SMOS derived Colored Detrital Matter product in the Black Sea

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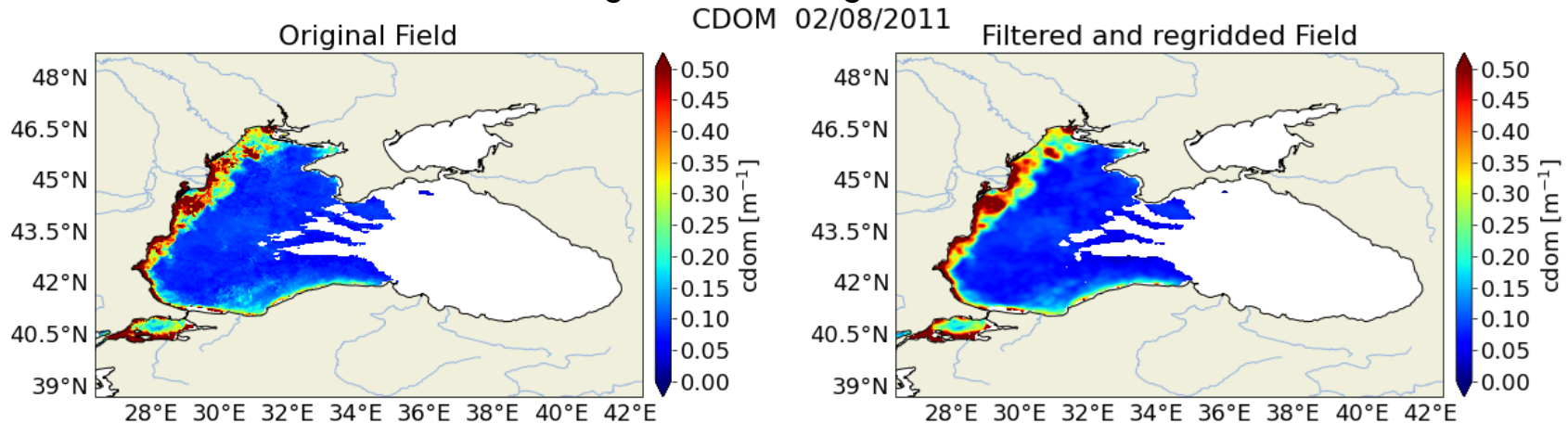
BEC
Barcelona Expert Center

In the framework of the regional initiative *An Earth Observation Data for Science and Innovation in the Black Sea (EO4SIBS)*, we aimed at generating a temporal series (2011-2019) of Colored Detrital Matter(CDM) from the SMOS SSS L4 maps.

- Characterize the connection of remote sensing biogeochemical variables and SSS. This connection is caused by the capability of SSS to track the proportion of freshwater contributed by the river.

- The main advantage of this product is the all-weather availability.

Data
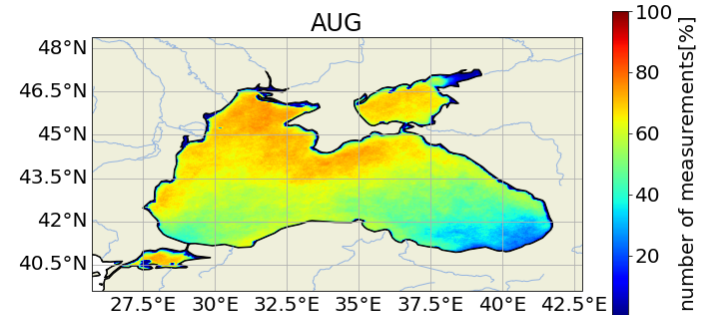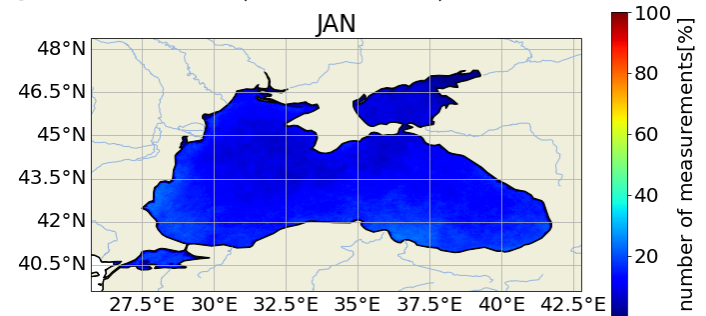
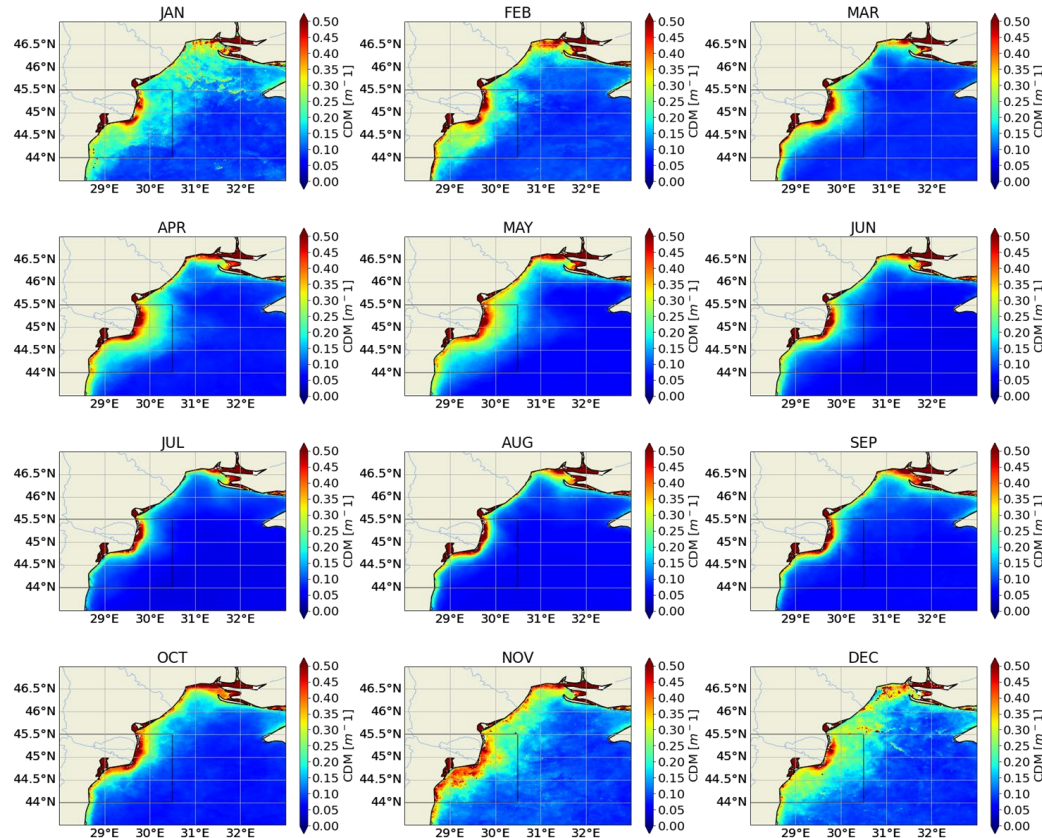| Observed Field	CDM	SSS
Provider	CMEMS-CNR	EO4SIBS-BEC
Identifier	OCEANCOLOUR_BS_OPTICS_L3_REP_OBSERVATIONS_009_096	SSS-BEC-L4
Spatial resolution	1 km x 1 km	0.05 deg x 0.0505 deg
Temporal resolution	daily	daily
Processing level	L3	L4
Period inferring relation CDM-SSS reconst. CDM and validation	2011-2019 2011-2018 2019	2011-2019 2011-2018 2019

- To analyze and study the relationship between CDM and SSS fields, both products need to be mapped on a common spatial grid (coarser grid: SSS).
- We proceed as follows:
  - CDM fields are filtered using a gaussian low pass filter (λcut= 25 km effective spatial scale of SSS L4 [Olmedo et al. 2021])
  - Filtered CDM fields are regridded to the grid of SSS.

CDOM 02/08/2011

[Olmedo et al. 2021] Nine years of SMOS sea surface salinity global maps at the Barcelona Expert Center, Earth Syst. Sci. Data, 13, 857–888, https://doi.org/10.5194/essd-13-857-2021, 2021

Temporal and spatial variability
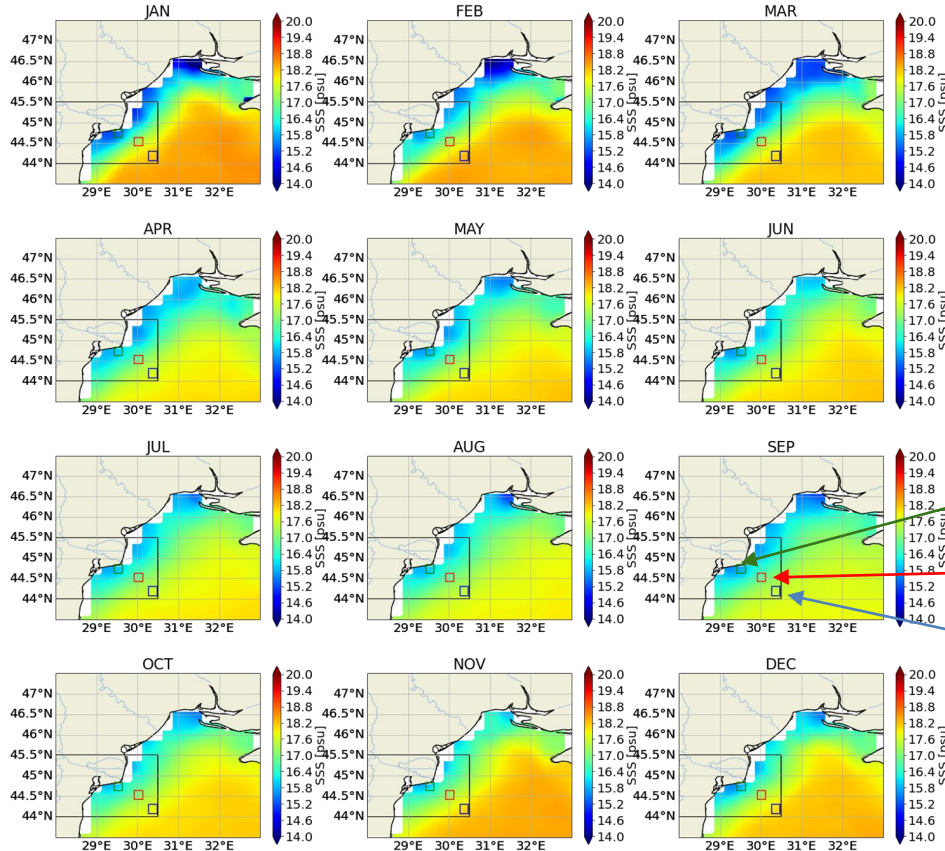
Monthly mean CDM (2011-2019)

- CDM fields present a seasonal behaviour.
- The extension of CDM plume is larger in winter and spring seasons and near the Danube mouth.
- We center the study in the Danube mouth region:

  lat : [44º N, 45.5ºN]
  lon: [28ºE , 30.5ºE]

Temporal and spatial variability

Monthly mean SSS (2011-2019)

- Plume waters, fresher than 16 psu.
- Larger extension of the plume in winter season.
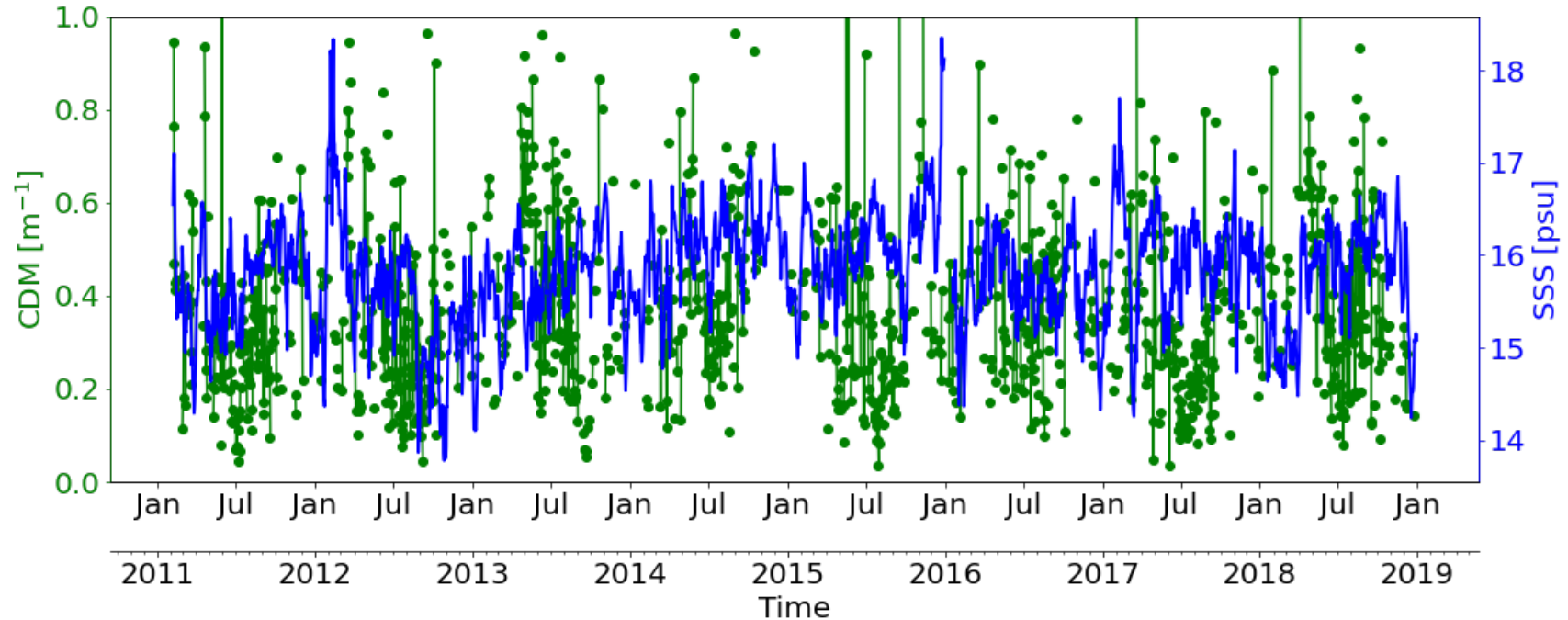- To further study the temporal variability we select three points:

○ P1: lat [44.63ºN,22.83ºN] lon [29.43ºE,29.63ºE]

○ P2: lat [44.43ºN, 44.63ºN] lon [29.93ºE,20.13ºE]

○ P3: lat [44.08ºN, 44.31ºN] lon [30.28ºE,30.48ºE]

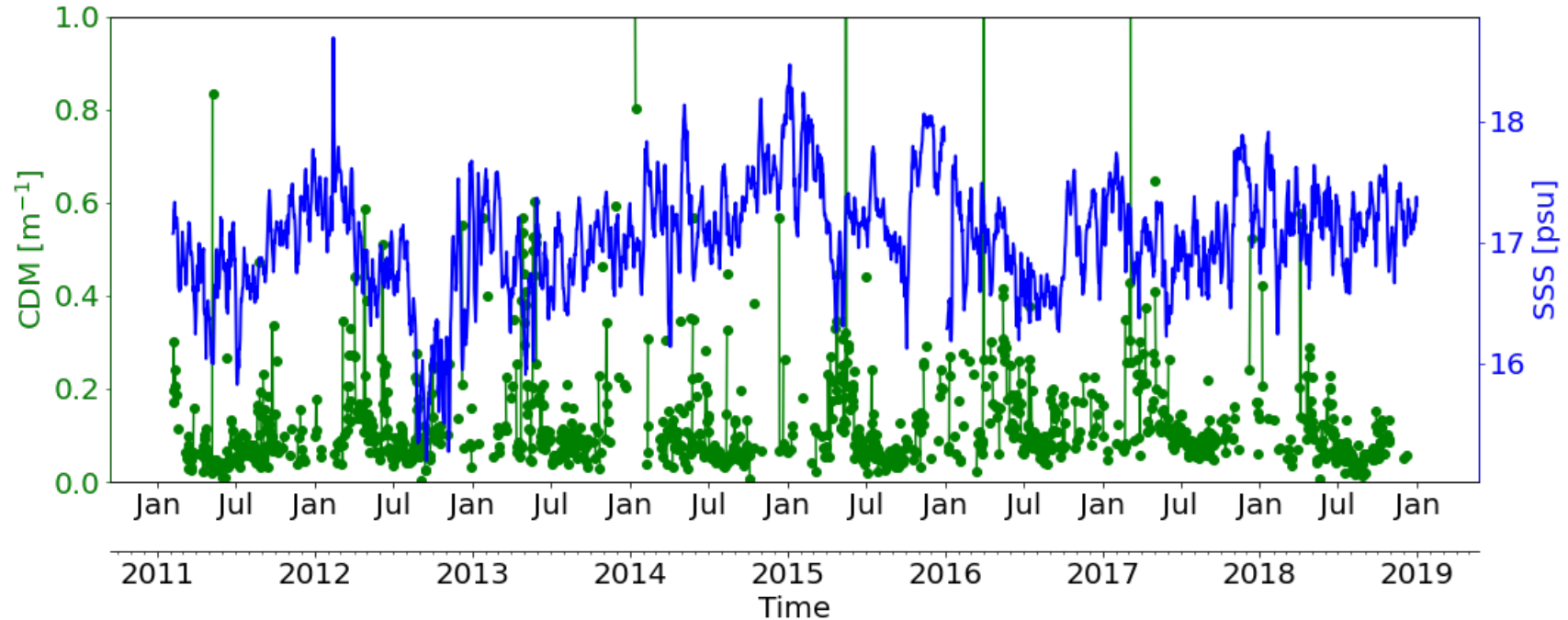P1: closer to Danube mouth

P2: mid point

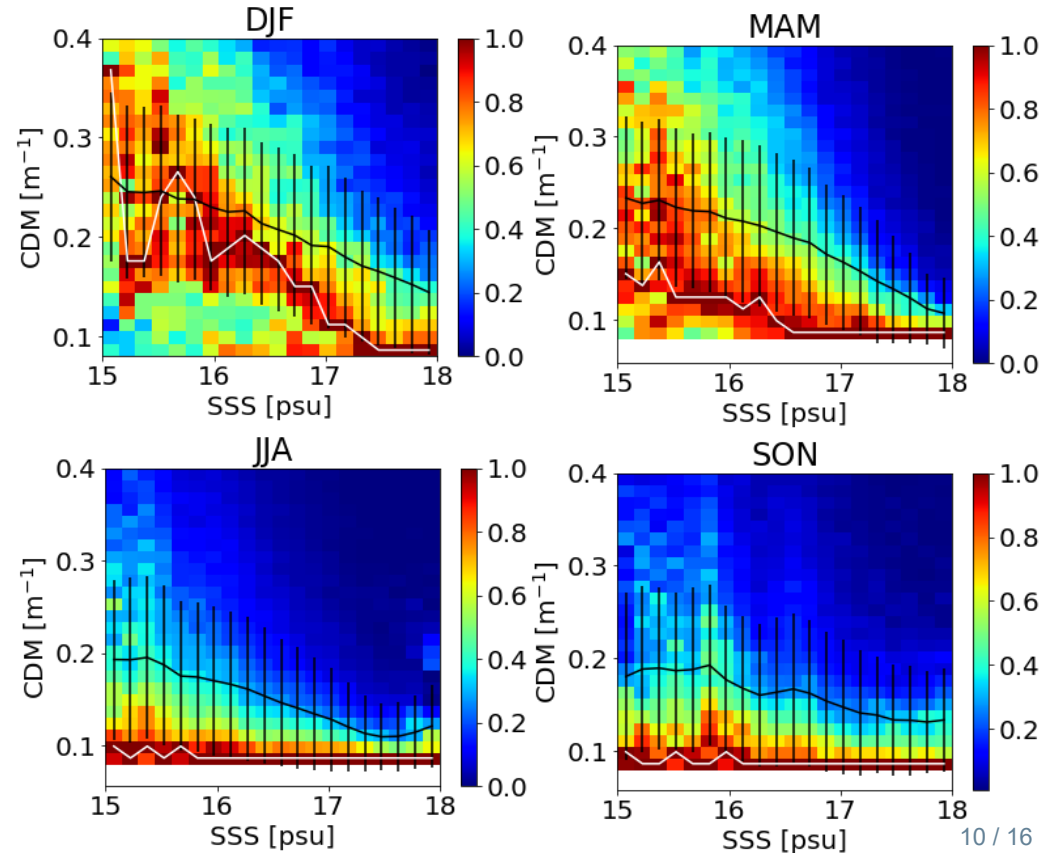P3: further to Danube mouth point

- The histogram of a variable conditioned by the value of another variable serves to evidence any functional dependence between both.
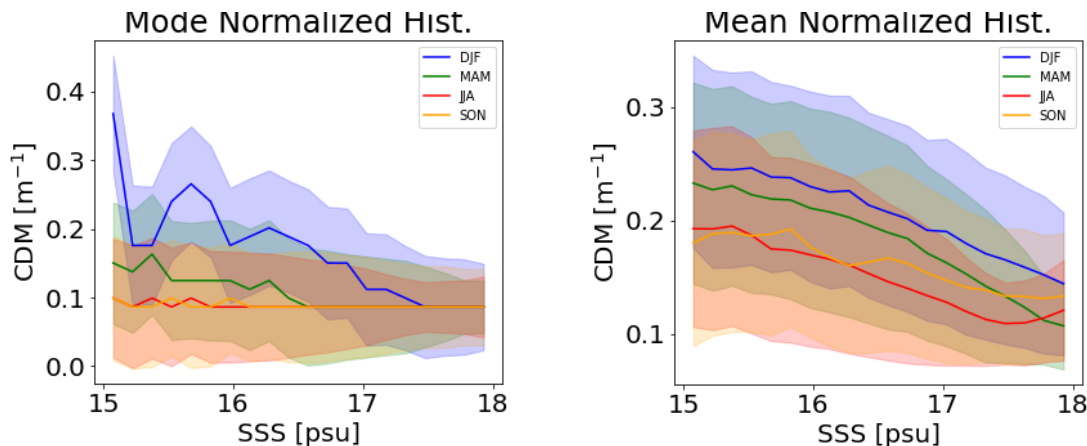
SSS: 20 bins ranging from 15 to 18 psu
(0.15 psu per bin)

CDM: 25 bins ranging from 0 to 0.4 m-1
(0.016 m-1 per bin)

- We infer CDM as function of SSS using a linear regression of the mean and mode of the normalized histograms

Mode Normalized Hist.

Mean Normalized Hist.

$$CDM = a\ SSS + b$$

Season	Mean Hist.		Mode Hist.	
	Slope $[m^{-1}\ psu^{-1}]$	Intercept $[m^{-1}]$	Slope $[m^{-1}\ psu^{-1}]$	Intercept $[m^{-1}]$
Winter (DJF)	-0.042	0.89	-0.065	1.24
Spring (MAM)	-0.034	0.73	-0.038	0.73
Summer (JJA)	-0.048	0.90	-0.006	0.18
Fall (SON)	-0.019	0.49	-0.004	0.16

Characterization of SSS and CDM relation

- We infer CDM as function of SSS using a linear regression of the mean and mode of the normalized histograms
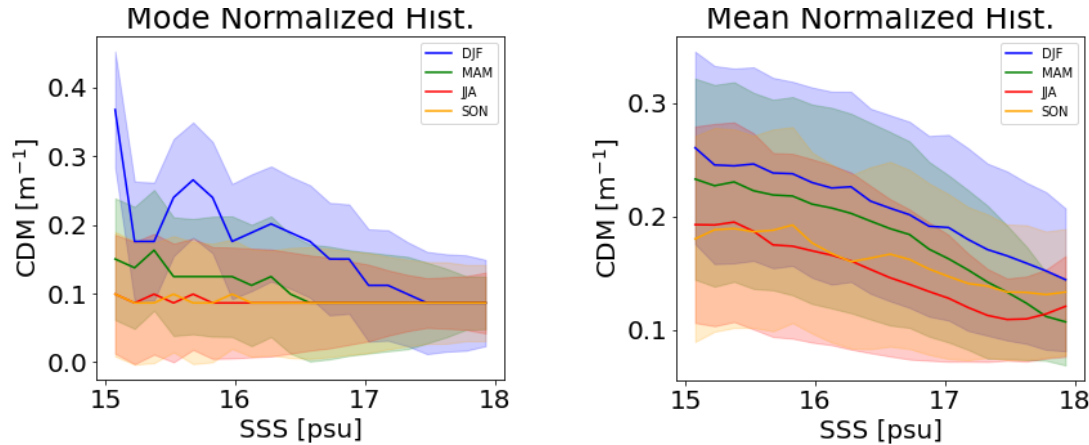

$$CDM = a\ SSS + b$$

|	Mean Hist.		Mode Hist.	
Season	Slope	Intercept	Slope	Intercept
	$[m^{-1}\ psu^{-1}]$	$[m^{-1}]$	$[m^{-1}\ psu^{-1}]$	$[m^{-1}]$
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- We reconstructed CDM field from L4 SSS maps using the estimated linear regression of the mode and mean of the normalized histograms (here we show the results for the mode) for the year 2019.
  Free cloud conditions fields are used for validation

CDM 2019-03-04
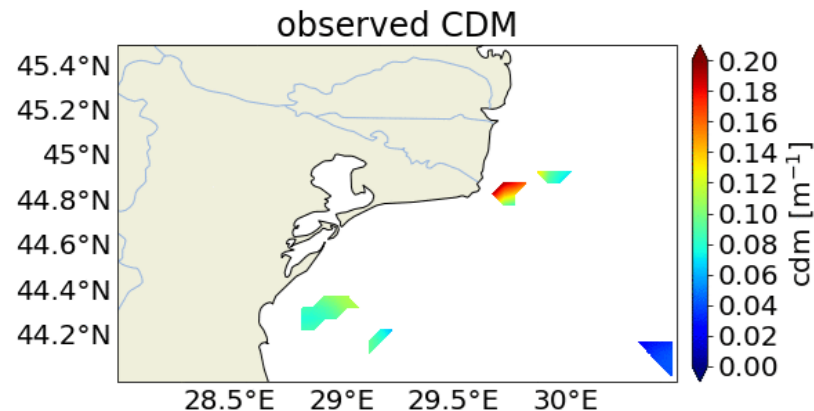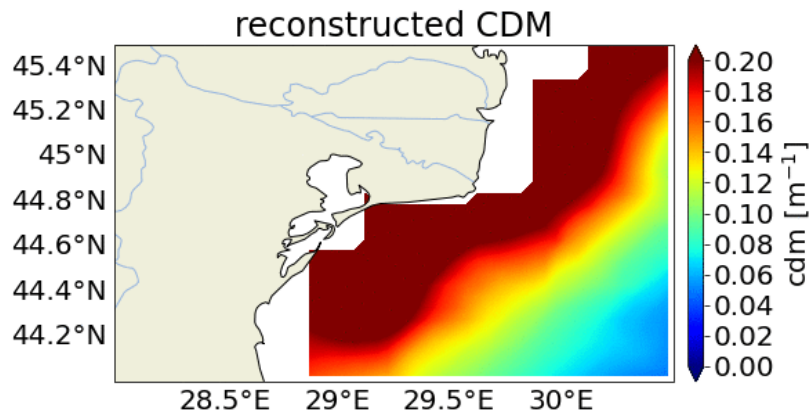
CDM reconstruction assessment
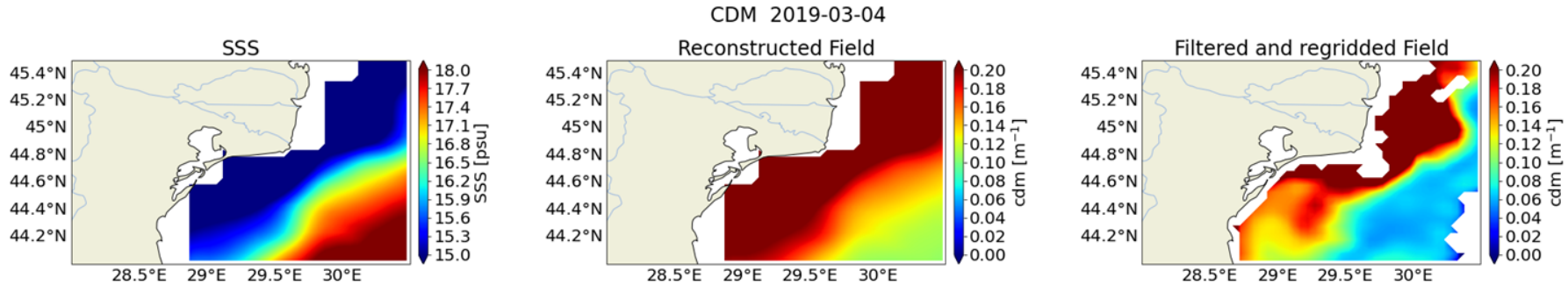
- Scatter plots of reconstructed CDM versus observed CDM (CMEMS-CNR) for the year 2019 (not used for the characterization)
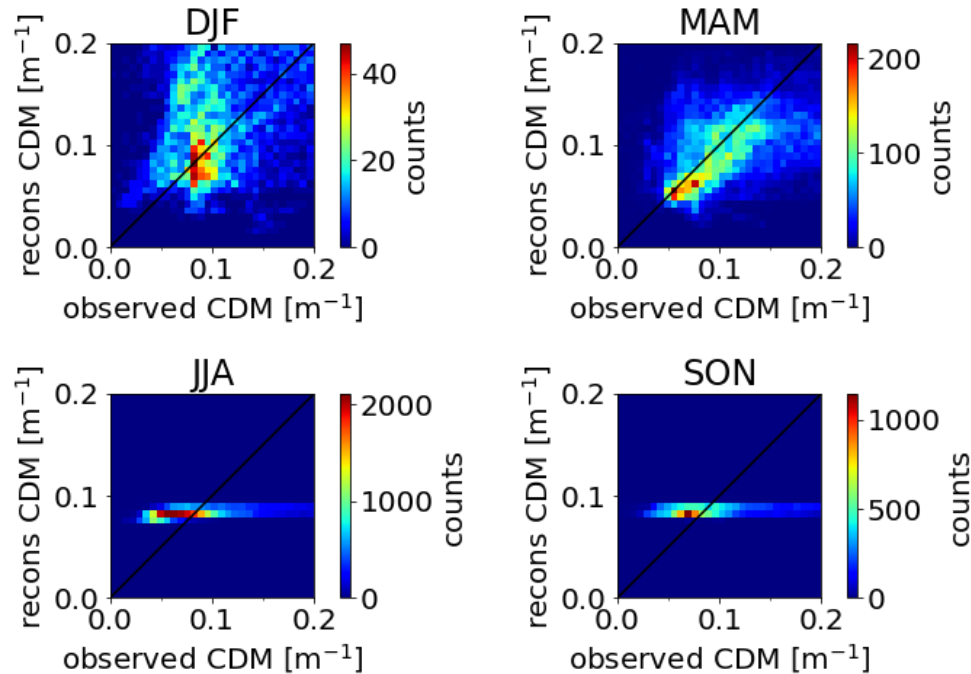
Experimental SMOS derived CDM

- This dataset is freely distributed through our sFTP: http://bec.icm.csic.es/bec-ftp-service/

2019-01-01

reconstructed CDM — observed CDM

Level	Temporal coverage	Temporal resolution	Spatial resolution	BEC FTP: sftp://becftp.icm.csic.es:27500
L4	Winter and Spring seasons 2011-2019	daily	0.05 deg.	/becftpdata/OCEAN/CDM/SMOS/BlackSea/v1.0/L4/daily

Final remarks

- We have presented the first attempt to retrieve **"all weather condition" CDM** observations using **SSS** as a **proxy** in the **Black Sea**.

- There is a **strong functional relation** between **SSS** and **CDM** during **winter** and **spring** seasons. However, there are also some effects originating a significant departure from the main functional branch of the conditioned histograms.

- Even with the shortcoming of current-day data, the consortium of EO4SIBS decided to **publish** and **distribute** the **derived CDM** as an **experimental dataset** for **winter** and **spring** seasons. An all weather condition CDM product may already be useful for the community given the high cloud coverage in the basin

- We **encourage** you to **use** the **data** and send us **feedback** to: smos-bec@icm.csic.es and cgharo@icm.csic.es

Enjoy the product!

Thank you your attention!
cgharo@icm.csic.es
smos-bec@icm.csic.es

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