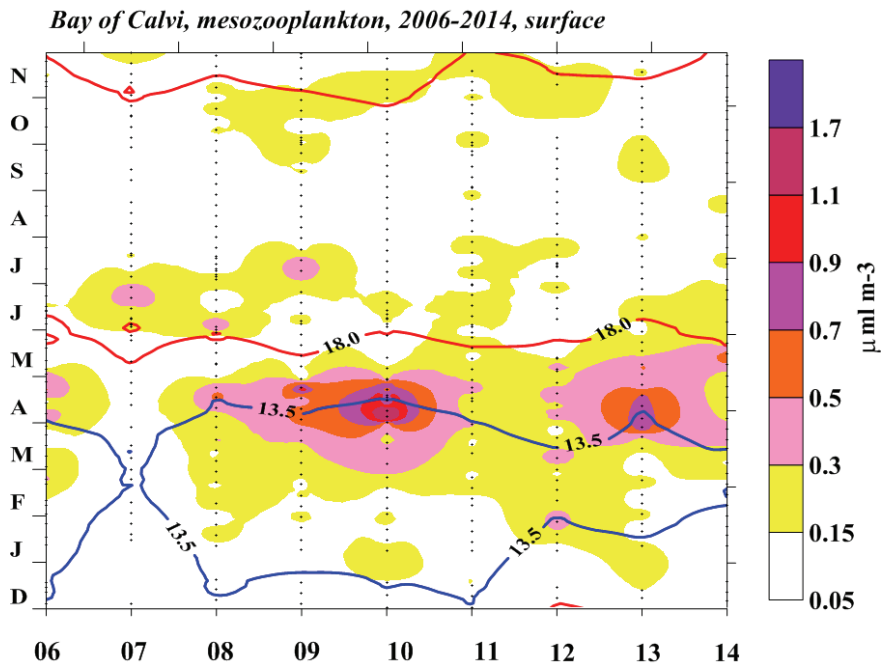
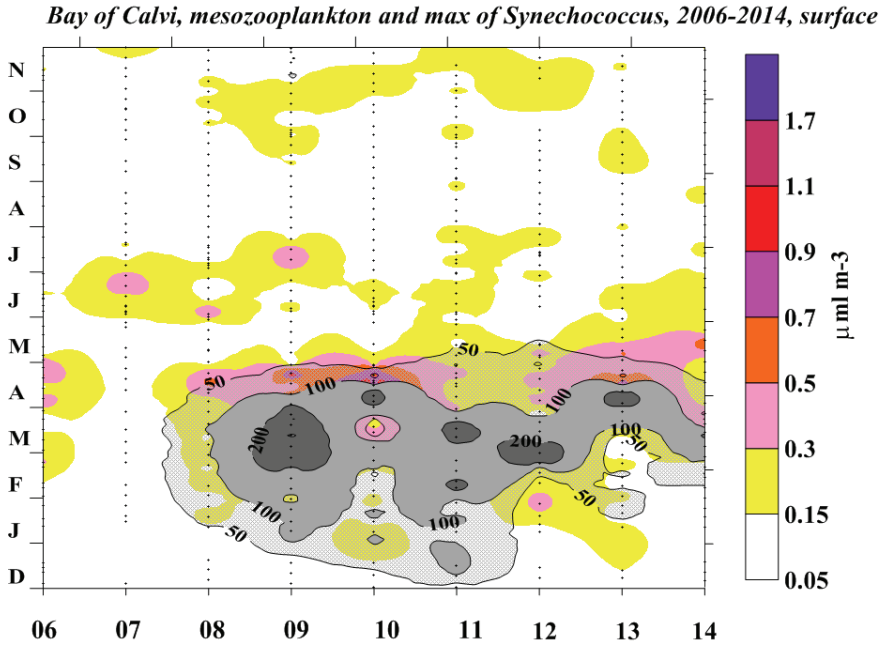
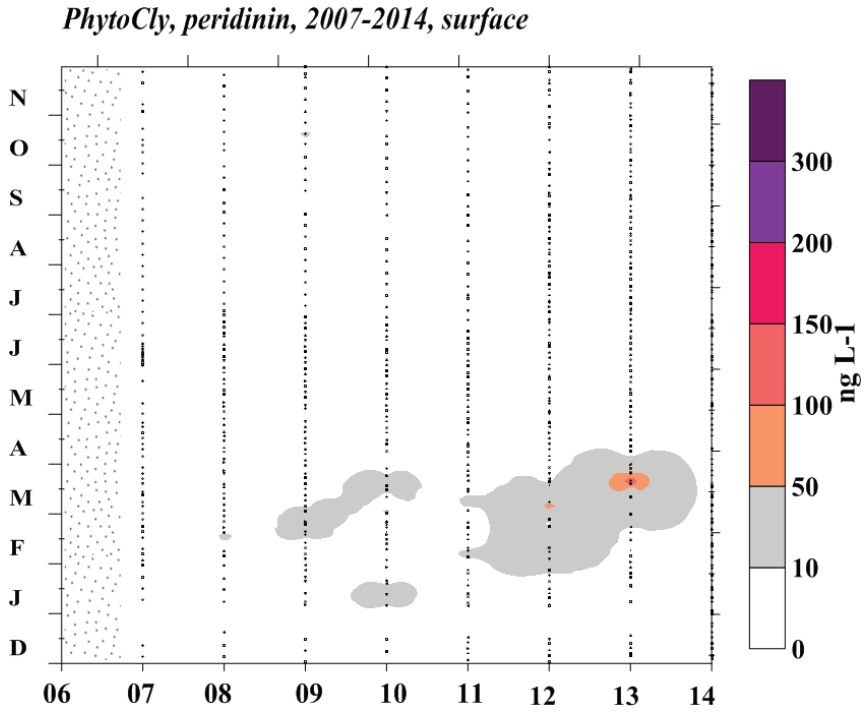
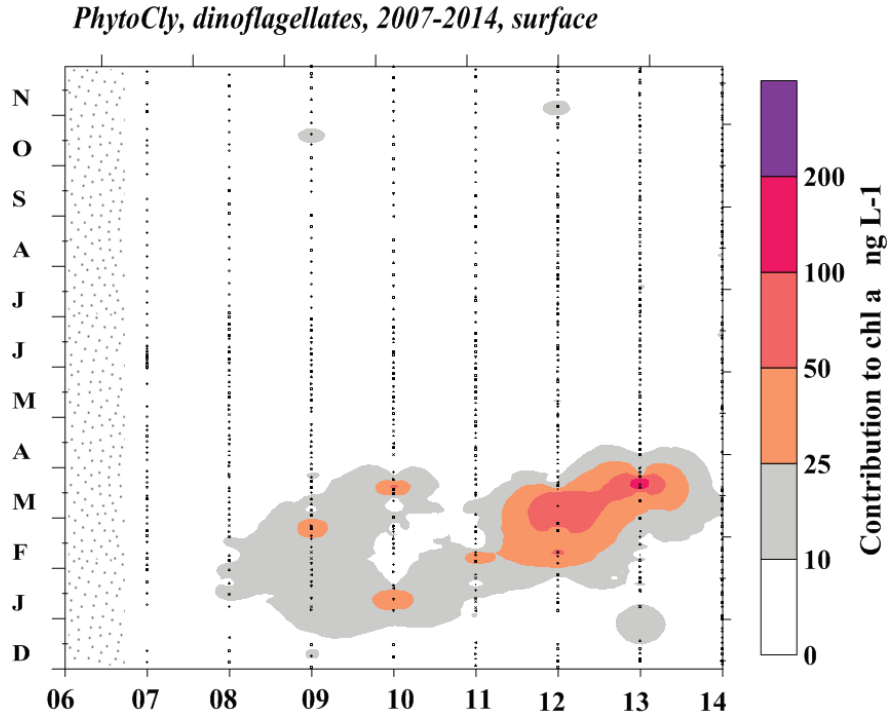
Picophytoplankton : cyanobacteria

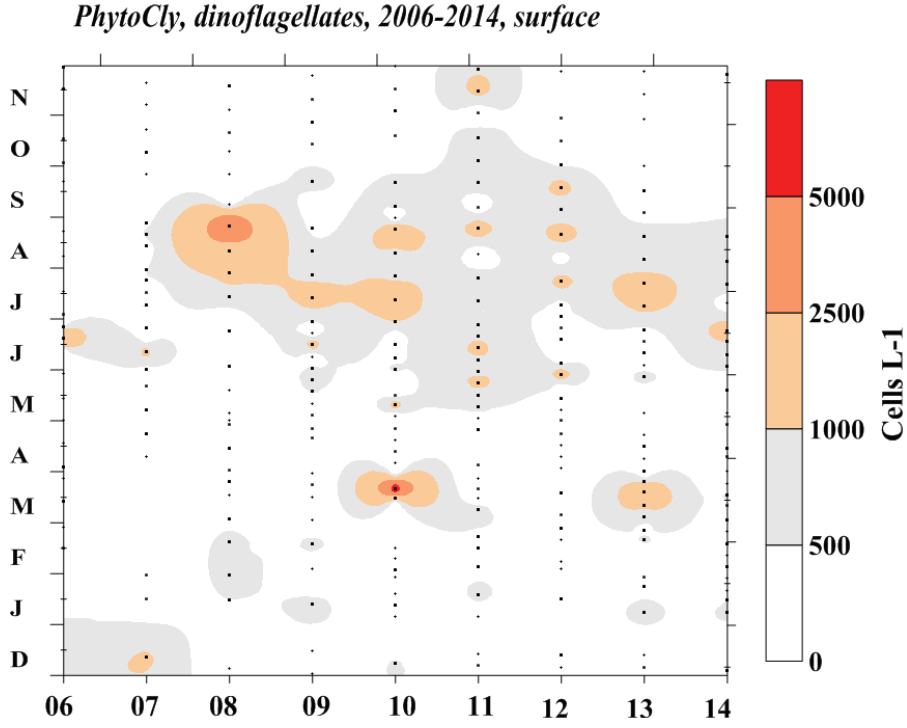




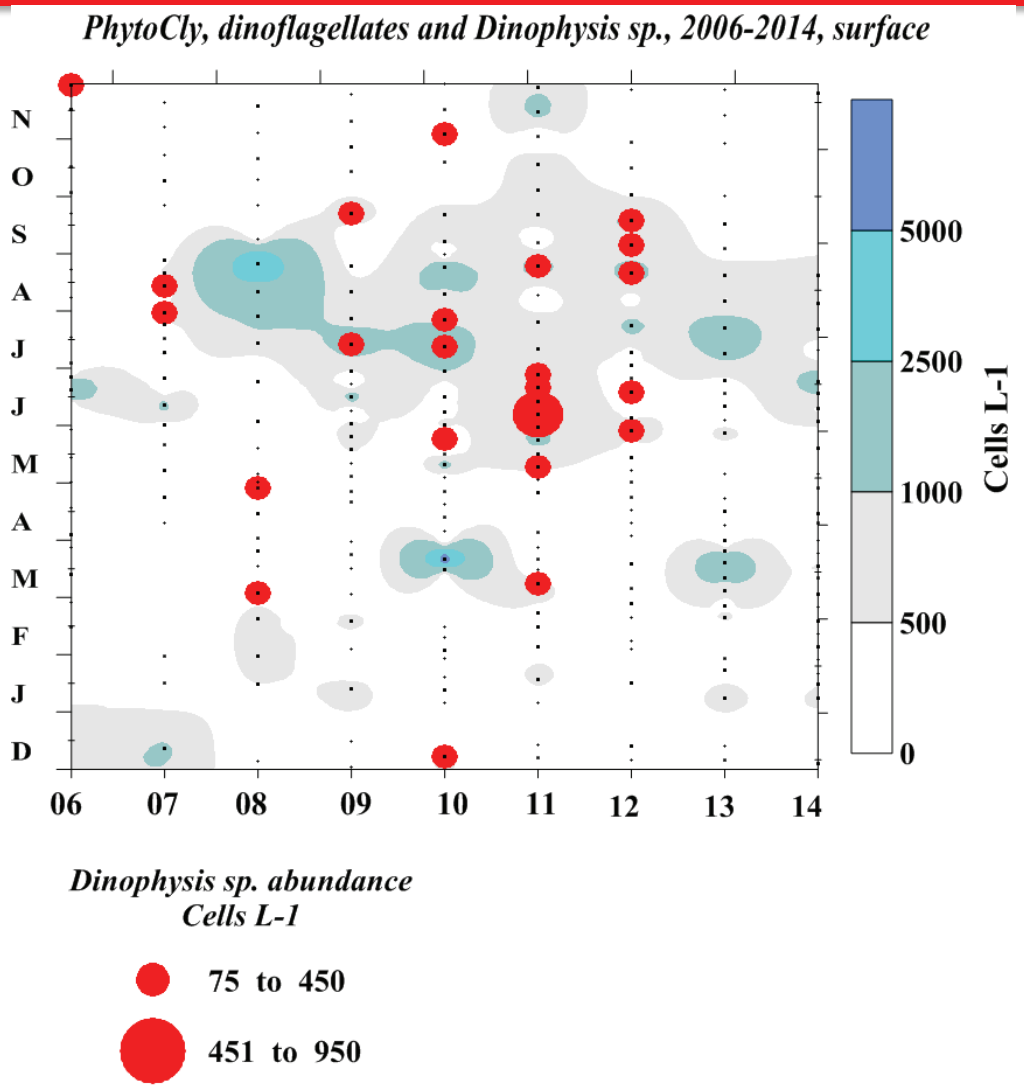
Microphytoplankton : dinoflagellates







Dinophysis sp.



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Conclusions & perspectives

Les suivis haute fréquence et la combinaison des outils « composition pigmentaire » et « flore totale » fournissent les informations permettant de comprendre comment les facteurs environnementaux contrôlent la dynamique des communautés phytoplanctoniques en terme de biomasse et de composition.

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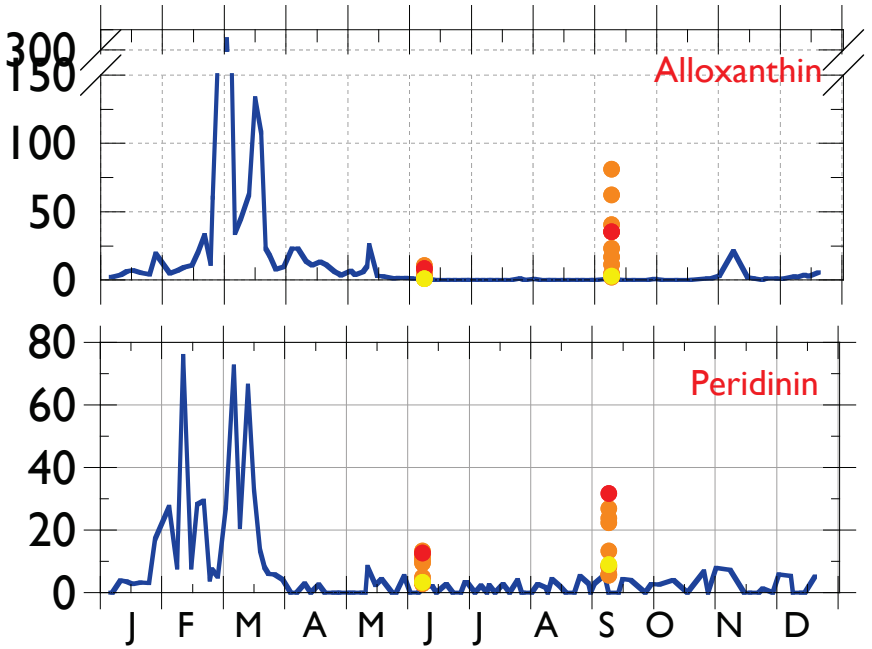
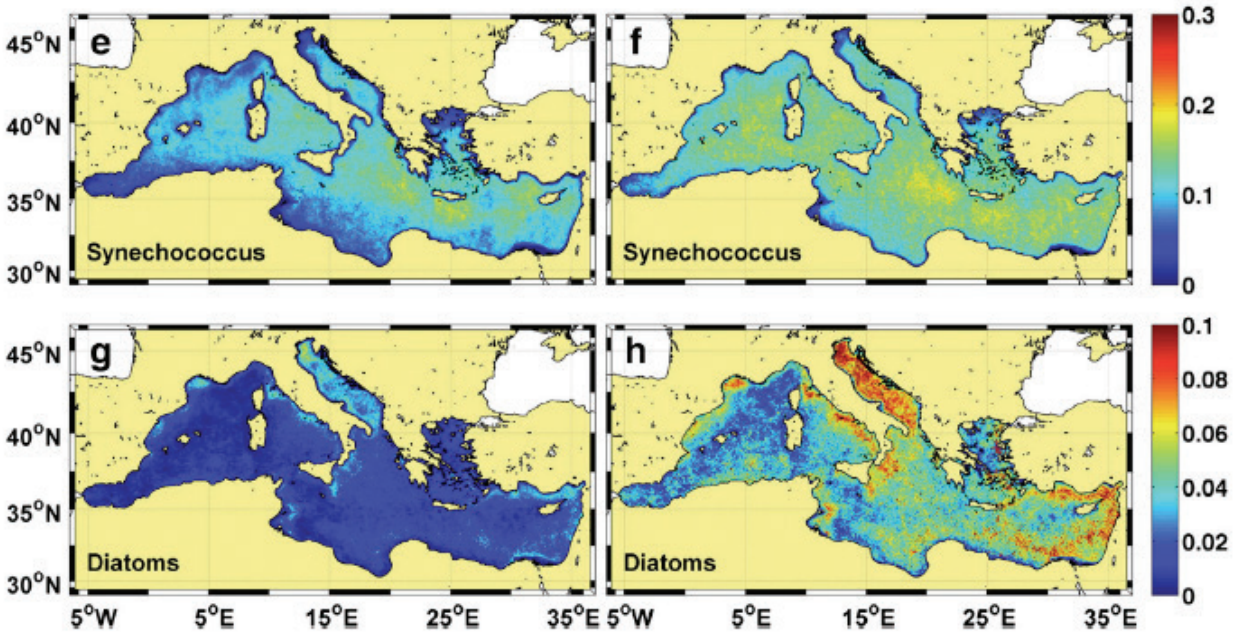
Conclusions & perspectives

Réalisés en zone de référence, les suivis haute fréquence permettent de construire des courbes de référence robustes indispensables à l'élaboration d'outils d'aide à la gestion (*e.g.* indice de composition IC MEDIT, projet ONEMA, collaboration IFREMER)



Conclusions & perspectives

Les suivis haute fréquence permettent une application croisée de méthode de terrain (signature pigmentaire du phytoplancton) et innovantes (imagerie satellitaire) pour déterminer la composition du phytoplancton à grande échelle (projet ONEMA, collaboration IFREMER de Toulon, Sylvain Coudray).



Navarro et al 14, based on pigment concentrations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Merci de votre attention !