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X International Symposium on Oceanography Of the Bay of Biscay



Trends of riverine nutrient inputs for thirty years in the northern Bay of Biscay, and schemes of phytoplankton responses

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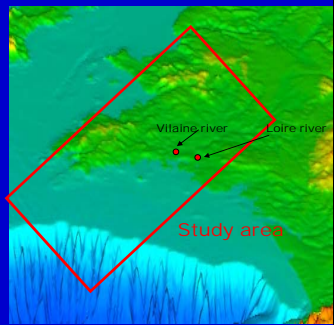
April 19-21 2006

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Northern Bay of Biscay

From watershed to shelf break...

- I . Long term trends of nutrient inputs by Vilaine and Loire rivers
- II . Behavior of nutrients within the estuarine system
- III . Seasonal schemes of phytoplankton responses in the open sea
- Conclusions



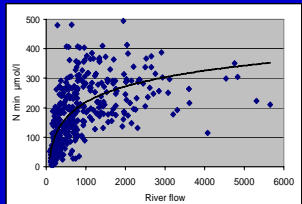
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I Loire nutrients fluxes...

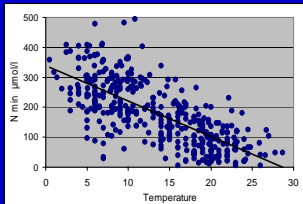
- Seasonal variability of N concentrations at 0 psu

Nitrogen concentrations (1971 – 2004) versus :

Loire river flow



Temperature

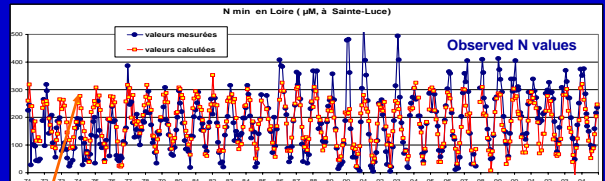


These relationships allow to construct a statistical model
 $[N \text{ min}] = f [\log(Q) , T^{\circ}C]$
 and to « eliminate » the role of river flow and T°C in the trend:

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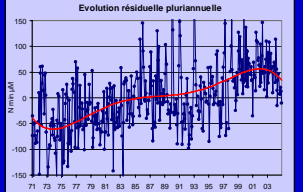
I Loire nutrient concentration trend ...

- Long term trend of N min at 0 psu



Calculated N values :
 $[N \text{ min}] = f [\log(Q) , T^{\circ}C]$
 $R^2 = 0.7$

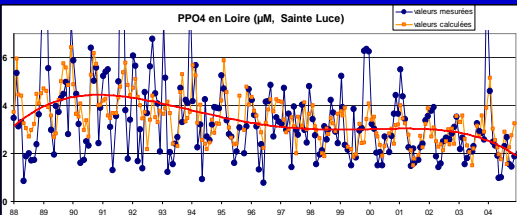
Residual trend
 Observed- Calculated = Résiduels :
 + 70 % in 30 years
 (+ 1,6 % per year)



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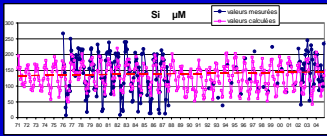
I Loire nutrient concentrations...

- Long term trend (P PO₄) at 0 psu



Minus 30 % in 16 years
 (- 2,2 % per year)

Stability of silicate



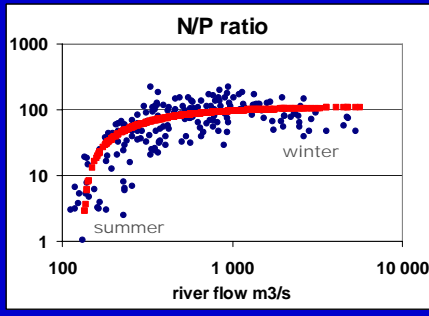
Same trends for Vilaine river

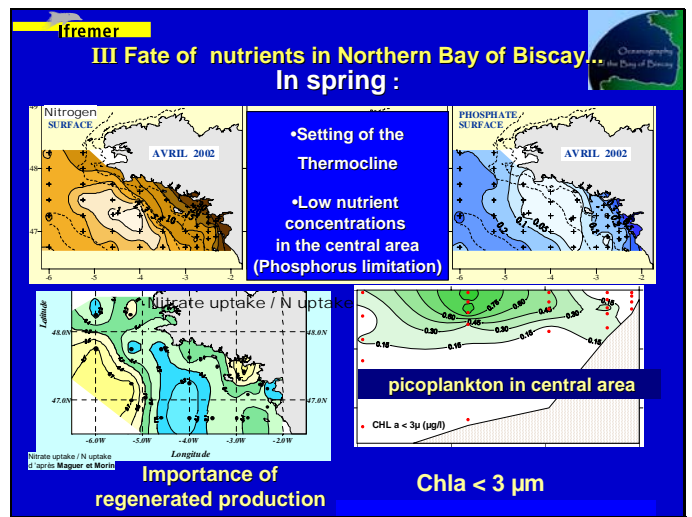
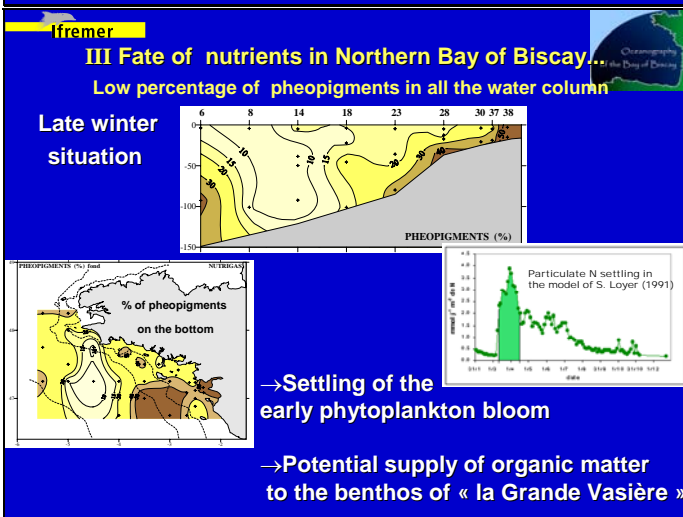
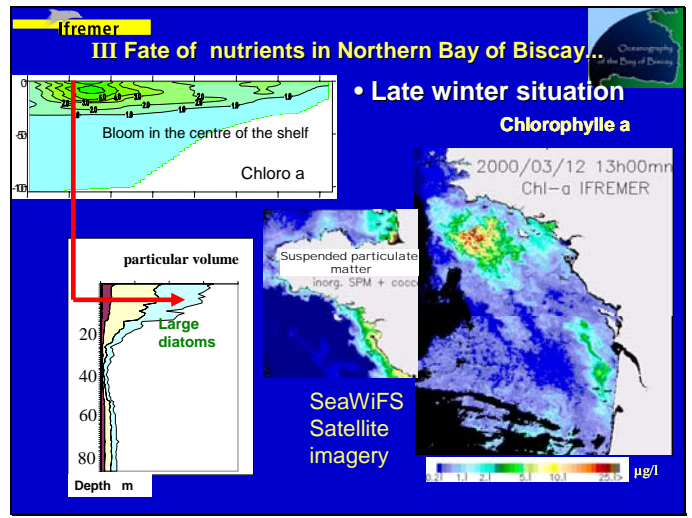
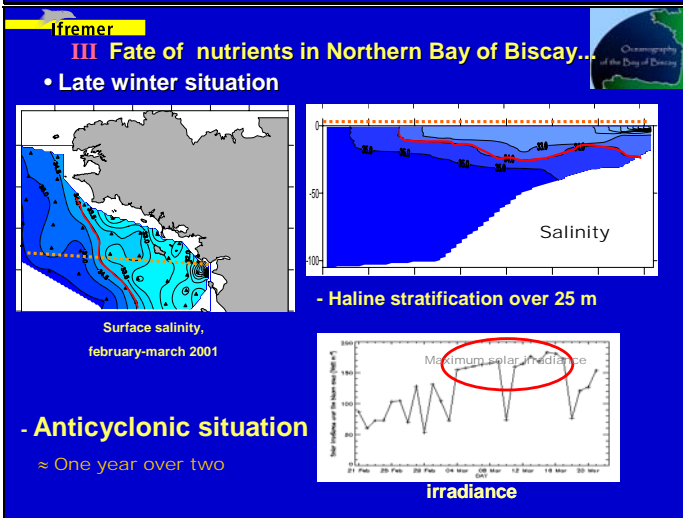
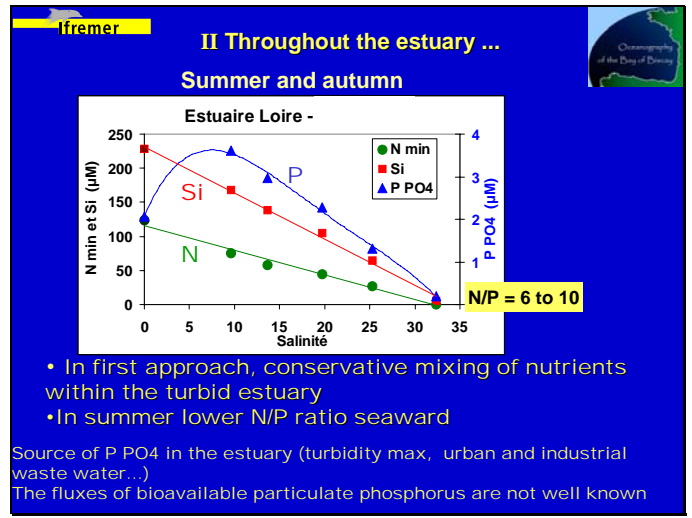
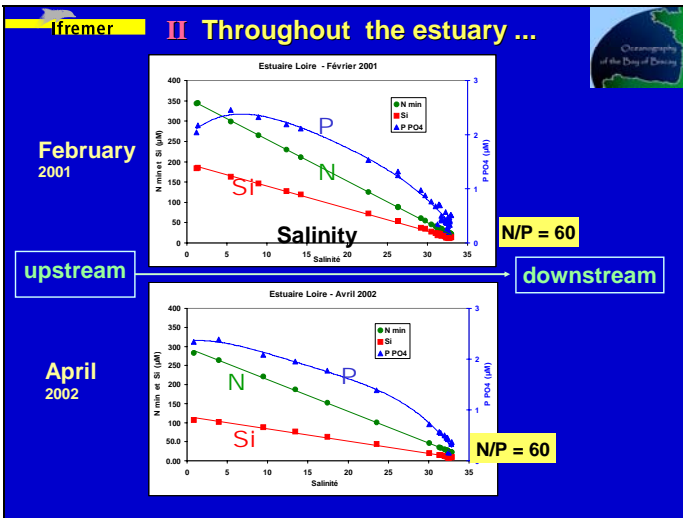
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I Loire nutrient concentrations...

N/P ratio in Loire at 0 psu

Annual variation

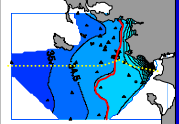




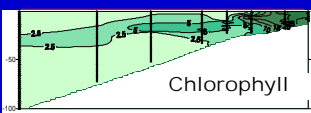
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III Fate of nutrients in Northern Bay of Biscay...

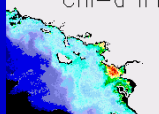
In summer



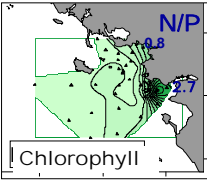
Smaller river plume



Chlorophyll



Chl-a IFF



Chlorophyll

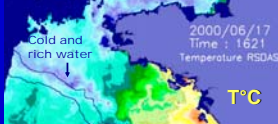
N/P

- Nitrogen could be the limiting nutrient in summer river plumes

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Also in summer...

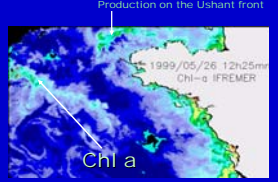
From May, role of internal waves at the shelf break



2000/06/17
Time : 1621
Temperature RSDAS
T°C

Cold and rich water

- mixing of the water column and nutrient enrichment
- Novel production independent of riverine nutrient inputs
- Potential cause of benthos enrichment at the edge of the shelf break ?
- Role for pelagic resources




Production on the Ushant front

1999/05/26 12h25m
Chl-a IFREMER

Chl a

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1 - Conclusions about riverine fluxes

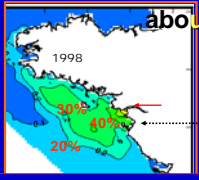


Vilaine watershed
Loire watershed
Estuary
Océan Atlantique

- Obvious long-term trends of riverine N and P fluxes
- These trends reflect the anthropogenic activities on watersheds :
 - Increase of N inputs (agriculture development)
 - Decrease of P inputs (wastewater treatment plants ...)
- In most of the cases, nutrients have a conservative behavior throughout the estuary
- Particulate fluxes, particularly for P bioavailable, are not well known

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2 - Conclusions about Northern Bay of Biscay



1998

20% 40%

Mean % of annual primary production linked to Loire nutrient inputs (model S. Loyer, 2001)

Large influence of continental inputs on the planktonic production of the coastal zone and the shelf

- Late winter phytoplanktonic blooms could partially supply benthos with fresh organic matter in the central area (« La Grande Vasière »)
- The limitation of these early blooms by phosphorus probably increased during the thirty last years (with increase of small planktonic form ?)
- The production of small summer plumes could rise because of nitrogen input increased during the thirty last years; with two consequences:
 - Beneficial role for coastal nurseries and shell fishing
 - But risk of eutrophication in some areas (like Bay of Vilaine or Loire plume)
- The planktonic production at the shelf break is not well known; but it could be important in mass and for some pelagic resources