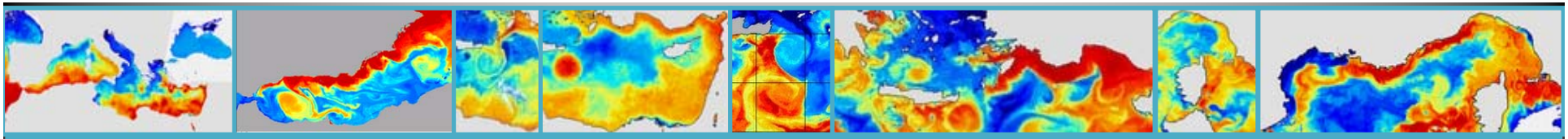
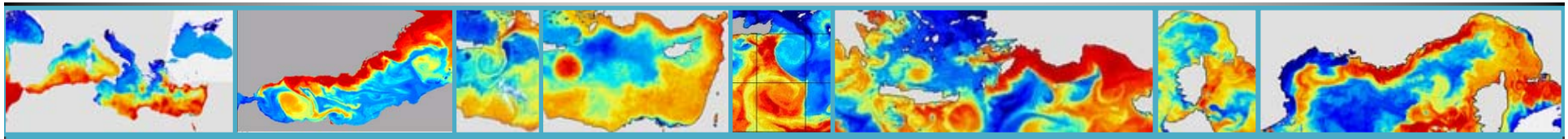


TRANSMED:
Séries temporelles de SSS et SST à travers le Bassin Occidental de la Méditerranée depuis 2012 : quelles leçons, quel avenir ?

Isabelle Taupier-Letage, Jean-Luc Fuda ***et al.!***

CNRS/ Mediterranean Institute of Oceanography (MIO)

isabelle.taupier-letage@univ-amu.fr



TRANSMED:
Séries temporelles de SSS et SST à travers le Bassin Occidental de la Méditerranée depuis ~~2012~~ : 2003 quelles leçons, quel avenir ?

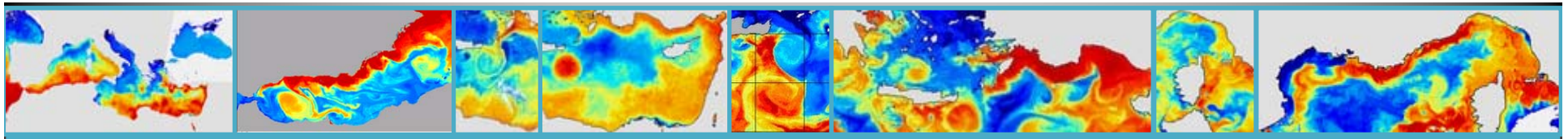
ciesm

Monitoring de l'évolution (x10ans) de la SSS et SST en Méditerranée (KISS principle, cf HydroChanges)

CNRS/ Mediterranean Institute of Oceanography (MIO)

isabelle.taupier-letage@univ-amu.fr

cnrs dépasser les frontières | Aix*Marseille université | mio Institut Méditerranéen d'Océanologie | IRD Institut de recherche pour le développement | Université de Sud | Observatoire des Sciences de l'Univers Institut PYTHEAS



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Séries temporelles de SSS et SST à travers le Bassin Occidental de la Méditerranée depuis 2012 : quelles leçons, quel avenir ?

Isabelle Taupier-Letage, Jean-Luc Fuda *et al.!*

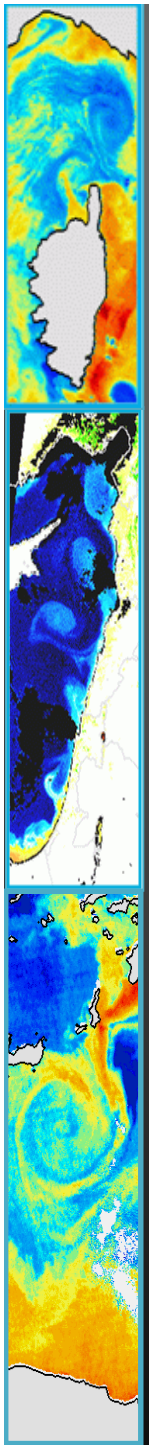
www.hymex.org

HyMeX
HYdrological cycle in Mediterranean EXperiment

HyMeX LOP (2010-2020):
DWF in the Western Med.

CNRS/ Mediterranean Institute of Oceanography (MIO)
isabelle.taupier-letage@univ-amu.fr

cnrs dépasser les frontières
Aix*Marseille université
mio Institut Méditerranéen d'Océanologie
IRD Institut de recherche pour le développement
Université de Toulon
Observatoire des Sciences de l'Univers Institut PYTHEAS

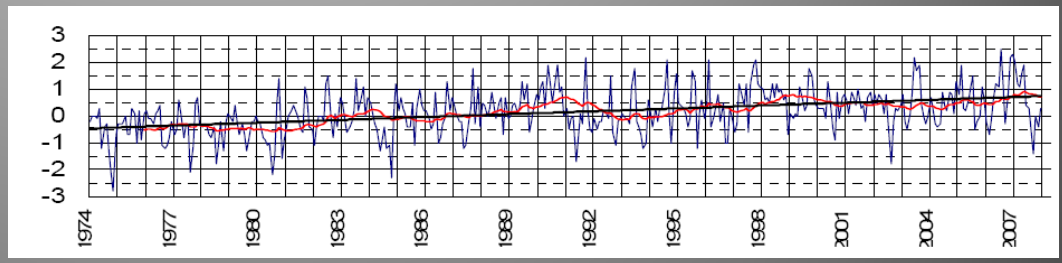


TRANSMED: THE KISS* PRINCIPLE TO COPE WITH MONOTORING AT THE CLIMATOLOGICAL SCALE (duration + spatial extent + « middle of nowhere and nolab » areas)

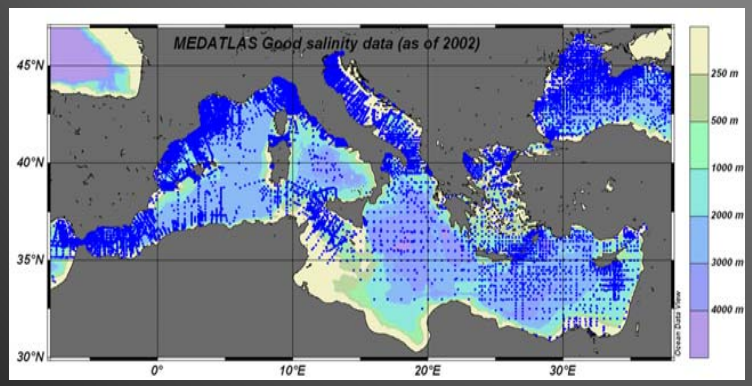
Weak climatological changes can be detected at the surface

SST anomalies:

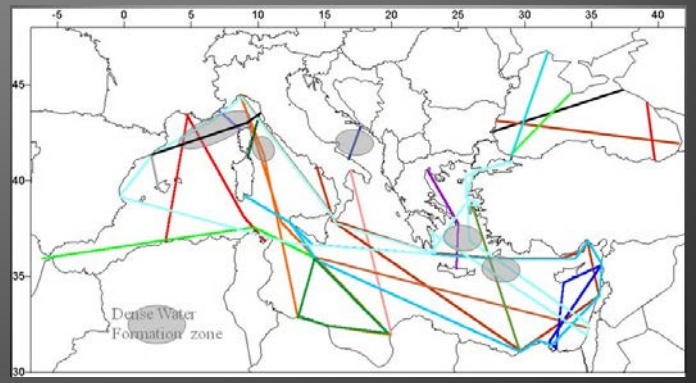
Increase of the sea surface temperature: 1.1°C / 27 years = 0.04°C / year



From Salat et Pascual, 2002. CIESM Workshop Series #16 on: « Tracking long-term hydrological change in the Mediterranean Sea » (updated)



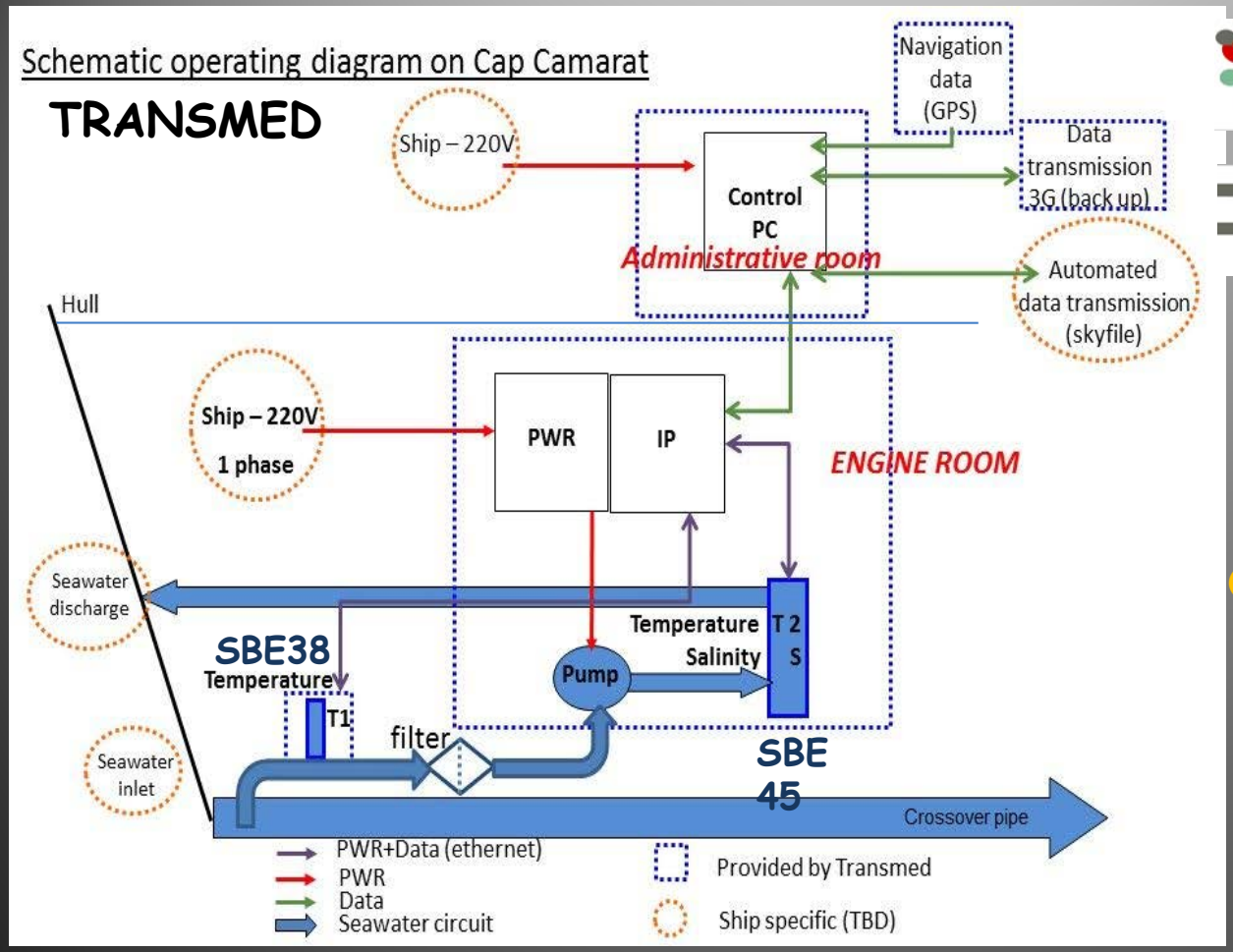
Salinity data missing in the southern and central areas



TRANSMED Project: network of low-cost autonomous (KISS) thermosalinographs (TSG) on ships of opportunity

KISS* : Keep It Simple Stupid

N.B.: applies to all remote (archipelago) areas



Gestion de flotte (…)

AUTONOMIE

QUALITE de la SSS

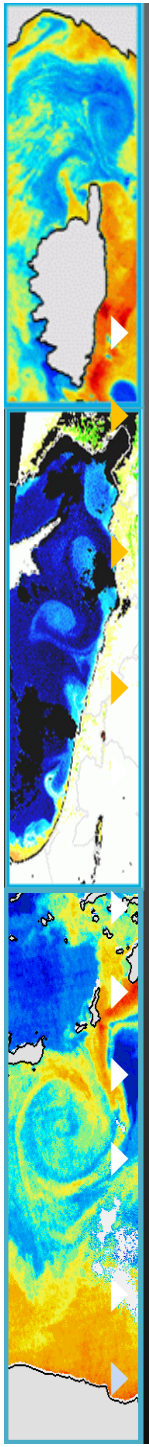
division technique de l'INSU

HyMeX
HYdrological cycle in Mediterranean EXperiment

CDD 18 mois IE

Ethernet => no distance limitation between modules
=> possibility to add extra channels/sensors

+ Capteurs météo/atm: SEOS/MF (GTS)



TRANSMED characteristics

To ensure data quality:

ON/OFF of the pump autonomous (function of the speed)

START/STOP of data acquisition in function of the speed or geographical areas, automatic reboot if PWR failure

Automated full resolution data transmission in near-real time (GSM, ship 's mail vacations)

No requirement for freshwater, anti-fouling rings

Basic system, interchangeable, all identical, 1 configuration standard file (but adaptations for each ship)

Cheaper installation: no through-hull valves

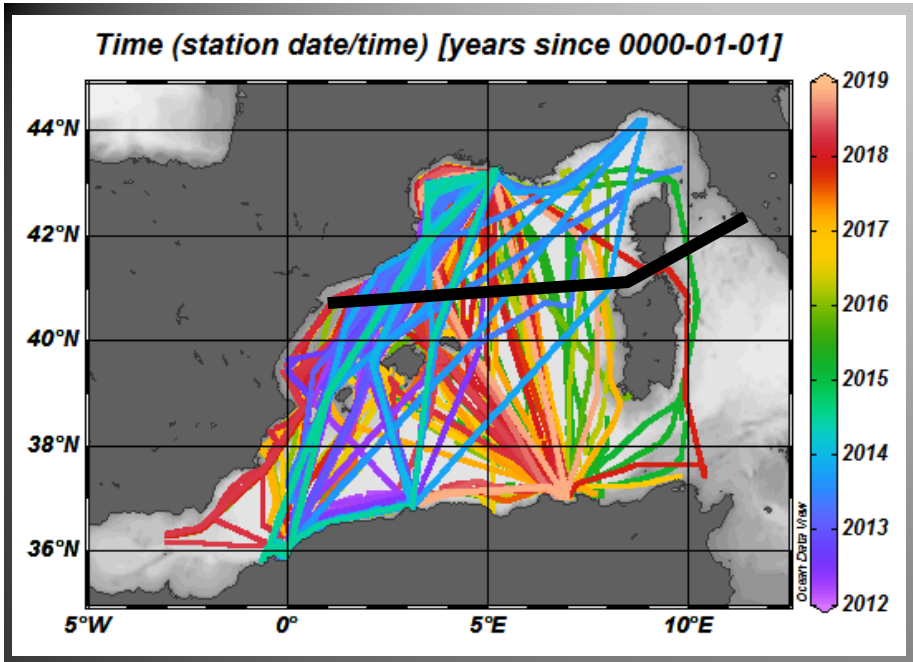
Softs in open source (DT INSU)

(Near-) real time monitoring (hourly status)

Automated data control on the fly, data base and data transmission (Coriolis, GOSUD)

Raw data: acquisition frequency 10s

www.ifremer.fr/transmed

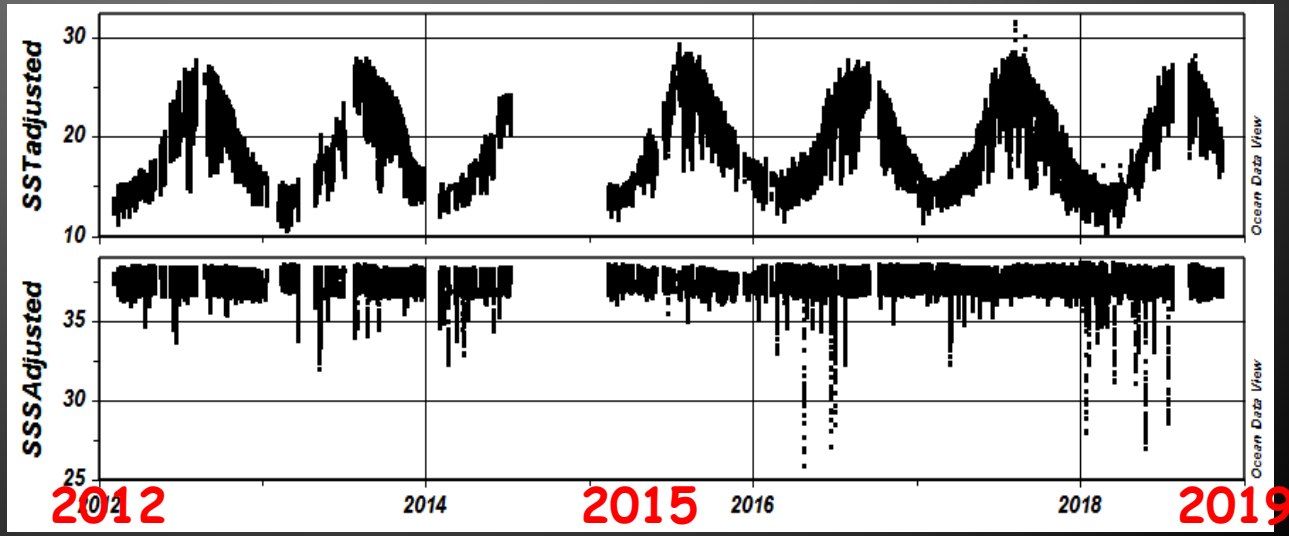


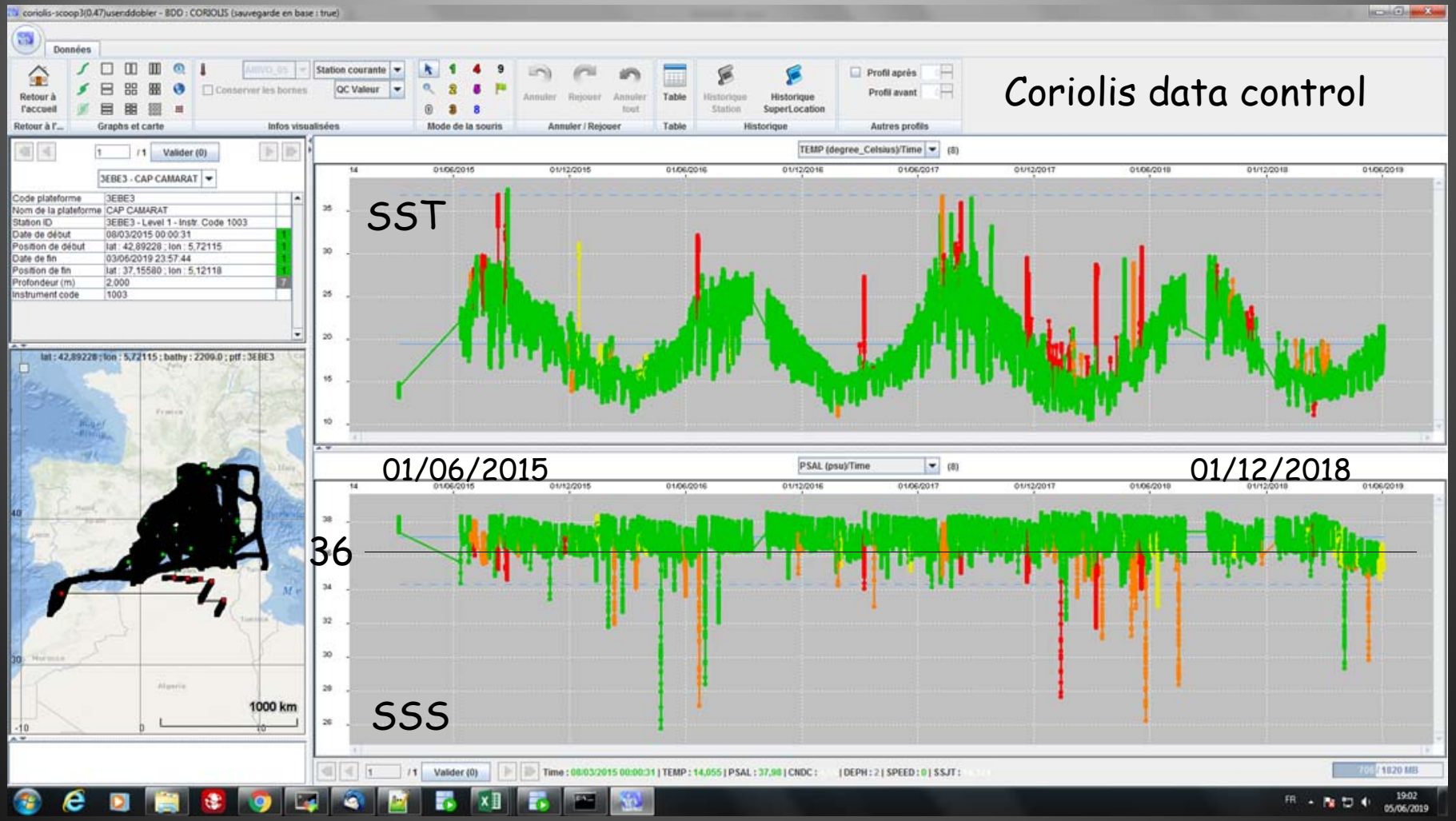
HyMeX ANR ASICS-MED

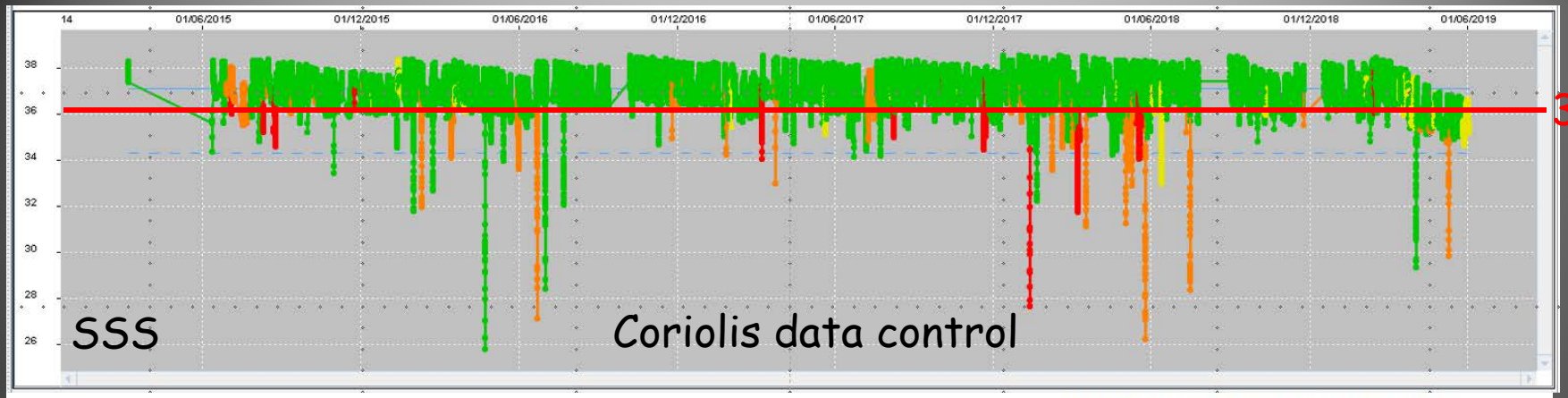
~1AR MRS-Algérie / *~10j

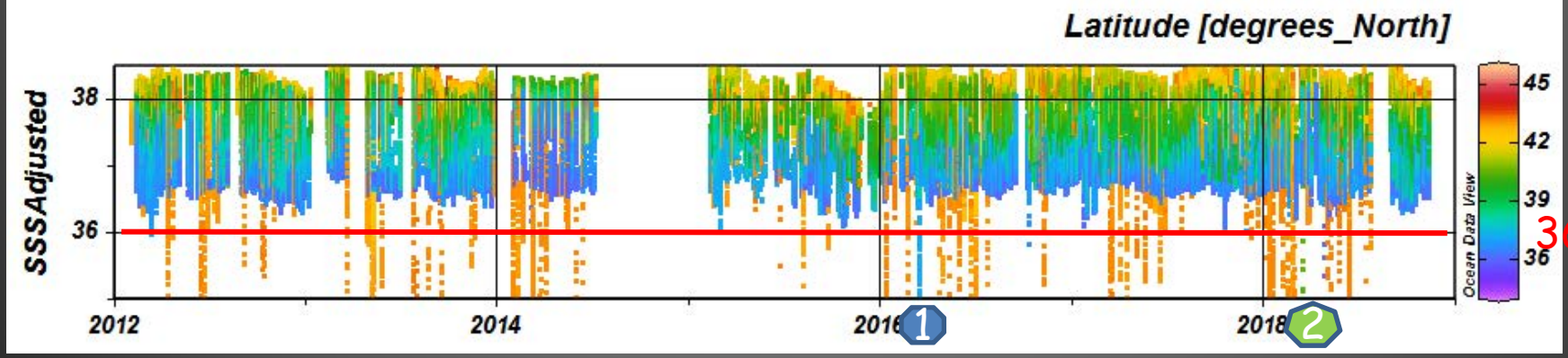
Marfret Niolon (2012-2014)

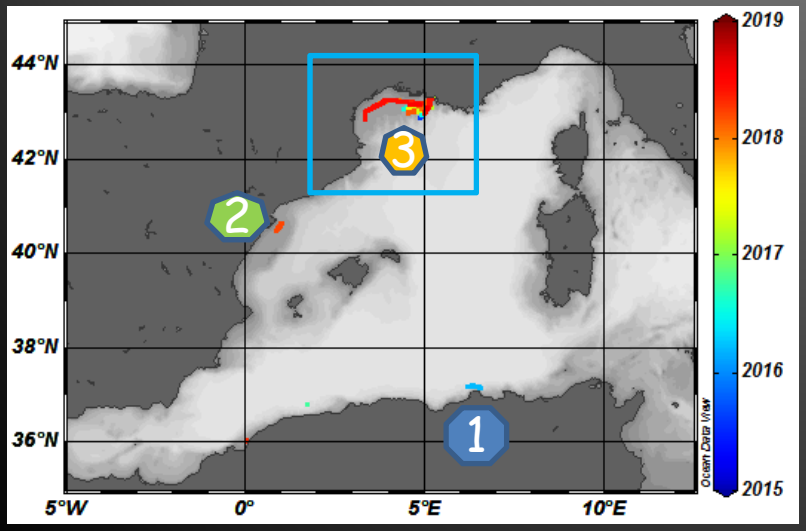
Cap Camarat (2015-…?)

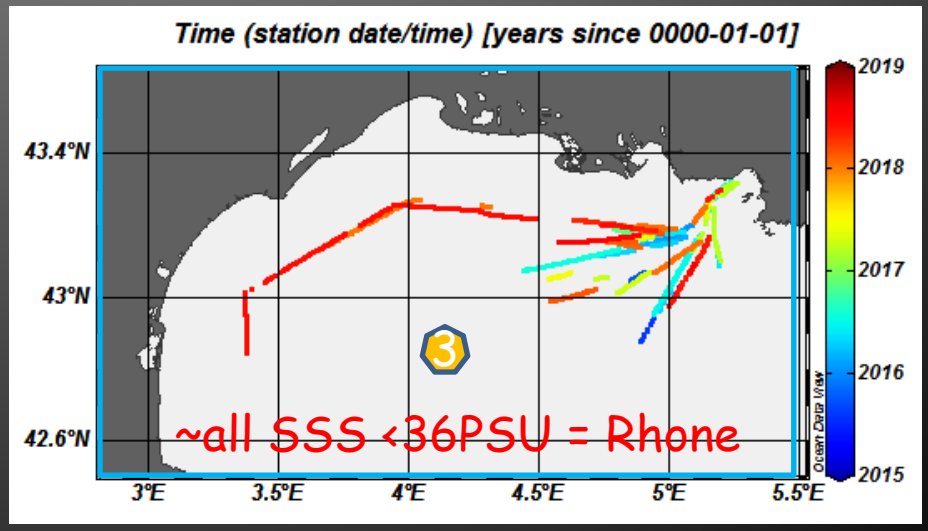


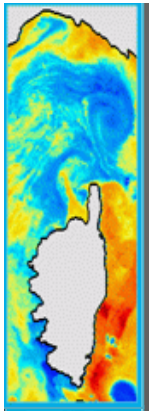
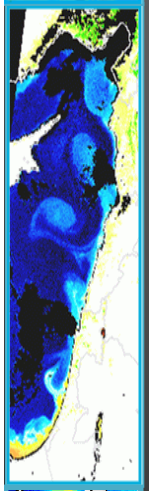
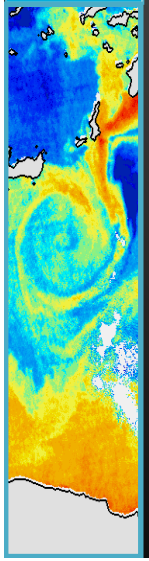

Coriolis data control
SST
SSS
01/06/2015
01/12/2018
36
TEMP (degree_Celsius)/Time
PSAL (psu)/Time
3EBE3 - CAP CAMARAT
Code plateforme 3EBE3
Nom de la plateforme CAP CAMARAT
Station ID 3EBE3 - Level 1 - Instr. Code 1003
Date de début 08/03/2015 00:00:31
Position de début lat : 42,89228 ; lon : 5,72115
Date de fin 03/06/2019 23:57:44
Position de fin lat : 37,15580 ; lon : 5,12118
Profondeur (m) 2,000
Instrument code 1003
1000 km


01/06/2015
01/12/2015
01/06/2016
01/12/2016
01/06/2017
01/12/2017
01/06/2018
01/12/2018
01/06/2019
38
36
34
32
30
28
26
SSS
Coriolis data control
36PSU


Latitude [degrees_North]
SSSAdjusted
38
36
2012
2014
2016
2018
45
42
39
36
Ocean Data View
36PSU
1
2


44°N
42°N
40°N
38°N
36°N
5°W
0°
5°E
10°E
2019
2018
2017
2016
2015
Ocean Data View
1
2
3


Time (station date/time) [years since 0000-01-01]
43.4°N
43°N
42.6°N
3°E
3.5°E
4°E
4.5°E
5°E
5.5°E
2019
2018
2017
2016
2015
Ocean Data View
3
~all SSS <36PSU = Rhone

Feedback Transmed prepared by Delphine Dobler Ifremer /Sismer (June 2019)

4) nombre de mesures,

Le champion toute catégorie est le Cap Camarat avec entre 100 000 et 130 000 mesures par an avec plus de 95% de bonnes mesures en température et en salinité, à la visualisation sous scoop, ça correspond, c'est-à-dire que même si quelques mauvais points n'ont pas été flaggués, on voit bien que la majorité semble cohérente.

…

⇒ Pas besoin de 1 canette/j
⇒ Autorisation Coriolis de ~50 canettes/an depuis 2018
⇒ Assimilation des données real-time ?/ Pas besoin de delayed mode pour certaines utilisations

TRANSMED contributes to the operational oceanography

[Data in real time on www.ifremer.fr/transmed](http://www.ifremer.fr/transmed)

Delayed mode; ~95% des données 2012-nov. 2018

DB ???

FORMAT COLCOR

Freq.	Processing	Origin	Destination
10s	acquisition	ship	local storage
1h	• 1h-data file sent • 1h-data file checked and processed on the fly (errors, missing data, thresholds…)	Ship MIO/La Seyne	Mail MIO/La Seyne TRANSMED DB
24h	• 24h of data from TRANSMED DB decimated (2min median) • 24h of data (re)checked , quality flags added	DT INSU CORIOLIS	CORIOLIS MyOCEAN GOSUD
1 month	data from TRANSMED DB manually screened for doutful data, routines for computation of derived parameters, decimation (2min median) … => **monthly provisory data files** of good quality	MIO/La Seyne	*TRANSMED DB** HyMeX/ SEDOO
1 year	• recalibrations of probes (« as is » + systematic cleaning and replatinization of the conductivity cell) • replay of 1 year of data to account for sensors drifts (~ null) => **monthly definitive data files**	SBE MIO/La Seyne	*TRANSMED DB** HyMeX/ SEDOO *: not implemented yet

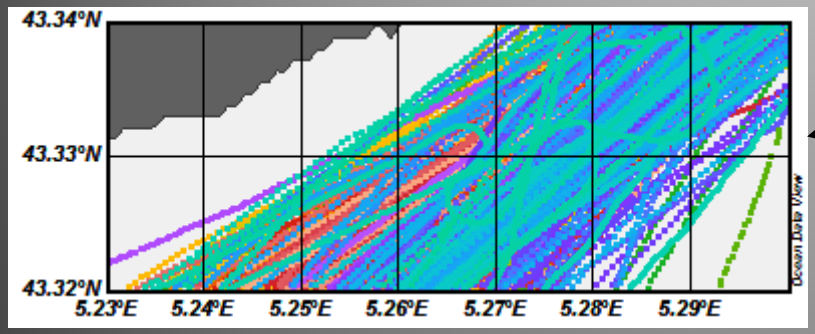
Taupier-Letage, I.; Bachelier, C.; Rougier, G. Thermosalinometer TRANSMED, Marfret Niolon, definitive data set. SEDOO OMP 2014. http://dx.doi.org/10.6096/MISTRALS-HyMeX.1127.

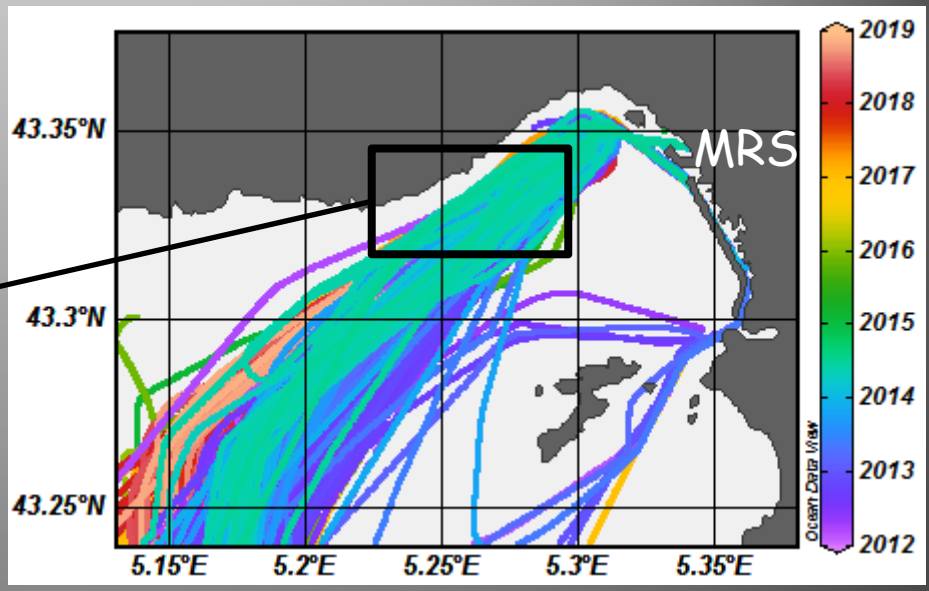
…..

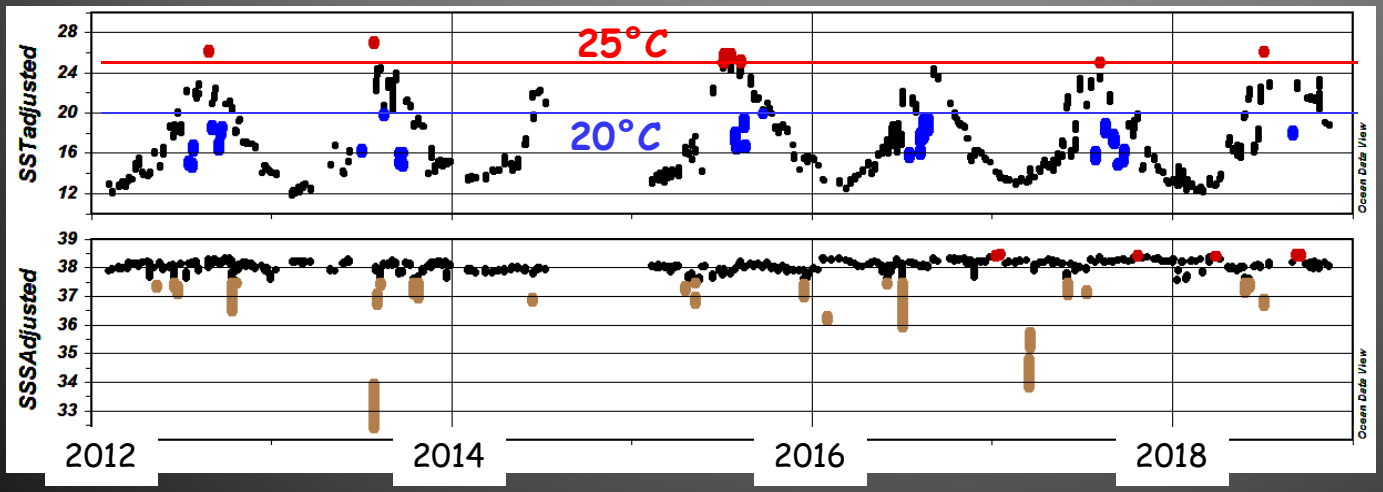
Cadres:

- LOP de HyMeX/MISTRALS (= > **2010 - 2020 !** …), Coriolis (canettes salinité)
- TRANSMED/PartnerSHIP de la CIESM (mais sans financement pour les lignes du Bassin Occidental)

BAY of MARSEILLE
(HR: 10s/~80m)





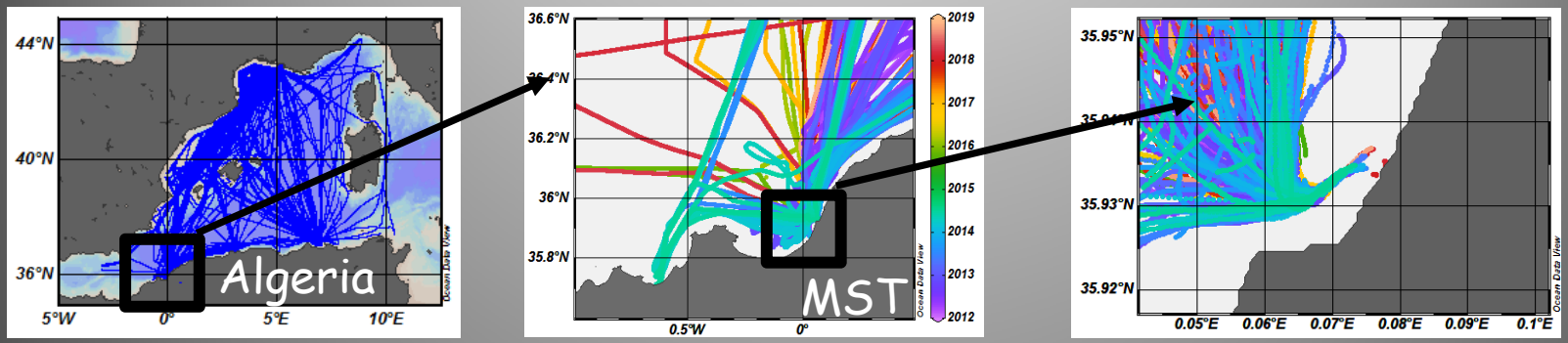


- Warm episode
- Upwelling
- High SSS
- Rhone influence

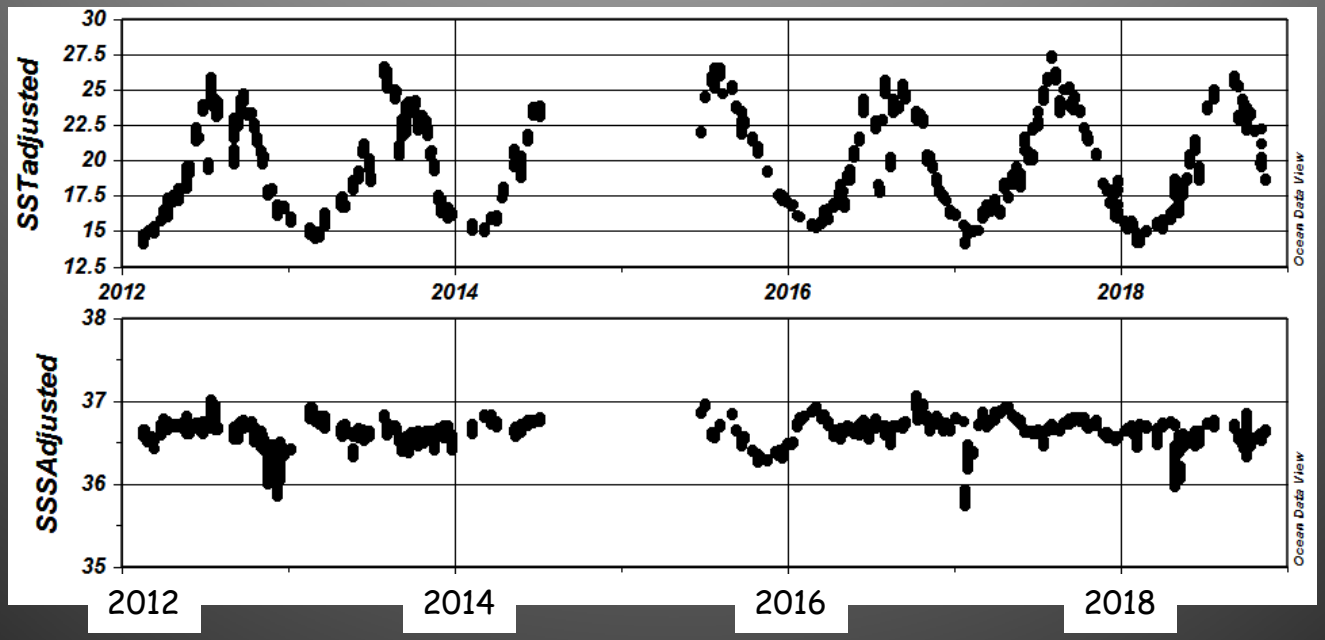
Mean SSS: 38,10 +/- 0,17PSU

MARINE HEAT WAVES

COASTAL MONITORING MADE EASY (...)



Bay of Mostaganem (HR: 10s/~80m)



Allows to address the missing 2/3 of the Mediterranean

N.B.: WMO#40 compliant

Coastal monitoring of remote areas (exotic archipelago) made easy (…)

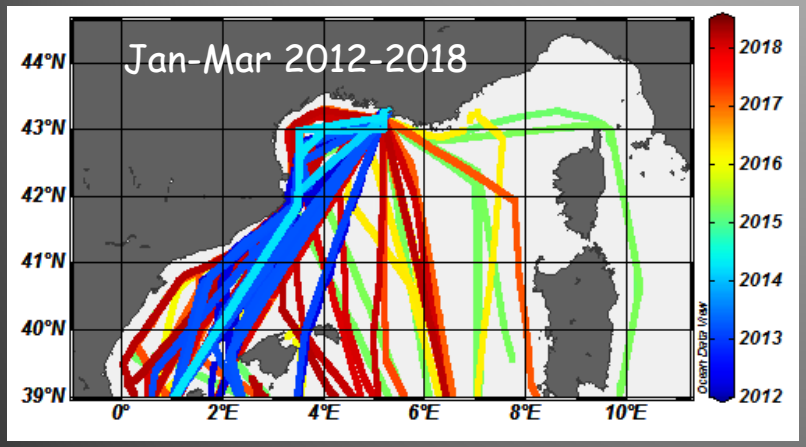
www.hymex.org

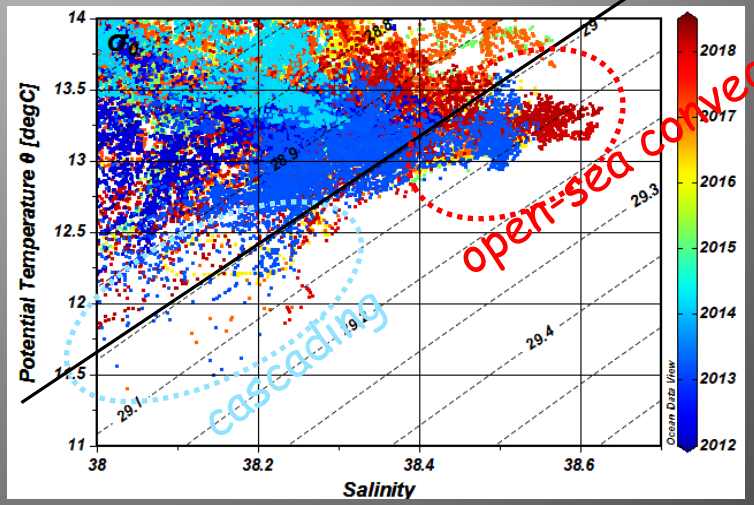
HyMeX

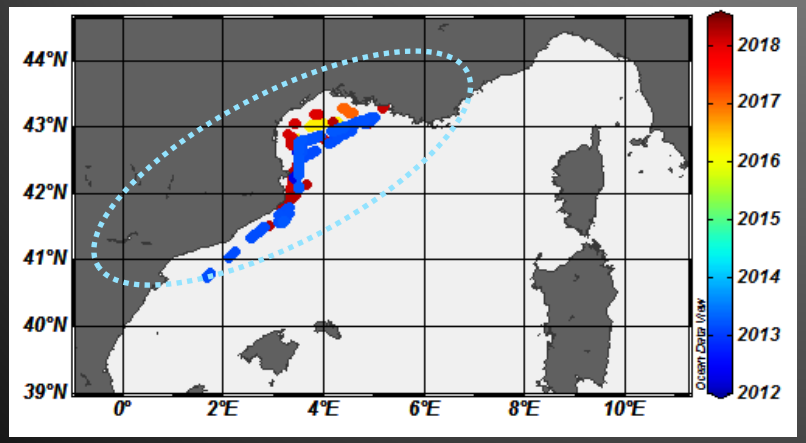
HYdrological cycle in Mediterranean EXperiment

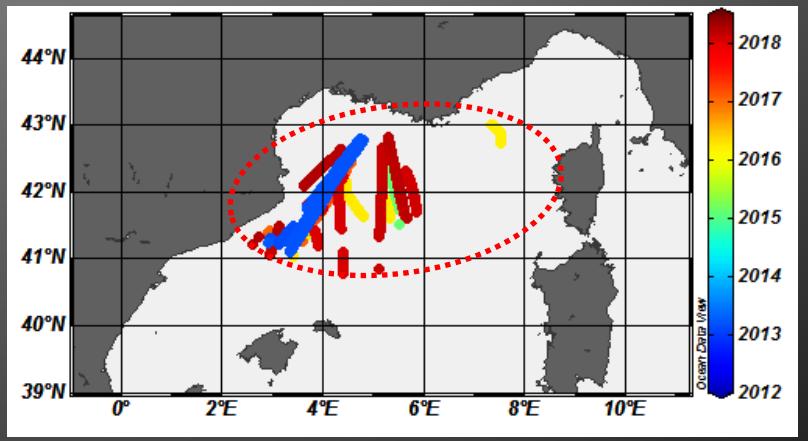
Dense Water Formation in the NW Med

TRANSMED specificity on these 2 lines:
transit time between T and C samplings known
=> sound density computation







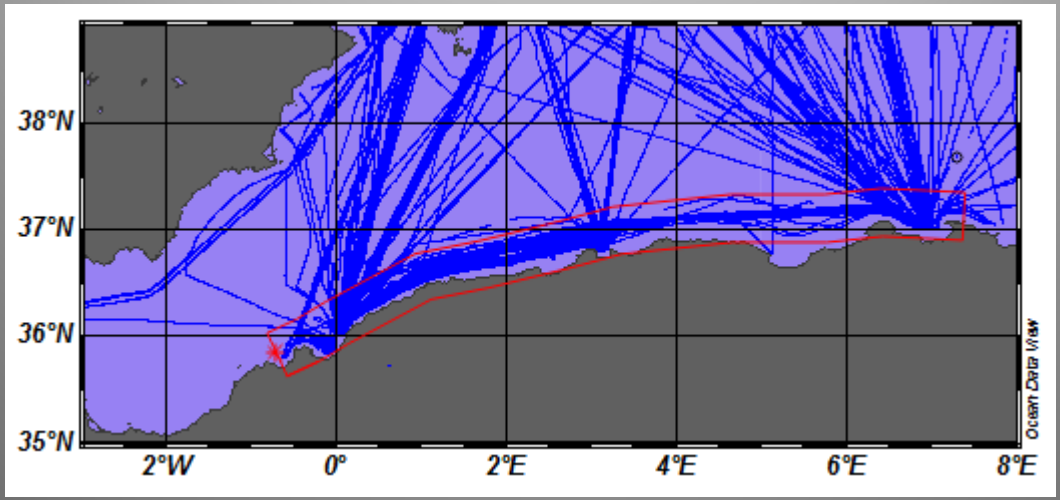


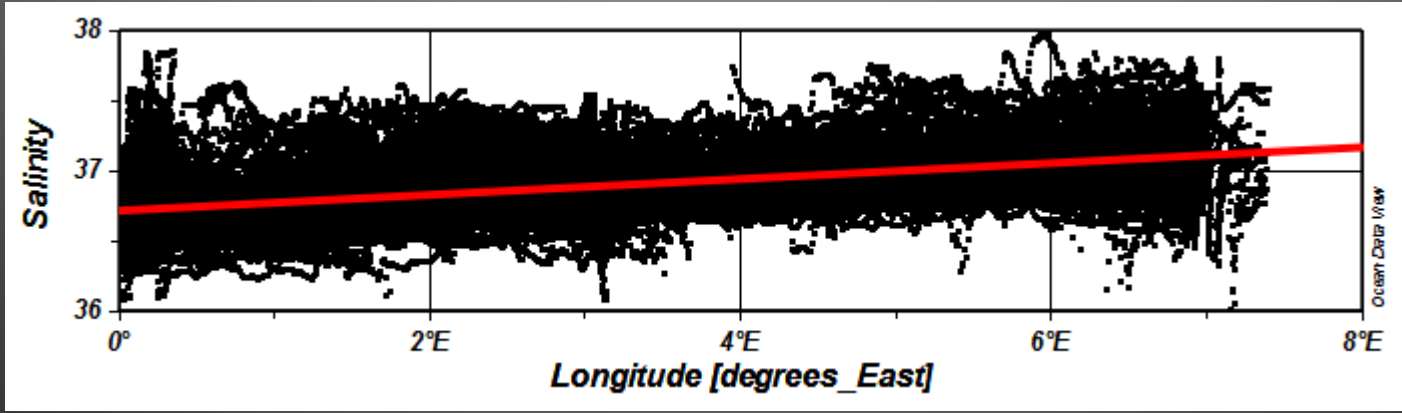
cascading

open-sea convection

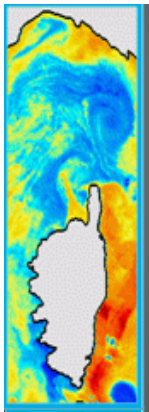
N.B.: data quality controlled /delayed mode

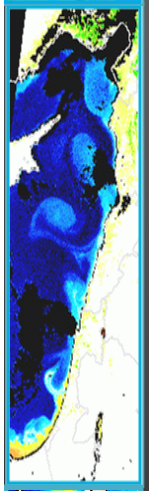
Shipborne LIDAR !?

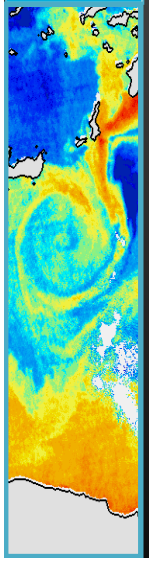




Impact of the mesoscale activity of the Algerian Current:
~ + 0.06 PSU / degrees_East
(criterion for models' quality assessment)







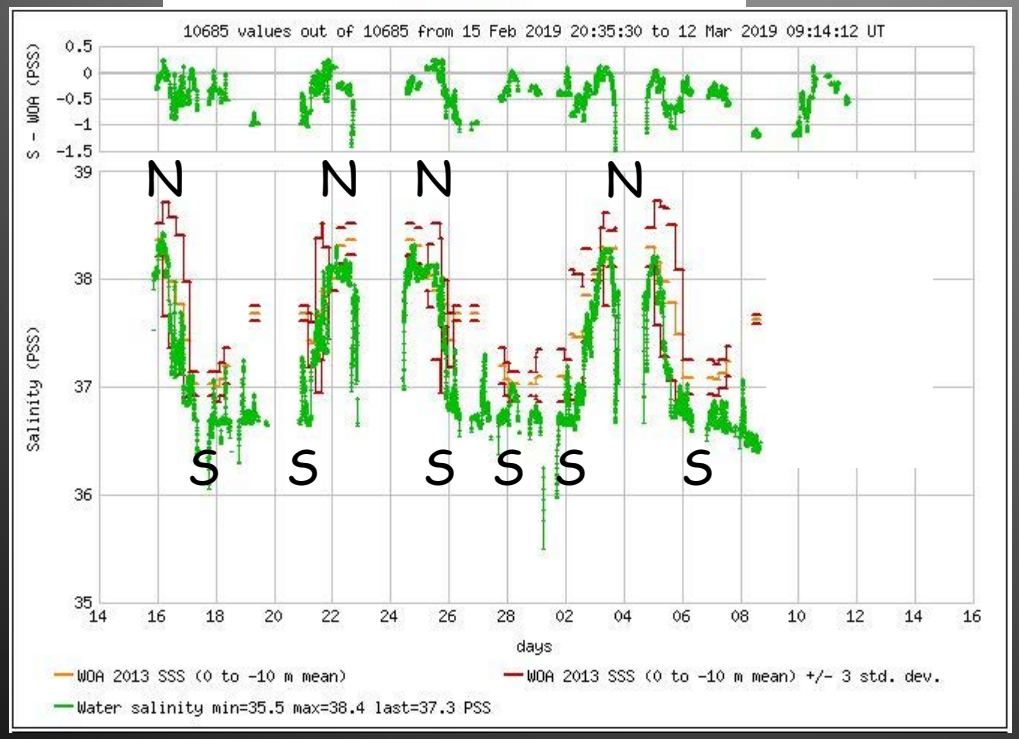
Amélioration de la simulation de la SSS en Méditerranée (Mercator) … et de la climatologie dans la partie Sud

Sea Surface Salinity Observation Service

Cap Camarat

Last updated processing on 14 Mar. 2019 09:30:27 UT

WATER and POSITION measurements within climatic limits

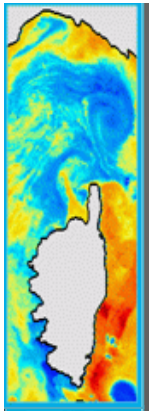


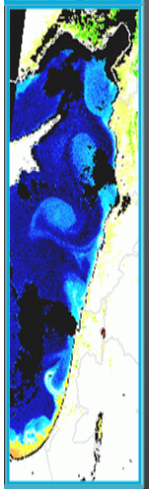
Évaluation continue des données de SSS par l'ORE SSS: données de TRANSMED

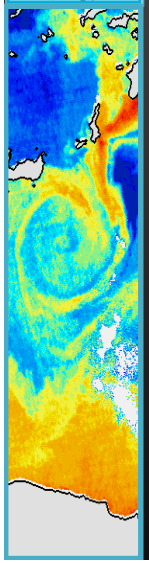
Les valeurs de SSS sont valides

La climatologie est valide dans la partie Nord (2019 hiver exceptionnellement doux),

… mais pas dans la partie Sud







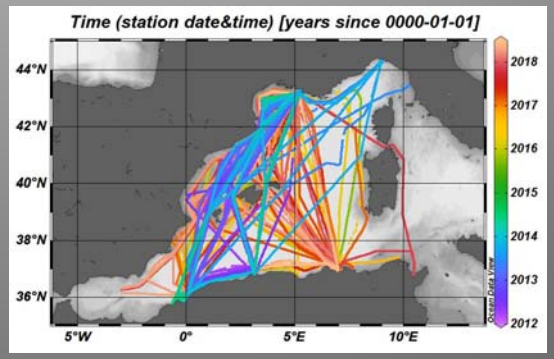
TRANSMED : (réseau de) thermosalinos low-cost et autonomes

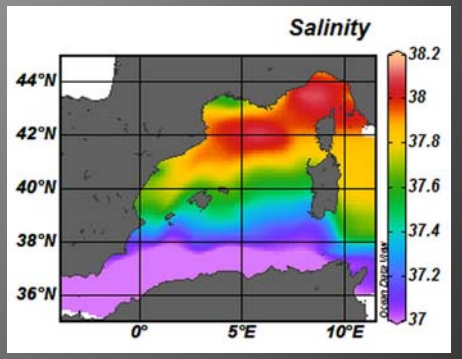
Support aux travaux de validation de SMOS

Data => GOSUD (partie de programme SoT : http://www.jcommops.org/sot/)

Olmedo, E. , Taupier-Letage, I. , Turiel, A and Alvera-Azcarate, A. 2018. Improving SMOS Sea Surface Salinity in the Western Mediterranean Sea through Multivariate and Multifractal Analysis. Remote Sens. 2018, 10(3), 485; https://doi.org/10.3390/rs10030485

(à suivre: extension à la période 2015-présent)

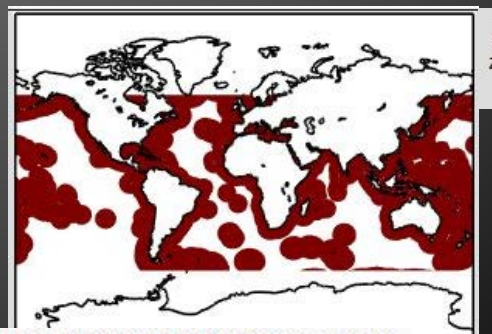




Soutien de N. Reul (IFREMER)

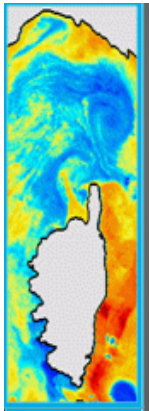
Pi-MEP Regions

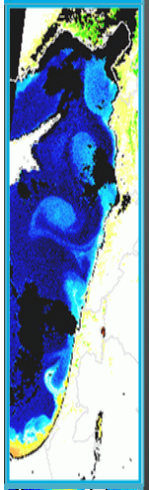
Mediterranean Sea

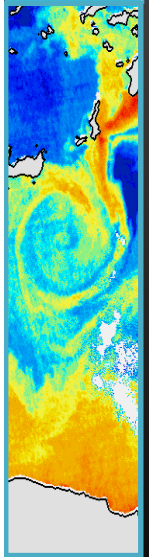


SMOS coastal zone (<800km) 60N-60S

Match-up databases are analyzed globally but also for each Pi-MEP validation region. A dedicated MDB report is provided for each triplet: Pi-MEP Region-Satellite SSS product-In situ SSS product.
These regions are defined in the following table:







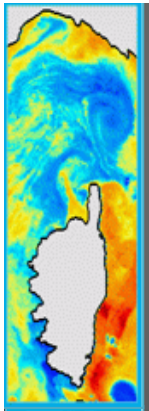
Leçon 1:

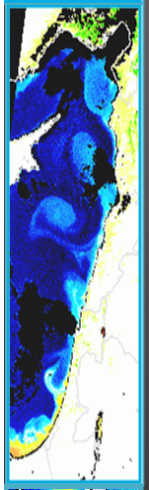
Le KISS principle : excellent rapport qualité-effort (prix/manpower) *

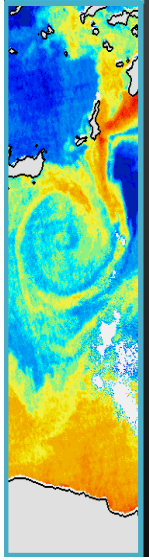
- adapté aux petites équipes
- adapté aux petits budgets **
- adapté aux zones côtières
- adapté aux grandes étendues/échelle de bassin
- soutenable sur la durée /décades/échelles climatiques

* budget TRANSMED garanti pour 10ans avec la LOP HyMeX/MISTRALS

** TRANSMED: ~10-15k€ équipement, ~5k€/an maintenance

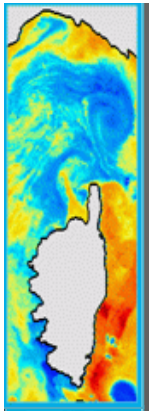


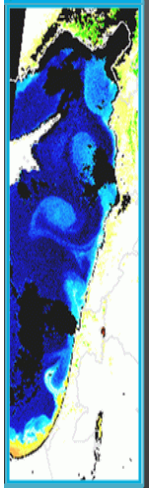


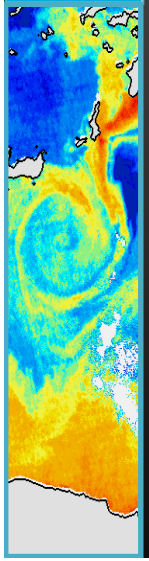


Leçon 2:

Le KISS principle c'est pas sexy !!
Pas de cutting-edge technology
=> beaucoup de guichets de financement fermés





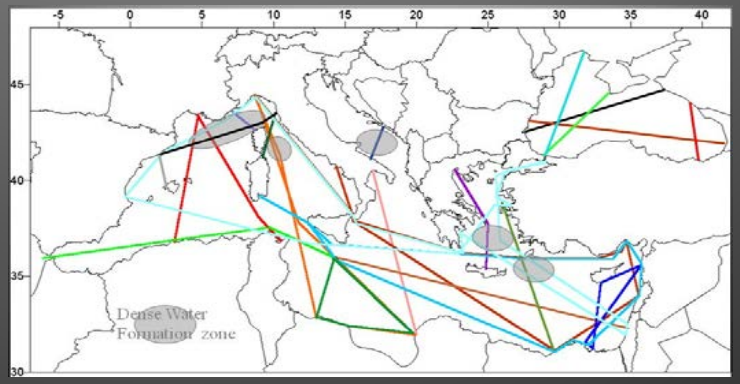


...

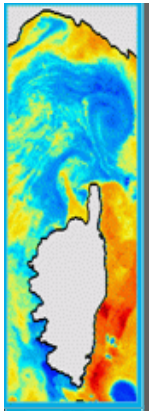
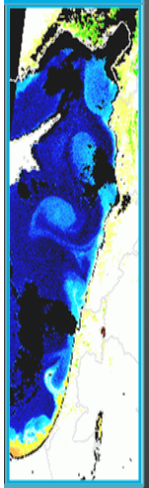
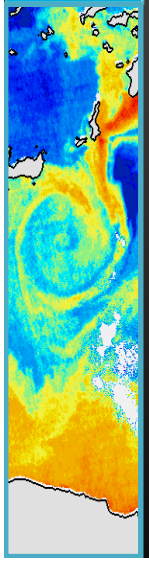
Leçon X:

Malgré le budget TRANSMED garanti pour 10ans avec la LOP HyMeX/MISTRALS, **après 10 (15) ans: y'en a marre !**
(slide Sabrina: cheveux blancs, « proche » de la retraite, pas d'ITA/relève, pas de budget récurrent)

La taille critique de l'équipe ne sera jamais atteinte pour monter un (des) réseau(x)



TRANSMED Project: network of low-cost autonomous (KISS) thermosalinographs (TSG) on ships of opportunity

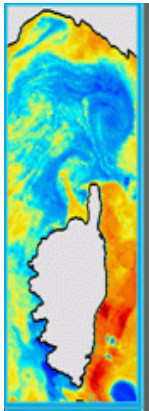
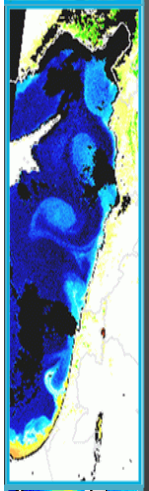
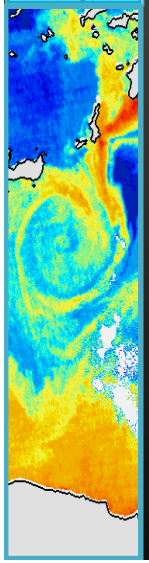




Quel avenir ?

- Miniaturisation du système TRANSMED sur Rasberry Pi (2019 DT INSU)
- => possibilité d'installation sur les navettes de passagers des petites îles/AMP , rades (Toulon)

- Fin financement HyMeX: 2020 => ??

PB: on ne surveille plus les caractéristiques
de l'eau atlantique qui entre à Gibraltar depuis 2012 !!
=> Pb pour les simulations de l'évolution de la Méditerranée

Quel avenir ?

- **Sous-traiter** à une structure qui a le savoir-faire dans l'opérationnel, est dimensionnée en conséquence,… et connaît les arcanes des financements/contractualisation.

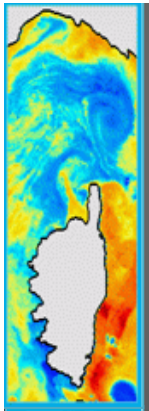
Avantages 1:

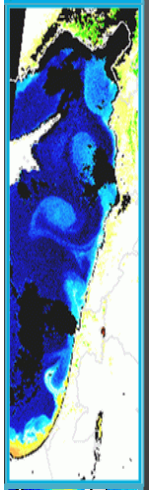
- le système TRANSMED peut être déployé partout et est interchangeable
- La « structure » peut gérer un réseau au niveau mondial avec quelques correspondants locaux
- Personnel « permanent »

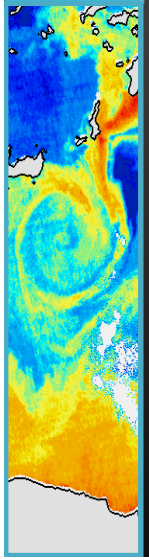
Avantages 2:

les chercheurs n'ont plus qu'à:

- Piloter le réseau (quelles lignes?)
- Vérifier la validation des données
- Chercher!!!!







Remerciements:

Compagnies maritimes (SNCM, Linea Messina, Marfret, CMA-CGM)

DT INSU

HyMeX/MISTRALS, ANR ASICS-MED

SISMER/Coriolis

Et toutes les personnes impliquées !