Suivi de la qualité de l'eau dans les bassins versants du Finistère: Apports des sciences participatives

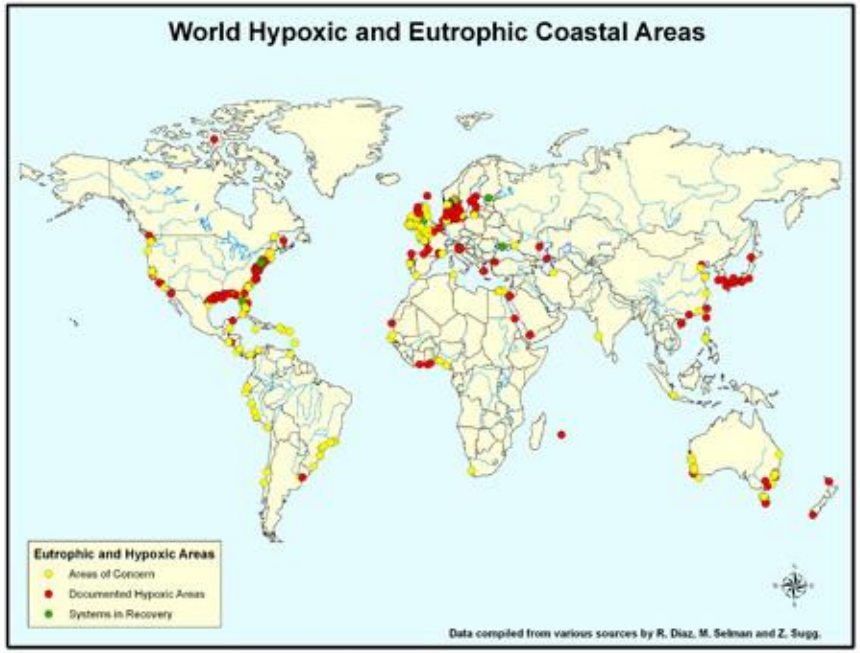
Moatar F., Gauthier O, Marie Czamanski M., Ragueneau O., Antoine V.

Contexte

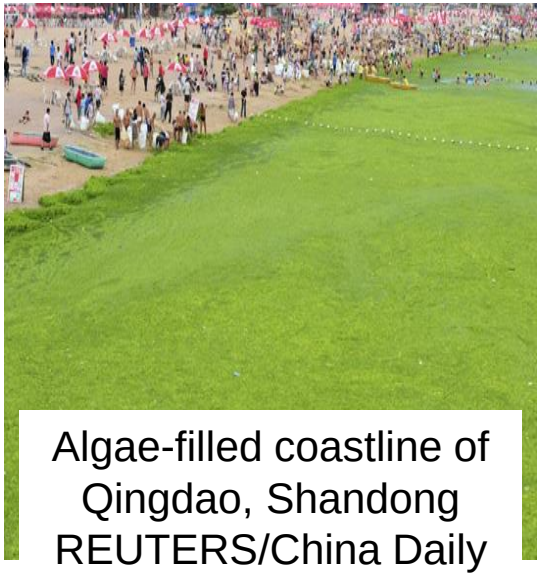
Contexte

Contexte

Contexte



Fish Kill, Greenwich Bay, RI

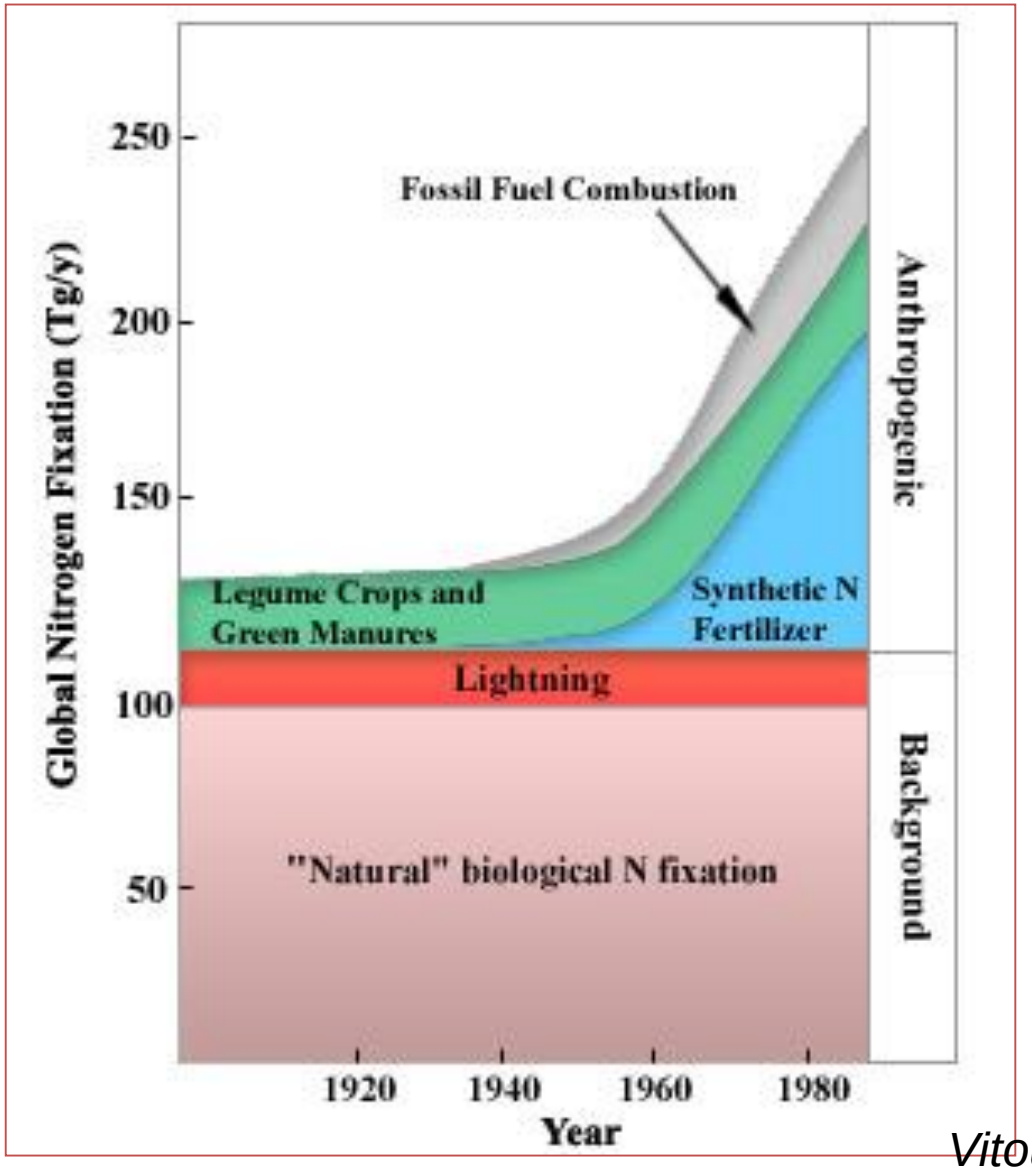


Algae-filled coastline of Qingdao, Shandong REUTERS/China Daily

Contexte

0
50
100km
Algal bloom
SWEDEN
North Sea
POLAND
UK
GERMANY
LATVIA
BALTIC SEA
SWEDEN
LITHUANIA
Algal bloom
RUSSIA
POLAND
SOURCE: ESA, 11 JULY

Contexte

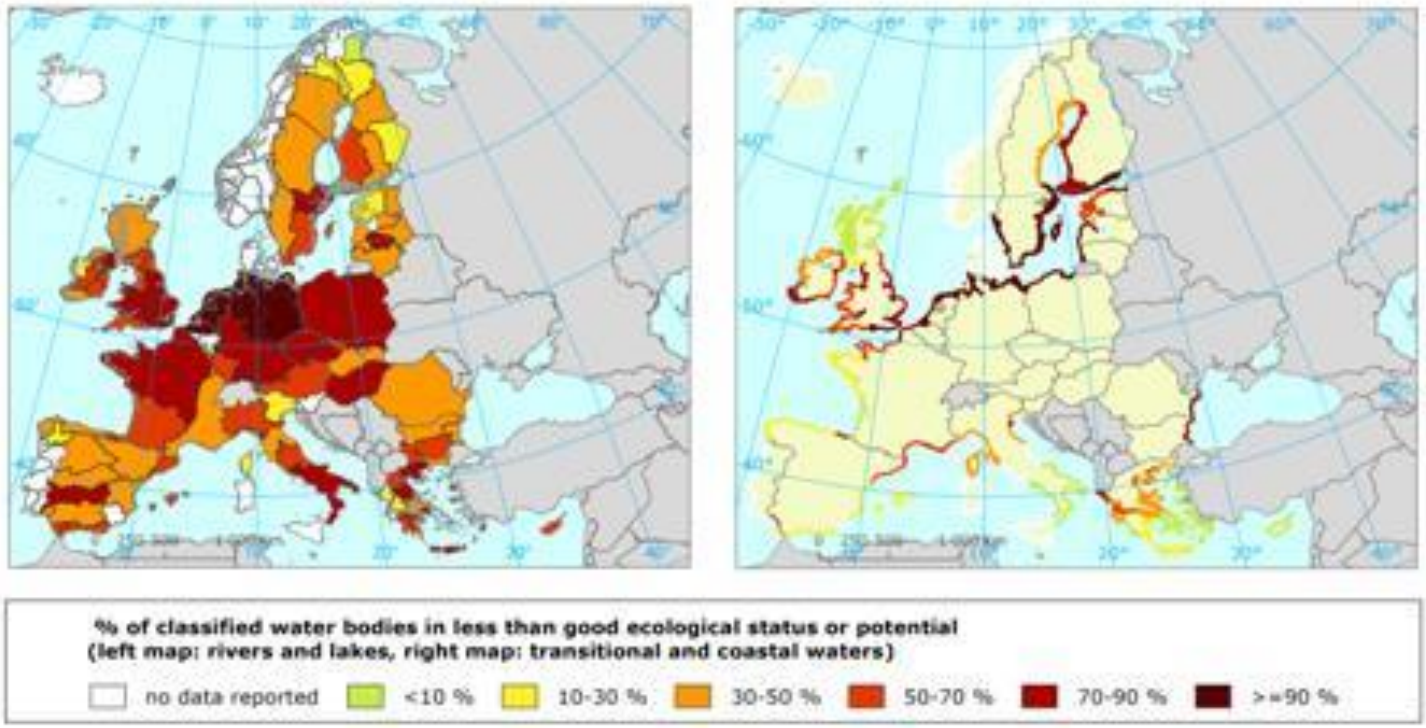


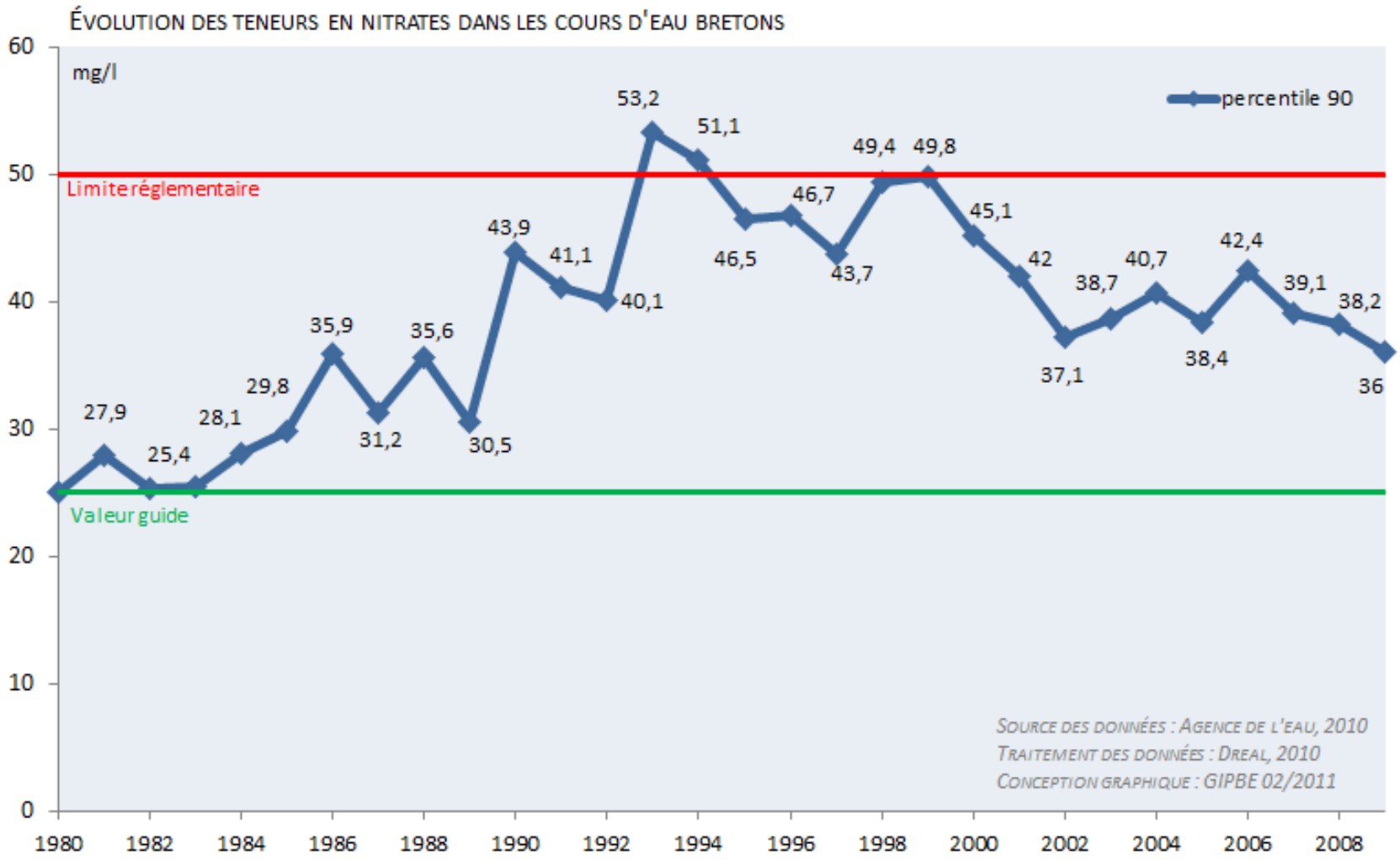
Vitousek & Matson 1999

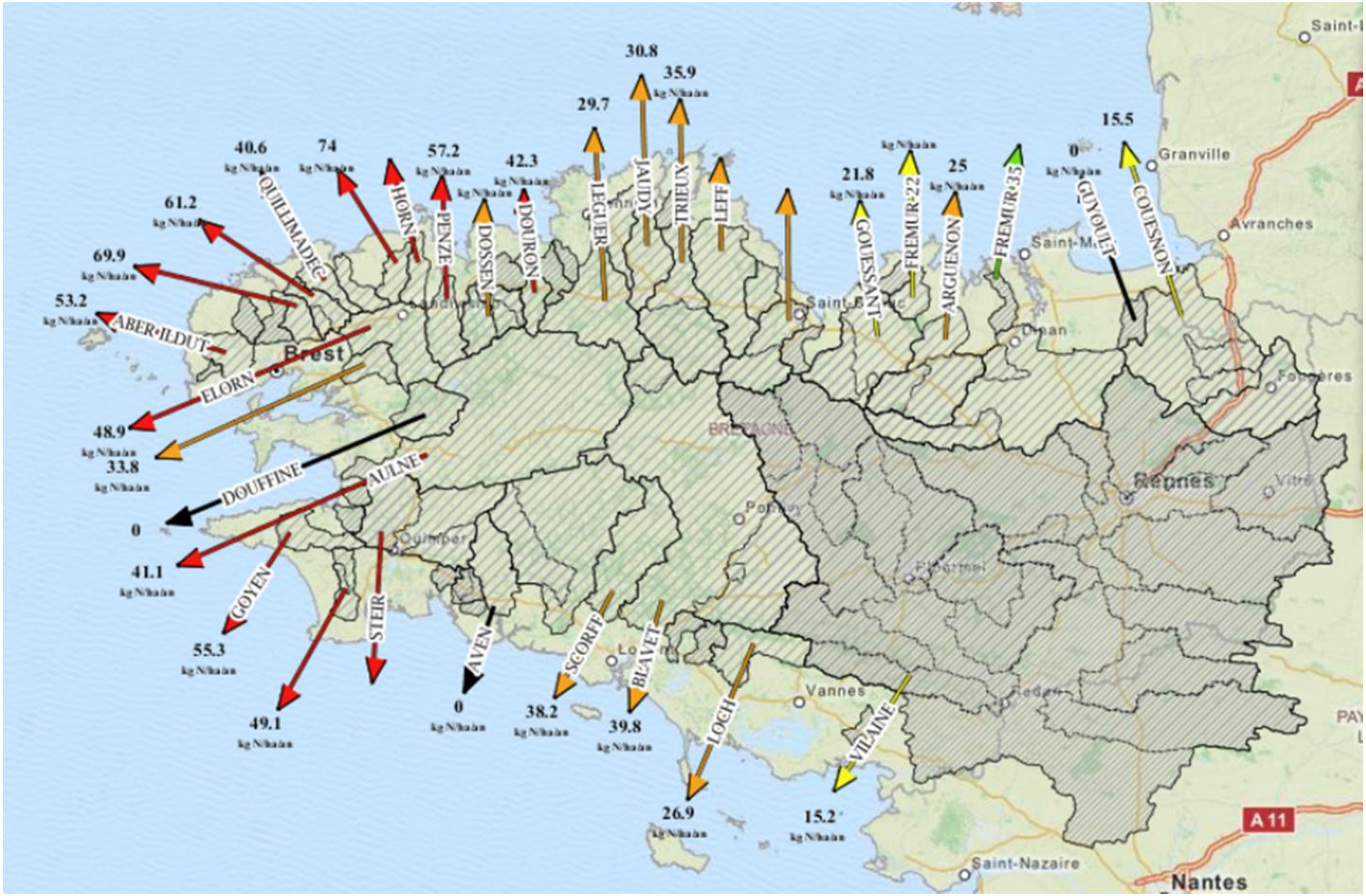
Contexte

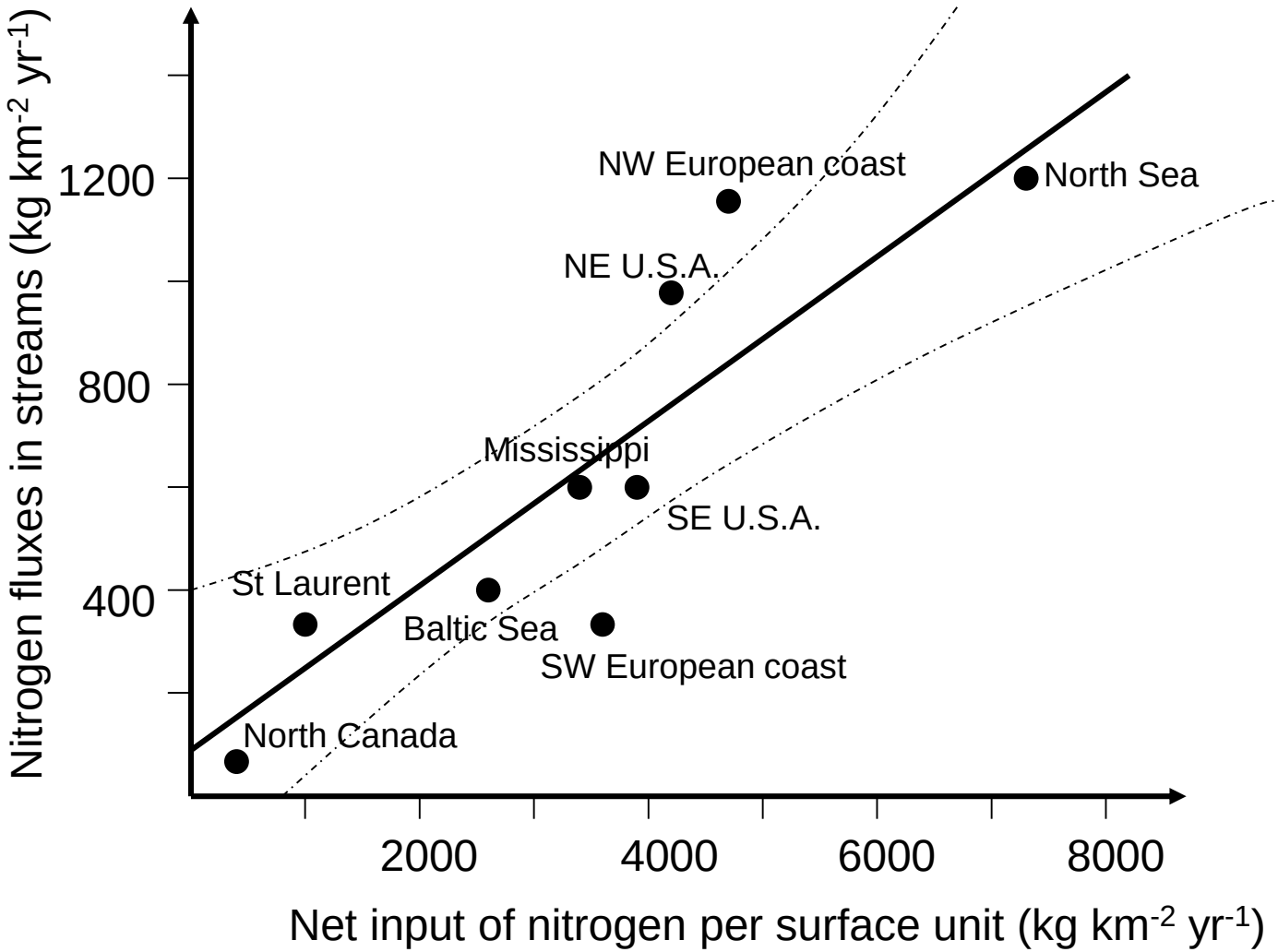
Contexte

Contexte

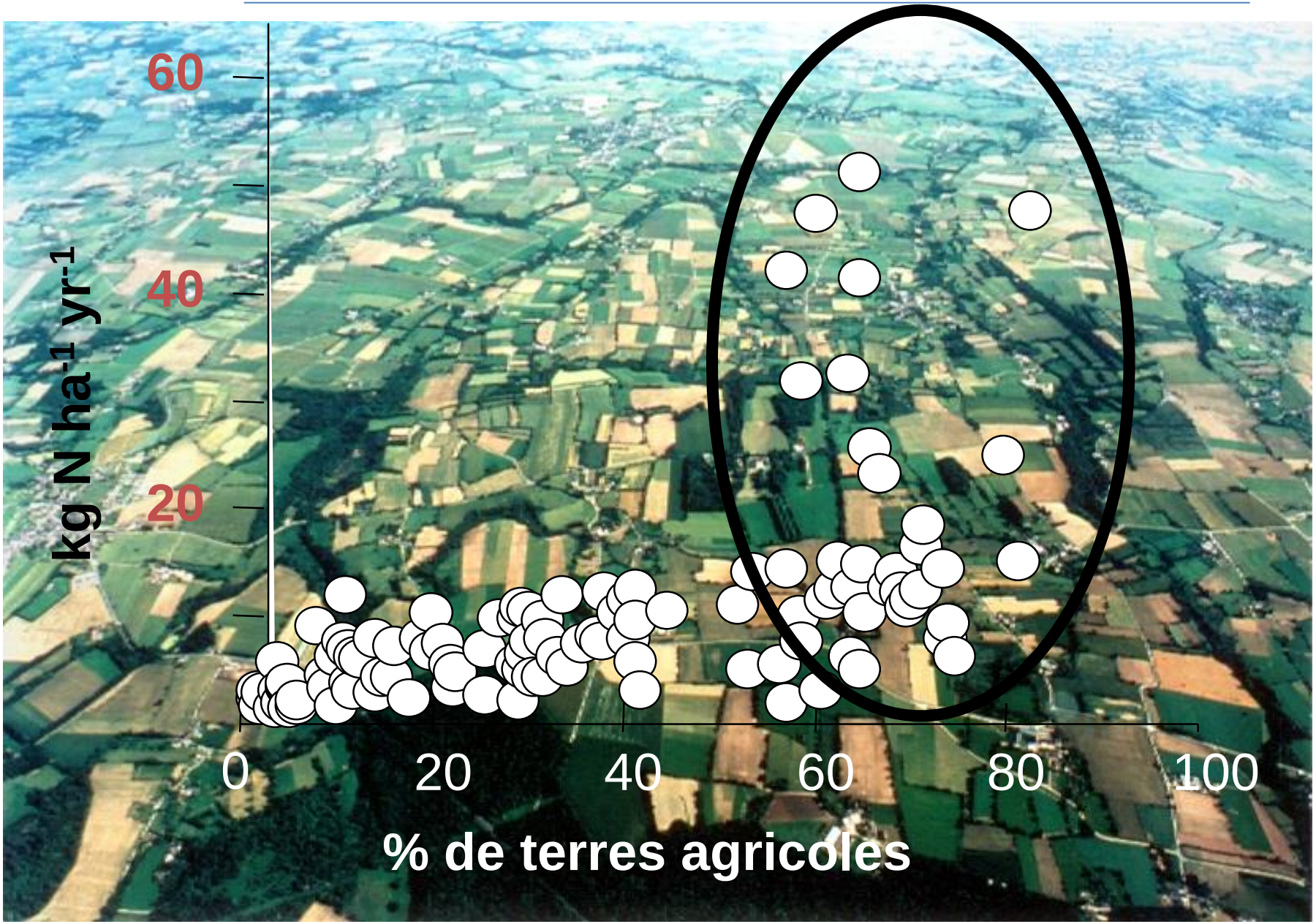

% of classified water bodies in less than good ecological status or potential
(left map: rivers and lakes, right map: transitional and coastal waters)
no data reported
<10 %
10-30 %
30-50 %
50-70 %
70-90 %
>=90 %


ÉVOLUTION DES TENEURS EN NITRATES DANS LES COURS D'EAU BRETONS
mg/l
percentile 90
Limite réglementaire
Valeur guide
60
50
40
30
20
10
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
27,9
25,4
28,1
29,8
35,9
31,2
35,6
30,5
43,9
41,1
40,1
53,2
51,1
46,5
46,7
43,7
49,4
49,8
45,1
42
37,1
38,7
40,7
38,4
42,4
39,1
38,2
36
SOURCE DES DONNÉES : AGENCE DE L'EAU, 2010
TRAITEMENT DES DONNÉES : DREAL, 2010
CONCEPTION GRAPHIQUE : GIPBE 02/2011


30.8
35.9
29.7
15.5
40.6
74
57.2
42.3
0
21.8
25
61.2
69.9
53.2
48.9
33.8
0
41.1
55.3
49.1
0
38.2
39.8
26.9
15.2
QUILLIMADEC
HORN
PENZE
DOSSEN
DOURON
LEGUER
JAUDY
TRIEUX
LEFF
GOUESSANT
FREMUR 22
ARGUENON
FREMUR 35
GUYOULT
COUESNON
ABER ILDUT
ELORN
DOUFFINE
AULNE
GOYEN
STEIR
AVEN
SCORFF
BLAVET
LOCH
VILAINE
Brest
Quimper
Vannes
Rennes
Saint-Brieuc
Dinan
Saint-Malo
Granville
Avranches
Fougères
Saint-Nazaire
Nantes
A 11



From Howarth et al. 1996


60
40
20
kg N ha-1 yr-1
0
20
40
60
80
100
% de terres agricoles

Types de réseaux de suivi de la qualité des cours d'eau

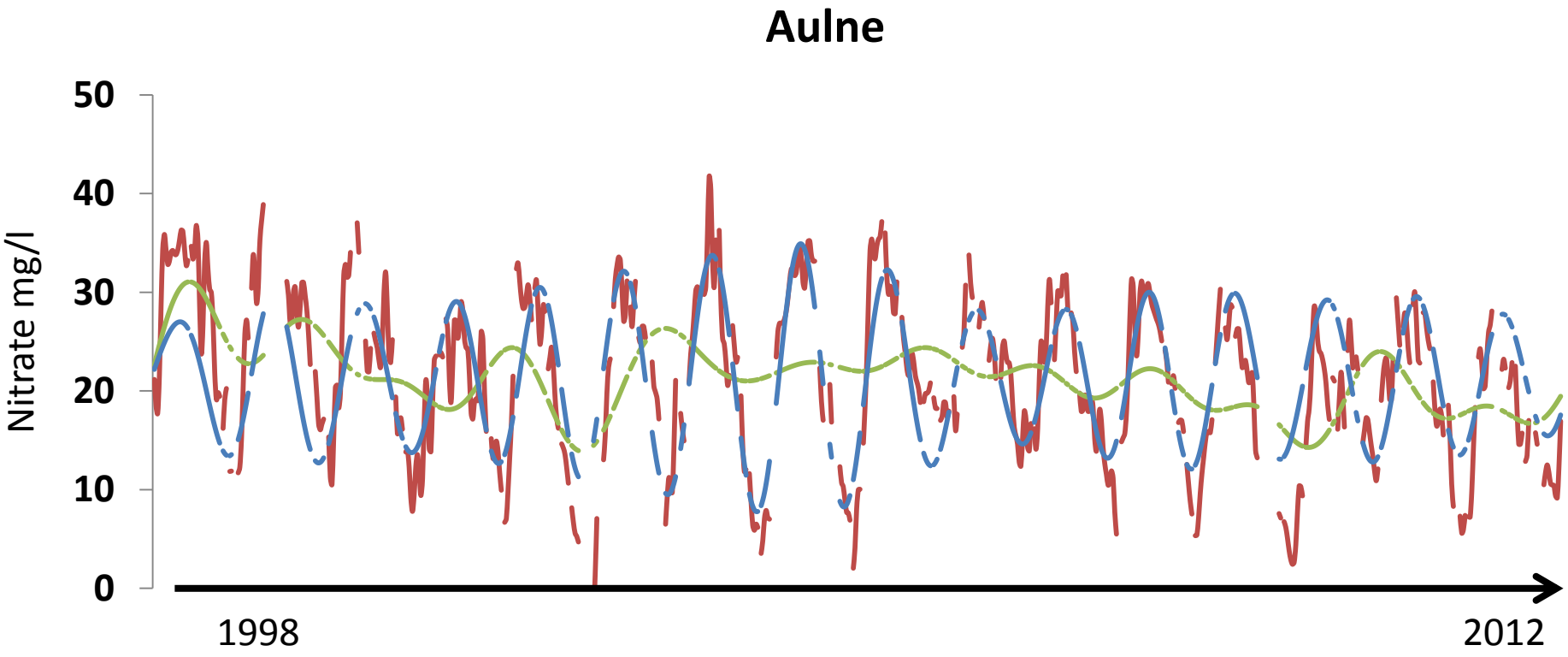
BVs Recherche	BV site pilote	Réseaux de surveillance
Données haute fréquence 365/an Sub-journalière	Données Moyenne fréquence 52/an	Données Basse fréquence 12/an 6/an 4/an

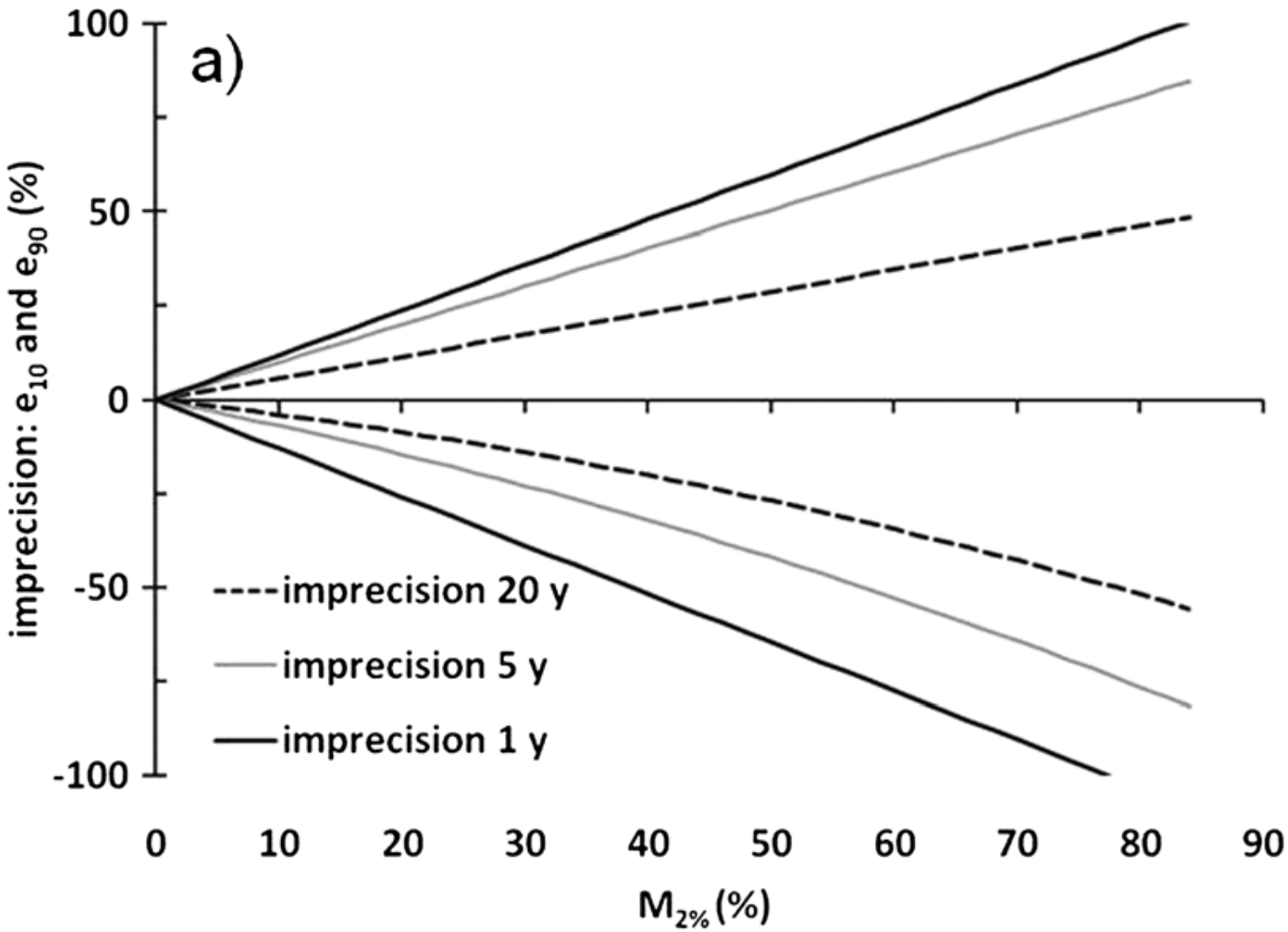
La haute fréquence est manquante pour les bassins intermédiaires (100 à 1000 km²)

La moyenne fréquence est disponible pour quelques bassins versants, mais nécessite d'être consolidée

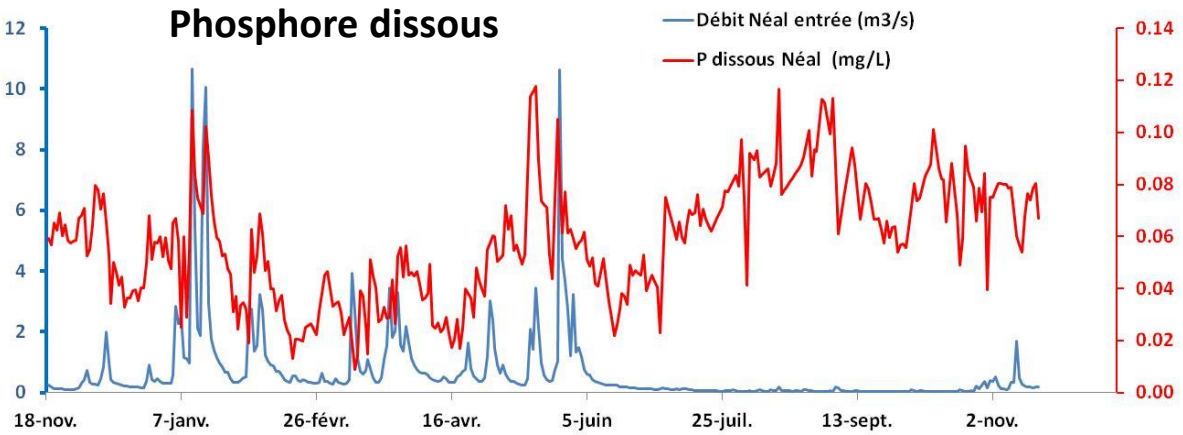
Décomposition du signal des concentrations en 3 composantes:

1) Composante « tendance » pluriannuelle
2) Composante « saisonnière »
3) Composante à court terme





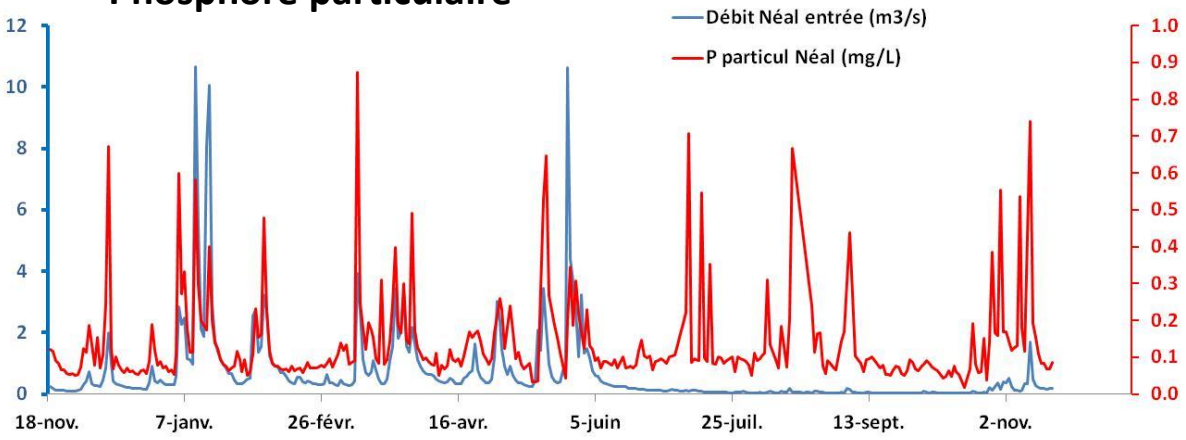
Moatar et al, Hydrological Processes, 2013



Fréquence journalière

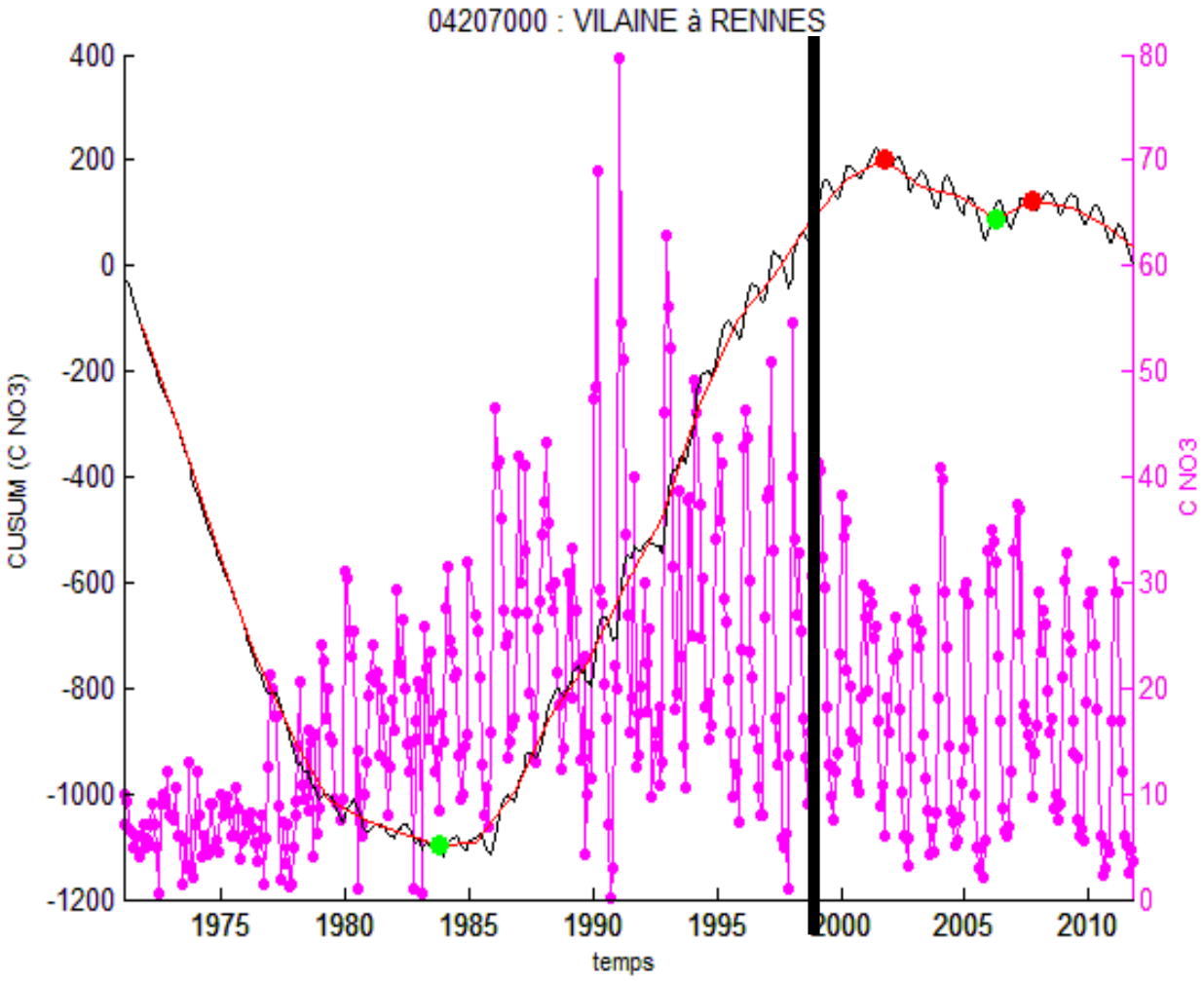
Haute Fréquence

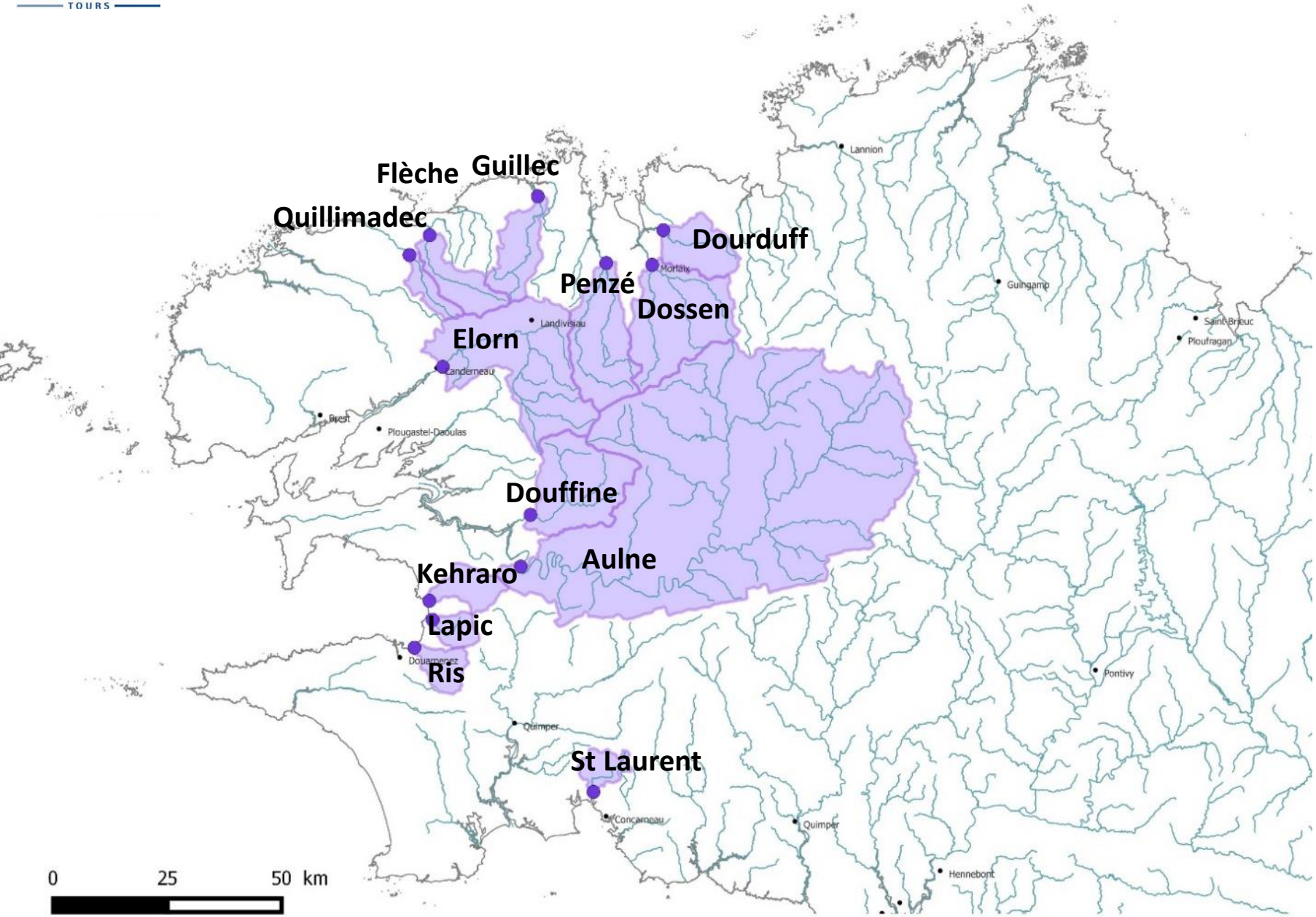
Phosphore particulaire

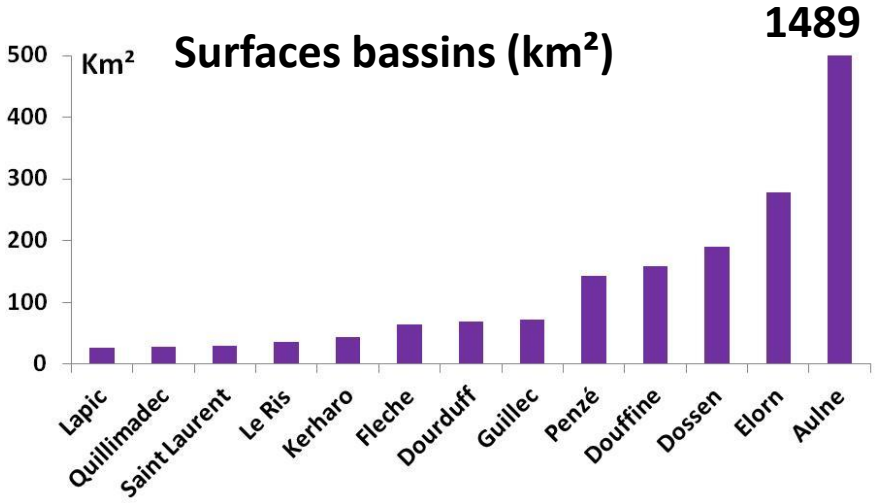


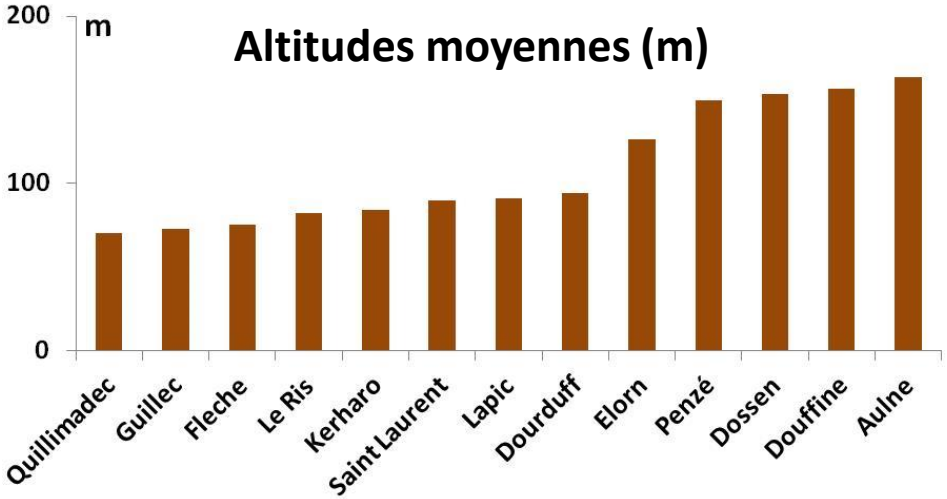
Fréquence journalière

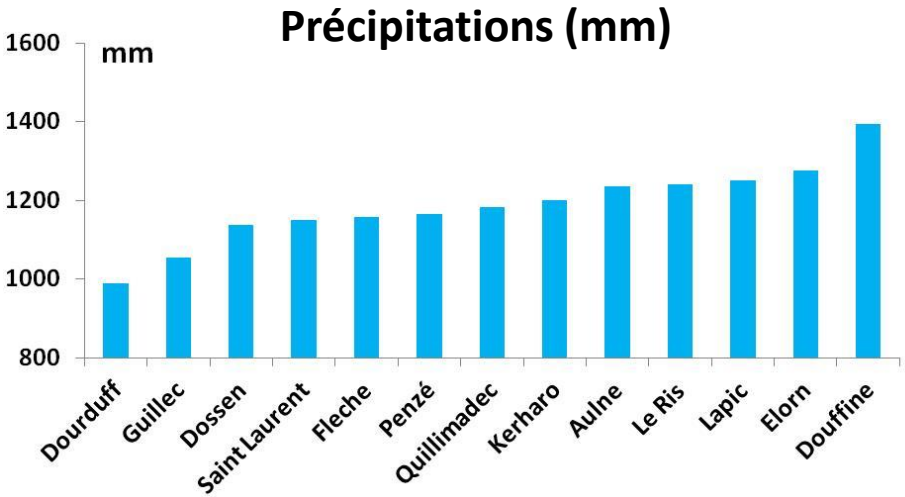
Haute Fréquence

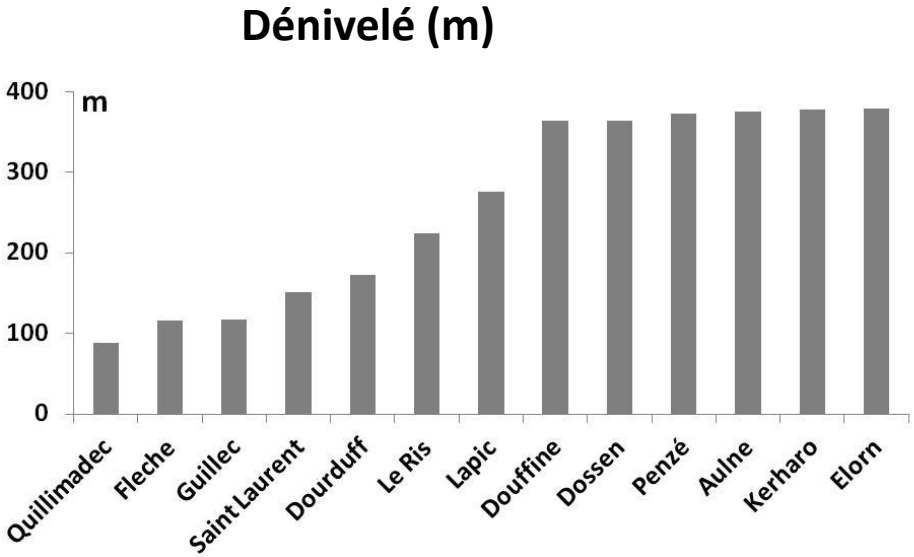

04207000 : VILAINE à RENNES
CUSUM (C NO3)
C NO3
temps
400
200
0
-200
-400
-600
-800
-1000
-1200
80
70
60
50
40
30
20
10
0
1975
1980
1985
1990
1995
2000
2005
2010

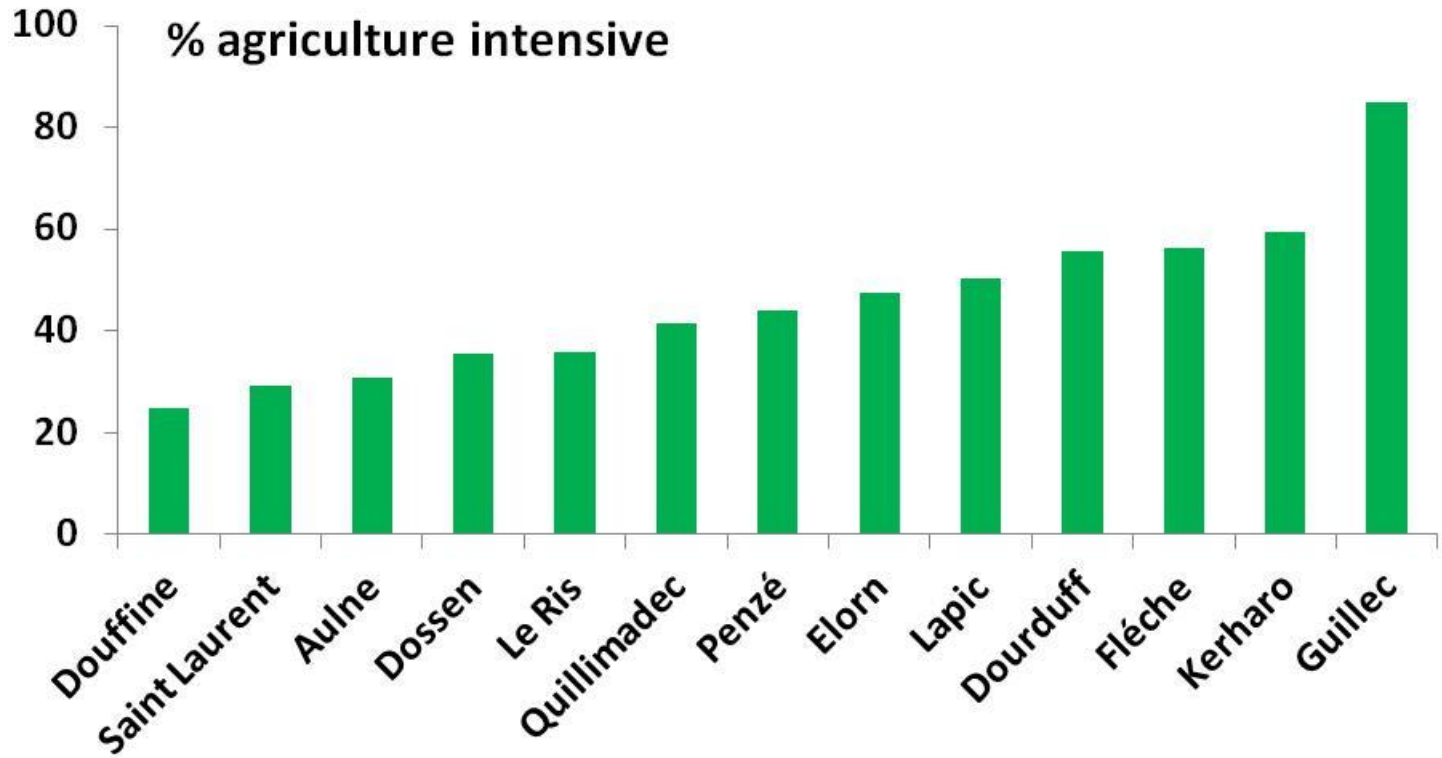

Flèche
Guillec
Quillimadec
Dourduff
Penzé
Dossen
Elorn
Douffine
Aulne
Kehraro
Lapic
Ris
St Laurent
Lannion
Guingamp
Saint-Brieuc
Ploufragan
Morlaix
Landivisiau
Landerneau
Brest
Plougastel-Daoulas
Douarnenez
Quimper
Concarneau
Pontivy
Hennebont
0
25
50 km


Surfaces bassins (km²)
Km²
1489
500
400
300
200
100
0
Lapic
Quillimadec
Saint Laurent
Le Ris
Kerharo
Fleche
Dourduff
Guillec
Penzé
Douffine
Dossen
Elorn
Aulne

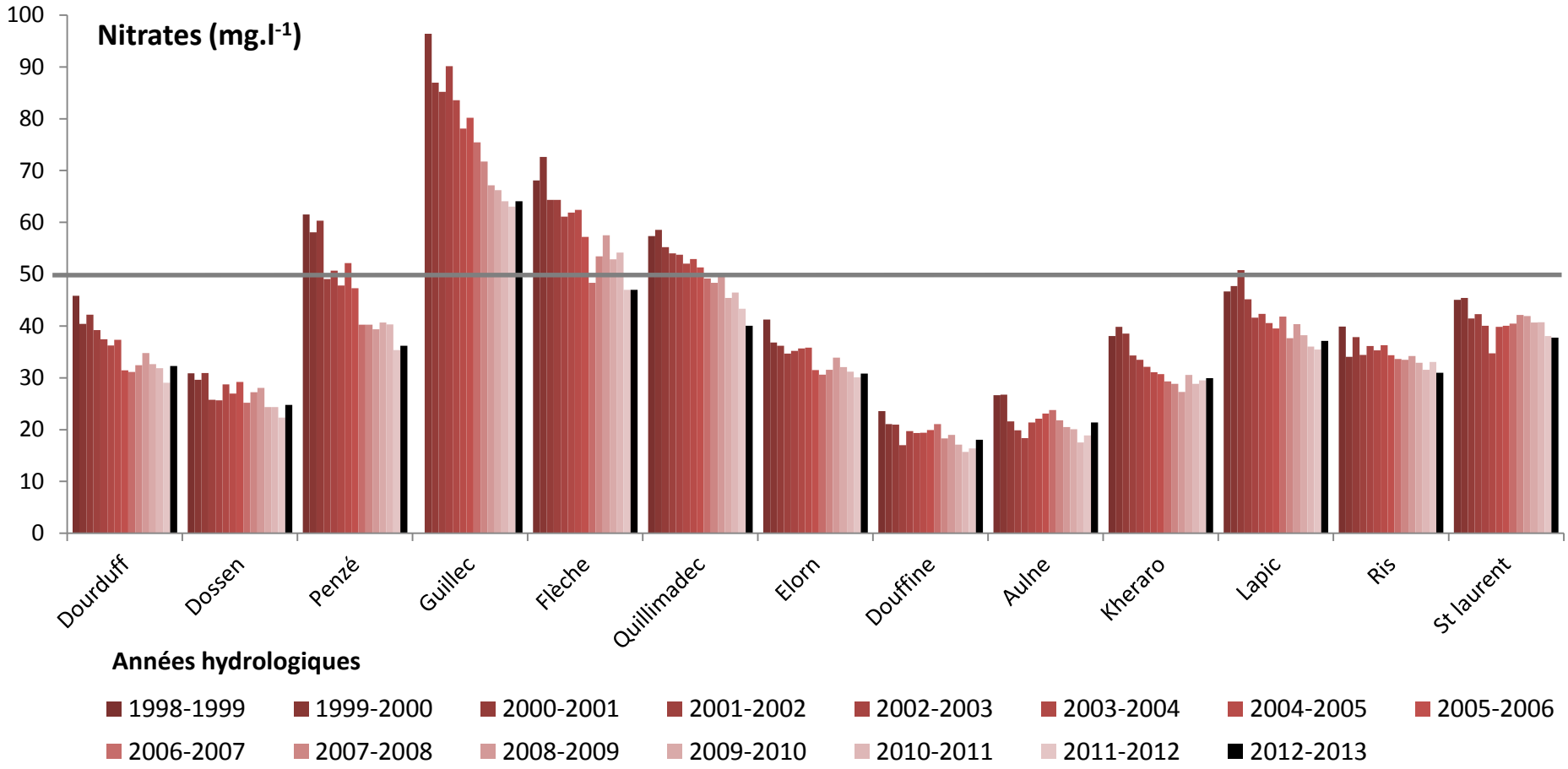

Altitudes moyennes (m)
m
200
100
0
Quillimadec
Guillec
Fleche
Le Ris
Kerharo
Saint Laurent
Lapic
Dourduff
Elorn
Penzé
Dossen
Douffine
Aulne


Précipitations (mm)
mm
1600
1400
1200
1000
800
Dourduff
Guillec
Dossen
Saint Laurent
Fleche
Penzé
Quillimadec
Kerharo
Aulne
Le Ris
Lapic
Elorn
Douffine

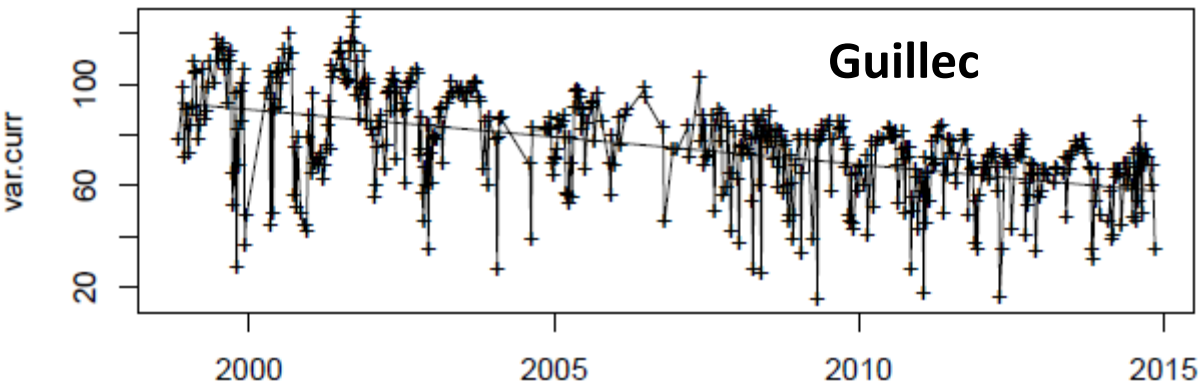

Dénivelé (m)
m
400
300
200
100
0
Quillimadec
Fleche
Guillec
Saint Laurent
Dourduff
Le Ris
Lapic
Douffine
Dossen
Penzé
Aulne
Kerharo
Elorn


% agriculture intensive
100
80
60
40
20
0
Douffine
Saint Laurent
Aulne
Dossen
Le Ris
Quillimadec
Penzé
Elorn
Lapic
Dourduff
Fléche
Kerharo
Guillec

Concentrations moyennes annuelles en nitrates



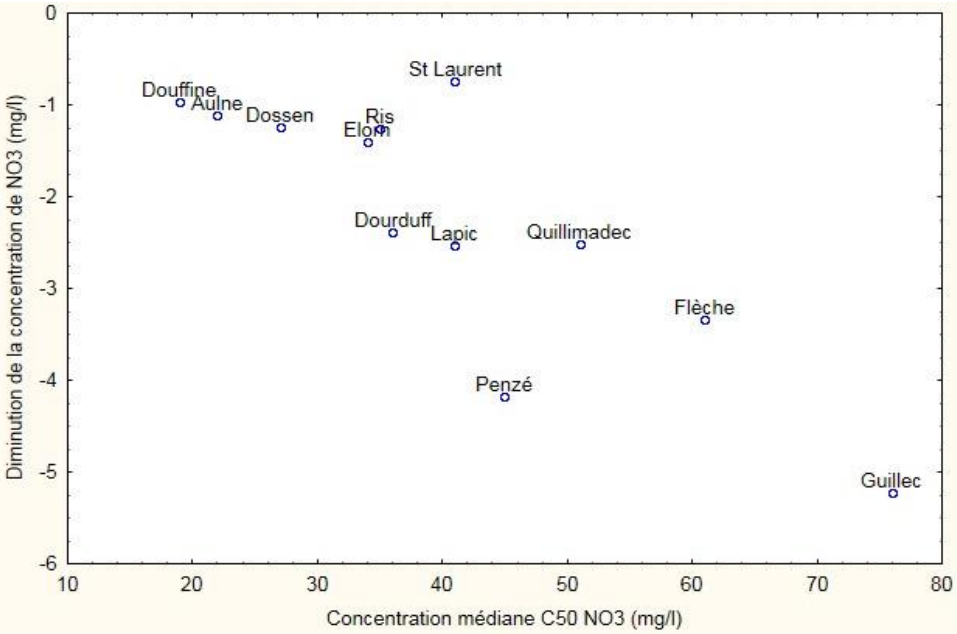
Nitrates

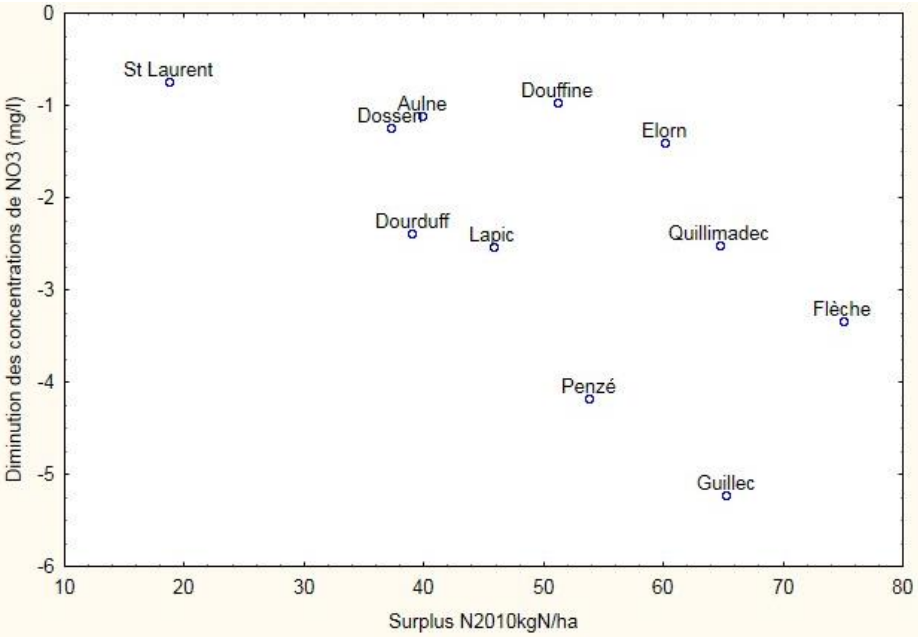


Diminutions significatives d'un point de vue statistique p-value< 10^{-16}

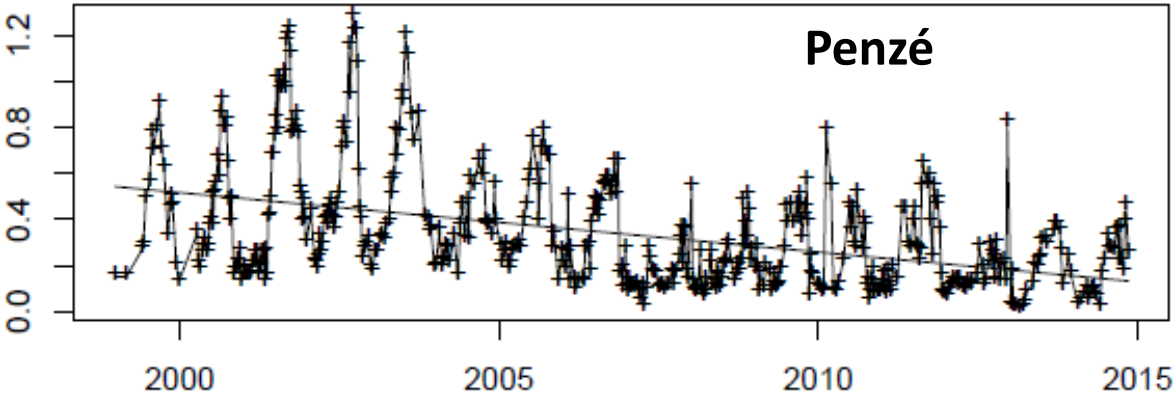
Mais seulement – 5% (en moyenne) de diminution

-3 à - 6 mg/l NO3 pour
-les plus fortes diminutions en 17 ans
-(soit 6 à 9 %)





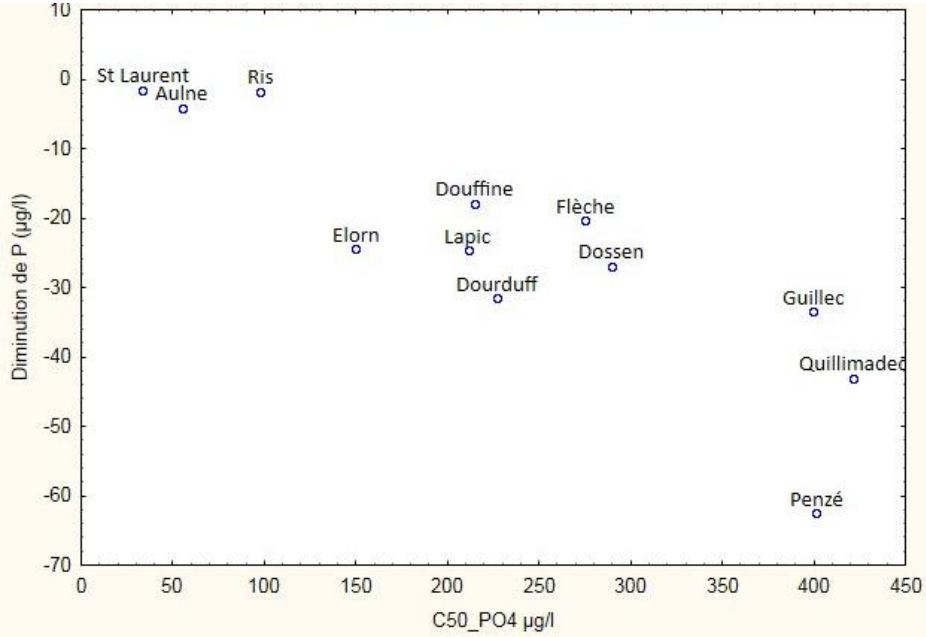
Orthophosphates

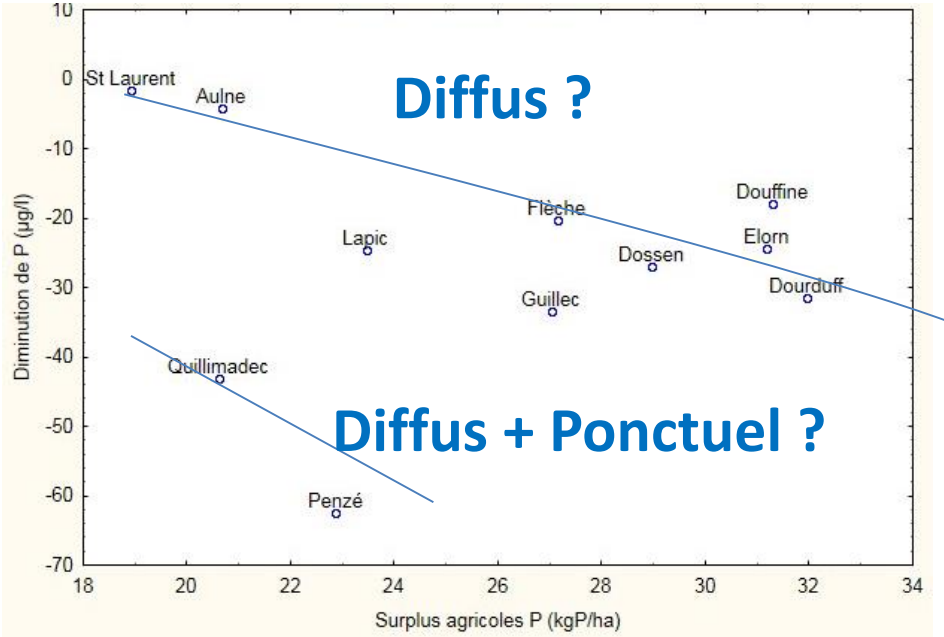


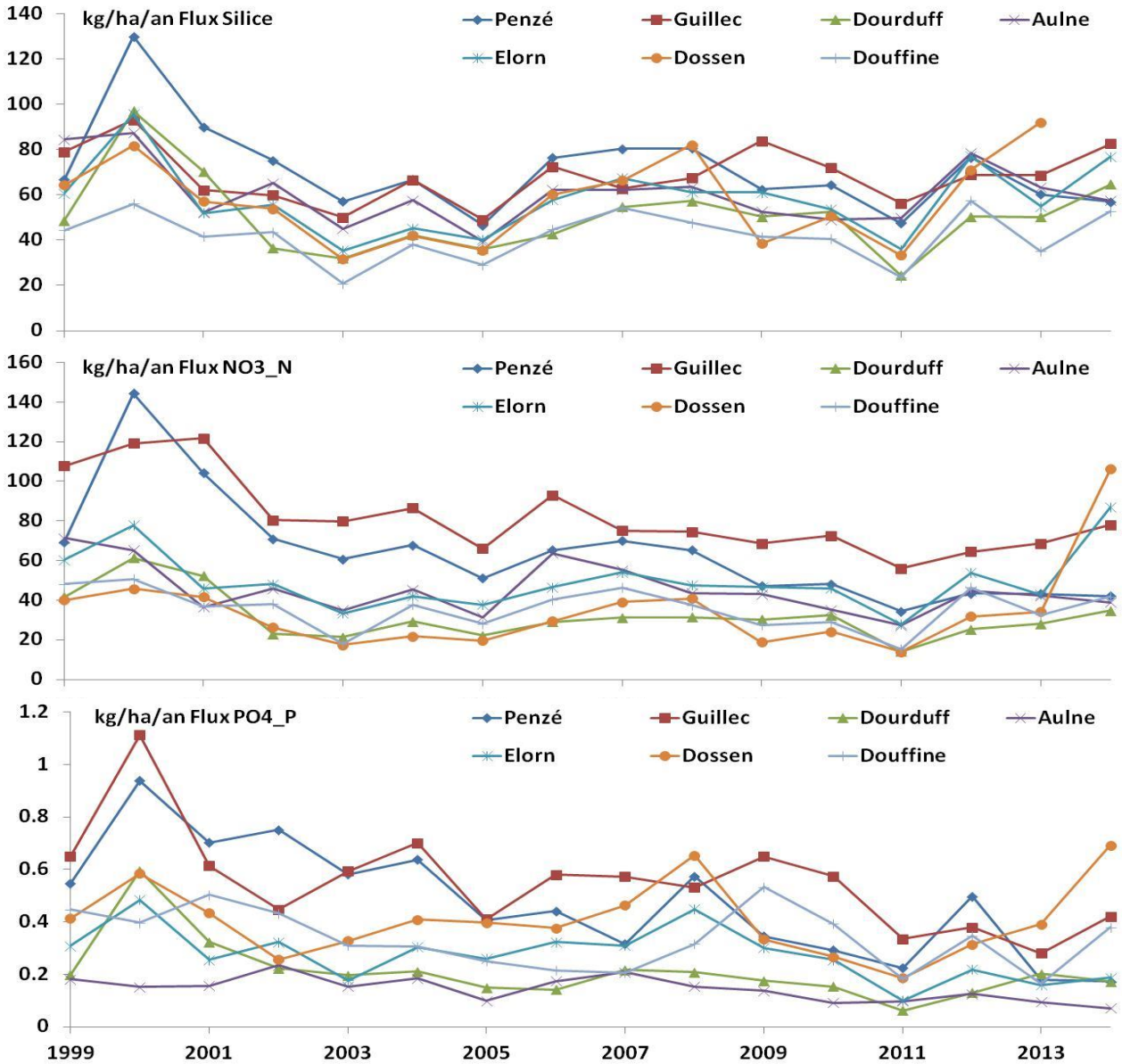
Pour 4 rivières
Diminutions significatives statistique (p-value< 10^{-16}

En moyenne -10%

Penzé – 16%







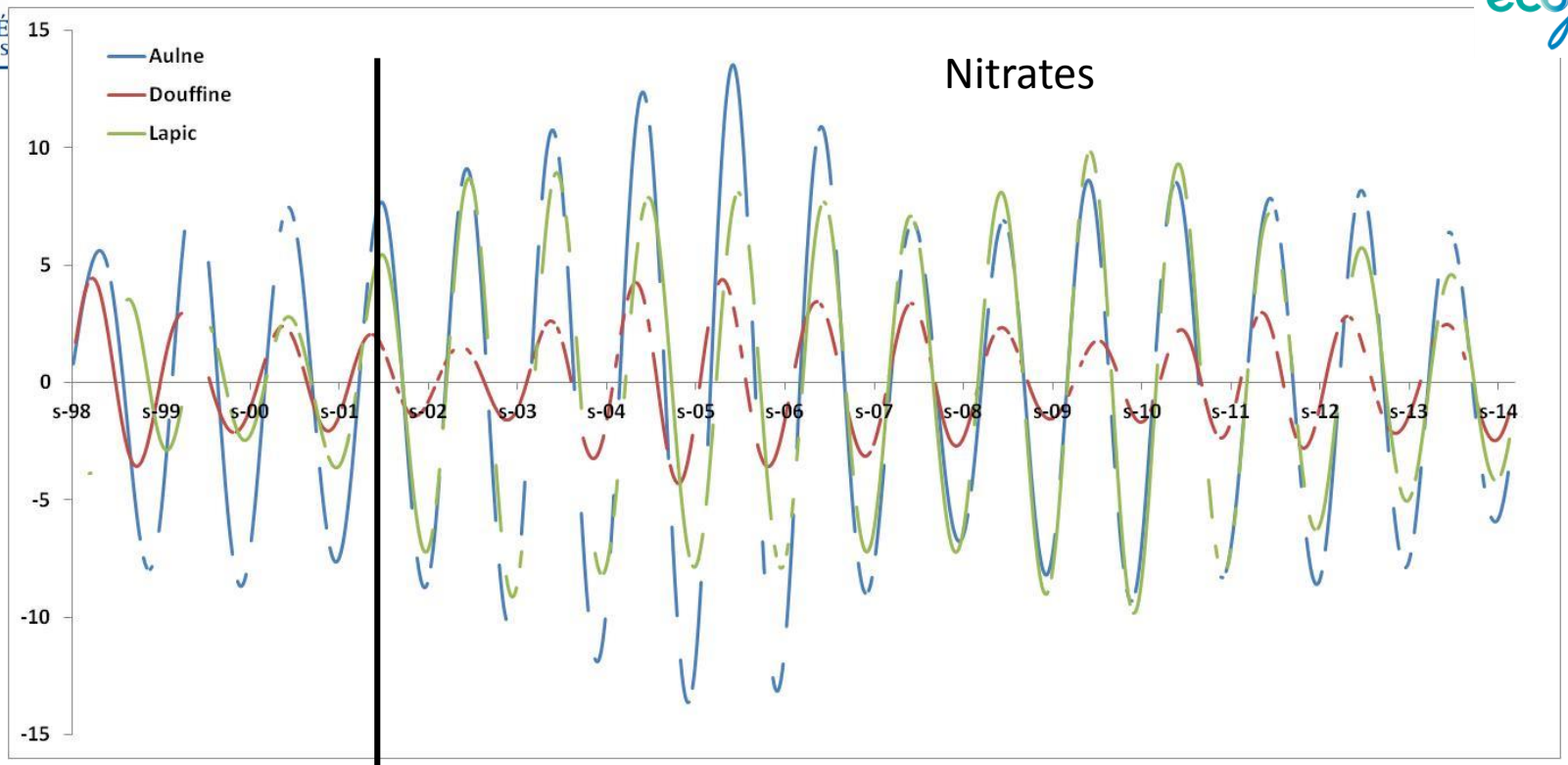
Variations
+ ou – 10%

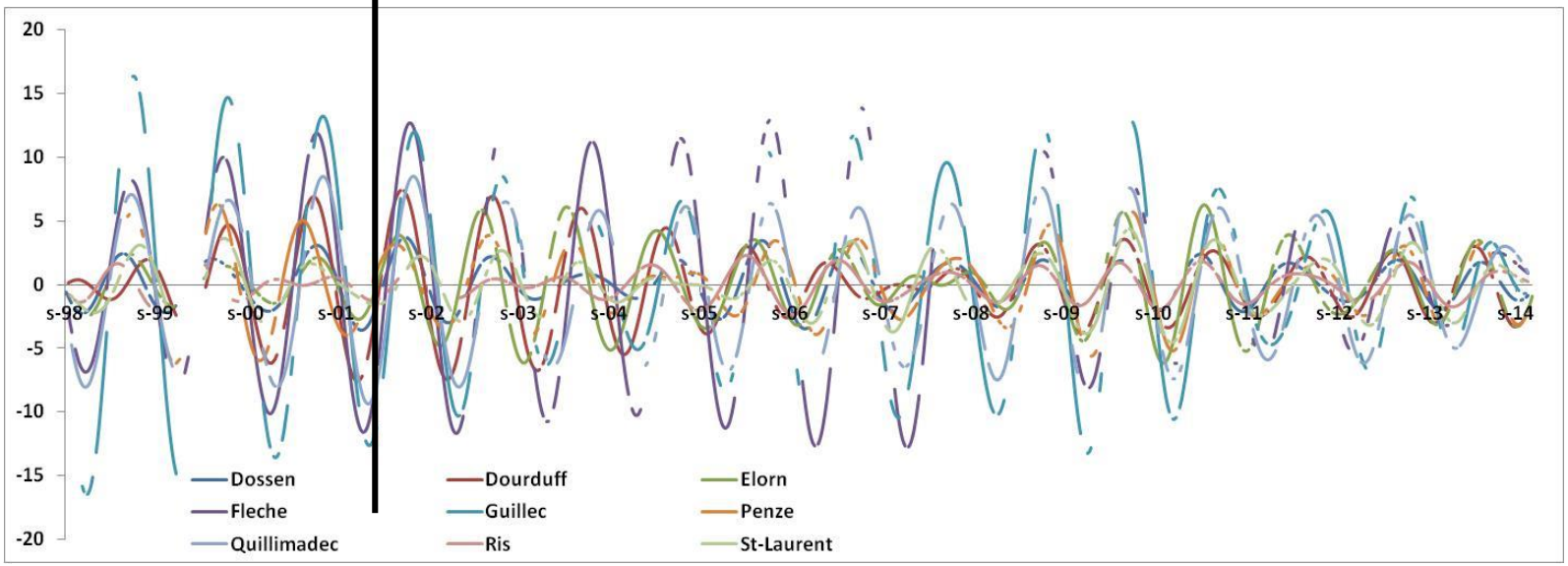
Diminution des flux
Guillec
Penzé
Env. -30%

Diminution des flux
Penzé
-45%
Guillec, Dourduff, Aulne
-20 à – 30%

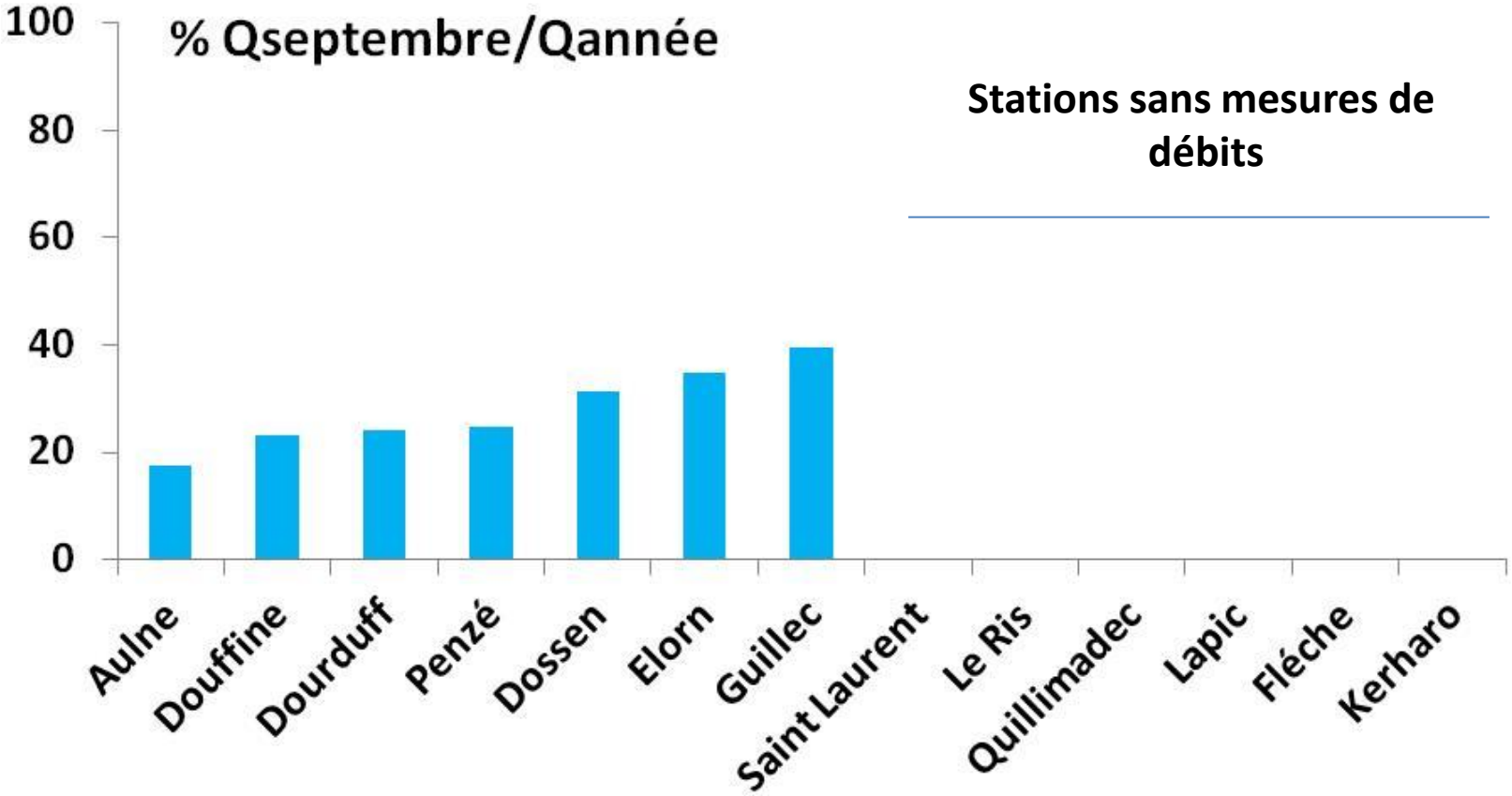
Les flux d'étiage diminuent plus

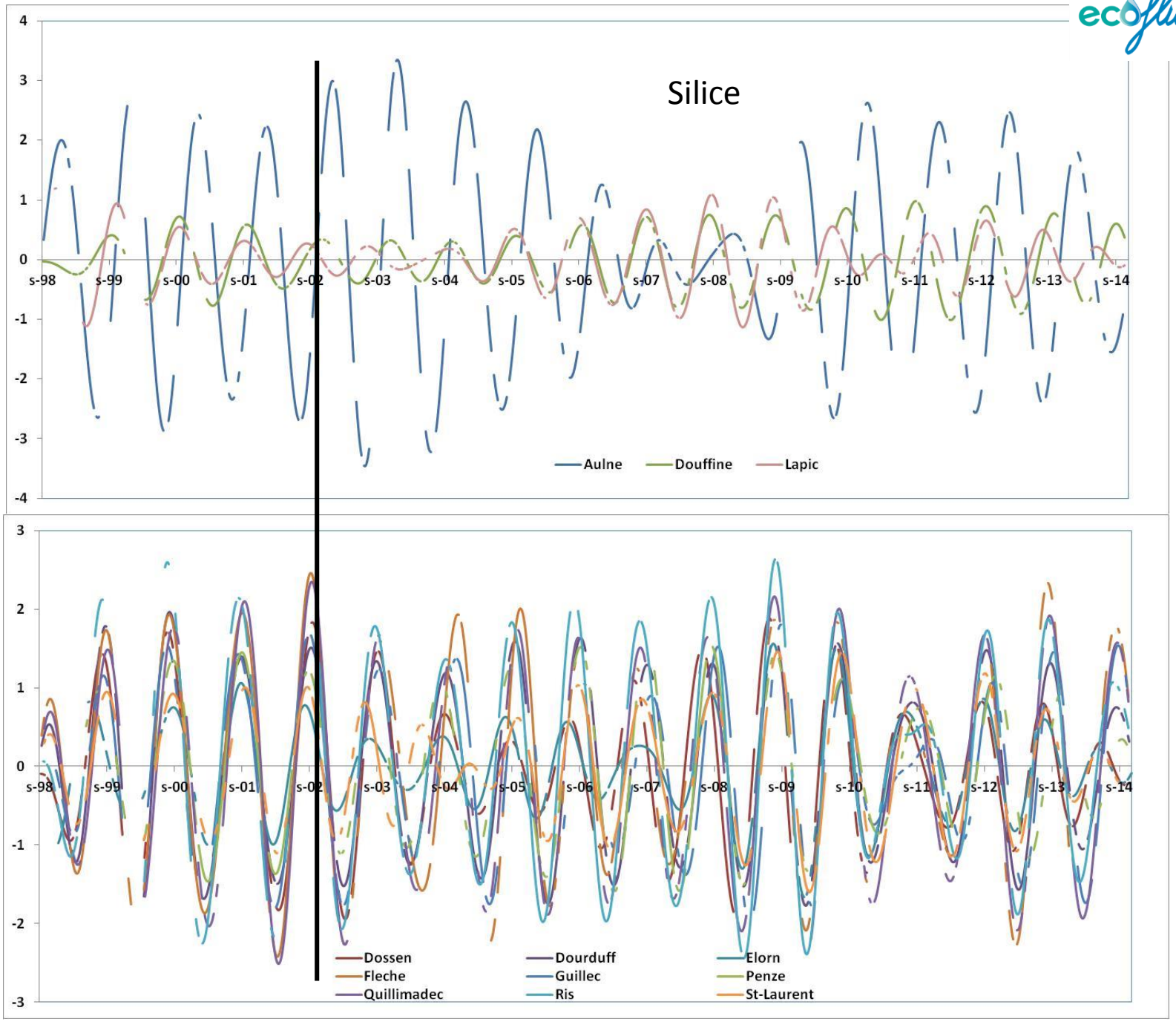
Nitrates


Aulne
Douffine
Lapic
15
10
5
0
-5
-10
-15
s-98
s-99
s-00
s-01
s-02
s-03
s-04
s-05
s-06
s-07
s-08
s-09
s-10
s-11
s-12
s-13
s-14

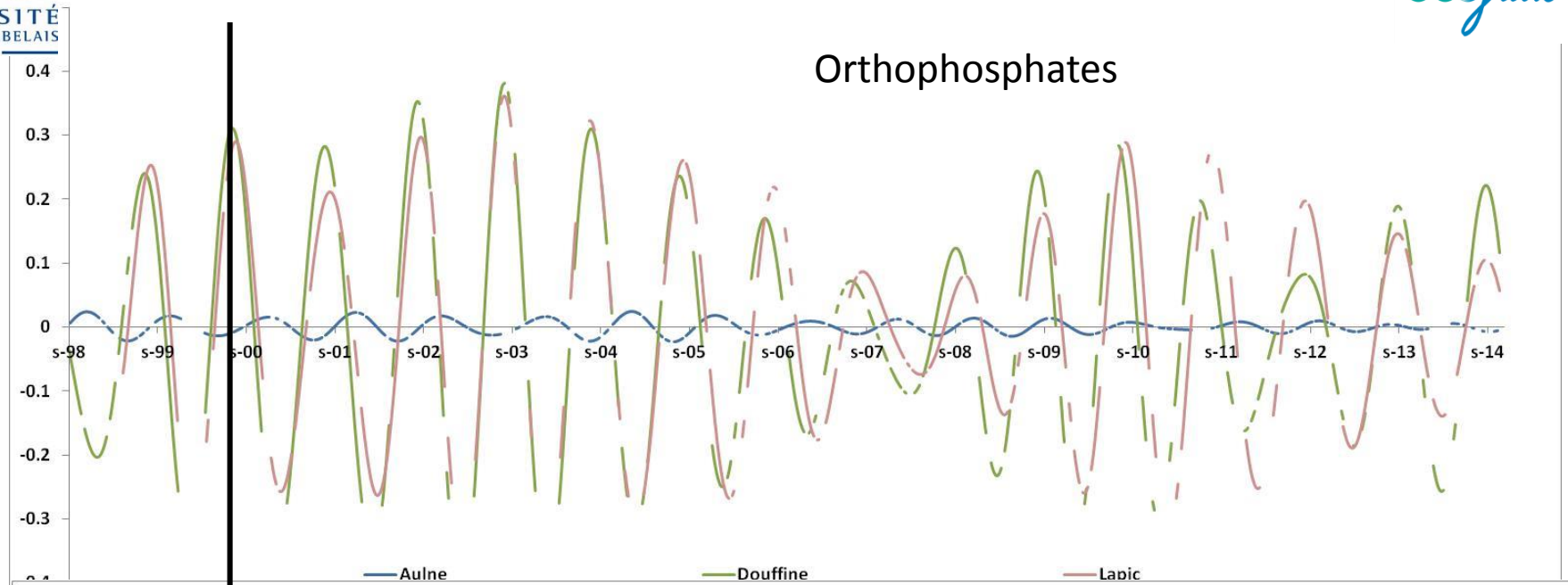

20
15
10
5
0
-5
-10
-15
-20
s-98
s-99
s-00
s-01
s-02
s-03
s-04
s-05
s-06
s-07
s-08
s-09
s-10
s-11
s-12
s-13
s-14
Dossen
Dourduff
Elorn
Fleche
Guillec
Penze
Quillimadec
Ris
St-Laurent

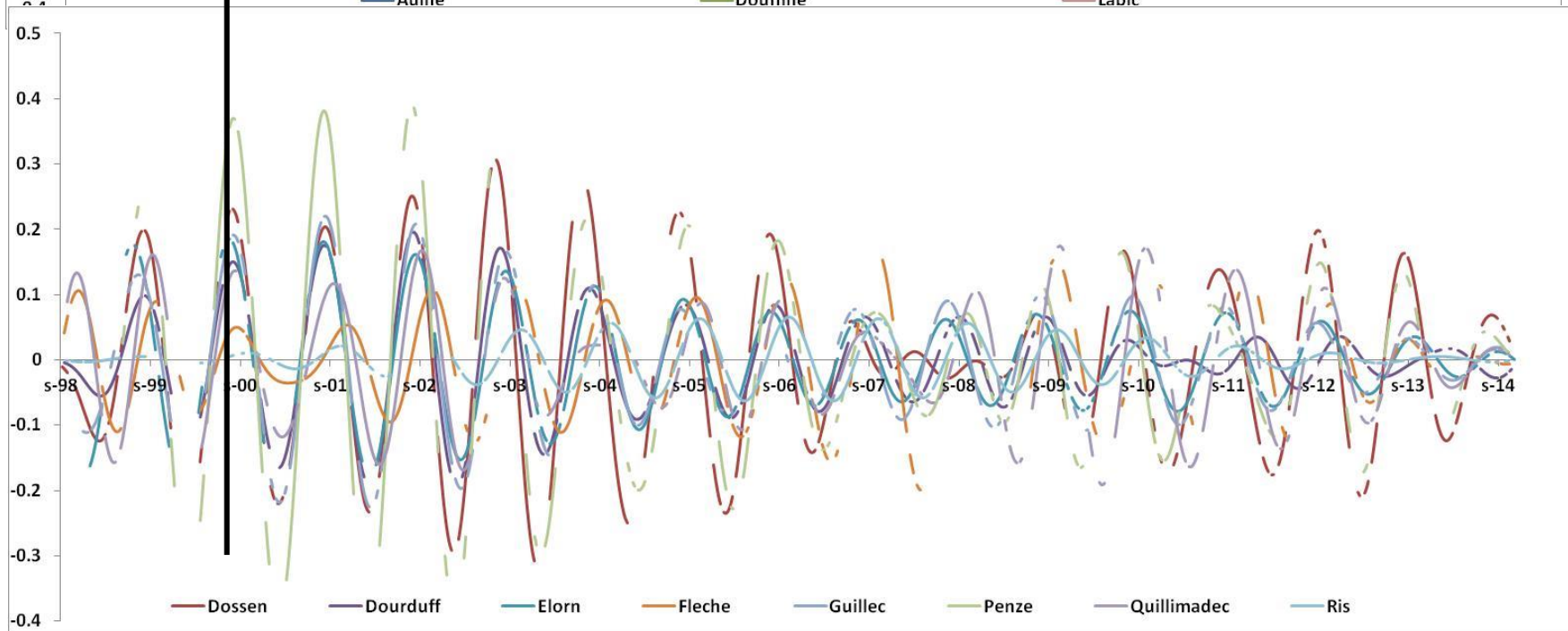
Apport de nappe

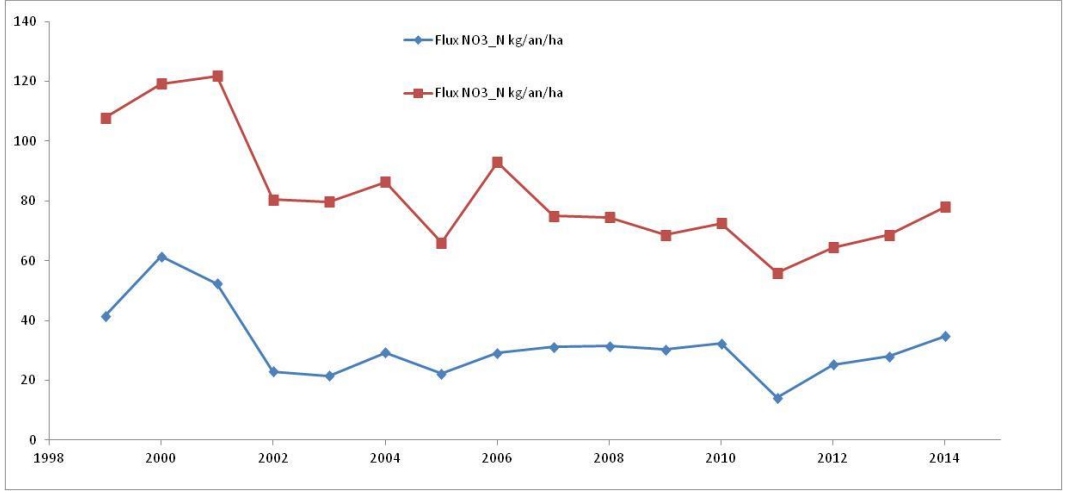


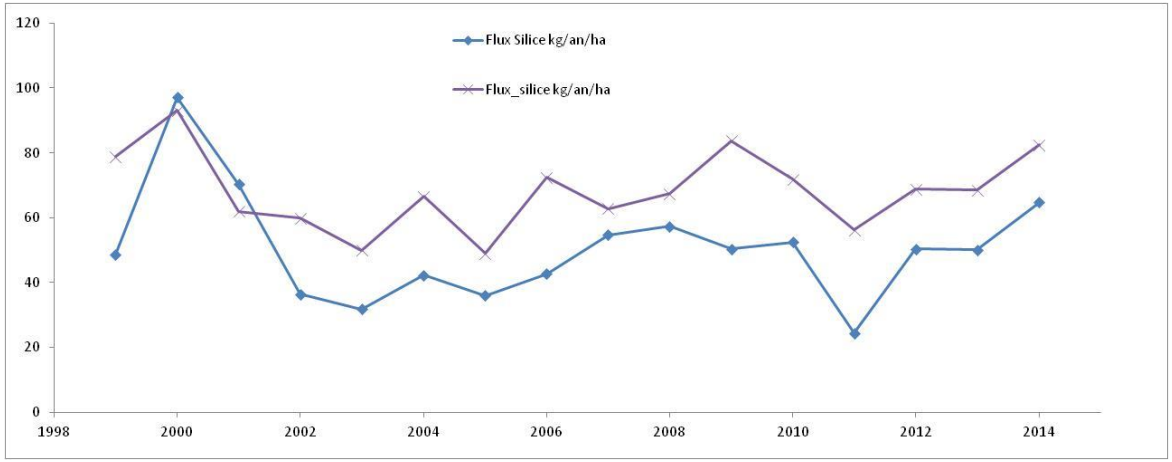

Silice
4
3
2
1
0
-1
-2
-3
-4
s-98
s-99
s-00
s-01
s-02
s-03
s-04
s-05
s-06
s-07
s-08
s-09
s-10
s-11
s-12
s-13
s-14
Aulne
Douffine
Lapic
Dossen
Dourduff
Elorn
Fleche
Guillec
Penze
Quillimadec
Ris
St-Laurent

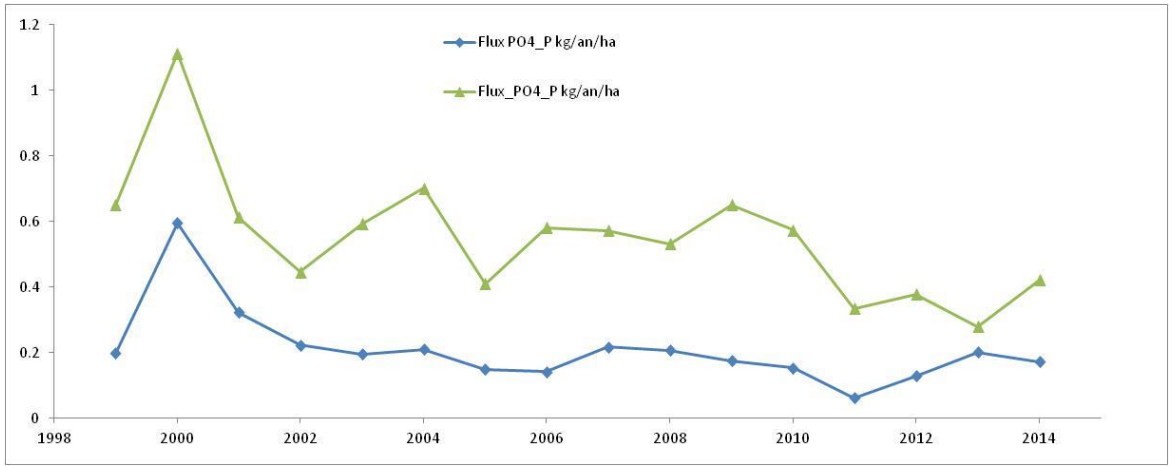
Orthophosphates



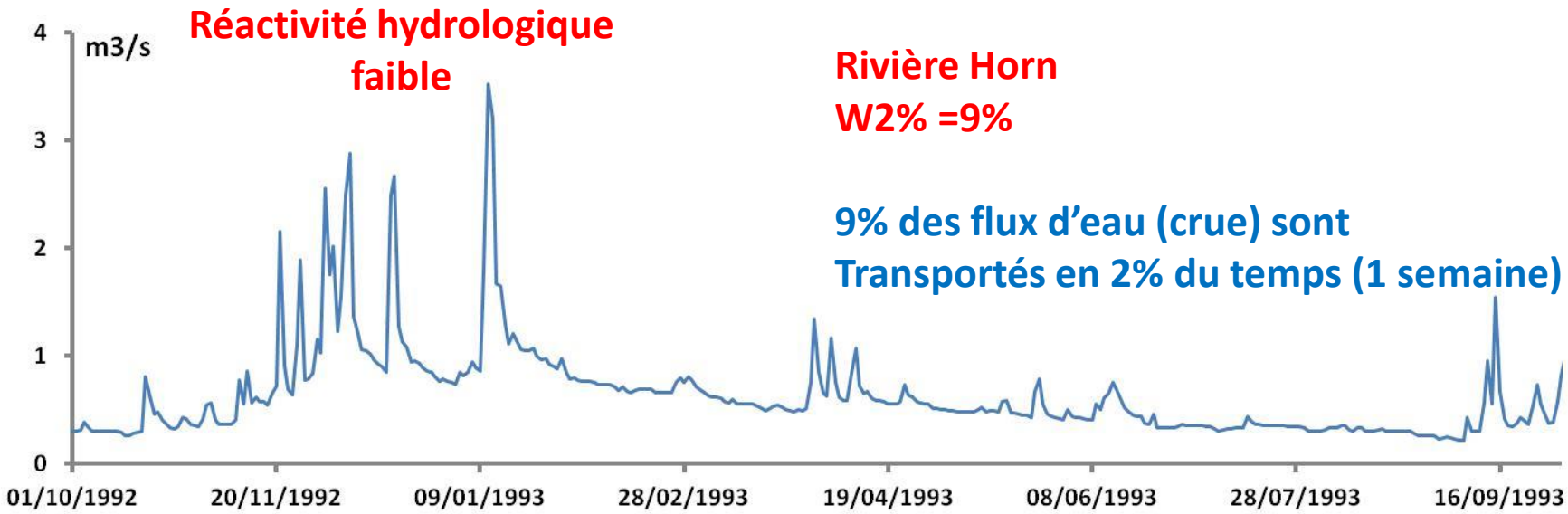



Flux NO3_N kg/an/ha
Flux NO3_N kg/an/ha
140
120
100
80
60
40
20
0
1998
2000
2002
2004
2006
2008
2010
2012
2014


Flux Silice kg/an/ha
Flux_silice kg/an/ha
120
100
80
60
40
20
0
1998
2000
2002
2004
2006
2008
2010
2012
2014


Flux PO4_P kg/an/ha
Flux_PO4_P kg/an/ha
1.2
1
0.8
0.6
0.4
0.2
0
1998
2000
2002
2004
2006
2008
2010
2012
2014

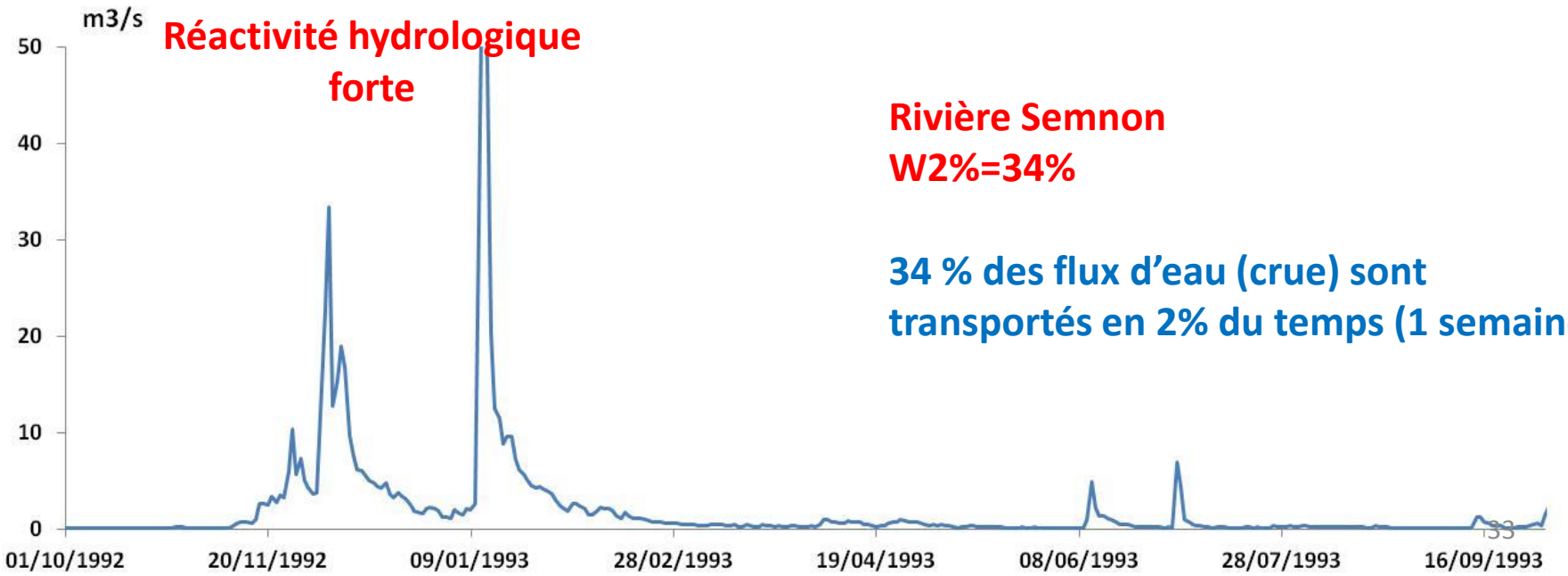
Indicateur de variabilité hydrologique - $W_{2\%}$



Réactivité hydrologique faible

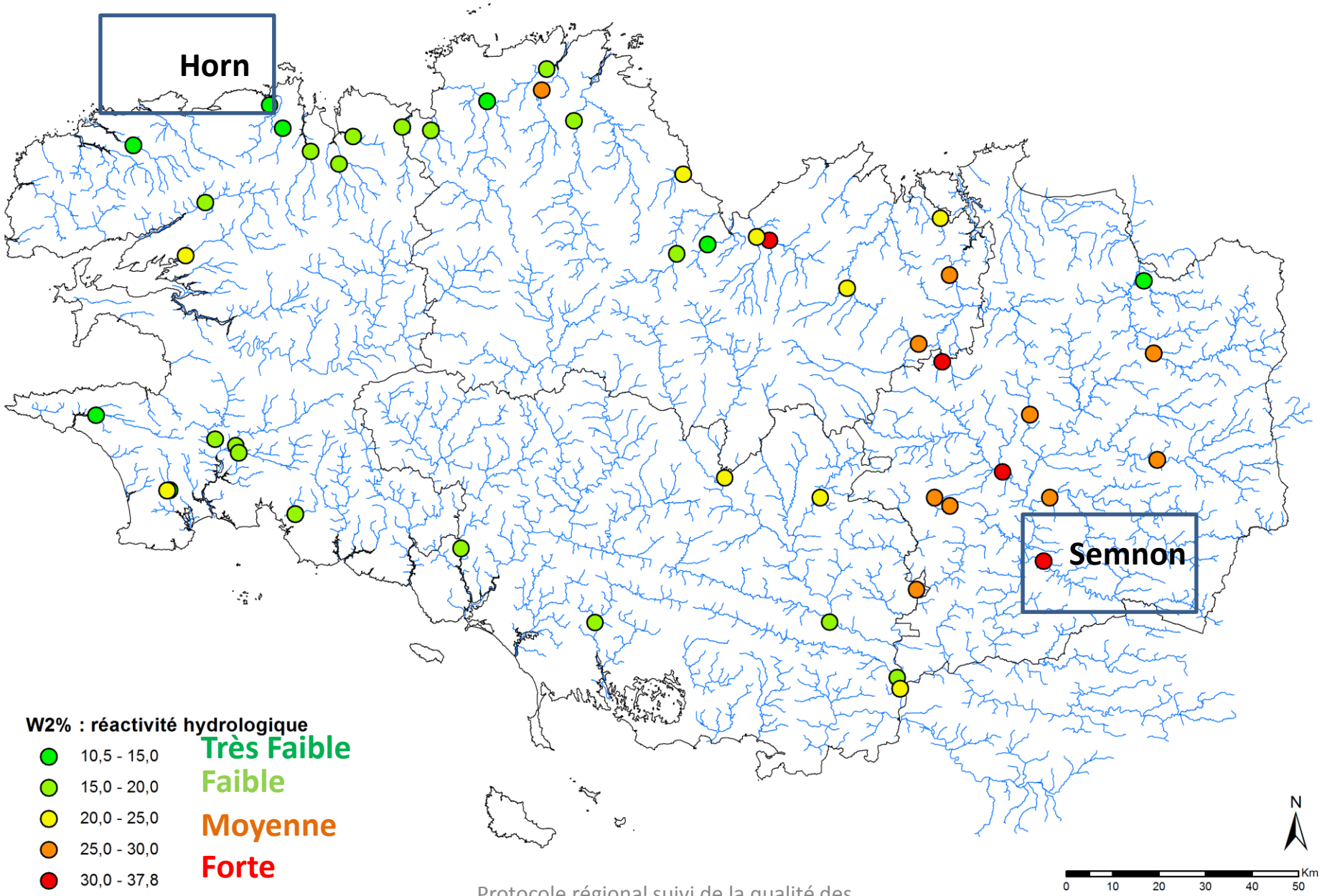
Rivière Horn
W2% =9%

9% des flux d'eau (crue) sont Transportés en 2% du temps (1 semaine)



Réactivité hydrologique forte

Rivière Semnon
W2%=34%

34 % des flux d'eau (crue) sont transportés en 2% du temps (1 semaine)

Variabilité hydrologique des stations GP5 - $W_{2\%}$