

BlueCloud VLab: Coastal currents from observations

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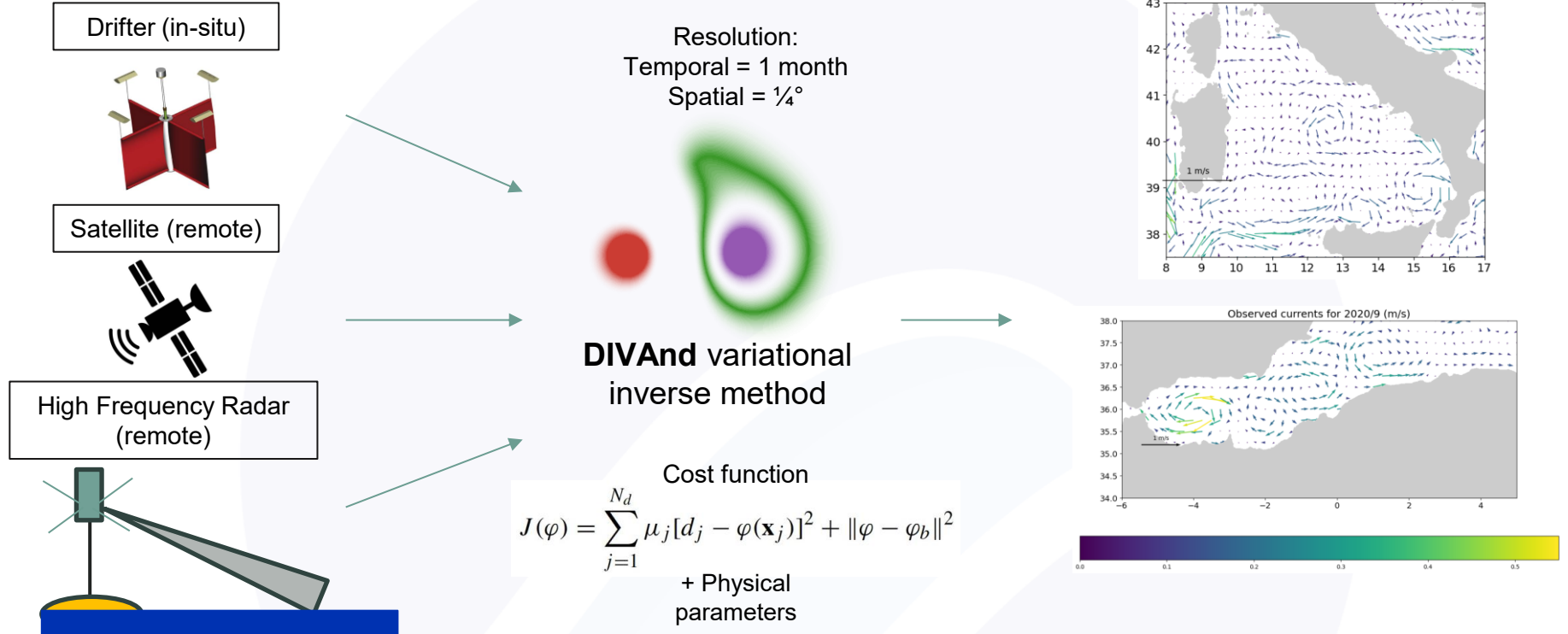


Partners involved: GHER-Liège, CMCC, SOCIB

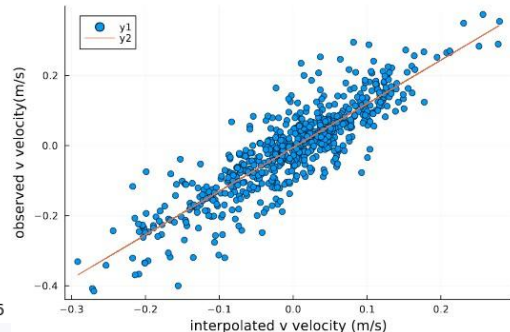
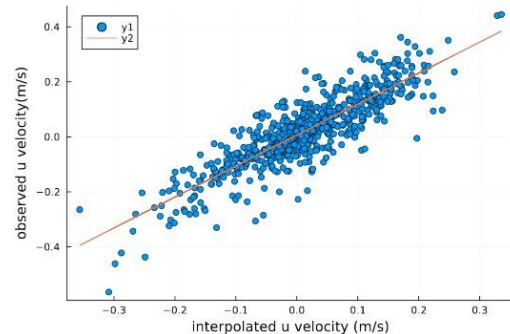
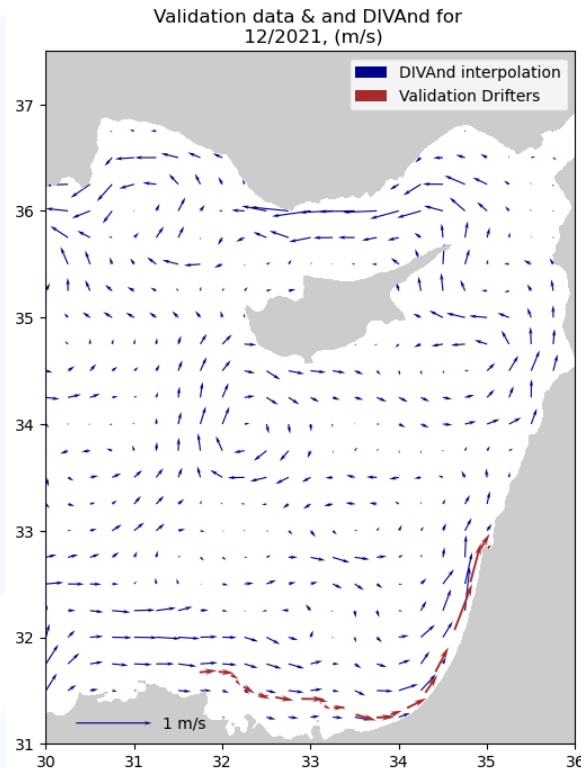


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Coastal currents from observations



- Operational method
- Parametrization optimized & validation performed
- Comparison to a geostrophic product (DUACS) with the same validation framework
- RMS on averaged doubled for the DUACS product
- Correction of the « Mediterranean Sea Physics Reanalysis » model
- The model velocities were on average reduced with the correction and the accuracy enhanced



- Current user version is not up to date

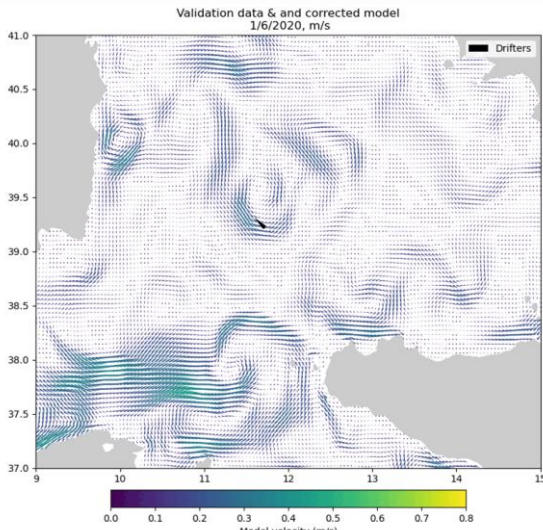
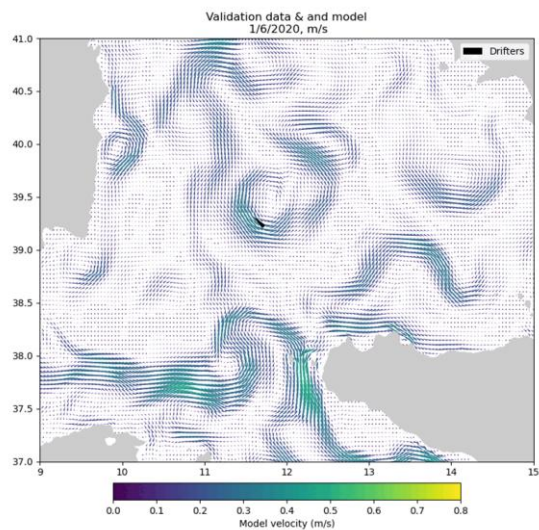
Correspond to the « basic version » used for the Hackathon without the comparison to DUACS geos. product and model correction

Still need work for automatisation and public release

Validation comparison for reanalysis model VS corrected reanalysis model :

RMS error for DIVAnd VS DUACS :

2021	RMS of the Meridional component of the velocity (m/s)	RMS of the Zonal component of the velocity (m/s)	RMS for the Meridional component of geostrophic velocity	RMS for the Zonal component of geostrophic velocity
January	0.093	0.095	0.139	0.243
February	0.157	0.148	0.25	0.392
March	0.114	0.076	0.231	0.247
April	0.136	0.098	0.250	0.223
May	0.065	0.060	0.129	0.162
June	0.045	0.042	0.170	0.094
July	0.096	0.096	0.248	0.263
August	0.153	0.136	0.251	0.326
September	0.059	0.068	0.194	0.247
October	0.086	0.078	0.212	0.211
November	0.070	0.053	0.107	0.077
December	0.072	0.029	0.112	0.208



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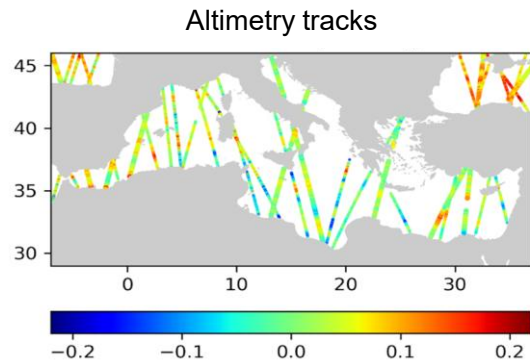


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Sources of observations that we use

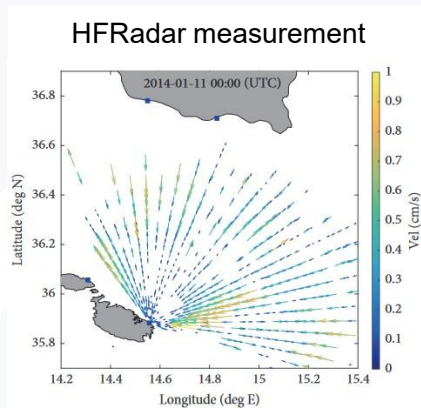


Altimetry

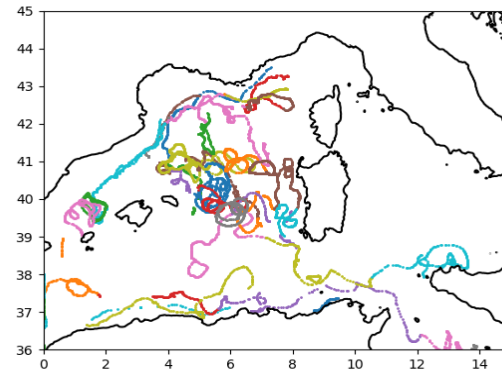
- Large spatial and temporal coverage
- Current is computed through geostrophic balance
- Only computed along tracks

HFRadar

- Small spatial and temporal coverage
- Most accurate way to measure coastline current
- High resolution product



Drifter positions



Drifters

- Large spatial and temporal coverage
- The only in-situ (direct) measurement
- Used to validate the interpolation

How does it works?

By computing a cost function, which minimizes over a given domain:

$$J(\varphi) = \sum_{j=1}^{N_d} \mu_j [d_j - \varphi(\mathbf{x}_j)]^2 + \|\varphi - \varphi_b\|^2$$

Ocean field

Observations

Background estimate

And we will penalize the abrupt variations of the interpolated field :

$$\|\varphi\|^2 = \int_{\Omega} (\alpha_2 \nabla \nabla \varphi : \nabla \nabla \varphi + \alpha_1 \nabla \varphi \cdot \nabla \varphi + \alpha_0 \varphi^2) d\Omega$$

Laplacien

Gradient

Anomalies



The advantage is that we can easliy add various constraints to our cost function!

Type of interpolation

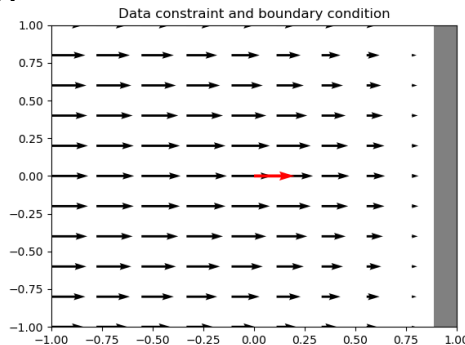
DIVAnd (data interpolating variational analysis in n dimensions)

- Penalizes abrupt variations

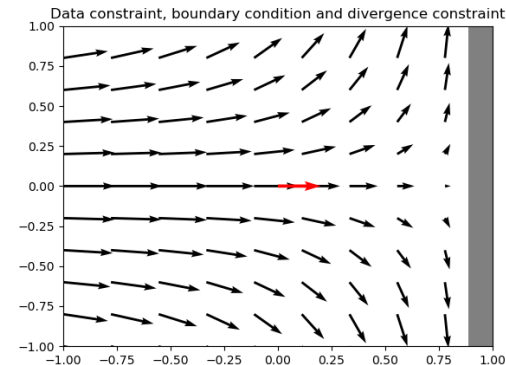
Several constraints are considered:

- Presence of the coastline (1)
- Horizontal divergence (2)
- Temporal coherence (3)
- Momentum balance (including Coriolis force)

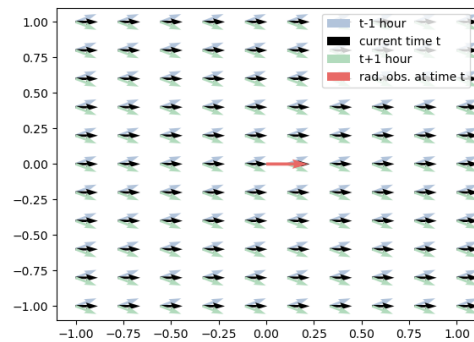
1.

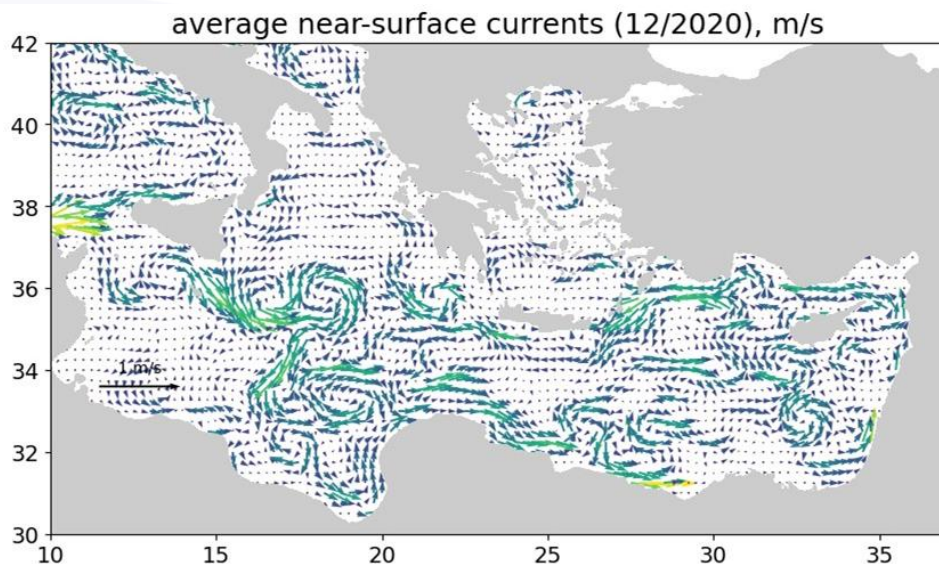
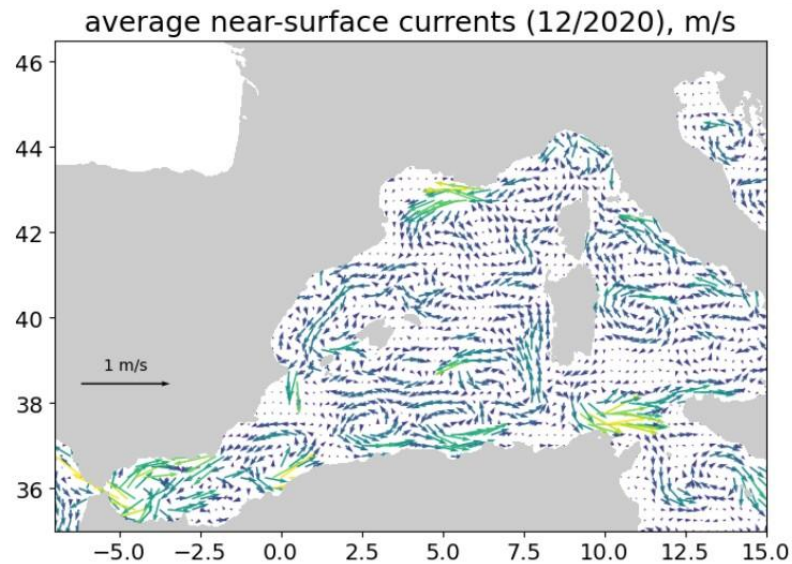


2.



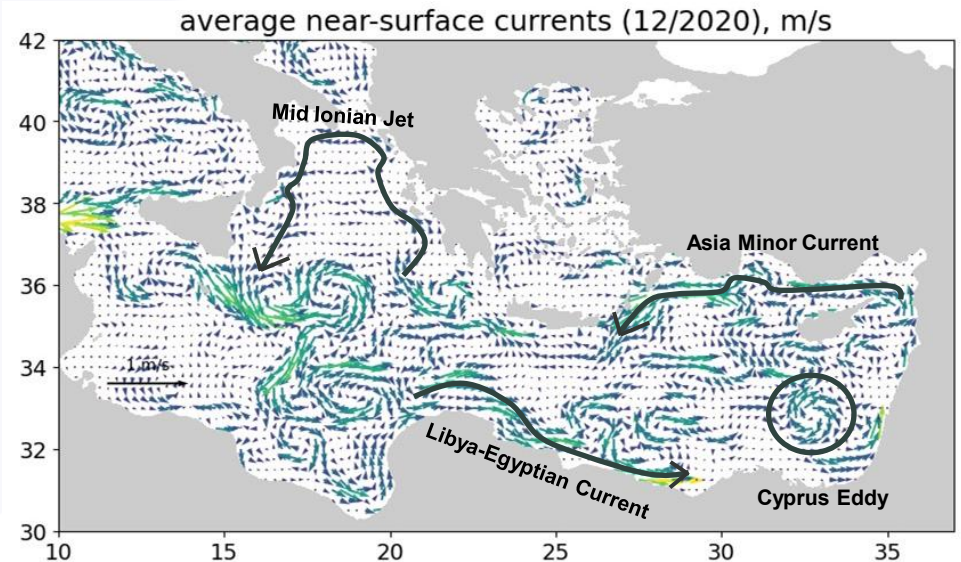
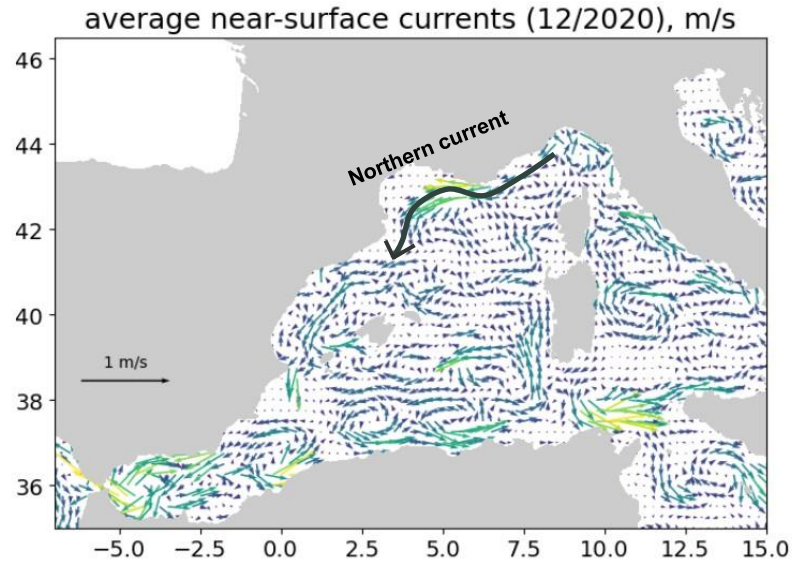
3.





Spatial resolution : 27.7 Km ($1/4^\circ$)

Temporal resolution : One month



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Temporal resolution : One month

Correction of a model for oil spill forecast

