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Context: The Jellywatch project (PI: Gaby Gorsky)

Main characteristics of *Pelagia Noctiluca*

Sparse informations on the Jellyfish repartition and the associated forcing (Temperature ? Current ? Wind ? Food ? Predator ? ...)

Numerous all along the year, in the NW-MED (*Morand et al., 1992*)

At surface during the night | migration in depth during the day (Dial vertical motion): can reach 400 m, *Gorsky personal communication*)



Main issues

What are the impacts of mesoscale and coastal dynamics on the jellyfish trajectories/distribution ?

In which way coastal-altimetry could be a powerful tools ?



Strategy and motivation

Strategy : Using altimetry to simulate the advection of Jellyfish both at surface and depth

Motivation : altimetry provide almost synoptic currents that should allow a long-term monitoring of Jellyfish transport

Limitation in coastal zone

- Sub-sampling of coastal dynamics
- Significant error

Develop / use alti. products dedicated to coastal zone

NO subsurface information

Dial vertical motion of jellyfish !!!!

Rely SSH to sub-surface geostrophic currents

Use of statistics from a realistic regional model

Methodology

- Step 1** Build daily Dynamic Height from T,S of the model (2001-2010)
- Step 2** Compute a database of daily vertical EOF from the model DH
- Step 3** Create an EOF climatology from 10 years of simulation
- Step 4** Reconstruct DH at depth by projecting altimetric ADT with the EOF climatology

Advection (RK4, *D'Ovidio et al. 2008***) with geostrophic currents by considering Jellyfish as passive particules with DVM

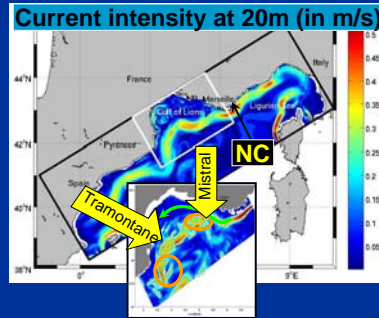
Model and study area characteristics

Model: SYMPHONIE (POC-SIROCO, Toulouse)

- Gulf of Lion regional configuration (*Hu et al., 2009***)
- Boussinesq model
- One way Nesting: 3km -> 1km
- Period: 2001-2010

Area of study: The NorthWestern Mediterranean Sea

- Northern Current (NC): seasonal variability (*Gostan, 1967***)
- NC intrusion over the GoL continental shelf (*Gati et al., 2006***)
- Intense mesoscale variability: eddies, meanders (*Millot, 1991***)

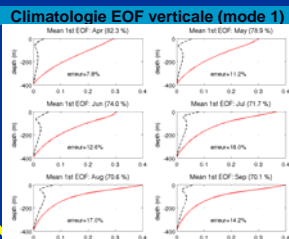


Altimetric data used

2 kinds of (M)SLA : From regional AVISO and Higher Resolution (HR) product (*Escudier et al., 2011***)

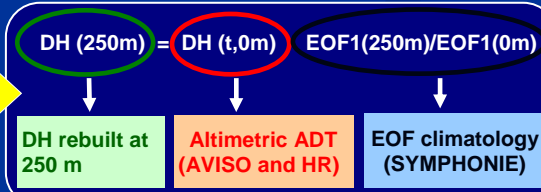
2 kinds of MDT: From *Rio et al., (2007**)* and *Dobricic et al., (2005**)*

Reconstruction of the sub-surface geostrophic current



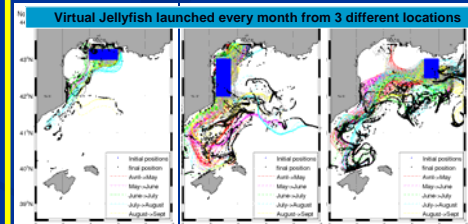
1st mode dominant: 70% < weights < 84%

Representativity of the climatologie 8% < error < 14%



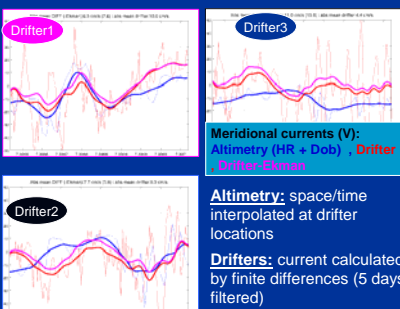
Jellyfish trajectories (first results)

40 days advection with DVM (250 m)



Altimetry vs drifters (*)

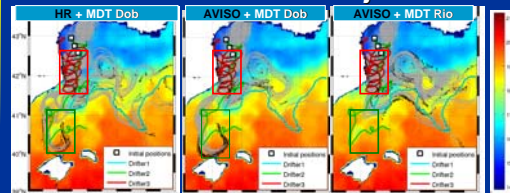
Meridional and zonal components



Comparisons (HR Dob)

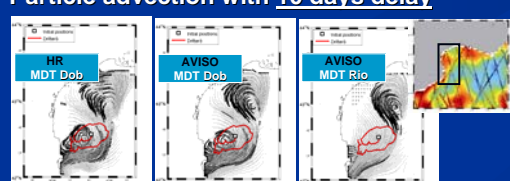
- Drifter 1 and 2**: Good agreement for both (U,V)
- Drifter 3**: Strong Disagreement (lag ...)
- Statistics slightly better with AVISO than with HR-Dob

Particle advection vs drifter trajectories



When same MDT is used, AVISO and HR show close results
MDT Dob allows a better agreement with drifter 2
No product show an advection by the coastal eddy

Particle advection with 10 days delay



In that case, both AVISO and HR product with MDT Dobricic capture the coastal Eddy (intercepted by 2 coastal tracks)
With MDT Rio: eddy not reproduced (coastal mask...)

Statistics

Spatial repartition

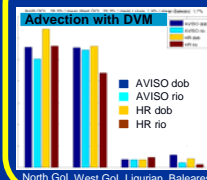
Much more particules over the GoL (~ 50%...)
Significant differences / products (West GoL > 10%)

Influence of DVM

Also significant

Influence of MDT

More particules shored with MDT Dob than with Rio



Conclusions

- Lagrangian approach is a powerful tool to evaluate coastal altimetry
- Comparisons with drifters show: **the importance of the MDT resolution in coastal zone / of the multi-mission**
- Our approach to simulate jellyfish trajectories shows the strong influence of the NC dynamics (in agreement with *Qiu et al., 2008***)

Perspectives (on-going work)

- The landfall of Jellyfish needs to be validated with independent data (observations of life guard: number of bites per season etc...)
- The effect of the wind has to be considered
- Add complexity in the Jellyfish behavior by coupling coastal altimetric current with an ecological model (*LAGOO, Qiu et al., 2008*)
- Study the interannual variability of jellyfish distribution and better understand its potential relation with climatological indexes

(*) From the LATEX 2008 experiment: influence of submesoscale coupled physics - biogeochemistry on cross-shelf exchanges: <http://www.com.univ-mrs.fr/LOB/LATEX>

(**) Please ask for the associated references