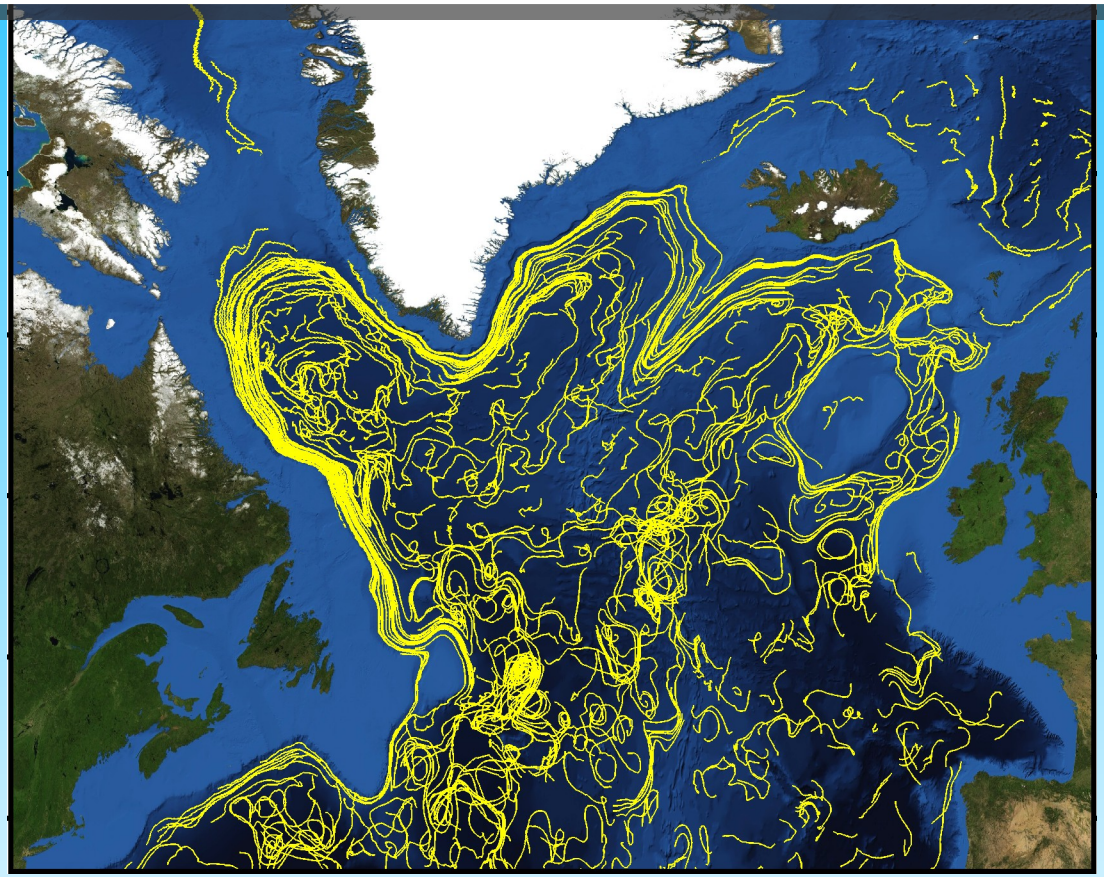
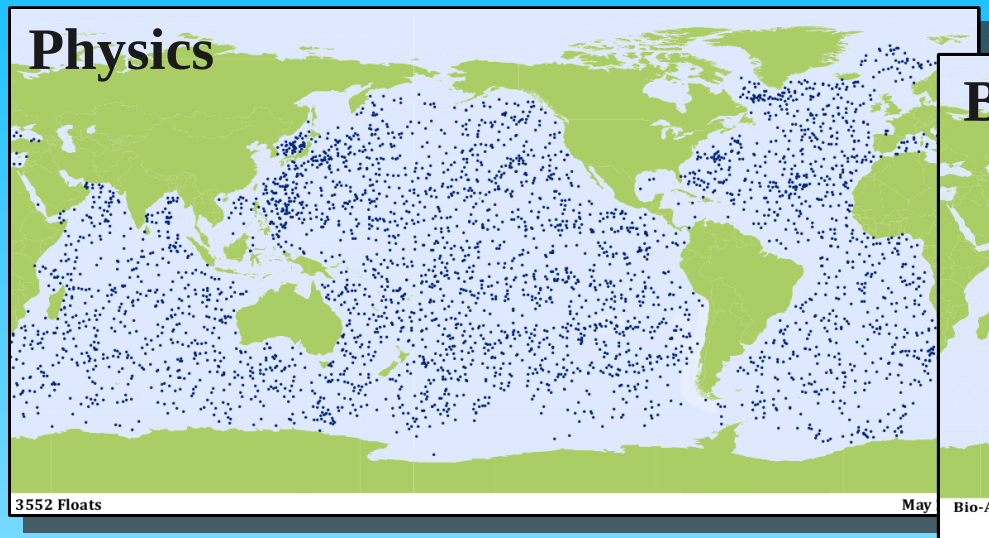
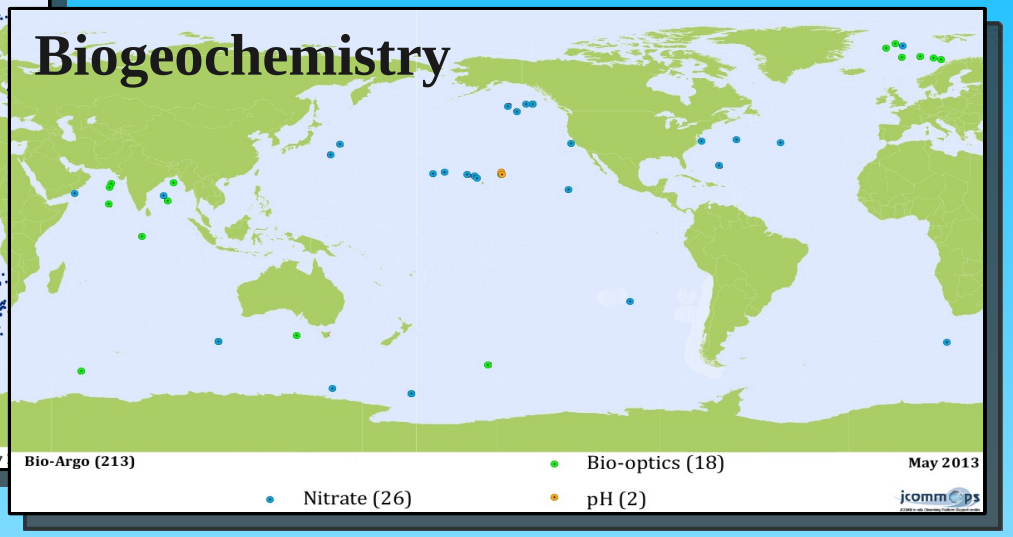
Optimal deployment of the BioArgo floats : a modeling approach



Fontana C., Claustre H., D'Ortenzio F.
Laboratoire d'Océanographie de Villefranche sur mer

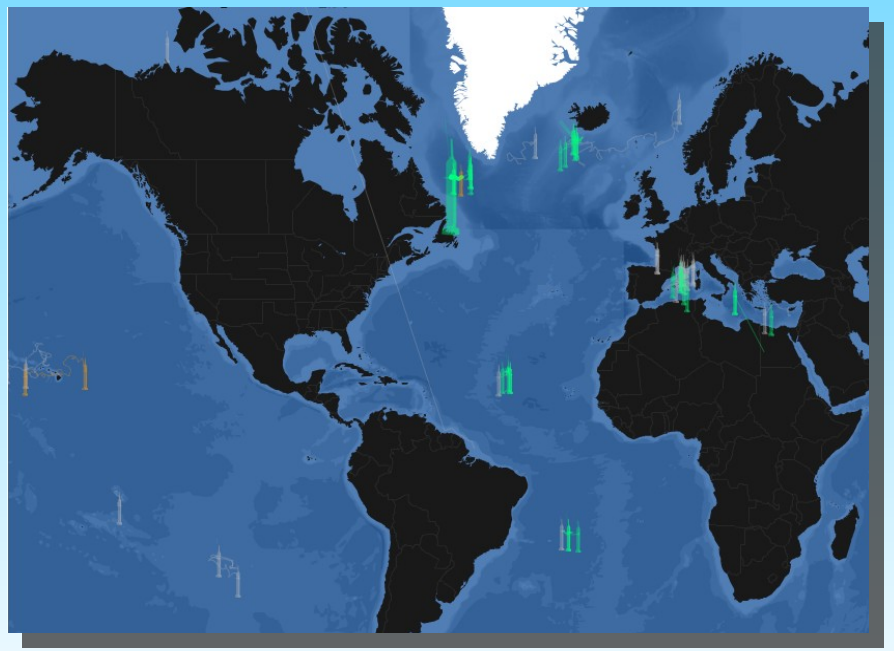
BioArgo context





http://argo.jcommops.org/maps.html

- **A new map to fill** …
- **How to fill it** ? Which processes to observe ?
  → *Bio processes strongly localized (time & space)*
- Which network would be **optimal** ?



http://www.oao.obs-vlfr.fr/carto/index.html

Optimality ?

- Deployment **zone/time** to observe a given process? *(e.g. North Atlantic bloom)*

- Sampling **strategy** ? *(e.g. cycling time, number of floats)*

- **Criteria** for optimality ?

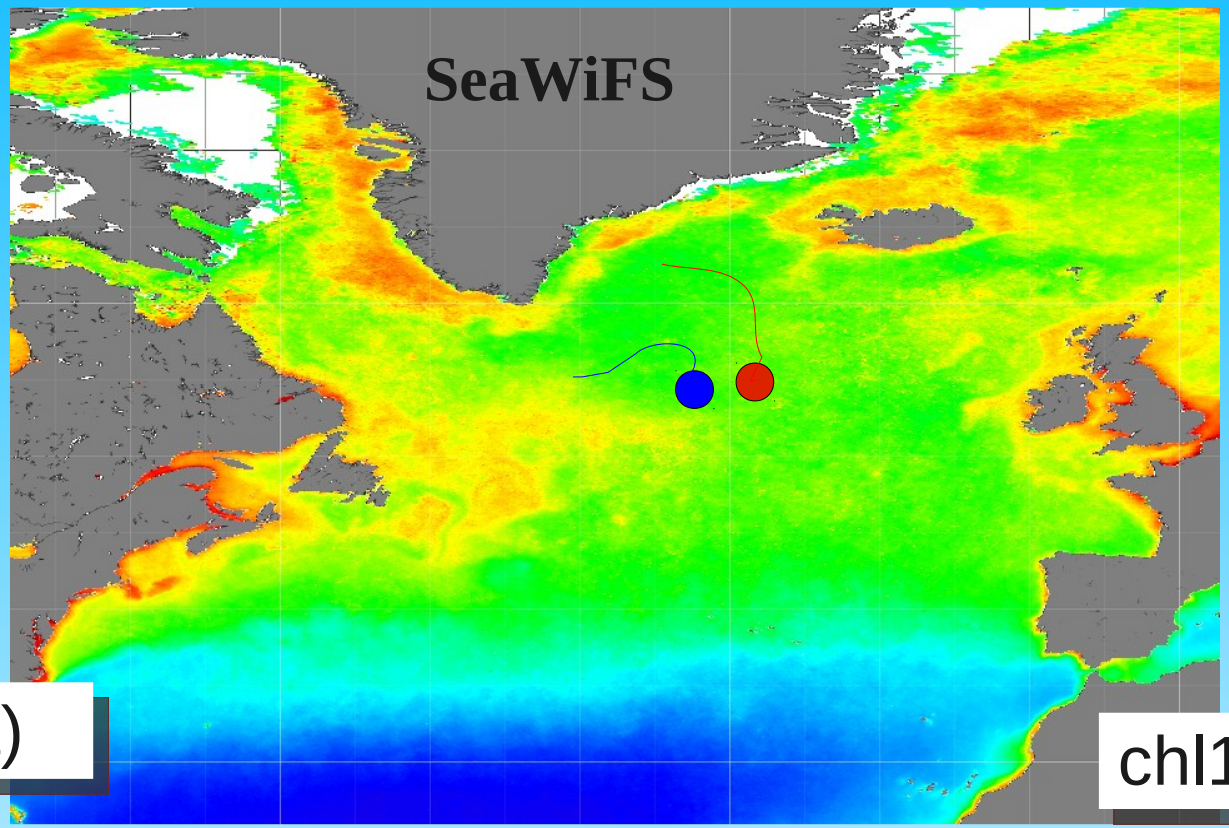
e.g : Reduce the distorsion in the estimation of a global quantity through sub-sampling

Outline

- Consideration about dispersion and sampling
- Methodology for time-series clustering
- Clustering results on the North Atlantic basin
- Conclusion and perspectives

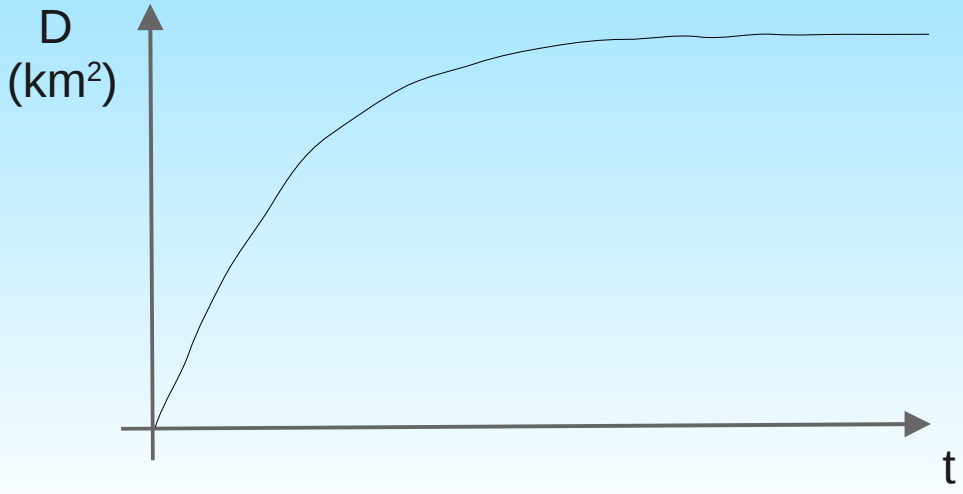
Dispersion vs sampling

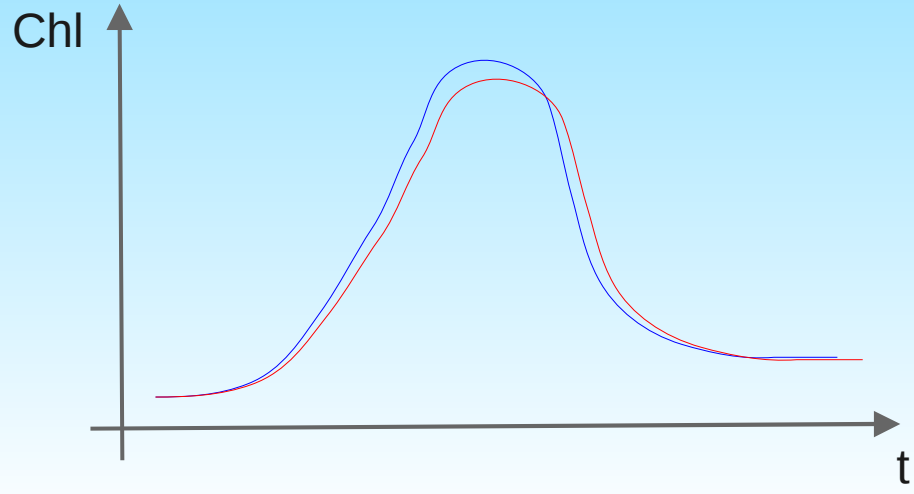
North Atlantic example



p1(t) ! = p2(t)

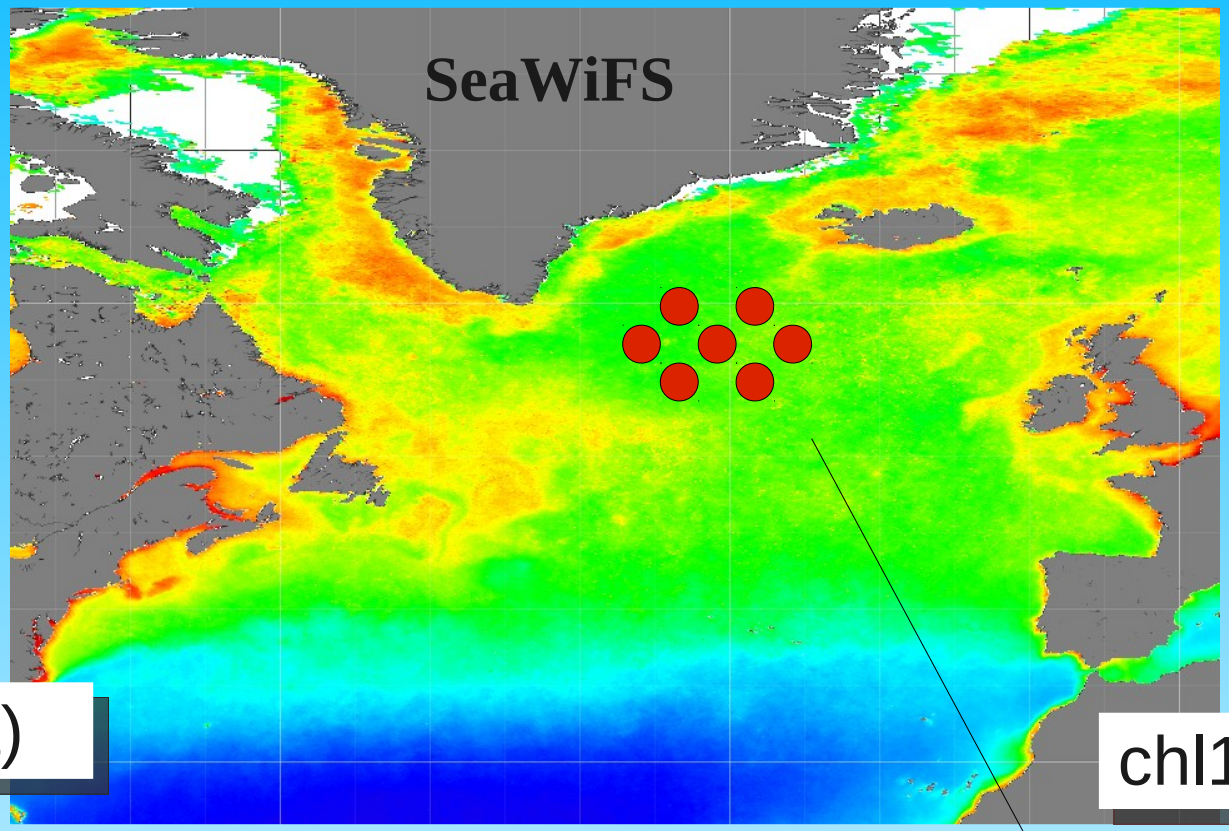
chl1(t) ~= chl2(t)





Dispersion vs sampling

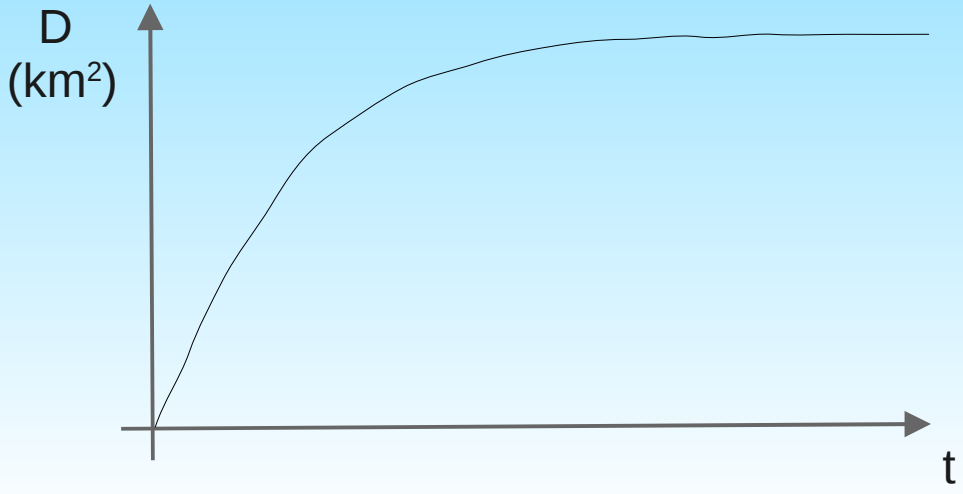
North Atlantic example

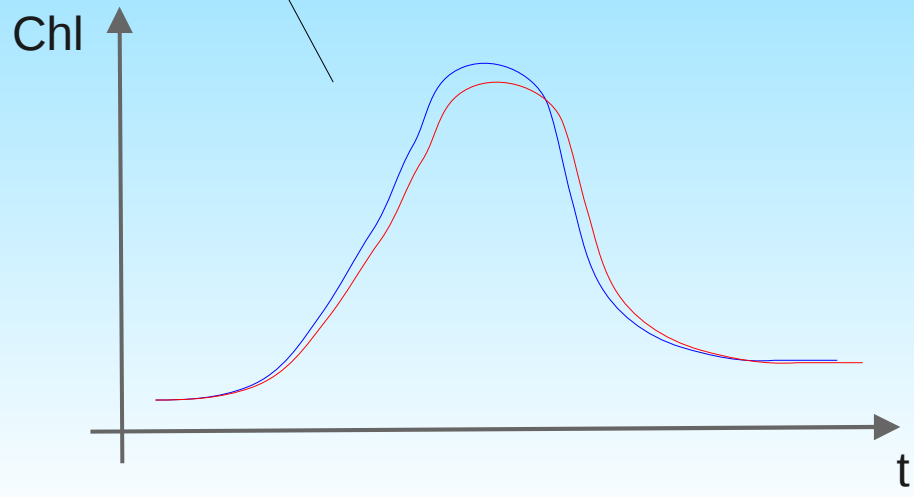


Homogenous regions for biogeochemical dynamics

p1(t) ! = p2(t)

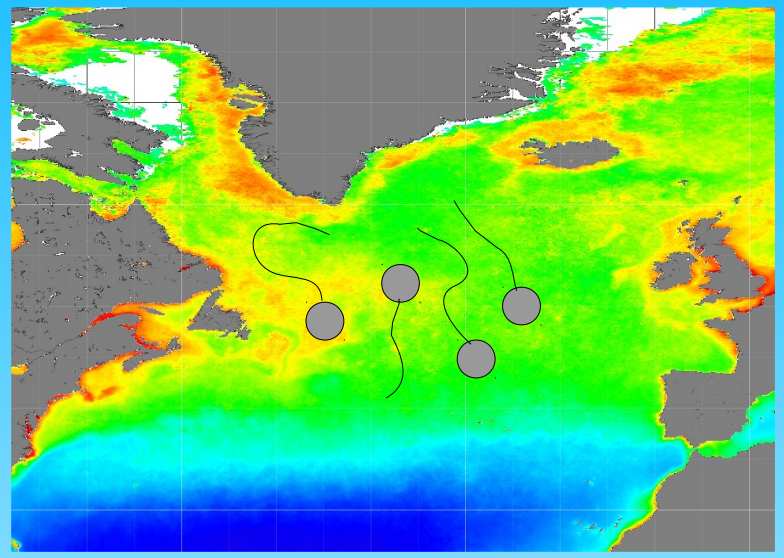
chl1(t) ~= chl2(t)

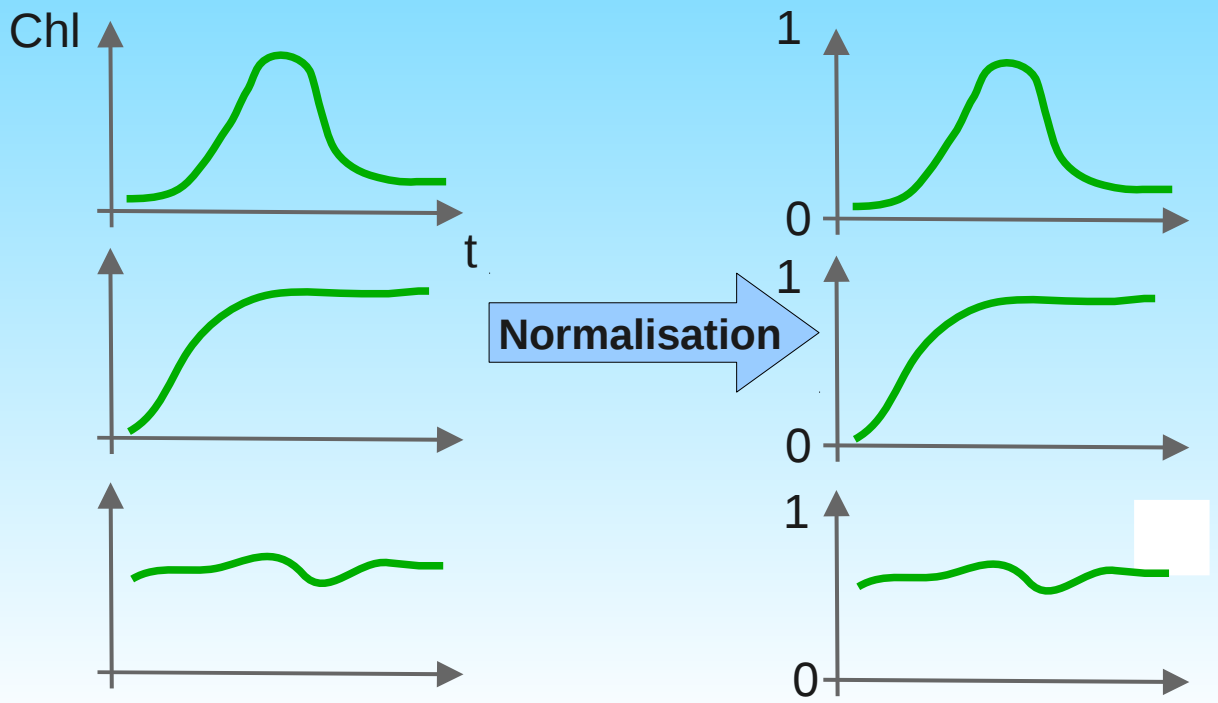




Methodology

Sampling of biogeochemical quantities (e.g. chlorophyll) along lagrangian trajectories





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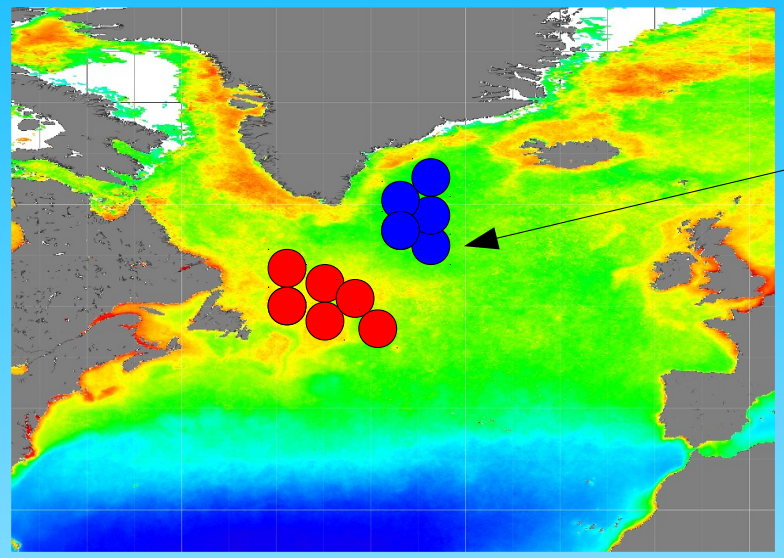
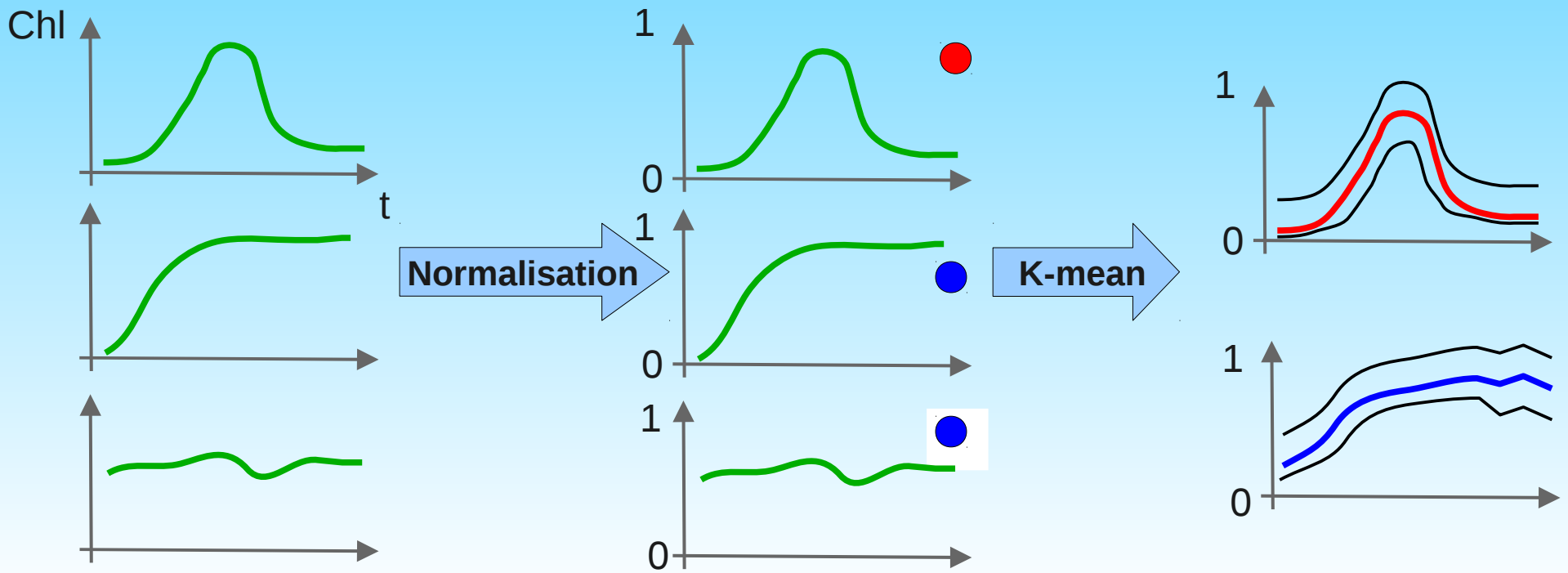


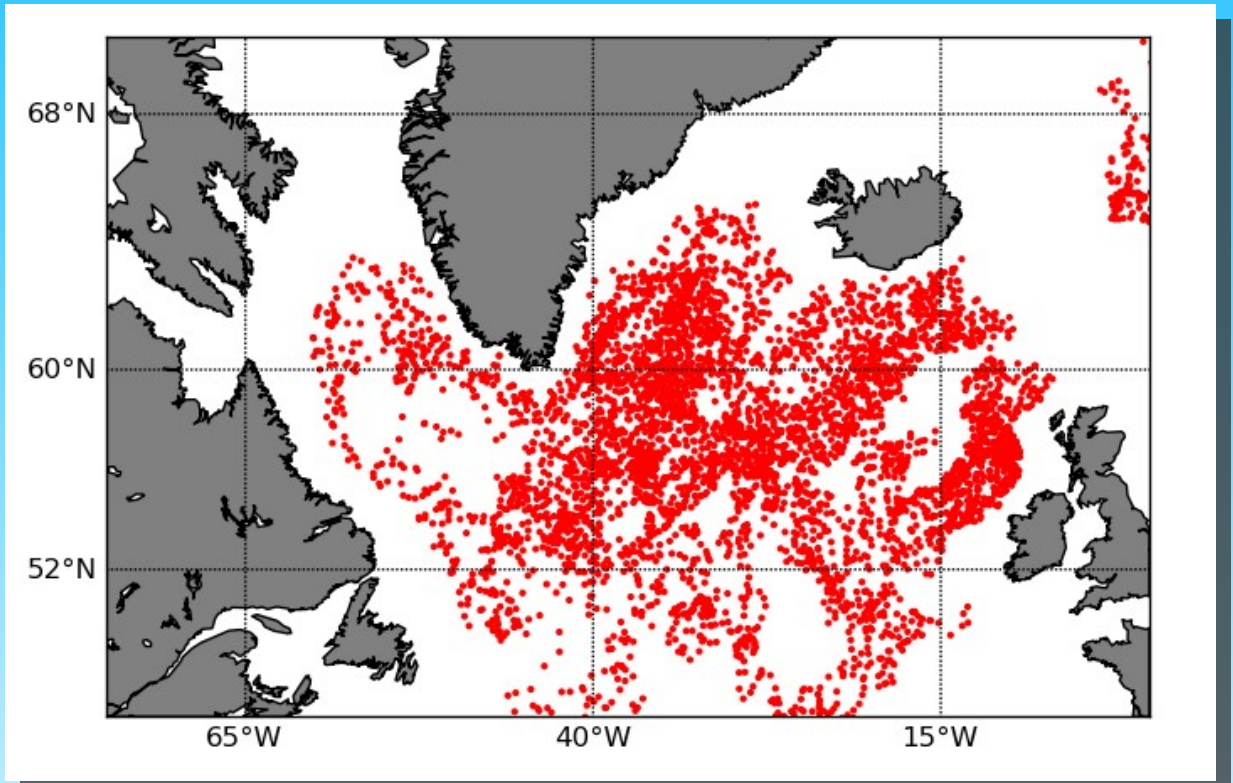
Cluster appartenance with respect to **deployment position**



Clustering of time-series

- **Consistent trajectory database** (10 days, 1000 m , minimum lifetime of 1 year)
- **Real or modelled trajectories** (LAVA, NEMO/NATL4)
- **SeaWiFS-Chl (8d) climatology** sampling

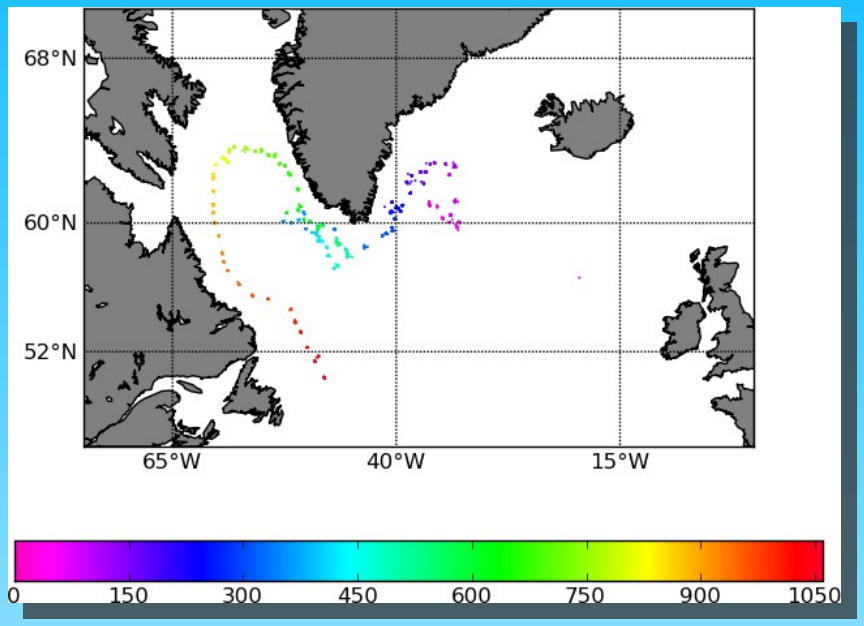
Assumption : every trajectory starts at the same date



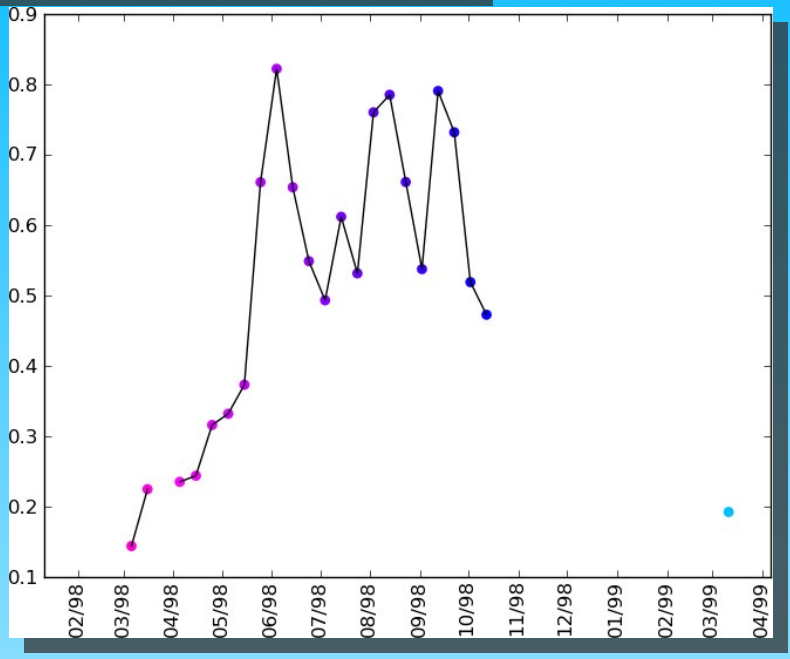
Starting position of trajectories

Examples

Jet

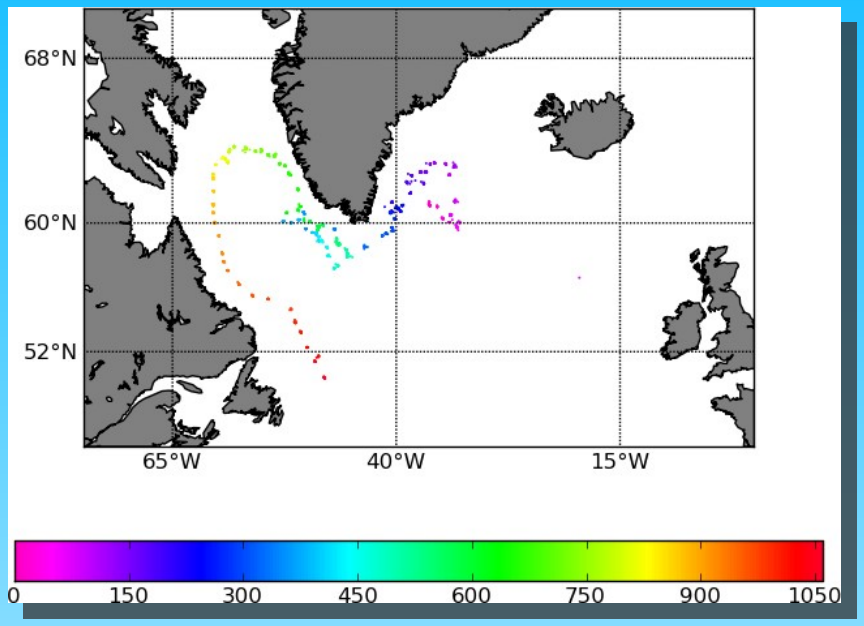


Chl
SeaWiFS
(mg.m-3)



Examples

Jet



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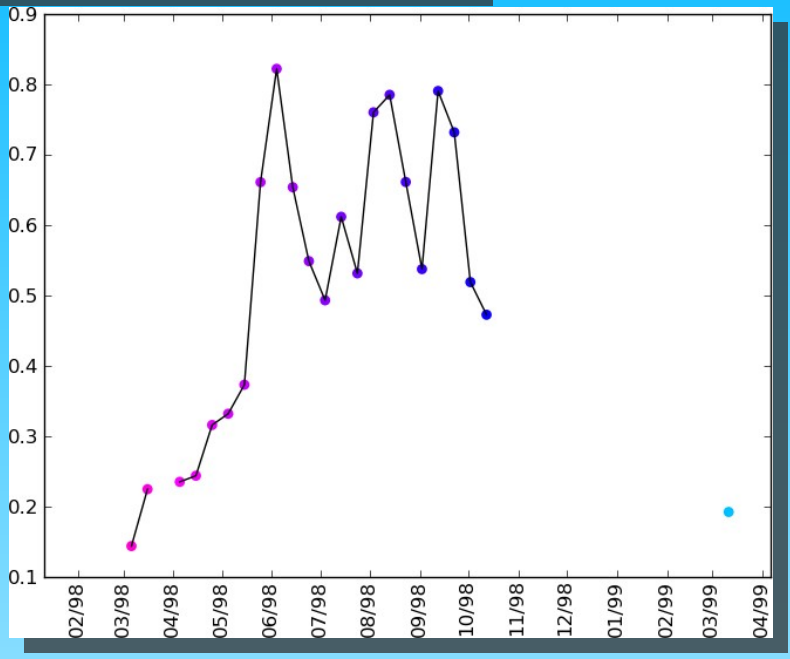
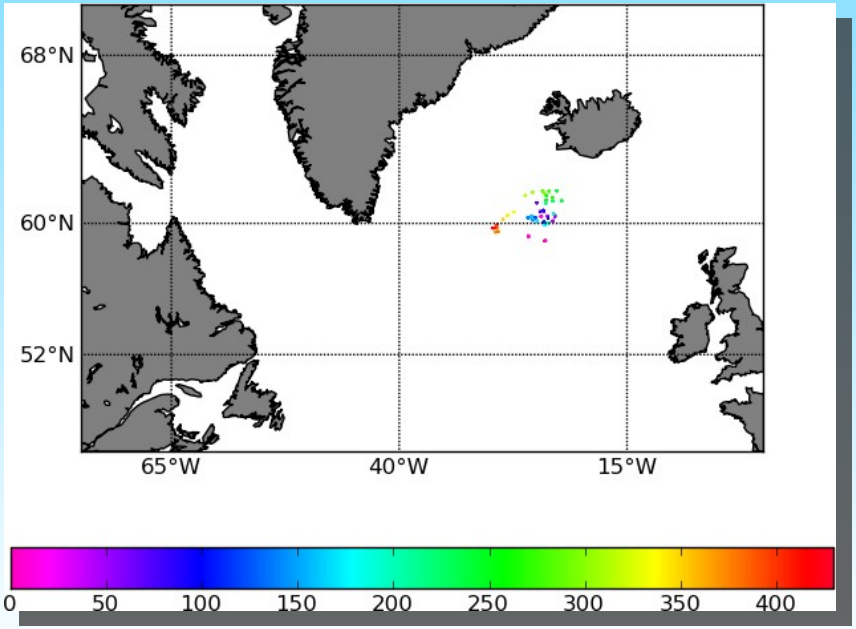
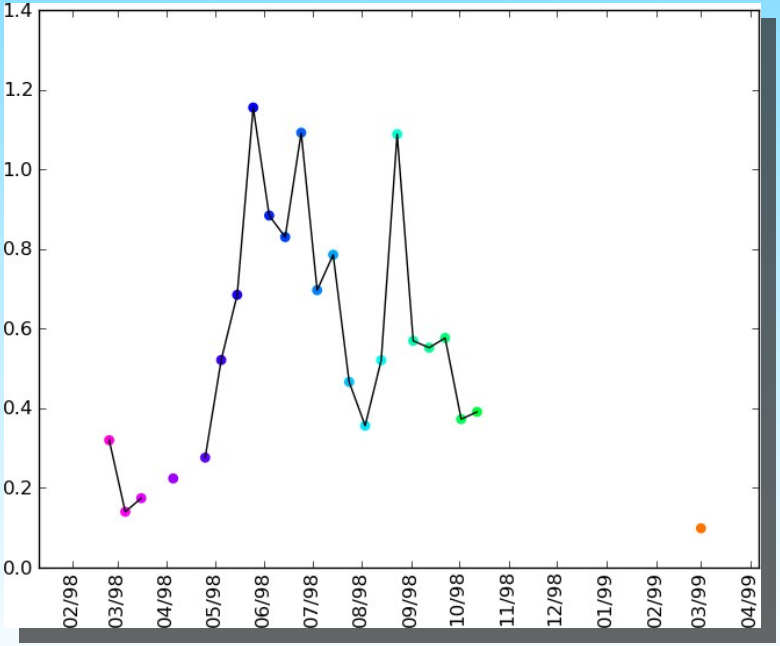


Gyre



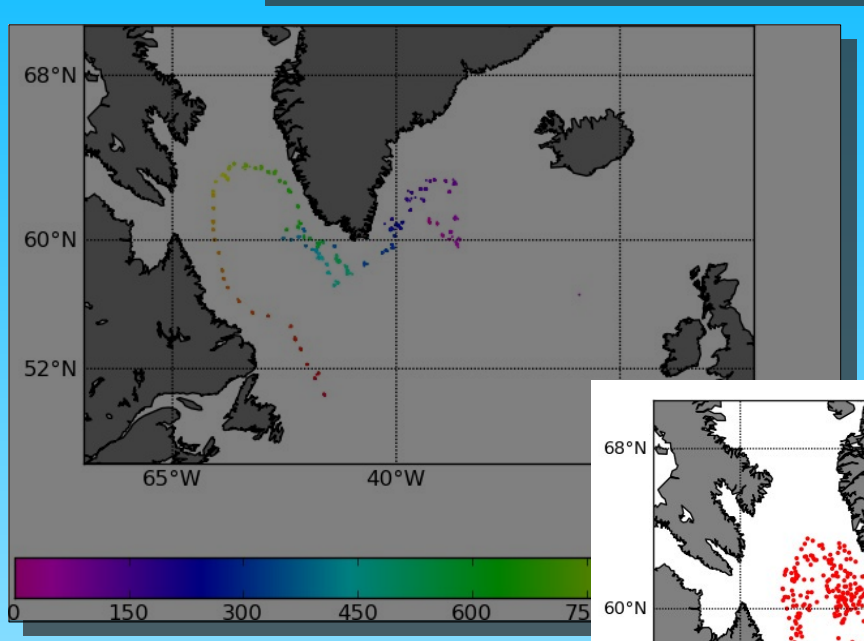
Days

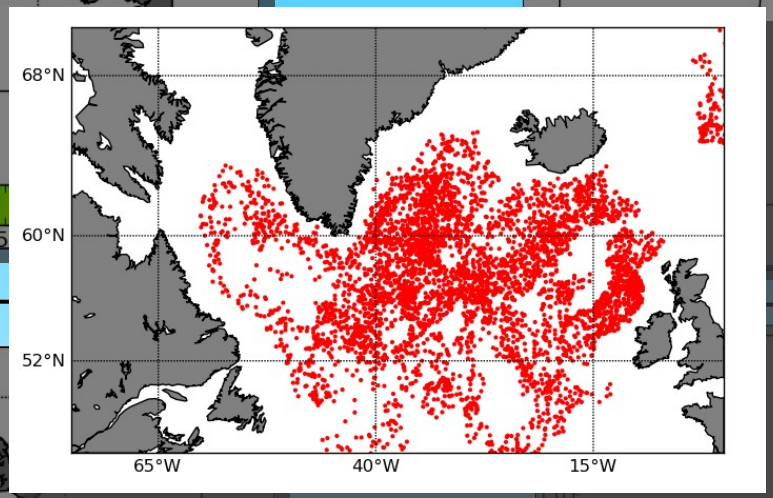


Date

Examples

Jet





Chl
SeaWiFS
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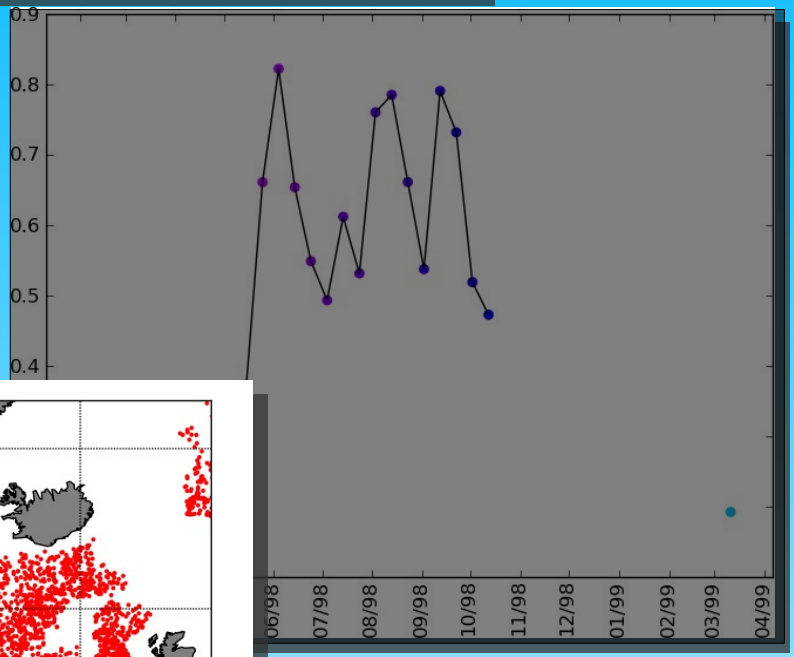
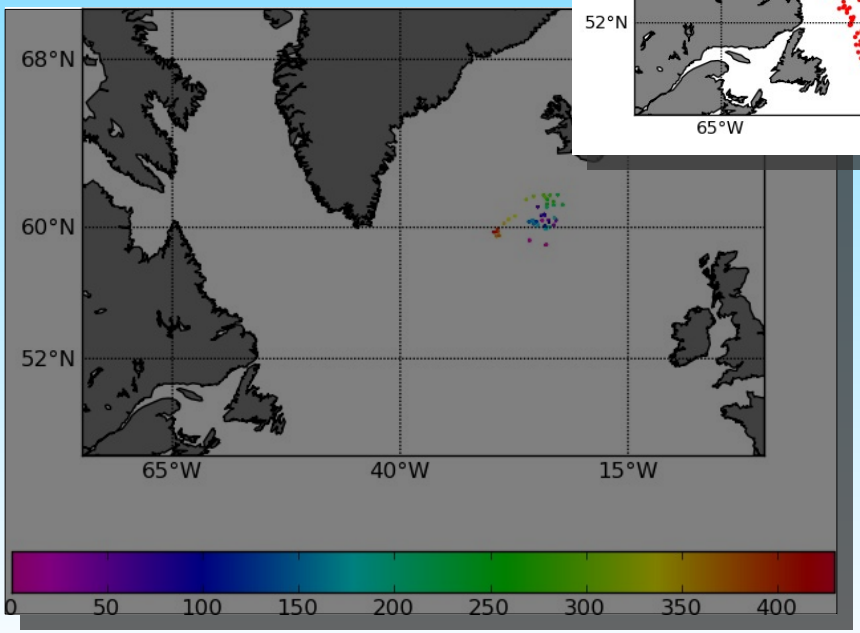
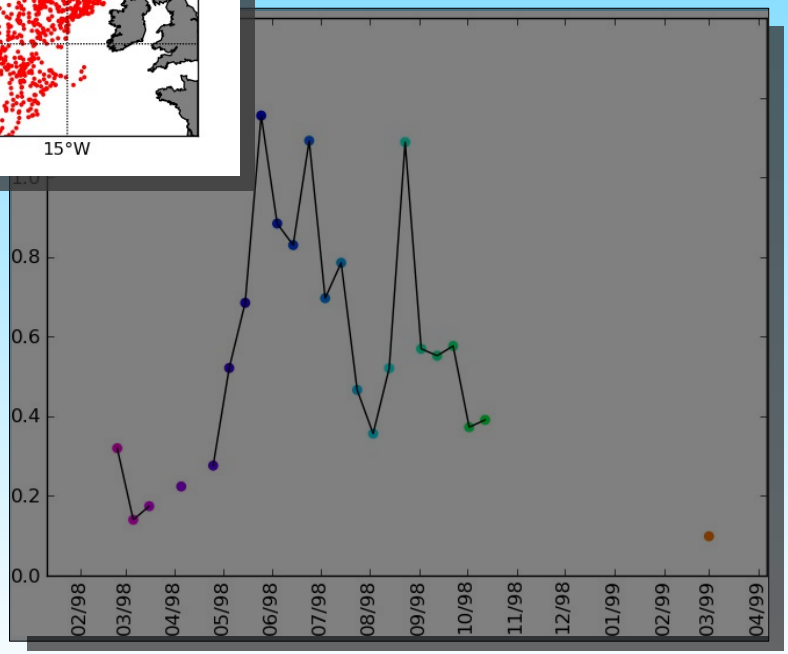


Gyre



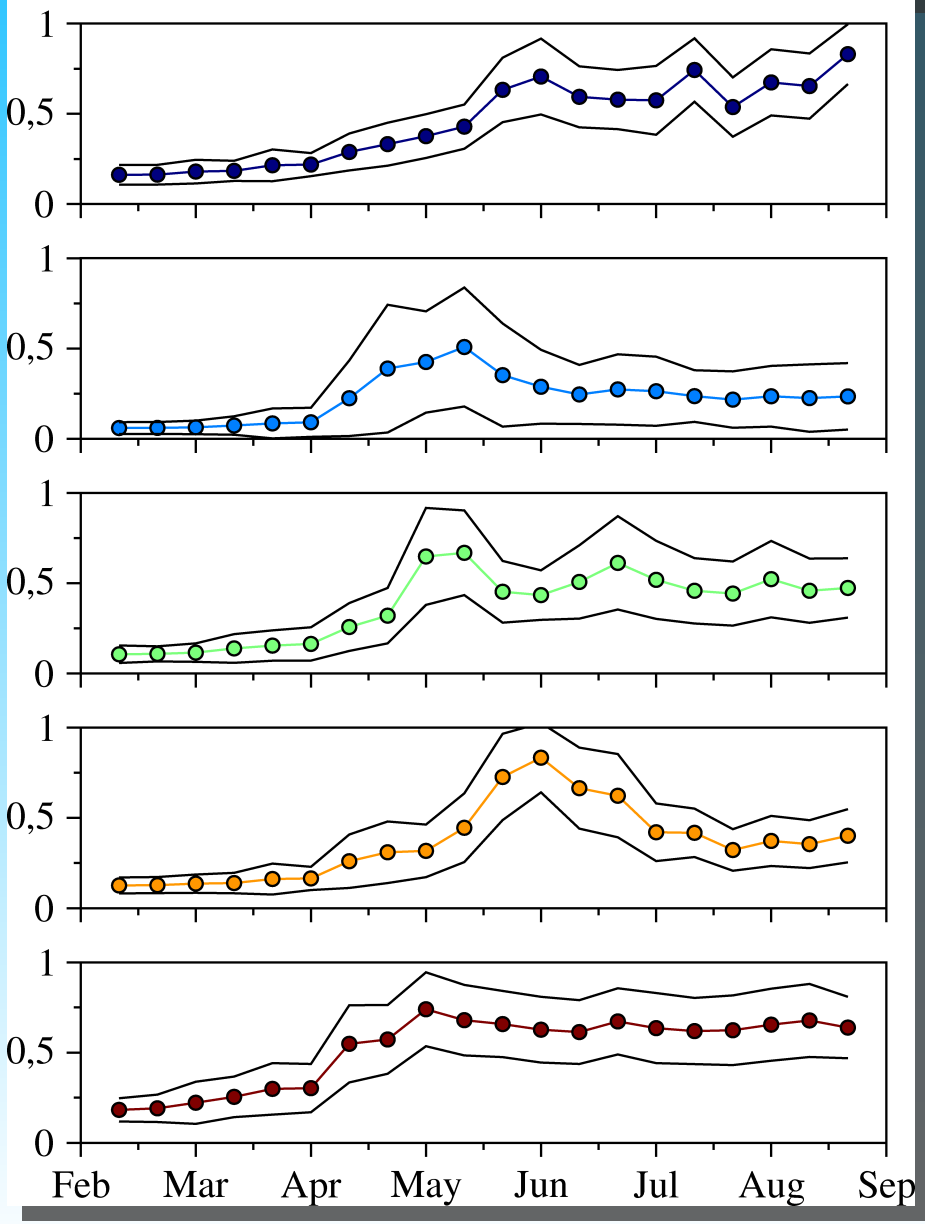
Days



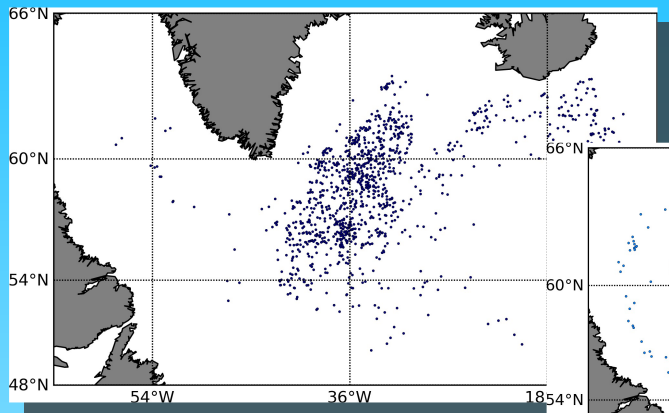
Date

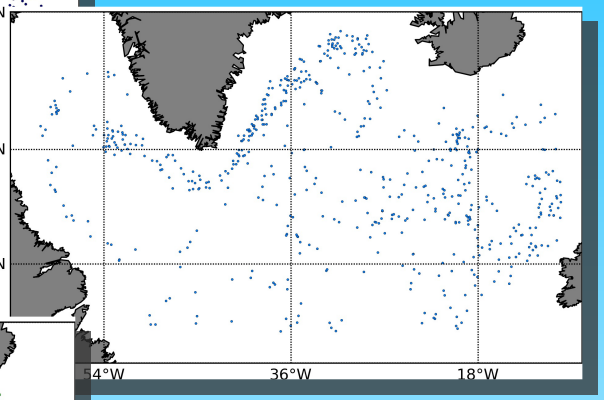
Clustering

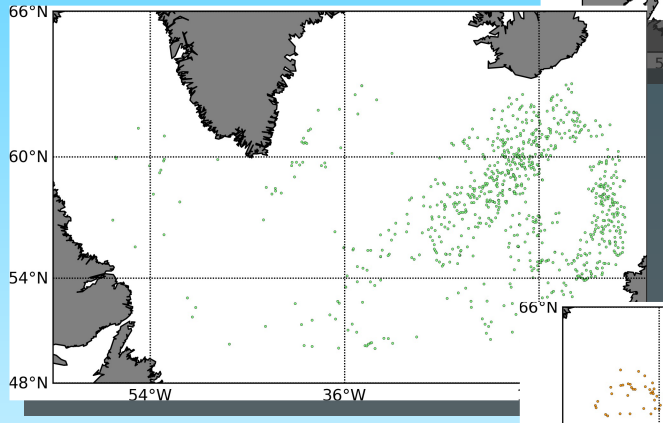
Mean time-series of each cluster

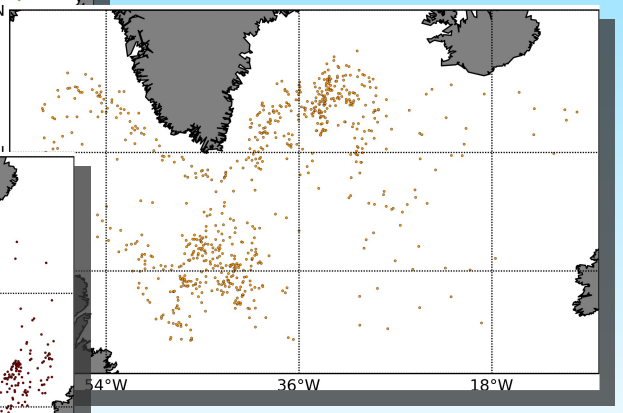


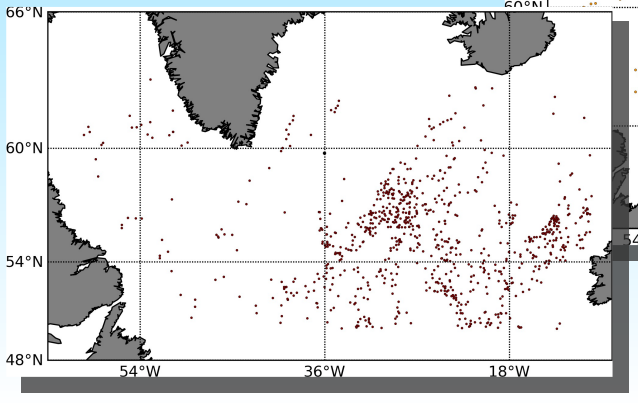
Modelled trajectories 5 clusters





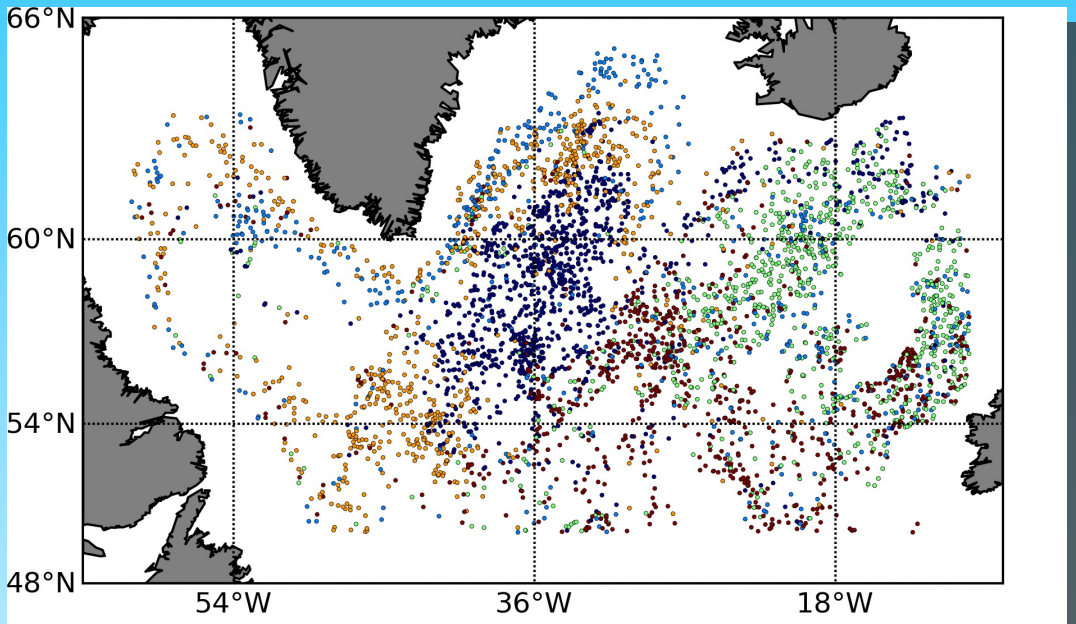


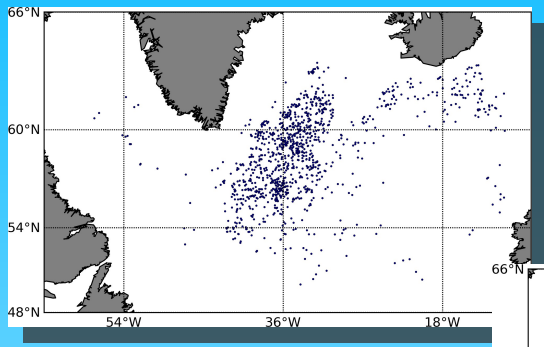


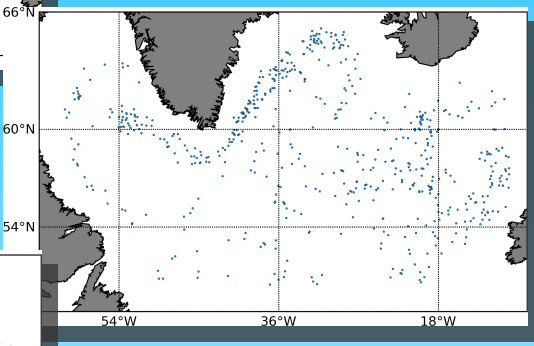


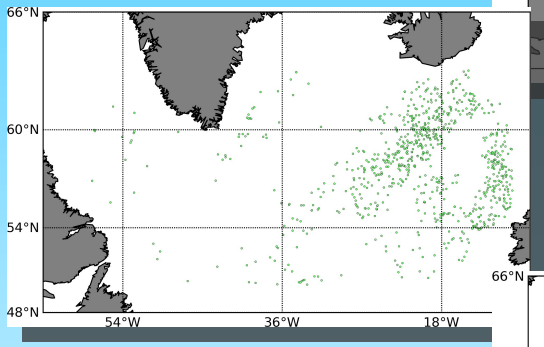
Clustering

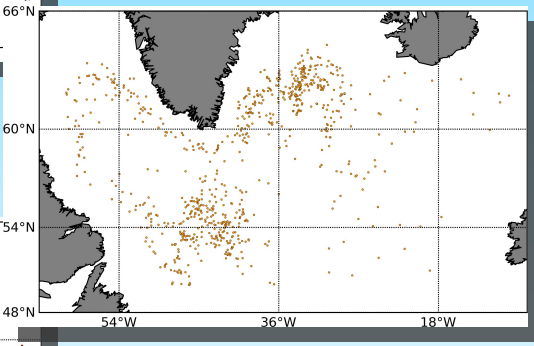
Modelled trajectories
5 clusters

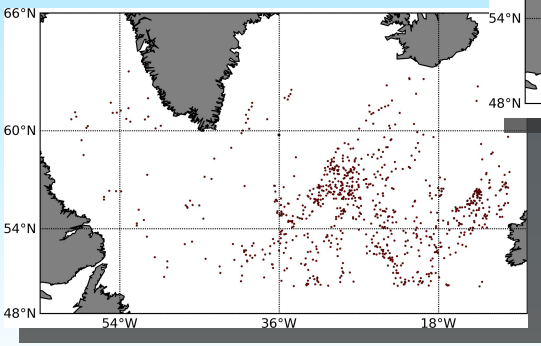






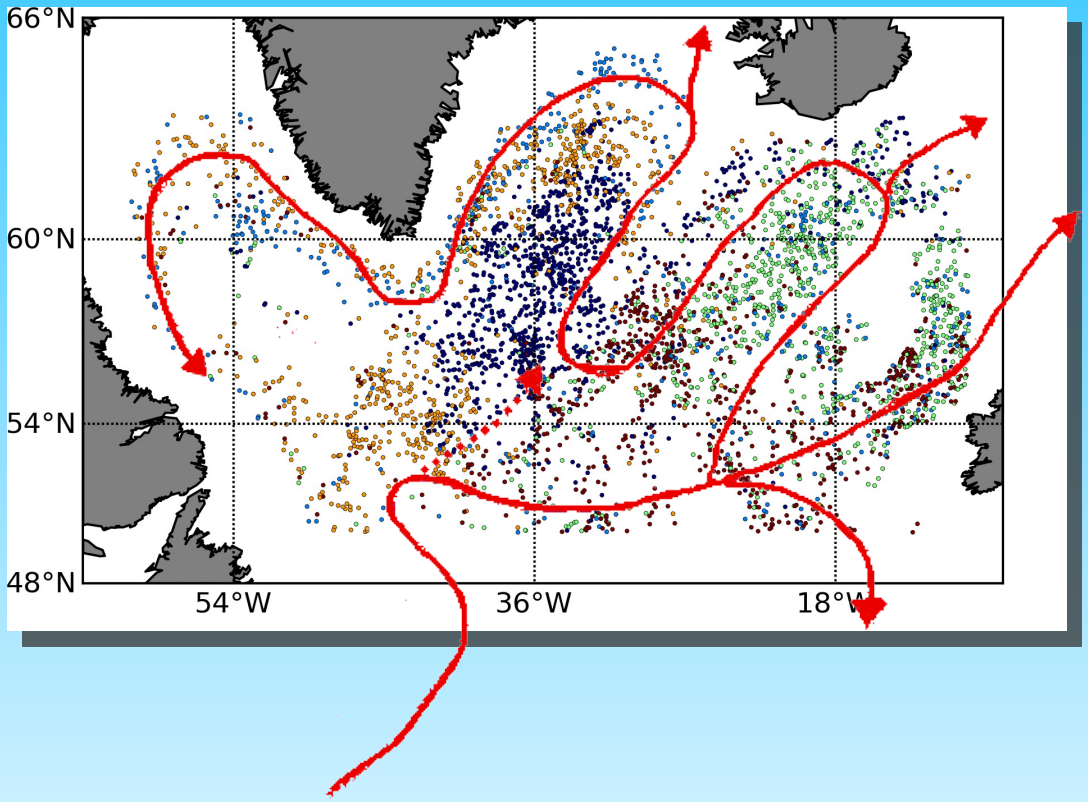


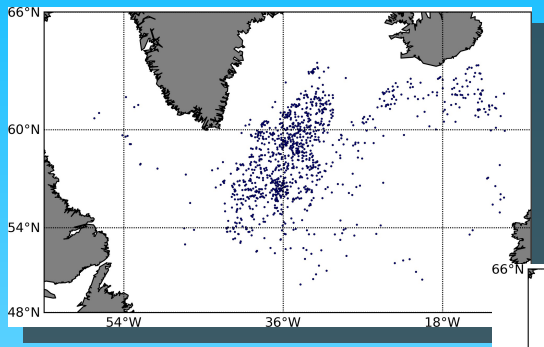


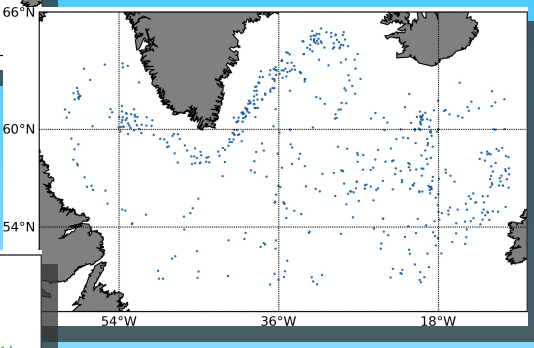


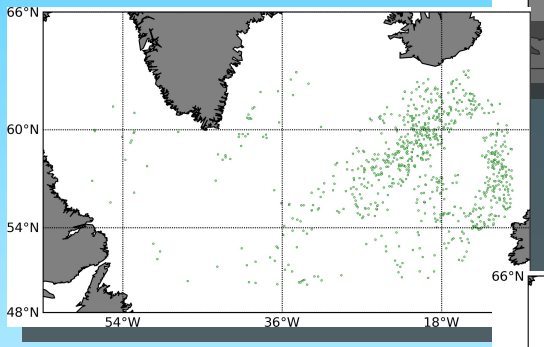
Clustering

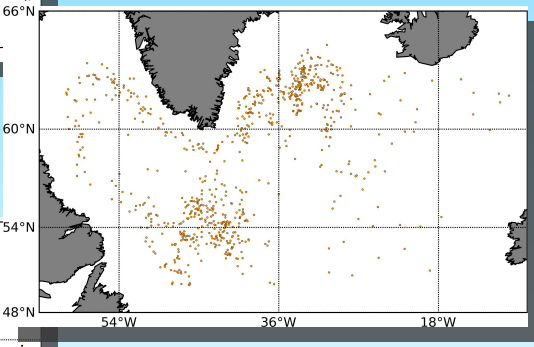
Modelled trajectories
5 clusters

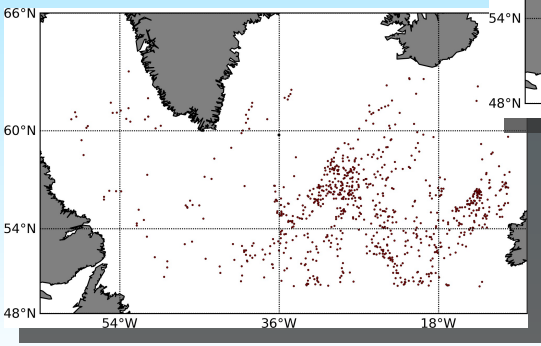




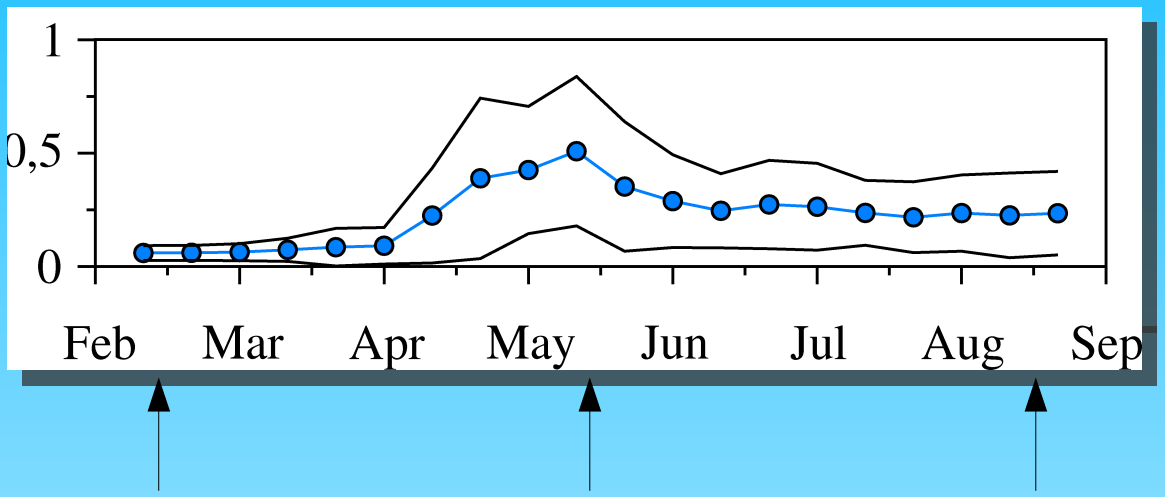




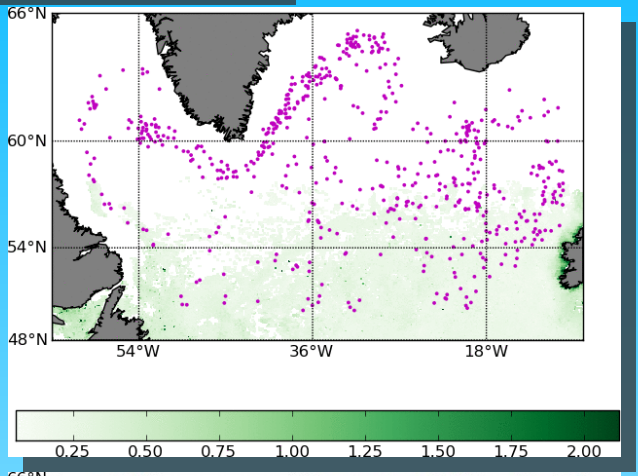




Cluster «Jet »



15 February



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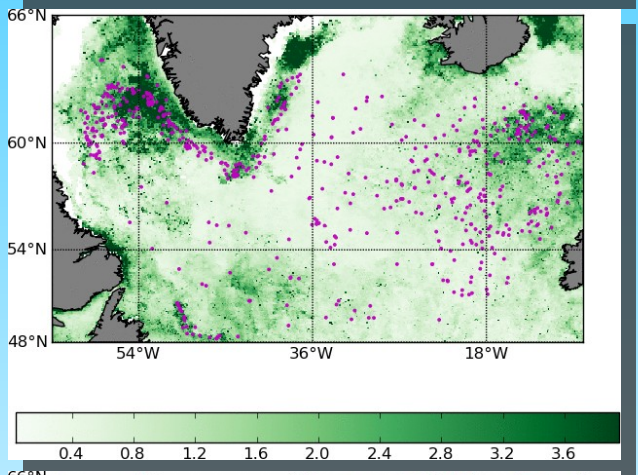

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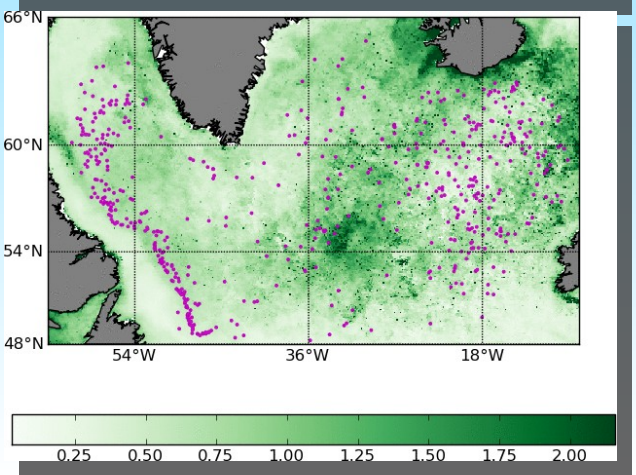
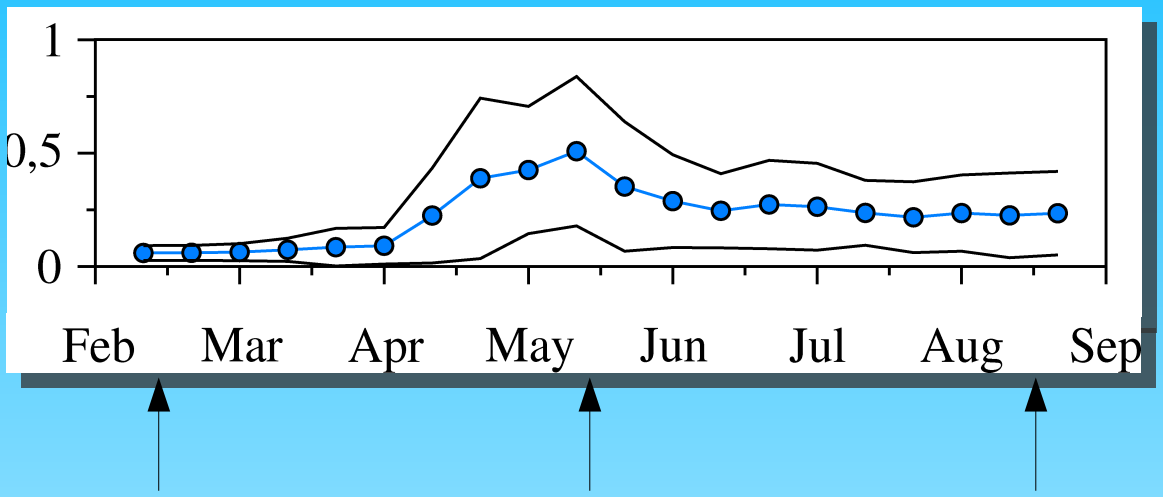


Cluster «Jet »



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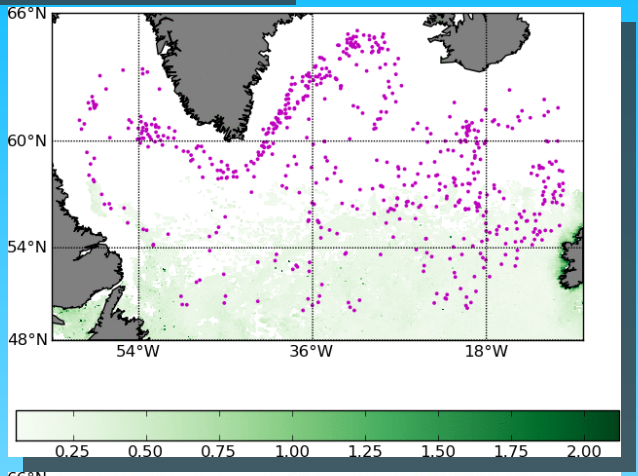

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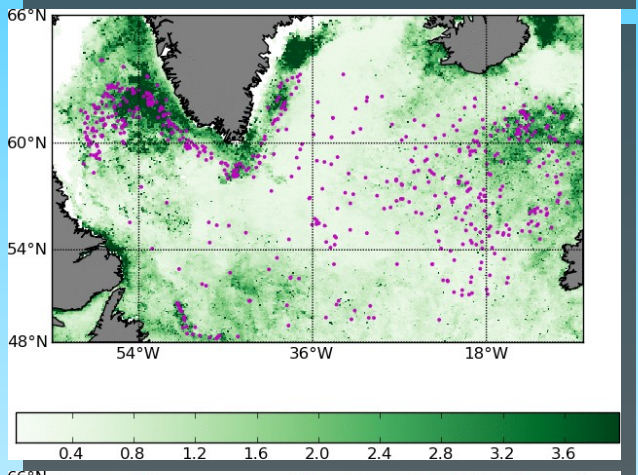

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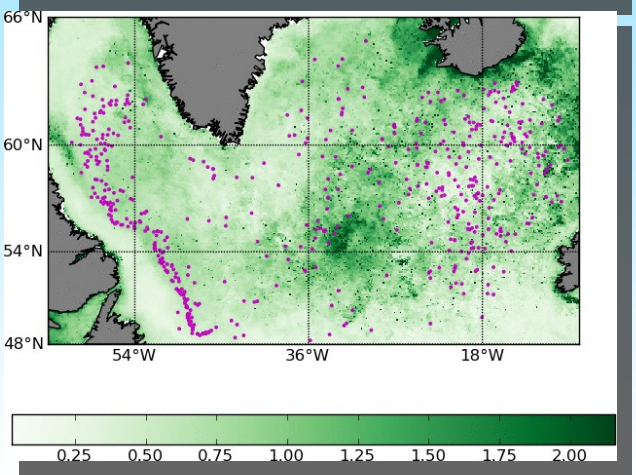
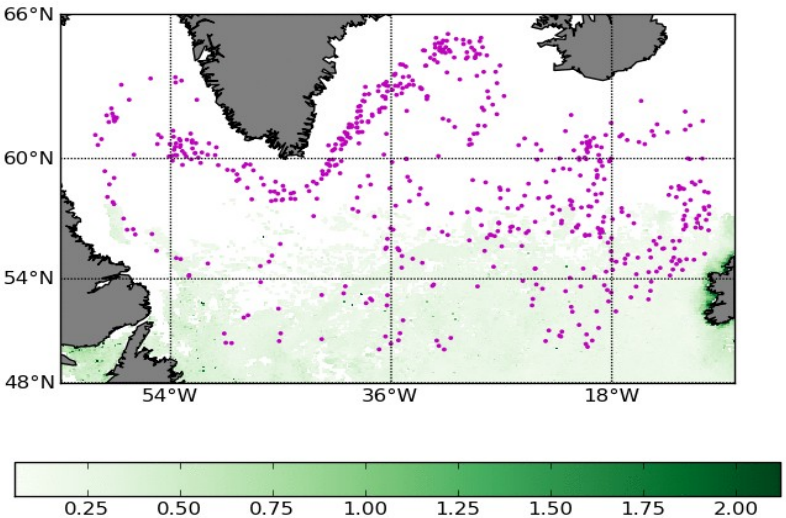
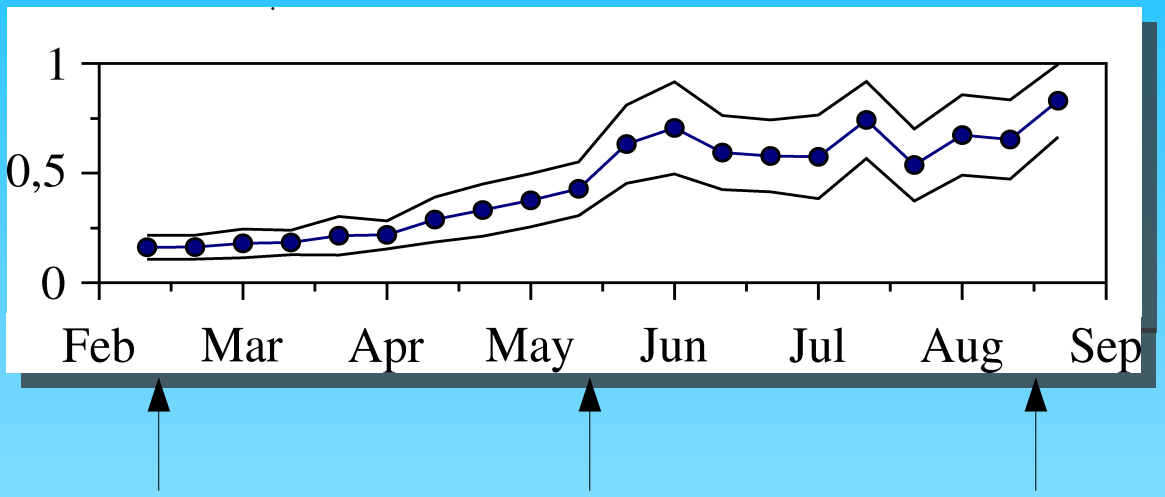




Cluster «Gyre»



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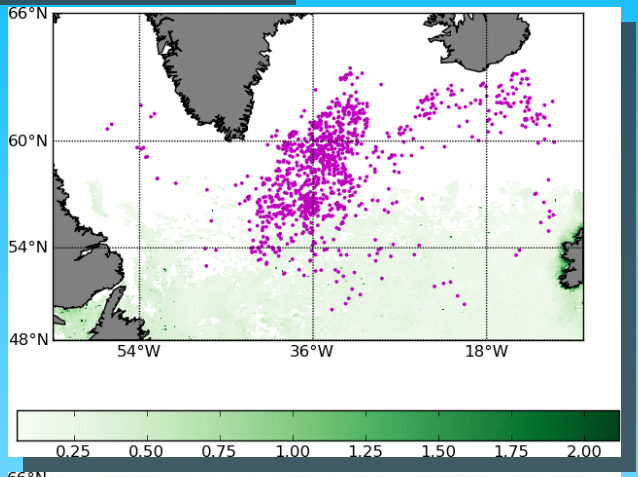

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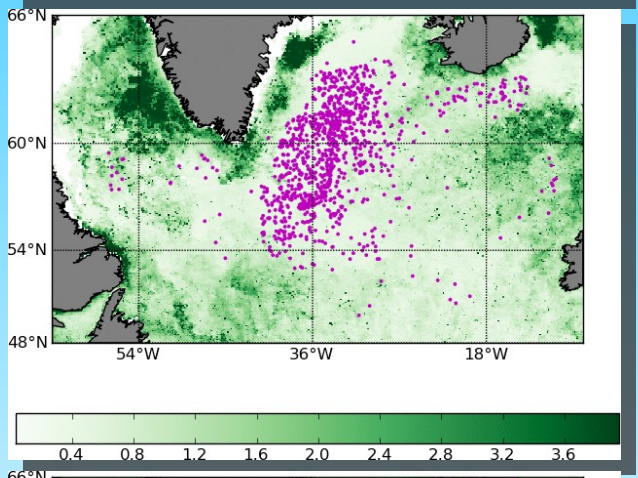

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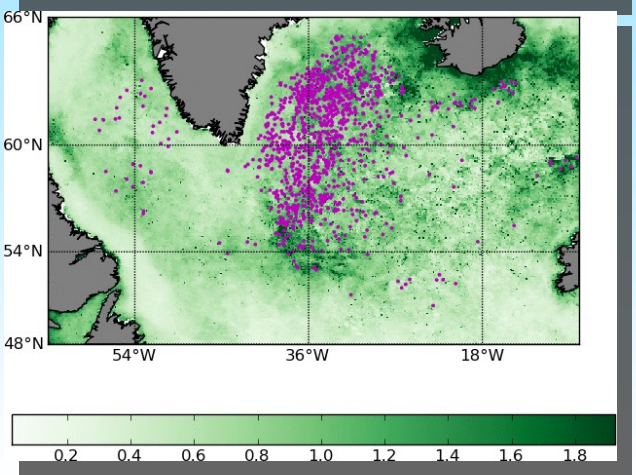
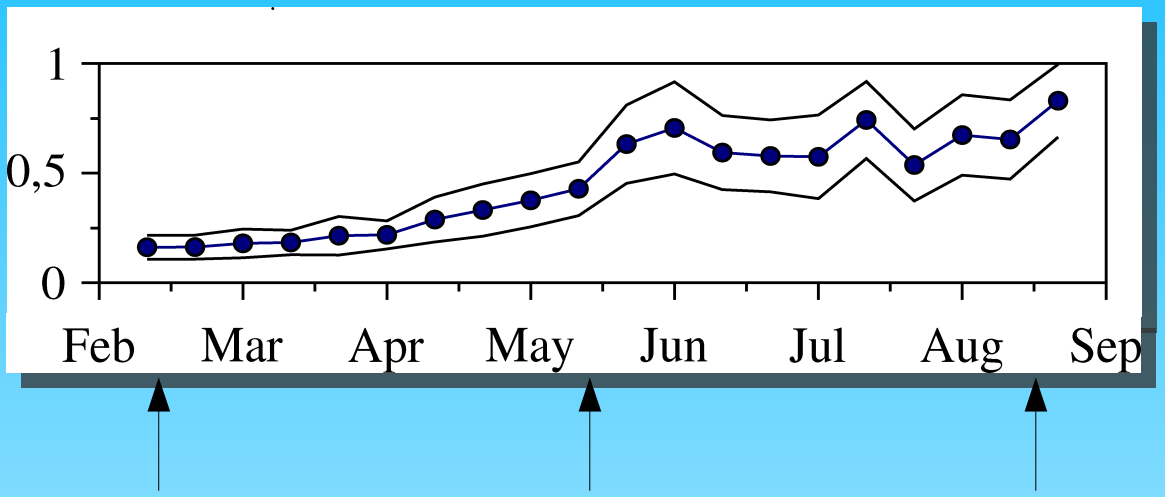
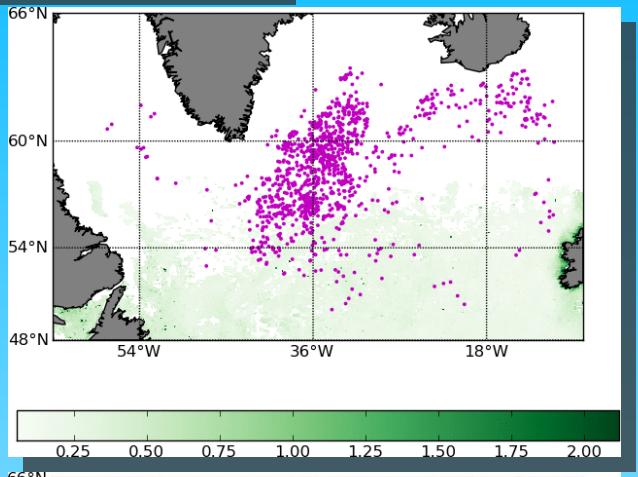


Cluster «Gyre»



15 February



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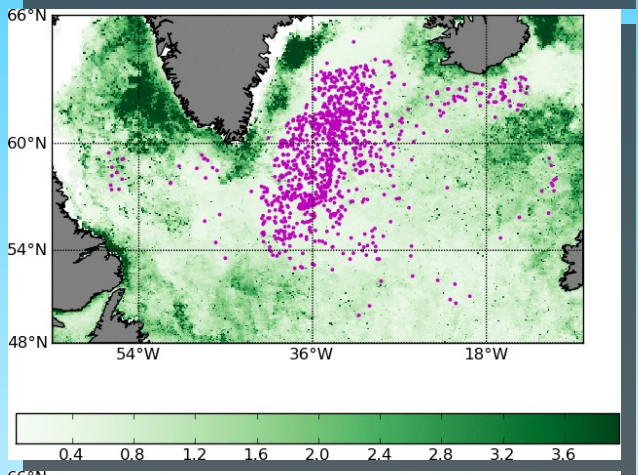

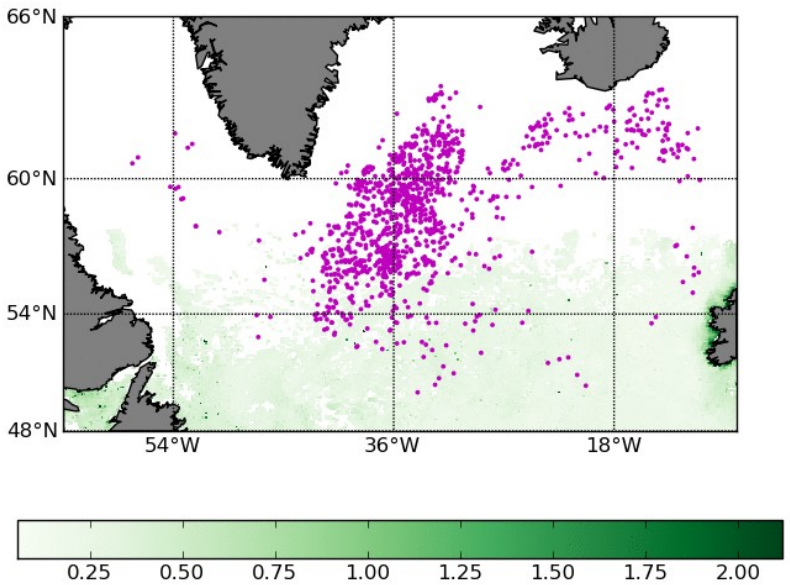

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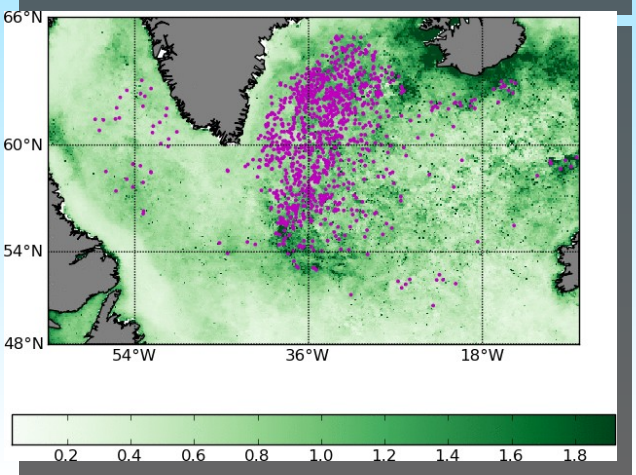


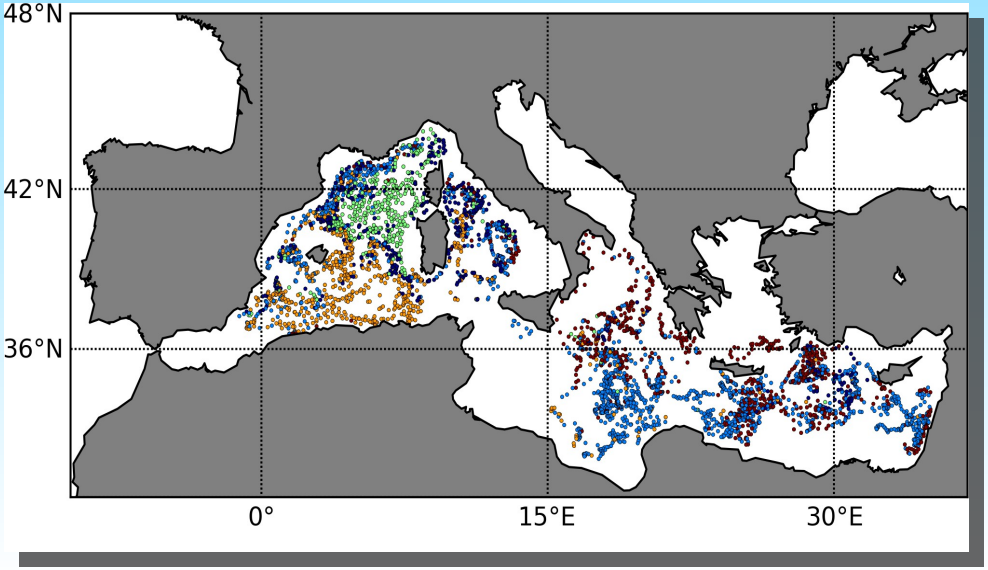
Conclusion

- **Set up of a methodology** to identity homogenous lagrangian bioregions
- **Coherent geographical structures** following large scale circulation :
  → already **some elements to decide** where and when deploy floats.
- **Optimisation** : X floats to sample the gyre, X floats to sample the jet

<u>Not shown here … :</u>

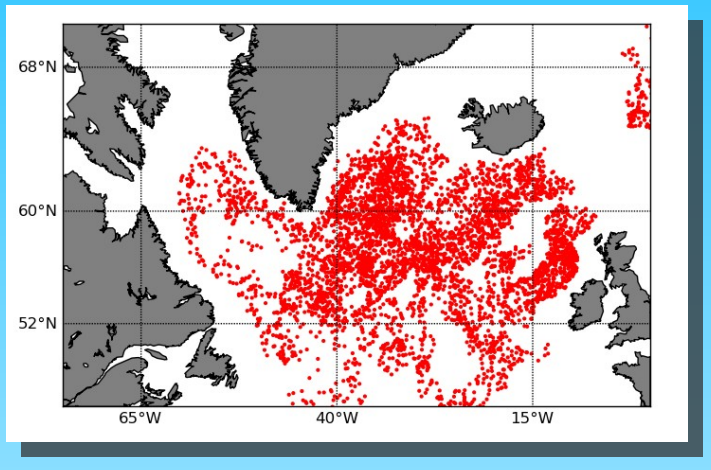
Cluster comparisons for **real and modelled trajectories,** good agreement.

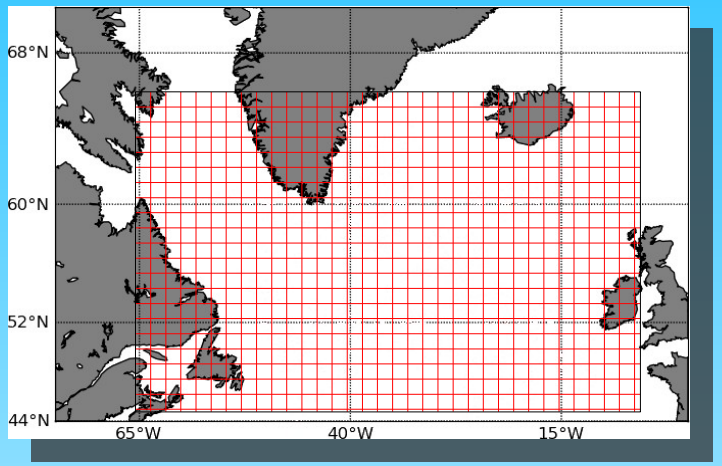
Applyable to any location in the ocean
(ex : Mediterranean sea)



Perspectives

• **Extrapolation** of the method **to the full model grid** to fill up exclusion area





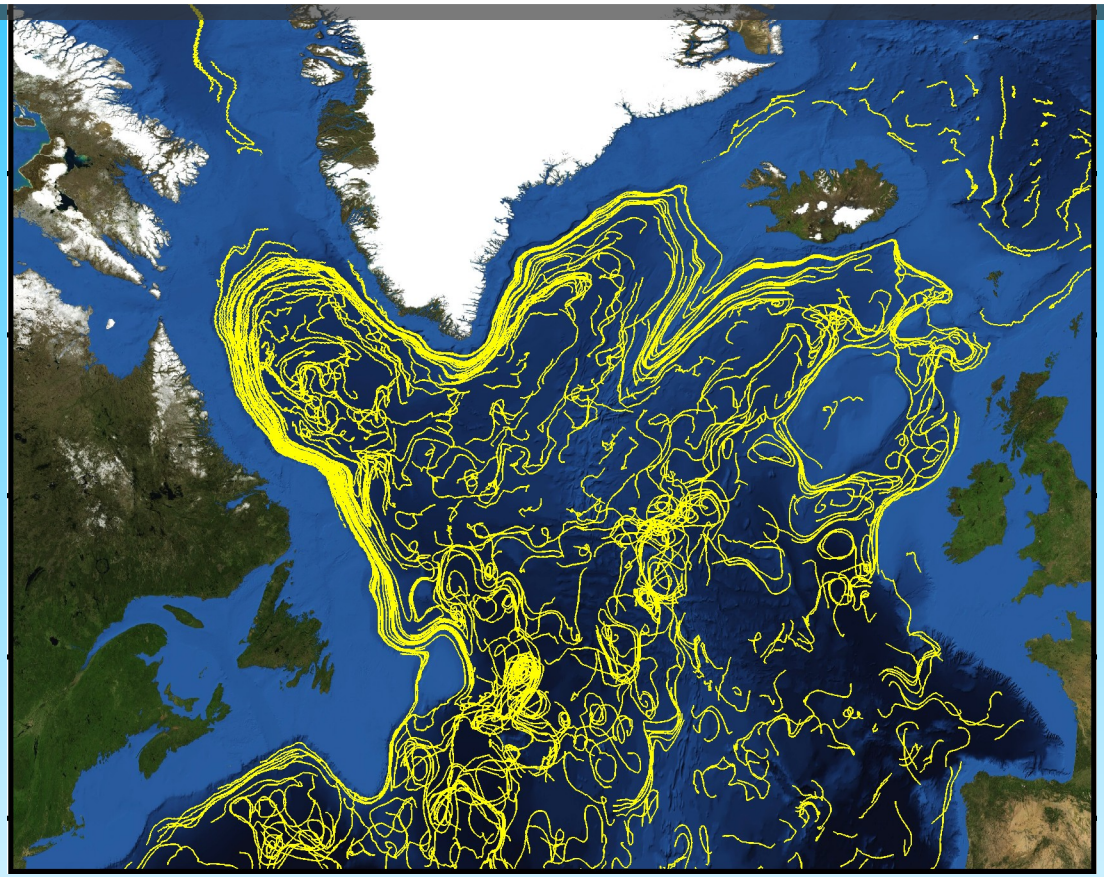
• Current and future deployment : **will they fulfill expectations ?**

→ *real time montoring*

… Coming next :

• **Observing system simulation experiments** (OSSE), sequential data assimilation framework

Optimal deployment of the BioArgo floats : a modeling approach



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Thank you !

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