



**MERCATOR
OCEAN**
INTERNATIONAL

IBIRYS reanalysis 1992-2017

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1) MERCATOR OCEAN

2) PUERTOS DEL ESTADO

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Introduction

Characteristics of the system

Mesoscale

Surface circulation

Summary

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Mercator Ocean is a non-profit company owned by 5 french agencies (all founding members): **CNRS, IFREMER, IRD, Météo-France, SHOM.**

In **December 2017**, the Mercator Ocean capital has been increased and opened up to four new shareholders, major international players in operational oceanography and key scientific partners of the Copernicus Marine Service. They include: the Italian **CMCC** (Centro Euro-Mediterraneo sui Cambiamenti Climatici), the Norwegian **NERSC** (Nansen Environmental and Remote Sensing Center), the British **MET OFFICE**, and the Spanish **Puertos Del Estado**. Therefore, Mercator Ocean has become Mercator Ocean International.

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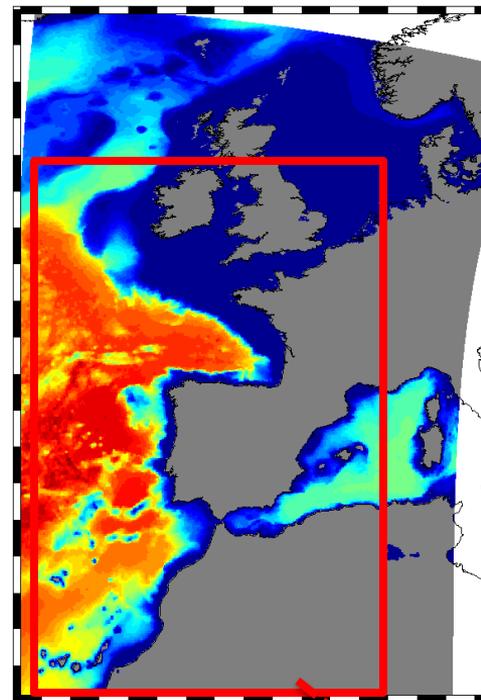
Summary

Operational forecasting system: **IBI36** (1/36°)

- 5-day daily forecasts for physics and bio

Reanalysis: **IBIRYS** (1/12°)

- 1992-2017 for physics and bio
- Data assimilation system (physics only)
 - Reduced order Kalman filter with IAU
 - A 3D-VAR scheme provides a correction for the slowly evolving large scale biases in T and S
 - adaptive tuning of observations errors (Desrozier diagnostic)
 - One analysis every 5 days
 - Assimilated data: along track altimeter data, in-situ vertical profiles in T and S, Sea Surface Temperature (1/4° x 1/4°), MADT : CNES_CLS13.
- developed and run by Mercator Ocean. Final products generated by the IBI-MFC Operational Team and distributed in the framework of CMEMS



full domain

CMEMS

IBI-MFC produ

	IBI36 operational system (CMEMS V4)	IBIRYS reanalysis (CMEMS V4)
NEMO version	3.6	3.6
Horizontal resolution	1/36° (2-3 km)	1/12° (5-6 km)
Vertical coordinates	$z^*=f(\text{ssh})$, 50 levels, Partial bottom cells	$z^*=f(\text{ssh})$, 75 levels , Partial bottom cells
Bathymetry	Composite (GEBCO_08 + different local databases)	Composite (GEBCO_08 + different local databases)
Free surface	Explicit, non-linear, time-splitting	Explicit, non-linear, time-splitting
Vertical mixing	k-epsilon	k-epsilon
Tracer advection	QUICKEST + ZALEZAK	QUICKEST + ZALEZAK
Rivers	As lateral point sources: Merge of daily SMHI & PREVIMER & Monthly climatology (GRDC), 35 rivers As precipitations: monthly climatology (Dai and Trenberth)	As lateral point sources: Merge of daily SMHI & PREVIMER & Monthly climatology (GRDC), 35 rivers As precipitations: monthly climatology (Dai and Trenberth)
Atm. forcing	ECMWF (3h) + analytic diurnal cycle from daily short wave irradiance	ECMWF ERA INTERIM (3h) + analytic diurnal cycle from daily short wave irradiance
Tides	Yes (11 tidal components, astro pot)	Yes (11 tidal components, astro pot)
Ocean color effects	Merged SEAWIF/IFREMER kpar climato.	Merged SEAWIF/IFREMER kpar climato.
IC & OBCs	From daily 1/12° PSY4V3R1	From daily 1/4° GLORYS2V4
Data Assimilation	SAM2 (SEEK Filter) + IAU	SAM2 (SEEK Filter) + IAU
Biogeochemical model	PISCES (coupled online)	PISCES (coupled online)

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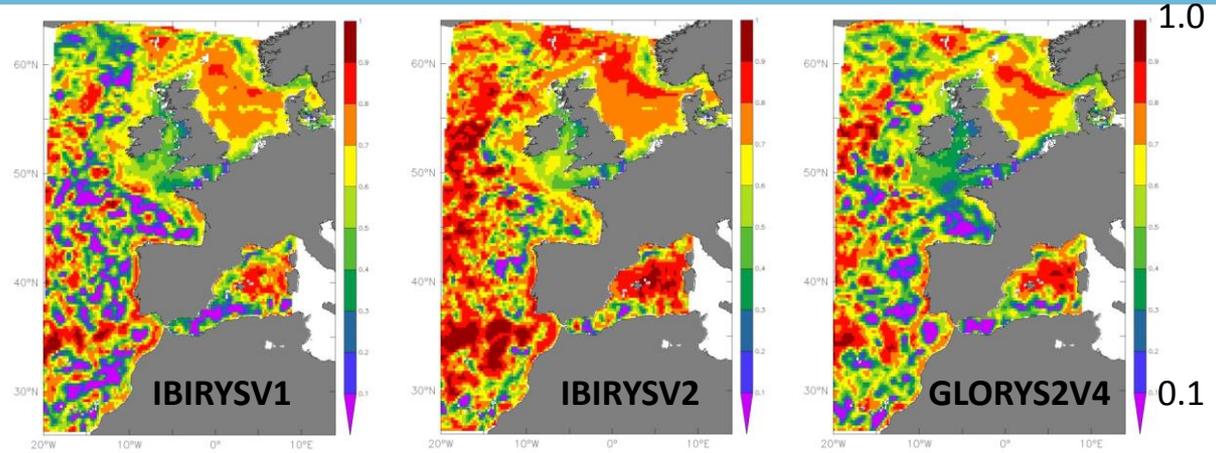
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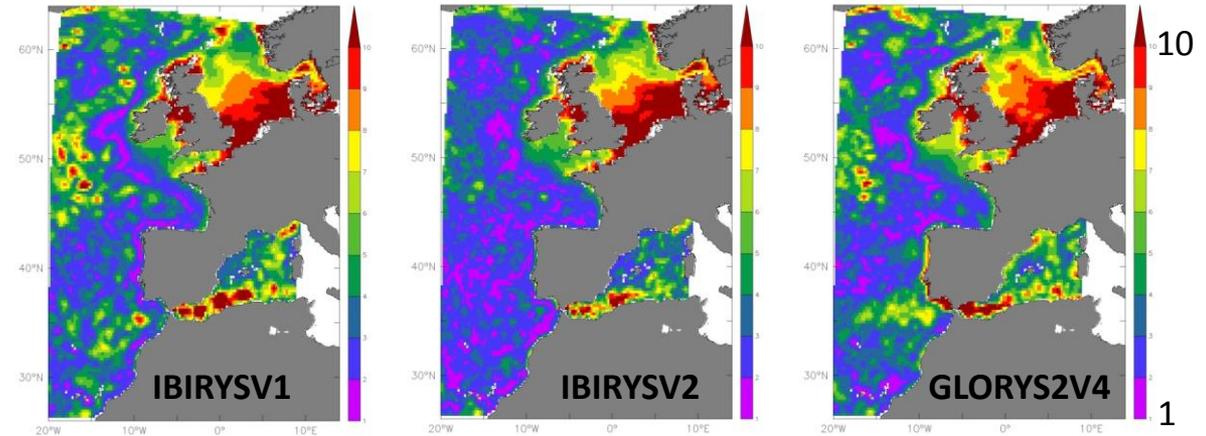
Summary

SSH: comparisons with
SSALTO/DUACS (daily L4
product, year 2014)

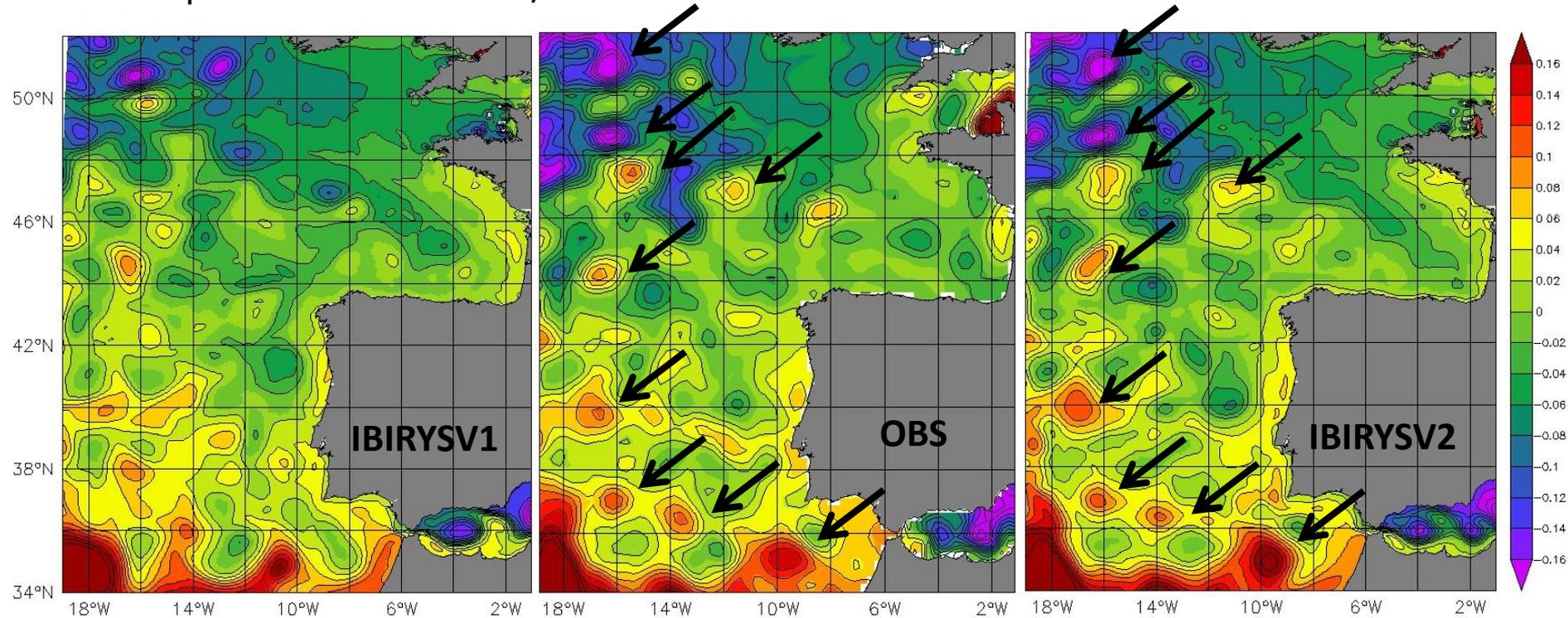
Correlation



RMS difference
(cm)



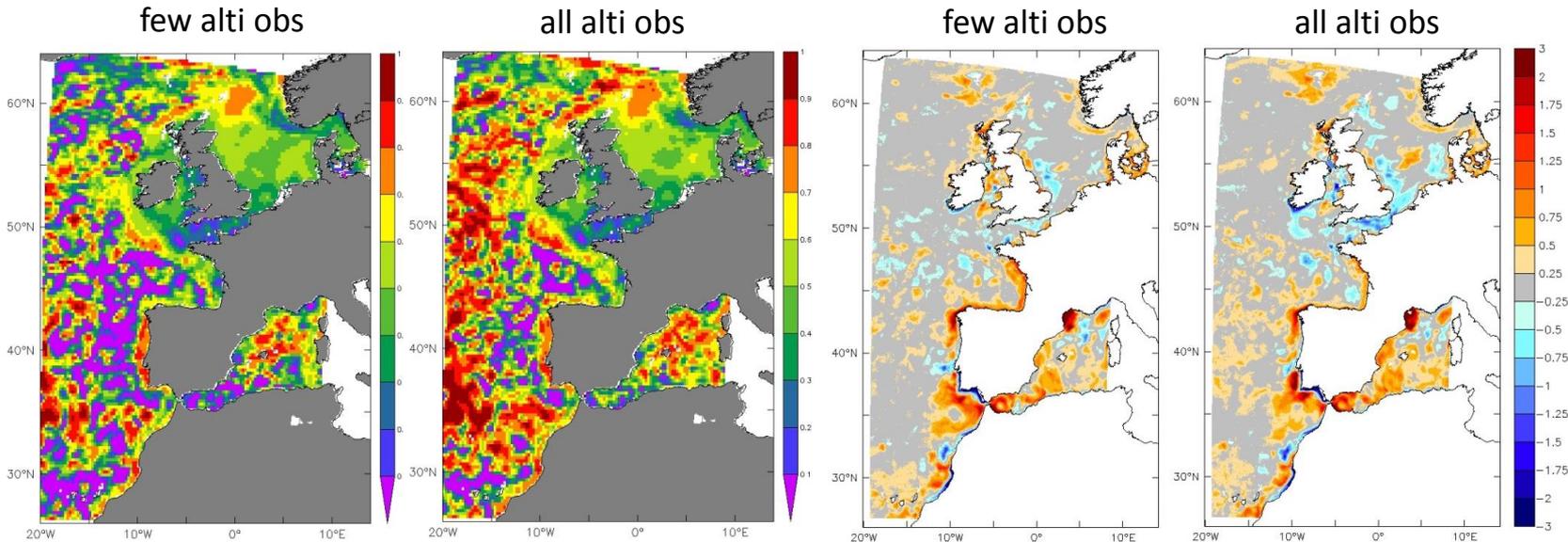
SSH: comparisons with SSALTO/DUACS



mean sea surface height for April 2014.

What happen if we release the assimilation of altimetry?

From 14-may-2017 to 24-dec-2017 the system ran with only 10 to 20% of the total amount of altimetric observations. It has been run again with all the observations available.

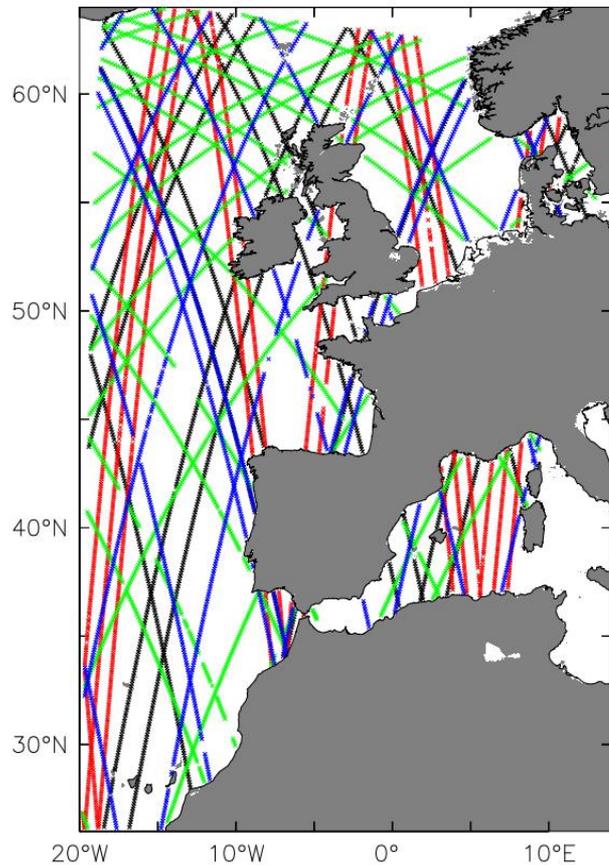


SLA correlation between SSALTO/DUACS and IBIRYSV2 (14-may-2017 to 24-dec-2017)

SST difference between L3S and IBIRYSV2 (July/August/Sept 2017)

Altimeters constellation in 2017

→ very good coverage thanks to the 4 satellites in operation



altika
cryosat
jason 3
sentinel 3

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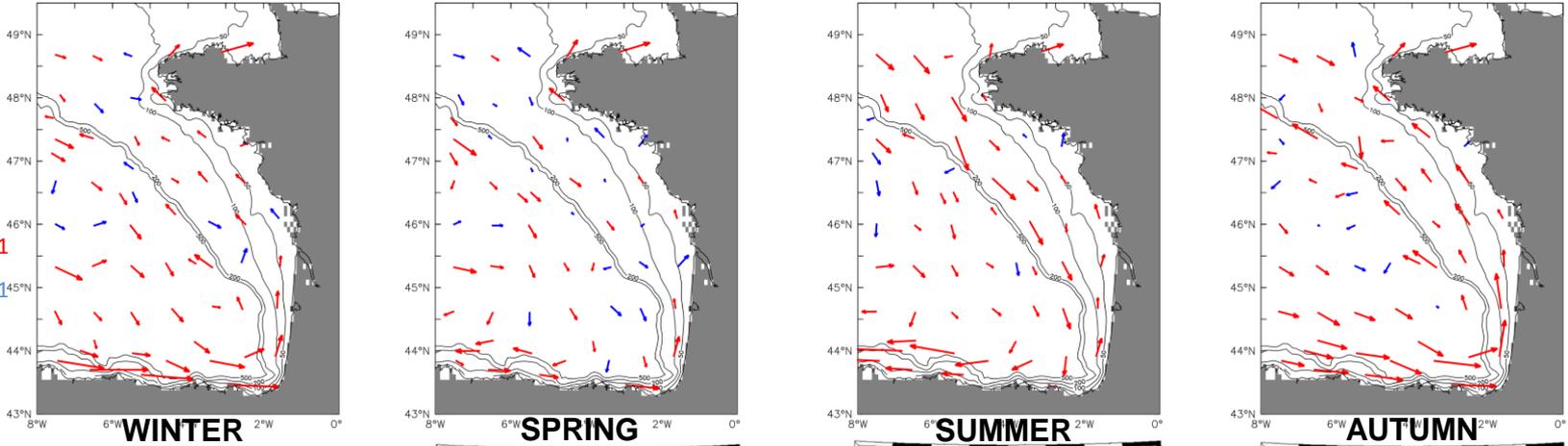
Summary

Surface circulation (1)

15m circulation (1992-2009): IBIRYS (top) and Charria et al, JMS 2013 (Figure 5)(bottom)

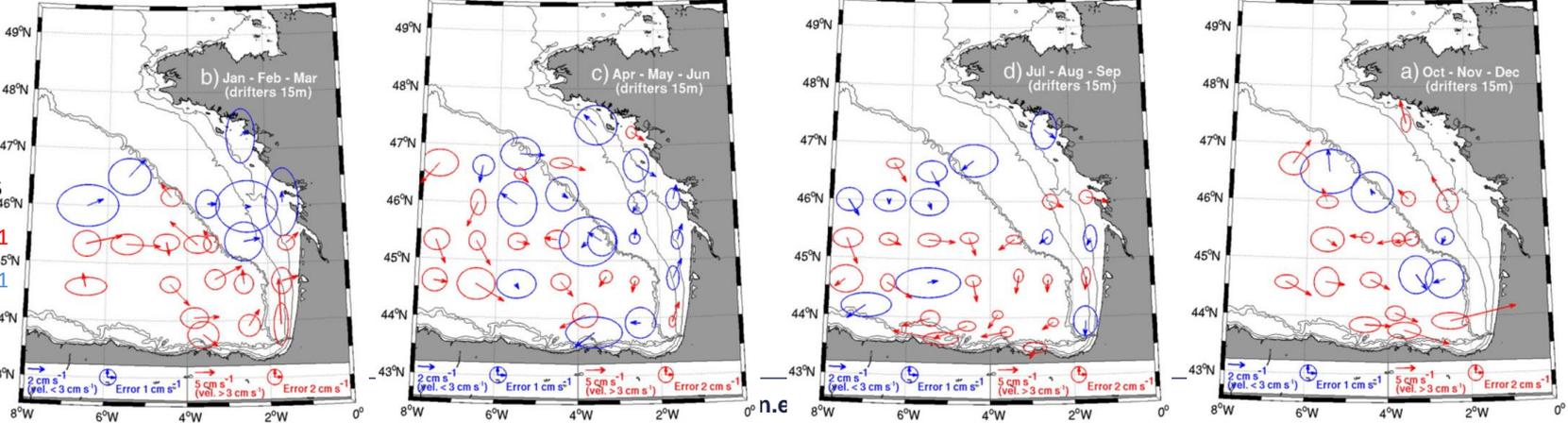
IBIRYSV2

vel > 1 cm.s⁻¹
vel < 1 cm.s⁻¹

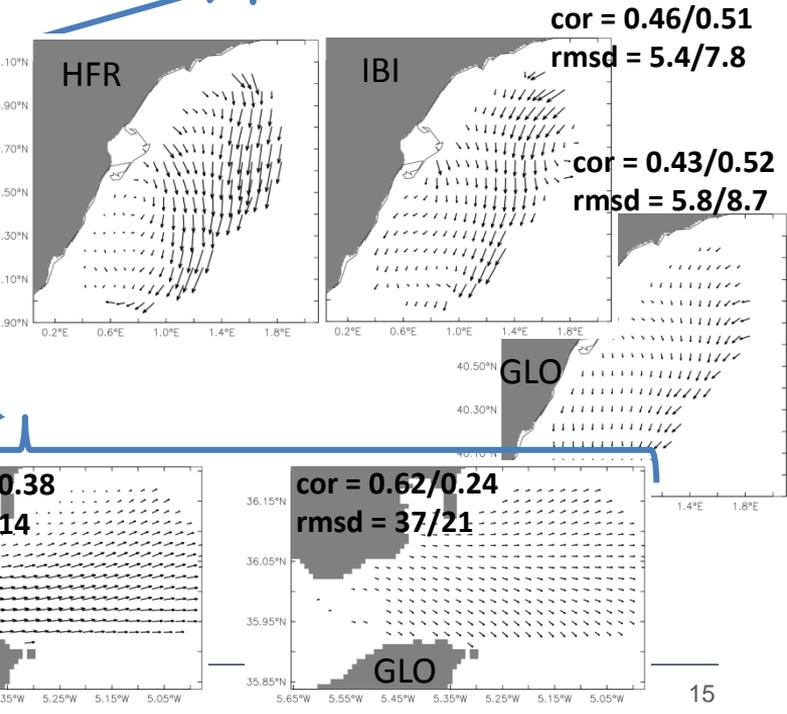
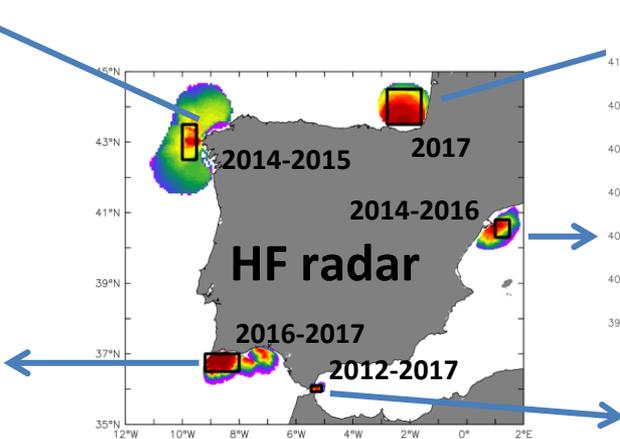
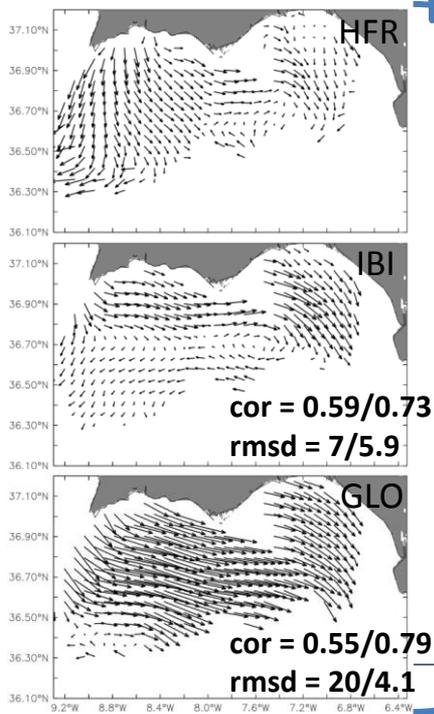
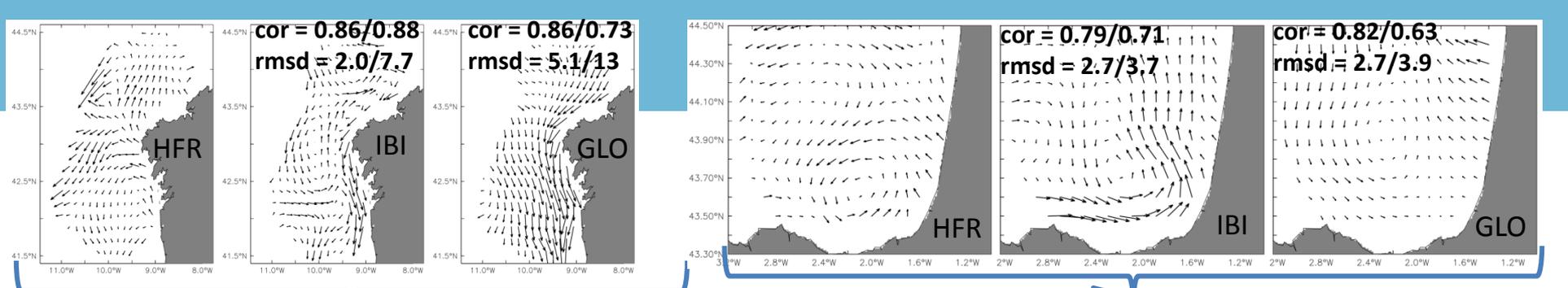


Climatology from drifters

vel > 3 cm.s⁻¹
vel < 3 cm.s⁻¹

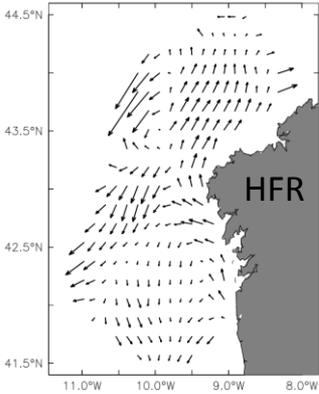


n.e.

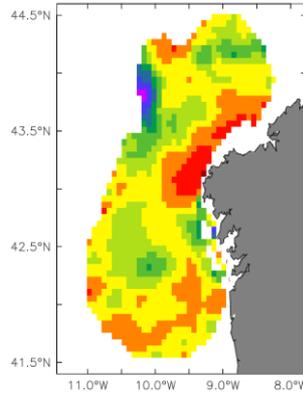
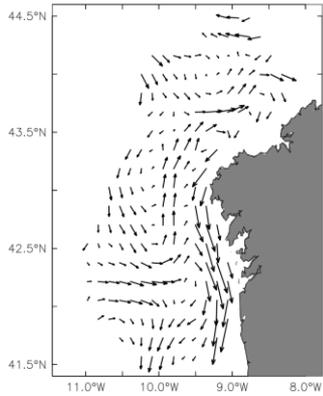


Zoom on Galicia Radar (2014)

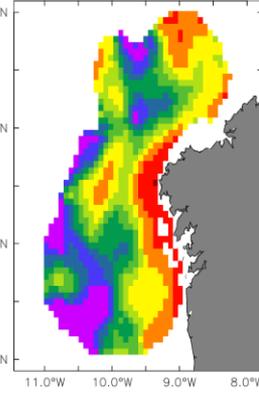
IBIRYSV2



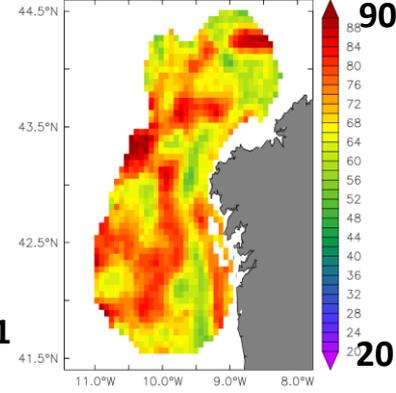
GLORYS12V1
(global reanalysis
at 1/12°)



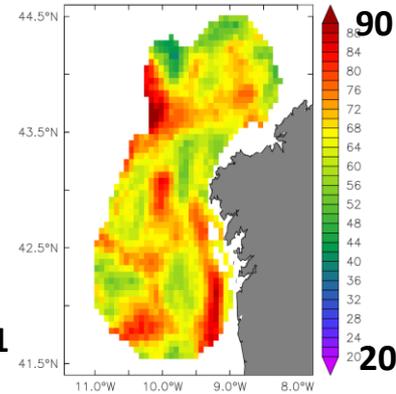
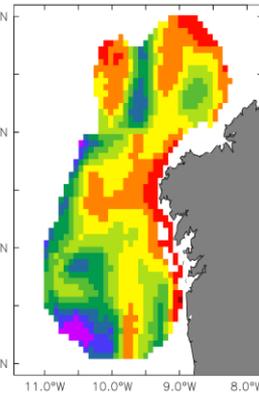
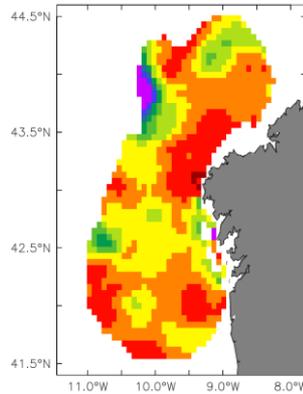
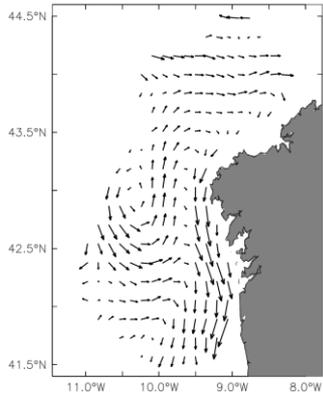
U correlation



V correlation



Angle RMS difference



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- The IBIRYS reanalysis has been updated and extended. It covers now the 1992-2017 period
- Following the recommended strategy, a set of common metrics were applied to global and regional reanalyses
- IBIRYS and GLORYS show consistent results at large scale
- Looking at small scale and high frequency processes shows the added value of regional reanalysis
- Issues still remain concerning the coastal circulation

Next steps

- Process studies in free run
- In the framework of CMES, the reanalysis will be extended on a monthly basis to be as close as possible to the real time (updated every month with near real time forcing, and re-run twice a year with delayed time forcing)
- Using $1/36^\circ$ for the reanalysis?