living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

Earth Observation for Science and Innovation in the Black Sea (EO4SIBS)

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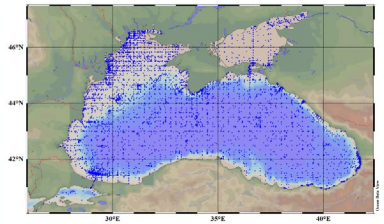
EO4SIBS at a glance

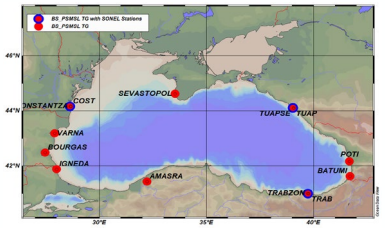
DATA

SATELLITE

- L1 SMOS
- L1 S2 & S3
- L1 & L2 S-3A, Cryosat-2, 20 Hz
- L4 CMEMS_DT SLA 2018

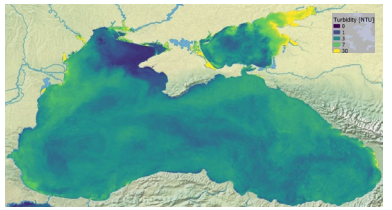
IN-SITU



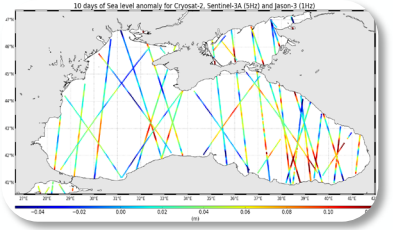


PRODUCTS (L2, L3 & L4)

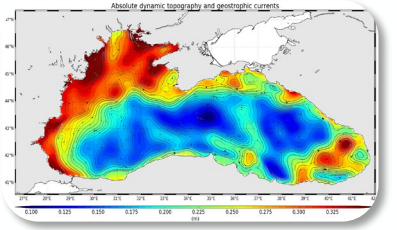
COLOUR

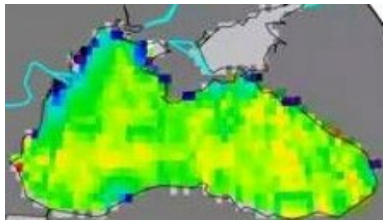


ALTIMETRY



SALINITY

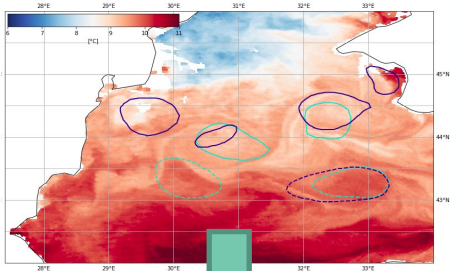




SCIENCE CASES

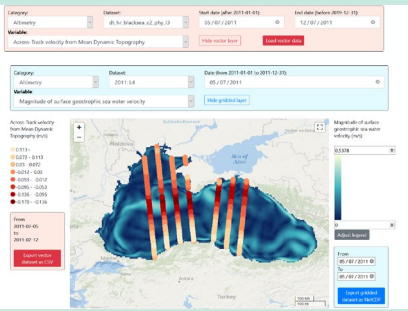
- Ocean forecasting
- Ocean health indicators
- Coastal sea state
- Mesoscale
- Deoxygenation

MESOSCALE



WEB SERVER

PRODUCTS



Ocean Colour

DATA

Sentinel 2 and 3

PRODUCTS

Turbidity,SPM, Chla, L3 and L4 products (2016-2017)

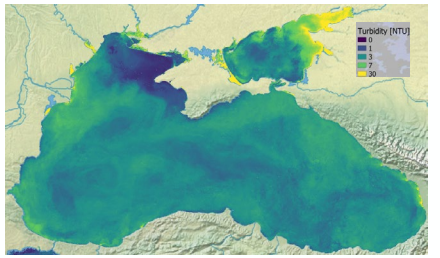
CHALLENGES

Optically complex waters, highly turbid, rich in CDOM, lot of sediments

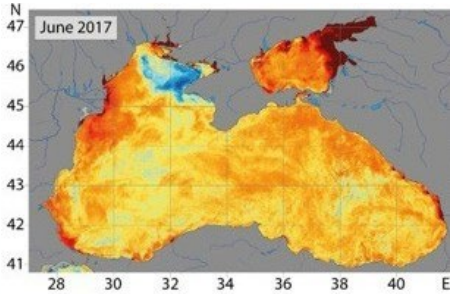
APPROACH

L3: Blending of algorithms adapted to the optical type of waters

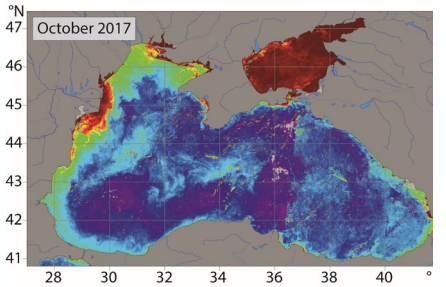
L4: DINEOF for filling the gaps



Turbidity



SPM



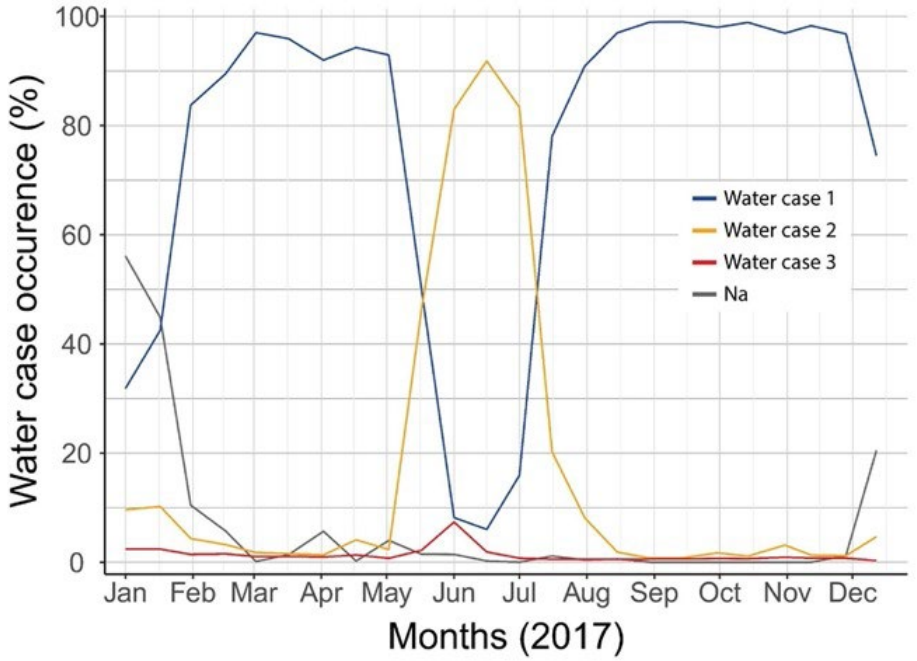
Chla

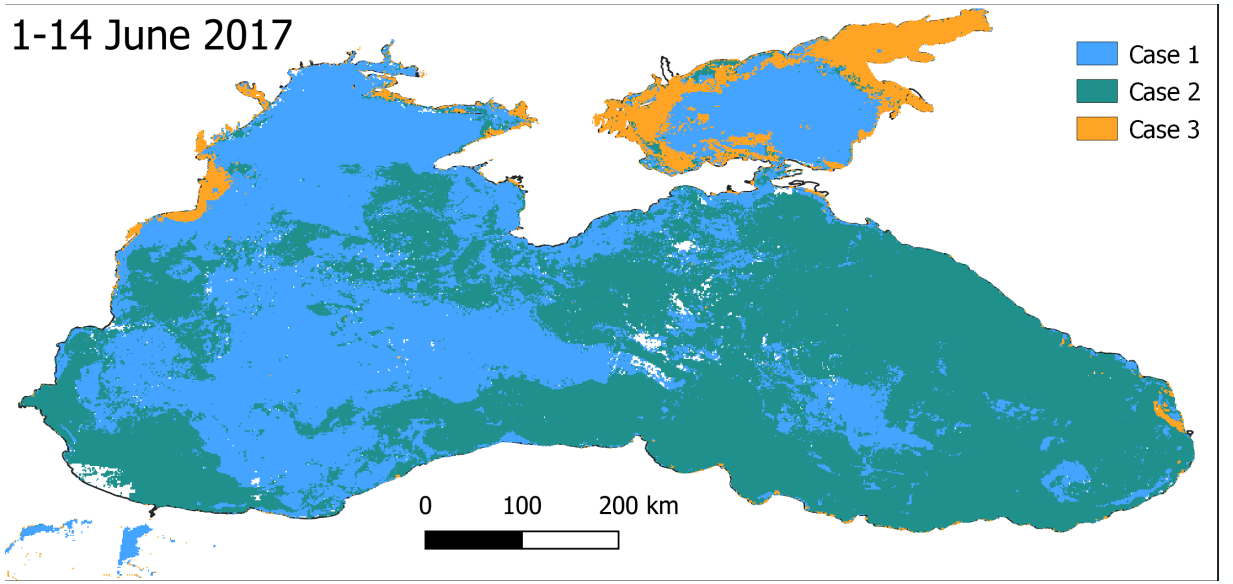
Water Classification

CASE-1: Chl-a

CASE-2: Chla, CDOM, mineral sediments (typical of coastal waters).

CASE-3: Mineral sediments





Surface Salinity

DATA

L1 Soil Moisture and Ocean Salinity (SMOS) (L-band)

PRODUCTS

L2: Daily product at 0.25x0.25º

L3: 9-day maps (generated daily) at 0.25x0.25º

L4: Daily maps at 0.05x0.0505º

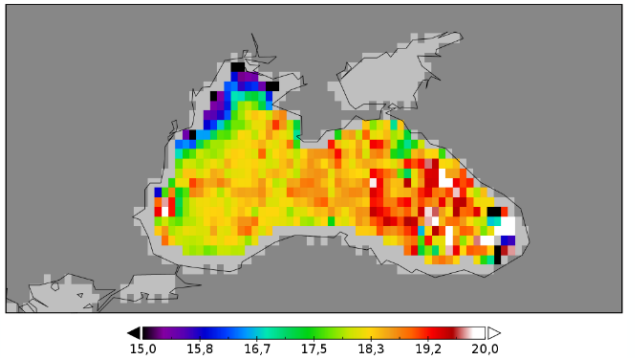
CHALLENGES

Radio frequency interference, land sea contamination, cold and fresh waters

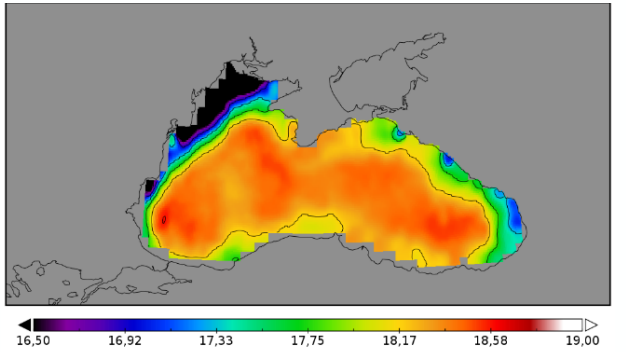
APPROACH

Nodal sampling technique, extrapolation of the dielectric constant model, biases correction, multifractal fusion algorithm

L2A



L3 & L4

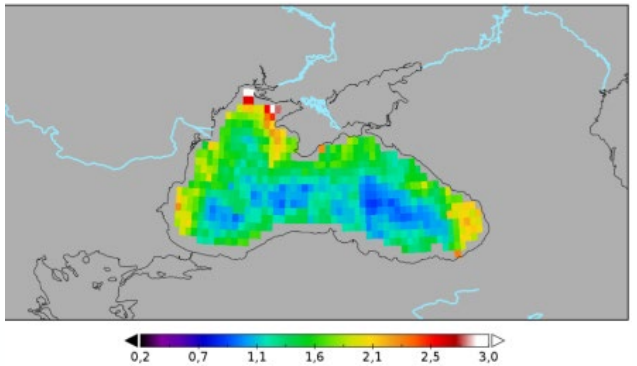


Details in Olmedo, Gonzales et al., talk at LPS, Black Sea regional initiative

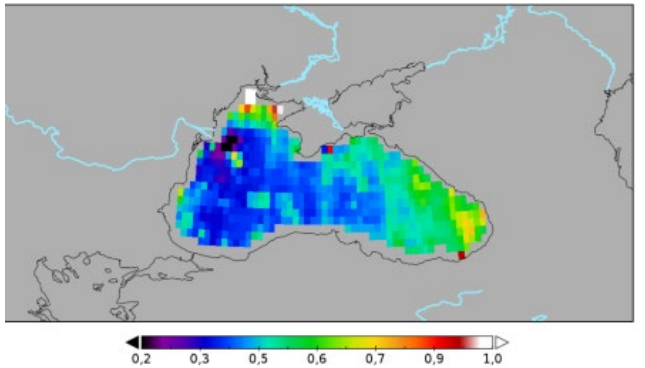
Surface Salinity uncertainty

Spatial distribution of the uncertainty associated with the SSS product with respect to model simulations

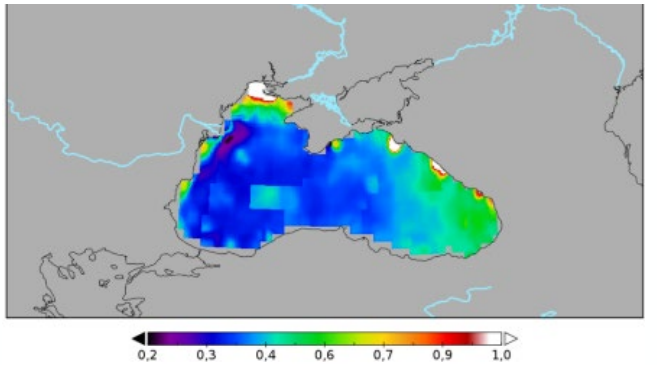
L2A



L3



L4



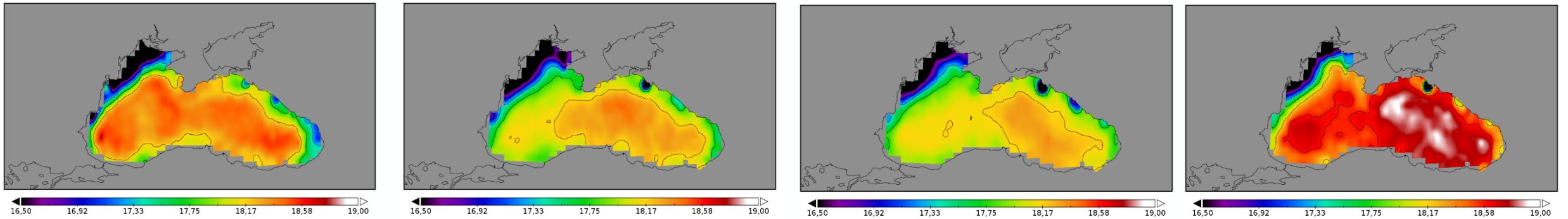
	Time coverage	Temporal resolution	Spatial resolution	Accuracy before 2016	Accuracy after 2016
Level 2	2011-2020	Daily	0.25ºx0.25º	1.85 psu	1.50psu
Level 3	2011-2020	9-day	0.25ºx0.25º	0.7 psu	0.5 psu
Level 4	2011-2019	Daily	0.05ºx0.0505º	0.6 psu	0.4 psu

Details in Olmedo, Gonzales et al., talk at LPS, Black Sea regional initiative

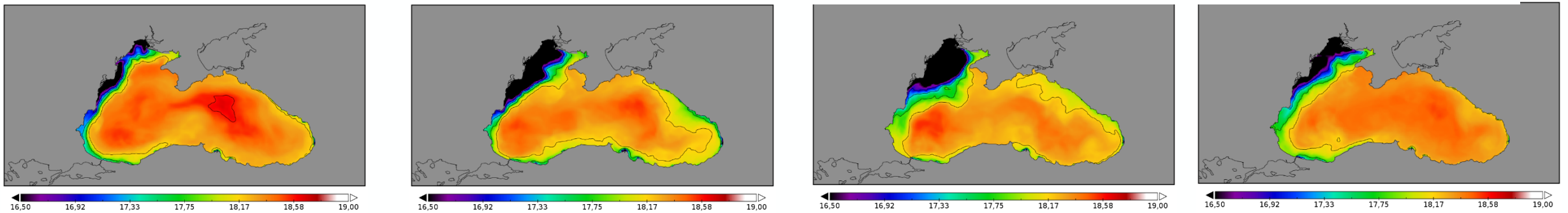
Surface Salinity seasonal cycle

WINTER | SPRING | SUMMER | FALL

SMOS



CMEMS MODEL



Details in Olmedo, Gonzales et al., talk at LPS, Black Sea regional initiative

Altimetry

DATA

L1 &L2 Cryosat-2 [2011, 2019] and Sentinel-3A [mid-2016, 2018] at 20 Hz

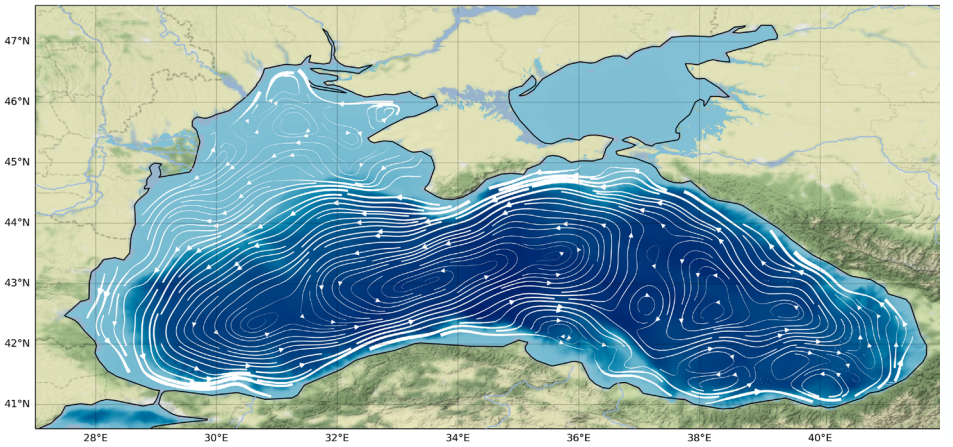
L4 gridded products (CMEMS)

PRODUCTS

Level-3 along-track products, 5Hz (~1.3km) (2011-2019)

L4 product that better resolve geostrophic currents (2011-2019)

Annual averaged circulation



APPROACH

L3: Use improved SAR processing &up-to-date altimeter standards and corrections

L4: Use upstream Level-3 5Hz & Improve mapping methodology

CHALLENGES

Reduced size, the limited number of satellite tracks, proximity of the coast

Details in Pujol et al., poster at LPS, Coastal Altimetry Algorithms, Products and Applications

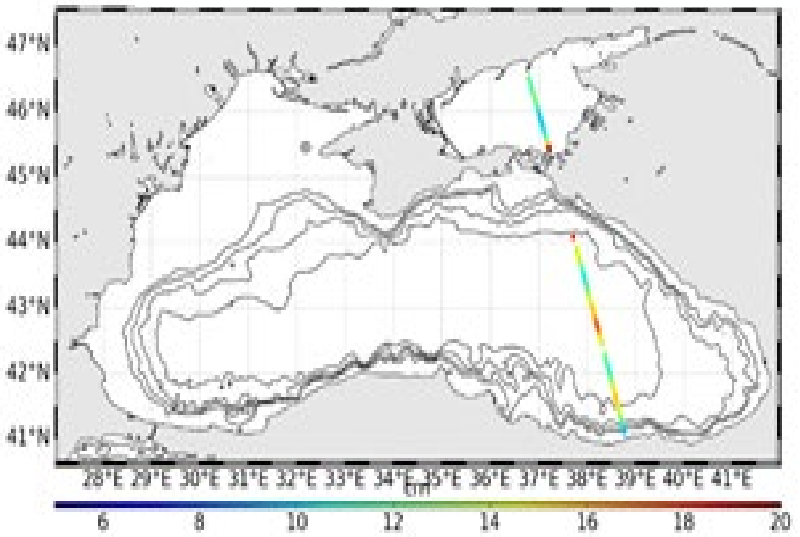
Altimetry: L3 along track (2011-2019)

5Hz L3 product better adapted to coastal studies

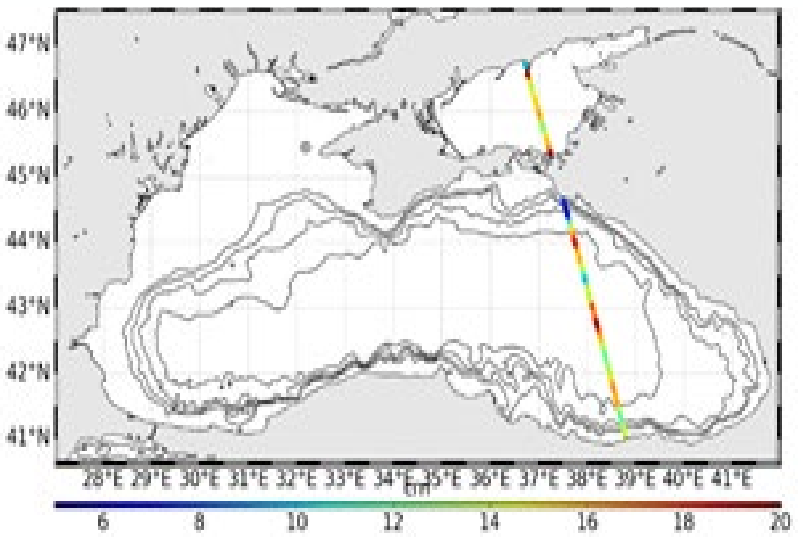
- Improved data availability, especially in near-coast area : +5 to 10%
- Better observability of the small mesoscale signal : observable wavelengths ~25 to 30 km i.e. reduced by more than 1/3 compared to the 1Hz product capability.

Example of SLA along a S3A track (date 2017/07/03)

CMEMS SLA - 1Hz



EO4SIBS SLA-5Hz



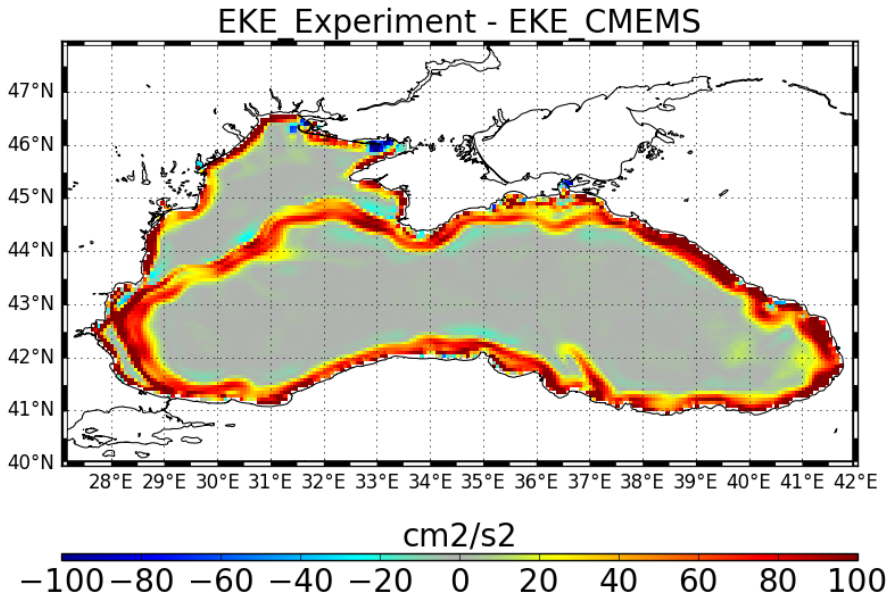
Details in Pujol et al., poster at LPS, Coastal Altimetry Algorithms, Products and Applications

Altimetry: L4 gridded (2011-2019)

Improved restitution of the mesoscale signal

- More intense currents. Gain in EKE
- Better consistency with independent drifter measurements

EKE diffrences between CMEMS conventional product and EO4SIBS experimental product.



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Eddy Tracking – Surface Properties

DATA

CMEMS-DT-L4 (1 Hz)

EO4SIBS L4 (5Hz)

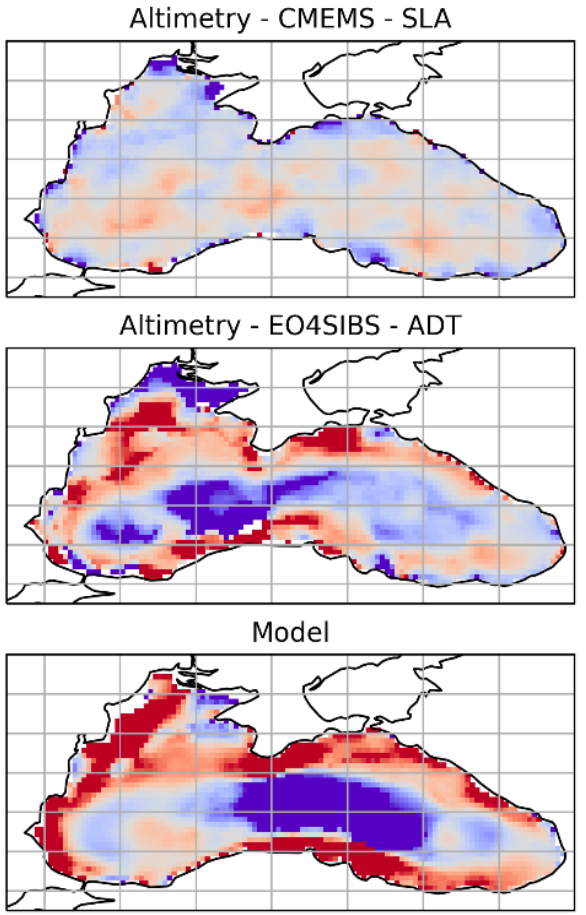
PRODUCTS

Eddies properties and tracks

APPROACH

Eddies detection (Lc~1-100km) and tracking

Better distinction and distribution of Cyclonic and Anticyclonic eddies in good agreement with that obtain by CMEMS model



Details in Capet et al., talk at LPS

Eddy Tracking – Subsurface

DATA

CMEMS-DT-L4

EO4SIBS L4

BGC-ARGO

APPROACH

Eddies detection and tracking

Composite analyses

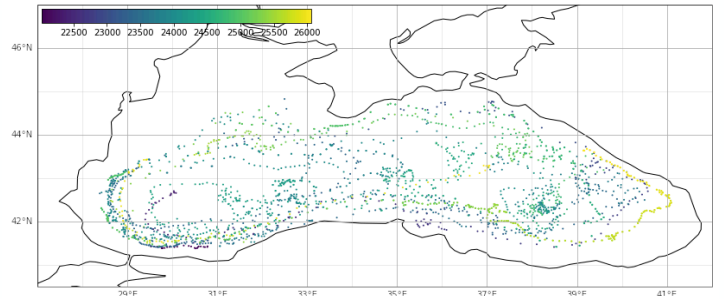
PRODUCTS

Eddies properties and tracks

Mean subsurface anomalies

Salinity and oxygen.

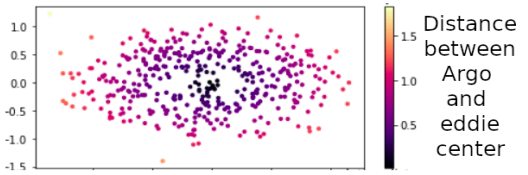
Composite analysis



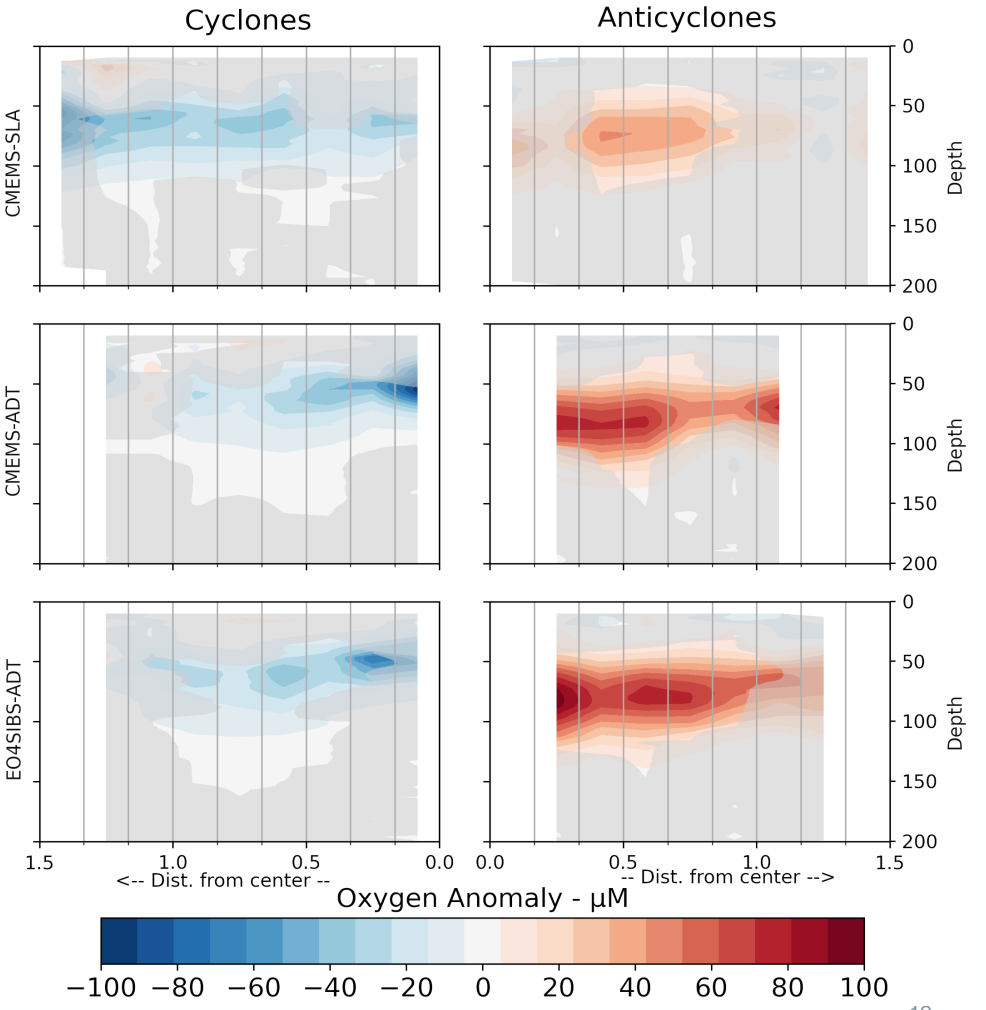
Real Argo Location + Eddy census

=

Composite Eddy-centered reference frame



Average Subsurface Anomaly

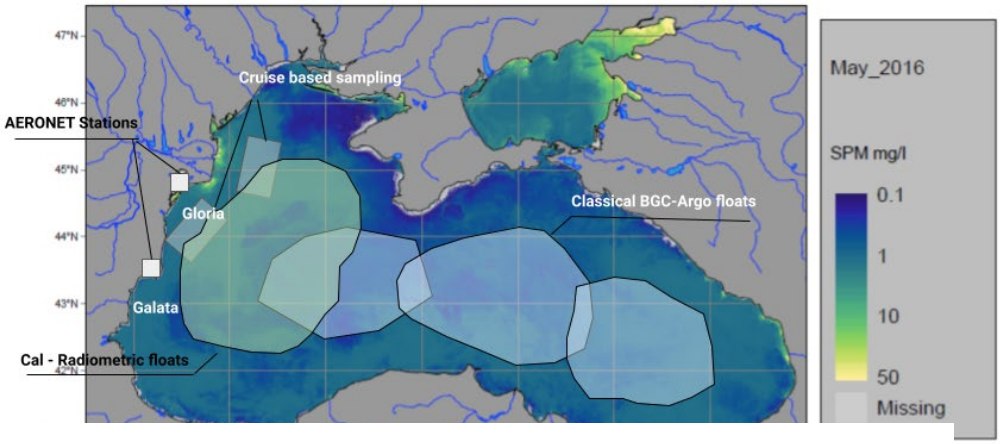


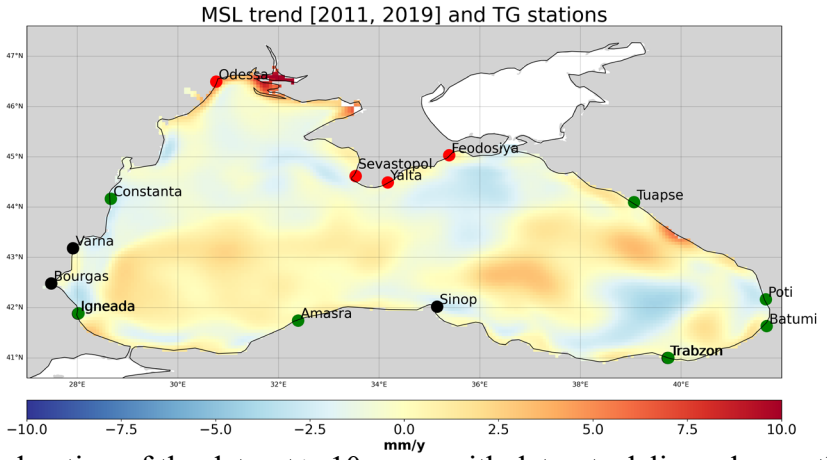
Details in Capet et al., talk at LPS

Key message

An integrated observing approach for the Black Sea:

- Reinforcing and sustaining the existing AERONET-OC network.
- Deploying and permanently maintaining 3 BGC-Argo floats including one equipped with hyperspectral instruments.
- Regularly (i.e. two times/year) visiting coastal waters with R/V to perform radiometric, chemical, skin salinity and biological sampling.
- To continue the monitoring of sea level at historical stations where long data series are already available and improved the processing, quality check, flagging and analysis of existing TG data at different scales (high frequency, monthly, yearly, …).
- Capacity building efforts and best practices to align the procedures across systems.





duration of the dataset > 10 years with datasets delivered recently i.e. >2015)
duration of the dataset > 10 years)
duration of the dataset < 10 years