SMOS derived Colored Detrital Matter product in the Black Sea

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Institut de Ciències del Mar (2)
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(4)
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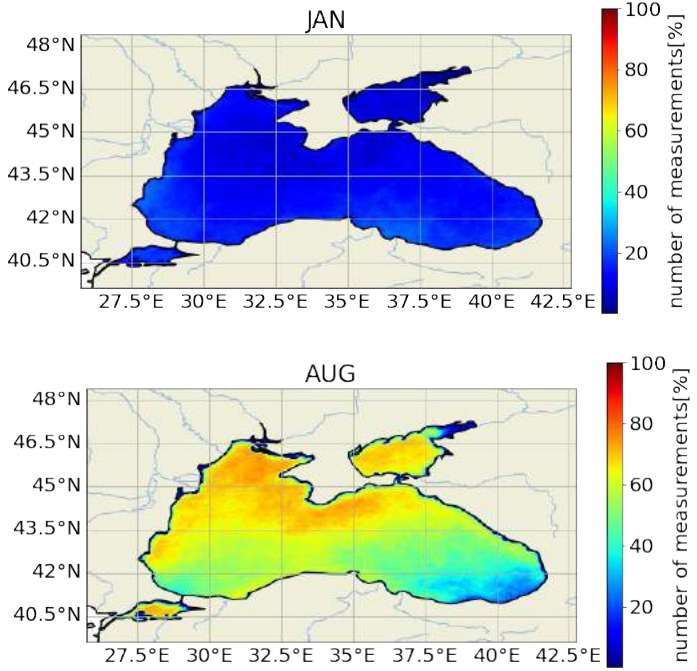
Introduction

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 Material (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.

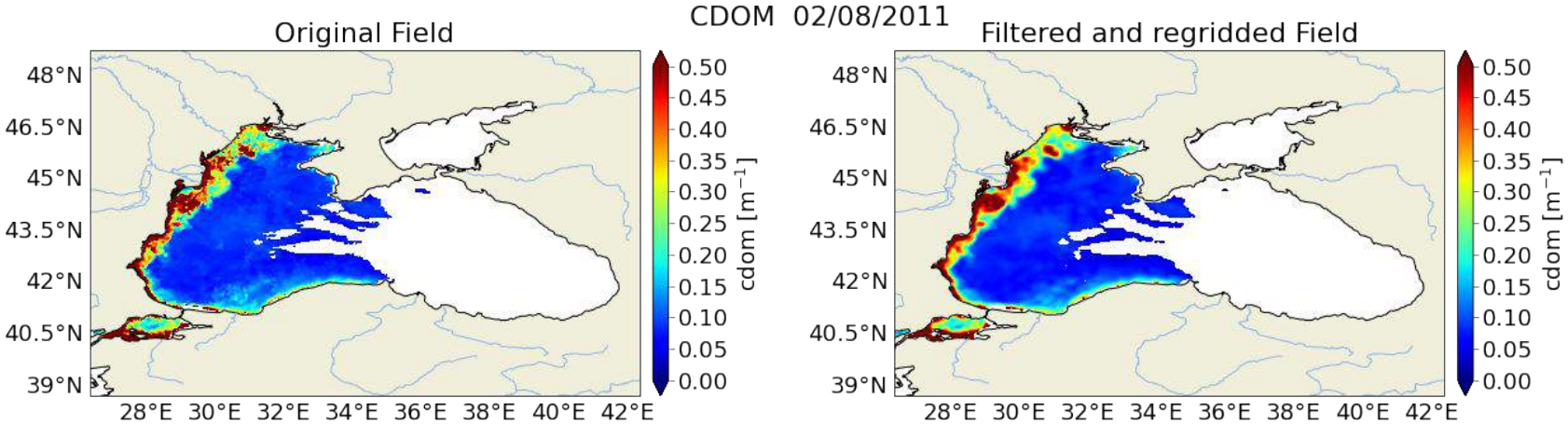


Data

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

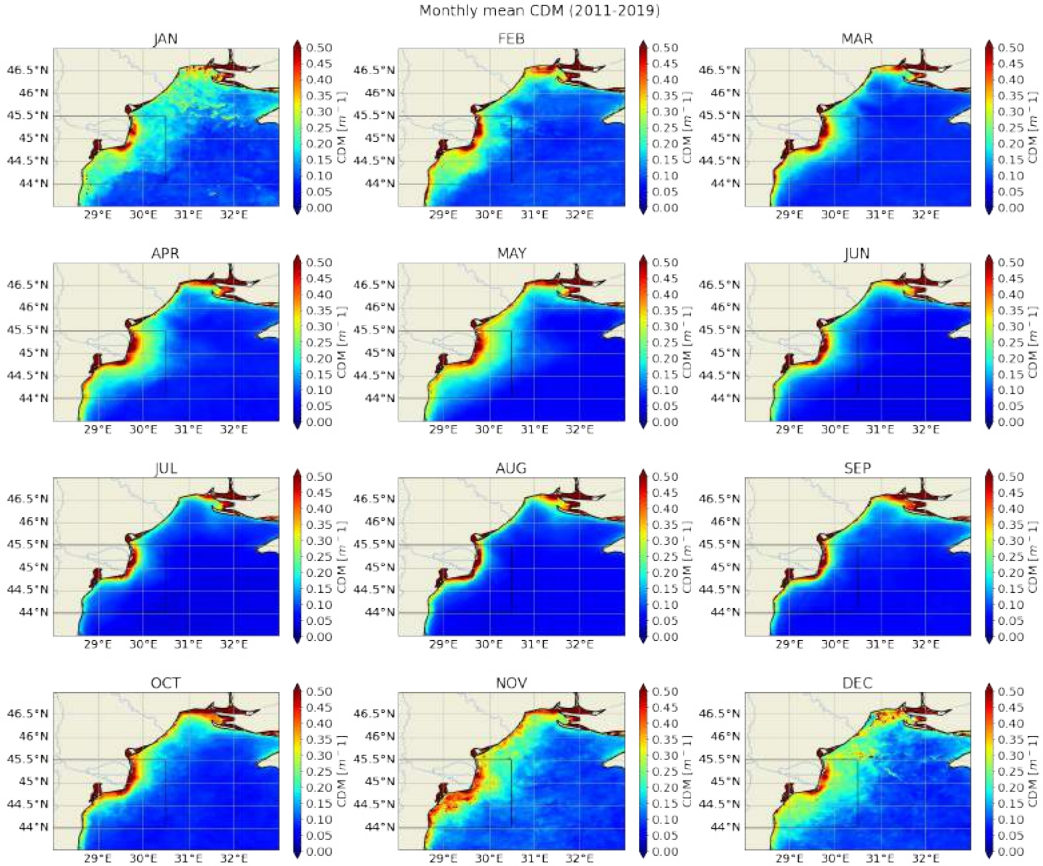
Data pre-processing

- 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.



[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

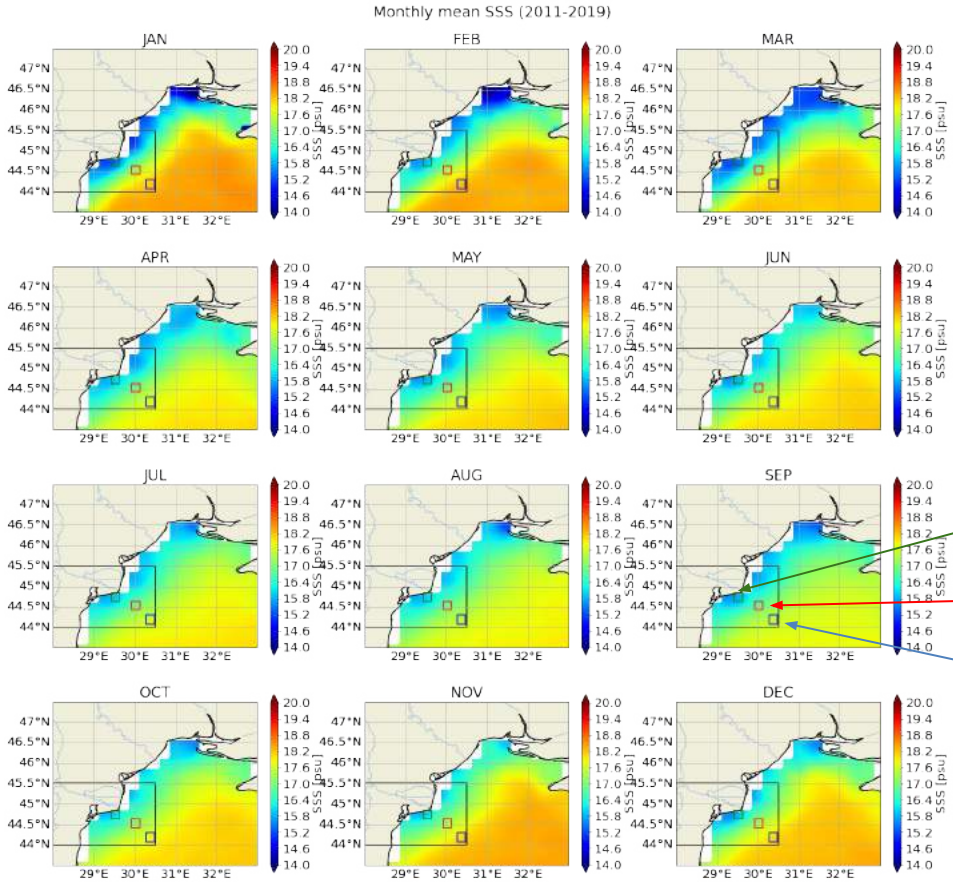
Temporal and spatial variability



- 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



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

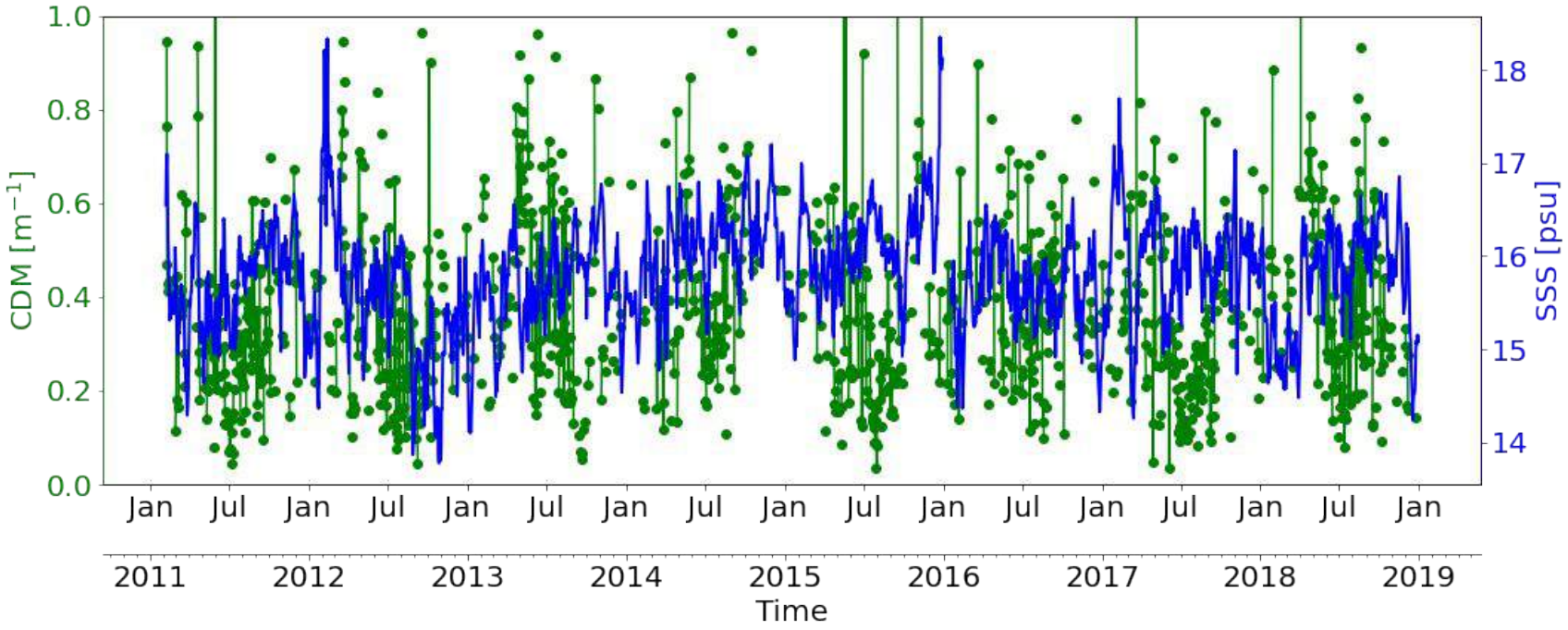
P1: lat [44.63ºN,22.83ºN]
lon [29.43ºE,29.63ºE]

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

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

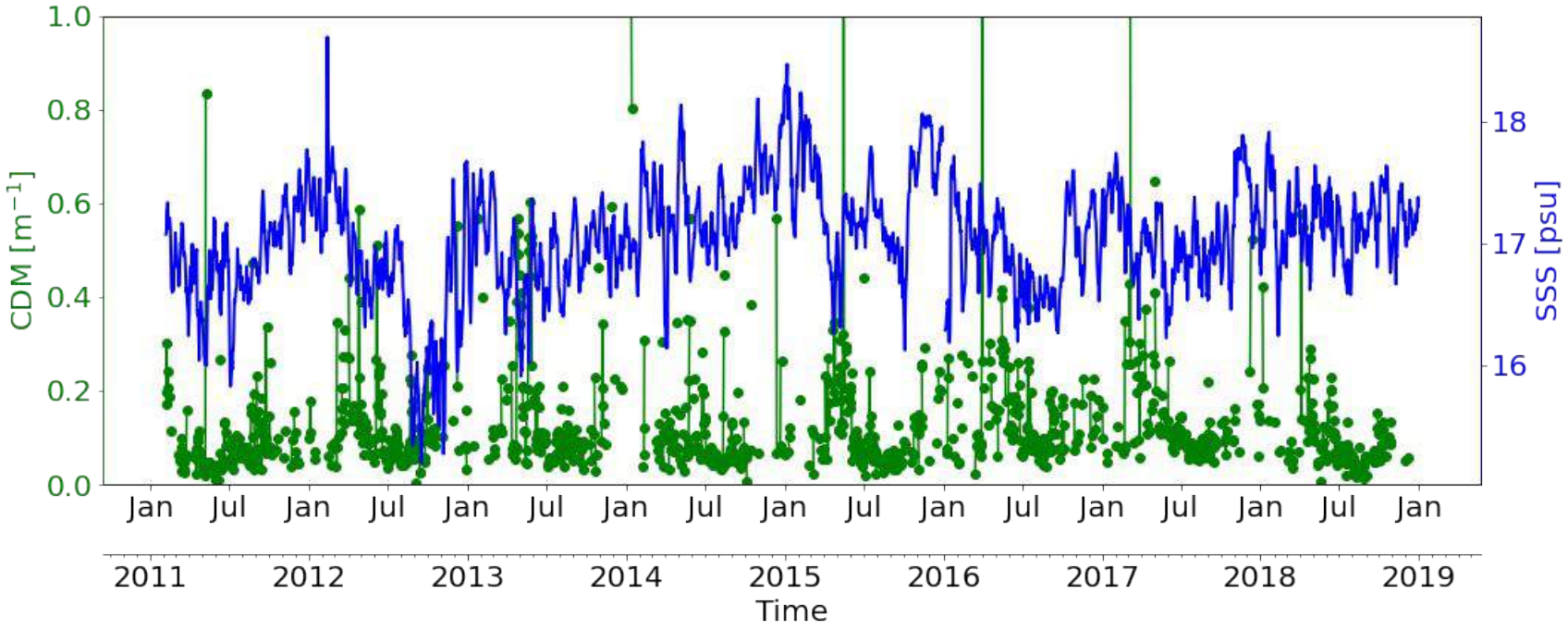
Temporal and spatial variability

P1: closer to Danube mouth



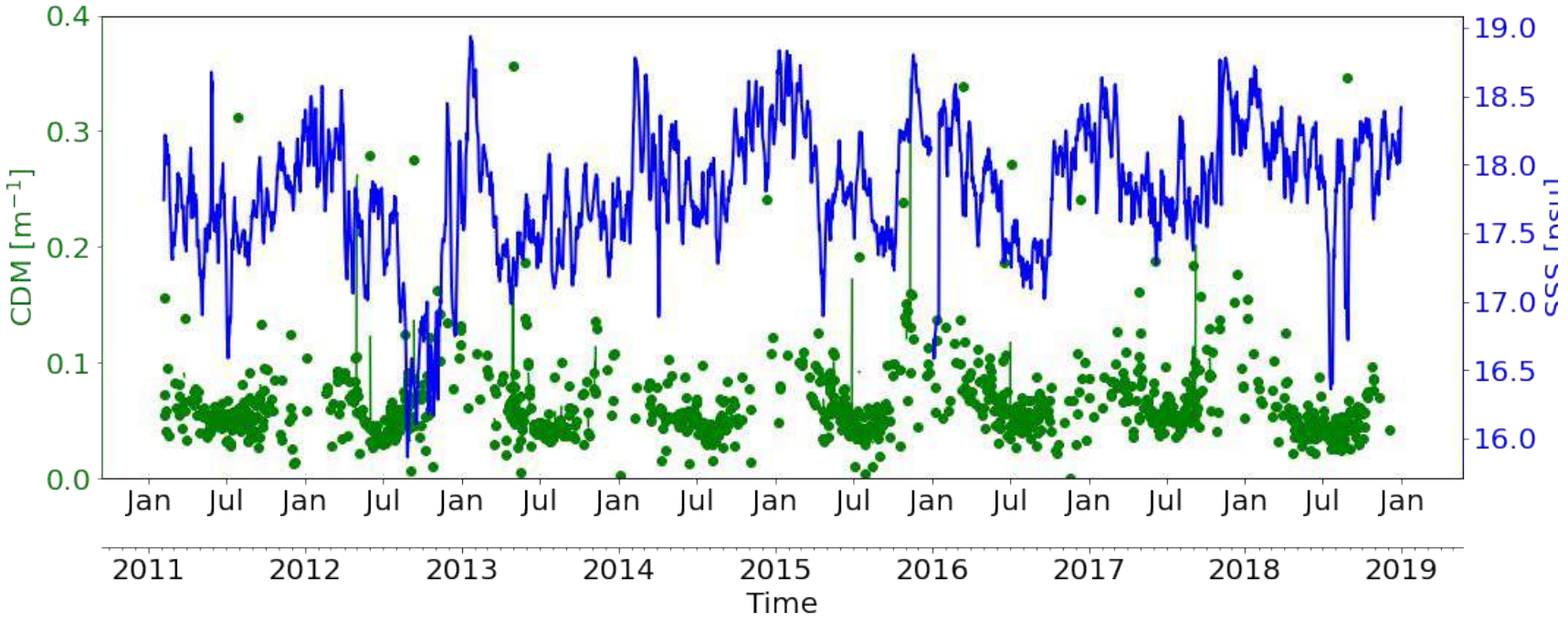
Temporal and spatial variability

P2: mid point



Temporal and spatial variability

P3: further to Danube mouth point

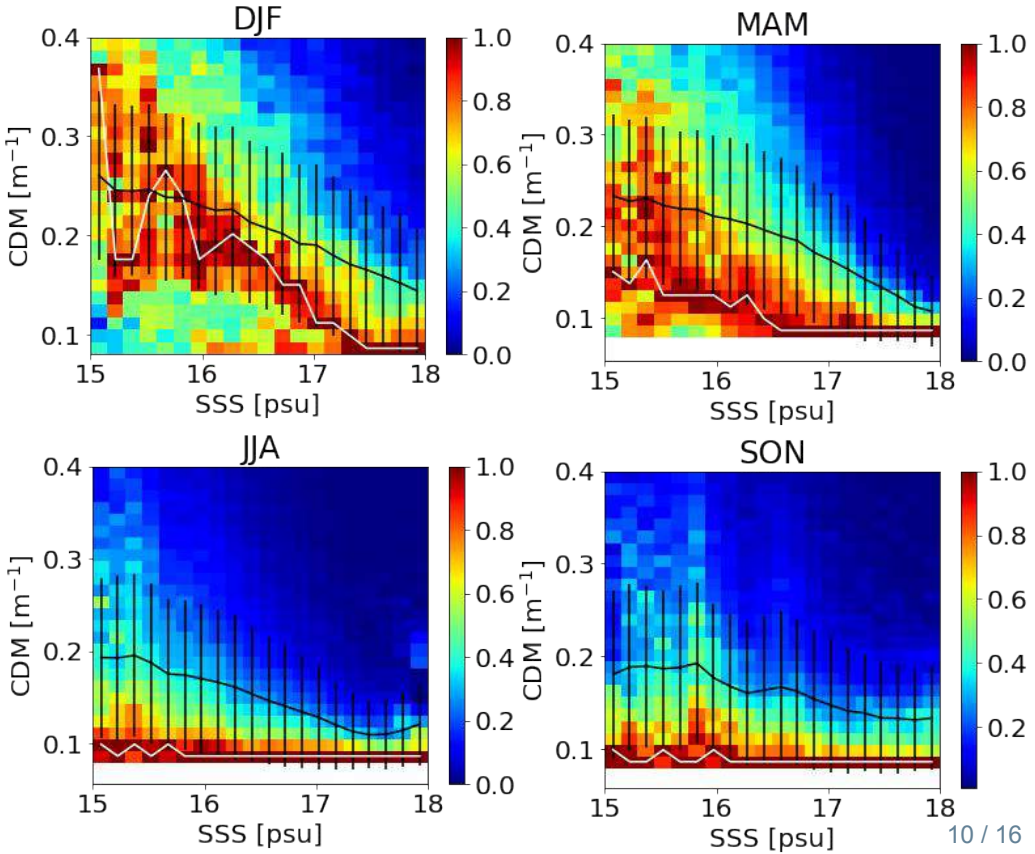


Characterization of SSS and CDM relation

- The histogram of a variable conditioned by the value of another variable serves to evidence any functional dependence between both.

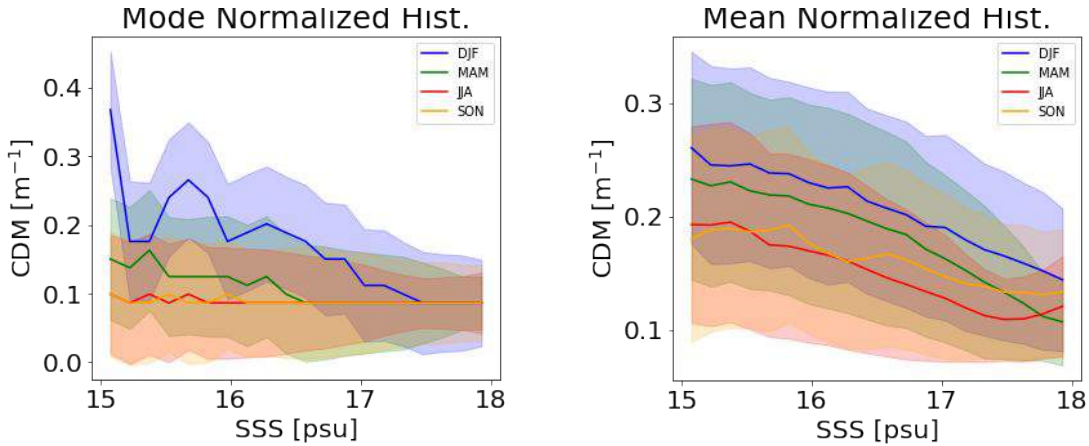
SSS: 20 bins ranging from 15 to 18 psu
(0.15 psu per bin)

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



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 [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

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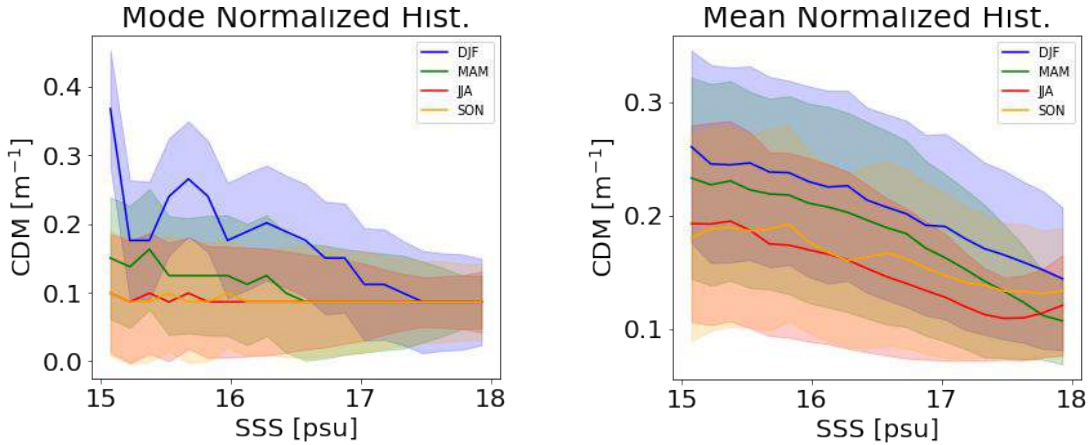

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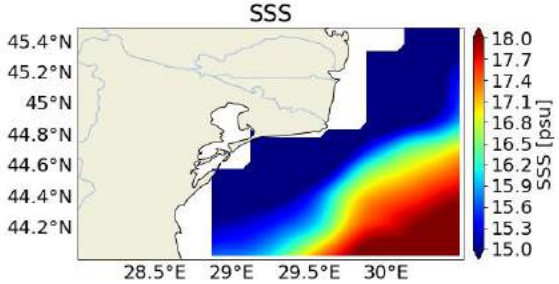
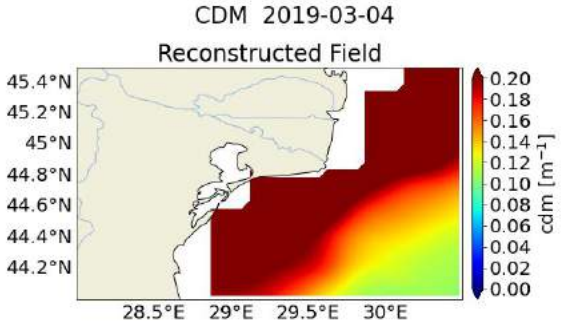
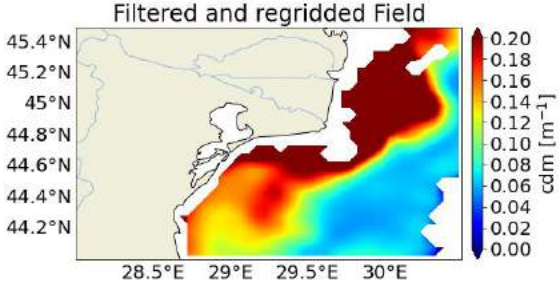
CDM reconstruction

- 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

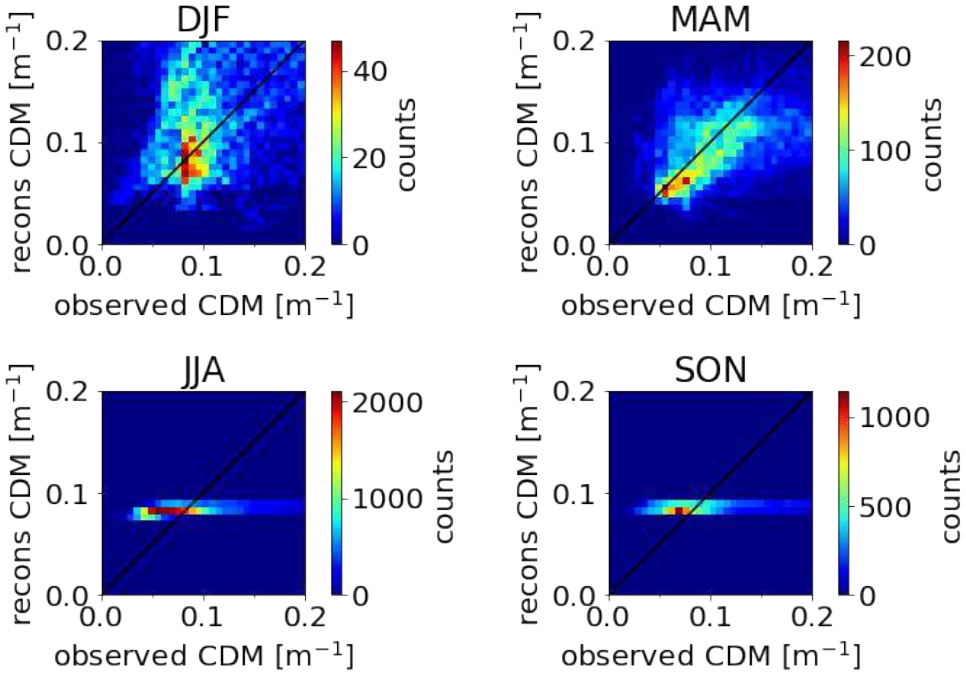






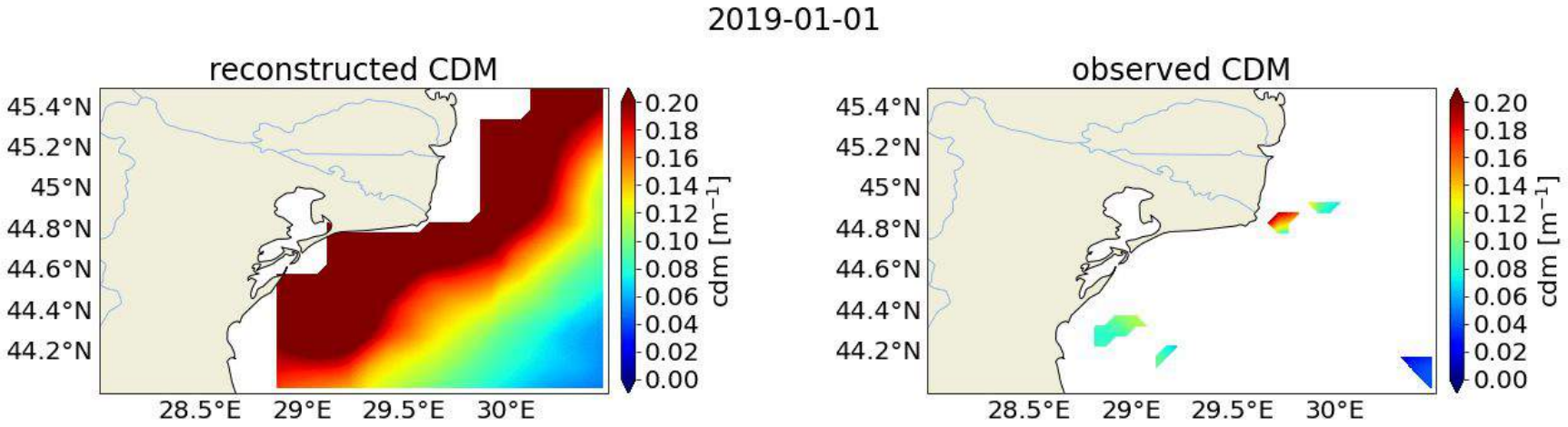
CDM reconstruction assessment

- Scatter plot 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/



Level	Temporal coverage	Temporal resolution	Spatial resolution	BEC FTP: sftp://becftp.icm.csic.es
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 datasets** for **winter** and **spring** seasons.
- We **encourage** you to **use** the **data** and send us **feedback** to: smos-bec@icm.csic.es and cgharo@icm.csic.es