File: BEC-SMOS-0008-QR.pdf , version 1.0

Title: Quality Report: Validation of debiased SMOS-BEC operational Sea Surface Salinity products. Years 2011-2015.

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Date: 11/07/2016

QUALITY REPORT: VALIDATION OF DEBIASED SMOS-BEC OPERATIONAL SEA SURFACE SALINITY PRODUCTS. YEARS 2011-2015

Abstract: This technical note focuses on the comparison of the Sea Surface Salinity (SSS) of the debiased SMOS-BEC operational global Ocean products distributed by BEC at http://cp34-bec.cmima.csic.es with respect to the SSS provided by Argo floats

Contents

1 INTRODUCTION

The aim of this technical note is to report the differences between the debiased operational SMOS SSS distributed by BEC and the Argo data. The BEC products have been generated from Level 2 v622 salinities processed by ESA and are described in *SMOS-BEC Ocean and Land Products Description* [BEC, 2015]. Three families of products are being considered here: the weighted averages, the objective analyzed, and the fused maps. The spatial grid of these products is 0.25 and 1.00 degrees (weighted average), 0.25 degrees (objective analyzed) and 0.05 degrees (fused). Three time averaging windows are also considered: 1 day and monthly (for weighted average) and 9 days (for objective analyzed and fused). These produts are distributed by BEC from http://cp34-bec.cmima.csic.es.

The structure of this technical note is the following. Section 2 describes the SMOS data used in this report. Section 3 describes how the SSS has been estimated from Argo profiles. The results are shown in section 4

2 NEW DEBIASED OCEAN SALINITY PRODUCTS

Land Sea Contamination has been mitigated by means of the empirical debiasing method proposed in [Olmedo et al., 2016]. Different new products are generated covering different needs of the user:

- Daily gridded L2 map: This product is devoted to users interested in working with SMOS SSS data, but who are not familiarized with the official format. All the L2 SSS satellite overpasses with the same orbit direction, that is ascending and descending separately, in the same day are put together in a regular cylindrical $0.25^o \times 0.25^o$ grid and distributed in netcdf format files.
- Monthly binned L3 map: This product aims to final users who are interested in global, calibrated SMOS SSS maps. The previous versions of the SMOS-BEC L3 maps were served at $0.25^o \times 0.25^o$ in an averaged period of 9 days. We observed that at those spatial and temporal resolutions, the noise dominated over the geophysical structures. Therefore, the new binned products are served at $1.0^o \times 1.0^o$ spatial resolution and an averaged period of one month.
- Objective analyzed L3 map: The previous optimal interpolated (OI) SSS maps are being replaced by objectively analyzed (OA) SSS maps. No external SSS field has been used for their generation. The new objective analyzed L3 maps are served daily, at $0.25^o \times 0.25^o$ spatial resolution and in an integrated temporal period of 9 days.
- Daily fused L4 maps: Operational Sea Surface Temperature and Sea Ice Analysis (OSTIA) daily maps at $0.05^o \times 0.05^o$ (see [Donlon et al., 2012]) have been used to increase the spatial and temporal resolution of the 9-day objective analyzed maps. The OSTIA system is part of the Group for High Resolution Sea Surface Temperature (GHRSST), and is currently served in the MyOcean web portal (http://www.myocean.eu.org). Several fusion parameters have been tuned to improve the fused product as described in [Olmedo et al., 2016].

Table 1 summarizes the products from years 2011, 2012, 2013, 2014 and 2015 validated in this study. Detailed information about the products generated by BEC can be found in [BEC, 2015].

Frequency	Average Period	Grid	Orbit	Product	Name
1 days	daily	$0.25^o \times 0.25^o$	ascending	Weighted averaged	BIN025A
			descending	Weighted averaged	BIN025D
	9 days	$0.25^o \times 0.25^o$	both	Objective Analyzed	OA_025B
		$0.05^o \times 0.05^o$	both	Fused	L4_005B
monthly	Natural months	$1.00^o \times 1.00^o$	both	Weighted averaged	BIN100B

Table 1: Ocean products validated in this study.

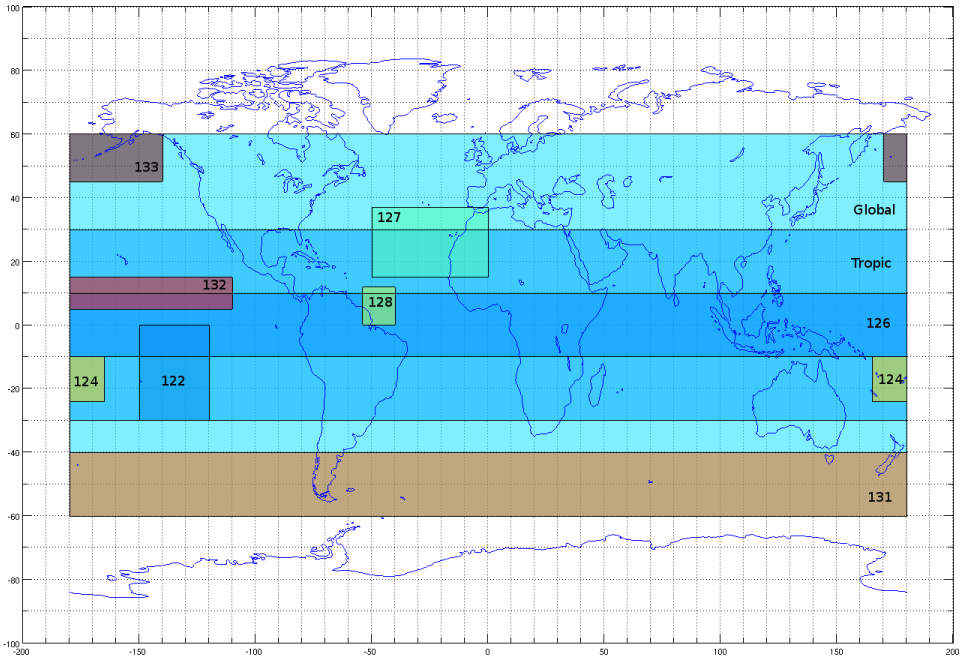

Figure 1: Main zones under study

3 ARGO

The SMOS-BEC products are compared in this section with in situ data. The statistical comparison is carried out with close-to-surface values acquired by Argo floats (Argo data is freely distributed by the CORIOLIS data center, http://www.coriolis.eu.org).

In particular, SSS values are being estimated from Argo data by interpolating the salinity profiles at 7.5m below the surface. To avoid extrapolation, only profiles with valid values at (at least) 5.5m depth are considered. For SOLO and PROVOR profiles, only data below 5 m depth are taken into account as their CTD probes do stop pumping water at arround 5 m below the surface ([Boutin et al., 2012]). The whole valid profile is used in the interpolation, with the exception of values taken above 0.5 m depth. As in [Ballabrera-Poy et al., 2009], interpolation artifacts are reduced by using three different interpolations methods: Akima splines ([Lancaster and Salkauskas, 1981]), cubic splines, and third order polynomial fitting ([Press et al., 1992]). The interpolated profile is obtained here by averaging the three methods, but profiles are rejected if any of the three interpolation schemes differs by more than the 5% from the average.

The differences between satellite and the external data are estimated in the regions described in table 2 and shown in figure 1.

4 RESULTS

The results rely upon the basic statistics of the difference between the SMOS an the ARGO value at each cell. A global summary of the performance of every product can be found in table 3. The values listed in the table 4 correspond to the global average value of the mean, the standard deviation and the root mean square statistics with respect to the different SMOS SSS procuts during the years 2011 and 2015. The time evolution of these statistics is shown in Figure 2 and 3. A more detailed analysis

Zone	**Description**	**Latitude**	**Longitude**
Global	Tropics and mid-latitudes	60^oS - 60^oN	All
Tropic	Tropics	30^oS - 30^oN	All
122	A region of the South Eastern Pacific	30^oS - 0^oN	150^oW - 120^oW
124	A region of the South Western Tropical Pacific	24^oS - 10^oS	165^oE - 165^oW
126	Equatorial oceans	10^oS - 10^oN	All
TARFAYA	North Atlantic region (Tarfaya model region)	15^oN - 37^oN	50^oW - 0^o
131	Southern Ocean	60^oS - 40^oS	All
132	Intertropical Pacific	5^oN - 15^oN	110^oW - 180^oW
NPac	A region of the North Pacific	45^oN - 60^oN	170^oE - 140^oW

Table 2: Zones under study

Table 3: Summary of statistics of the comparison with Argo

Product	<Mean>	<STD>	<RMS>
BIN025A	-0.01	0.59	0.62
BIN025D	-0.01	0.60	0.63
BIN100B	-0.02	0.22	0.23
OA_025B	-0.01	0.26	0.27
L4_005B	-0.02	0.24	0.25

under the regions described in 2 are presented for every product by separate in Tables 5, 6, 7, 8 and 9.

References

[BEC, 2015] (2015). *SMOS-BEC Ocean and Land Products Description BEC-SMOS-0001-PD*. BEC. version 1.4.

[Ballabrera-Poy et al., 2009] Ballabrera-Poy, J., Mourre, B., García-Ladona, E., Turiel, A., and Font, J. (2009). Linear and non-linear T-S models for the eastern North Atlantic from Argo data: Role of surface salinity observations. *Deep-Sea Res. I, 56, pp. 1605-1614*.

[Boutin et al., 2012] Boutin, J., Martin, N., Yin, Y., Font, J., Reul, N., and Spurgeon, P. (2012). First assessment of SMOS data over open ocean: Part II-sea surface salinity. *IEEE Trans. Geosci. Remote Sens., vol. 50, no. 5. pp. 1662-1675*.

[Donlon et al., 2012] Donlon, C. J., Martin, M., Stark, J., Roberts-Jones, J., Fiedler, E., and Wimmer, W. (2012). The operational sea surface temperature and sea ice analysis (ostia) system. *Remote Sensing and Enviroment*, 116(0):140 – 158.

[Lancaster and Salkauskas, 1981] Lancaster, P. and Salkauskas, K. (1981). Surfaces generated by moving least squared methods. *Mathematics and Computing*, 37:141–158.

[Olmedo et al., 2016] Olmedo, E., , Martínez, J., Umbert, M., Hoareau, N., Portabella, M., Ballabrera-Poy, J., and Turiel, A. (2016). Improving time and space resolution of smos salinity maps using multifractal fusion. *Remote Sensing of Environment*, in press.

Table 4: Statistics of the comparison with Argo

		SMOS - ARGO in [60^{o}S:60^{o}N]			**SMOS - ARGO in [30^{o}S:30^{o}N]**		
Year	Product	<Mean>	<STD>	<RMS>	<Mean>	<STD>	<RMS>
2011	BIN025A	-0.04	0.57	0.60	-0.04	0.50	0.53
	BIN025D	0.02	0.59	0.62	0.02	0.49	0.53
	BIN100B	-0.02	0.22	0.22	-0.03	0.20	0.20
	OA_025B	-0.00	0.25	0.26	-0.03	0.22	0.22
	L4_005B	-0.01	0.23	0.24	-0.04	0.21	0.22
2012	BIN025A	0.02	0.59	0.62	0.02	0.51	0.54
	BIN025D	0.04	0.59	0.62	0.03	0.50	0.53
	BIN100B	0.02	0.21	0.22	-0.00	0.19	0.21
	OA_025B	0.03	0.25	0.26	-0.01	0.21	0.23
	L4_005B	0.02	0.24	0.25	-0.01	0.22	0.22
2013	BIN025A	0.01	0.58	0.61	0.00	0.49	0.52
	BIN025D	0.00	0.59	0.61	-0.03	0.47	0.63
	BIN100B	-0.01	0.20	0.21	-0.02	0.19	0.20
	OA_025B	-0.00	0.26	0.26	-0.03	0.23	0.24
	L4_005B	-0.01	0.24	0.25	-0.03	0.24	0.24
2014	BIN025A	-0.04	0.57	0.60	-0.02	0.50	0.52
	BIN025D	0.02	0.59	0.62	-0.05	0.50	0.56
	BIN100B	-0.04	0.21	0.22	-0.04	0.20	0.21
	OA_025B	-0.02	0.26	0.26	-0.04	0.24	0.24
	L4_005B	-0.04	0.24	0.25	-0.05	0.23	0.24
2015	BIN025A	-0.02	0.58	0.60	-0.01	0.51	0.54
	BIN025D	-0.05	0.59	0.62	-0.04	0.50	0.54
	BIN100B	-0.04	0.22	0.22	-0.04	0.21	0.22
	OA_025B	-0.01	0.27	0.28	-0.03	0.25	0.26
	L4_005B	-0.03	0.26	0.26	-0.06	0.24	0.26

Table 5: Statistics of the comparison with Argo: Daily binned product for ascending orbits

Year	Region	IQR	Median	Mean	STD	RMS
2011	122	0.60	-0.05	-0.06	0.42	0.55
	124	0.69	0.03	0.02	0.47	0.57
	126	0.69	-0.01	-0.00	0.47	0.54
	131	1.29	0.06	0.07	0.90	1.05
	132	0.65	-0.09	-0.10	0.46	0.60
	3030	0.70	-0.05	-0.04	0.50	0.53
	6060	0.81	-0.06	-0.04	0.57	0.60
	TARFAYA	0.52	-0.13	-0.14	0.37	0.58
2012	122	0.59	-0.03	-0.03	0.41	0.56
	124	0.65	0.08	0.09	0.45	0.54
	126	0.69	0.05	0.05	0.47	0.55
	131	1.32	0.12	0.12	0.92	1.10
	132	0.64	-0.03	-0.03	0.45	0.60
	3030	0.73	0.00	0.02	0.51	0.54
	6060	0.83	-0.01	0.02	0.59	0.62
	NPac	0.89	0.15	0.18	0.64	0.98
	TARFAYA	0.62	-0.08	-0.07	0.43	0.62
2013	122	0.60	-0.03	-0.02	0.42	0.55
	124	0.65	0.04	0.05	0.45	0.53
	126	0.68	0.05	0.04	0.47	0.54
	131	1.29	0.05	0.06	0.88	1.05
	132	0.69	-0.01	-0.02	0.48	0.63
	3030	0.70	-0.01	0.00	0.49	0.52
	6060	0.81	-0.02	0.01	0.58	0.61
	NPac	0.85	-0.38	-0.34	0.63	0.97
	TARFAYA	0.56	-0.02	-0.02	0.38	0.59
2014	122	0.70	-0.03	0.03	0.50	0.63
	124	0.67	0.00	0.01	0.46	0.53
	126	0.69	0.03	0.03	0.47	0.55
	131	1.43	-0.04	-0.04	0.99	1.18
	132	0.63	-0.11	-0.11	0.44	0.61
	3030	0.71	-0.03	-0.02	0.50	0.52
	6060	0.81	-0.05	-0.03	0.58	0.60
	NPac	1.37	-0.10	-0.10	0.97	1.16
	TARFAYA	0.59	-0.05	-0.03	0.42	0.58
2015	122	0.59	-0.08	-0.08	0.41	0.53
	124	0.69	0.01	0.01	0.48	0.55
	126	0.71	0.01	0.02	0.48	0.55
	131	1.31	-0.04	-0.04	0.91	1.06
	132	0.61	0.02	0.02	0.43	0.57
	3030	0.73	-0.03	-0.01	0.51	0.54
	6060	0.82	-0.05	-0.02	0.58	0.60
	NPac	1.07	0.27	0.28	0.76	1.09
	TARFAYA	0.62	-0.09	-0.09	0.44	0.61

Table 6: Statistics of the comparison with Argo: Daily binned product for descending orbits

Year	Region	IQR	Median	Mean	STD	RMS
2011	122	0.62	0.00	0.01	0.44	0.56
	124	0.67	0.01	0.01	0.47	0.57
	126	0.63	0.04	0.05	0.43	0.51
	131	1.27	0.04	0.05	0.89	1.06
	132	0.60	0.01	0.02	0.42	0.54
	3030	0.70	0.01	0.02	0.49	0.53
	6060	0.85	-0.01	0.02	0.59	0.62
	NPac	1.25	0.18	0.20	0.88	0.96
	TARFAYA	0.56	-0.05	-0.06	0.39	0.56
2012	122	0.65	0.01	0.01	0.45	0.56
	124	0.64	0.09	0.10	0.44	0.55
	126	0.68	0.08	0.08	0.48	0.57
	131	1.24	0.10	0.10	0.85	1.04
	132	0.70	-0.05	-0.06	0.49	0.61
	3030	0.72	0.03	0.03	0.50	0.53
	6060	0.84	0.02	0.04	0.59	0.62
	NPac	0.95	0.11	0.09	0.67	0.81
	TARFAYA	0.58	-0.12	-0.09	0.40	0.63
2013	122	0.57	-0.04	-0.05	0.40	0.52
	124	0.66	0.02	0.03	0.46	0.54
	126	0.68	0.01	0.02	0.46	0.55
	131	1.25	0.06	0.07	0.88	1.04
	132	0.67	-0.03	-0.03	0.47	0.63
	3030	0.72	-0.03	-0.02	0.49	0.53
	6060	0.84	-0.03	0.00	0.59	0.61
	NPac	1.13	0.37	0.32	0.80	1.16
	TARFAYA	0.54	-0.03	-0.02	0.37	0.53
2014	122	1.01	0.03	0.08	0.73	0.93
	124	0.75	0.03	0.04	0.52	0.64
	126	0.68	-0.04	-0.04	0.47	0.55
	131	1.21	-0.06	-0.09	0.85	1.05
	132	0.77	-0.19	-0.21	0.54	0.68
	3030	0.72	-0.07	-0.05	0.50	0.56
	6060	0.83	-0.09	-0.06	0.59	0.63
	NPac	1.08	-0.01	-0.01	0.76	1.08
	TARFAYA	0.60	-0.19	-0.18	0.42	0.58
2015	122	0.76	-0.04	0.01	0.55	0.68
	124	0.67	0.00	-0.01	0.46	0.55
	126	0.69	-0.07	-0.06	0.48	0.55
	131	1.33	-0.10	-0.07	0.92	1.09
	132	0.66	-0.10	-0.09	0.47	0.61
	3030	0.73	-0.06	-0.04	0.50	0.54
	6060	0.84	-0.07	-0.05	0.59	0.62
	NPac	1.26	-0.09	-0.09	0.89	1.28
	TARFAYA	0.66	-0.06	-0.08	0.46	0.60

Table 7: Statistics of the comparison with Argo: Monthly binned product for both orbits

Year	Region	IQR	Median	Mean	STD	RMS
2011	122	0.24	-0.01	-0.01	0.17	0.18
	124	0.26	-0.00	0.00	0.19	0.19
	126	0.28	0.00	0.01	0.20	0.21
	131	0.30	0.00	0.02	0.23	0.24
	132	0.27	-0.06	-0.04	0.20	0.21
	3030	0.28	-0.04	-0.03	0.20	0.20
	6060	0.30	-0.04	-0.02	0.22	0.22
	NPac	0.73	-0.05	-0.03	0.51	0.55
	TARFAYA	0.19	-0.12	-0.11	0.13	0.20
2012	122	0.21	0.02	0.02	0.15	0.16
	124	0.25	0.05	0.06	0.18	0.19
	126	0.27	0.02	0.03	0.20	0.22
	131	0.33	0.08	0.10	0.25	0.27
	132	0.27	-0.02	-0.01	0.19	0.23
	3030	0.27	-0.01	-0.00	0.19	0.21
	6060	0.29	0.00	0.02	0.21	0.22
	NPac	0.53	-0.02	-0.01	0.39	0.42
	TARFAYA	0.19	-0.08	-0.07	0.14	0.21
2013	122	0.18	-0.01	-0.01	0.13	0.14
	124	0.23	0.01	0.02	0.17	0.18
	126	0.29	0.01	0.03	0.22	0.22
	131	0.31	0.00	0.02	0.23	0.25
	132	0.27	-0.07	-0.05	0.20	0.22
	3030	0.26	-0.04	-0.02	0.19	0.20
	6060	0.28	-0.03	-0.01	0.20	0.21
	NPac	0.42	-0.01	0.02	0.31	0.35
	TARFAYA	0.19	-0.09	-0.07	0.13	0.17
2014	122	0.19	-0.05	-0.04	0.14	0.15
	124	0.25	-0.01	0.01	0.18	0.19
	126	0.31	-0.01	-0.00	0.22	0.23
	131	0.31	-0.07	-0.06	0.23	0.25
	132	0.27	-0.12	-0.11	0.19	0.23
	3030	0.28	-0.05	-0.04	0.20	0.21
	6060	0.29	-0.05	-0.04	0.21	0.22
	NPac	0.47	0.00	-0.01	0.35	0.37
	TARFAYA	0.21	-0.08	-0.06	0.15	0.18
2015	122	0.21	-0.05	-0.05	0.15	0.16
	124	0.25	-0.01	-0.00	0.18	0.18
	126	0.31	-0.03	-0.02	0.23	0.24
	131	0.31	-0.06	-0.05	0.23	0.25
	132	0.30	-0.06	-0.05	0.21	0.25
	3030	0.29	-0.05	-0.04	0.21	0.22
	6060	0.30	-0.05	-0.04	0.22	0.22
	NPac	0.49	0.06	0.07	0.37	0.39
	TARFAYA	0.23	-0.10	-0.08	0.16	0.20

Table 8: Statistics of the comparison with Argo: Objective analyzed product for both orbits

Year	Region	IQR	Median	Mean	STD	RMS
2011	122	0.22	-0.03	-0.02	0.16	0.17
	124	0.26	-0.03	-0.02	0.19	0.20
	126	0.30	0.01	0.02	0.22	0.22
	131	0.39	0.03	0.05	0.29	0.31
	132	0.28	-0.01	0.01	0.20	0.22
	3030	0.30	-0.04	-0.03	0.22	0.22
	6060	0.35	-0.02	-0.00	0.25	0.26
	NPac	0.78	0.17	0.22	0.56	0.62
	TARFAYA	0.26	-0.27	-0.26	0.18	0.33
2012	122	0.19	-0.02	-0.02	0.14	0.15
	124	0.26	0.01	0.02	0.19	0.19
	126	0.30	0.03	0.04	0.22	0.24
	131	0.42	0.11	0.14	0.31	0.35
	132	0.27	0.02	0.03	0.19	0.23
	3030	0.29	-0.01	-0.01	0.21	0.23
	6060	0.34	0.01	0.03	0.25	0.26
	NPac	0.63	0.12	0.13	0.45	0.50
	TARFAYA	0.26	-0.25	-0.24	0.18	0.32
2013	122	0.19	-0.05	-0.04	0.14	0.15
	124	0.27	-0.03	-0.02	0.19	0.20
	126	0.33	0.03	0.05	0.25	0.26
	131	0.38	0.03	0.05	0.29	0.31
	132	0.28	-0.02	-0.00	0.20	0.22
	3030	0.32	-0.04	-0.03	0.23	0.24
	6060	0.35	-0.02	-0.00	0.26	0.26
	NPac	0.58	0.15	0.17	0.41	0.46
	TARFAYA	0.25	-0.29	-0.27	0.17	0.33
2014	122	0.20	-0.07	-0.06	0.14	0.16
	124	0.28	-0.04	-0.03	0.20	0.21
	126	0.33	0.00	0.02	0.24	0.25
	131	0.38	-0.04	-0.02	0.28	0.31
	132	0.29	-0.06	-0.05	0.21	0.24
	3030	0.32	-0.05	-0.04	0.24	0.24
	6060	0.35	-0.04	-0.02	0.26	0.26
	NPac	0.65	0.14	0.15	0.45	0.50
	TARFAYA	0.28	-0.24	-0.23	0.19	0.31
2015	122	0.22	-0.09	-0.09	0.16	0.19
	124	0.27	-0.06	-0.05	0.20	0.21
	126	0.40	-0.02	0.00	0.29	0.29
	131	0.40	-0.01	0.00	0.30	0.32
	132	0.31	0.05	0.06	0.22	0.26
	3030	0.35	-0.05	-0.03	0.25	0.26
	6060	0.37	-0.03	-0.01	0.27	0.28
	NPac	0.60	0.21	0.22	0.43	0.51
	TARFAYA	0.28	-0.21	-0.19	0.20	0.30

Table 9: Statistics of the comparison with Argo: Fused product for both orbits

Year	Region	IQR	Median	Mean	STD	RMS
2011	122	0.24	-0.04	-0.03	0.16	0.18
	124	0.25	-0.04	-0.03	0.18	0.19
	126	0.30	0.01	0.02	0.22	0.23
	131	0.27	0.05	0.06	0.20	0.23
	132	0.28	0.00	0.02	0.20	0.22
	3030	0.29	-0.05	-0.04	0.21	0.22
	6060	0.32	-0.03	-0.01	0.23	0.24
	NPac	0.53	0.10	0.14	0.37	0.42
	TARFAYA	0.25	-0.33	-0.31	0.17	0.37
2012	122	0.19	-0.02	-0.01	0.14	0.15
	124	0.24	0.00	0.01	0.17	0.18
	126	0.29	0.03	0.04	0.22	0.23
	131	0.31	0.13	0.15	0.23	0.29
	132	0.27	0.04	0.05	0.20	0.23
	3030	0.30	-0.02	-0.01	0.22	0.22
	6060	0.33	0.00	0.02	0.24	0.25
	NPac	0.52	0.09	0.11	0.37	0.40
	TARFAYA	0.27	-0.31	-0.29	0.19	0.36
2013	122	0.17	-0.05	-0.05	0.12	0.14
	124	0.26	-0.04	-0.02	0.18	0.19
	126	0.33	0.03	0.05	0.24	0.25
	131	0.27	0.04	0.06	0.20	0.23
	132	0.30	0.01	0.03	0.22	0.23
	3030	0.32	-0.05	-0.03	0.24	0.24
	6060	0.33	-0.03	-0.01	0.24	0.25
	NPac	0.48	0.09	0.13	0.32	0.37
	TARFAYA	0.24	-0.32	-0.30	0.16	0.35
2014	122	0.20	-0.08	-0.07	0.14	0.17
	124	0.28	-0.05	-0.03	0.20	0.21
	126	0.33	0.01	0.03	0.24	0.25
	131	0.26	-0.03	-0.01	0.19	0.23
	132	0.30	-0.02	-0.01	0.21	0.24
	3030	0.32	-0.07	-0.05	0.23	0.24
	6060	0.33	-0.06	-0.04	0.24	0.25
	NPac	0.61	0.07	0.14	0.40	0.44
	TARFAYA	0.28	-0.27	-0.26	0.19	0.33
2015	122	0.20	-0.10	-0.10	0.14	0.18
	124	0.25	-0.07	-0.06	0.18	0.20
	126	0.37	-0.02	-0.00	0.26	0.27
	131	0.29	0.00	0.02	0.21	0.24
	132	0.26	0.08	0.09	0.19	0.25
	3030	0.34	-0.07	-0.06	0.24	0.26
	6060	0.35	-0.05	-0.03	0.26	0.26
	NPac	0.50	0.19	0.20	0.35	0.43
	TARFAYA	0.28	-0.25	-0.23	0.20	0.32

[Press et al., 1992] Press, W. M., Teukolsky, S. A., T., V. W., and Flannery, B. P. (1992). Numerical recipies in c. *Cambridge. Cambridge University Press*.

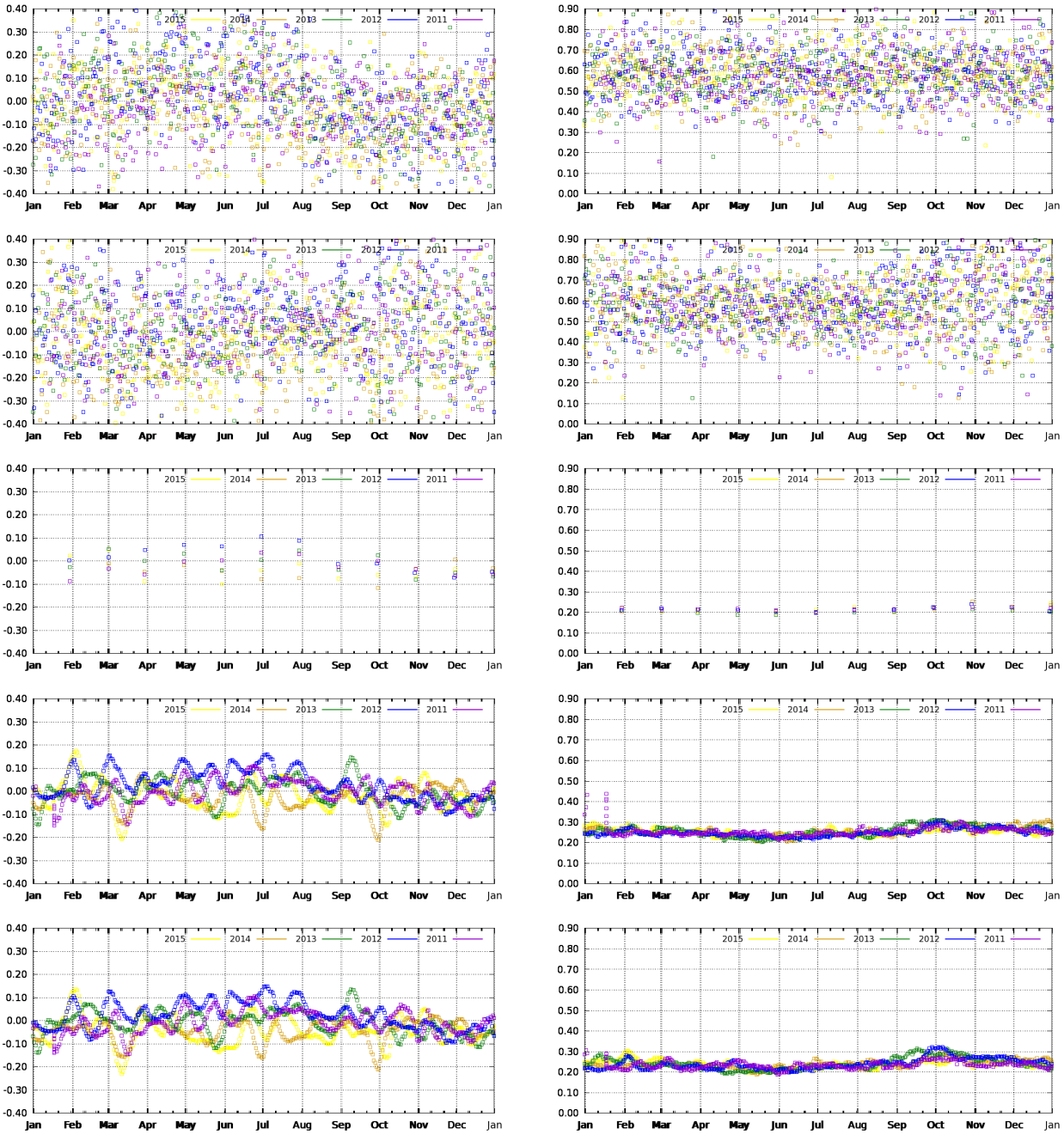

Figure 2: Differences of the SMOS SSS with respect to ARGO in [60^{o}S:60^{o}N]. From top to bottom: Daily binned product at $0.25^o \times 0.25^o$ ascending orbits; daily binned product at $0.25^o \times 0.25^o$ descending orbits; monthly binned product at $1.00^o \times 1.00^o$ both orbits; 9-day objective analyzed at $0.25^o \times 0.25^o$both orbits; 9-day fused at $0.05^o \times 0.05^o$ both orbits. Left: mean of the differences SMOS-Argo; Right: standard deviation of the differences SMOS-Argo.

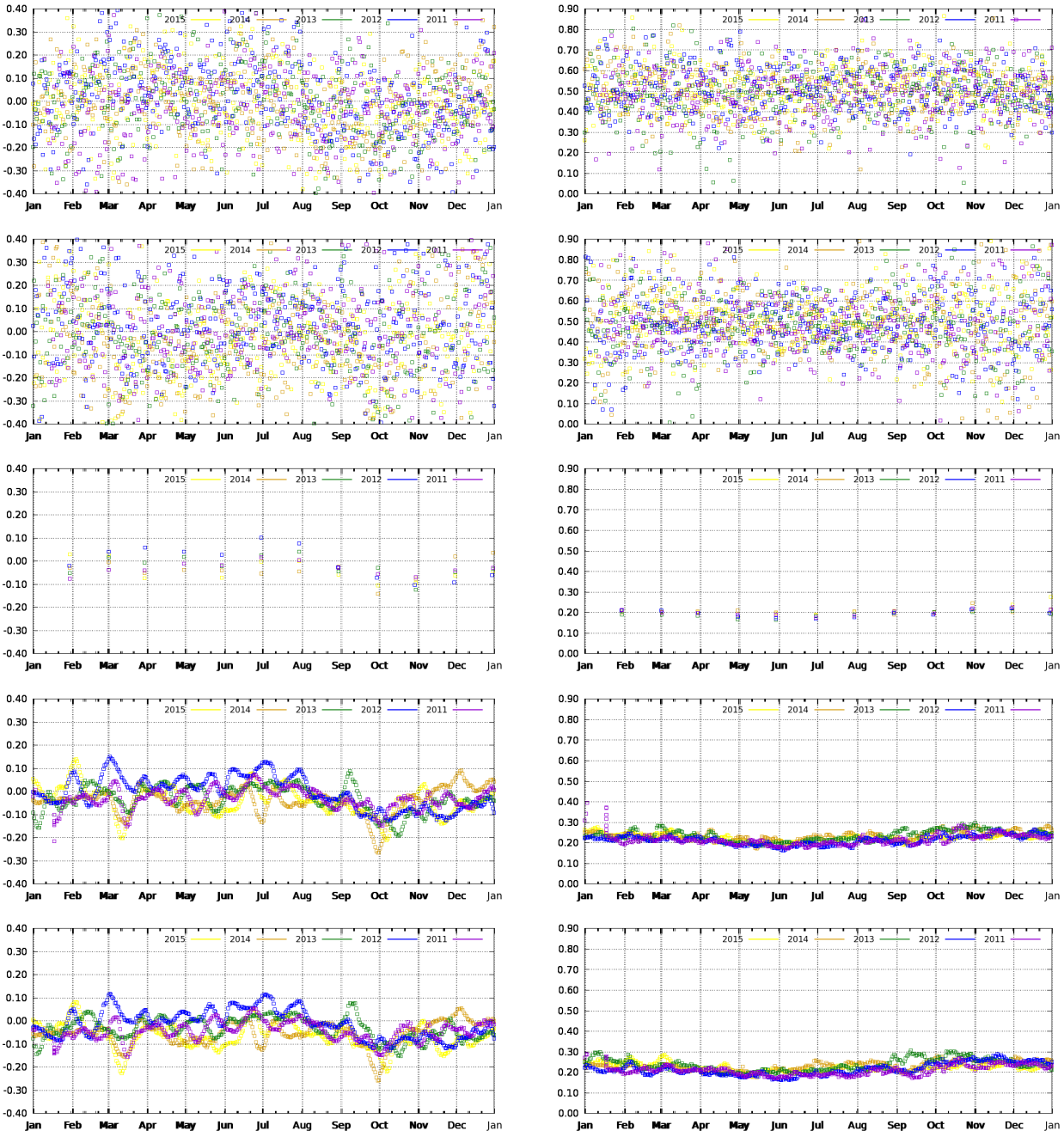

Figure 3: Differences of the SMOS SSS with respect to ARGO in [30^{o}S:30^{o}N]. From top to bottom: Daily binned product at $0.25^o \times 0.25^o$ ascending orbits; daily binned product at $0.25^o \times 0.25^o$ descending orbits; monthly binned product at $1.00^o \times 1.00^o$ both orbits; 9-day objective analyzed at $0.25^o \times 0.25^o$both orbits; 9-day fused at $0.05^o \times 0.05^o$ both orbits. Left: mean of the differences SMOS-Argo; Right: standard deviation of the differences SMOS-Argo.