4th SDC Plenary Meeting, October 30th 2020

SeaDataCloud

V2 Climatologies and new products

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Status of V2 climatologies and new products

Production of V2 climatologies and new products is at various stages:

- ready, need to finalize the PIDoc or PIDoc ready for review
- some need final analysis of experiments to launch production and finalize PIDoc
- some are facing computational issues
- some are still in test phase

we expect to have them ready before the end of November for D11.7 and publication

Objectives

1. to optimize the workflow
2. to ameliorate QC during the data integration process
3. to track the metadata of external data
4. to improve the quality assessment of climatologies (residuals, cross validation)
5. to improve the consistency analysis versus WOA to consider each produced gridded field

V2 Regional Climatologies

	resolution	time cov	Annual	Seasonal	Monthly	External Source
ARC_1	**1/4x1/8°**	1955-2019		x	x	WOD18
ARC_2	**1/4x1/8°**	6 decades		x	x	WOD18
BAL_1	1/16°x1/32°	1955-2018		x	x	CORA5.2
BAL_2	1/16°x1/32°	6 decades		x	x	CORA5.2
NAT_1	1/2°	1955-2019		x	x	CORA5.2
NAT_2	1/2°	6 decades		x	x	CORA5.2
MED_1	1/8°	1955-1984		x	x	CORA5.2
MED_2	1/8°	1985-2018		x	x	CORA5.2
MED_3	1/8°	6 decades		x		CORA5.2
BLS_1	1/8°	1955-2019		x	x	WOD18, CORA5.2
BLS_2	1/8°	1955-1999		x	x	WOD18, CORA5.2
BLS_3	1/8°	2000-2019		x	x	WOD18, CORA5.2
BLS_4	1/8°	6 decades		x		WOD18, CORA5.2

Harmonized approach

- new V2 data input
- cover the time period 1955-2018/9
- adopted WOA standard vertical levels
- **integration with external sources: WOD and/or CORA**
- all use **DIVAnd**

NS_1	1/8°	1955-2014	x		x	WOD18
NS_2	1/8°	6 decades		x		WOD18
NAT_3	1/4°	1955-2019		x	x	CORA5.1
NAT_4	1/4°	6 decades		x	x	CORA5.1

North Sea only V1

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V2 climatologies

Product	main activities
GLO	update input WOD18 - NLQC applied to WOD18 - optimized DIVAnd tuning
ARC	update input V2 dataset - DIVAnd uptake
BAL	update input V2 dataset
NAT	update input V2 dataset - DIVAnd uptake (issues due to the large input dataset)
MED	update input V2 dataset - optimized DIVAnd tuning using syntetic profiles from reanalysis - DIVAnd optimization tool – cross validation
BLS	update input V2 dataset, coupled T-S data (to avoid density inversions in merged T-S climatology)

Global Climatologies

Name	horizontal resolution	time coverage	monthly	Data Source
GLO_1	1/4°	1900-2018	x	WOD18
GLO_2	1/4°	2003-2018	x	WOD18

A global SDC product has been created for the first time

→ two different monthly climatological fields for T and S with a different time coverage, computed from **WOD18** data since spatial coverage of SDN data at global scale is still too sparse

→ implemented Non Linear Quality Check

Next releases would integrate SDN and WOD data

Data integration in SDC (BLS example)

	SDC unrestricted	SDC restricted	WOD	CORA
% stations	74	7	18	1
% samples	60	6	34	0.14

Excluding internal duplicates

- 1605 WOD
- 20915 CORA

Identifying and excluding overlapping data

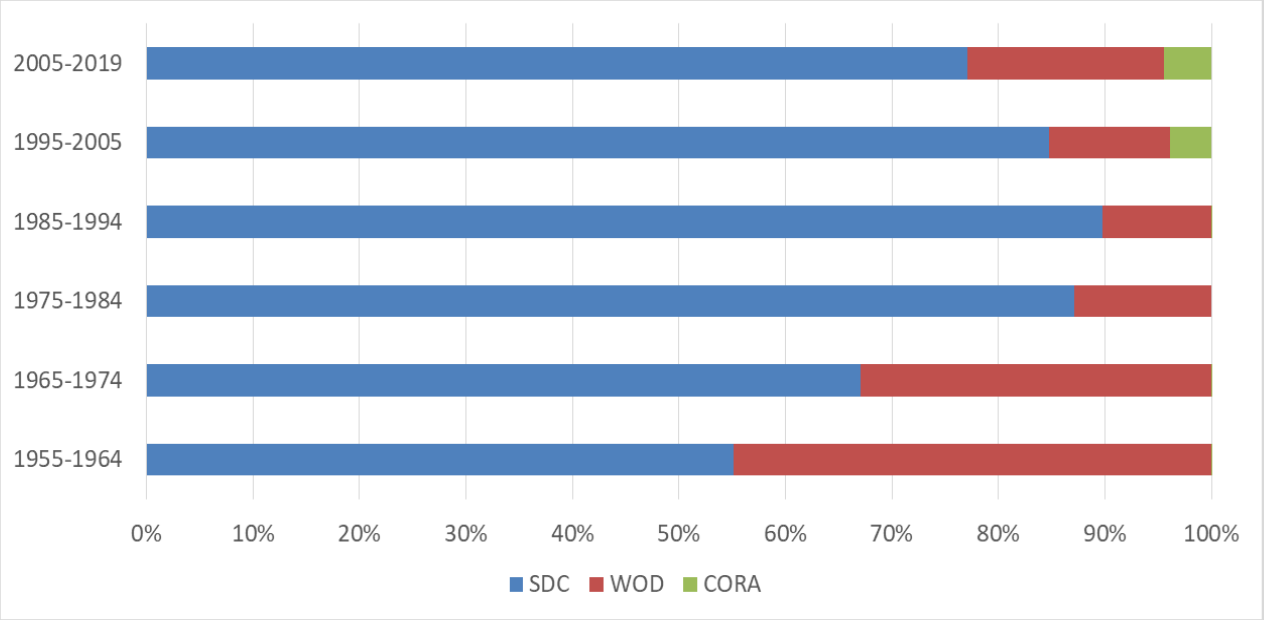
- 50249 WOD stations overlapping with SDC
- 38131 CORA stations overlapping with SDC and 34985 overlapping with WOD

Merging non-overlapping data

- SDC_BLS_DATA_TS_V2 taken as a primary,
- SDC restricted dataset added
- non-overlapping part of the WOD added
- non-overlapping part of the CORA dataset was added

Data integration in SDC (BLS example)

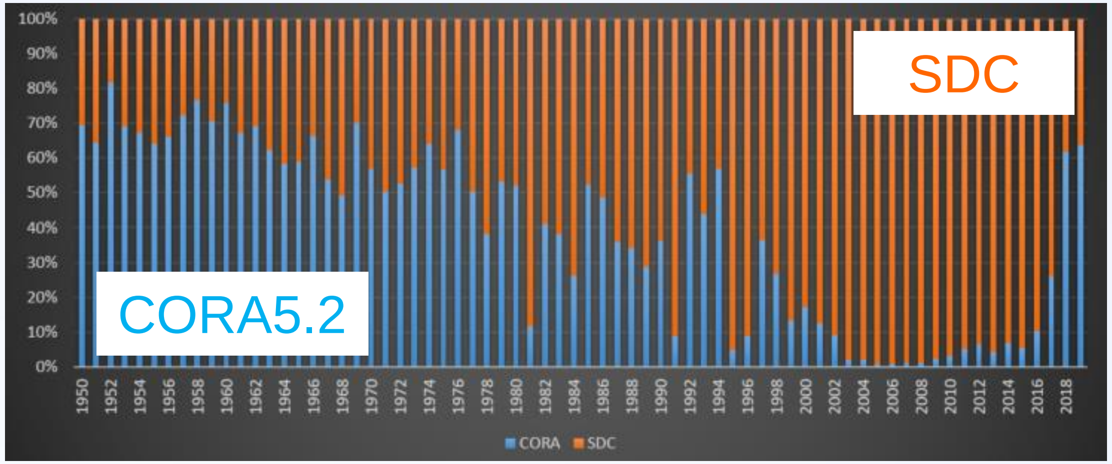
	SDC unrestr	SDC restr	WOD	CORA
% stations	74	7	18	1
% samples	60	6	34	0.14

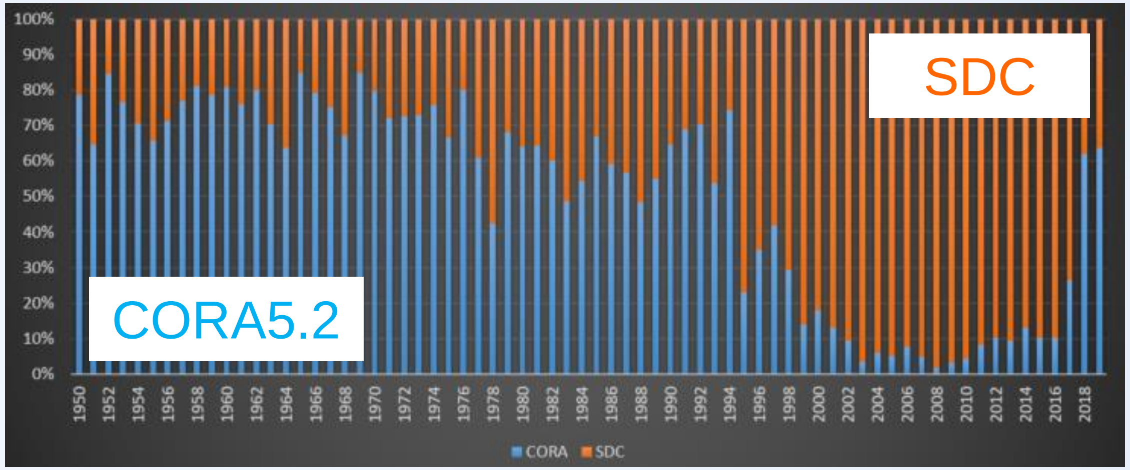


Including data from external data sources significantly increased data availability in BLS 1955-1964 → the contribution from external data sources reaches 45%

Data integration in SDC (NAT)

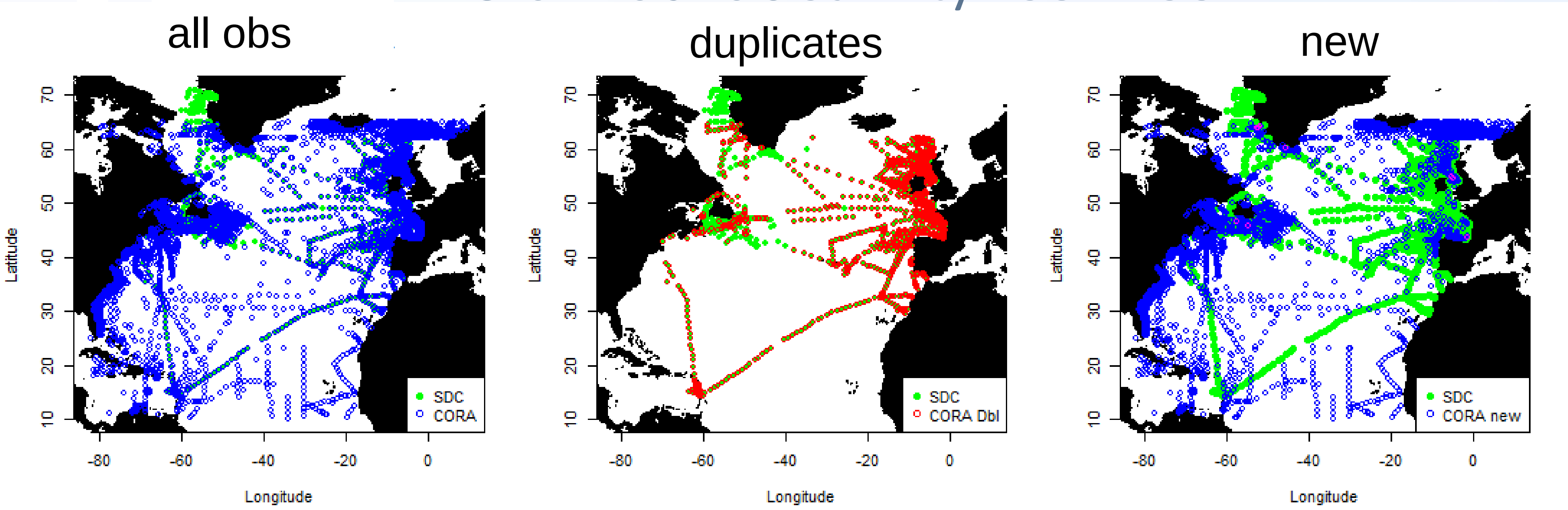
Temperature





Salinity

North Atlantic Salinity 1951-1954



Distribution of CORA and SDC data in the final input data set

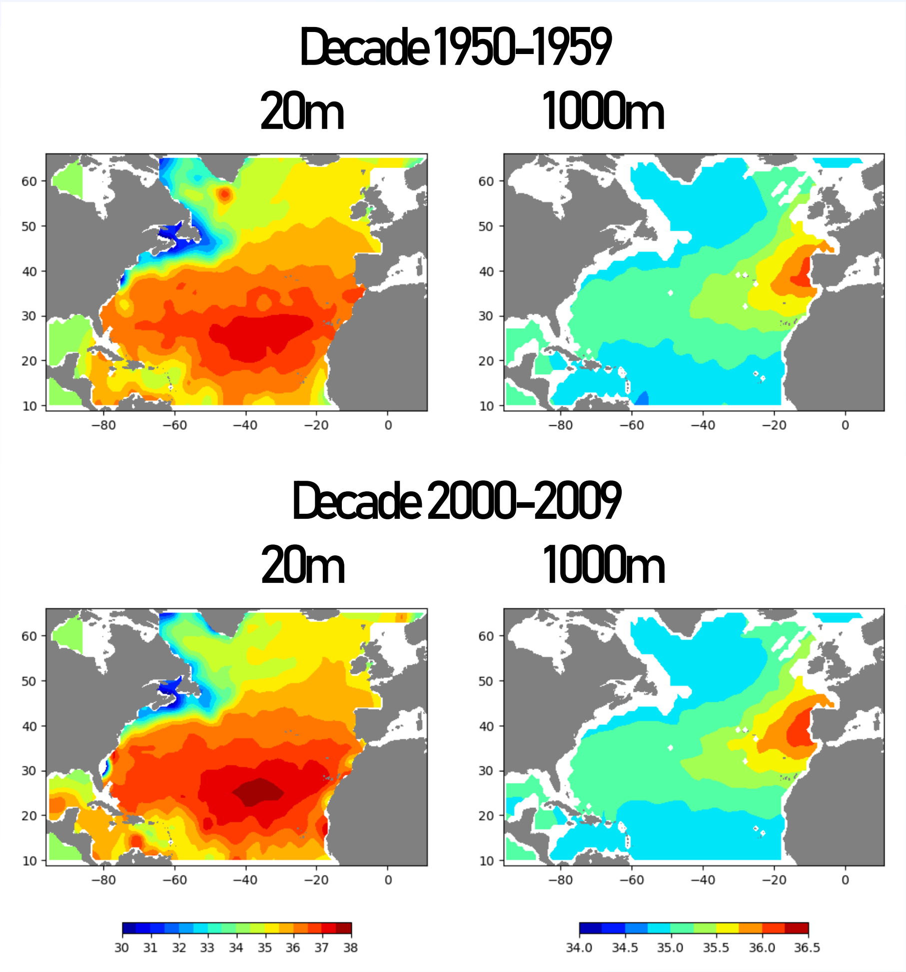
Preliminary Quality Control

- Preview (ODV) of WOD and CORA datasets revealed presence of a significant number of anomalous data that were originally flagged as good→ additional QC was applied to before data integration in particular to identify and flag
- obvious outliers,
- bad profiles

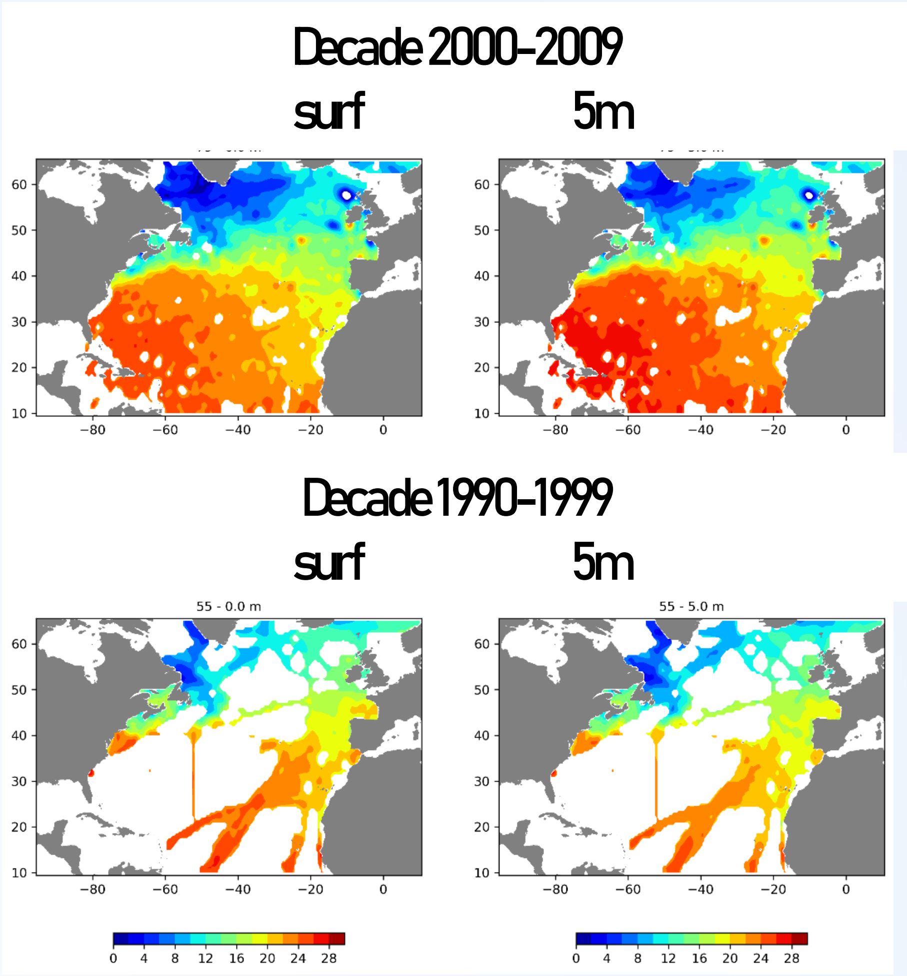
keeping track of data anomalies through unique station identifier

Preliminary Results (NAT)

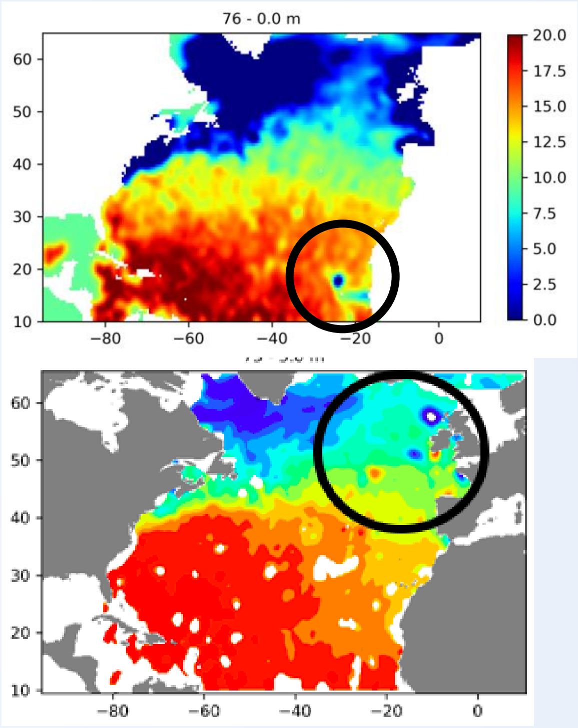
Autumn Salinity



July Temperature



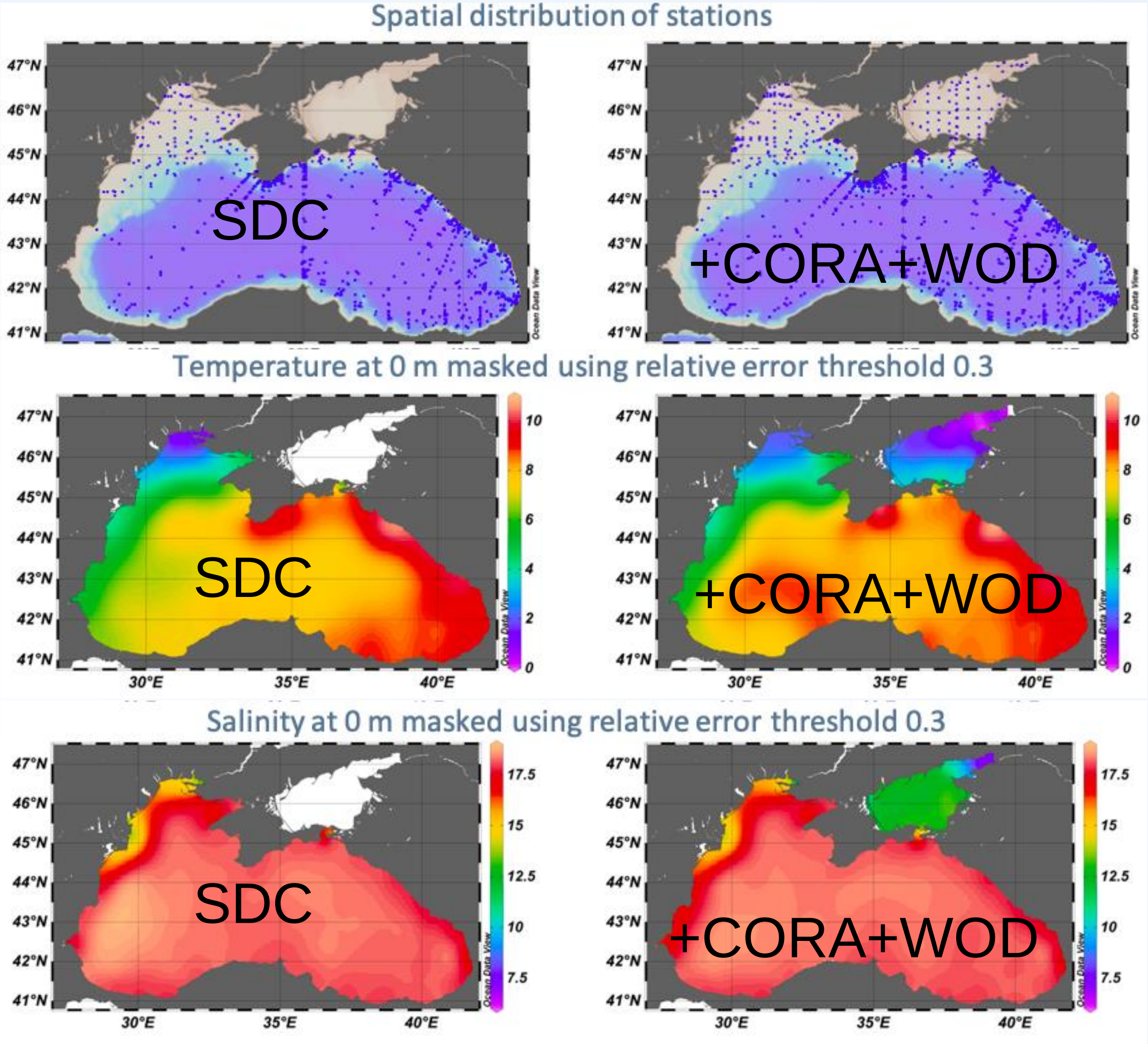
“outliers”

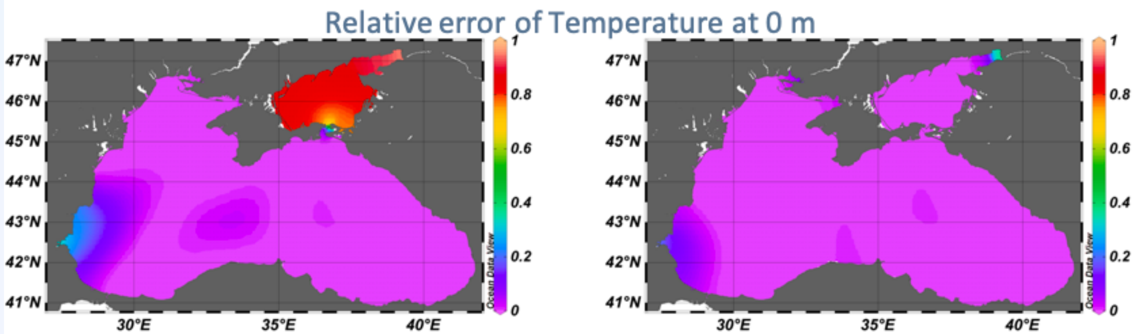


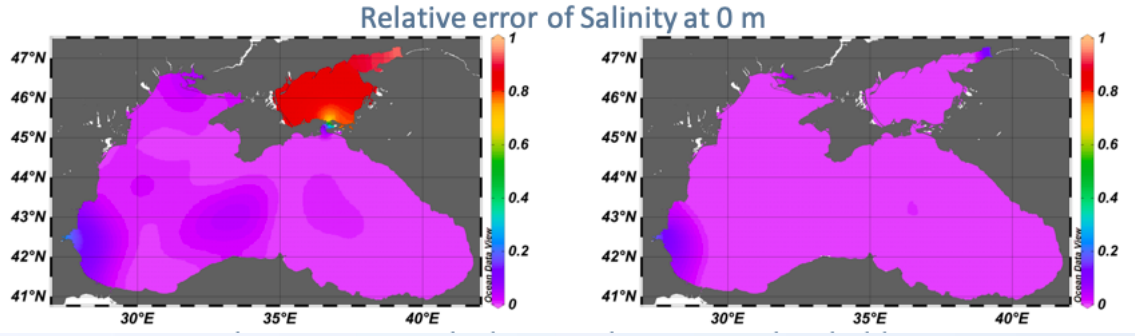
Difficulties to switch to DIVAnd due to large dataset (~200 M data)

Results (BLS)

1955-1964 decade







Impact of addition external data sources → relative error decrease
elimination of the areas where relative error exceeds 30%

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Preliminary Results (MED)

Synthetic Experiments using CMEMS Med Reanalysis data set 1987-2018

Simoncelli et al. (2019)

https://doi.org/10.25423/MEDSEA_REANALYSIS_PHYS_006_004

analyses with **mean subtracted as reference**

- matrix of RMSE vs MEDREA
- matrix of % evar
- matrix of RMSE residuals
- hovmoller plots
- error fields
- look at interannual variability (months)
- look at the skill along the water column

L: 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1

epsilon2: .2, .4, .6, .8, 1.0, 1.2, 1.4, 1.6, 1.8, 2, 4, 6, 8, 10, 12

MEDSEA_REANALYSIS_PHYS_006_004

MEDITERRANEAN SEA PHYSICS REANALYSIS

MODEL | MED

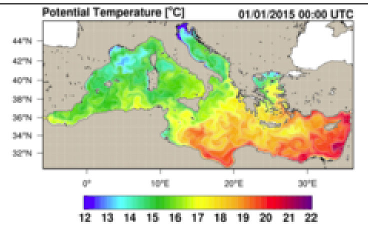
T S SSH 3DUV

0.063 degree x 0.063 degree (72 depth levels)

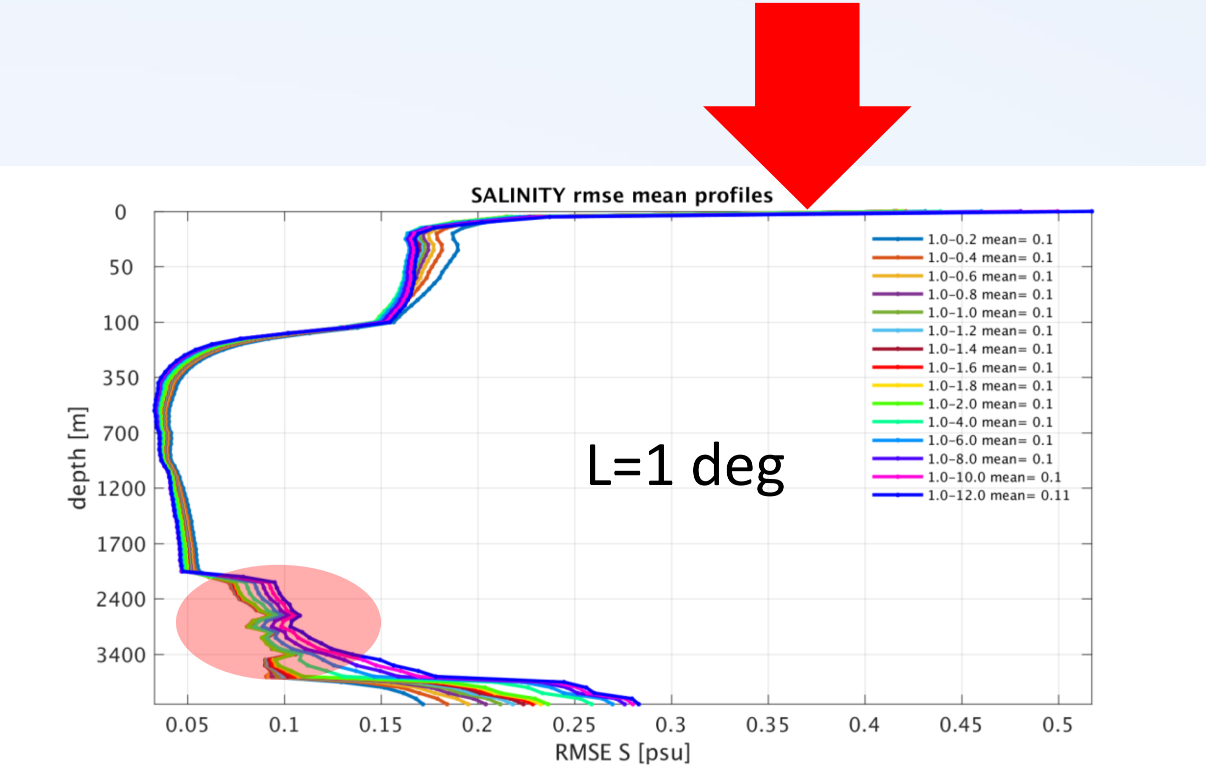
From 1987-01-01 to 2018-12-31

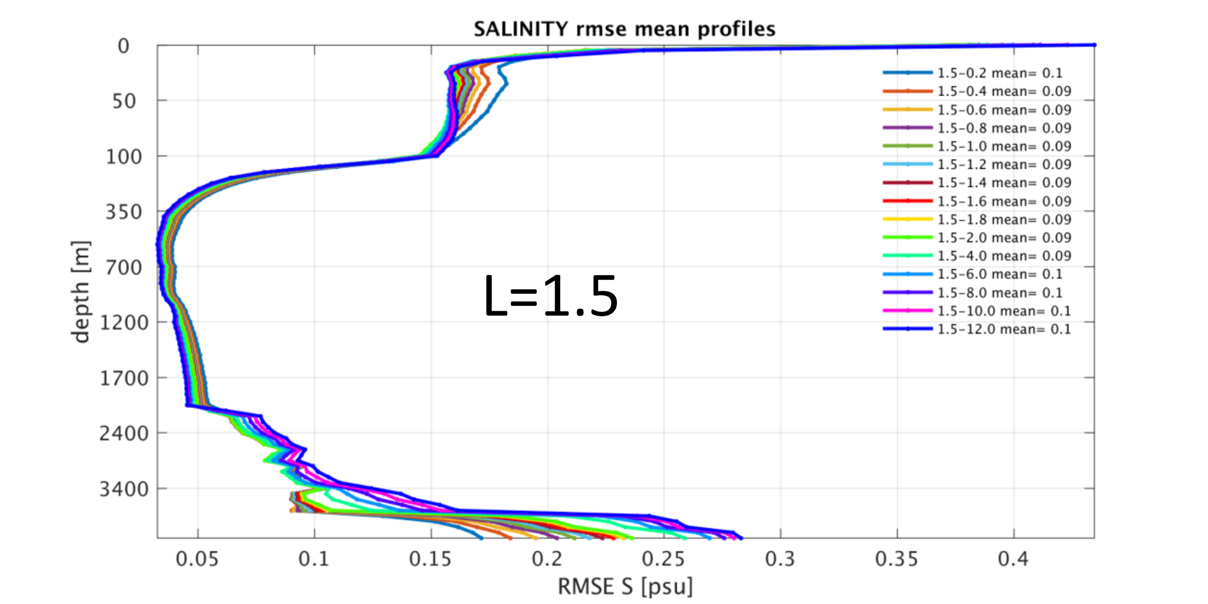
daily-mean,monthly-mean

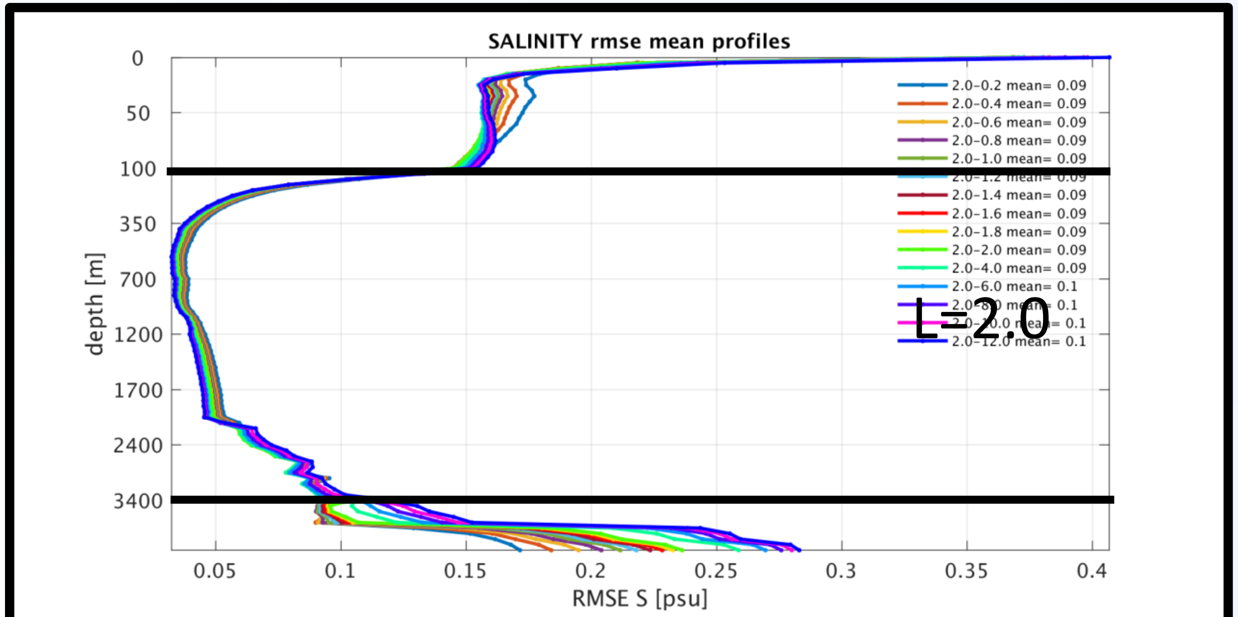
MORE INFO | ADD TO CART | WMS | Sub-setting



Preliminary Results (MED)







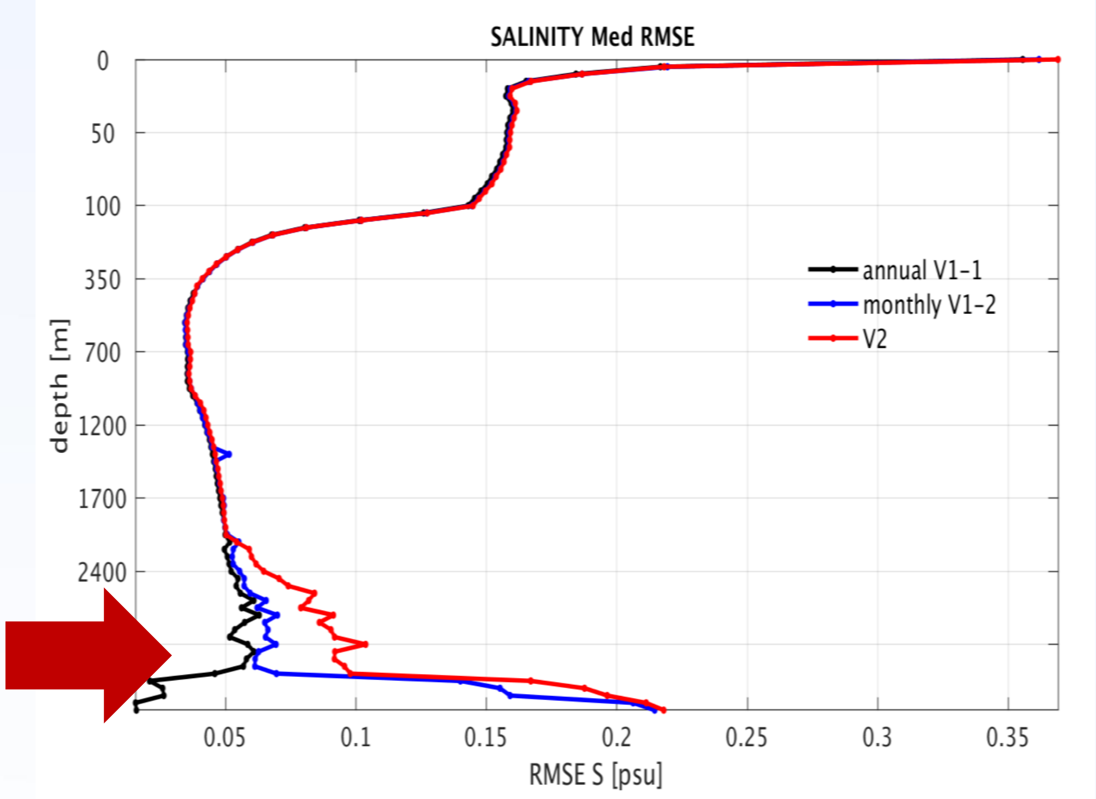
RMSE computed versus MEDREA climatology

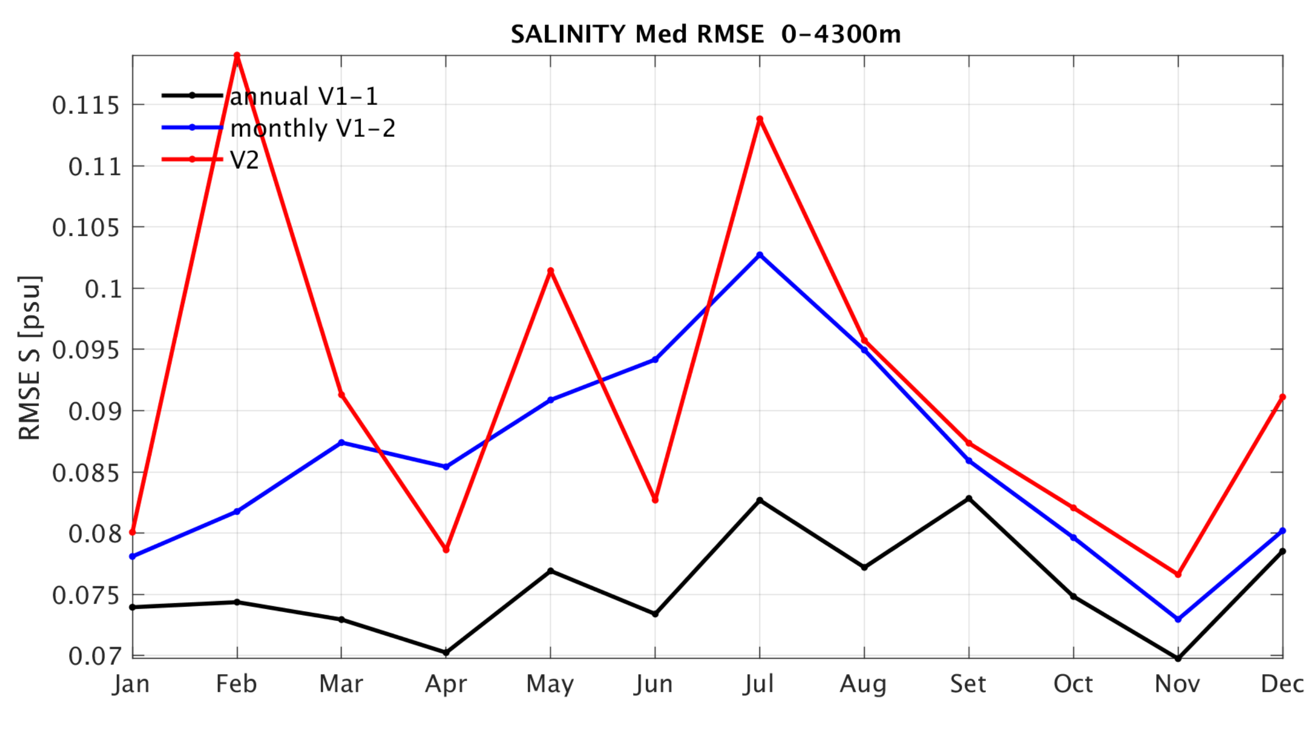
3 layers for S

1. 0-100m → 0.6<epsilon2<8.0
2. 125-3300m → small sensitivity
3. 3400m-bottom → epsilon2<1.6

introducing a background field
L=2, epsilon2=1.2

Preliminary Results (MED)





- finishing to analyze the experiments, L optimization, cross-validation results
- integrating SDC_V2 with CORA5.2

→ production

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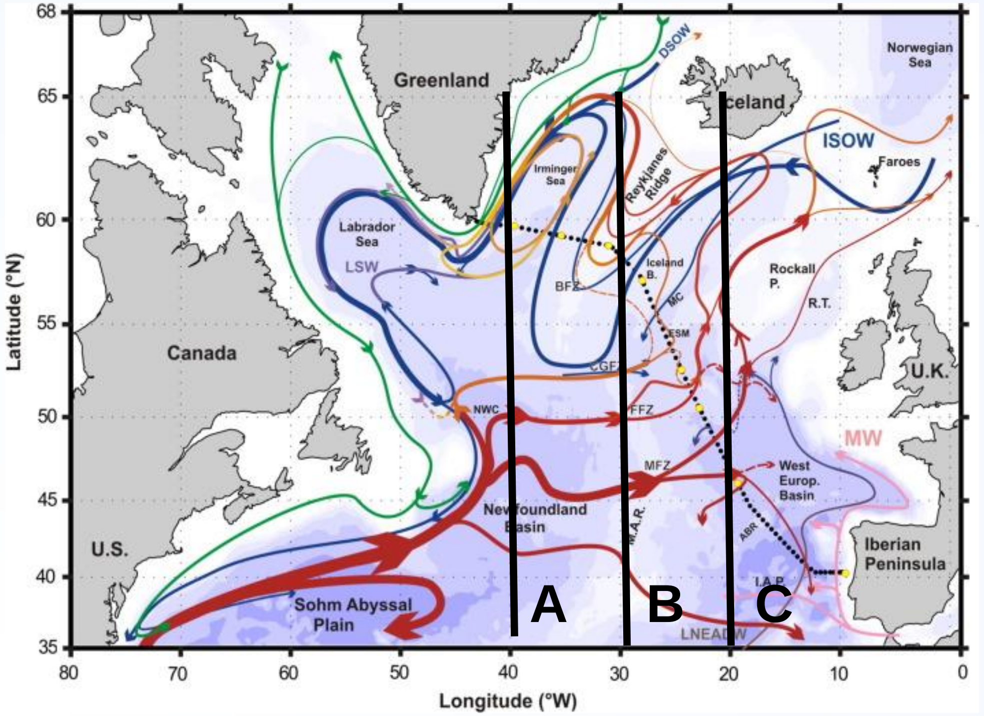
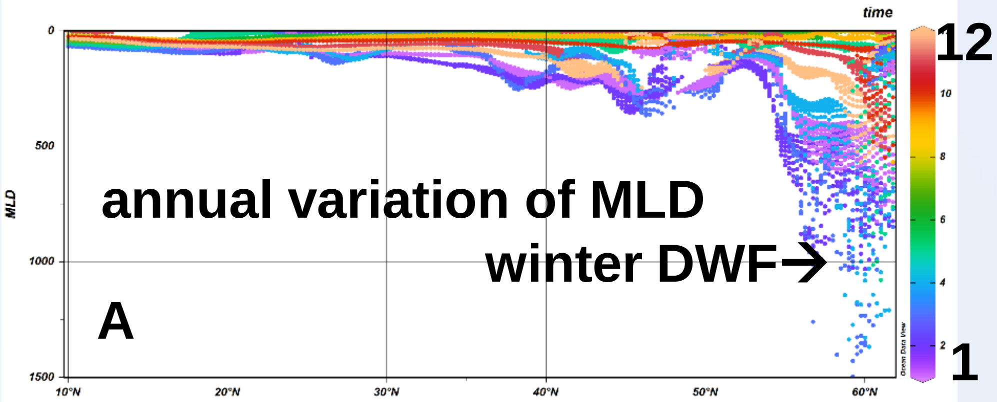
New Data Products

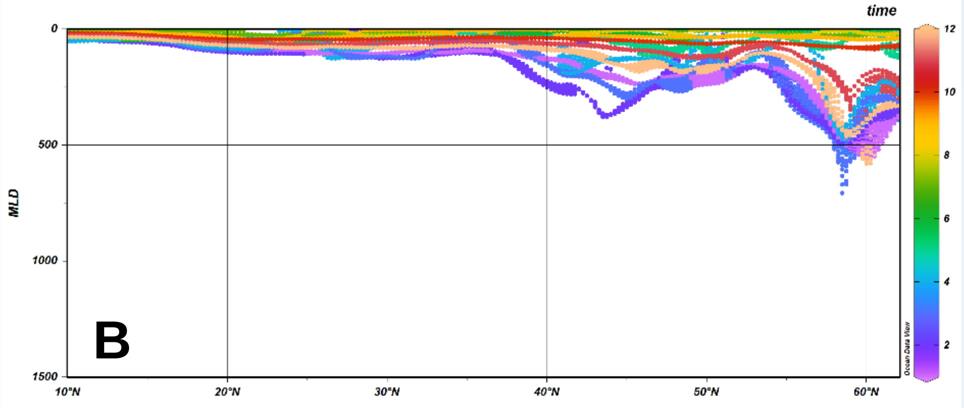
SDC_GLO_DP1	Density and BV fields (2003-2017)	ongoing
SDC_GLO_DP2	AOU at 1/4° (2003-2017)	
SDC_BAL_DP1	regional and sub-regional T and S monthly stats	ongoing
SDC_NAT_DP1	Monthly climatology for MLD at 1/4°	ready
SDC_MED_DP1	Monthly climatology for MLD at 1/8°	ongoing
SDC_MED_DP2	OHC time series and trend (0-700m; 0-2000m)	
SDC_BLS_DP1	Monthly climatology CIL cold content at 1/8°	ready
SDC_BLS_DP2	Decadal seasonal CIL cold content at 1/8°	
SDC_BLS_DP3	sliding decades CIL cold content at 1/8°	
SDC_ULG_DP1	Currents climatologies from HF radars	ready

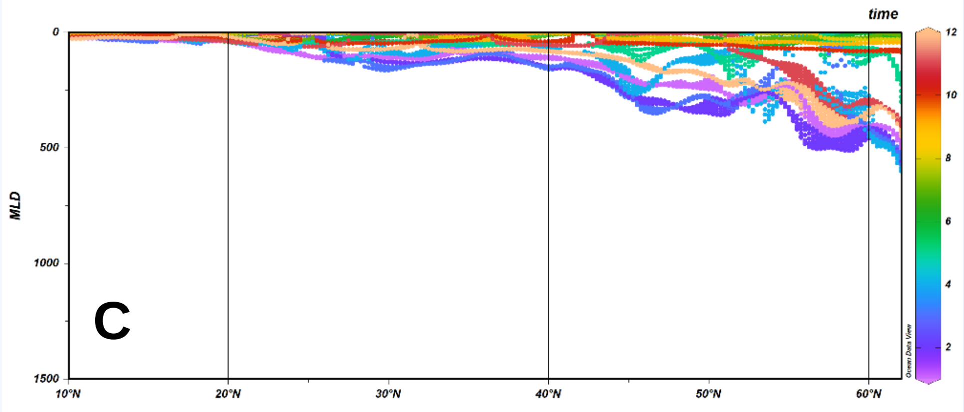
NAT MLD monthly climatology (1/4°)

Deep winter MLD (depth where T variation > 0.5°C with respect to the 10m depth) set ocean's subsurface properties in regions of deep and intermediate water formation



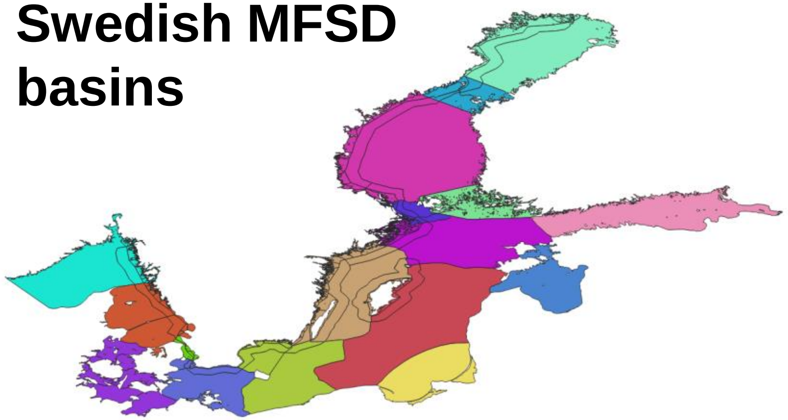




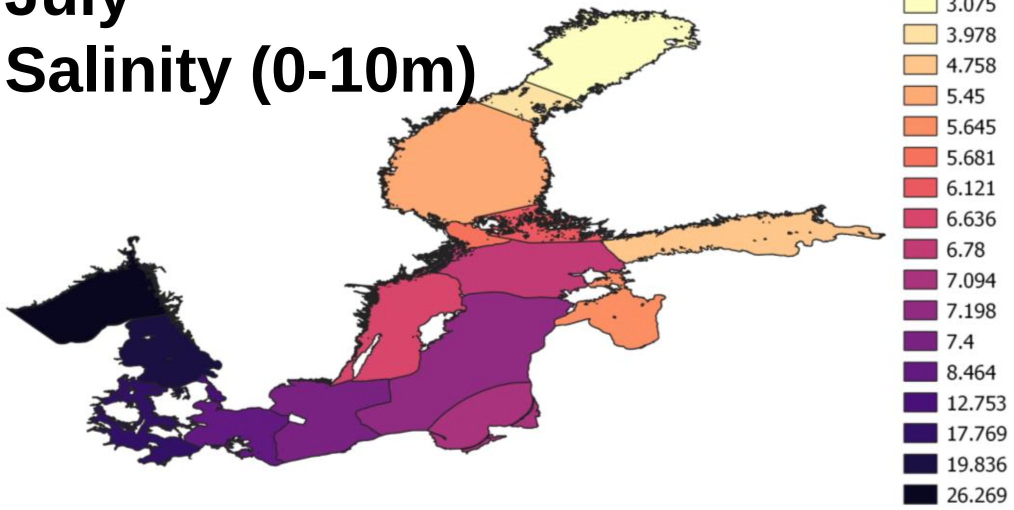


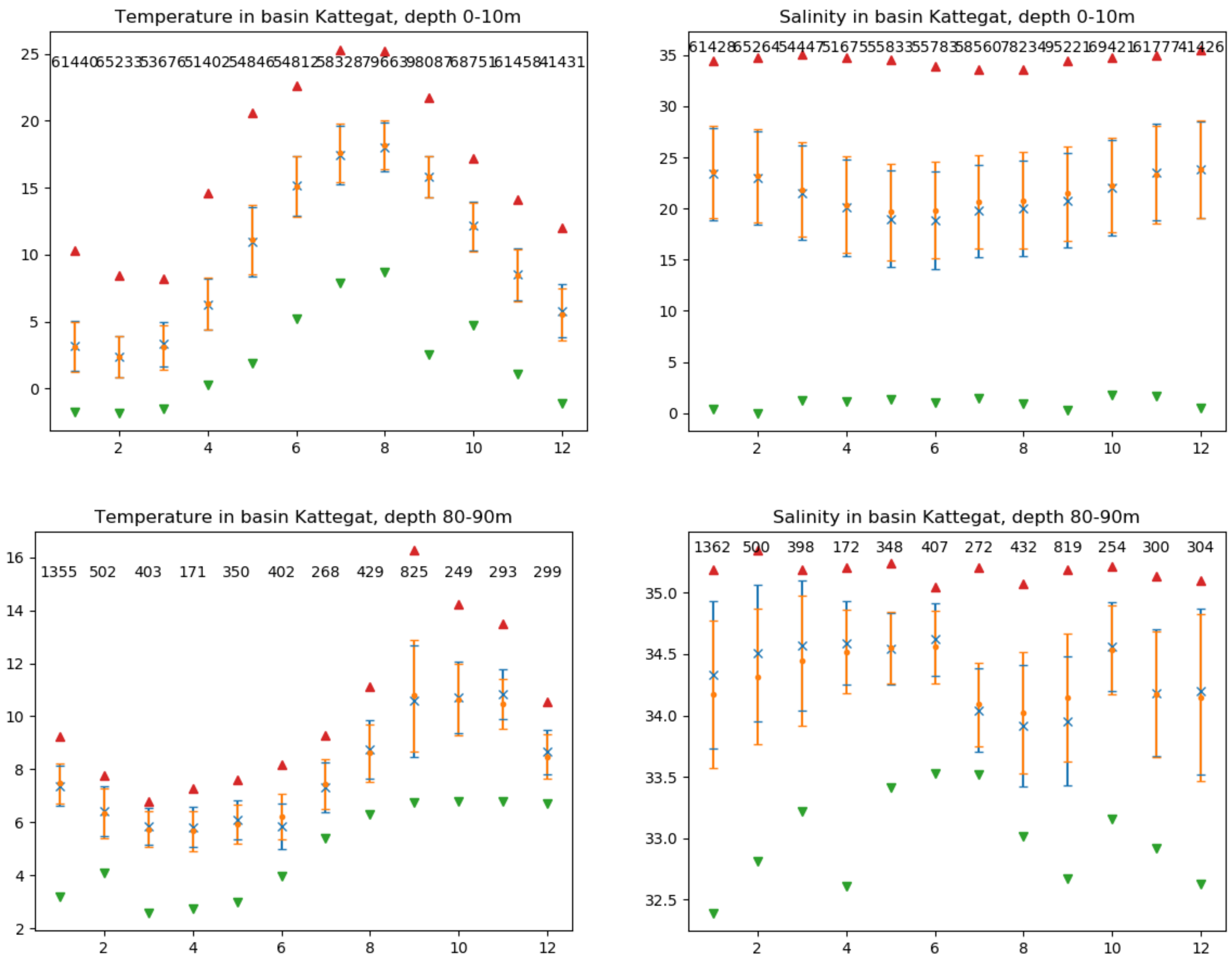
BAL T and S monthly statistics

Swedish MFSD basins



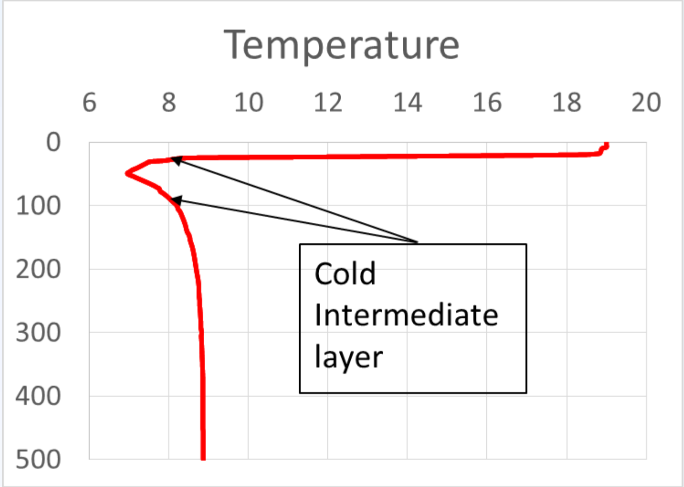
July
Salinity (0-10m)

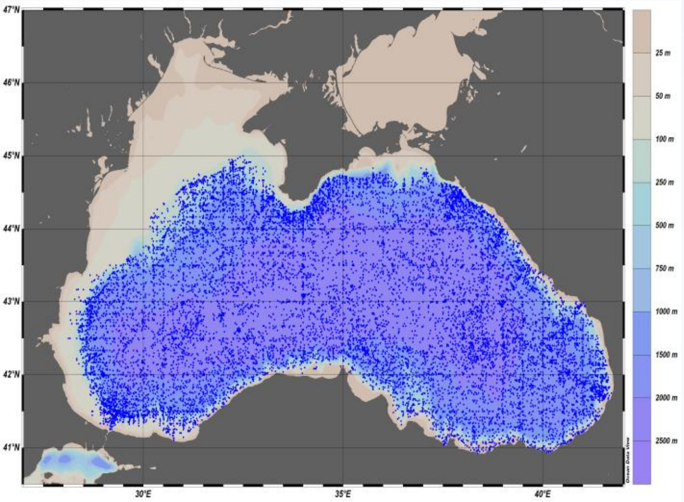




Probably published as txt files with shapefile for basins (zipped)

BLS CIL cold content (1/8°)



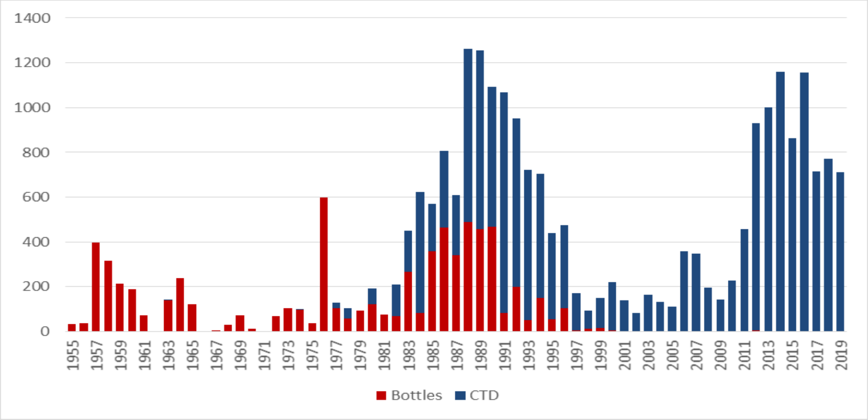


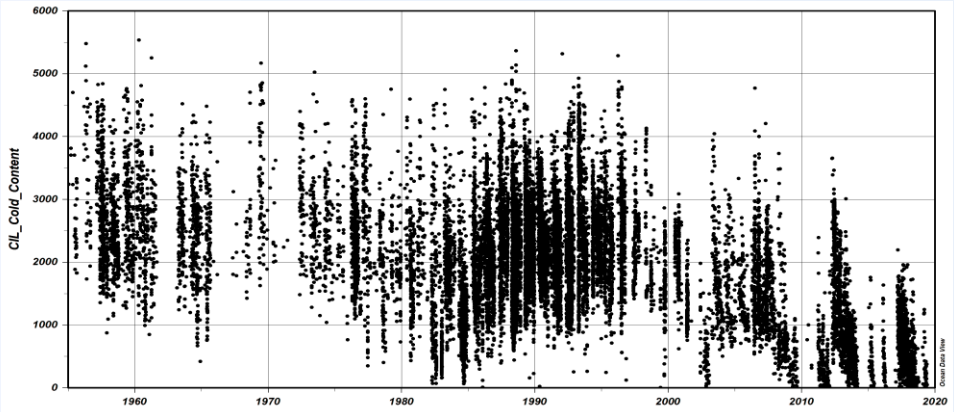
CIL is the layer with T < 8C° in subsurface waters

→ occurs in depth range up to 200 m

Climatic changes in the last two decades → the CIL T are gradually increasing, while CIL volume is decreasing up to total disappearance in certain areas and periods

→ to get unbiased assessment of CCC monthly field the analysis period was limited to 1955-1999





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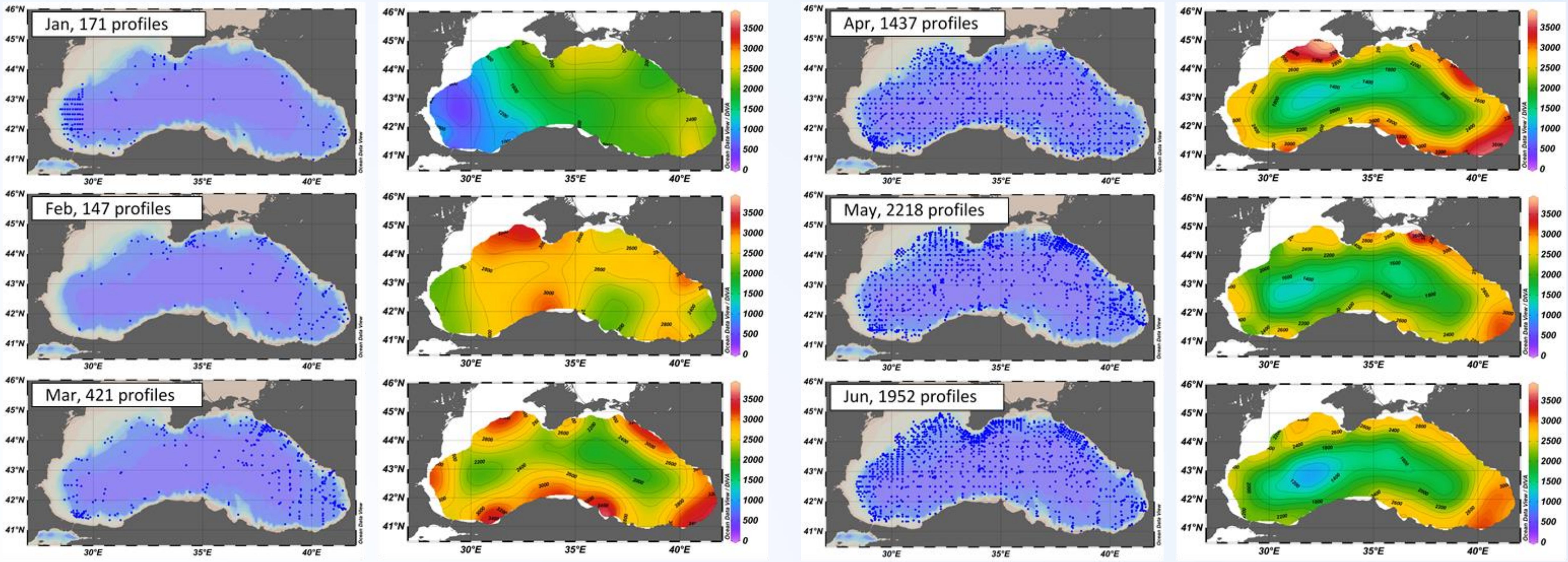
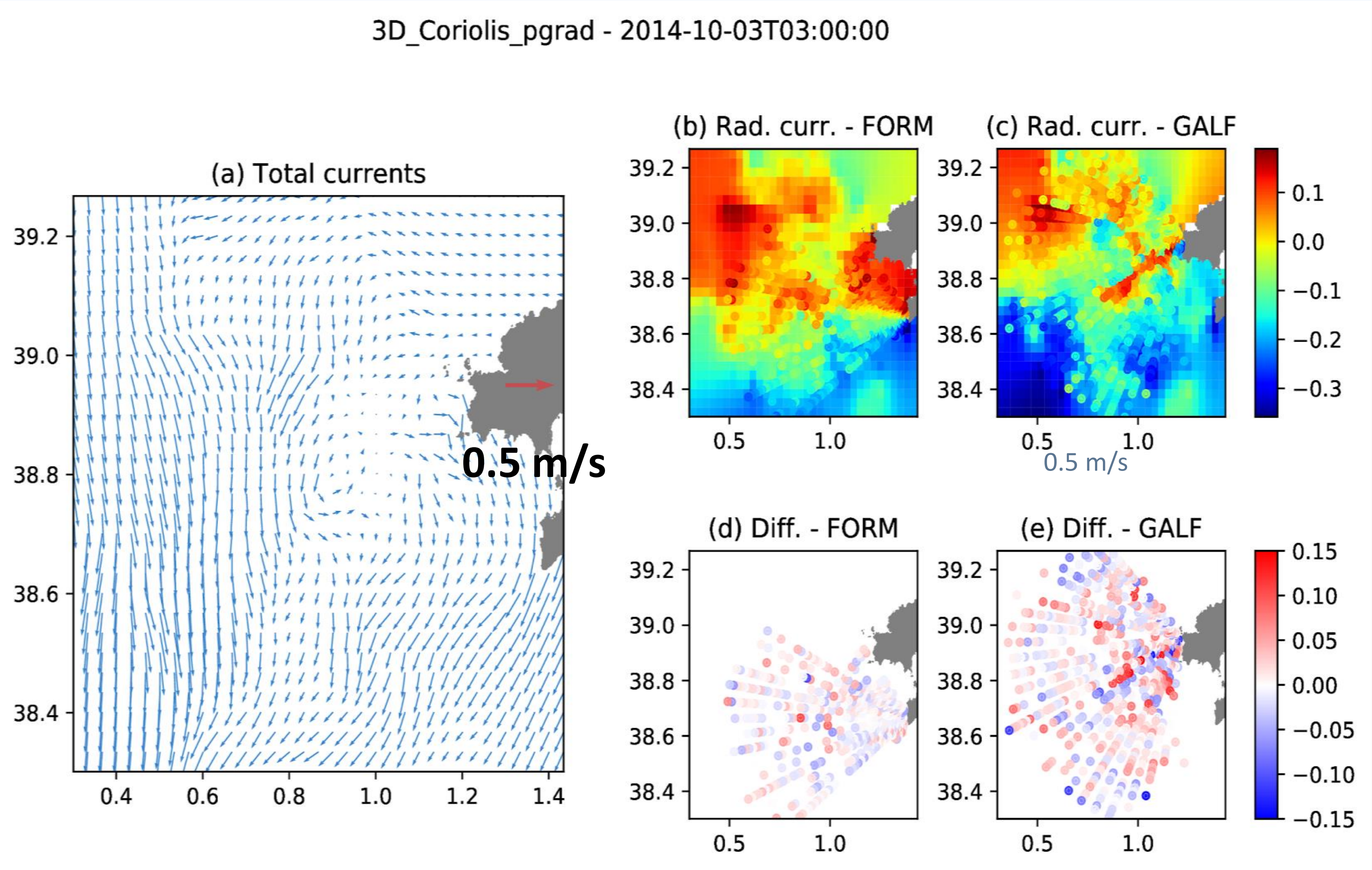


High-frequency radar surface currents using DIVAnd (ULG)

DIVAnd → additional dynamic constraints relevant to surface currents, imposing a zero normal velocity at the coastline, a low horizontal divergence of surf currents, temporal coherence and simplified dynamics based on the Coriolis force and the possibility of including a surface pressure gradient

- radial currents from two radar sites are combined to derive total surf currents in the Ibiza Channel and then compared to the cross-validation data set and to drifter observations
- impact is evaluated by cross-validation using the HF radar surface current and drifter observations from SOCIB

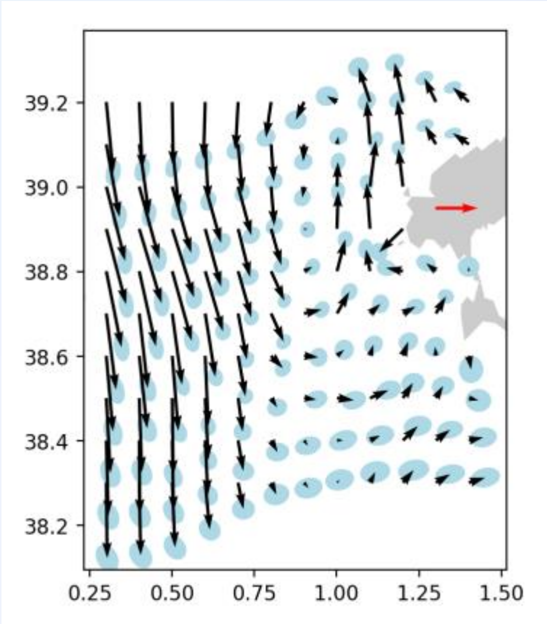
High-frequency radar surface currents using DIVAnd (ULG)



Reconstructed current velocity:
(a) analysed total currents
(b-c) radial currents (HF radar measurements and reprojected analysis) for the two HF radar sites
(d-e) difference between the HF radar measurements and the reprojected analysis

Barth et al. submitted to Ocean Dynamics

Surface current statistics →
arrows: reconstructed mean current velocity
ellipses: temporal variability



Conclusions

- V1 and V2 climatologies integrating external data sources released in SDC → major upgrade
- new data products explored the potential of SDN data and tools providing interesting results
- the workflow has been established (V1), improved (V2) but still room for optimization
- each climatology and new product, its methodology and validation has been described in the **PIDoc**
- double stage revision in order to assure good quality of product and documentation → increase user confidence and uptake
- massive DIVAnd testing
- data integration process has been improved including metadata track of external data

we NEED your FEEDBACK!!!