



Drift applications with NEMO/Mercator

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Summary

- ❑ Applicative context
- ❑ Description of a study case
- ❑ Applications with Mothy (Météo France)
- ❑ Applications with Ariane
- ❑ Perspectives



Applicative context

Phd topic: Operational modeling of in sea pollutant/objects

Context: to force Mothy (Météo-France) with Mercator forecasts

Keys: a/ Identify the best parameters in Nemo/Mercator systems to succeed oceanic drift forecasting

b/ Currents introduction strategies in a model such as Mothy

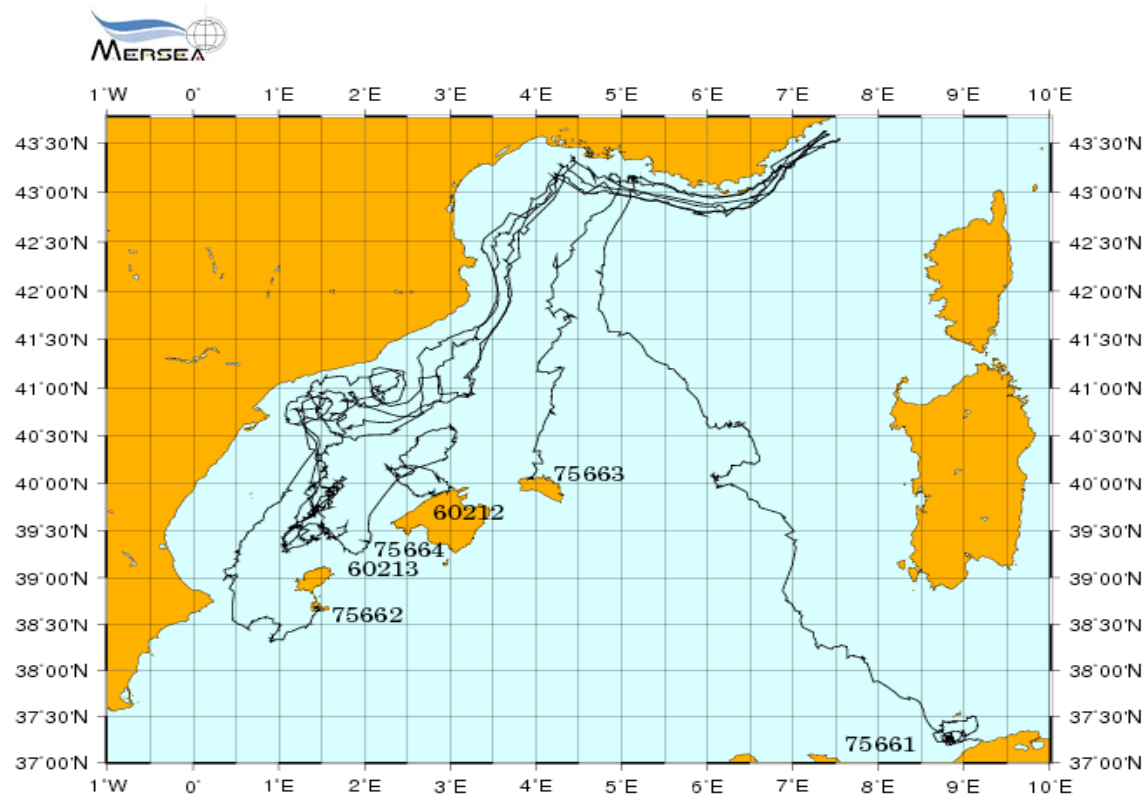
c/ Lagrangian predictability, ensemblist approach



In practice: test cases and sensibility studies



Case study



Mersea drift experiment, Western Med.

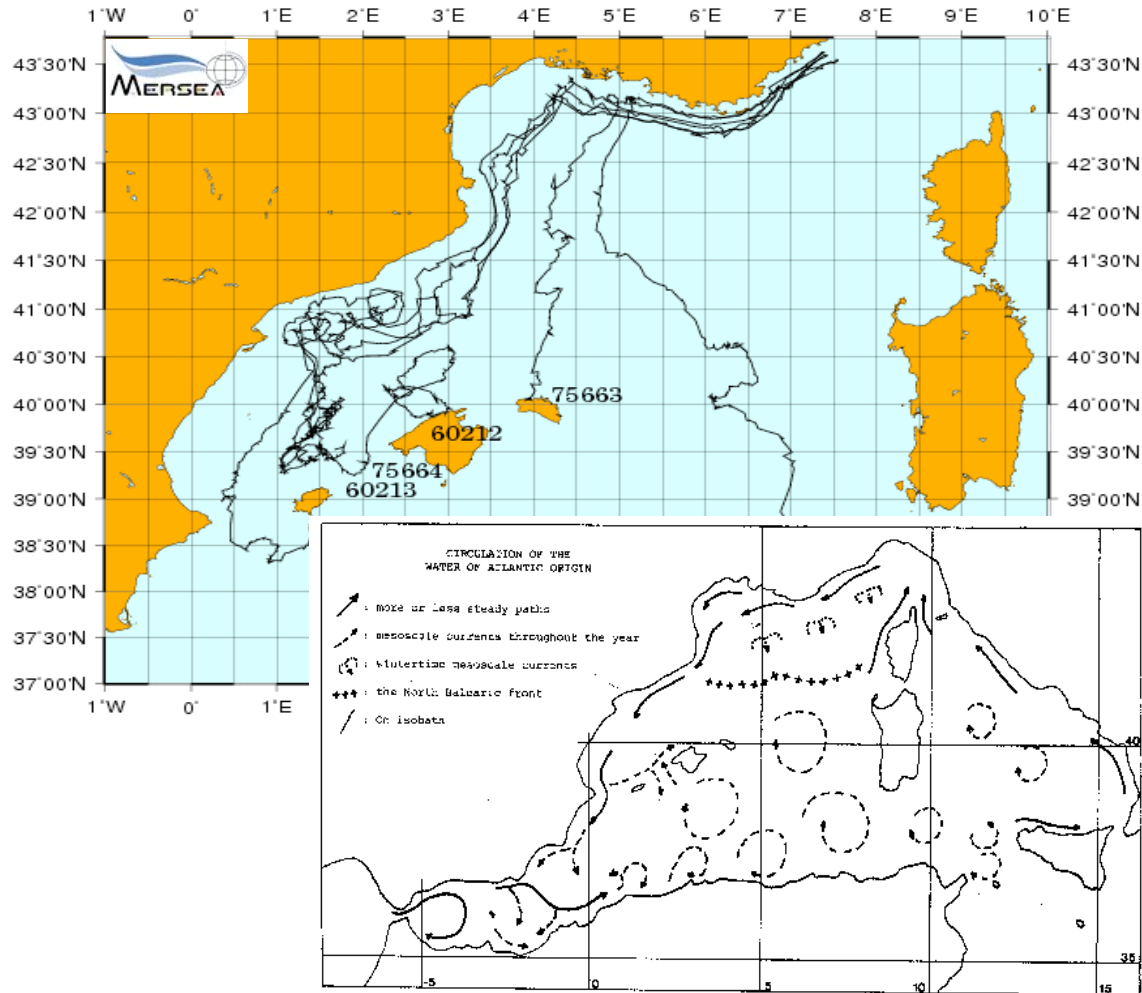
- North West Mediterranean basin
- 6 drifting buoys

Period: from 10/10/2007 to 06/12/2007

Course: from Azur coast to Balearic islands



Case study



Mersea drift experiment, Western Med.

Oceanic features

- Ligurian coastal current
- South winds: Mistral winds
- Turbulent areas: Balearic islands



Mothy

Mothy (Météo France) = operational oil spill drift forecasting model

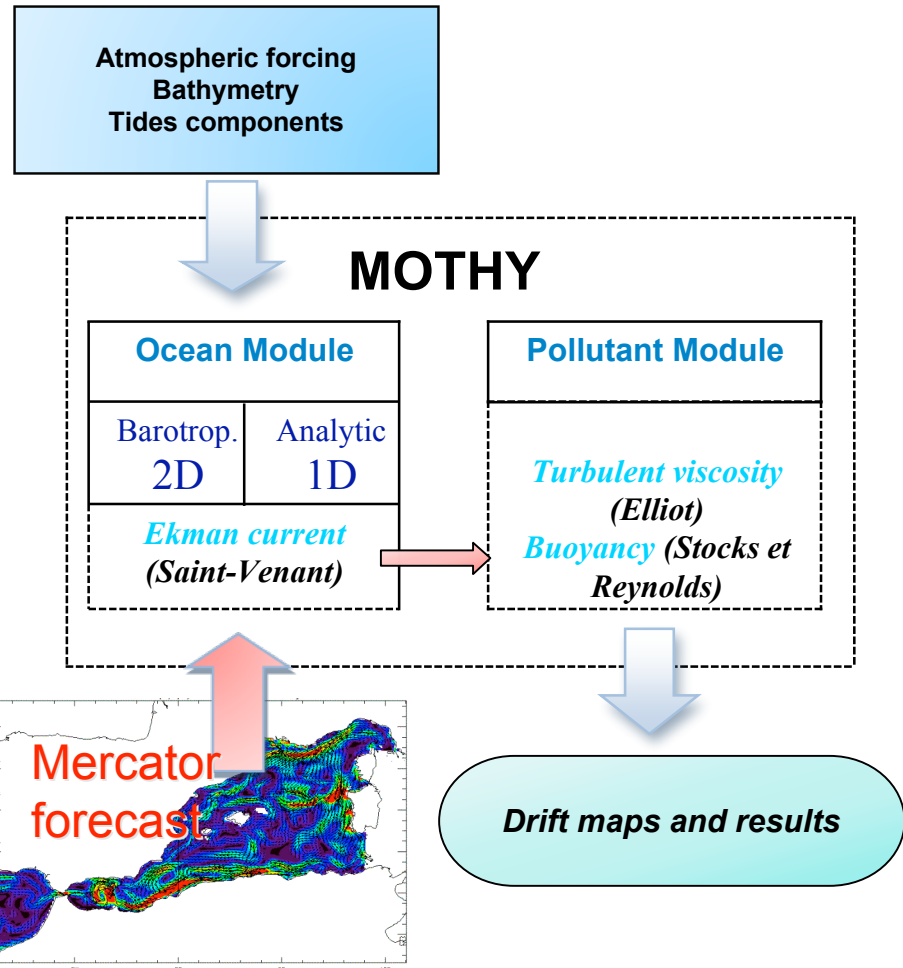
- o **2,5 D Ocean modelling**
Barotropic 2D (improved Ekman) +
Analytic 1D (vertical profile)

Doesn't take into account:

-3D oceanic behaviors:
Stratification/ Turbulence
- *General oceanic circulation*

Solution: additional **oceanic forcing** (Mercator Océan) **without wind effects**

For these results: *imbricate study configuration: Western Med 1/12° configuration (boundary forcing + without data assim.)*

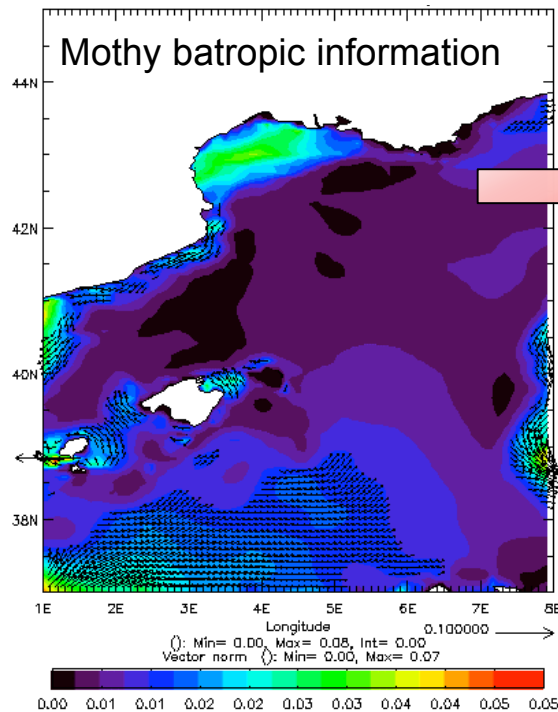




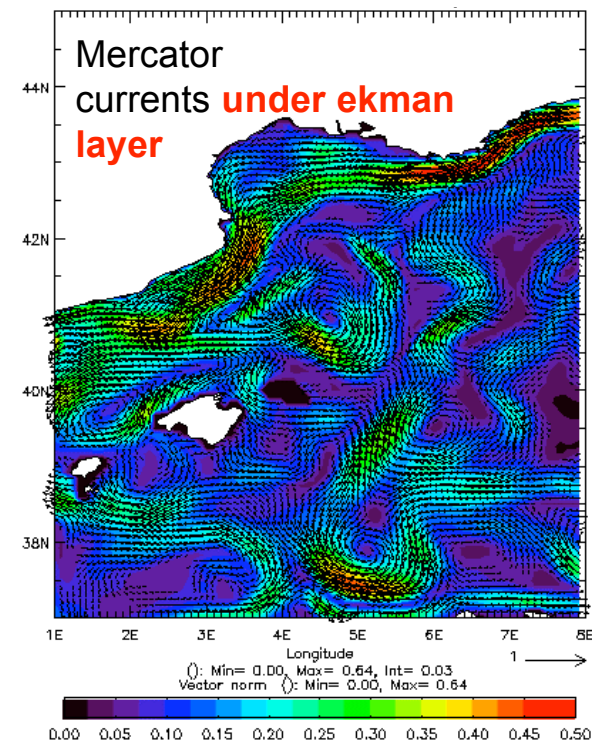
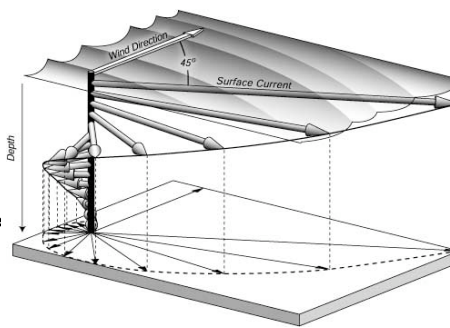
Why forcing Mothy with annex currents ?

Mothy's 2,5D curent = high frequencies
linked with direct atmospheric forcing,
shelf description

• Mercator's curent = low frequency of
oceanic signal = **general circulation +
baroclinic components**



Analytic vertical
profile = surface
oceanic information

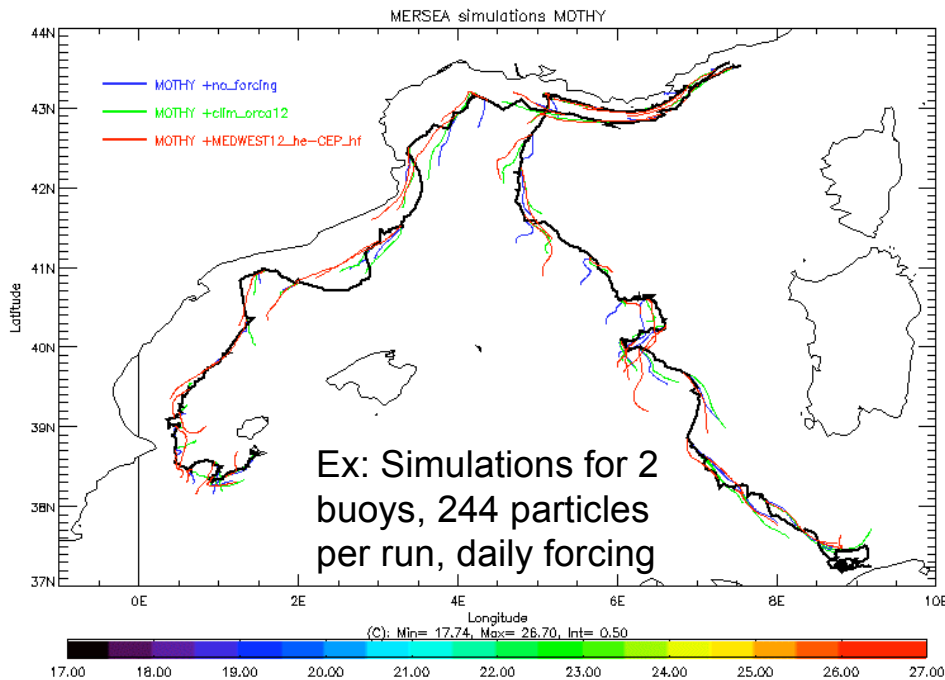




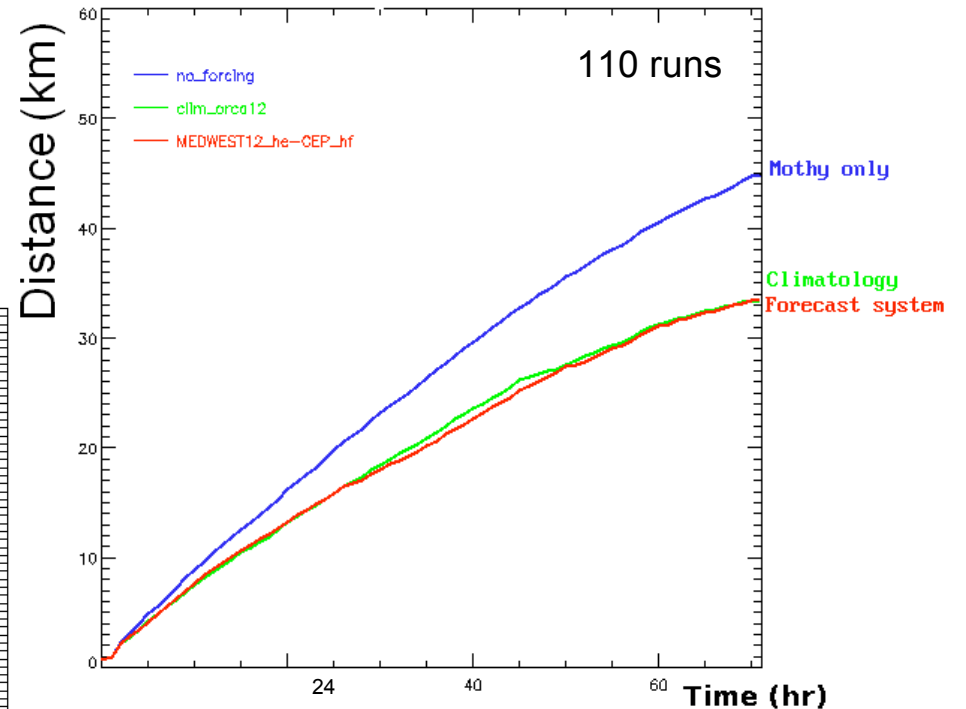
Protocols and results

Protocol:

A 3 days drift forecast each 48 hr
→ 110 independent simulations per test:
Mothy_alone, **Forecast**, **Climatology**



Average distance error (km) vs time (hr)

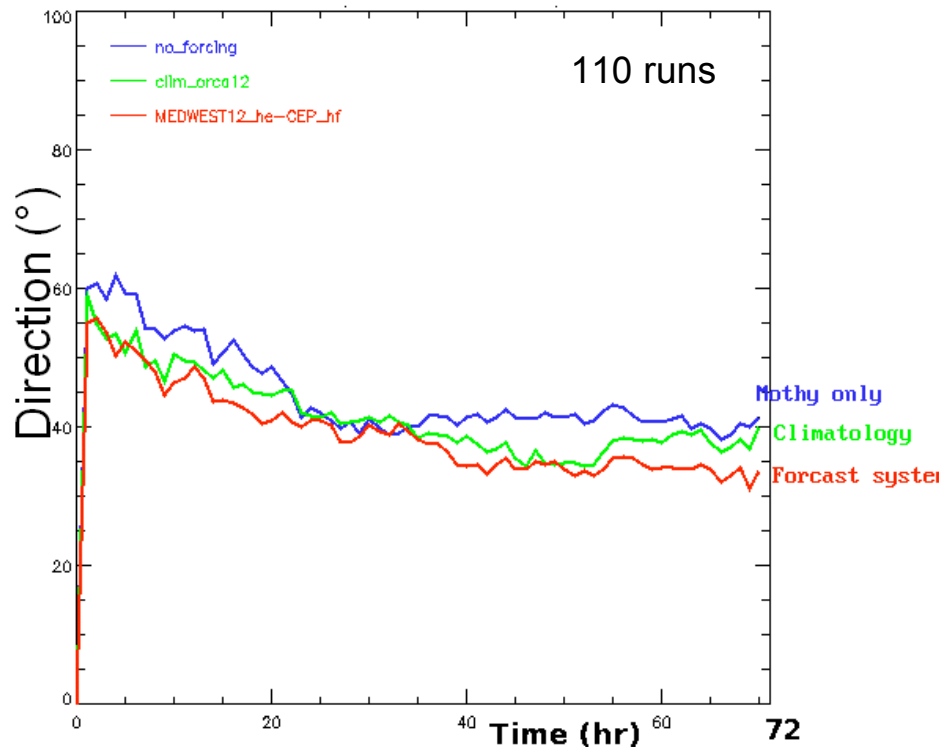


Forecast vs Mothy_alone = 30 % improvement
Forecast ~ Climatology



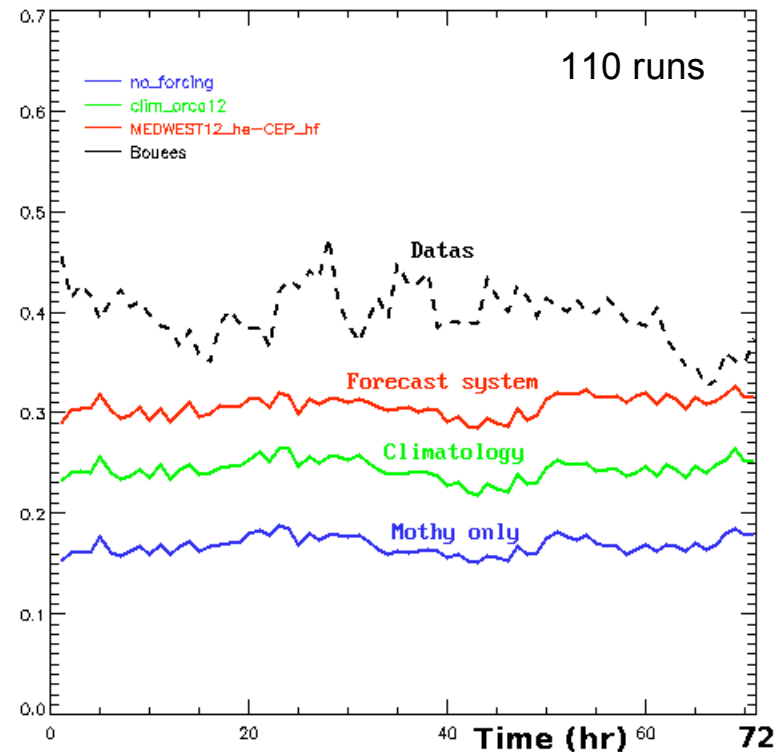
Results (2)

Average direction error (°) vs time (hr)



- **Forecast** vs **Climatology** = better advective direction constriction

Average velocity (m.s-1) vs time (hr)



- Speed bias attenuation
- High frequencies in **datas**, not represented by models



Ariane

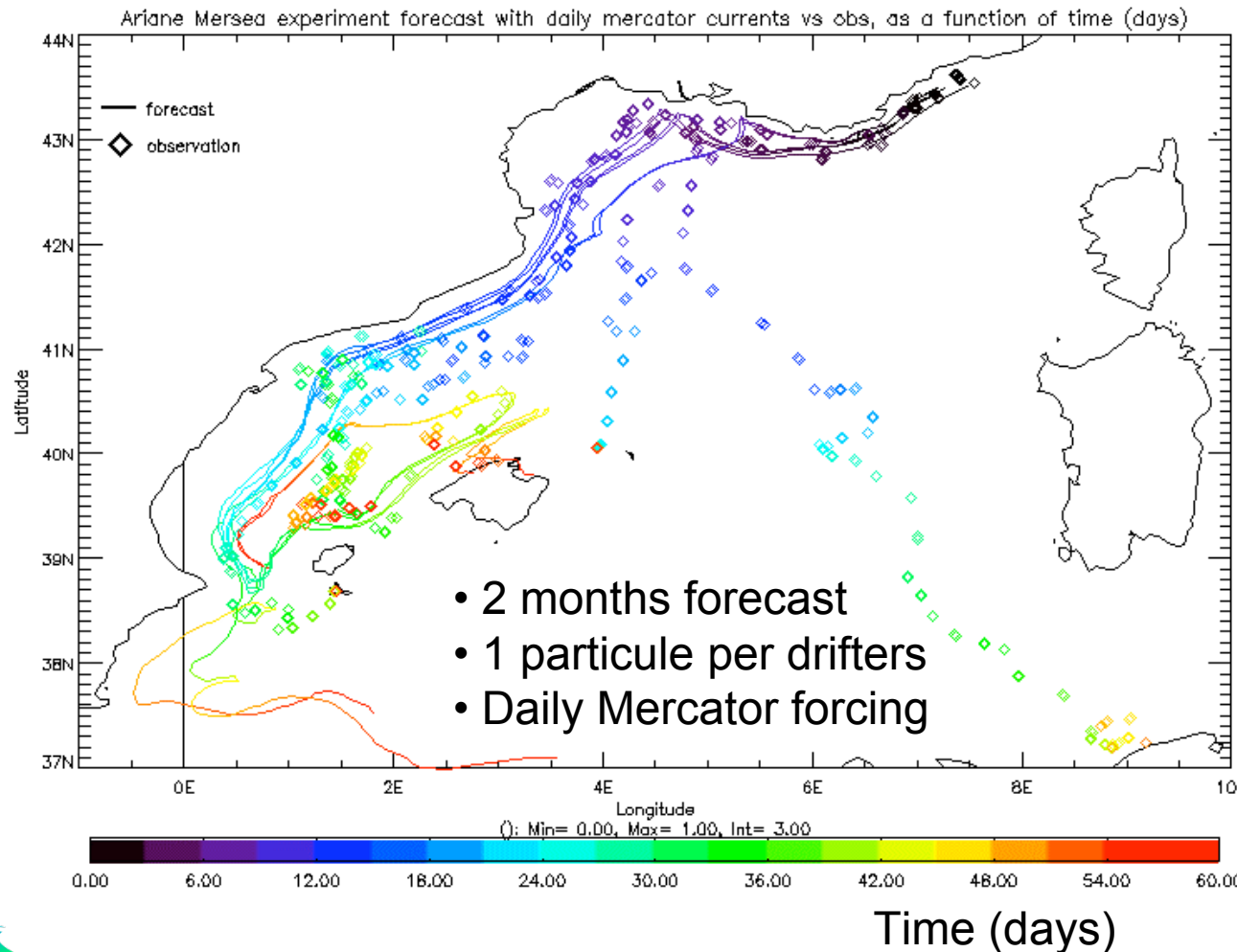
- Ariane: offline lagrangian diagnostic tool (LPO)
- uses OPA, Roms, Symphony outputs

Web site: www.univ-brest.fr/lpo/ariane/

- Interests in our situation
 - more flexible than Mothy
 - permits to test the 3D NEMO/Mercator information



Primary determinist run



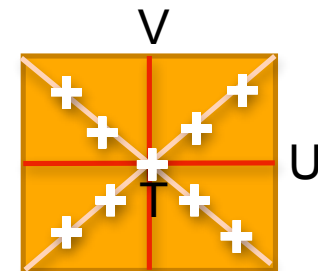
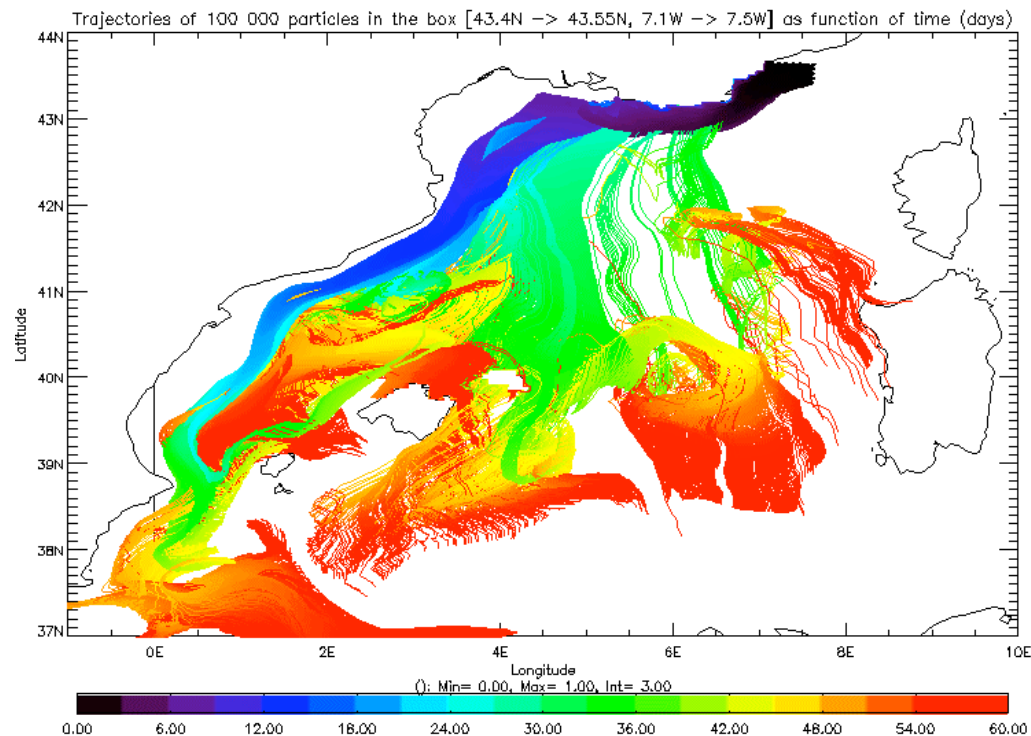
→ Coherent in time with datas

→ absence of turbulent structures



Statistical experiment

- o High number of particle seeding = statistical study
- o 100 824 particles in [43.4N, 43.55N, 7.1W, 7.5W] (4200 particles per mesh),
- o **surface advection (2D)**

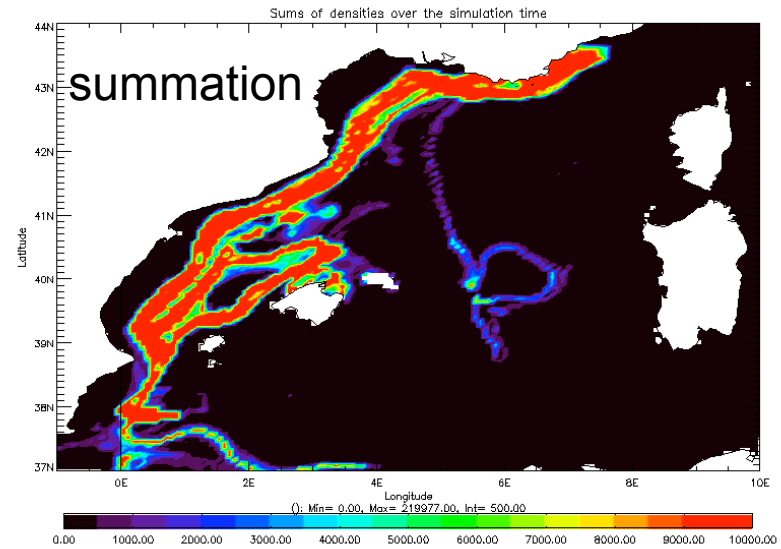
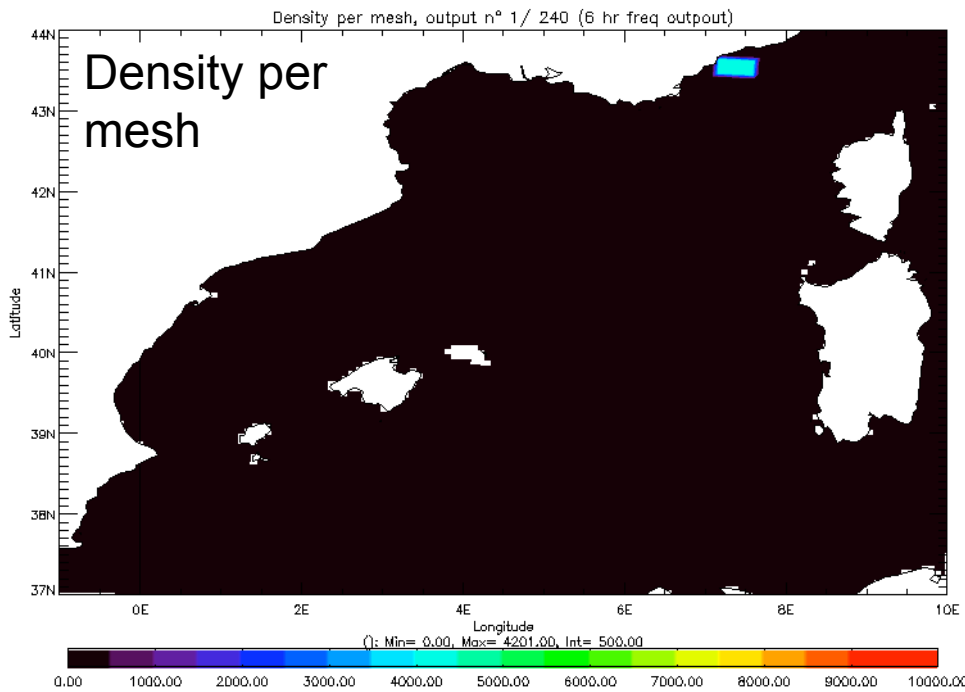


Ex: sub mesh
initialisation

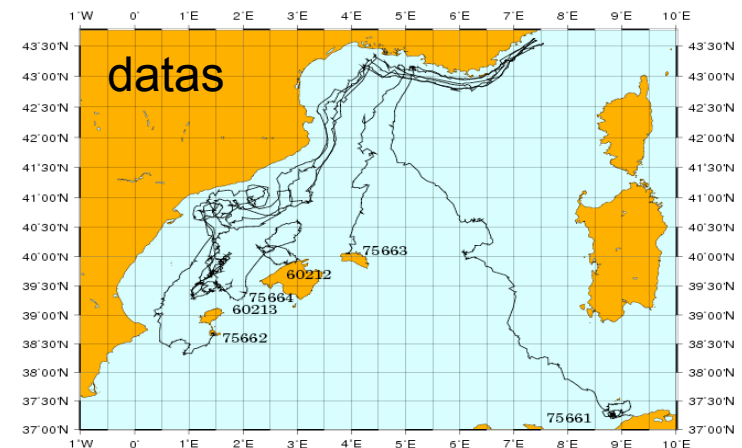
→ the particles are able to reach very different parts of the domain from a small initial box



Statistical experiment (2)

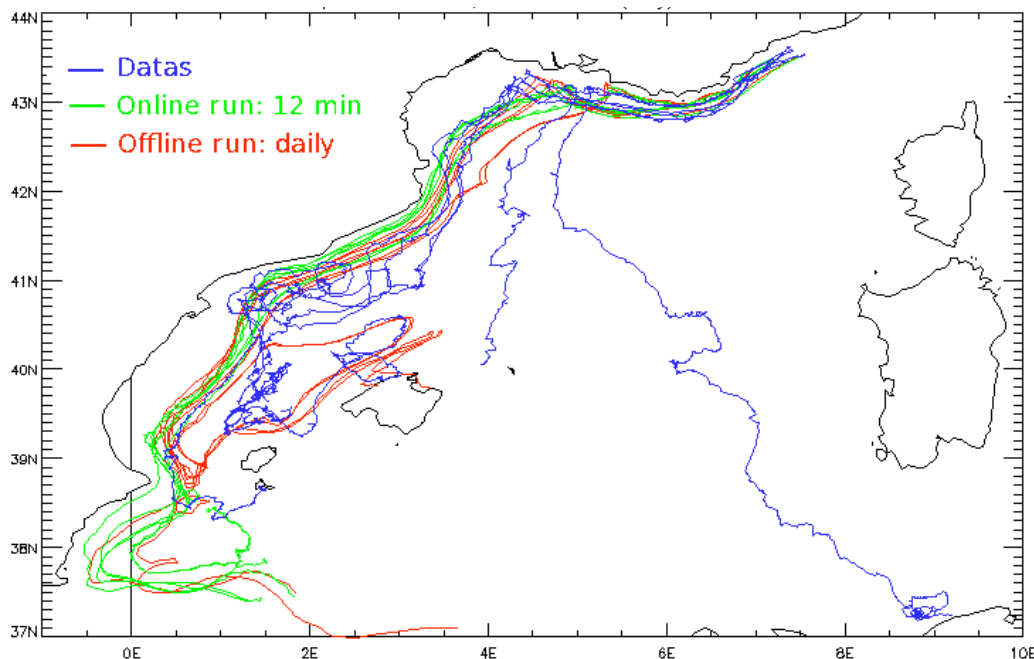


→ Detachment, groupment of particles





Perspectives



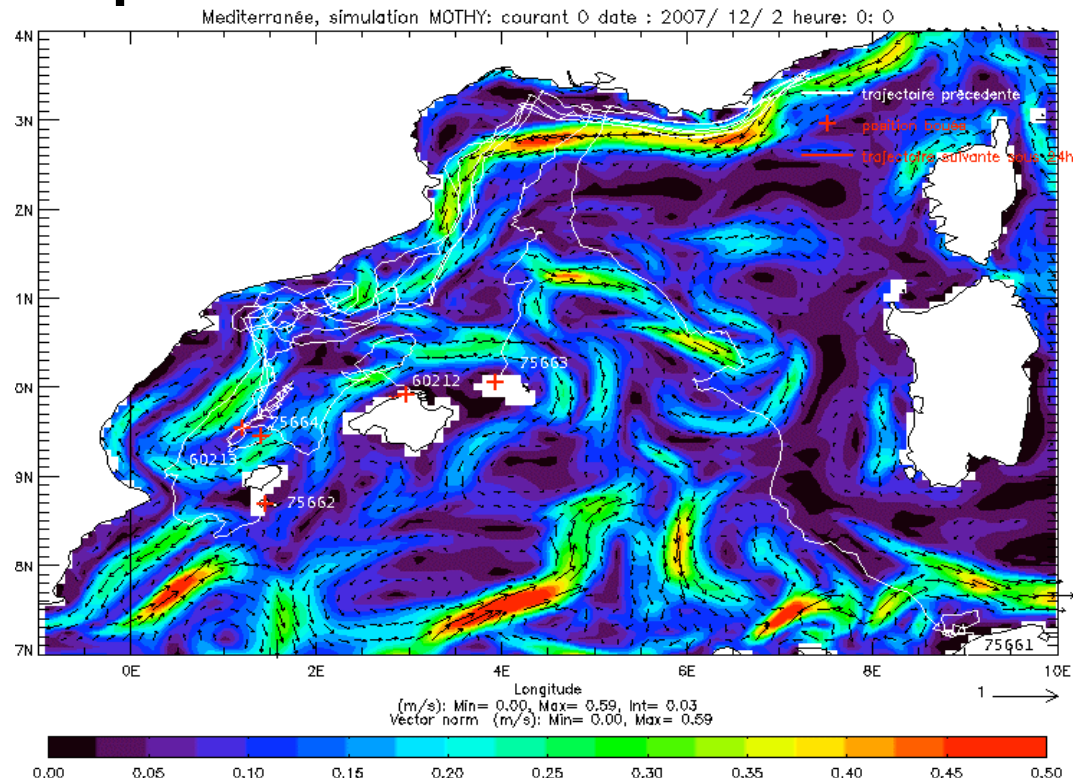
- Impact of the oceanic forcing frequency (tests with the online version)
- Sensibility to initial conditions in space/time/ geometry- system resolution
- Ensemble simulations with perturbed current fields



Thanks for your interest

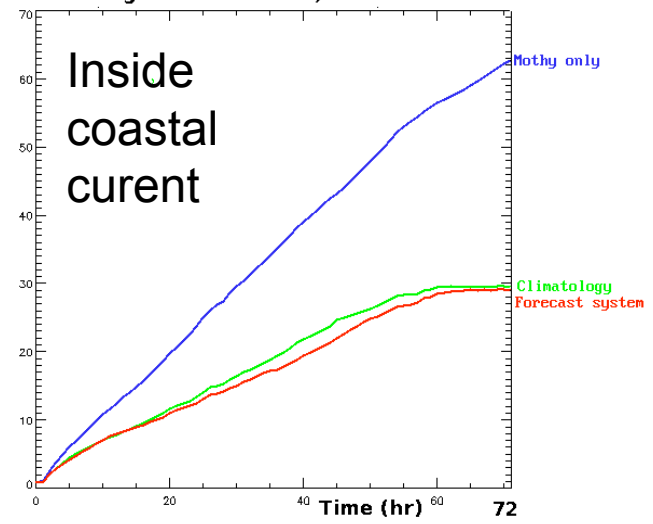


Results (3) drift regimes



- Stable regions (like a coastal current) → good information
- Turbulent area → miss described submesoscale process = bad information in average

Average distance error, 42 first runs



Average distance error, 68 last runs

