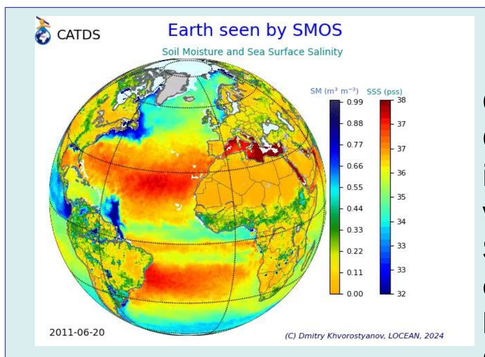
Novel Global and Arctic SSS fields at CATDS

J. Boutin[(1)], JL. Vergely[(2)], F. Bonjean[(1)], D. Khvorostyanov[(1)], S. Guimbard[(3)], S. Tarot[(4)]
(1) LOCEAN, France – (2) ACRI-ST, France – (3) Ocean-scope, France – (4) IFREMER, France

jacqueline.boutin@locean.ipsl.fr

Key messages

- CATDS provides improved global and Arctic SMOS SSS Level-3 products.
- Global CEC v10 reduces systematic errors, including solar contamination effects.
- CATDS-CEC Arctic V2 improves Arctic SSS through temporal optimal interpolation and geometry-dependent bias corrections.
- Validation shows a clear improvement of Arctic V2 relative to Arctic V1.
- CPDC Arctic L3G now provides operational 9-day Arctic SSS fields for recent monitoring.

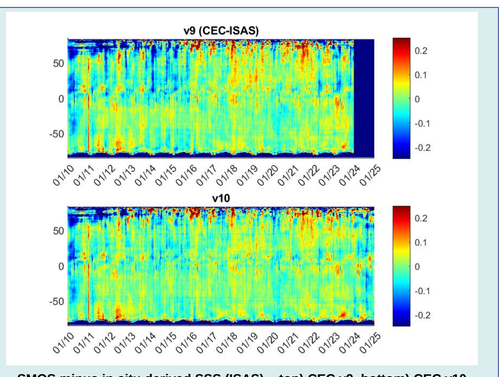


Film on: https://www.catds.fr/News/Earth-seen-by-SMOS-15-years-video

Global Ocean Salinity in CATDS Centers (CATDS CEC-OS & CPDC)

CATDS CEC-OS works at improving methodologies to be next implemented in the near real time CATDS processing chain (CATDS-CPDC). Global level 3 SMOS SSS fields, the CEC v10 (2010-2024) includes a correction related to the sun emission, leading to a more accurate SSS interannual variability in the northern hemisphere (Right Figure). CEC v11 (2010–2025) is scheduled for release in Summer 2026. It will include similar corrections as CEC v10, with the addition of an ice-sea contamination correction.

Near real time SSS fields with time/space resolution equivalent to CEC products are available at CATDS CPDC (L3G SSS products).



SMOS minus in situ derived SSS (ISAS) – top) CEC v9, bottom) CEC v10

CATDS-CEC Arctic V2 fields

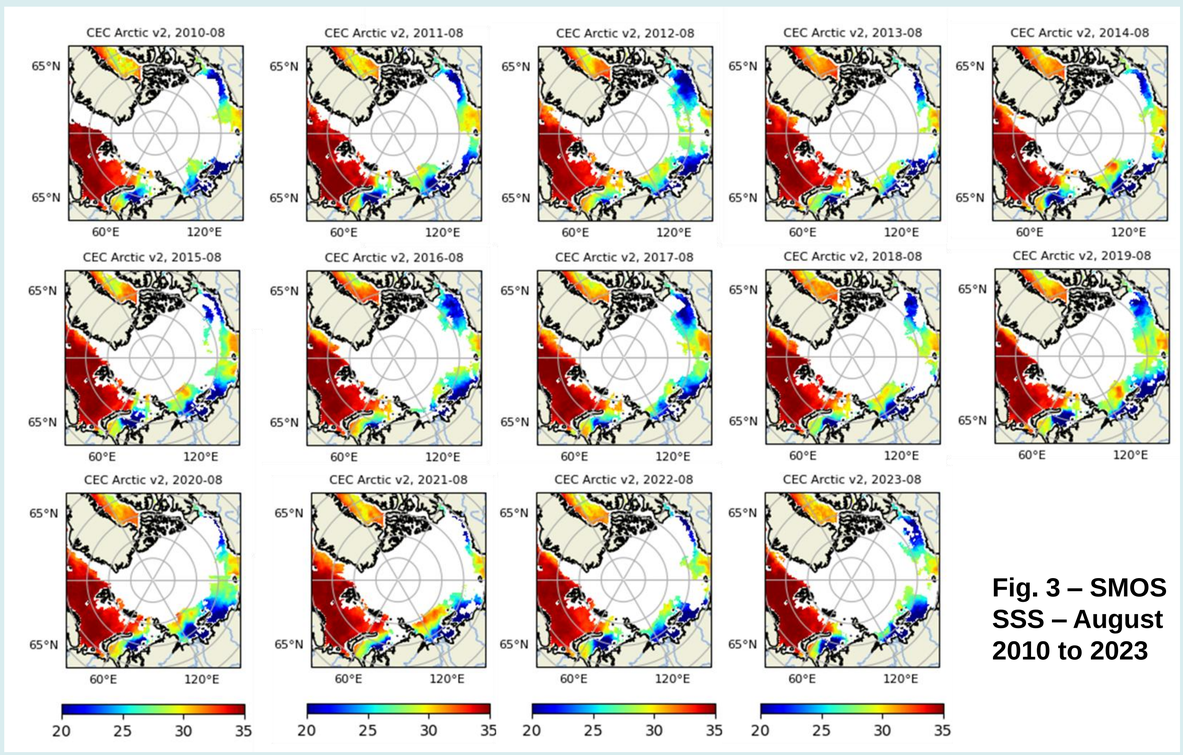


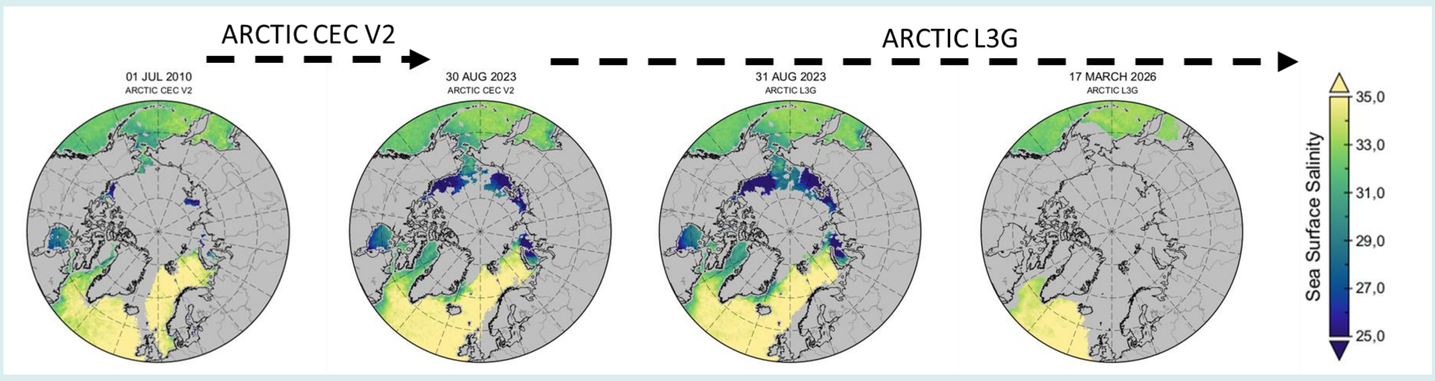
Fig. 3 – SMOS SSS – August 2010 to 2023

The SMOS ARCTIC SSS V1 processing [*Supply et al.*, 2020] has been revisited. A temporal optimal interpolation with a bias removal depending on the SMOS observation geometry (as in [*Boutin et al.*, 2018]) has been added. 9-day and 18-day maps are provided from June 2010 to August 2023 (Fig. 3 & Table 2). Comparisons with independent in situ datasets, indicate a clear improvement with respect to ARCTIC V1 product, (std difference decreases by ~a factor 2 and r^2 increases); with V2 r^2 is greater than 0.8 for 40% of the data sets considered at PIMEP (Table 1).

Table 1: Statistics of comparisons (SSS 9day Arctic v2 – in situ)

in situ database	#	Median	Mean	Std	RMS	IQR	r^2	Std*
argo	28443	-0.01	0.00	0.64	0.64	0.69	0.839	0.51
tsg-legos-dm	56172	0.00	-0.02	0.59	0.59	0.70	0.858	0.52
tsg-gosud-research-vessel	9955	-0.20	-0.10	0.57	0.58	0.61	0.649	0.45
tsg-gosud-sailing-ship	67849	-0.20	-0.74	1.97	2.10	2.03	0.839	1.23
tsg-samos	21674	-0.22	-0.40	1.85	1.89	1.97	0.751	1.42
mammal	876	0.09	-0.31	1.43	1.47	0.93	0.839	0.62
drifter	11036	0.03	0.11	0.49	0.50	0.47	0.098	0.34
tsg-polarstern	54922	-0.04	-0.02	0.95	0.95	0.97	0.719	0.72
saildrone	112935	-0.24	0.01	2.78	2.78	1.23	0.201	0.92
ices	61202	-0.05	0.02	0.64	0.64	0.71	0.208	0.52
tsg-amundsen	197622	-0.27	-0.66	1.96	2.07	1.88	0.730	1.36
tsg-lauge-koch	1336	0.49	0.84	1.08	1.37	1.28	0.908	0.78

Arctic SSS fields now produced operationally in CATDS CPDC



Following CATDS-CEC ARCTIC V2, CPDC ARCTIC SSS maps (ARCTIC L3G) are now produced operationally, at a 9day resolution.

For scientific studies, we recommend using CEC ARCTIC V2 products when available (up to 30 August 2023) and supplementing them with operational ARCTIC L3G products for recent period, the former being a bit better filtered for RFI, and even though the SSS produced by the two chains are very similar (rmsd ~0.3pss).

PIMEP validation reports available on : www.salinity-pimep.org/reports/mdb.html?region=ARCO&satellite=smos-l3-catds-cpdc-arctic-v333-9dr.

Table 2: Characteristics of Global and Arctic CATDS CPDC & CEC L3 data processings

	L3 OPERATIONAL PRODUCTS			L3 EXPERIMENTAL RESEARCH PRODUCTS	
Product Name	**CPDC CSQ3**	**CPDC L3G**	**CPDC ARCTIC L3G**	**CEC DEBIAS V10 (Global)**	**CEC ARCTIC V2**
doi	10.12770/0f02fc28-cb86-4c44-89f3-ee7df6177e7b	10.12770/9c97fb5c-d7d5-4bc2-a5c7-57944026cd60	10.12770/621d5bcc-01e9-480e-a764-518127dea272	10.17882/52804	10.17882/98769
SSS retrieval	SMOS/CATDS L2OS v7 (iterative retrieval along dwell lines)		SMOS/ESA L2OS v7 SSS(Acard) (no WS retrieval)	SMOS/CATDS L2OS v7	SMOS/ESA L2OS v7 SSS(Acard) (no WS retrieval)
Calibration & Systematic corrections	OTT, land-sea contamination & seasonal/latitudinal biases		OTT, land-sea	OTT, land-sea, seasonal/latitudinal & sun	OTT, land-sea
SMOS Filtering	L2OS v7 flags	3σ self-consistency analysis		3σ self-consistency analysis	
SMOS swath	+/-400km across swath			+/-400km across swath	
Temporal sampling	1 Day			4 days	
Grid sampling	25km & 50km	25km		25km	
Temporal average	10day or monthly running simple means (error weighted)	9day FWHM gaussian weighted mean		Temporal optimal interpolation: 9day or 18day FWHM gaussian smoothing	
Spatial average	Original SMOS resol. (~50km) *100km also available*	median over nearest neighbors (~70km effective resolution)		median over nearest neighbors (~70km effective resolution)	
Format	Netcdf – EASE2 grid		Netcdf – EASE2 polar grid	Netcdf – EASE2 grid	Netcdf – EASE2 polar grid
Access	ftp://ext-catds-cpdc:catds2010@ftp.ifremer.fr/ or https://data.catds.fr/cpdc/			ftp://ext-catds-cecos-ifremer:catds2010@ftp.ifremer.fr/ or https://data.catds.fr/cecos-locean/	
Period	Jan 2010 - Current (<1d delay)	Jan 2010-Current (25days delay)	Jan 2010-Current (20days delay)	Jan 2010-Dec 2024	July 2010-Aug 2023
Updated	Everyday	Everyday	Everyday	Yearly	TBD

Contacts

General : contact@catds.fr
C-PDC service desk : support@catds.fr
C-EC OS : jb@locean-ipsl.upmc.fr

References

Boutin et al. (2018), New SMOS Sea Surface Salinity with reduced systematic errors and improved variability, *RSE*, doi: 10.1016/j.rse.2018.05.022.
Supply et al. (2020), New insights into SMOS sea surface salinity retrievals in the Arctic Ocean, *RSE*, doi:10.1016/j.rse.2020.112027.