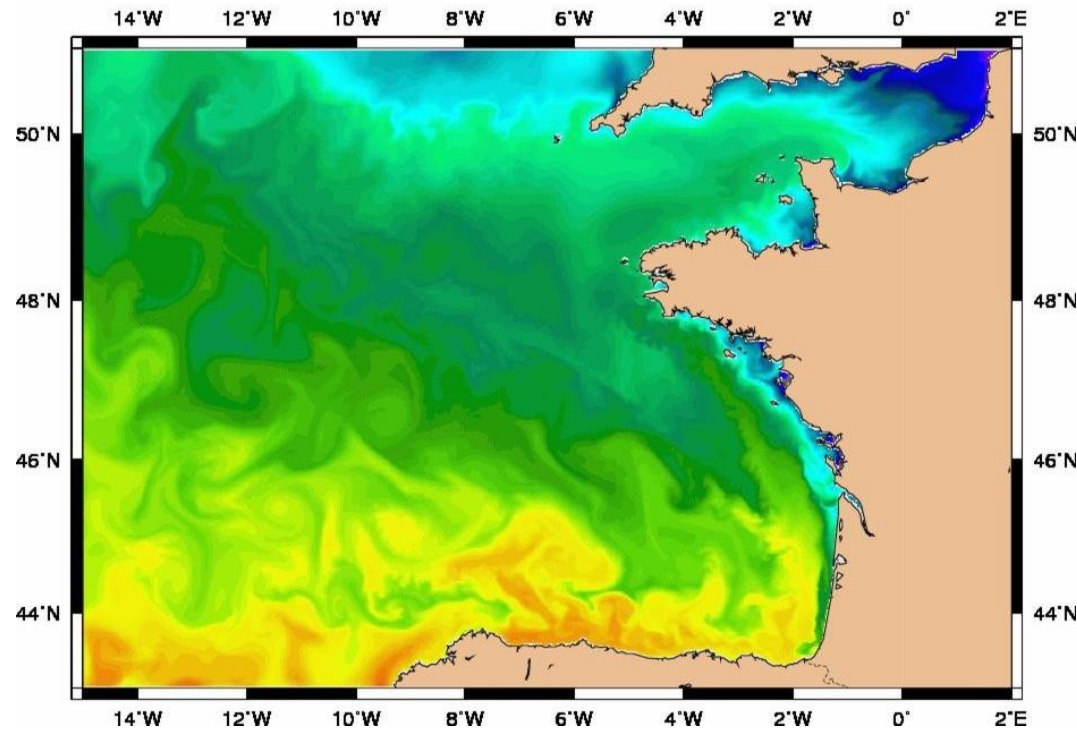


Real time modeling of the bay of Biscay



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Pichon, Cyril Lathuilière, Yves Morel**

EPIGRAM Ile de Ré Mai 2011

Purpose

- ✓ to include the bay of Biscay model in PREVIMER by this year
- ✓ to have an operational system that provides data for both civil and military uses

Outline

1- System description

2- Diagnostics

3- Validation

1- System description

Bay of Biscay HYCOM model

Area : 15°W to 3°E, 43°N to 51°N

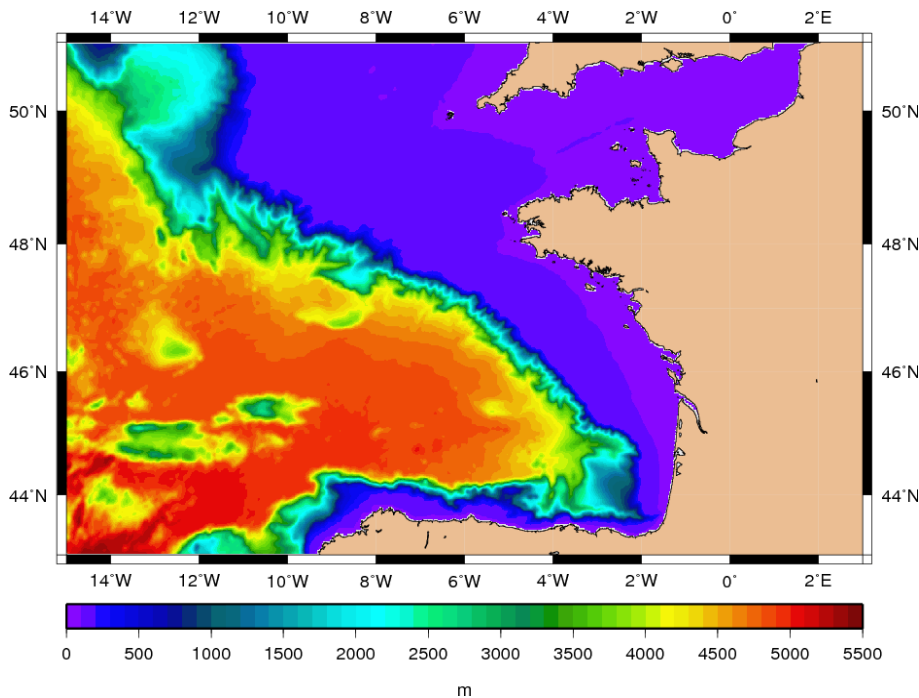
Resolution : 1' (720x471), 32 layers

Configuration :

- ✓ no assimilation
- ✓ meteorological forcing : Météo-France (0.5°)
- ✓ tide : MOG2D (Legos lab)
- ✓ boundary conditions : Mercator outputs
- ✓ rivers outflows

A few characteristics

- ✓ KPP mixing
- ✓ non-linear barotropic equations
- ✓ monthly target densities



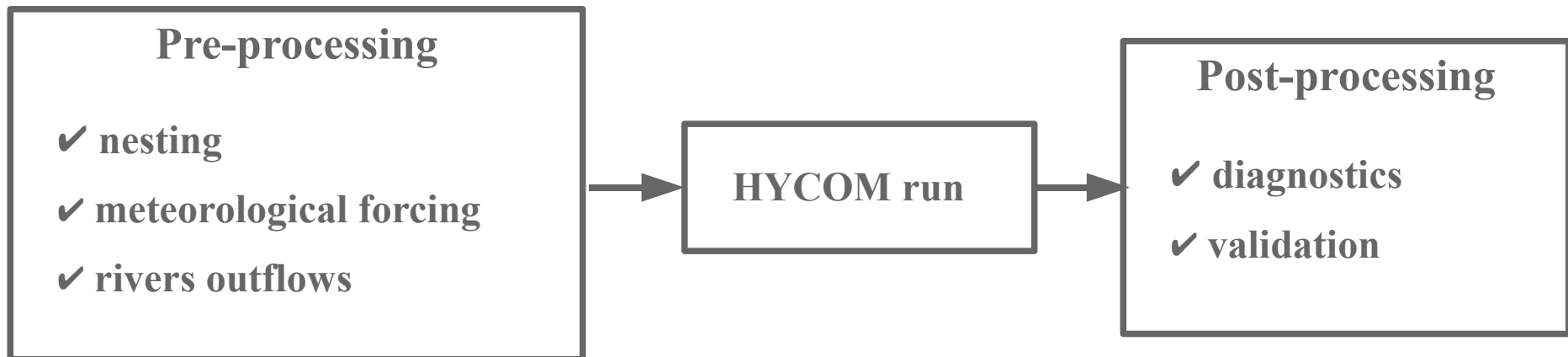
Bathymetry

1- System description

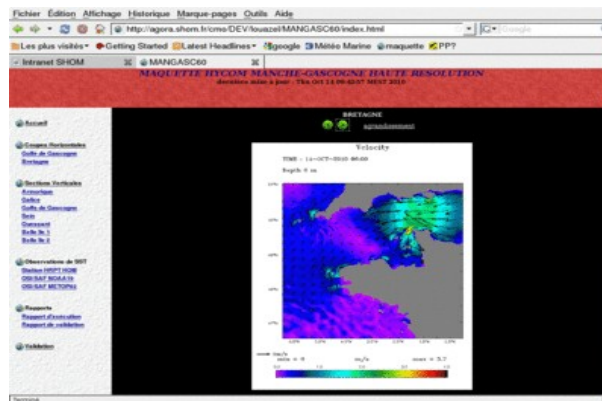
Scenario

✓ the system is run daily from D-2 to D+5,

✓ 3 steps



✓ intranet website daily updated



1- System description

Performance report

Chaîne de flux		<ul style="list-style-type: none">• Infos :<ul style="list-style-type: none">◦ 1000 : Pas de precipitations.• Warnings :<ul style="list-style-type: none">◦ 1000 : Fichier Manquant 110514*ARPEGE_PMer.grib◦ 1000 : Fichier Manquant 110514*ARPEGE_THu.grib◦ 1000 : Fichier Manquant 110514*ARPEGE_Vent.grib◦ 1000 : Fichier Manquant 110520*ARPEGE_Flux.grib◦ 1000 : Fichier Manquant 110520*ARPEGE_PMer.grib◦ 1000 : Fichier Manquant 110520*ARPEGE_THu.grib◦ 1000 : Fichier Manquant 110520*ARPEGE_Vent.grib
Chaîne de nesting		
Chaîne de fleuves		<ul style="list-style-type: none">• Warnings :<ul style="list-style-type: none">◦ 400 : Loire persistance depuis le : 2011-05-18
Run d'analyse		
Run de prevision		
Chaîne de conversion au format PREVIMER		
Verification des donnees d'analyse		<ul style="list-style-type: none">• Warnings :<ul style="list-style-type: none">◦ 1400 : [comparaison_seuil] 9545 cas avec saln en sortie du modele trop elevee
Verification des donnees de prevision		<ul style="list-style-type: none">• Warnings :<ul style="list-style-type: none">◦ 1500 : [comparaison_seuil] 281 cas avec temp en sortie du modele trop elevee◦ 1500 : [comparaison_seuil] 52776 cas avec saln en sortie du modele trop elevee

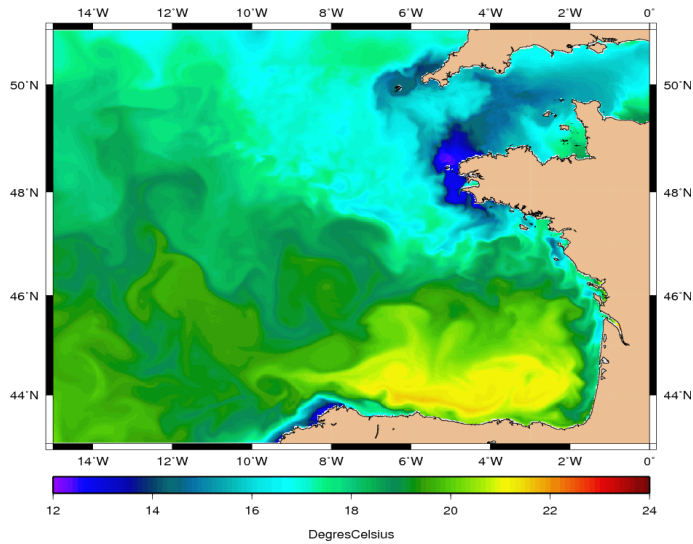
2- Diagnostics

Maps

Temperature

Date : 2010/08/16 00:00 TU

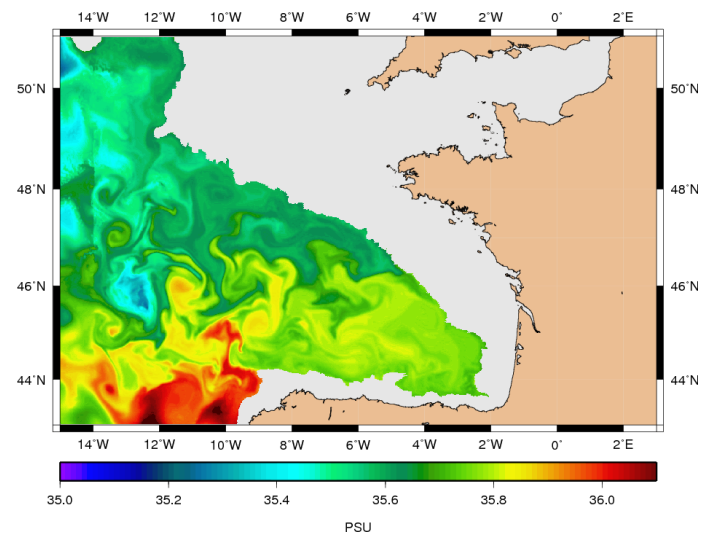
Layer 1



Salinity

Date : 2011/01/26 03:00 TU

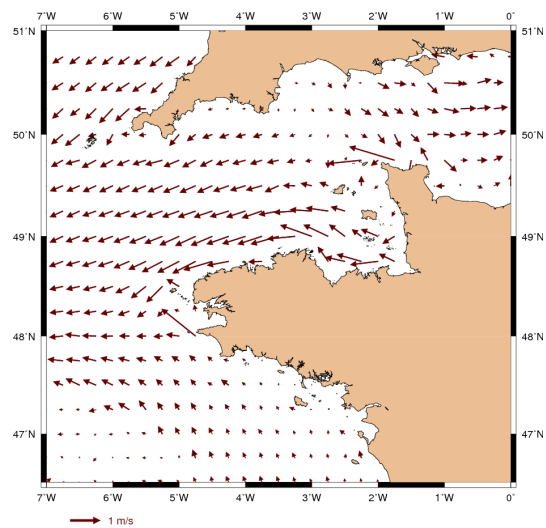
Depth 1000.00 m



Current

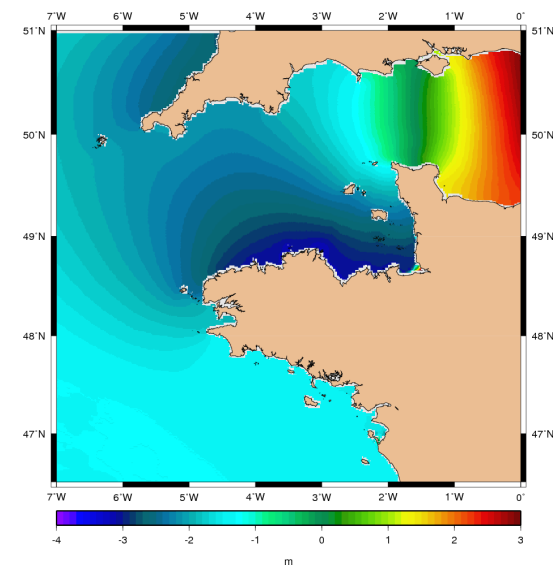
Date : 2010/12/10 01:00 TU

Layer 1



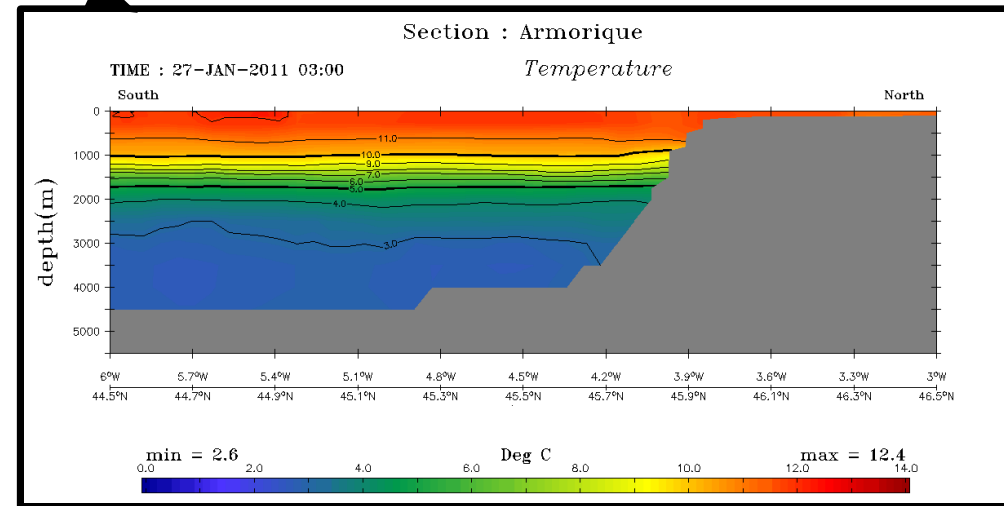
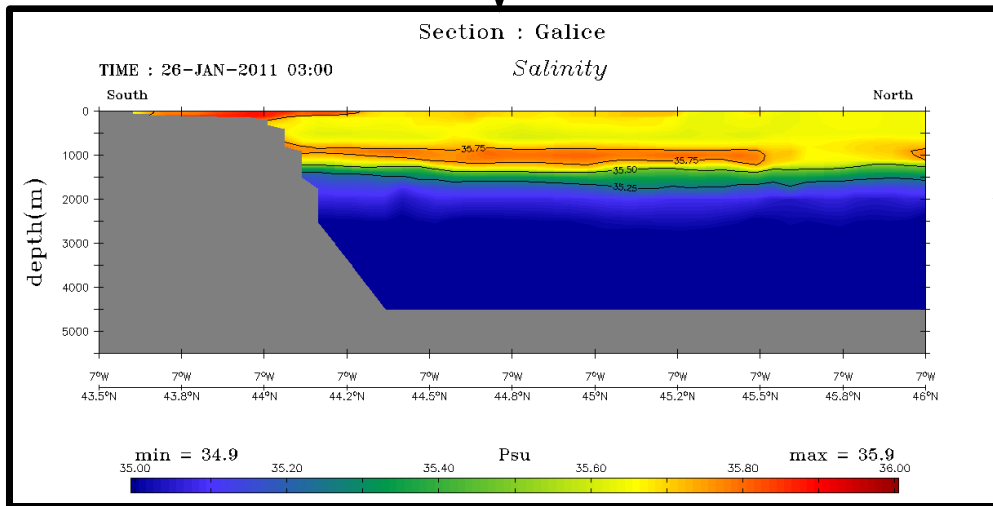
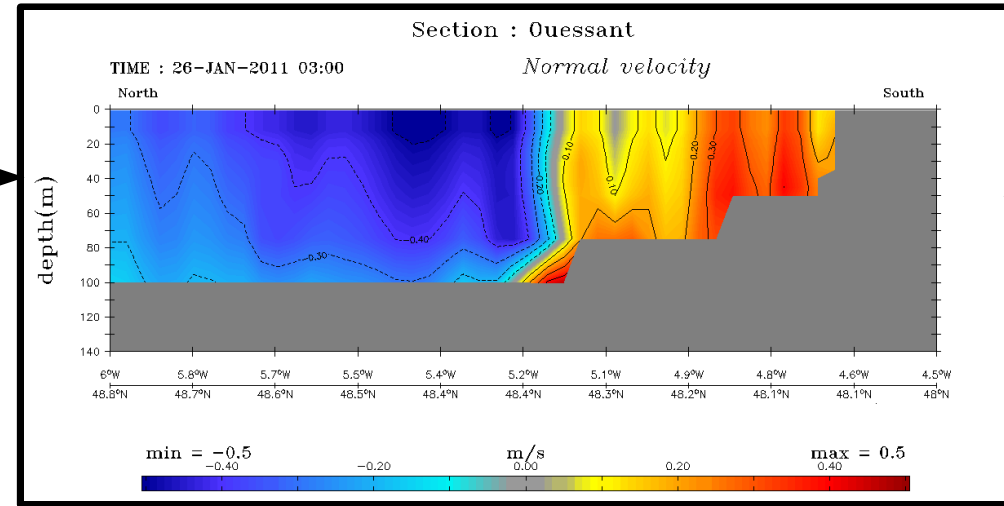
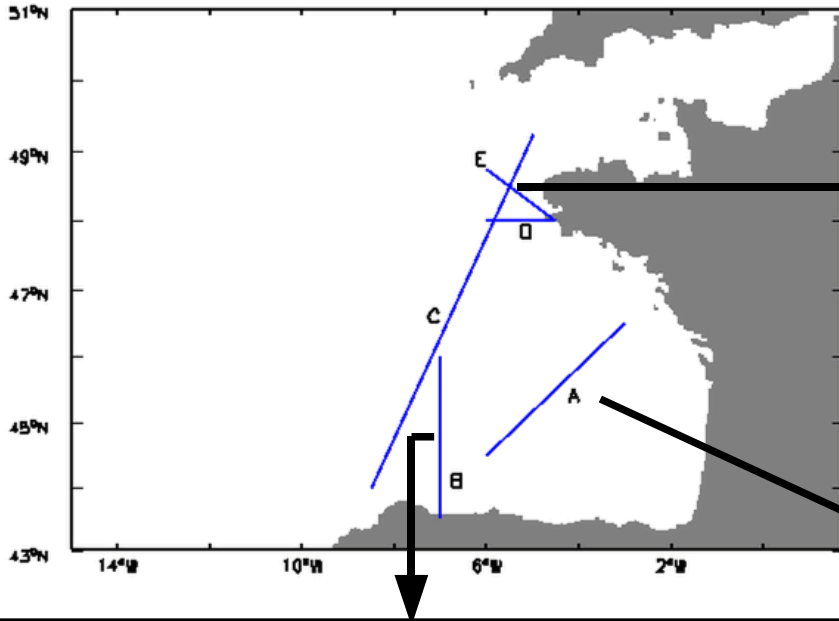
SSH

Date : 2010/12/10 01:00 TU



2- Diagnostics

Vertical sections



2- Diagnostics

Processes detection

Criteria have been defined to automatically detect in the model output the following dynamical processes :

✓ Ushant front

✓ upwelling

✓ warm water tongue

✓ cold water masses

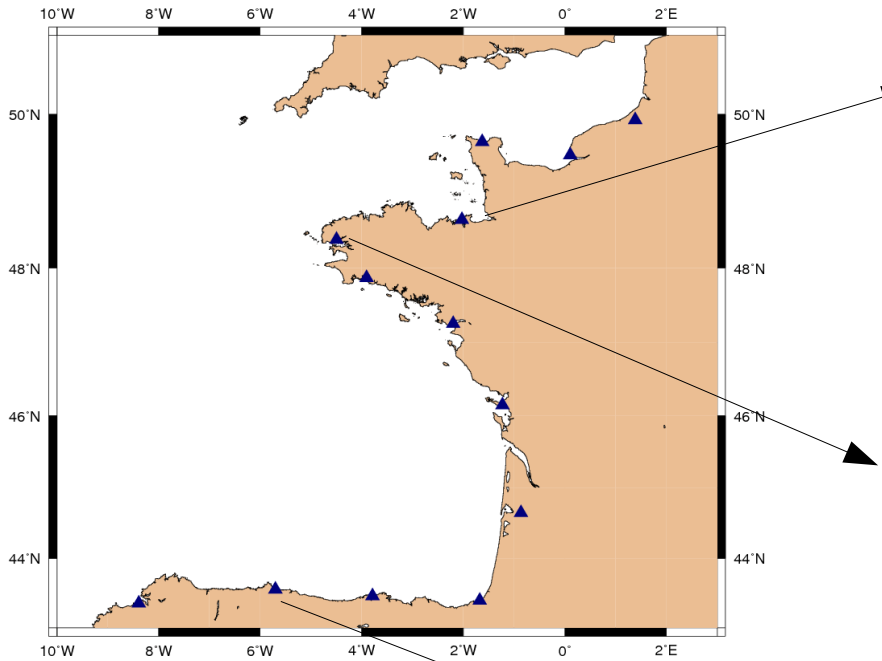
✓ winter warm current

✓ mediterranean water

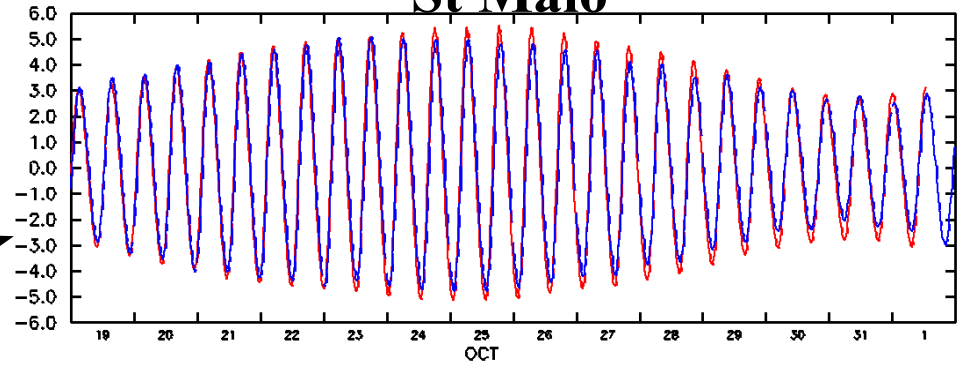
Front Ouessant	✓	<ul style="list-style-type: none"> • Sur la zone Ouest, le gradient vertical des moyennes de temperature par profondeur doit presenter des valeurs negatives inferieures a -1.80 (3 valeurs inferieures) • Sur la zone Est, le gradient vertical des moyennes de temperature par profondeur doit presenter des valeurs absolues faibles inferieures a 0.80 (13 valeurs inferieures) • L'ecart entre les moyennes de temperature de surface des zones Ouest et Est doit atre superieur a 2.00 (2.90)
Up welling des Landes	✗	<ul style="list-style-type: none"> • ⚠ Moyenne des temperatures de la zone en bord de cote doit etre inferieure a 18.00 (18.62) • Moyenne des temperatures de surface de la zone au large doit etre superieure a 18.00 (20.89) • Moyenne des temperatures au large, a 50m de profondeur doit etre inferieure a 18.00 (15.74) • Moyenne de la ssh au large (-6.32) doit etre superieure a la moyenne de la ssh sur la cote (-6.40)
Langue d'eau chaude sur le plateau	✗	<ul style="list-style-type: none"> • Moyenne des temperatures de surface sur la zone doit etre superieure a 17.00 (17.51) • ⚠ Amplitude de la temperature le long de la coupe doit etre superieure a 2.00 (1.54) • La valeur du quantile a 80pourcent est comprise dans l'intervalle des temperatures correspondant a la langue : [16.50 - 20.50] (18.88)
Bourrelet Froid	✓	<ul style="list-style-type: none"> • Moyenne des temperatures de surface sur la zone doit etre superieure a 17.00 (17.39) • Moyenne des temperatures a 65m sur la zone doit etre inferieure a 12.00 (11.79) • Ecart-type des temperatures a 65m doit etre inferieur A 0.50 (0.17)
Navidad	✗	<ul style="list-style-type: none"> • Moyenne des temperatures de surface sur la zone doit etre superieure a 13.00 (19.64) • Moyenne des temperatures a 50m sur la zone doit etre superieure a 13.00 (14.29) • ⚠ Le courant de surface doit etre oriente a l'Est, valeur absolue inferieure a 30.00°, (angle en surface= 146.46°) • ⚠ Le courant a 50m doit etre oriente a l'Est, valeur absolue inferieure a 30.00°, (angle a 50 m= 179.86°) • Vitesse moyenne du courant doit etre superieure a 10.00cm/s (41.90cm/s)
Eau mediterraneenne	✓	<ul style="list-style-type: none"> • Salinite moyenne a 1000m de profondeur doit etre superieure a 35.60 (35.62)

3- Validation

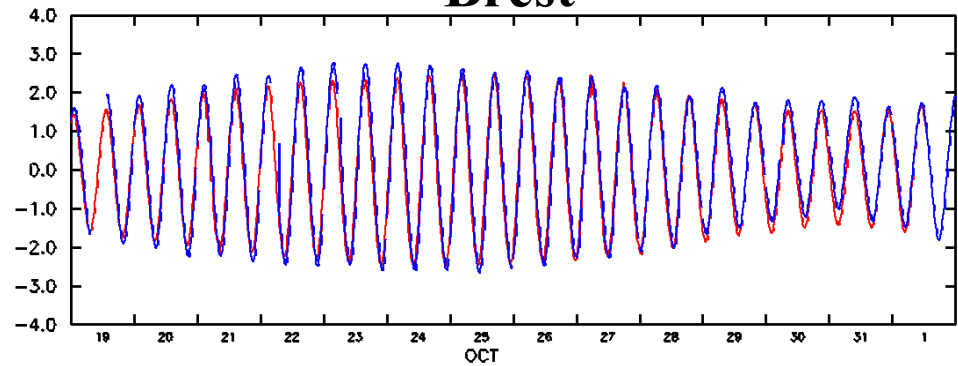
SSH: comparison with tidal gauges



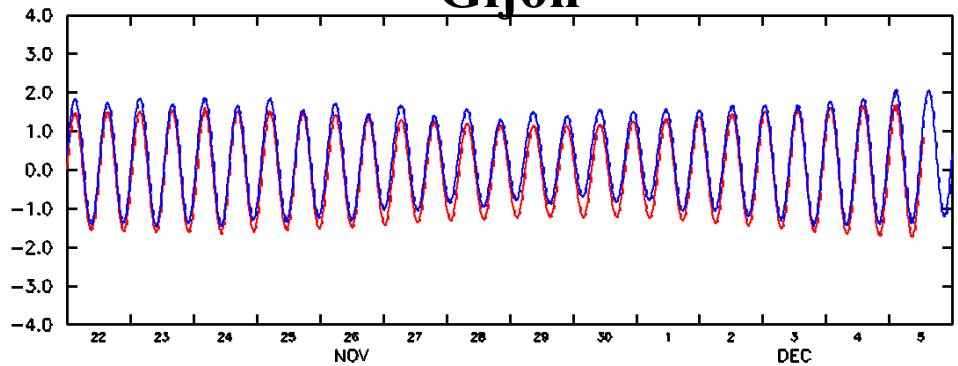
St Malo



Brest



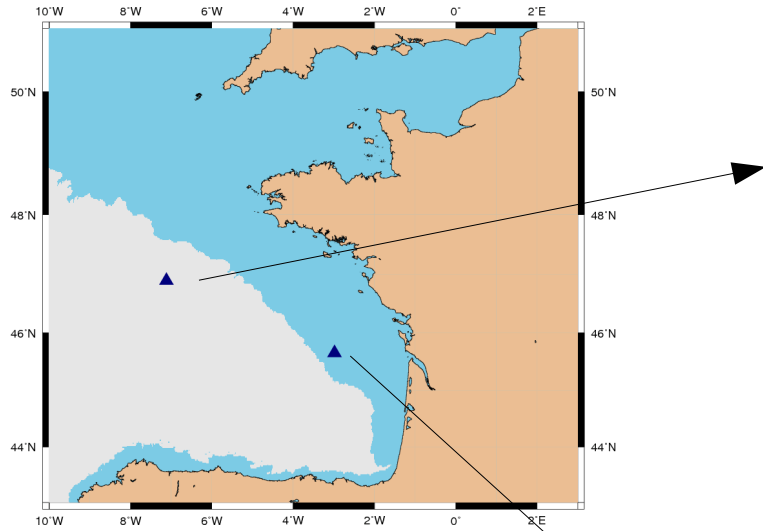
Gijón



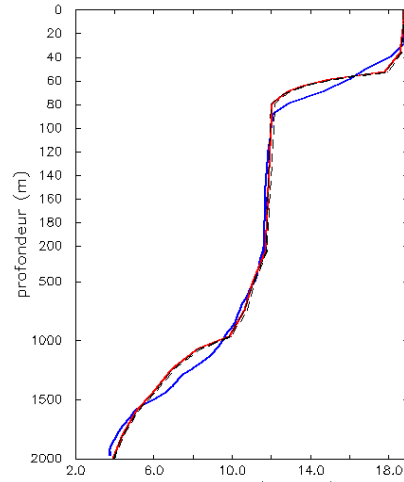
— tidal gauge
— model output

3- Validation

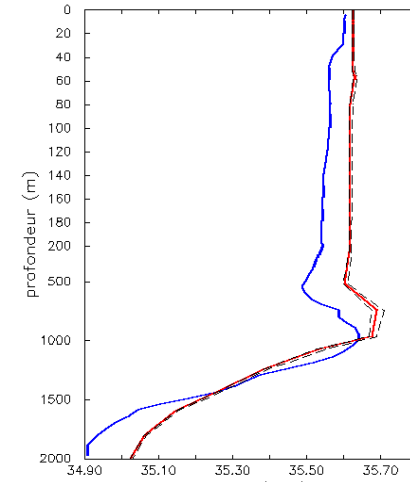
Temperature and salinity: comparison with in-situ profiles



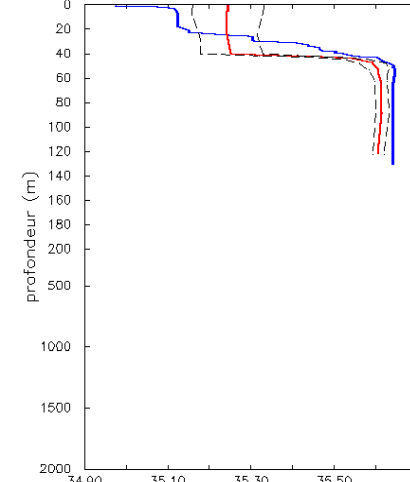
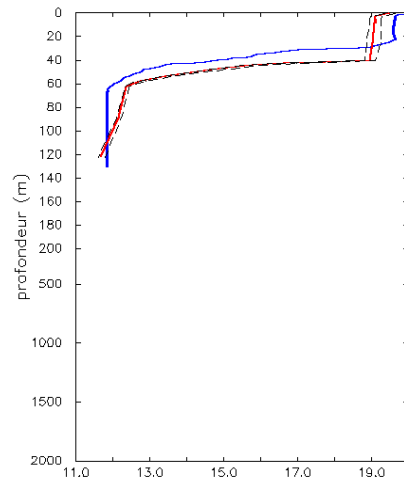
— in-situ profile
— model profile



temperature

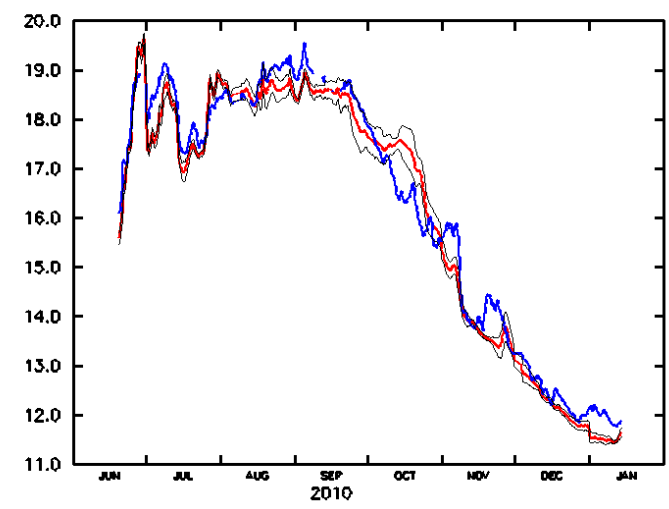
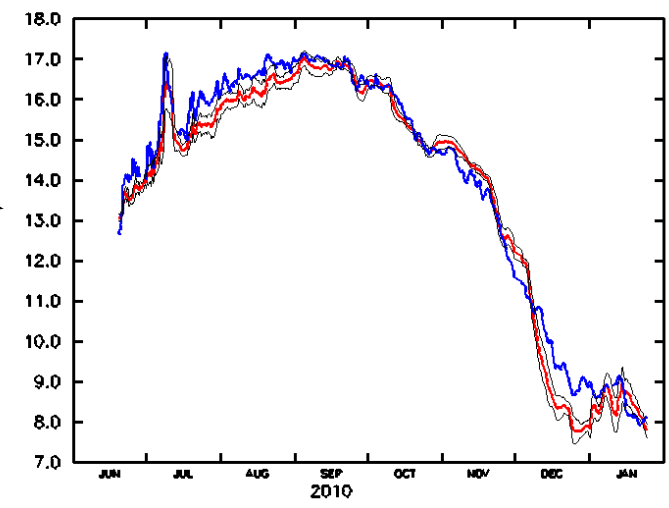
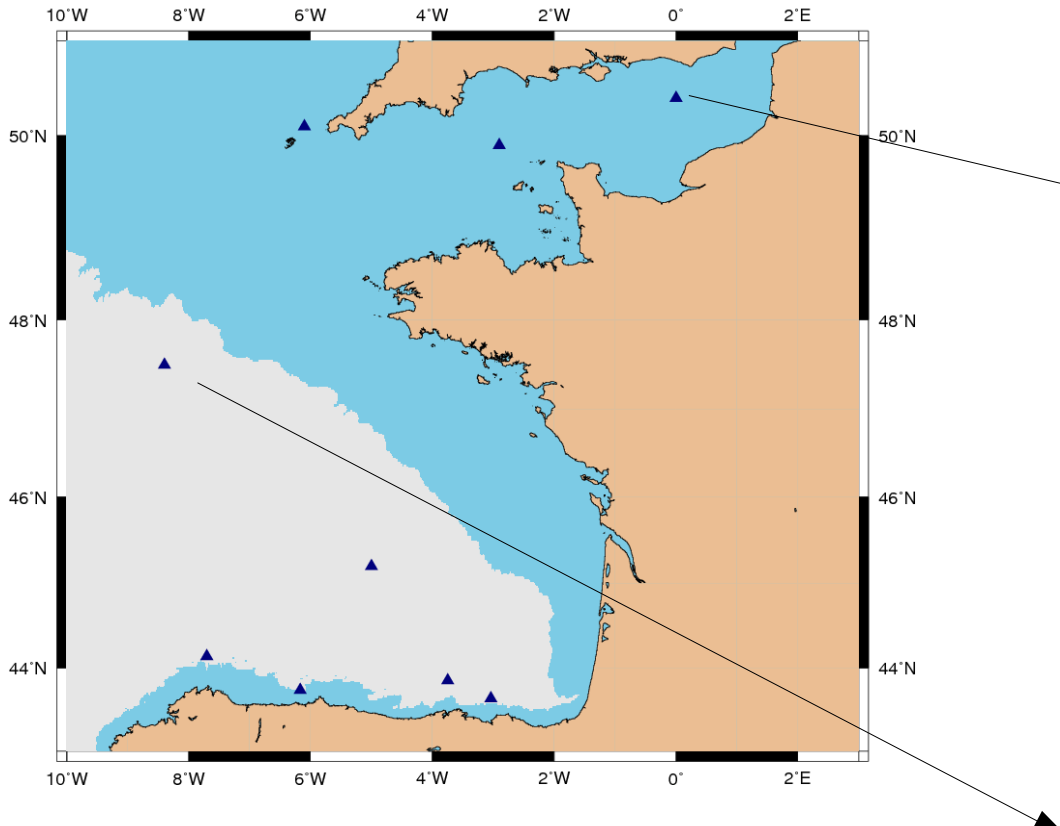


salinity



3- Validation

SST: comparison with permanent mooring data



mooring data
model output

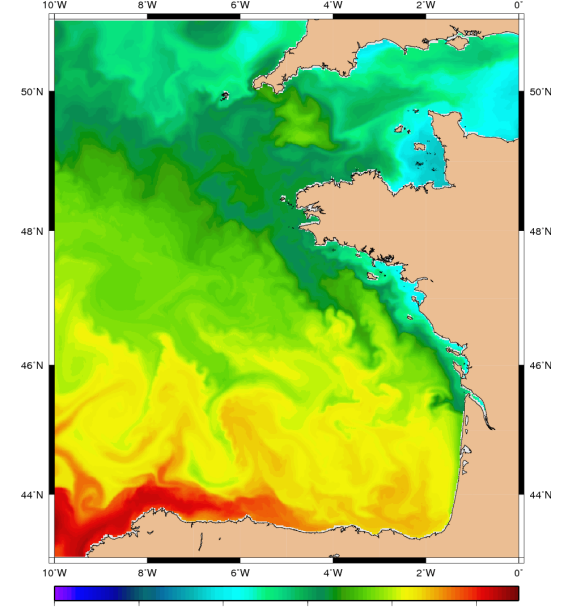
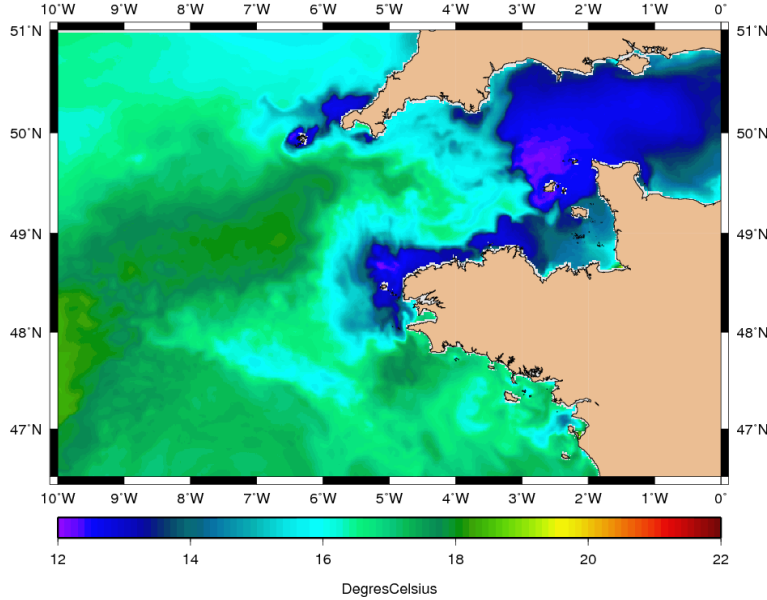
3- Validation

SST: comparison with satellite data

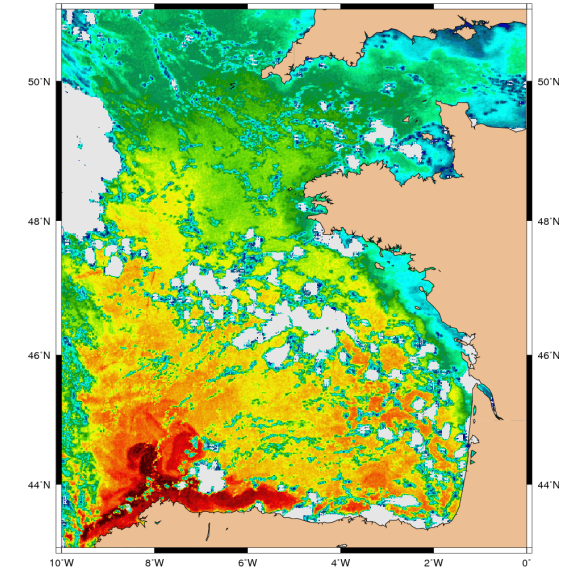
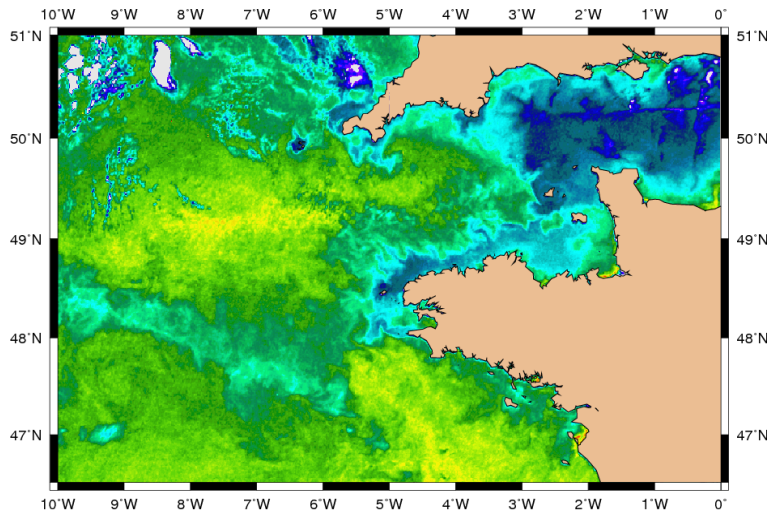
06/25/2010

01/09/2011

Model



Satellite

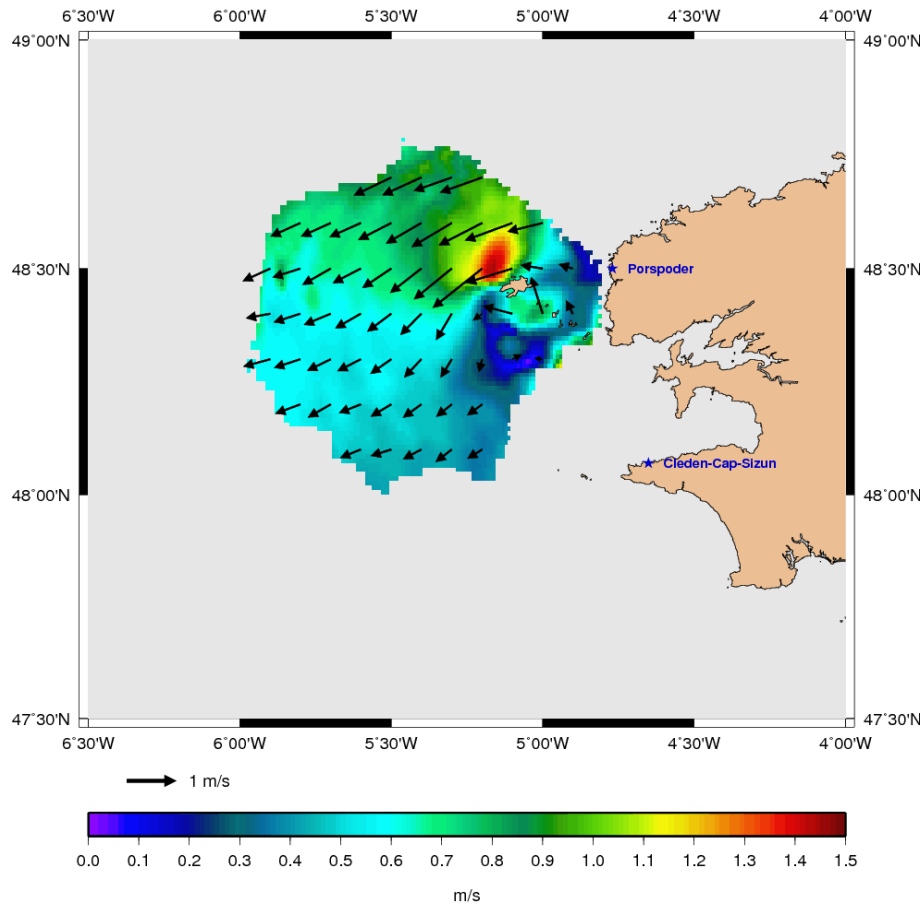


3- Validation

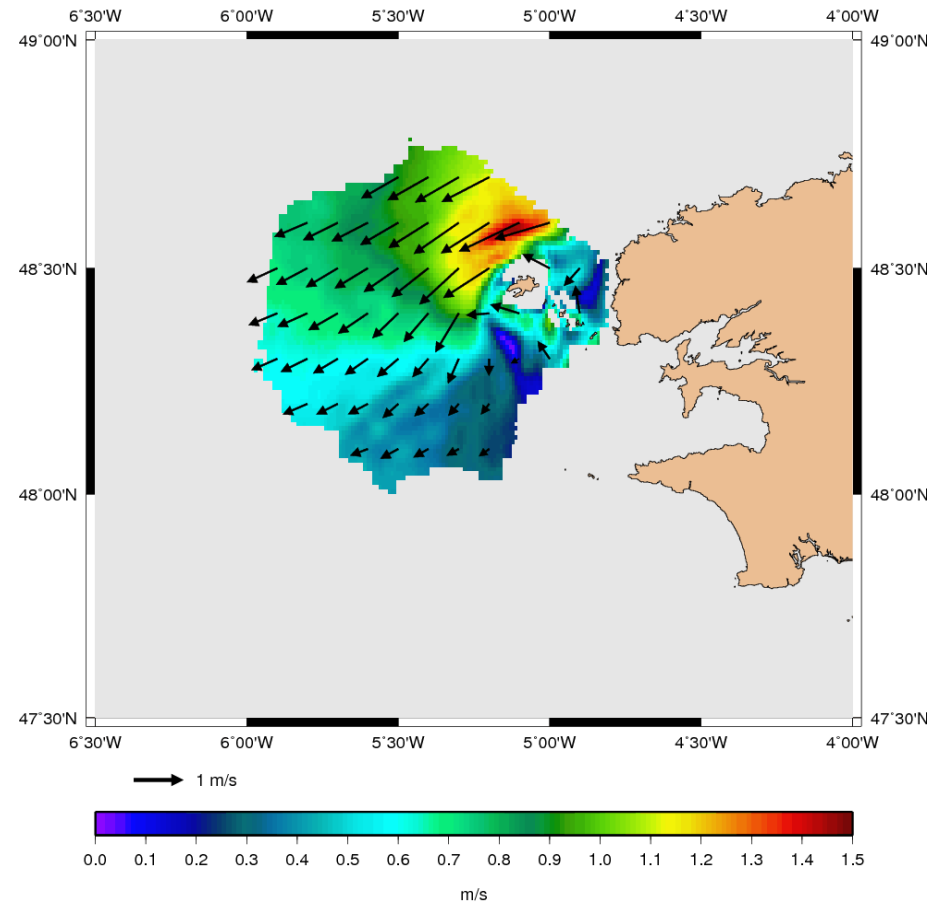
Surface currents: comparison with HF radars data

Total current 12/25/2010 01.00 PM

HF radars



Model

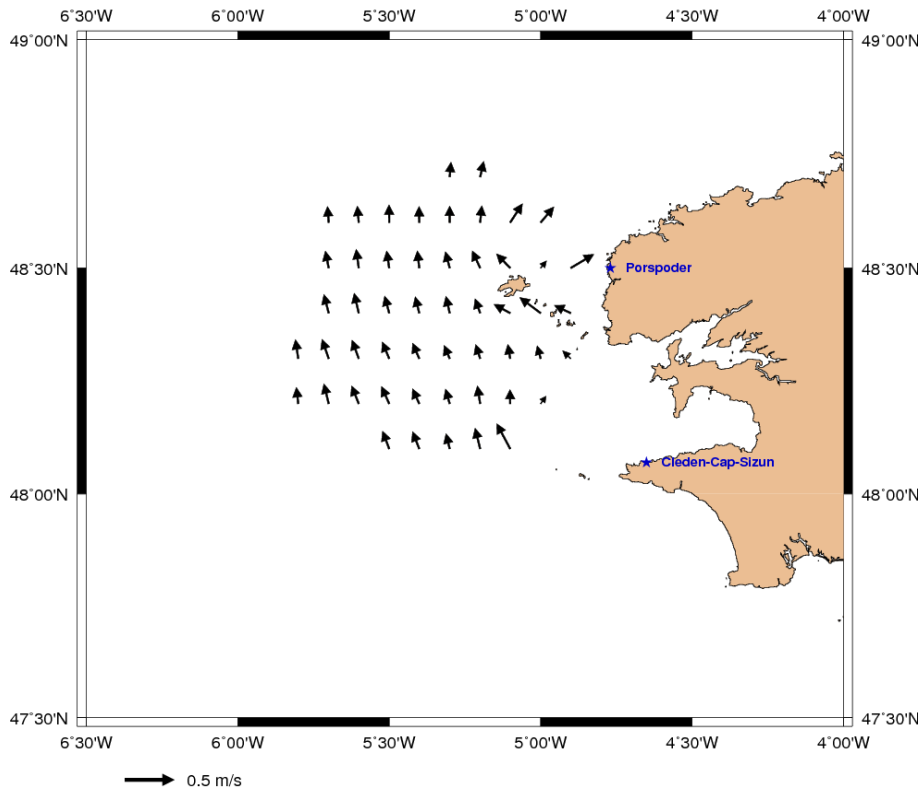


3- Validation

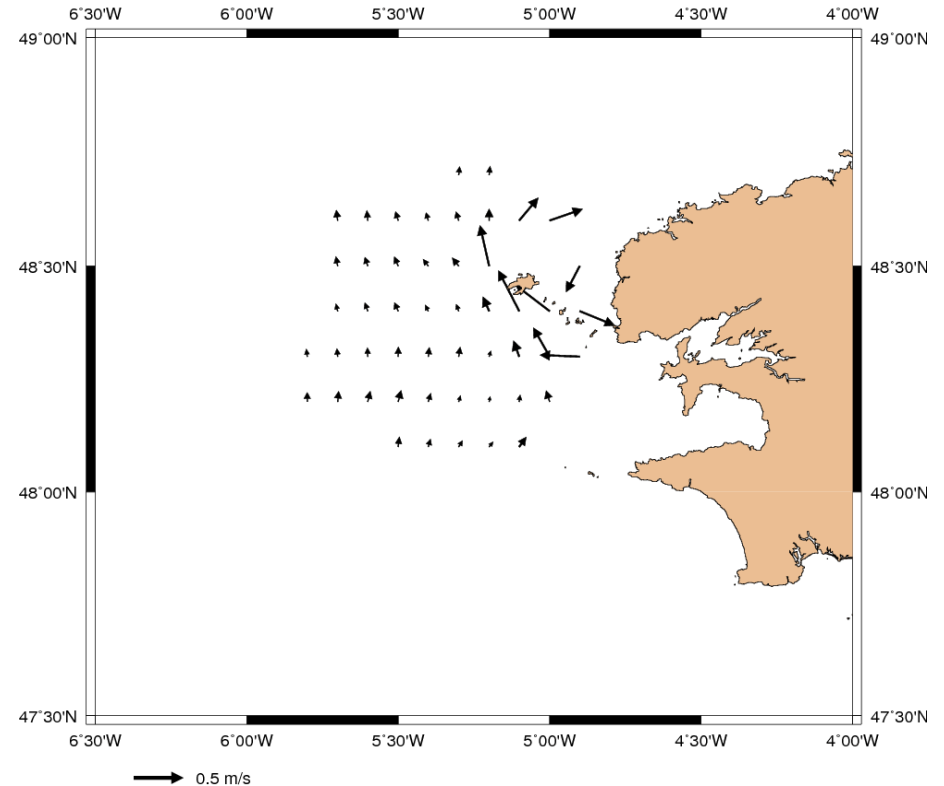
Surface currents: comparison with HF radars data

Residual current 12/26/2010 12.00

HF radars



Model



What can explain these differences ?

- small signal compared to the total current
- Stokes drift absent in the model
- smoothed HF radars data
- signal very sensitive to the rough bathymetry

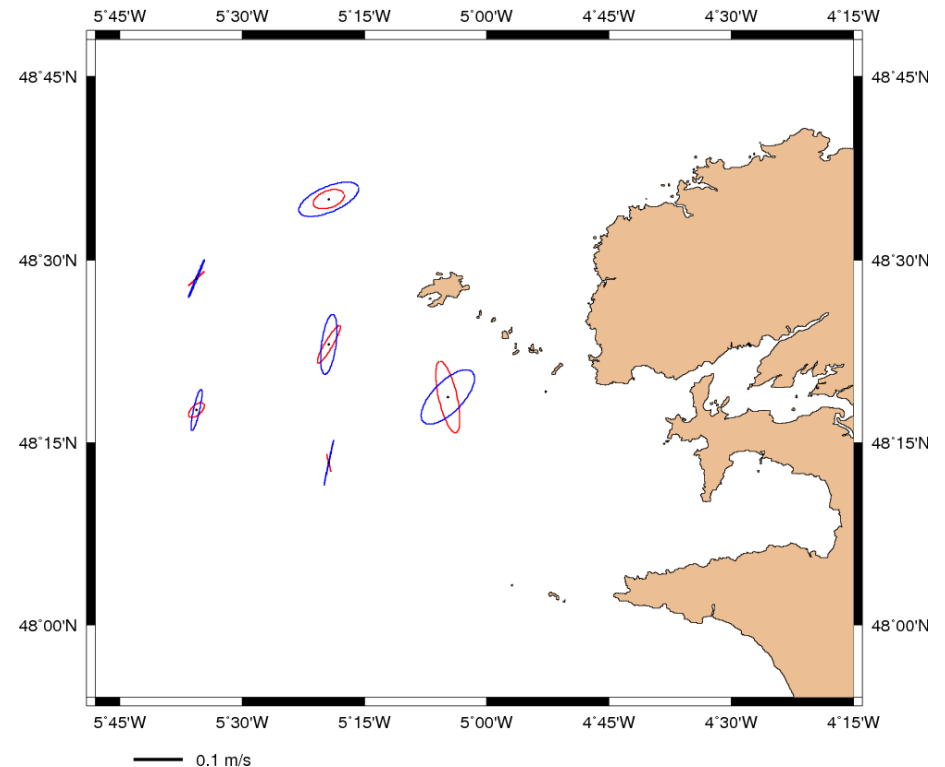
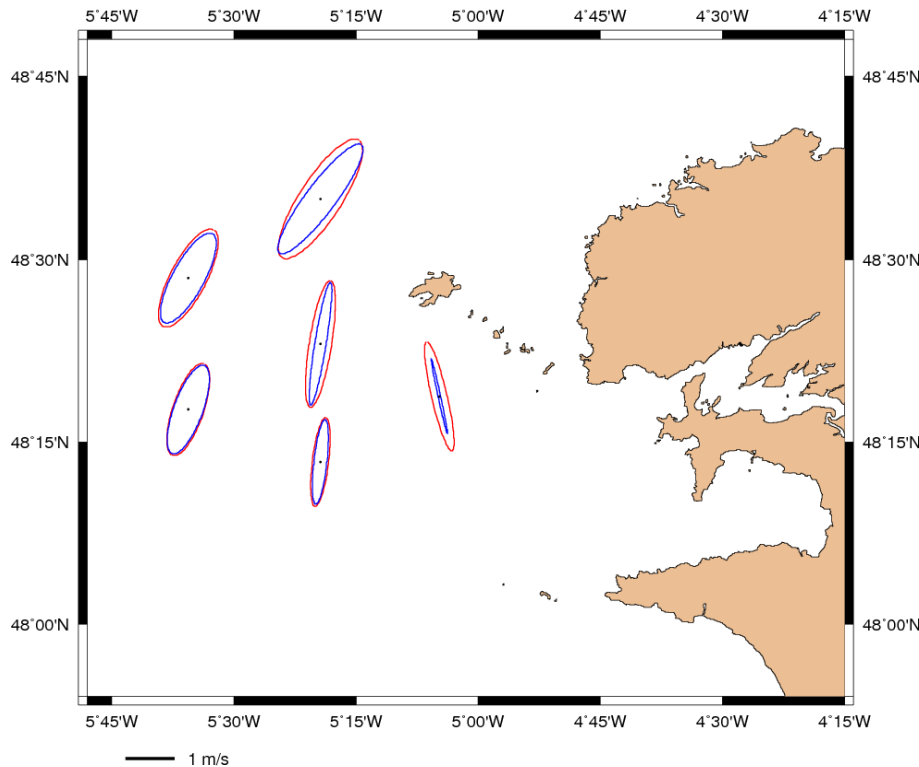
3- Validation

Surface currents: comparison with HF radars data

Tidal current ellipses

M2 constituent

M4 constituent



— Model — HF radars

bottom friction, bathymetry ?
accurate HF radars data ?

Conclusion

Real time system is continuously evolving

Validation tools

- ✓ **to be improved**
- ✓ **quantitative indicators need to be developed**

Model evolutions

- ✓ **data assimilation**
- ✓ **introduction of atmospheric pressure effects**
- ✓ **AGRIF implementation to make zooms**
- ✓ **coupled to a wave model**