Progress on Short Time Prediction from the Basque Country HFR network

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Outline

i. Data set and approach
ii. Method used for STP
iii. Comparison to real trajecotires
iv. STP spatio-temporal performance
v. Conclusions and future work

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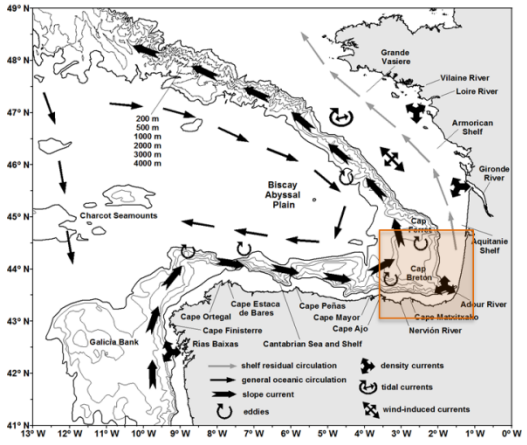
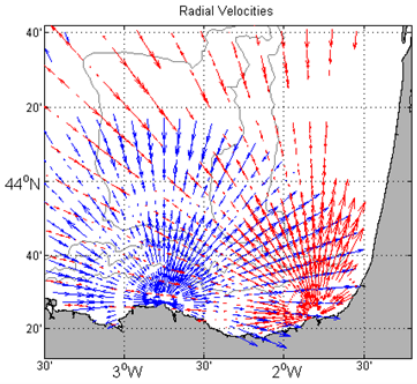
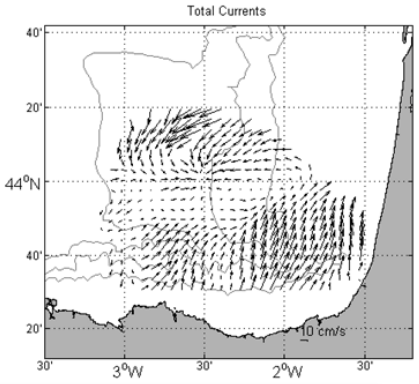
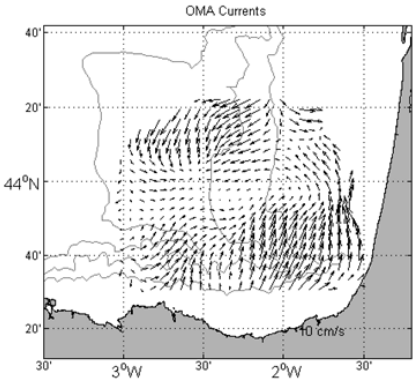
i. Data set and approach

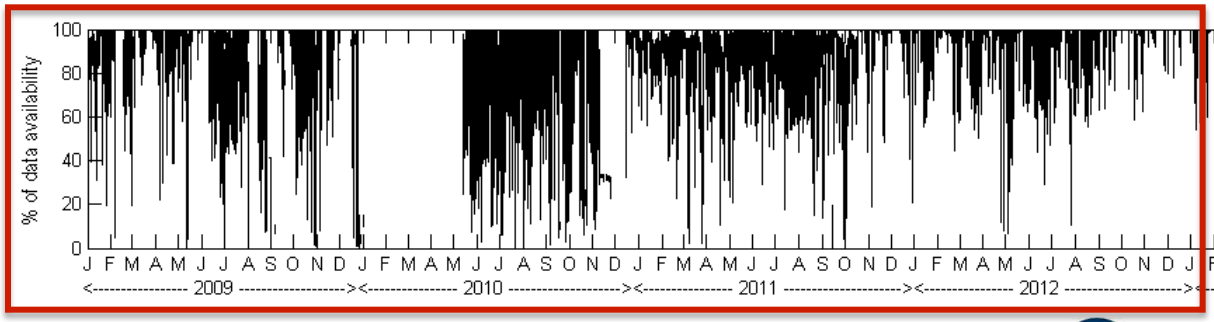
- Two Seasonde CODAR systems 4.5 MHz frequency, 200 km range with 5 km radial and 5º angular resolutions.
- Hourly radials (from MUSIC) are QC and converted to total fields, using the HFR Progs MATLAB package , gridded into a 5 km resolution regular orthogonal mesh (1416 nodes, LMS algorithm R=10 km) .





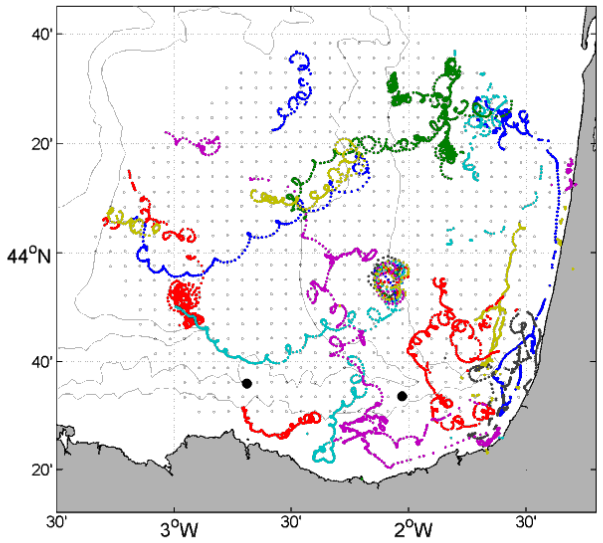




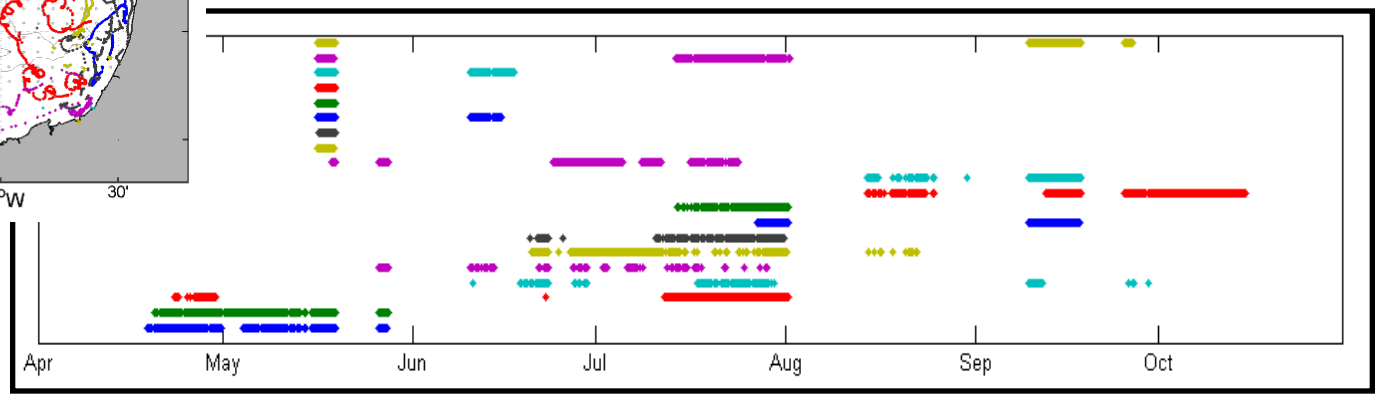


i. Data set and approach

- 22 trajectories from several campaigns within the Bay of Biscay (Charria et al. 2013)
- Surface float linked to a long holey sock drogue (~10 m) centered at 15 m depth (hourly ARGOS positioning)



- Eulerian correlations of buoys comparable to those obtained for slope moorings 12.5 m data for stratified conditions and significantly higher that those for mooring data at 1.5m (*Rubio et al. 2011, Solabarrieta et al., 2013)



2009

i. Data set and approach

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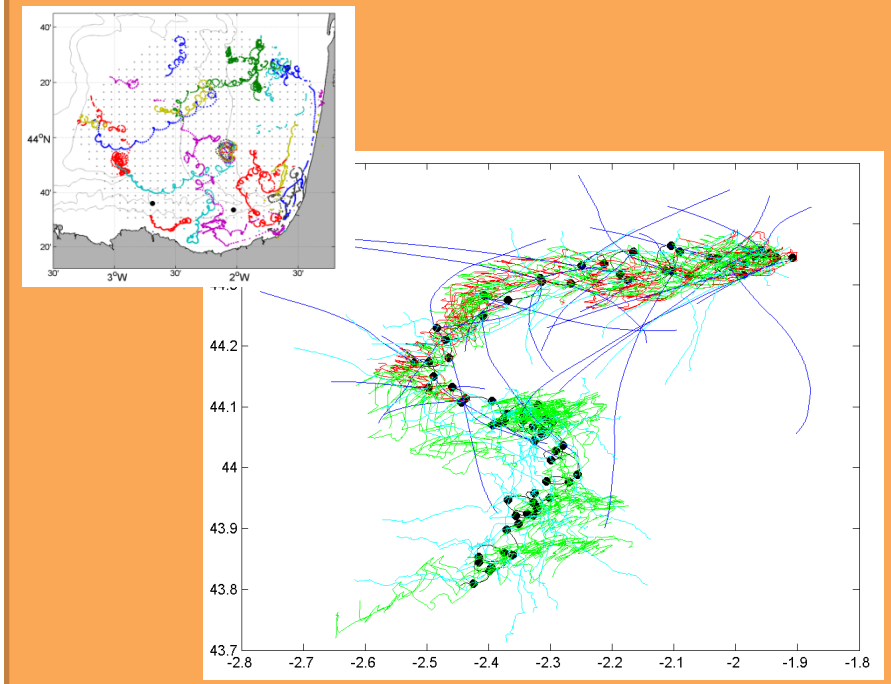
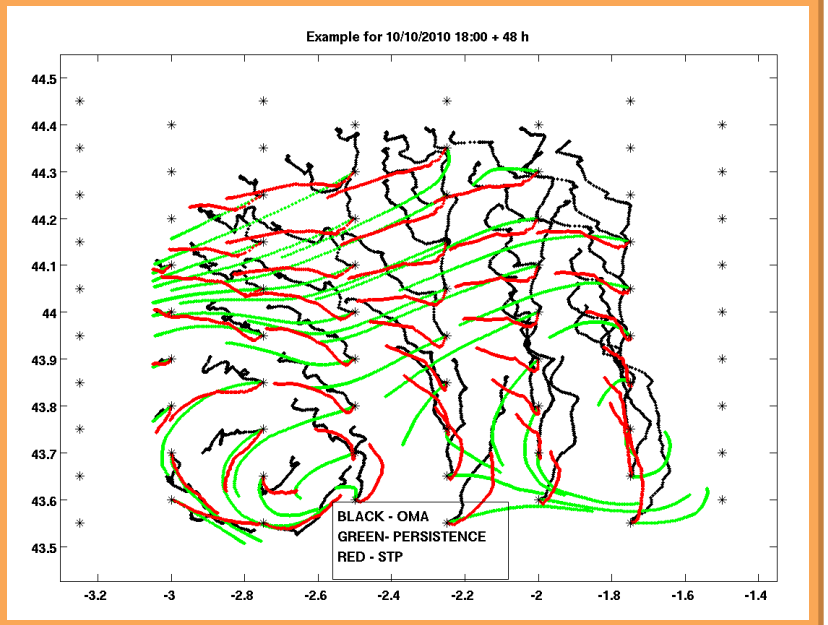
May 2010 - Dec 2012 → Training of the STP model

2009→ Comparison of TOTALs, OMA, PRESIS. and STP and real trajectories (1 trajectory /6h along the real track)



2009-2012 → Further evaluation of STP results, prediction vs. persistence (1 trajectory/ 1h using a regular grid)



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ii. Method used for the STP

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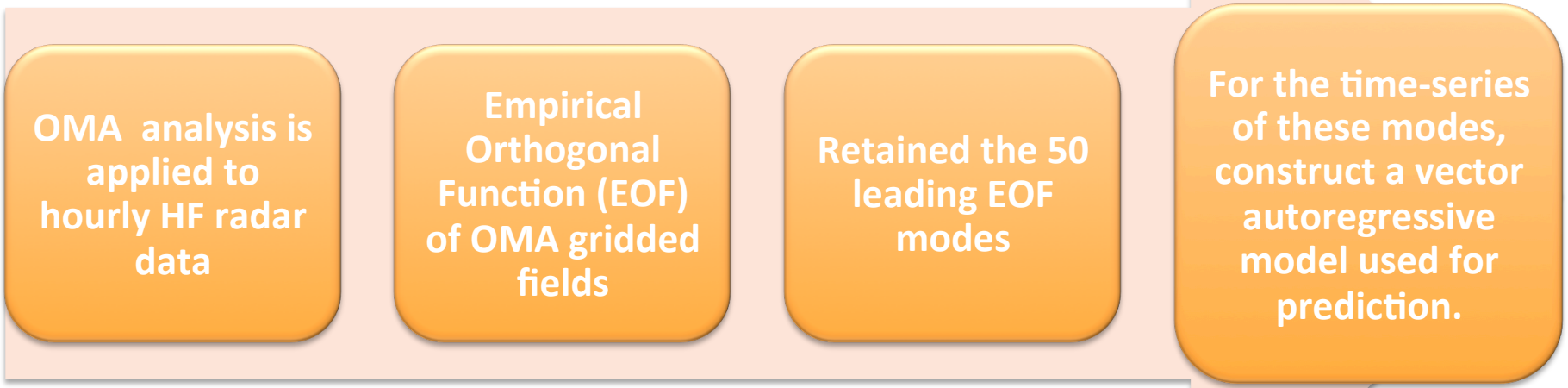
WE use the linear autoregressive models described in Frolov et al., 2012.

MAIN STEPS



Because of the combination of the EOF pre-processing and the time-embedding in the autoregressive model (up to to 48 in the past), this forecast model learns both the tidal and inertial signals and the basin-wide modes of the circulation at the same time.

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iii. Comparison to real trajectories

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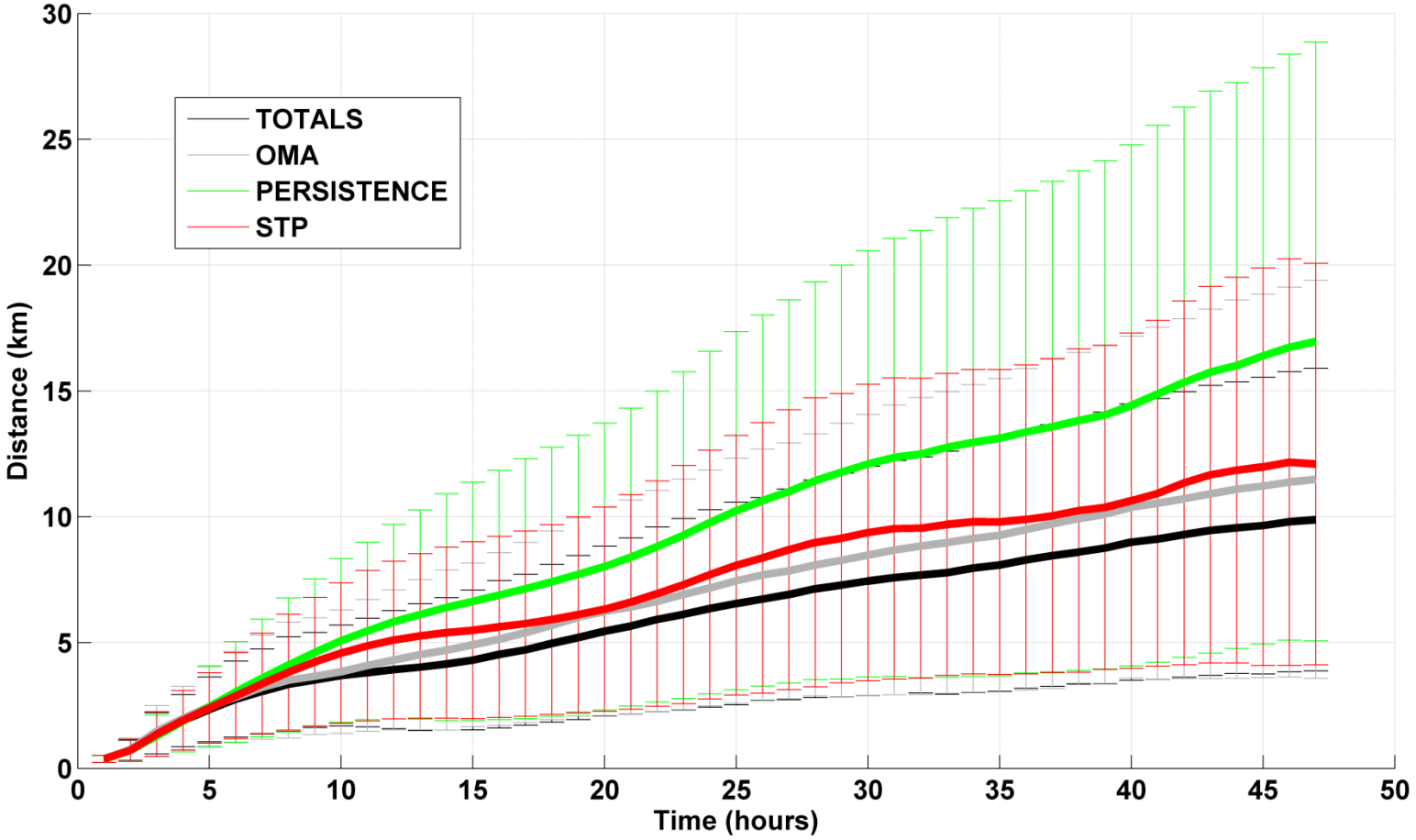

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iii. Comparison to real trajectories

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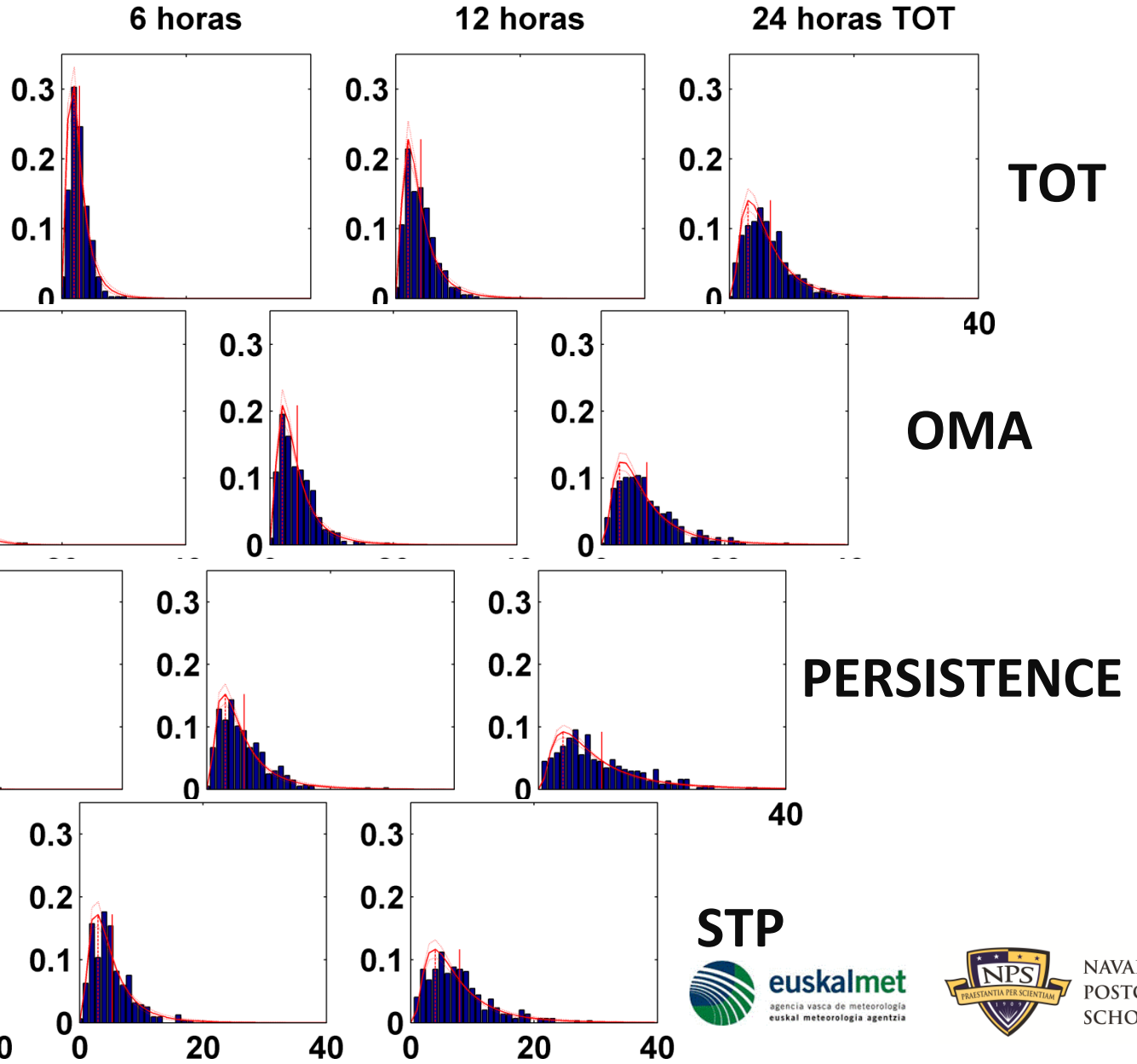
Distribution of distances with real trajectories [km] and lognormal fit



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iii. Comparison to real trajectories

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Time (h)	Main statistical parameters [km] (adjusted lognormal distributions)							
	TOTALS		OMA		PERS		STP	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
6	2.85 [2.61, 3.14]	2.01 [1.69, 2.42]	2.91 [2.65, 3.21]	2.14 [1.081, 2.58]	3.15 [2.85, 3.49]	2.51 [2.09, 3.05]	2.98 [2.69, 3.34]	2.24 [1.85, 2.77]
12	4.07 [3.68, 4.54]	3.19 [2.65, 3.91]	4.47 [4.01, 4.96]	3.61 [2.99, 4.43]	6.048 [5.44, 6.77]	5.08 [4.20, 6.24]	5.29 [4.74, 5.95]	4.12 [3.37, 5.14]
24	6.59 [5.92, 7.38]	5.25 [4.32, 6.49]	7.42 [6.66,8.33]	6.13 [5.03, 7.59]	10.23 [9.08, 11.64]	9.47 [7.68, 11.93]	7.93 [7.06,9.00]	6.36 [5.13,8.05]

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iv. STP spatio-temporal performance

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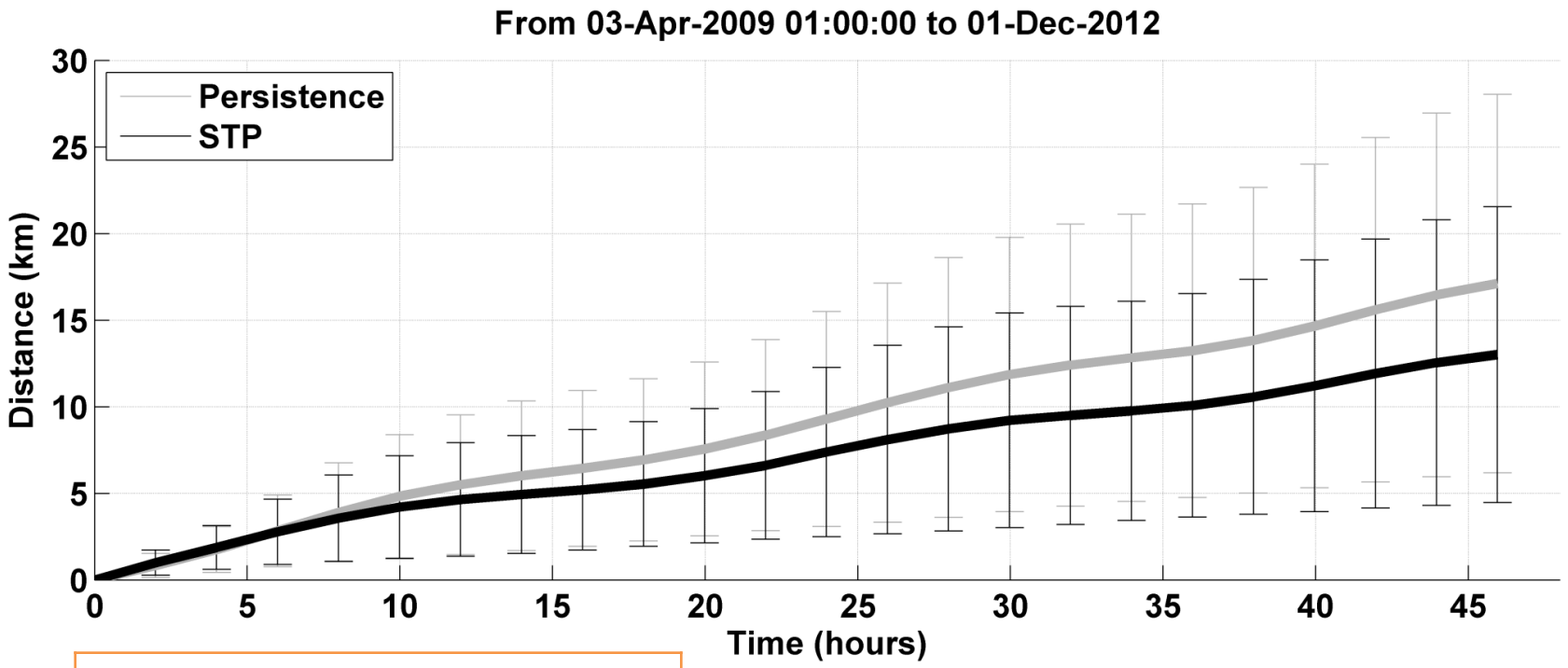

Time (h)	Benefit of STP	
	All	2009
6	<1%	<1%
12	8%	12.5%
24	20,4%	22.5%

STP vs. PERSISTENCE

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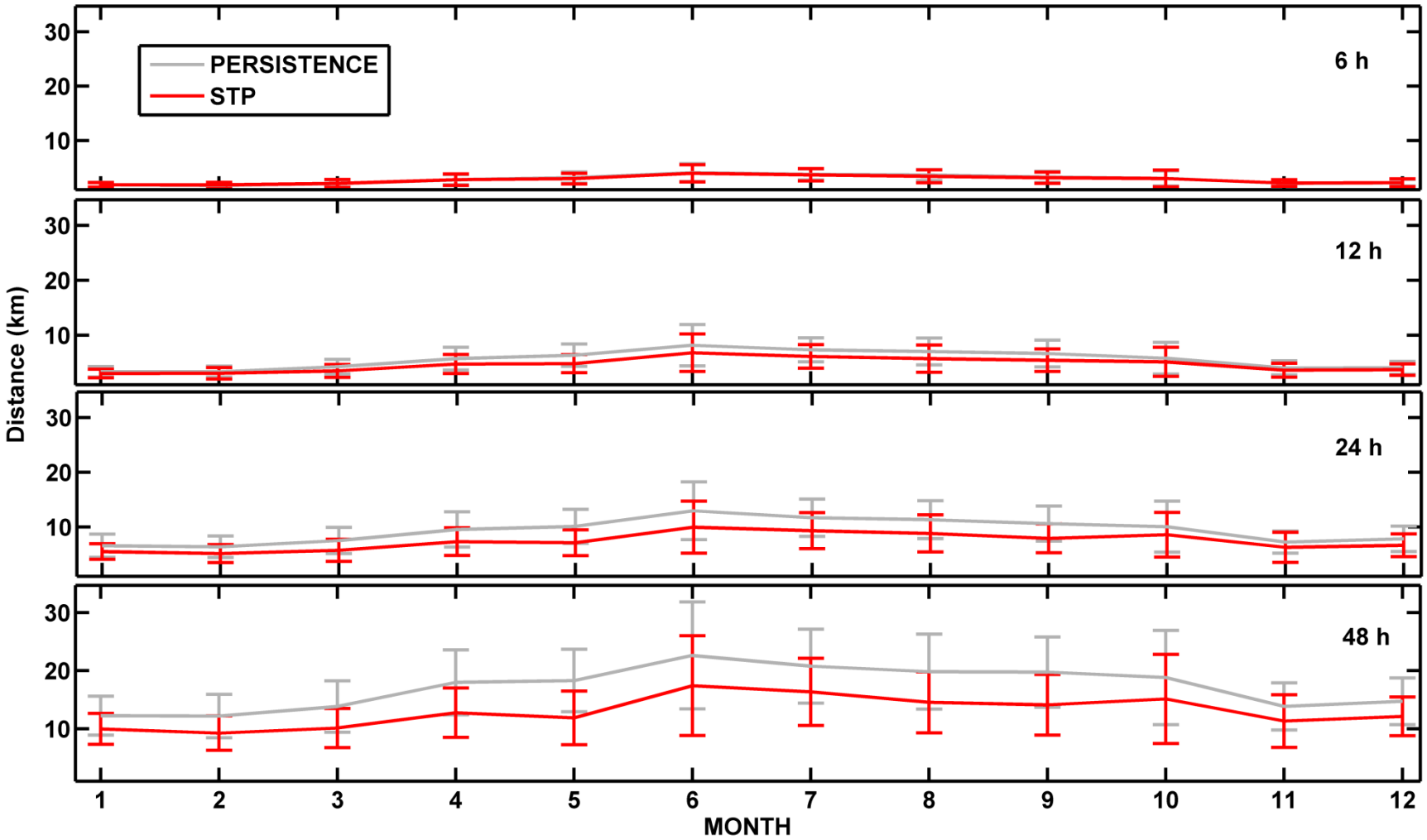

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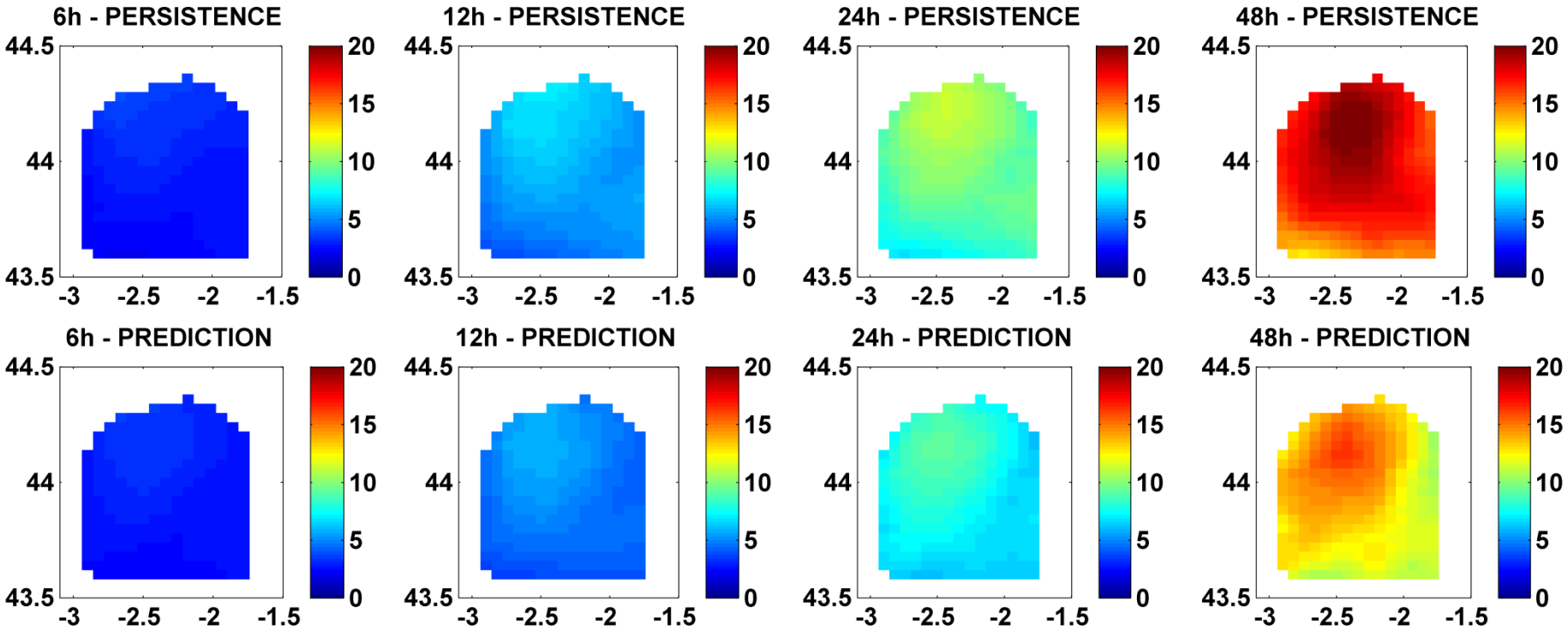

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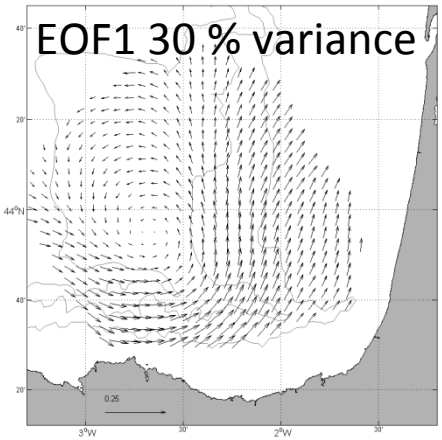
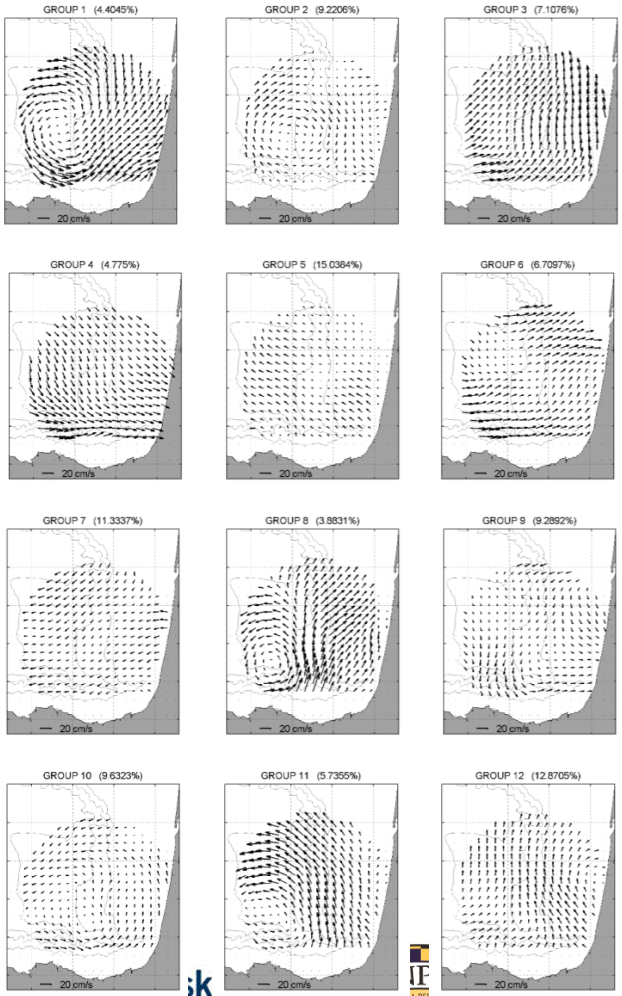
SE Bay of Biscay dynamics…

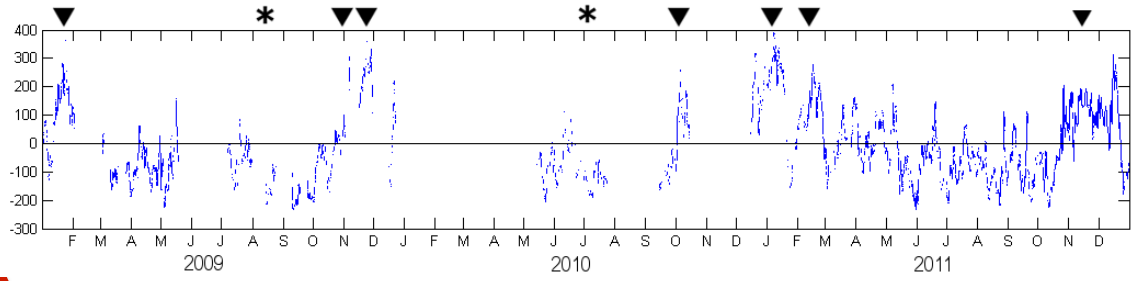
- *Seasonal slope current and seasonal winds*
- *Recurrent observation of mesoscale features*



EOF and K-means analysis

* Solabarrieta, et al. 2013, Cont Shelf Res; Solabarrieta, et al. 2015 Oc Dyn.





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iv. STP spatio-temporal performance

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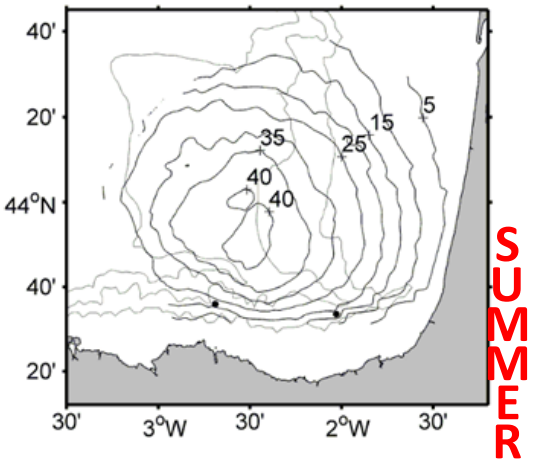
SE Bay of Bscay dynamics…

❖ *Seasonal distribution of energy at high-frequency bands*

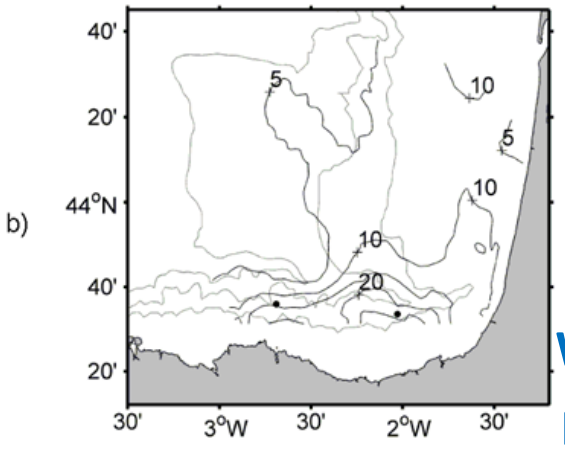
INERTIAL BAND

Contribution (%) to the total KE (2009-2011)

* Solabarrieta, et al. 2013, Cont Shelf Res; Rubio et al. 2011 GRL

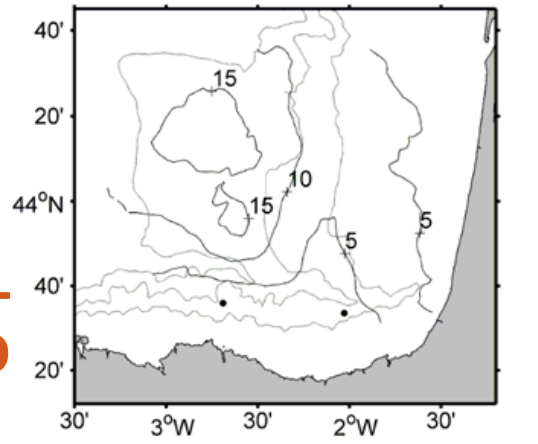


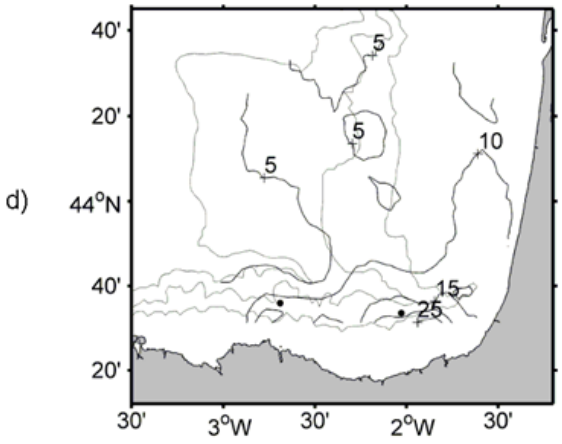
SUMMER



WINTER

SEMIDIURNAL BAND





WINTER

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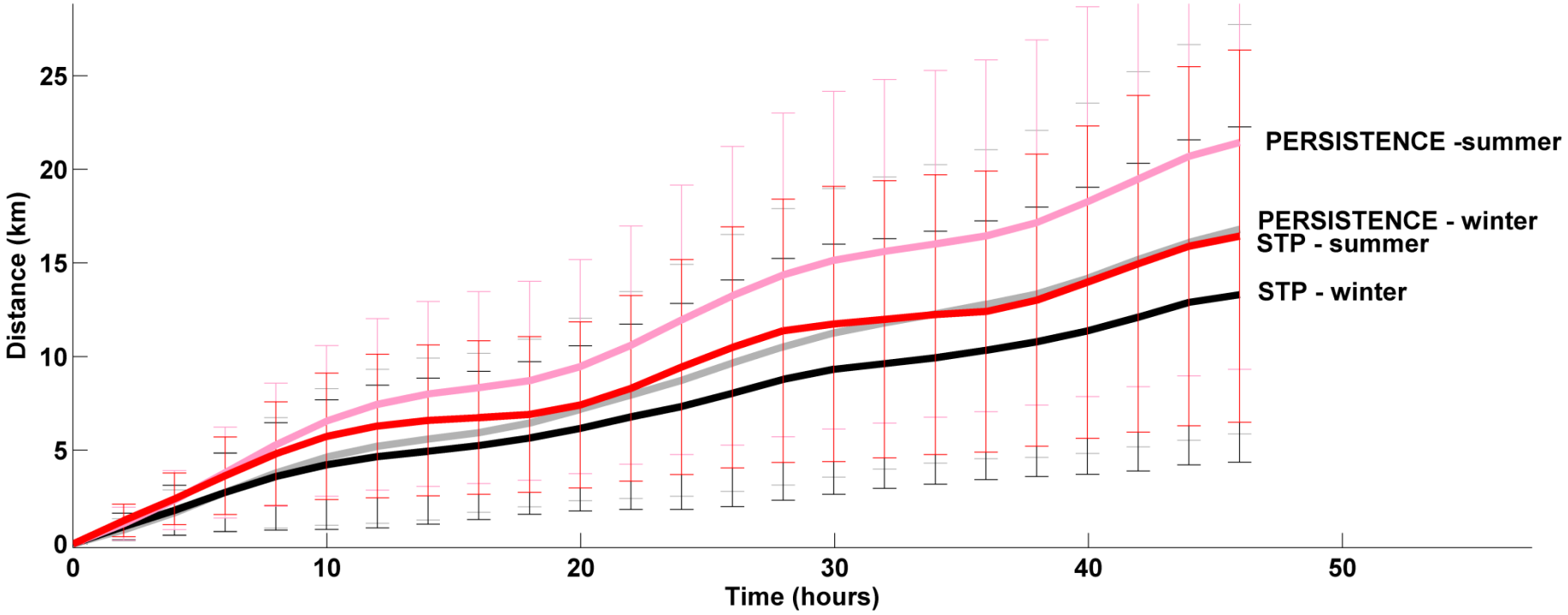
iv. STP spatio-temporal performance

Winter – months 10 11 12 (not data available for 2009)
Summer – months 6 7 8



iv. STP spatio-temporal performance

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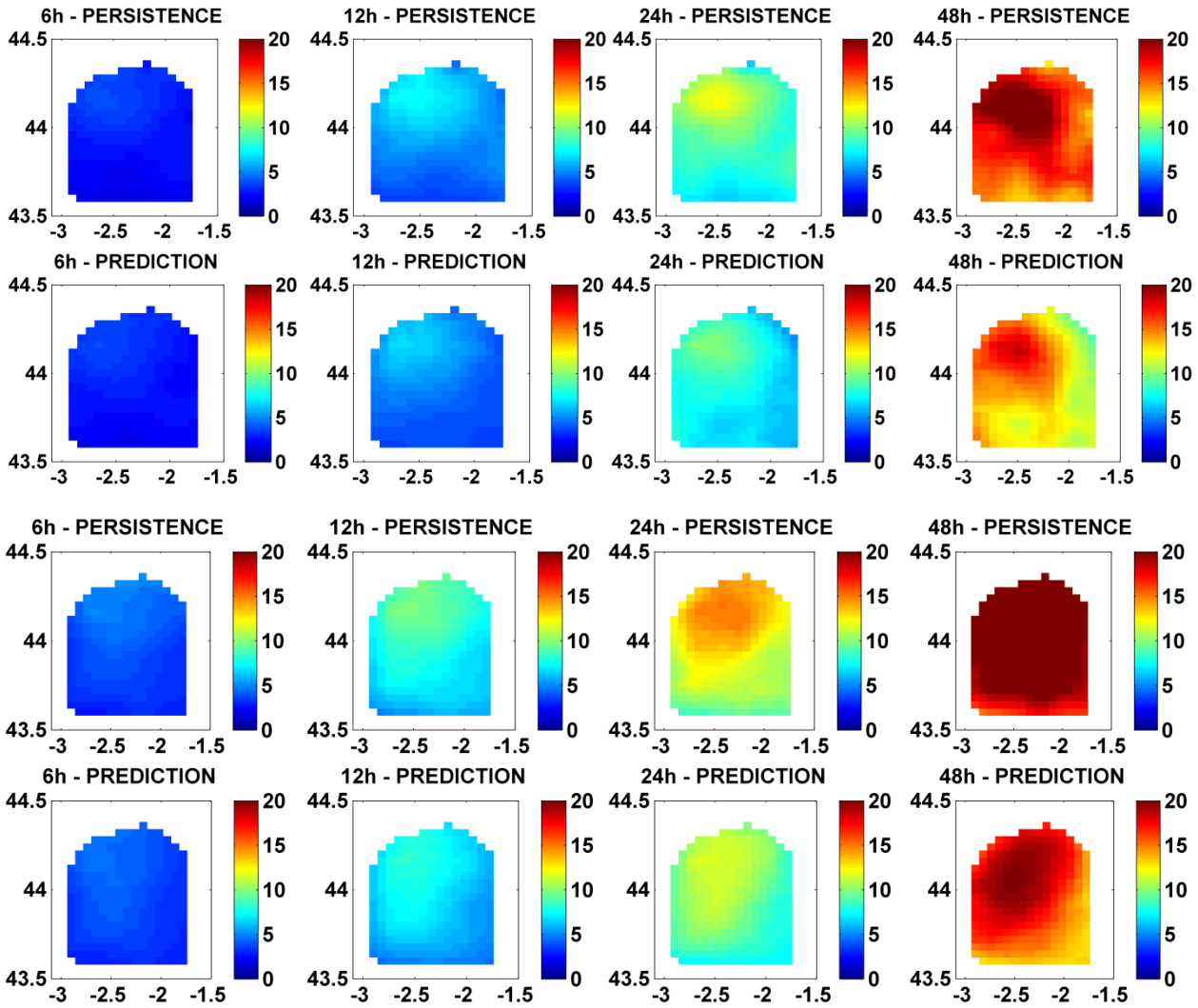
winter

summer



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iv. Conclusions and future work

- ✓ Taking account differences in depth, the radar provide good estimations of real trajectories with distances < at 12 h
- ✓ In comparison with real buoys ST results pro vides errors around , improving persistence at time > 24 h
- ✓ The performances of the STP vary seasonally and spatially (in agreement with the persistence). Different local processes which modulate the local circulation may be responsible of this variability
- ✓ The method developed by Frolov et al. 2012 is a good tool for STP in our area, improvement could be acquired by understanding better the impact of the different scale processes on the transports in the area and applying STP following different strategies (“seasonal training”, “process-oriented training”)

iv. Conclusions and future work

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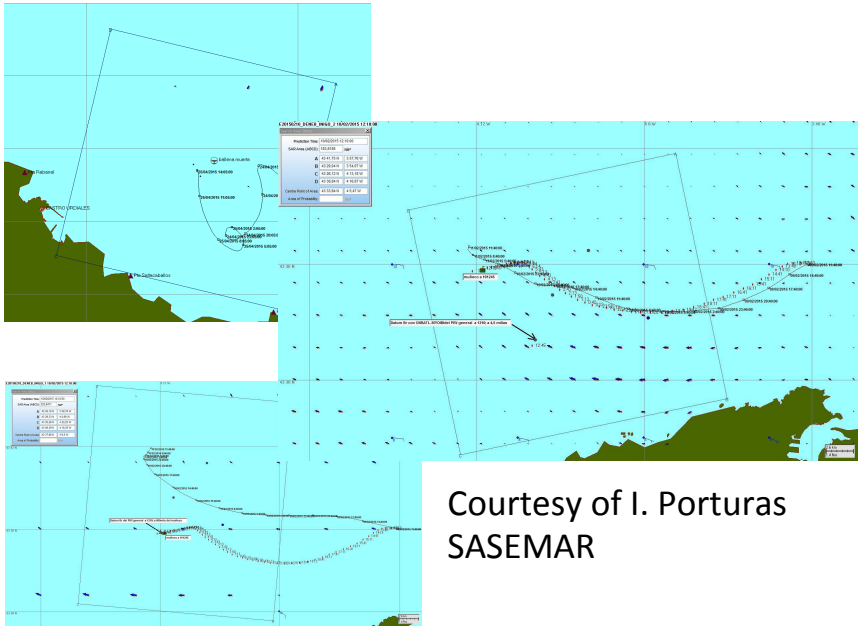
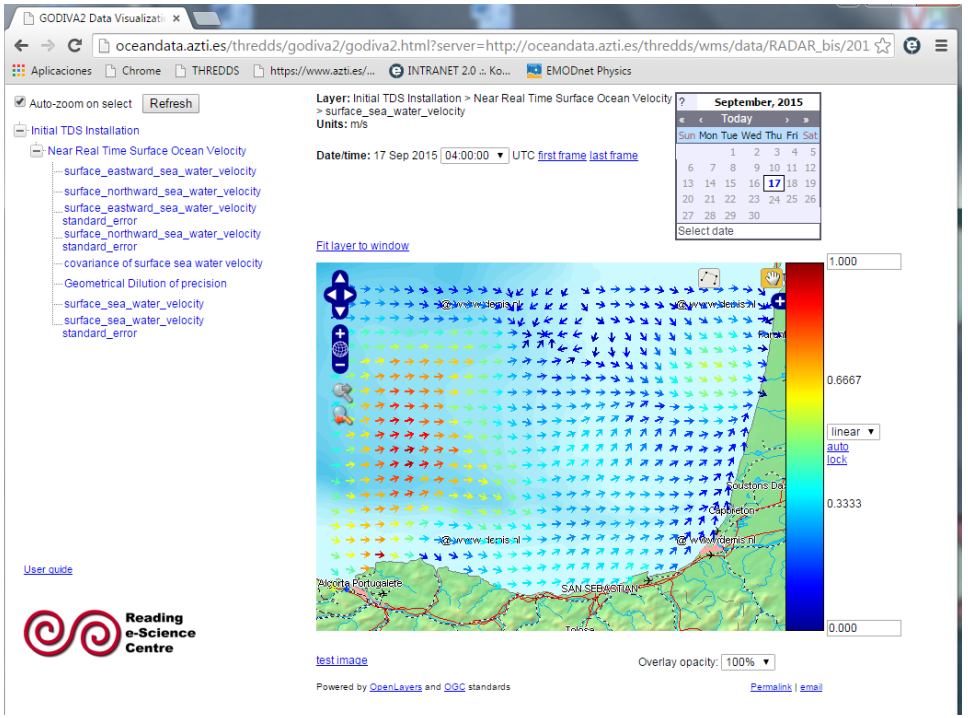
- ✓ Need for monitoring and forecast near the coast. Imporved OMA analysis (already operational)



Courtesy of I. Porturas
SASEMAR



- ✓ Promote the use of HFR data & products derived from the Basque System
- ✓ Next step: apply STP operationally to OMA currents extended to the coast

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Thank you for your attention!

AKNOWLEDGEMENTS

L. Solabarrieta was supported by Fundación de Centros Tecnológicos Iñaki Goenaga. Directorate of Emergency Attention and Meteorology of the Basque Government, Euskalmet and the Department of Industry, Trade and Tourism and the Department of Transport and Civil Works of the Basque Government.

This work has also been partially funded by the Spanish Ministry of Economy and Competitiveness under the research project PLVMA (TRA2011-28900) the Spanish Ministry of Science and Innovation (National R&D&I Plan, MESOANCHOA project) and by the French project ENIGME(ANR/LEFE-IDAO).