



# CATDS CEC-LOCEAN debiased version 4 Sea Surface Salinity

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## Take home messages

With 10 years and counting, the Soil Moisture and Ocean Salinity (SMOS) mission provides the longest record for satellite Sea Surface Salinity (SSS) (2010-present).

Recent reprocessings of SMOS successfully mitigates most systematic errors while preserving natural SSS variability (e.g. river fresh-water plumes).

An updated version of CATDS CEC-LOCEAN SSS has been released (debias v4): with respect to version 3, better removal of SST and wind speed spurious effects and better filtering of sea ice (=>improvements in the Southern Ocean)

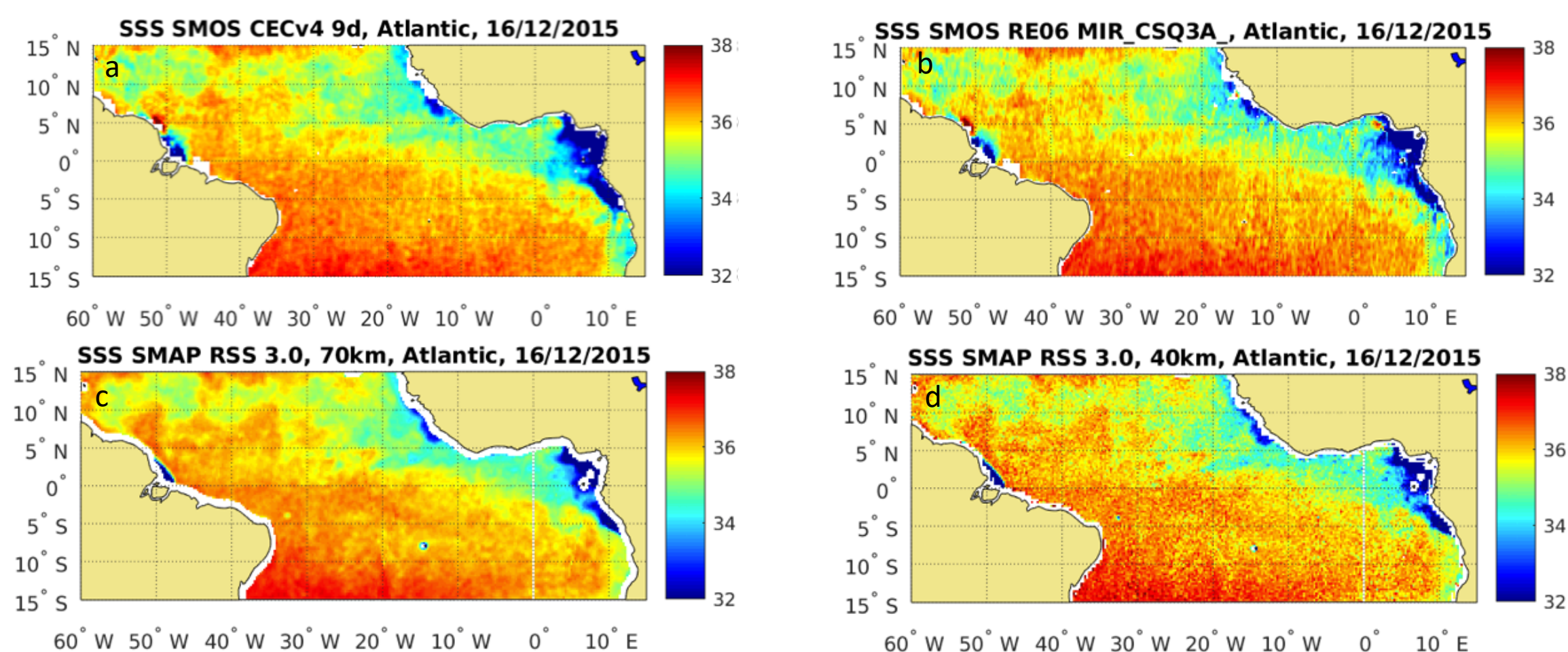


Fig. 1: SMOS and SMAP SSS in the tropical Atlantic Ocean – December 16<sup>th</sup> 2015:

a) SMOS SSS updated version (CATDS CEC-LOCEAN debias v4 - 70km effective spatial resolution); b) SMOS Operational SSS (CATDS CPDC RE06 L3Q - 50km resolution); c) SMAP RSS v3.0, 70km resolution; d) SMAP RSS v3.0, 40km resolution

## 1. Introduction

- **CATDS** (Centre Aval de Traitement des Données SMOS), developed by the CNES in collaboration with the CESBIO and IFREMER, produces and continuously improves SMOS Sea Surface Salinity (SSS) products.

- **CEC** (CATDS Expertise Center) **products** : The L3 products are at 9-day and 18-day resolution (Gaussian averaging). They contain a bias correction based on internal consistency of SMOS SSS retrieved in various locations across swath (Boutin et al. 2018).

## Evolution of products

CATDS CEC-LOCEAN	CATDS CPDC products	Main evolutions	Reference
Debiased v4 2010/01/16 2019/10/25	N/A	= V3 + ACARD (ice) filtering, Wind<16m/s, absolute calibration: upper quantiles (70% to 90%) of 6-yr ISAS SSS	<a href="https://doi.org/10.17882/52804#69293">https://doi.org/10.17882/52804#69293</a>
Debiased V3 2010/01/16 2017/12/25	RE06 (reprocessed until XXX) and OPER (operational)	= V2 + SSS <b>seasonal</b> natural variability; absolute calibration: upper quantile of 6-yr ISAS SSS	<a href="http://doi.org/10.17882/52804#57467">http://doi.org/10.17882/52804#57467</a>
Debiased V2 2010/01/16 2016/12/26	N/A	= V0 + seasonal latitudinal correction + SSS spatial natural variability; abs. cal.: median 7-yr ISAS SSS	Boutin et al., 2018
Debiased V0	N/A	Reduced land-sea contamination; absolute calibration: 3-yr ISAS SSS median	Kołodziejczyk et al., 2016

## 2. What is new in CATDS CEC V4

- Ice filtering based on SMOS pseudo dielectric constant (Waldteufel et al. 2004)  
Acard: over ocean Acard is much larger (fig 2a) than in ice contaminated pixels (fig 2b)

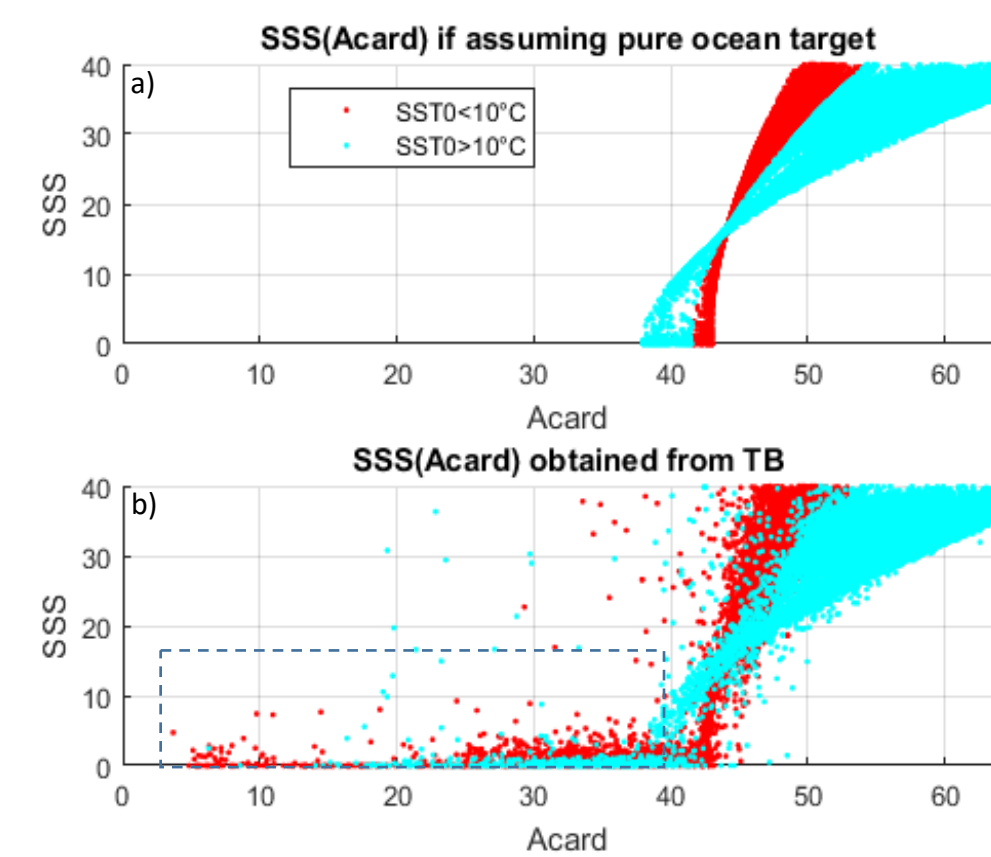


Figure 2: a) SSS(Acard) if assuming pure ocean target. b) SSS(Acard) obtained from Tb. Dashed rectangle: contaminated points (sea ice, RFI, land)

- improved SST correction in cold waters, by correcting for the SSS systematic difference observed between Aquarius SSS processed with the Klein and Swift dielectric constant model and Argo SSS (Fig 3, open circles)

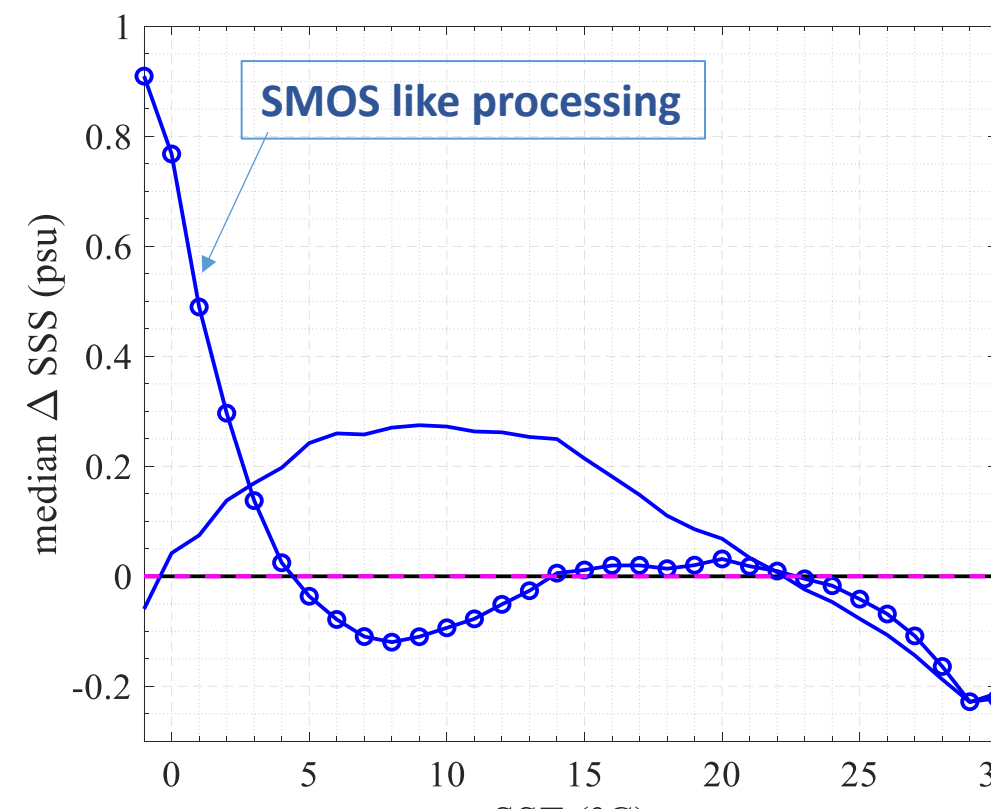


Figure 3: SST adjustment from Dinnat et al. 2019: SST dependent systematic difference between Aquarius and Argo SSS: Plain line: Aquarius v3 model; open circles: Aquarius processed with direct models similar to SMOS processing, Period 09/2011 - 05/2015

- new SSS absolute calibration : use of upper quantiles of the 2012-2018 SSS distribution

- Wind filtering: SSS for winds stronger than 16m s<sup>-1</sup> are discarded

## 3. Improvements in comparison with CATDS CEC V3

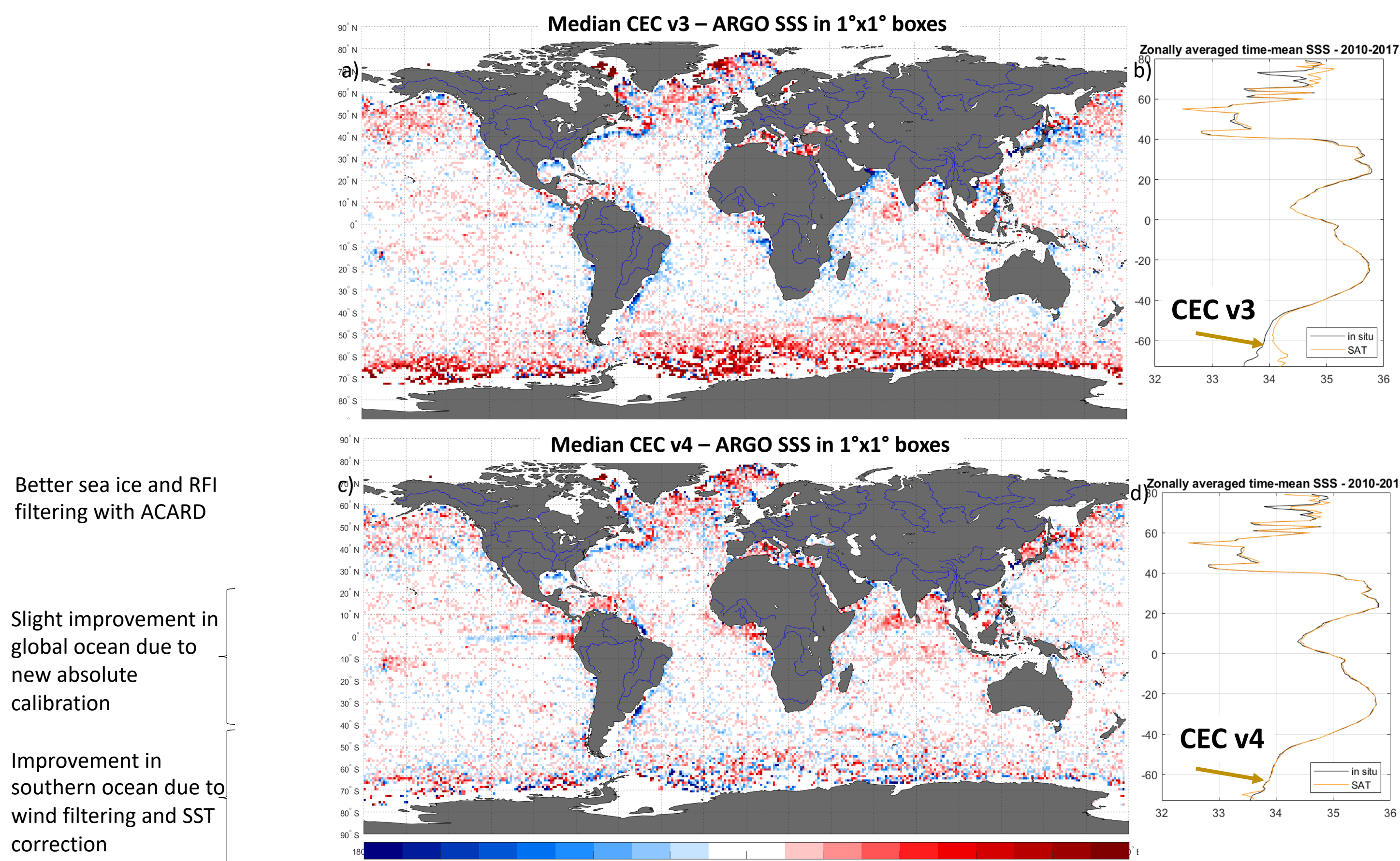


Figure 4: Major improvements from version 3 to version 4: comparisons with Argo. Temporal mean over 1° boxes for v3 (a) and v4 (c). Zonally averaged time-mean SSS for v3 (b) and v4 (d). (Matchups provided by PIMEP)

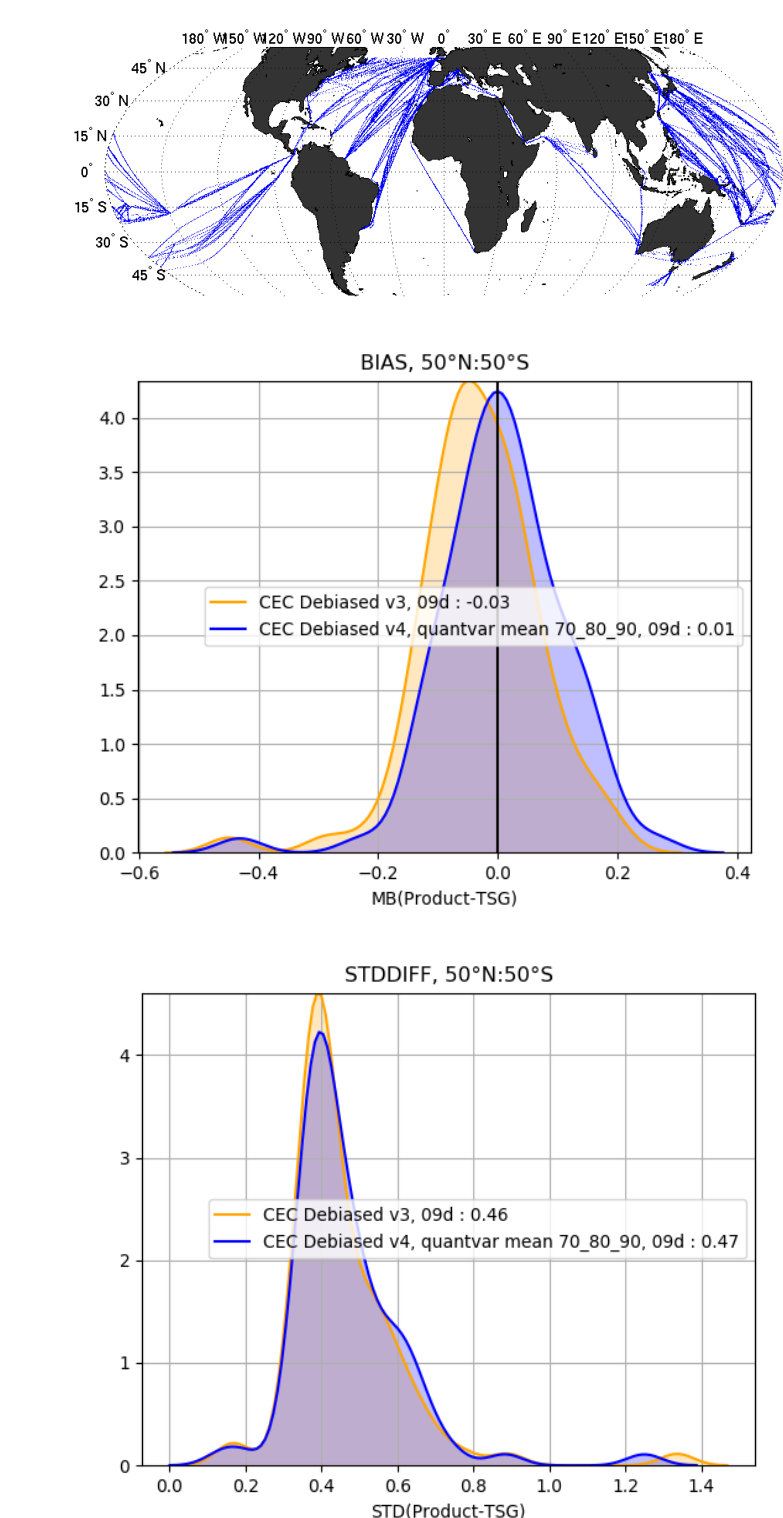


Figure 5: Statistical distributions of difference (a) and std difference (b) for CECv3 (orange) and CECv4 (blue) products, with respect to ships measurements

## 4. Comparisons between SMOS CEC v4 and in-situ measurements (PI-MEP)

in situ database	#	Median	Mean	Std	RMS	IQR	r <sup>2</sup>	Std*
argo	1236494	0.01	0.02	0.43	0.43	0.41	0.95	0.30
tsg-legos-dm	4855868	0.02	0.09	0.86	0.86	0.58	0.74	0.43
tsg-gosud-research-vessel	4167131	0.07	0.08	0.72	0.73	0.60	0.88	0.45
tsg-gosud-sailing-ship	859702	0.03	0.04	0.74	0.74	0.45	0.85	0.33
tsg-samos	17470396	0.09	0.20	1.36	1.37	0.69	0.66	0.51
mammal	88087	-0.05	-0.04	0.46	0.46	0.51	0.46	0.38
drifter	1858981	0.00	0.00	0.45	0.45	0.38	0.93	0.28
tsg-legos-survostral	574769	-0.05	-0.04	0.36	0.36	0.47	0.64	0.35
tsg-legos-survostral-adelie	8049	-0.17	-0.07	0.43	0.44	0.37	0.11	0.28
tsg-ncei-0170743	446303	0.11	0.11	0.36	0.38	0.45	0.79	0.33
tsg-polarstern	279688	-0.01	-0.08	0.73	0.74	0.47	0.77	0.35

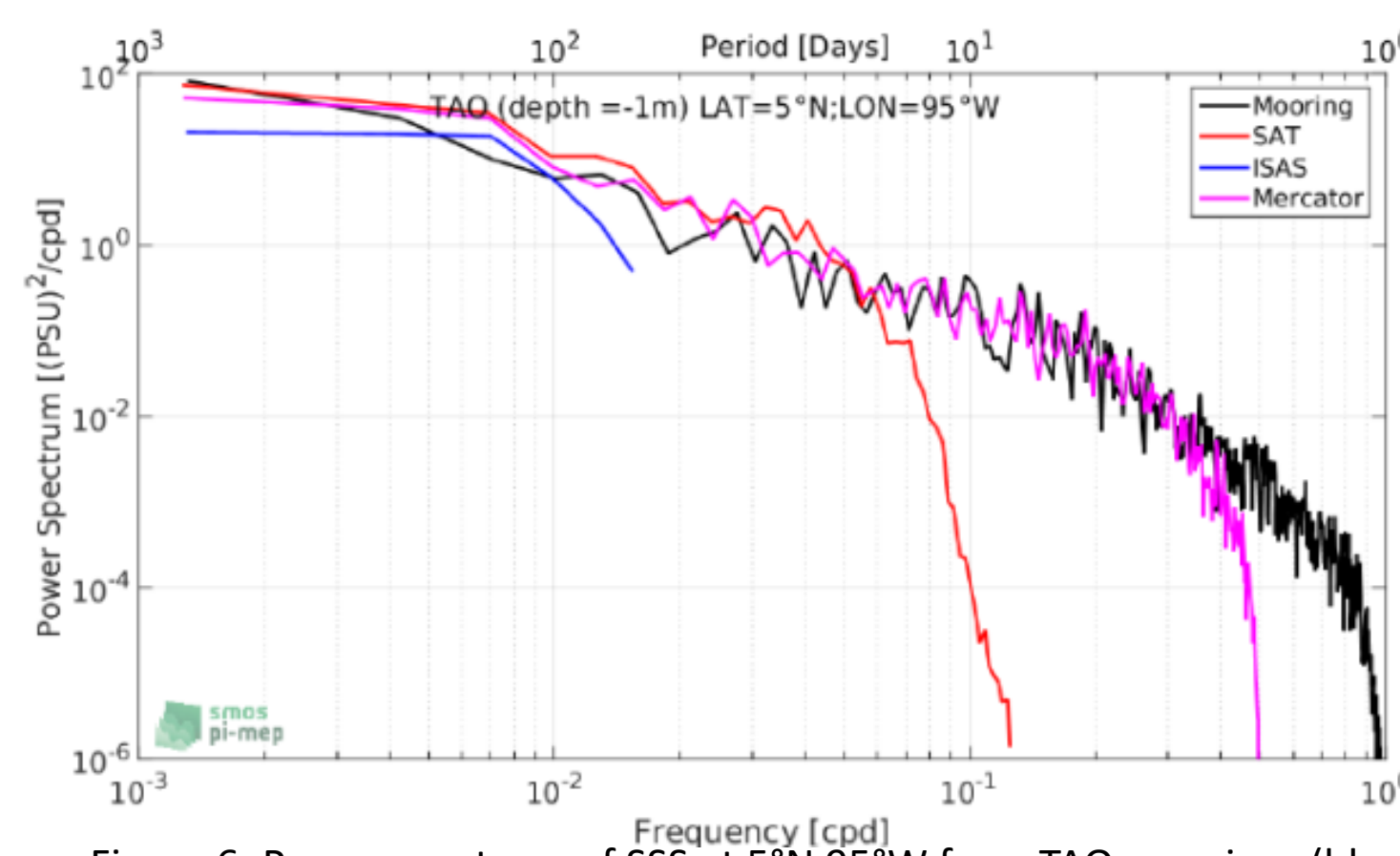


Figure 6: Power spectrum of SSS at 5°N 95°W from TAO moorings (black), SMOS CEC V4 9d SSS (red), ISAS (blue) and Mercator (pink)

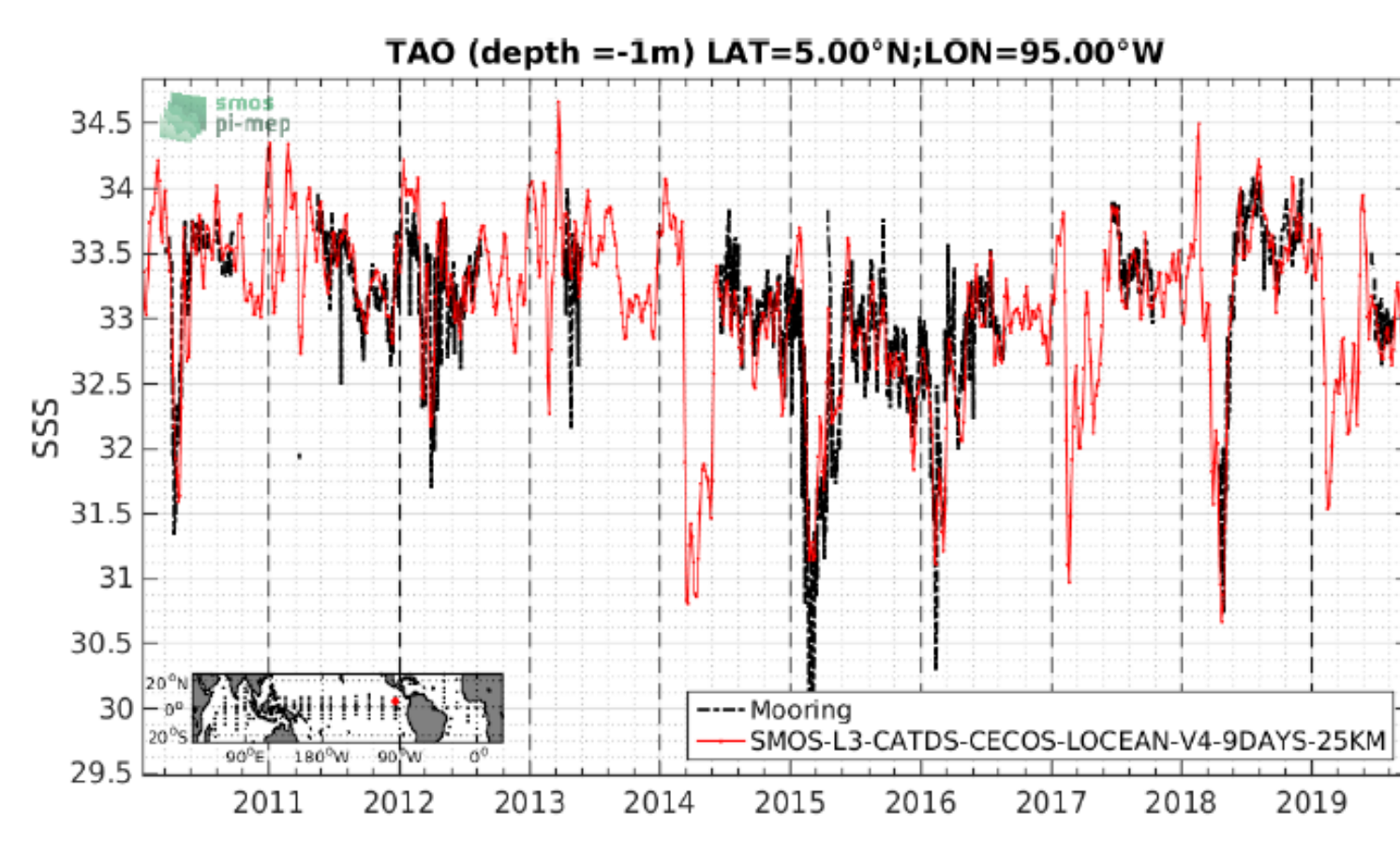


Figure 7: Example of time series in comparison to TAO mooring at 5°N 95°W

## References:

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