

Master 2 Océanographie Option Physique et biogéochimie

Année 2012-2013

Étude numérique lagrangienne de la connectivité en Mer Méditerranée

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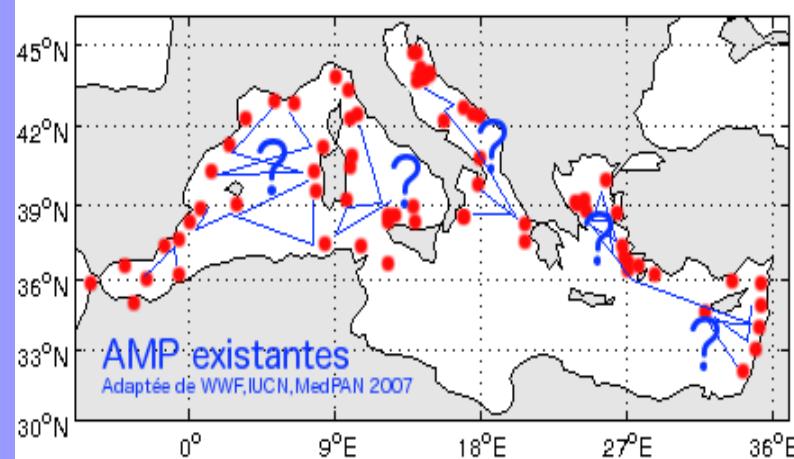
Introduction

Contexte & Objectif

Étude de réseau
des AMP



Connectivité



Dispersion
des larves



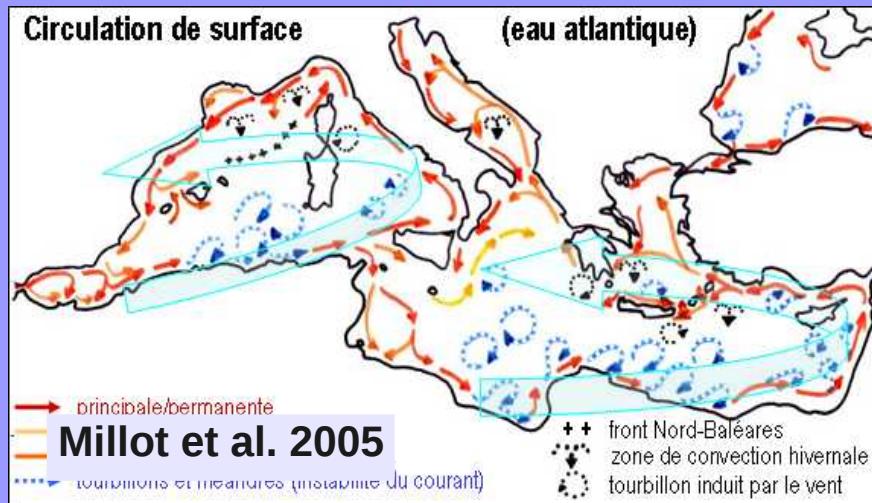
Difficultés
des études
in-situ

Étude
numérique

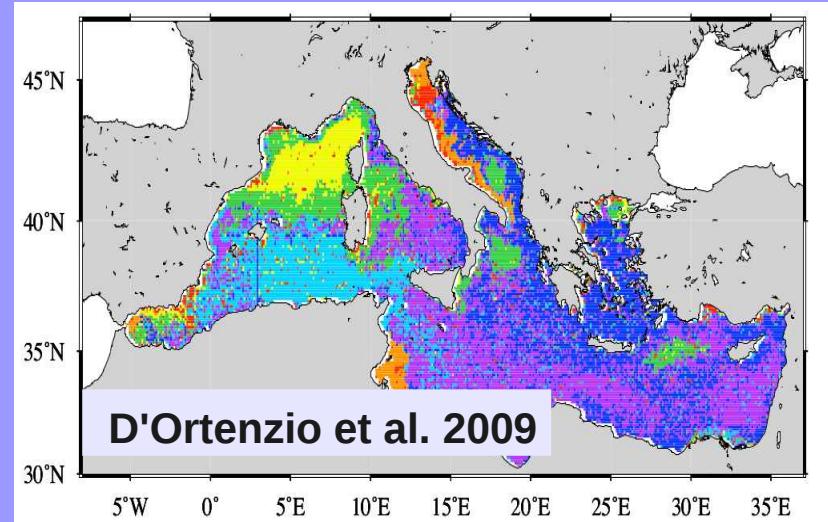
Introduction

Quelles sont les régions interconnectées dans la Mer Méditerranée?

Régionalisation de la Mer Méditerranée à partir les courants

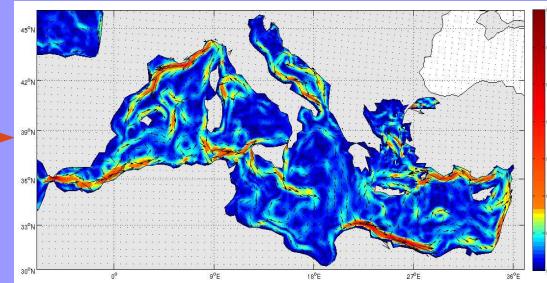


Régionalisation de la Mer Méditerranée à partir la Chl de la surface

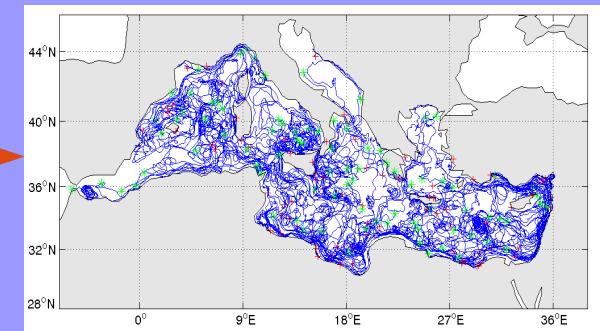


Méthodologie

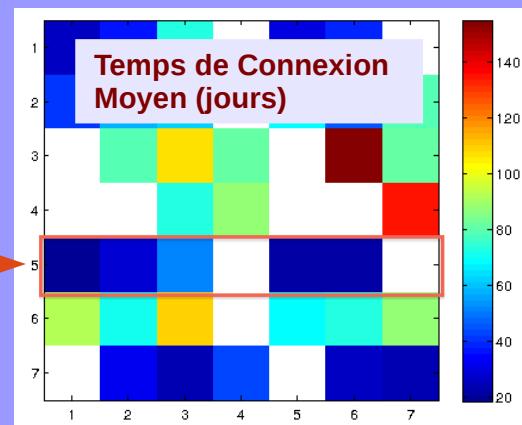
Champ Eulérien



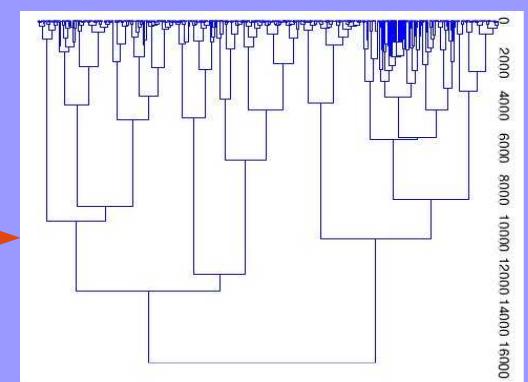
Module lagrangien



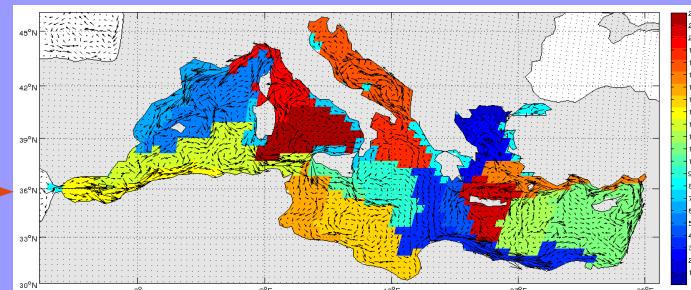
Diagnostic de connectivité



Classification Hiérarchique



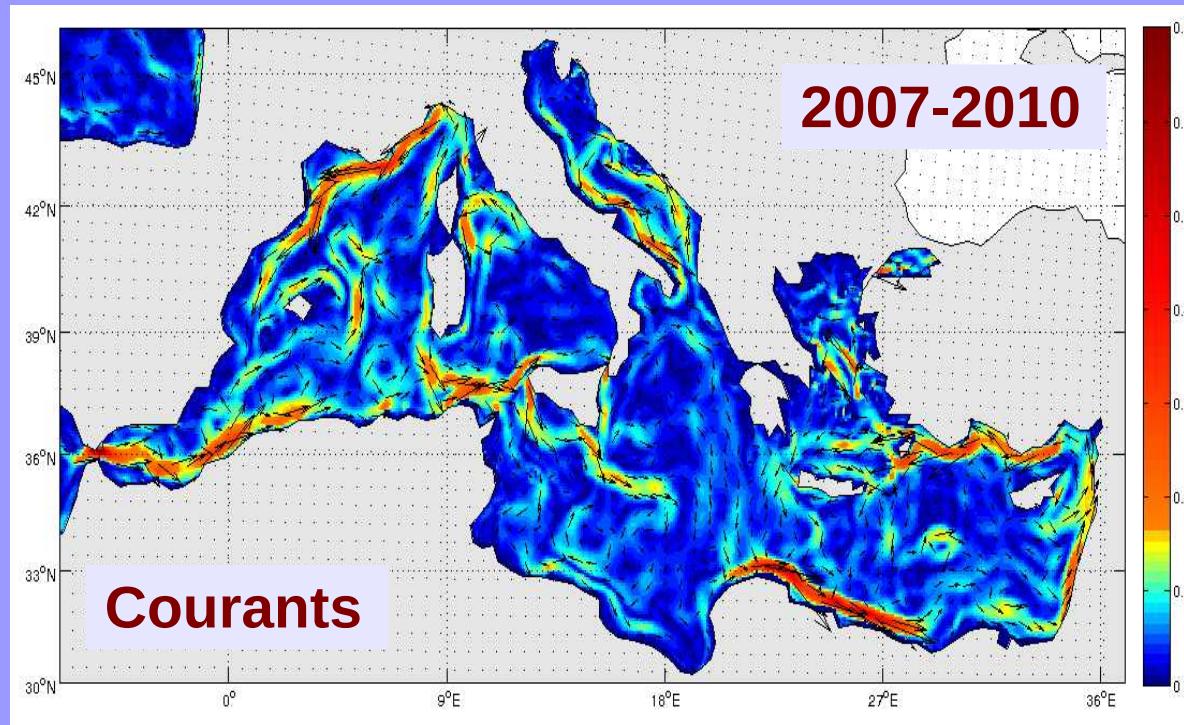
Régionalisation



Méthodologie

Champ
Eulérien

MERCATOR

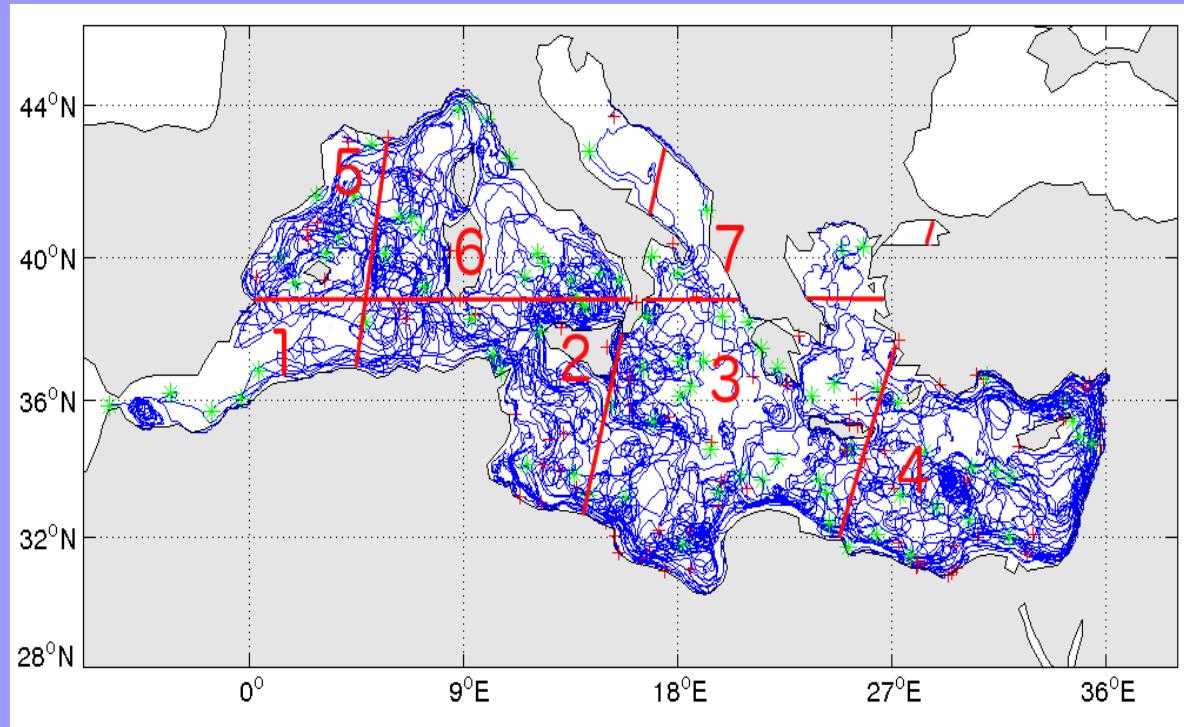


Données journalières
4 ans de données de champ de vitesse

Méthodologie

Module
lagrangien

ARIANE



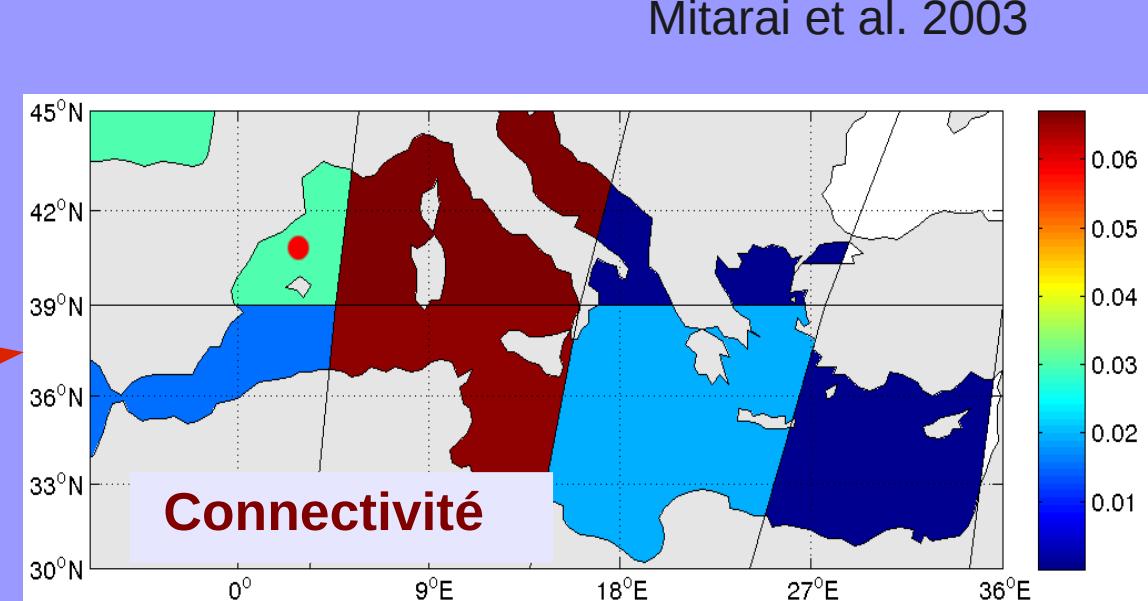
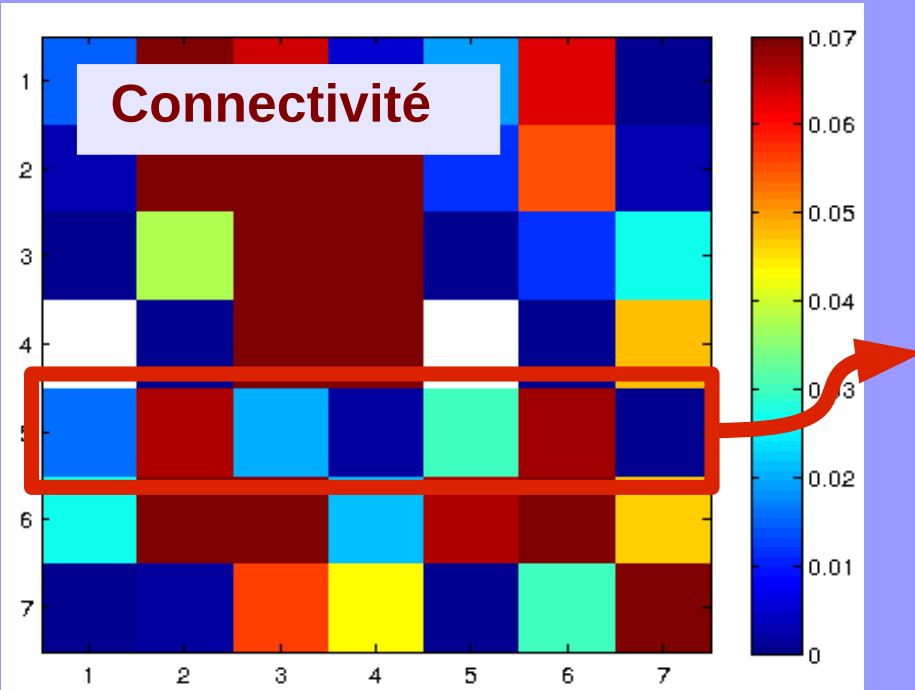
Advection horizontal à la surface
Pas de vitesse verticale
Temps d'advection 1 an

Méthodologie

Diagnostic de connectivité

Matrice de connectivité

$$C(i, j) = \frac{N t.q. \mathbf{x}(t) = i \& \mathbf{x}(t + t_{adv}) = j}{N_{tot}}$$

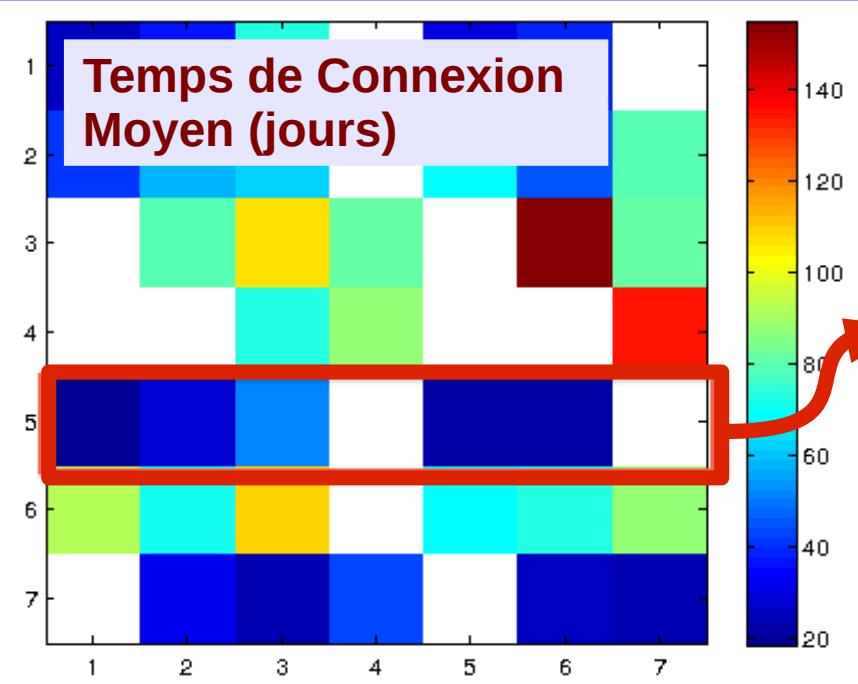


Méthodologie

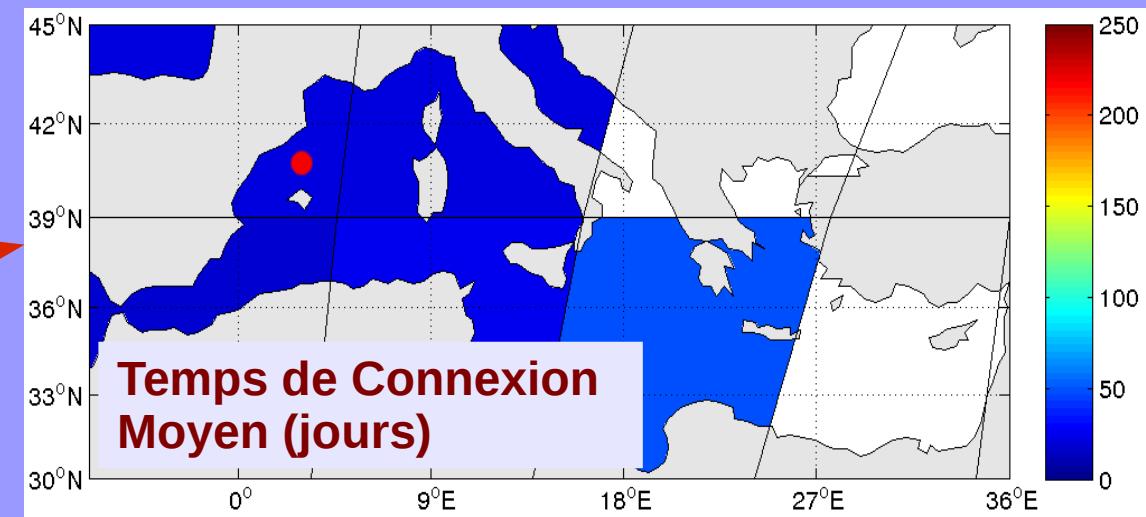
Diagnostic de connectivité

Temps de connexion moyen

$$MCT(i, j) = \frac{1}{M} \sum_{n=1}^{n=N} T_n(i, j)$$



Mitarai et al. 2003



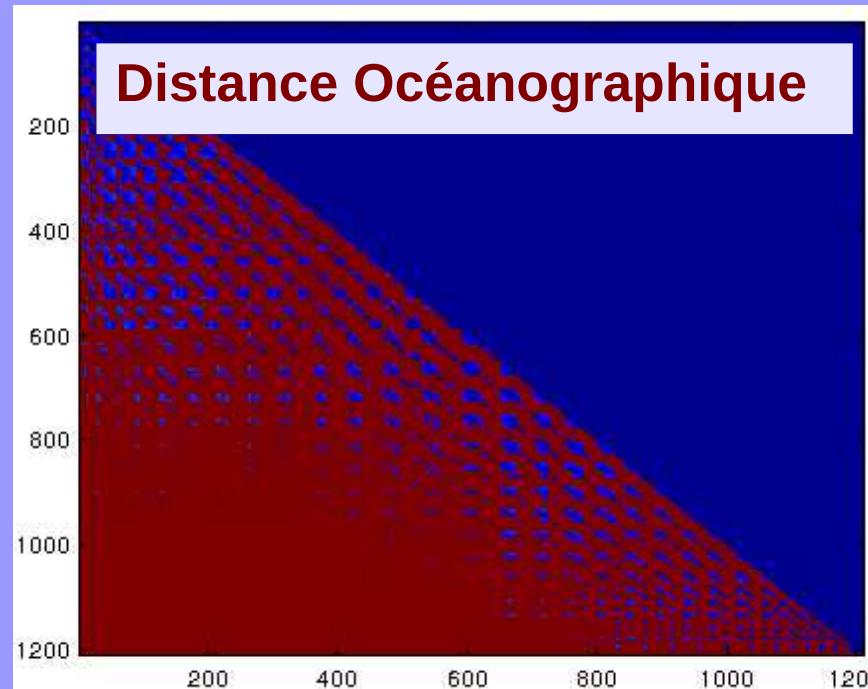
Méthodologie

Diagnostic de connectivité

Distance océanographique

$$DO(i,j) = \text{sym}(\min(MCT(i,j), MCT(j,i)))$$

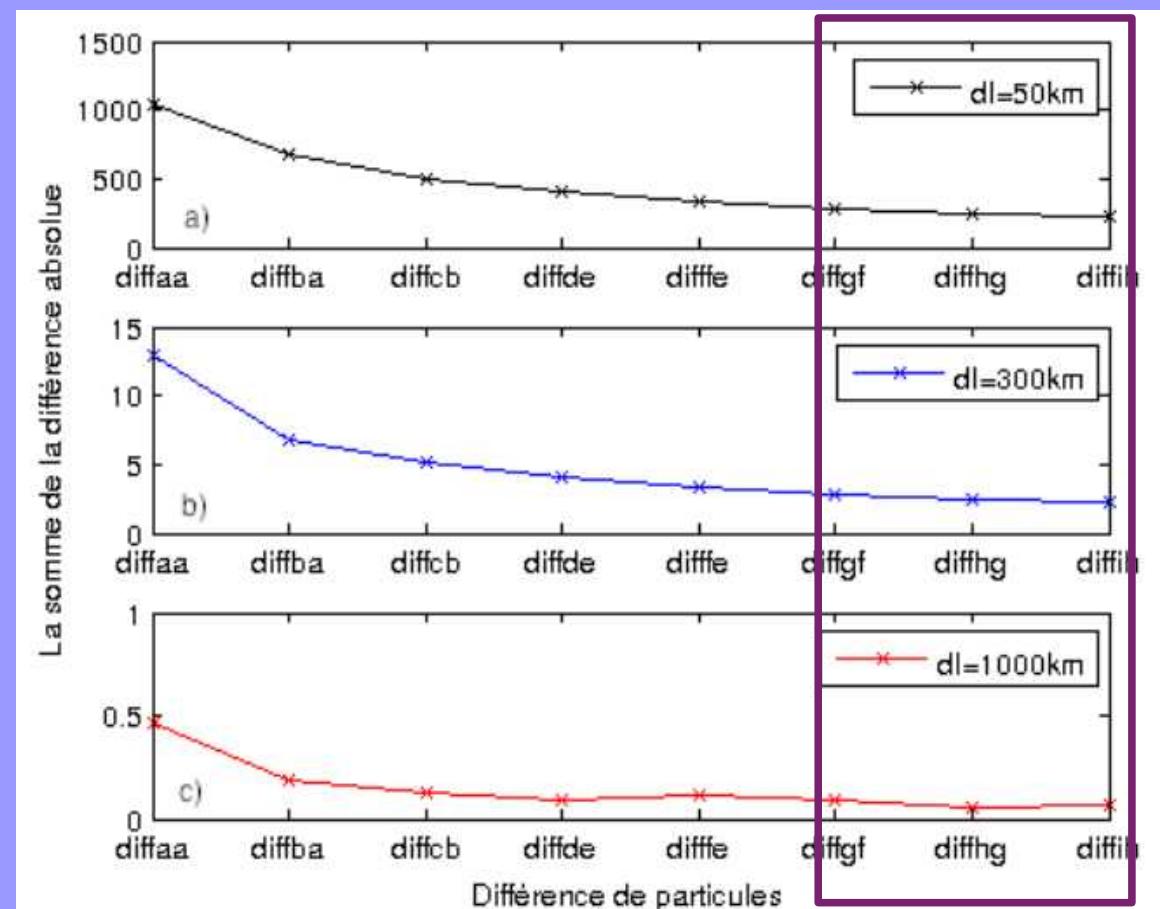
Alberto et al. 2011



Méthodologie

Influence du nombre de particules

<i>I</i>	Nmax	lâchers/ mois	augmentat ion p.r. <i>I</i> -1
a	25.646	1	-
b	51.292	2	100
c	76.938	3	50
d	102.584	4	33
e	128.230	5	25
f	153.876	6	17
g	179.522	7	14
h	205.168	8	12
i	230.814	9	11

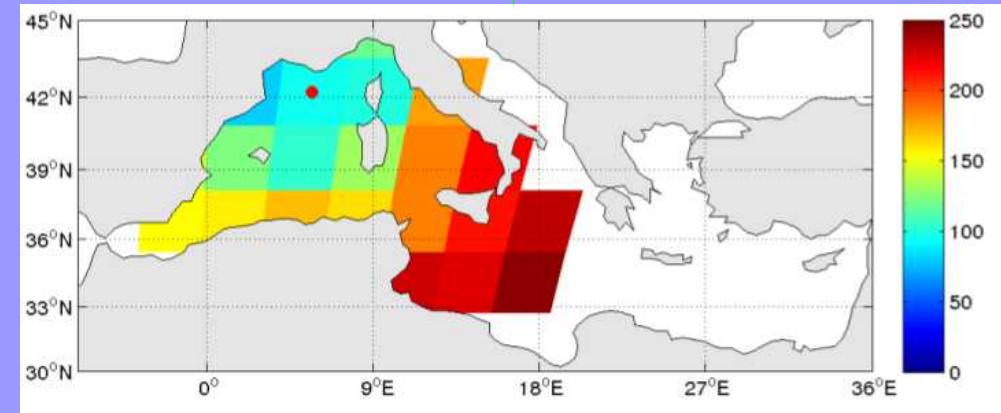
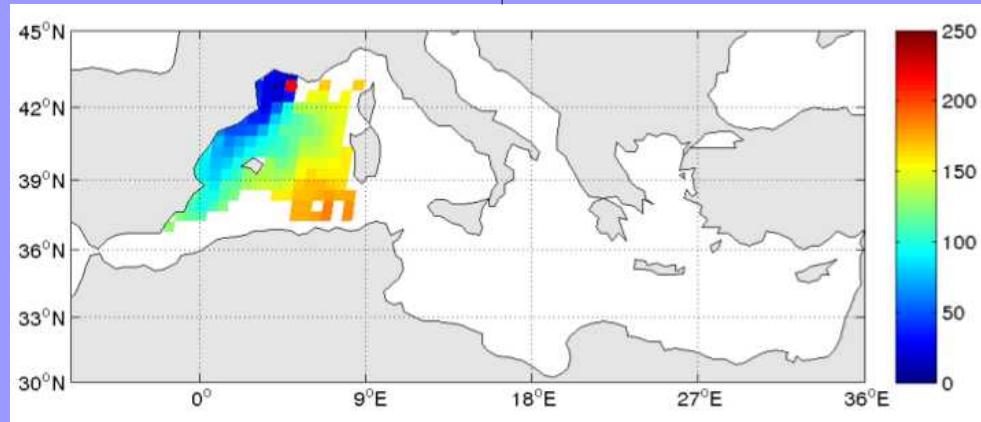
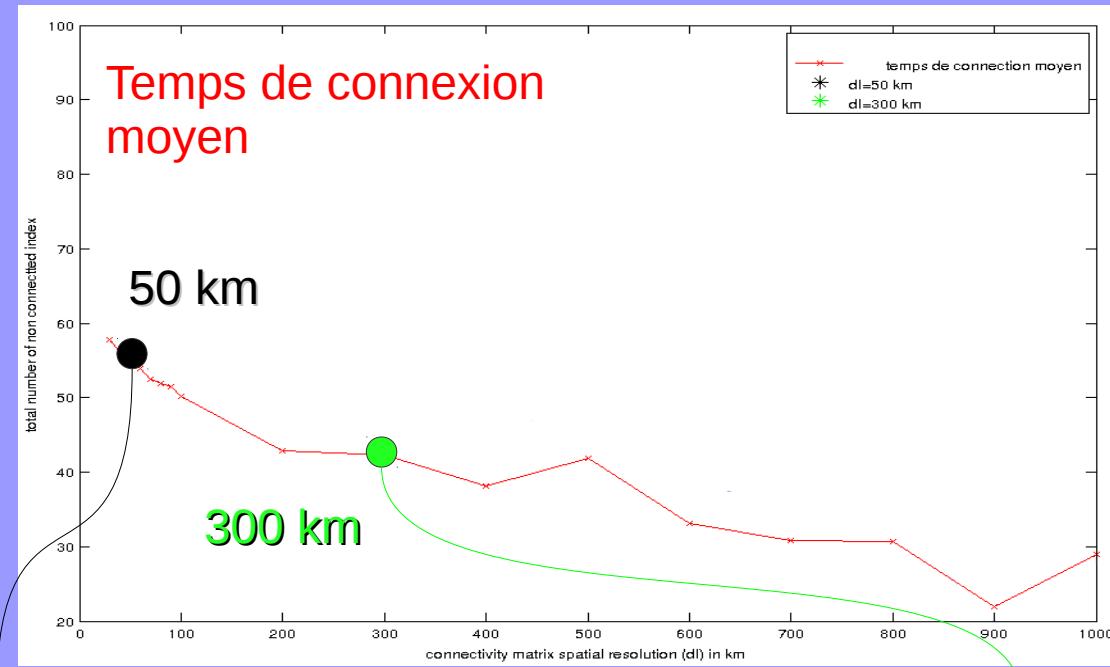


Lâcher 9 particules par mois

Méthodologie

Influence de la résolution de la grille de connectivité

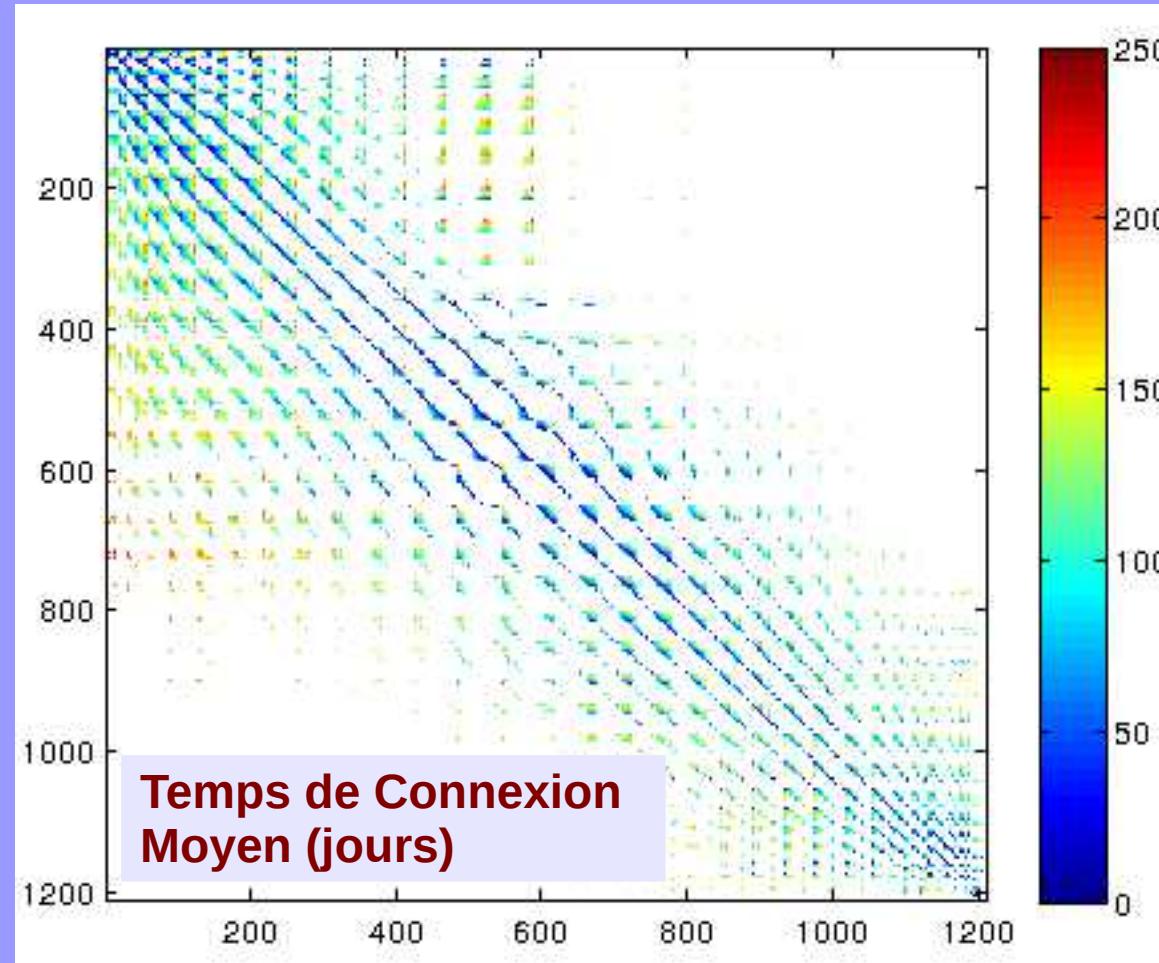
50 km



Méthodologie

N=8.309.304

dl=50 km

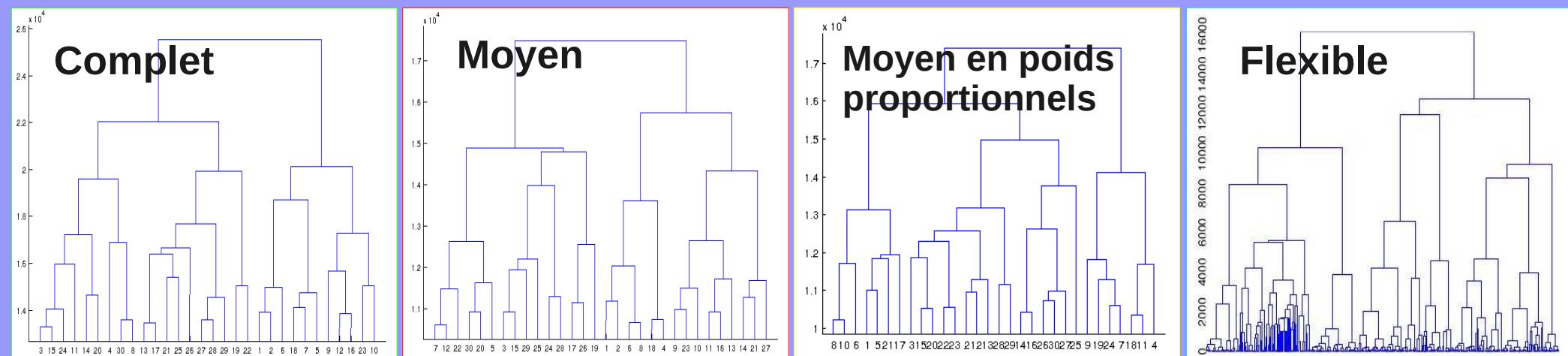


Classification Hiérarchique

Méthodologie

Classification hiérarchique et critères d'agrégations

$$D(m,g) = \alpha_k D(k,g) + \alpha_l D(l,g) + \beta D(k,l) + \gamma |D(k,g) - D(l,g)|$$



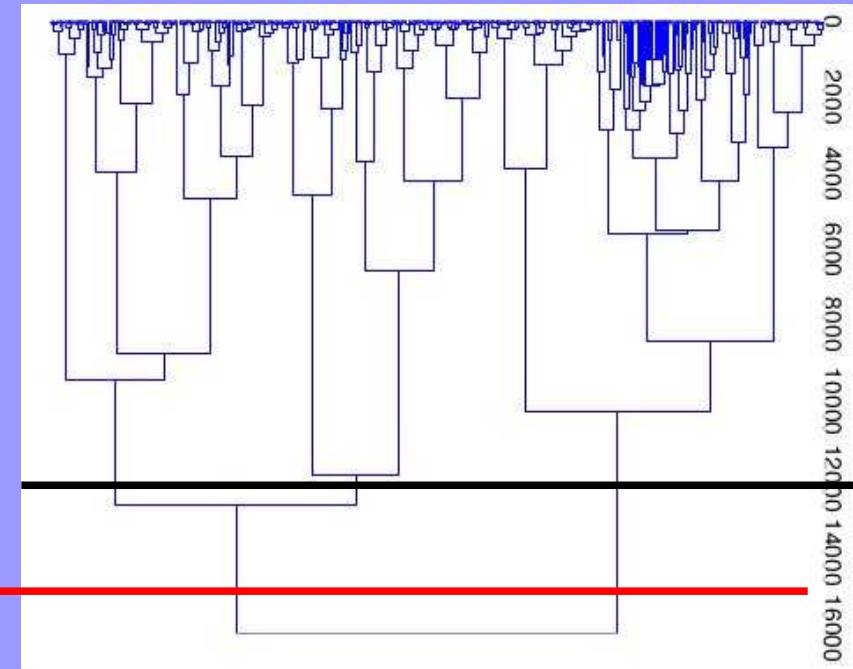
$$D(m,g) = \max(\text{dist}(x_k, x_l))$$

$$D(m, g) = \frac{1}{w_m * w_g} \sum_{w_m}^l \sum_{w_g}^l dist(x_k, x_l)$$

$$D(m,g) = \frac{D(k,g) + D(l,g)}{2}$$

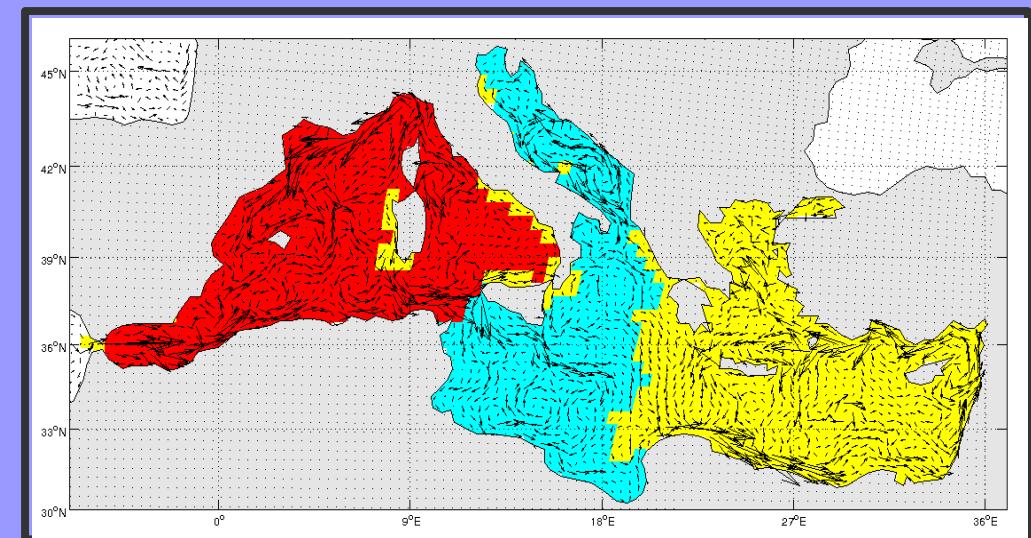
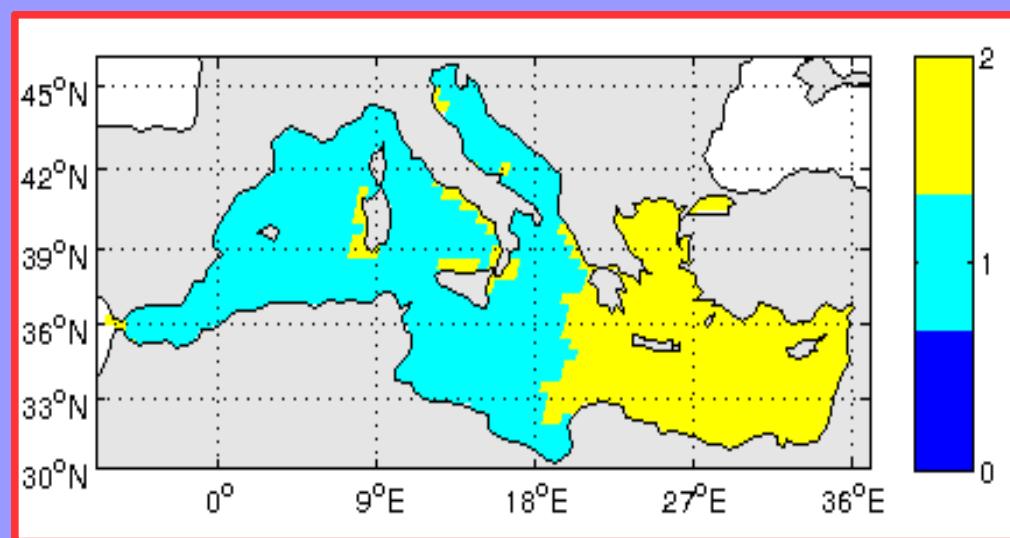
$$D(m,g) = 0,625 D(k,g) + 0,625 D(l,g) - 0,25 D(k,l)$$

Résultats



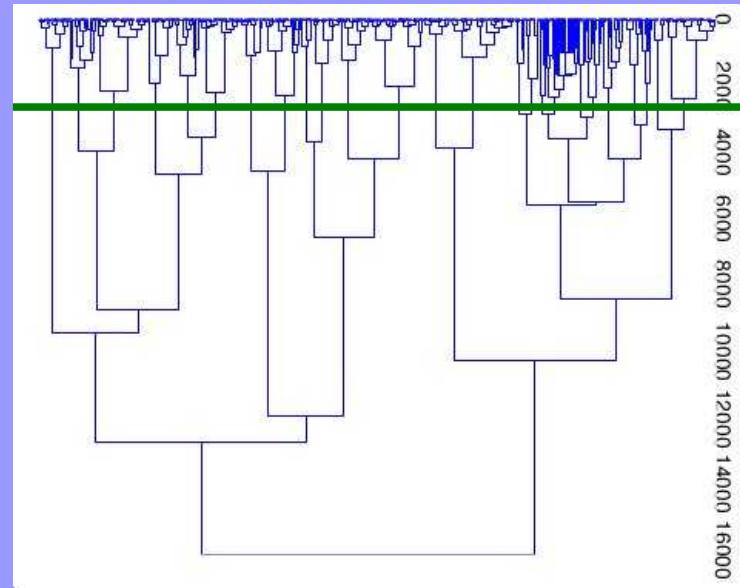
2 classes

3 classes

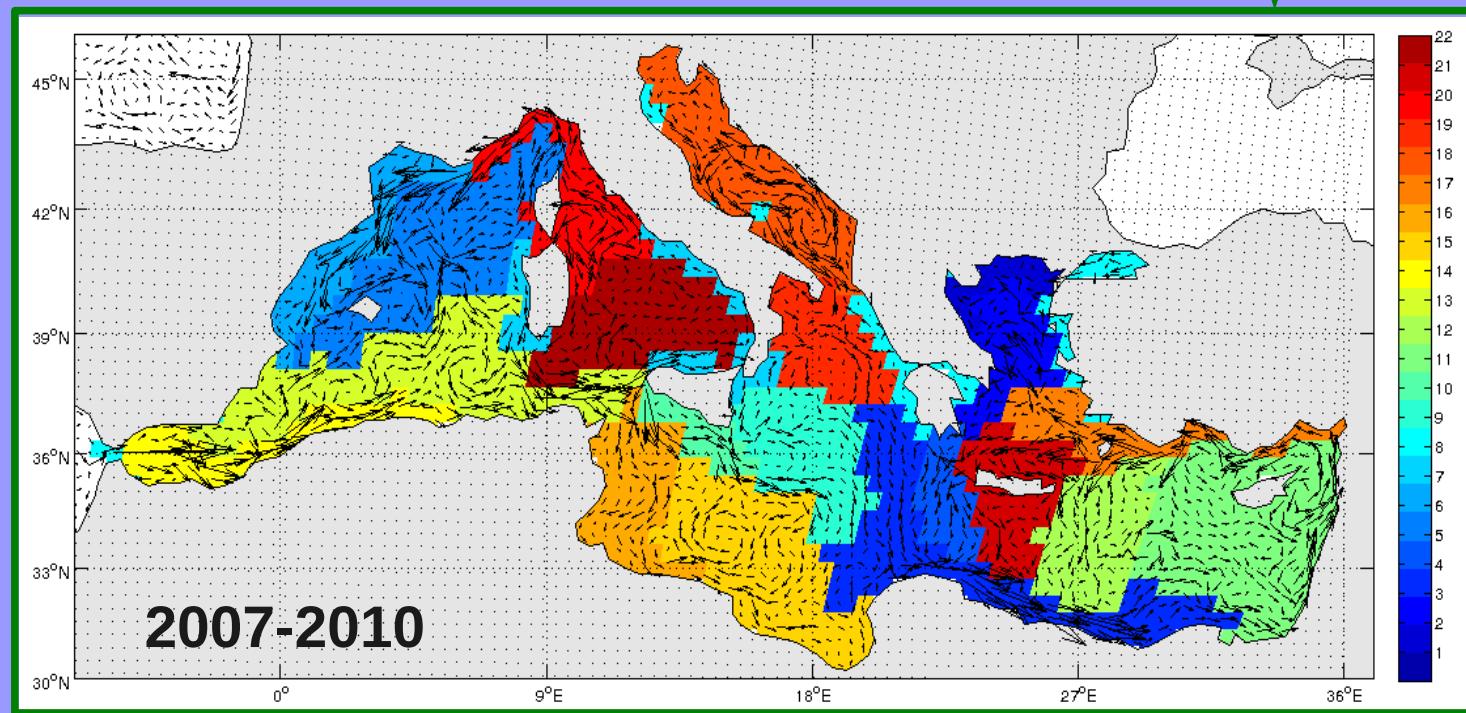


Conclusion

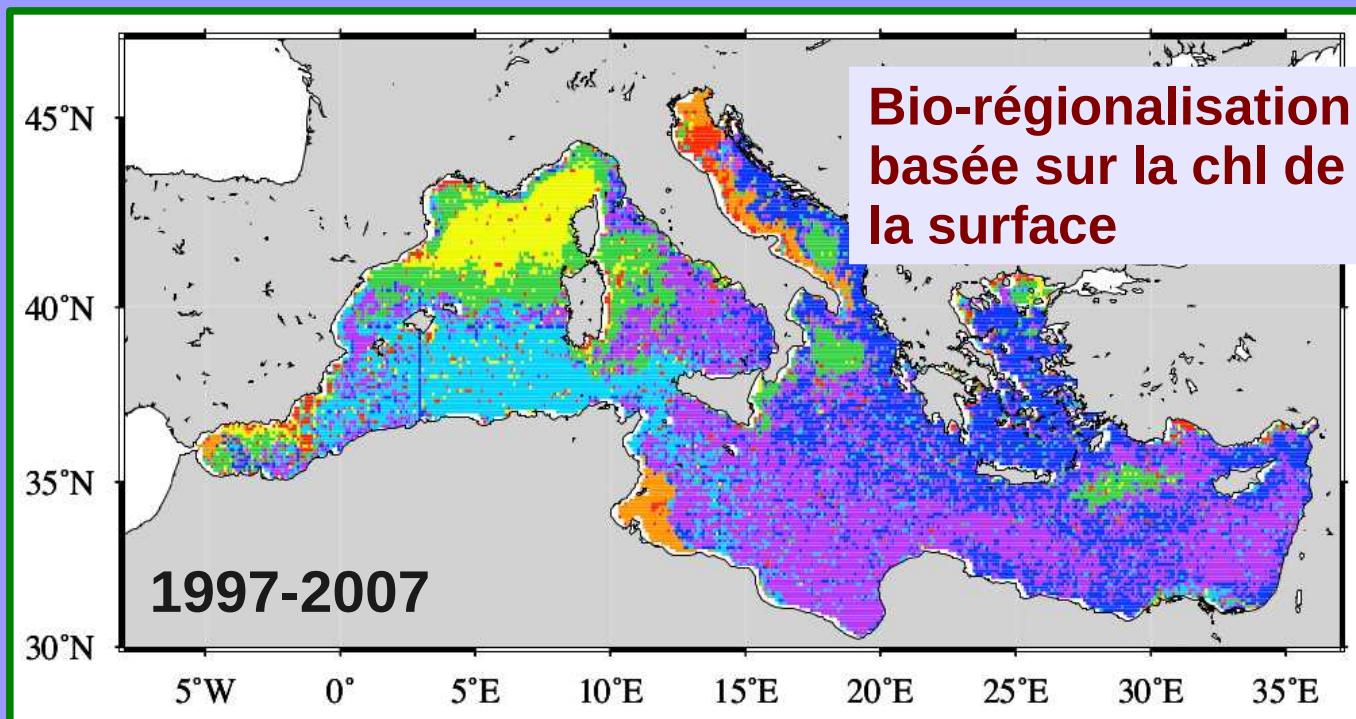
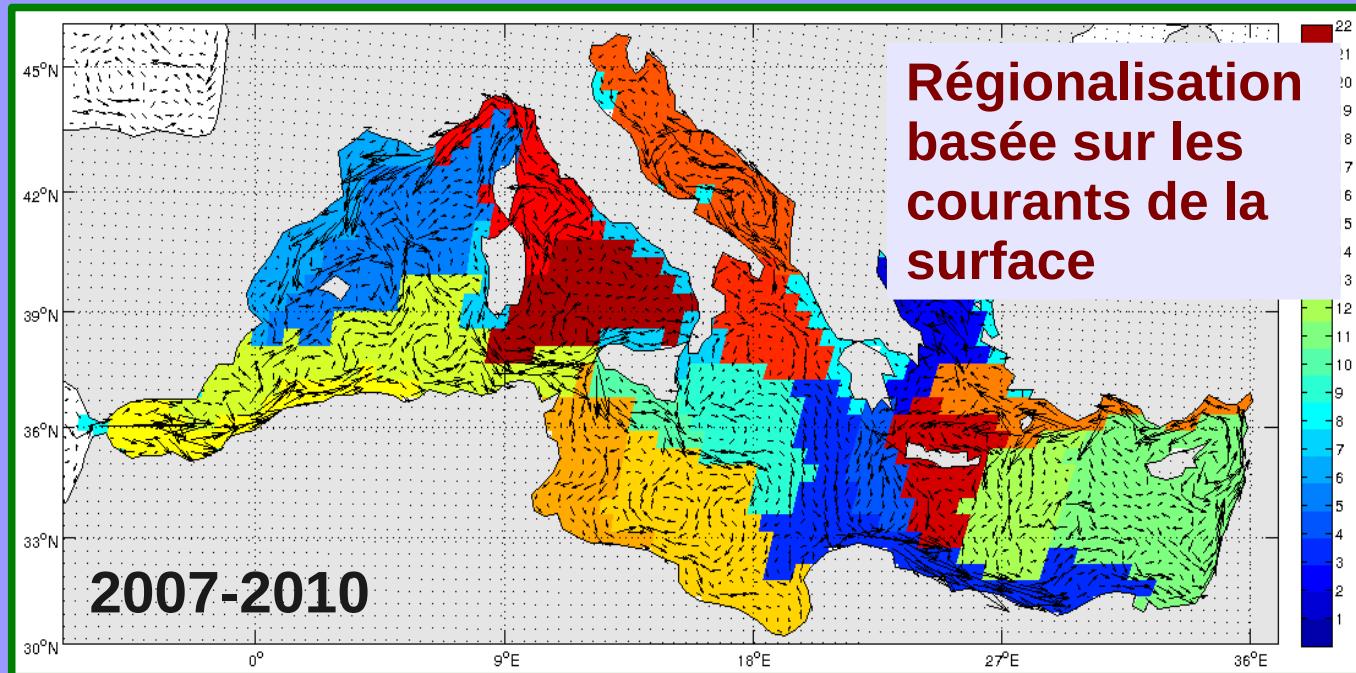
Image plus claire
de la connectivité
dans la Mer
Méditerranée



22 classes



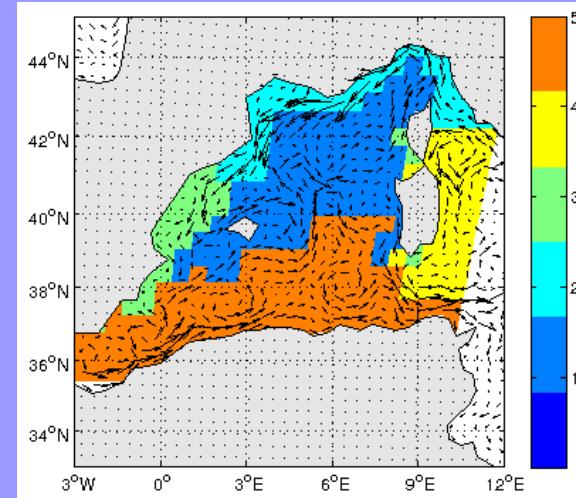
Conclusion



Perspectives

1. Comparer les régions d'interconnexion avec des aires de répartitions

2. Se focaliser sur des plus petites-échelles



3. Étude de la variabilité saisonnière et de la sensibilité à la durée de l'ensemble

4. Tester différentes profondeurs d'advection

5. Introduire du comportement : taux de mortalité, durée de la phase planctonique, migration verticale

6. Comparaison avec d'autres méthodes lagrangiennes