Diagtool Report

Round Robin (GT cotier) : Tide. Medsea. J3. fes14b struct vs fes14b unstruct vs fes14b unstruct reg vs EOT20.

11 juillet 2022

Table of Contents

Table des figures

1 General description

- Figures and notes have been included in this report to evaluate different altimetry products.
- In order to test different version of the Tide used to calculate the sea level anomaly. Each version has been compared with a reference version. In this case the Fes14b_struct is the reference one.
- The sea level anomaly has been calculated using each version of the variable and has been compared to the sea level anomaly calculated using the reference version.
- The region of study is Medsea
- Mission : J3
- Git last tag :
- Git changeset number : 3b970d7-2022-07-05

2 Processing

2.1 sla formula

2.1.1 fes14b_struct product ' sla

sla = ORBIT.ALTI.CNES_POE_F -
RANGE.ALTI -
MEAN_SEA_SURFACE.MODEL.CNESCLS15 -
SEA_STATE_BIAS.ALTI -

IONOSPHERIC_CORRECTION.MODEL.GIM -
WET_TROPOSPHERIC_CORRECTION.RAD -
DRY_TROPOSPHERIC_CORRECTION.MODEL.ECMWF -
DYNAMICAL_ATMOSPHERIC_CORRECTION.MODEL.MOG2D_HR -
OCEAN_TIDE_HEIGHT.MODEL.FES14B -
SOLID_EARTH_TIDE_HEIGHT.MODEL.CARTWRIGHT_TAYLER_71 -
POLE_TIDE_HEIGHT.MODEL.DESAI_2015

2.1.2 fes14b_unstruct product ' sla

sla = ORBIT.ALTI.CNES_POE_F -
RANGE.ALTI -
MEAN_SEA_SURFACE.MODEL.CNESCLS15 -
SEA_STATE_BIAS.ALTI -
IONOSPHERIC_CORRECTION.MODEL.GIM -
WET_TROPOSPHERIC_CORRECTION.RAD -
DRY_TROPOSPHERIC_CORRECTION.MODEL.ECMWF -
DYNAMICAL_ATMOSPHERIC_CORRECTION.MODEL.MOG2D_HR -
tide_FES2014b_unstruct -
LOAD_TIDE.MODEL.FES14B -
SOLID_EARTH_TIDE_HEIGHT.MODEL.CARTWRIGHT_TAYLER_71 -
POLE_TIDE_HEIGHT.MODEL.DESAI_2015

2.1.3 fes14b_unstruct_reg product ' sla

sla = ORBIT.ALTI.CNES_POE_F -
RANGE.ALTI -
MEAN_SEA_SURFACE.MODEL.CNESCLS15 -
SEA_STATE_BIAS.ALTI -
IONOSPHERIC_CORRECTION.MODEL.GIM -
WET_TROPOSPHERIC_CORRECTION.RAD -
DRY_TROPOSPHERIC_CORRECTION.MODEL.ECMWF -
DYNAMICAL_ATMOSPHERIC_CORRECTION.MODEL.MOG2D_HR -
tide_RegAT -
LOAD_TIDE.MODEL.FES14B -
SOLID_EARTH_TIDE_HEIGHT.MODEL.CARTWRIGHT_TAYLER_71 -
POLE_TIDE_HEIGHT.MODEL.DESAI_2015

2.1.4 EOT20 product ' sla

sla = ORBIT.ALTI.CNES_POE_F -
RANGE.ALTI -
MEAN_SEA_SURFACE.MODEL.CNESCLS15 -
SEA_STATE_BIAS.ALTI -
IONOSPHERIC_CORRECTION.MODEL.GIM -
WET_TROPOSPHERIC_CORRECTION.RAD -
DRY_TROPOSPHERIC_CORRECTION.MODEL.ECMWF -
DYNAMICAL_ATMOSPHERIC_CORRECTION.MODEL.MOG2D_HR -
tide_EOT20 -
LOAD_TIDE.MODEL.FES14B -
SOLID_EARTH_TIDE_HEIGHT.MODEL.CARTWRIGHT_TAYLER_71 -
POLE_TIDE_HEIGHT.MODEL.DESAI_2015

2.2 Binning

Each track has been divided to a set of sections, where the center of each section is separated by the sample frequency of the satelitte times it's velocity.

The data located within the sections limits represent the altimetry time-series on which the statistics will be calculated and visualized in this report.

2.3 Filtering

- The sla has been filtered by a threashold of 1 m.
- Each sla time-serie has been filtred by a window of $[-4\sigma, 4\sigma]$, where σ is the standard deviation of the sla time serie

3 Spatial coherence analysis

3.1 sla

3.1.1 sla 's count

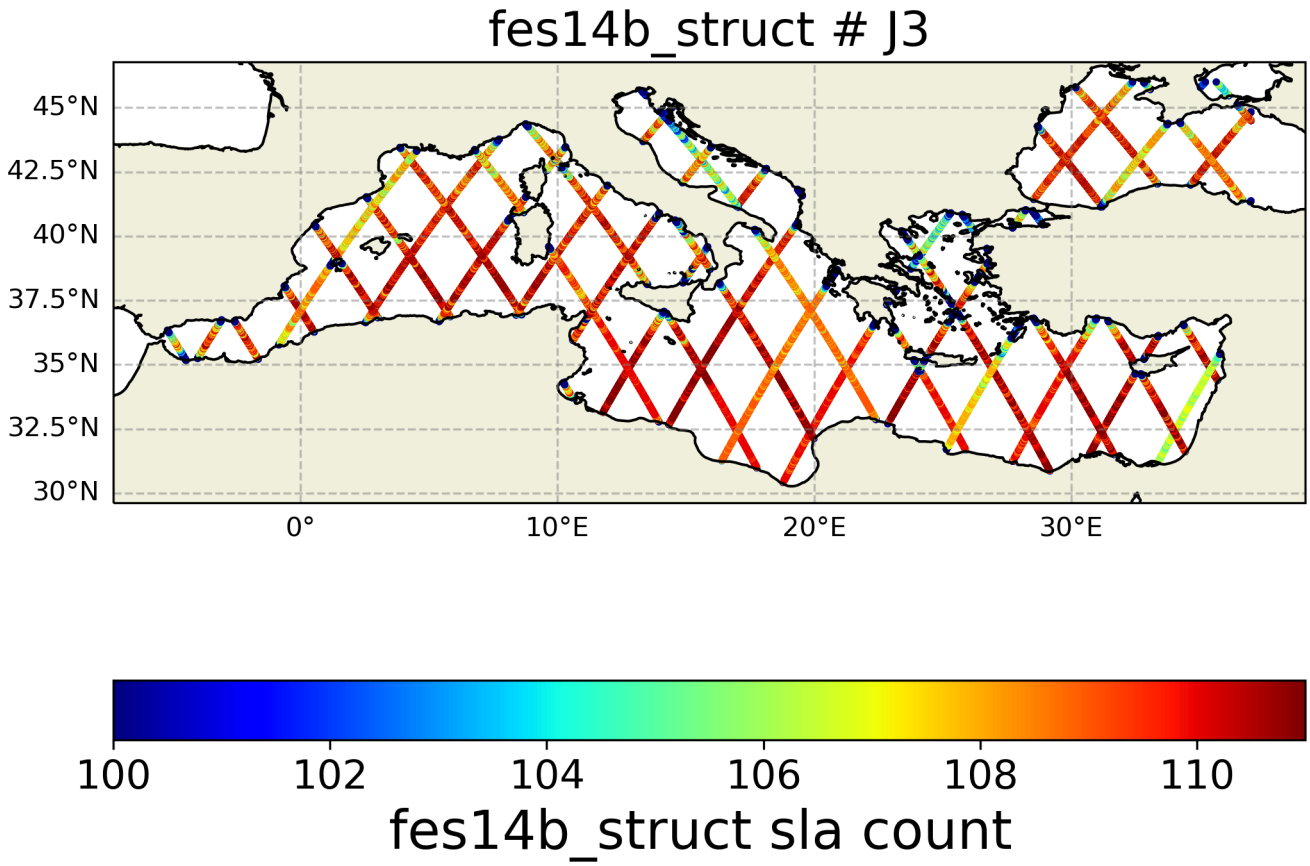

FIGURE 1 – Spatial coherence analysis of the count of the fes14b_struct version of sla variable

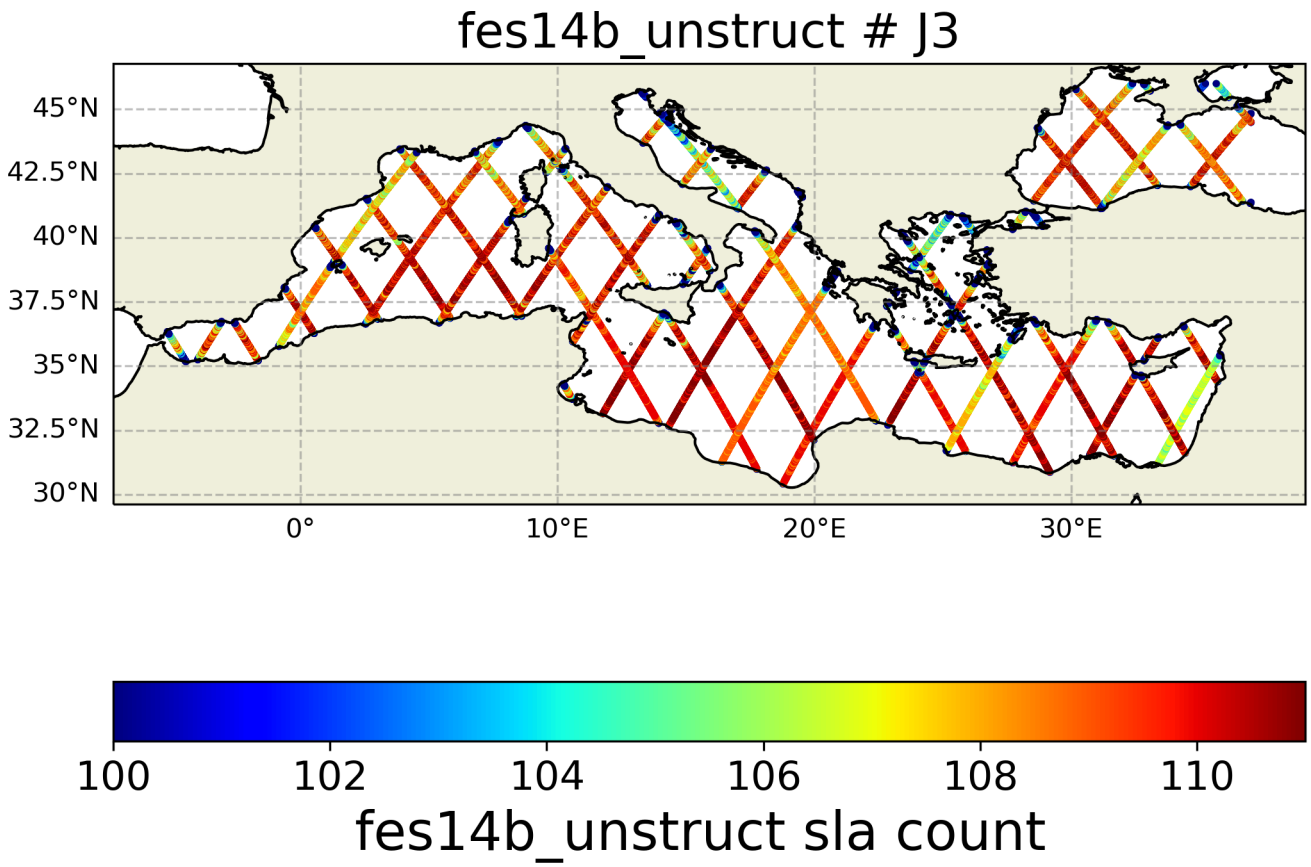

FIGURE 2 – Spatial coherence analysis of the count of the fes14b_unstruct version of sla variable

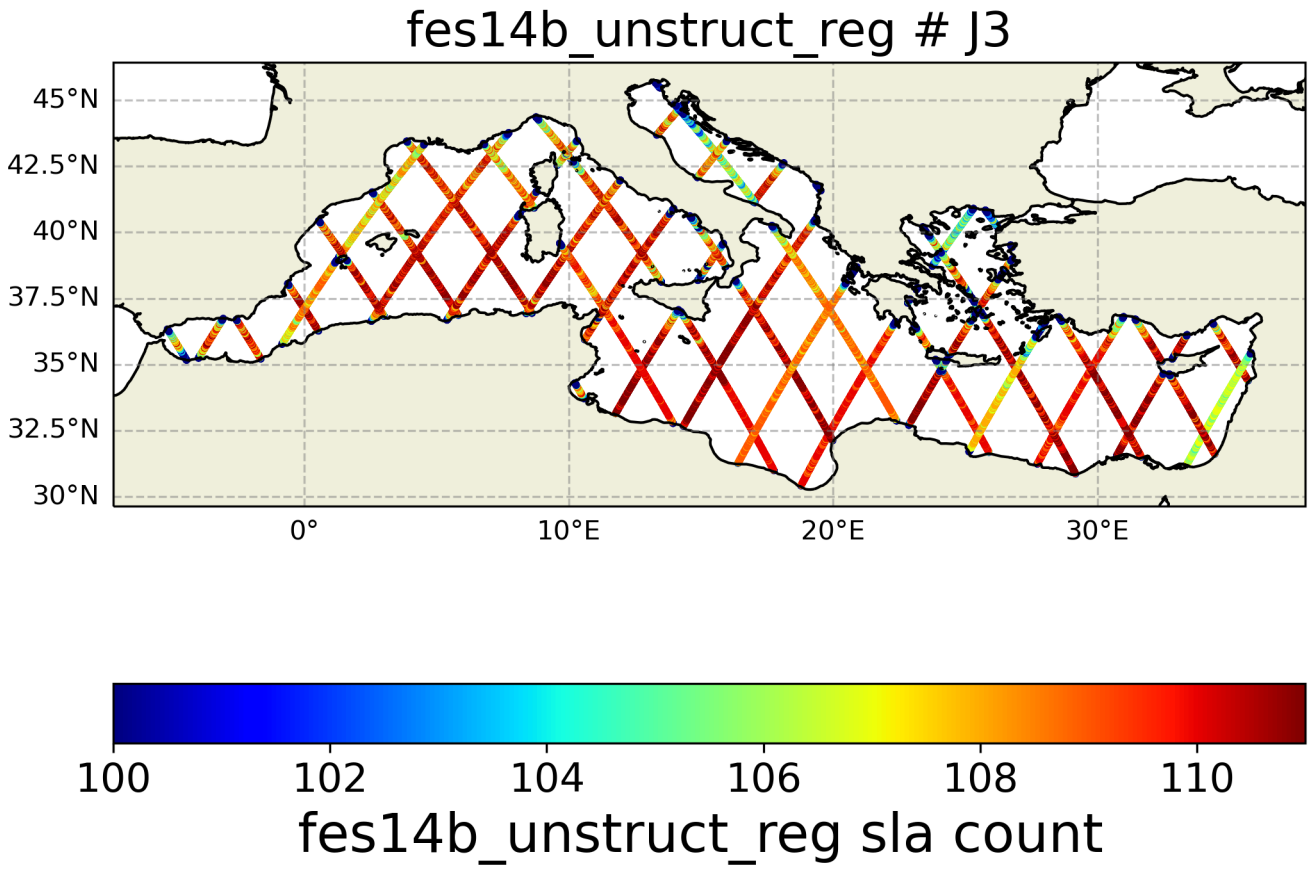

FIGURE 3 – Spatial coherence analysis of the count of the fes14b_unstruct_reg version of sla variable

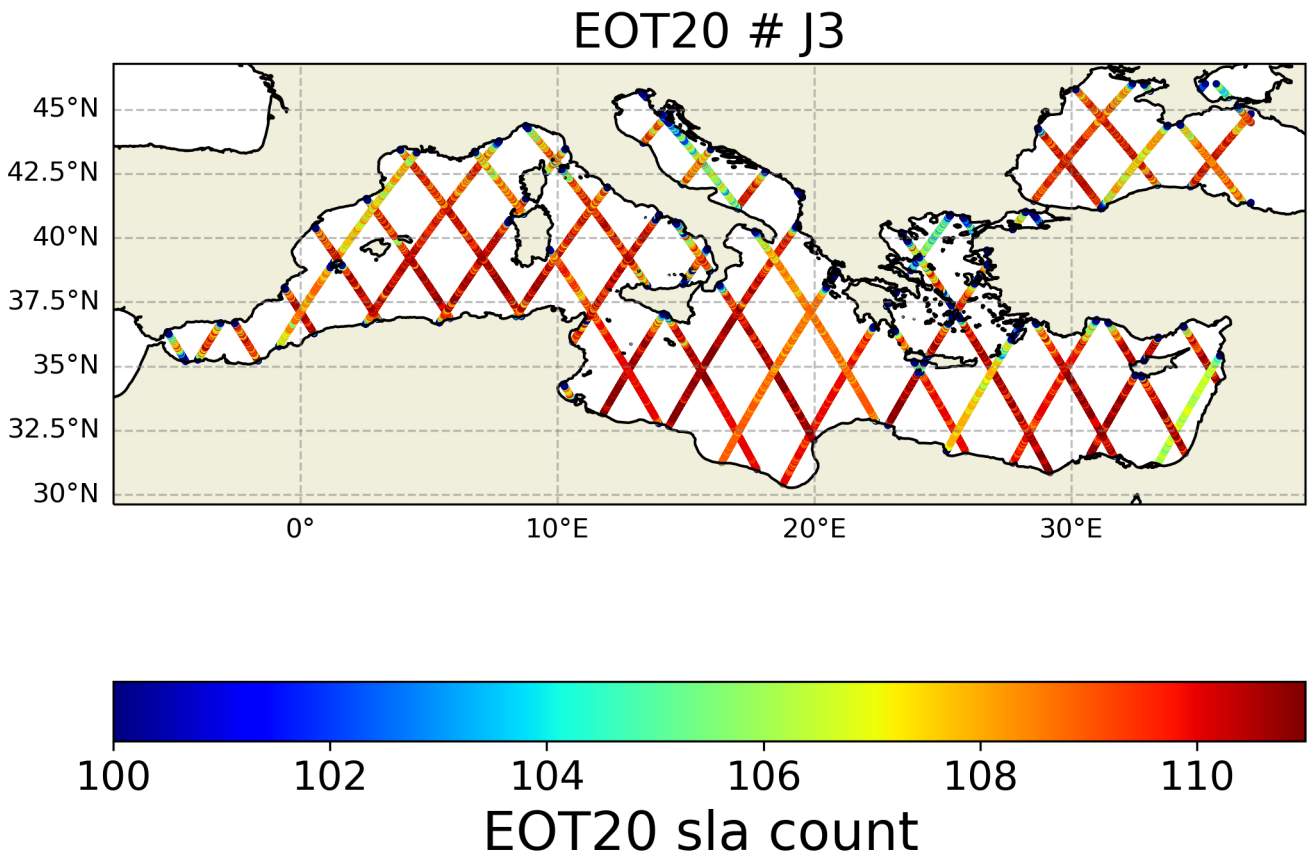

FIGURE 4 – Spatial coherence analysis of the count of the EOT20 version of sla variable

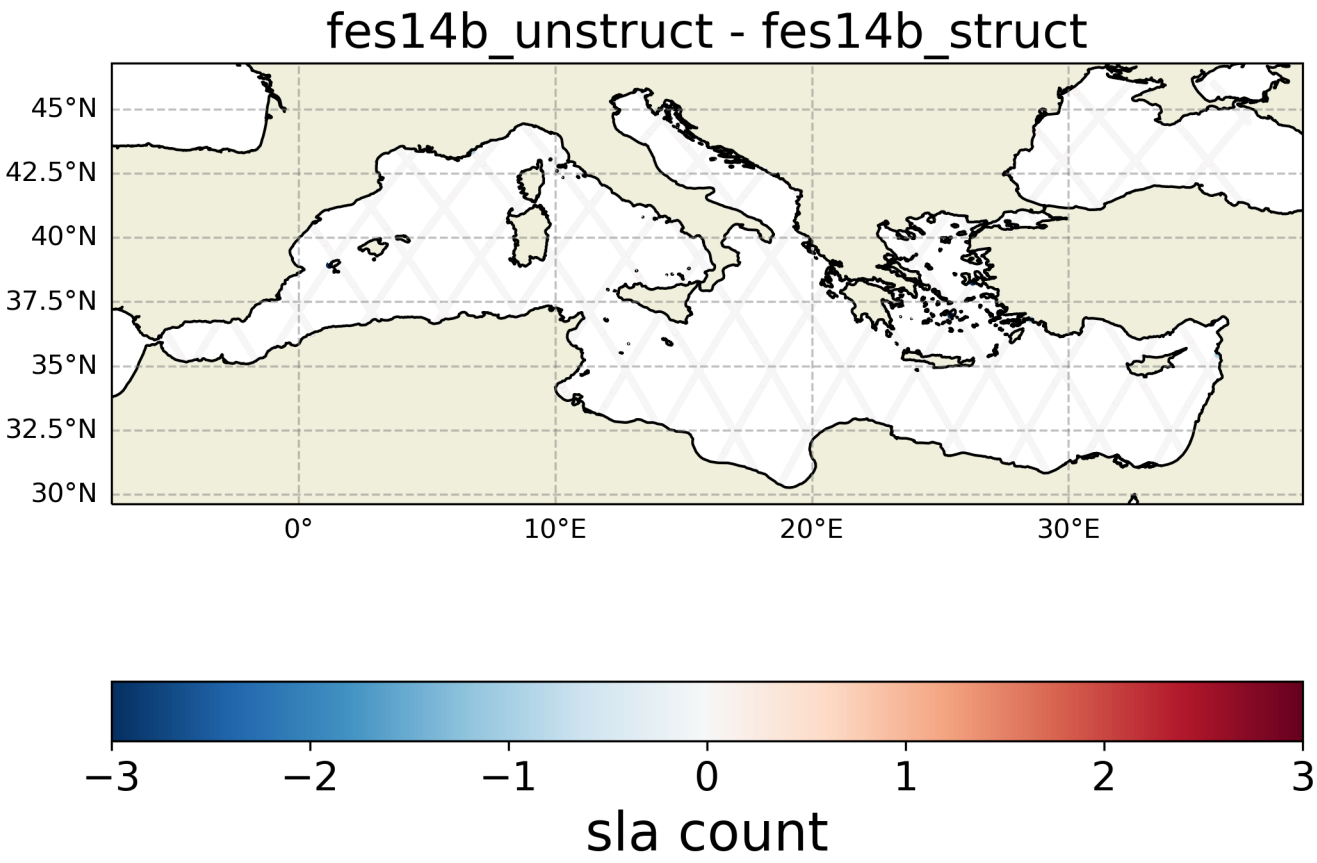

Figure 5 – Spatial coherence analysis of the Difference in sla 's count between fes14b_unstruct and fes14b_struct

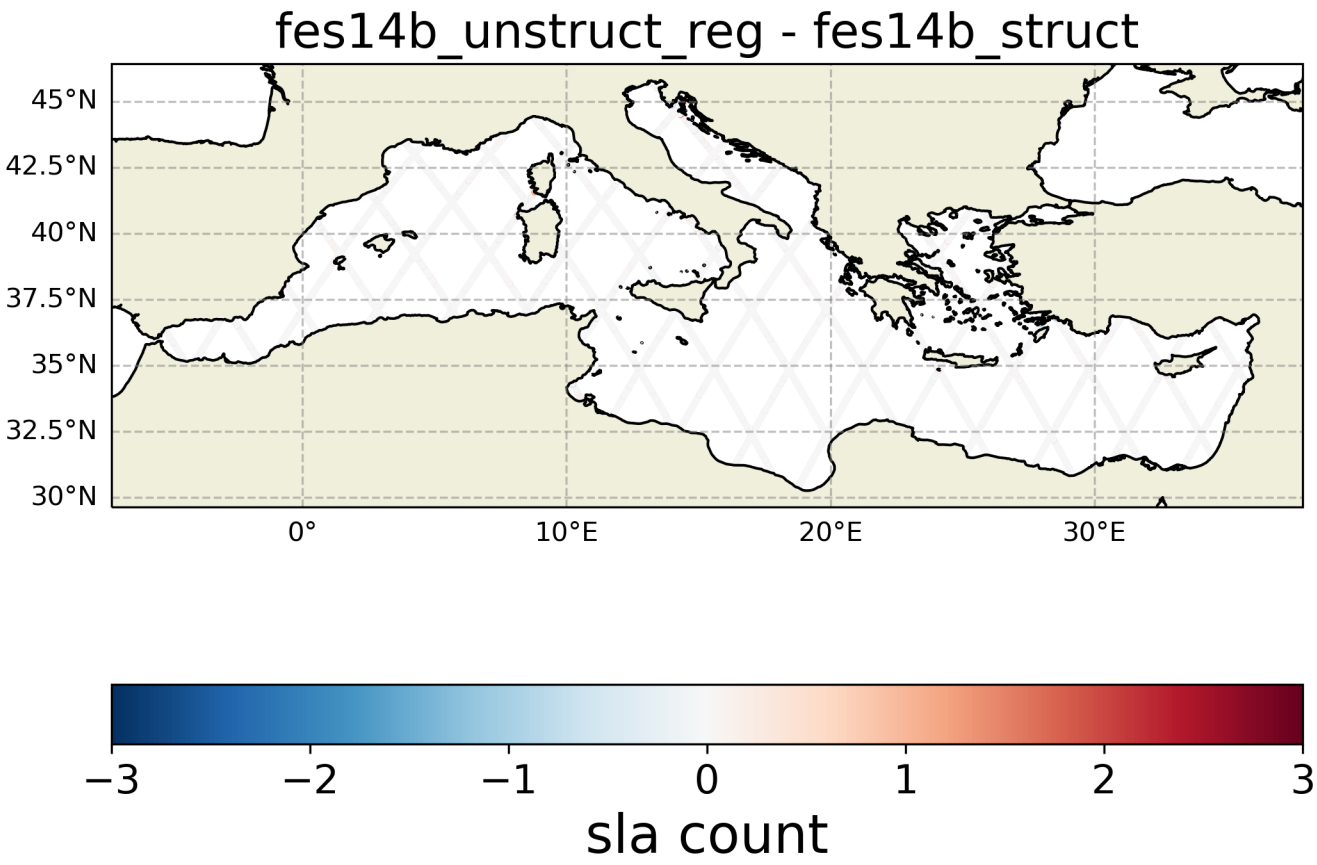

Figure 6 – Spatial coherence analysis of the Difference in sla 's count between fes14b_unstruct_reg and fes14b_struct

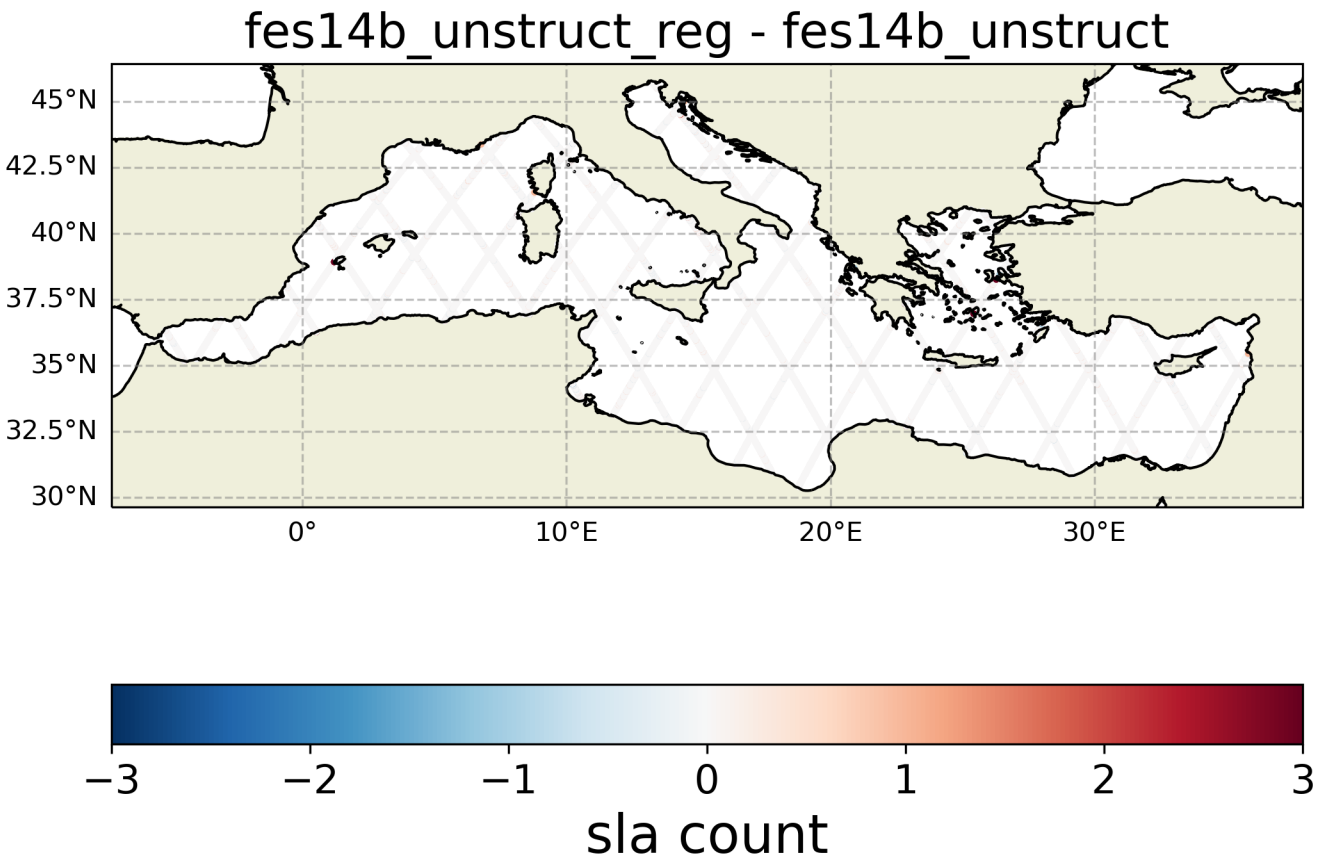

Figure 7 – Spatial coherence analysis of the Difference in sla 's count between fes14b_unstruct_reg and fes14b_unstruct

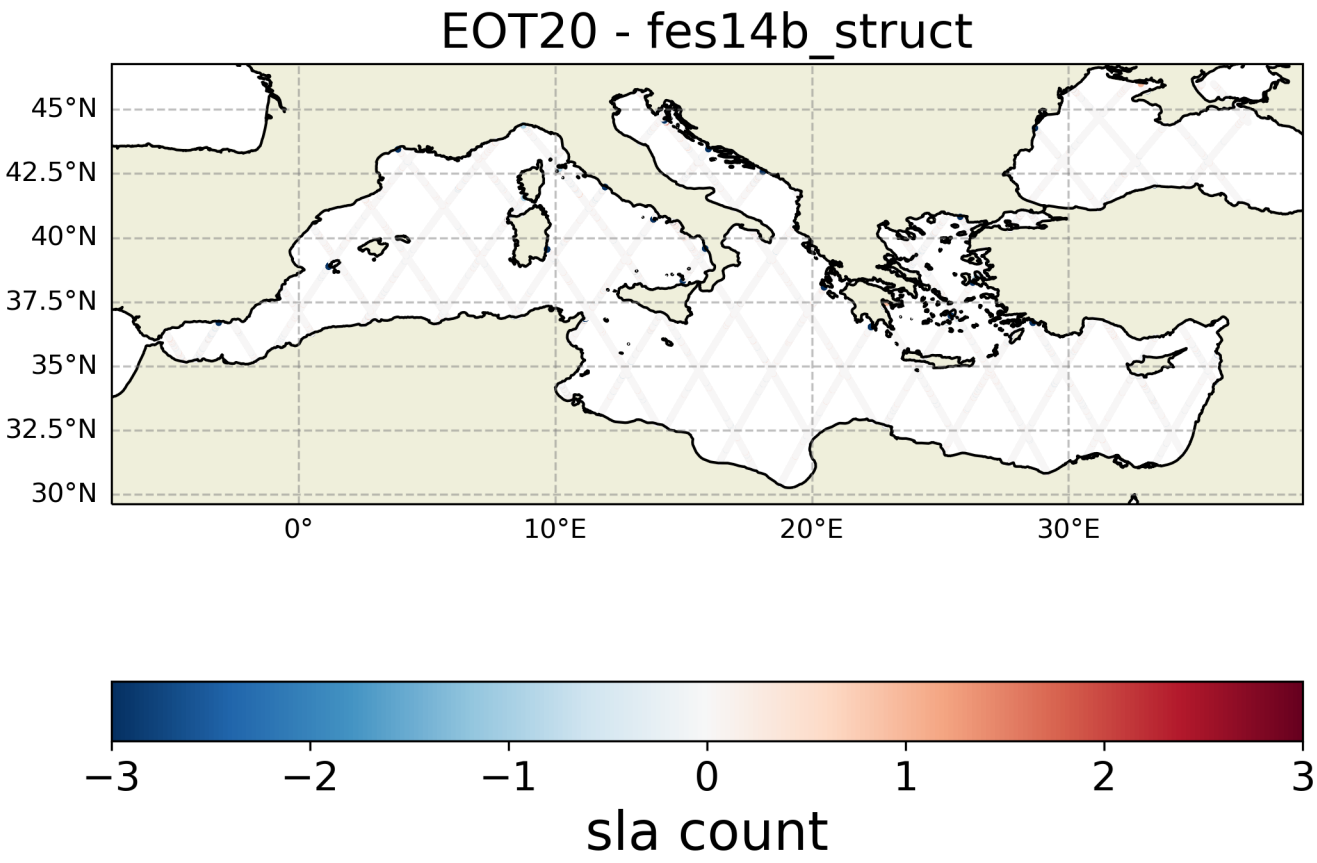

FIGURE 8 – Spatial coherence analysis of the Difference in sla 's count between EOT20 and fes14b_struct

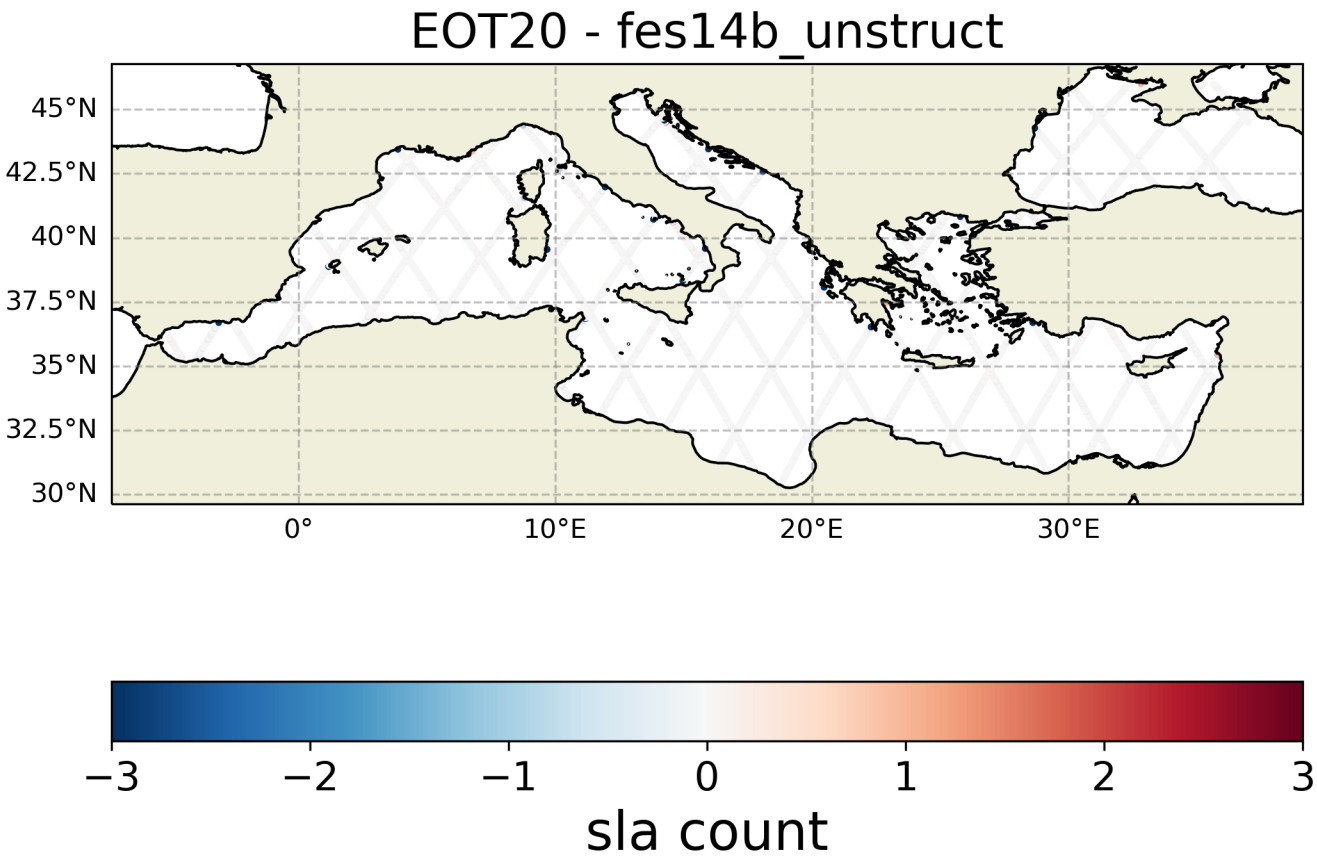

Figure 9 – Spatial coherence analysis of the Difference in sla 's count between EOT20 and fes14b_unstruct

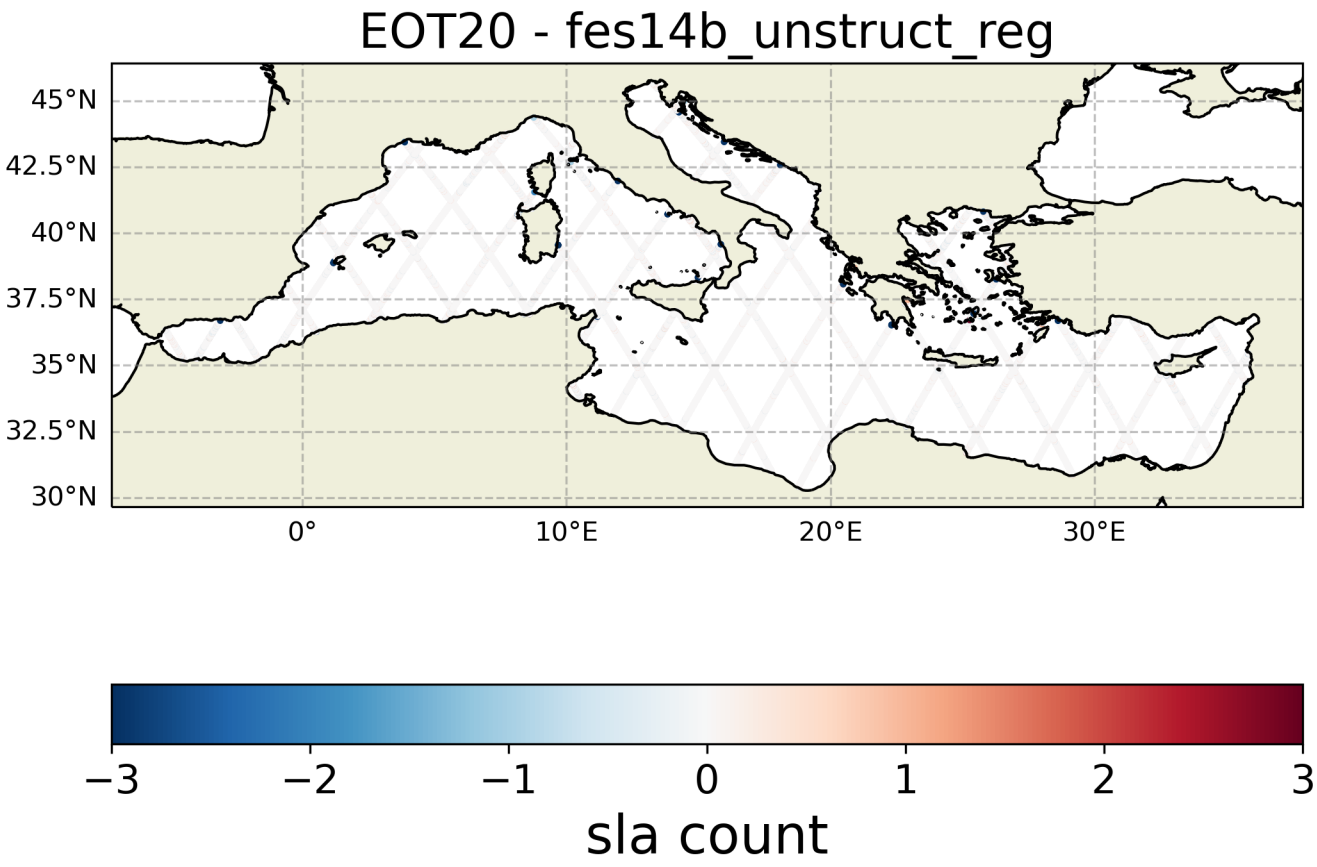

Figure 10 – Spatial coherence analysis of the Difference in sla 's count between EOT20 and fes14b_unstruct_reg

3.1.2 sla 's std

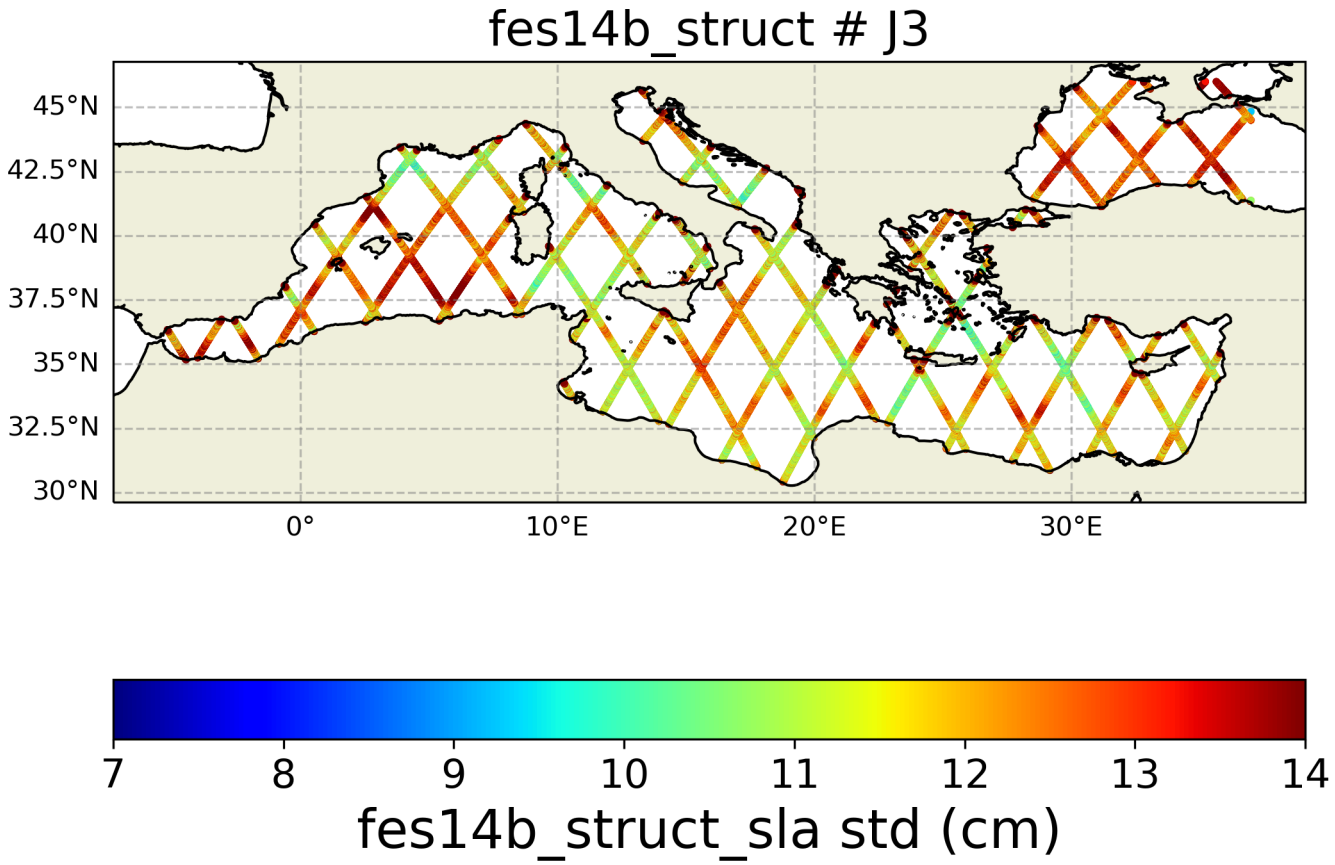

FIGURE 11 – Spatial coherence analysis of the std of the fes14b_struct version of sla variable

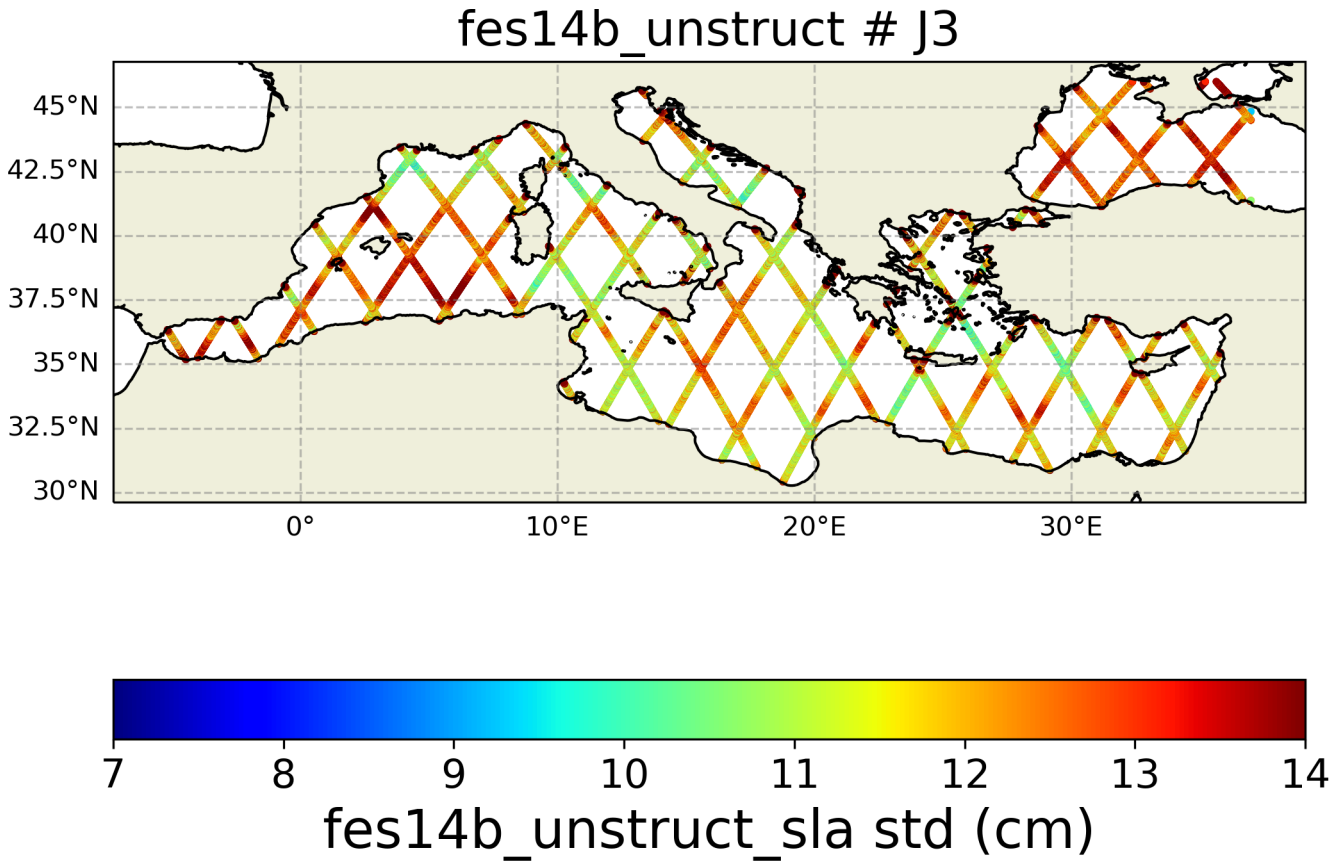

FIGURE 12 – Spatial coherence analysis of the std of the fes14b_unstruct version of sla variable

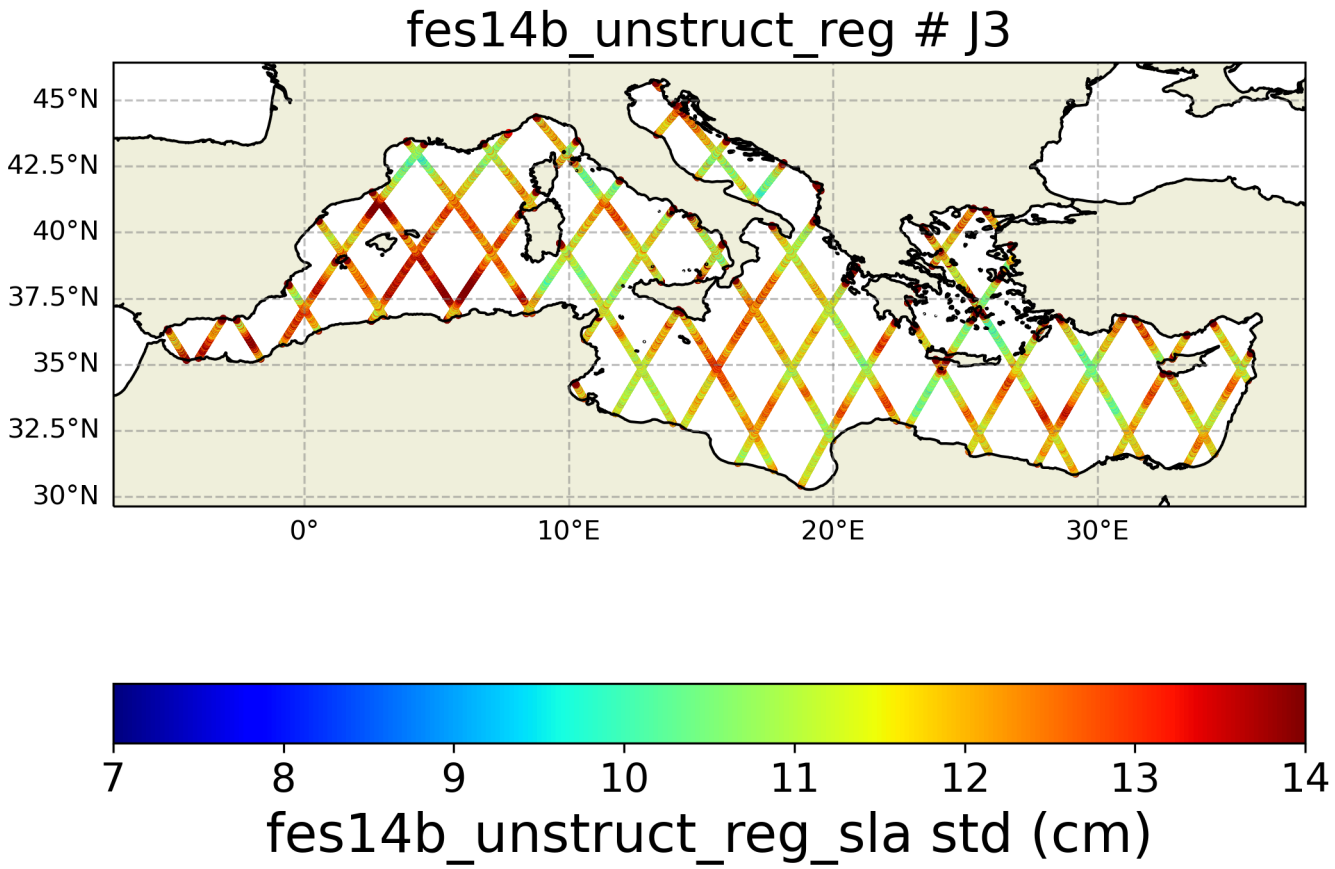

FIGURE 13 – Spatial coherence analysis of the std of the fes14b_unstruct_reg version of sla variable

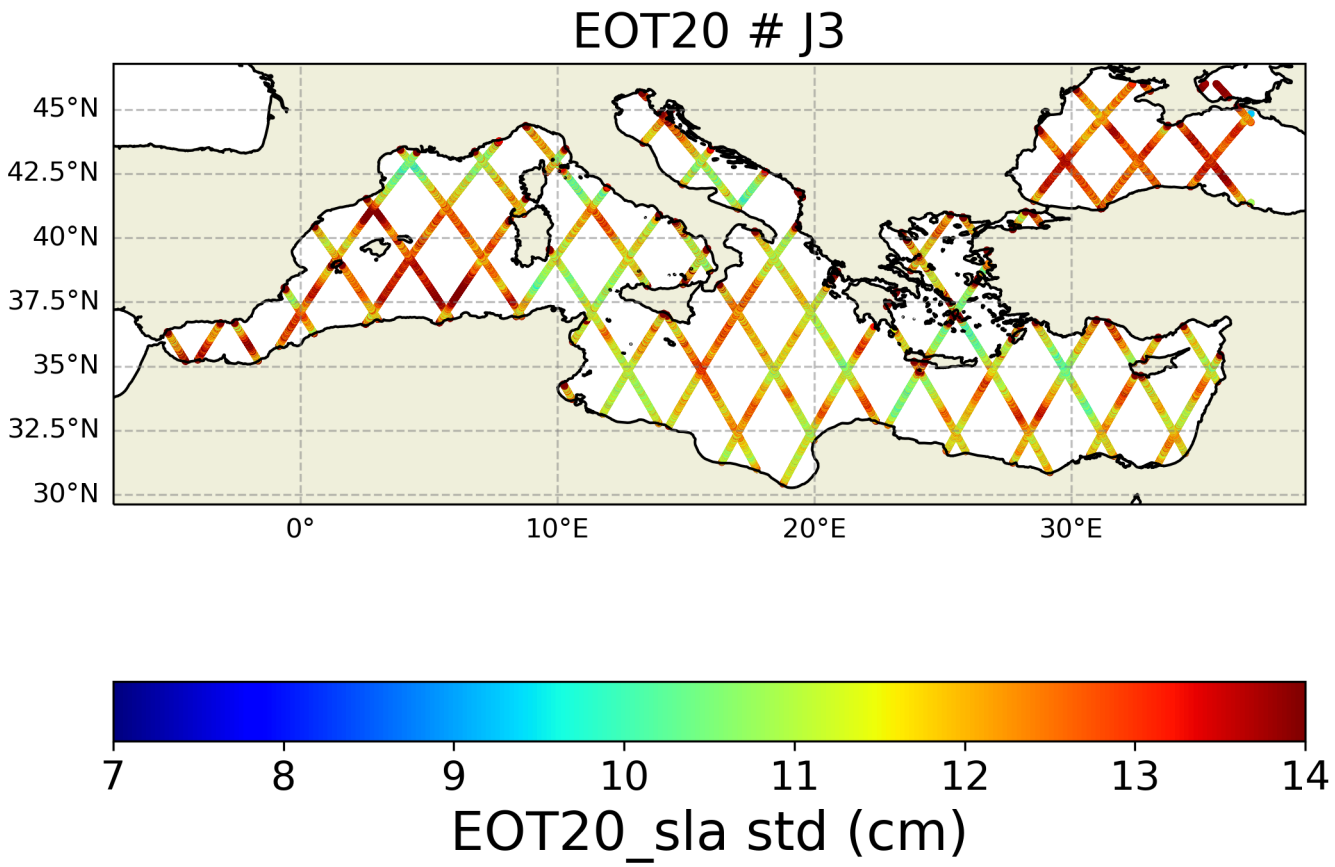

FIGURE 14 – Spatial coherence analysis of the std of the EOT20 version of sla variable

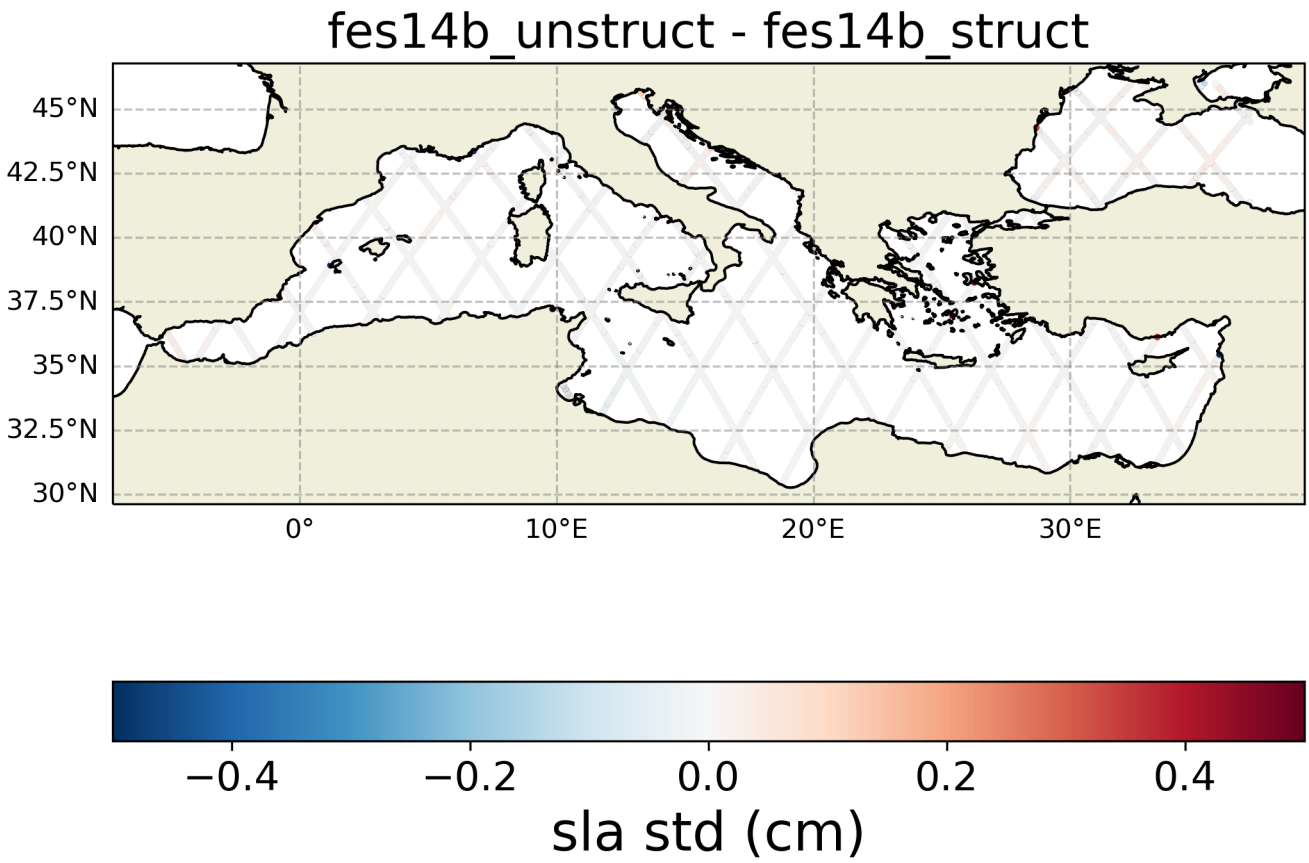

Figure 15 – Spatial coherence analysis of the Difference in sla 's std between fes14b_unstruct and fes14b_struct

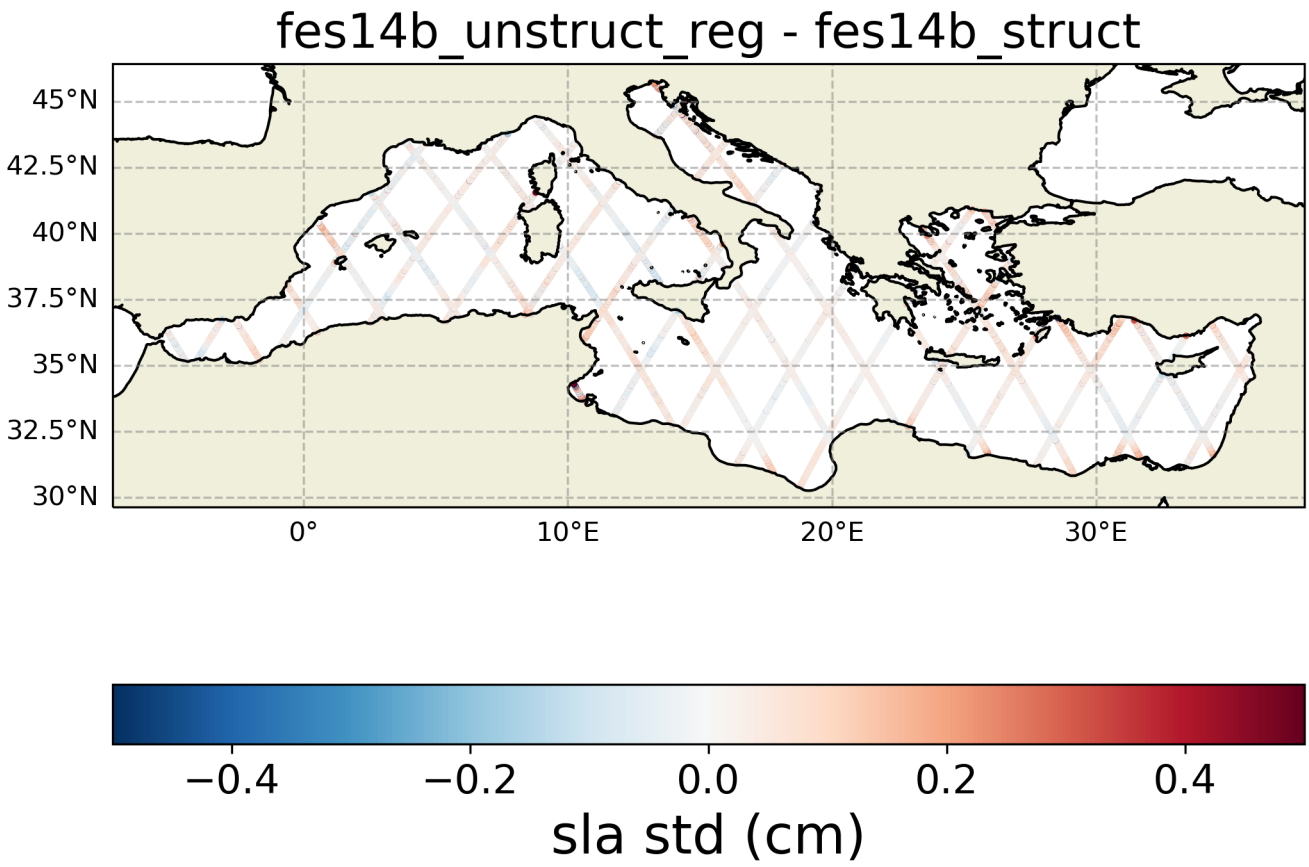

FIGURE 16 – Spatial coherence analysis of the Difference in sla 's std between fes14b_unstruct_reg and fes14b_struct

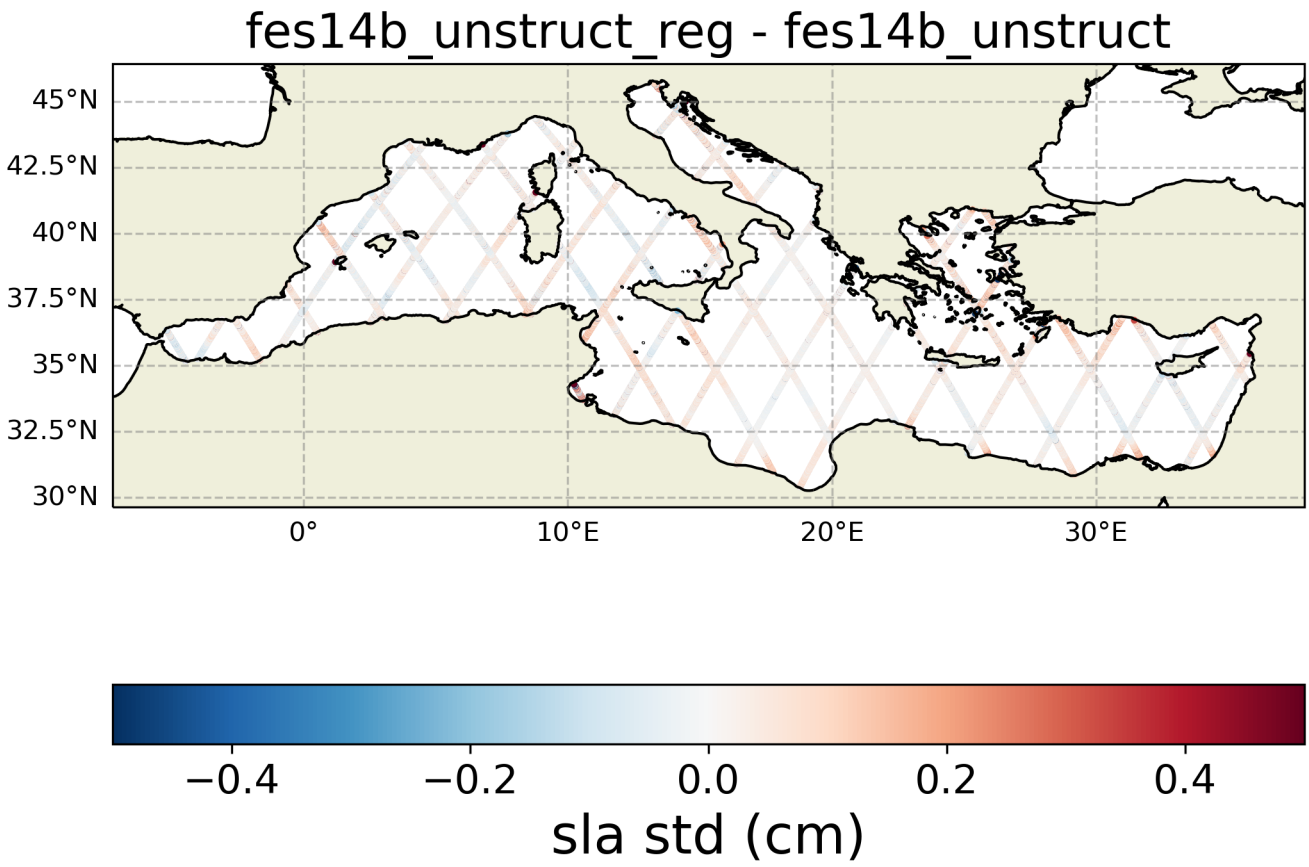

FIGURE 17 – Spatial coherence analysis of the Difference in sla 's std between fes14b_unstruct_reg and fes14b_unstruct

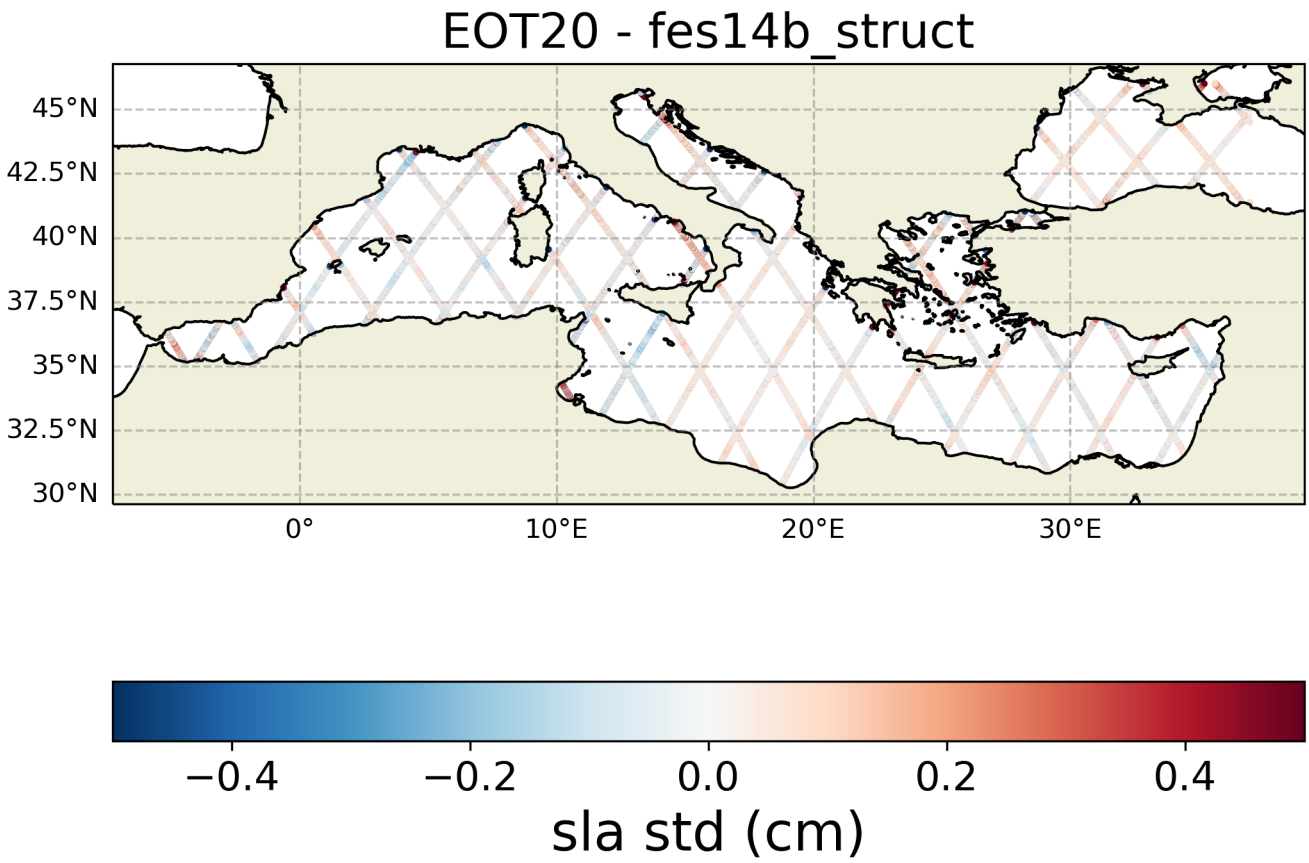

FIGURE 18 – Spatial coherence analysis of the Difference in sla 's std between EOT20 and fes14b_struct

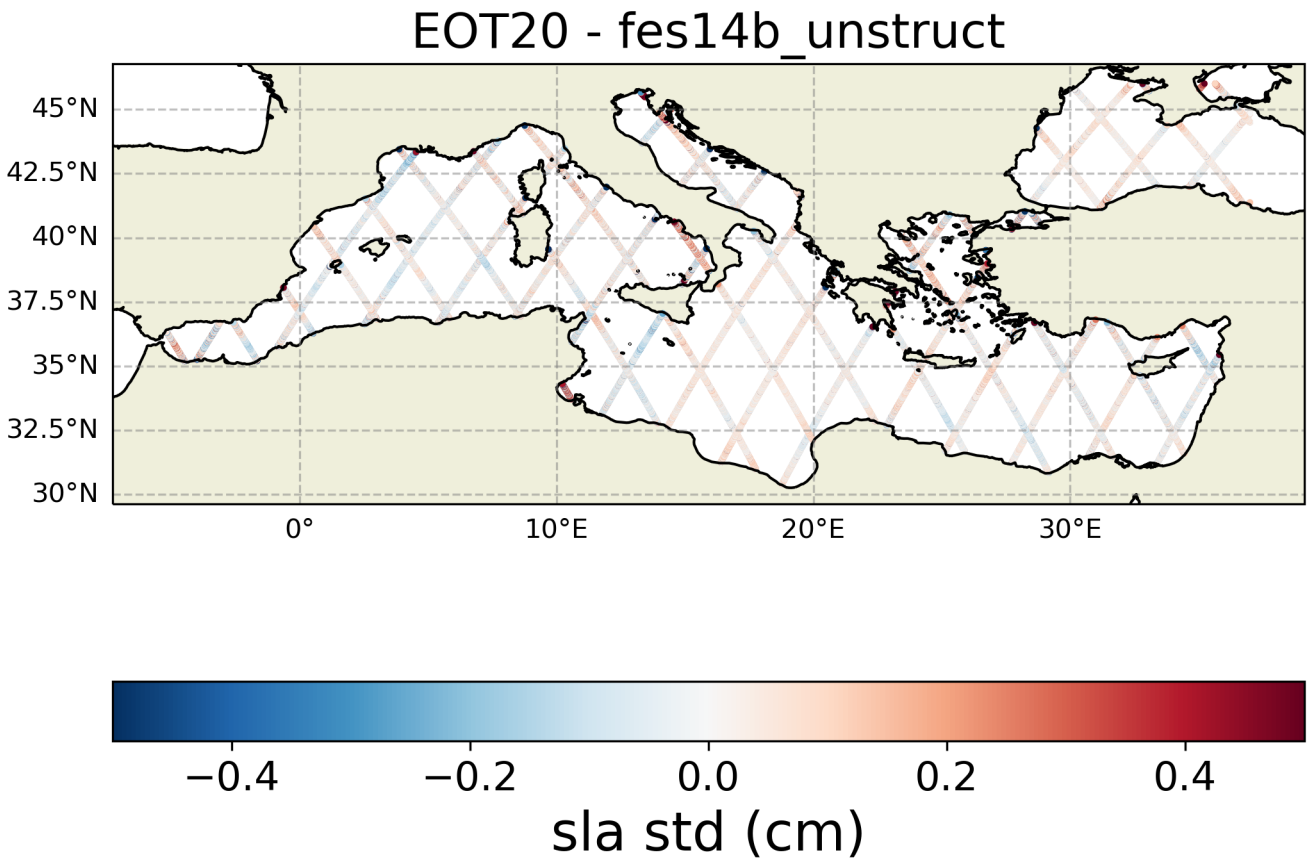

FIGURE 19 – Spatial coherence analysis of the Difference in sla 's std between EOT20 and fes14b_unstruct

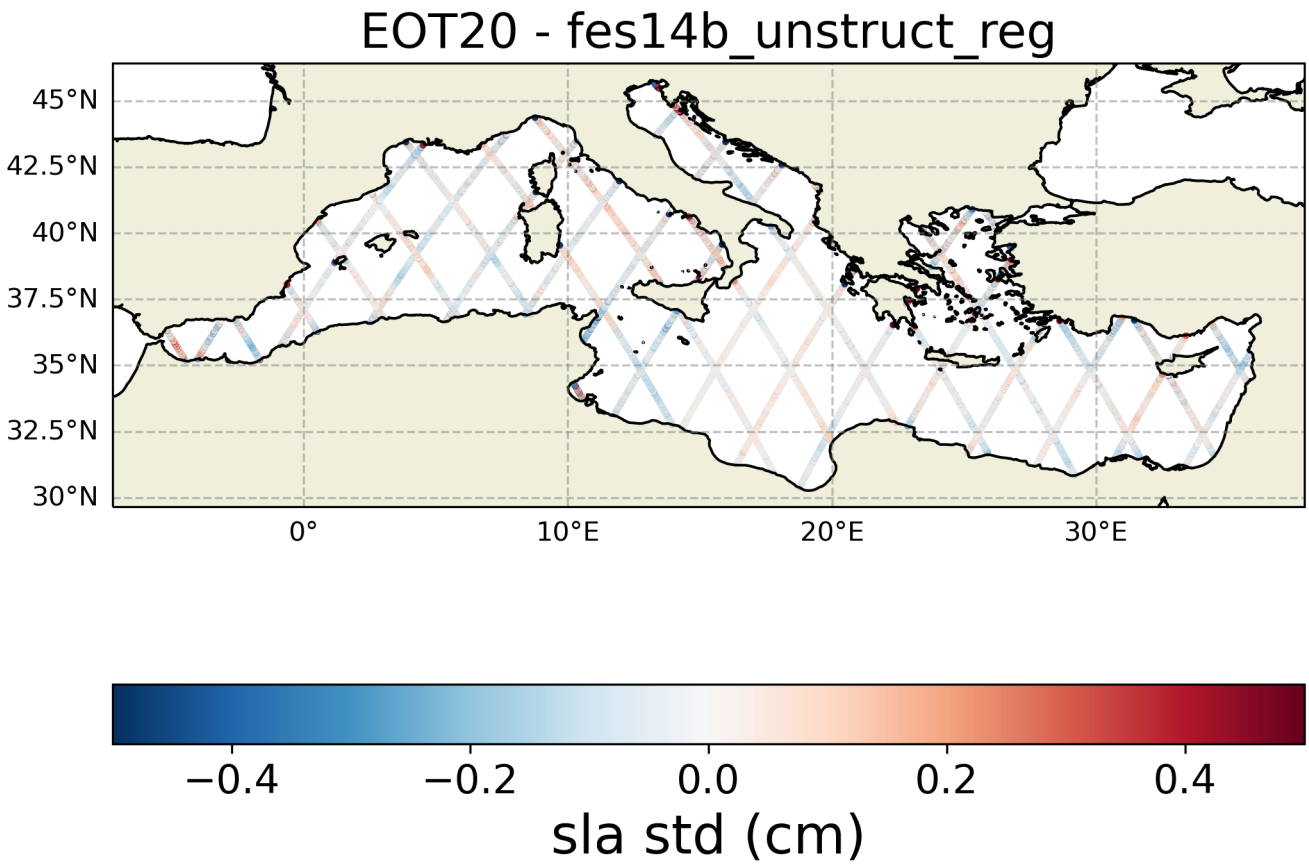

FIGURE 20 – Spatial coherence analysis of the Difference in sla 's std between EOT20 and fes14b_unstruct_reg

3.1.3 sla 's mean

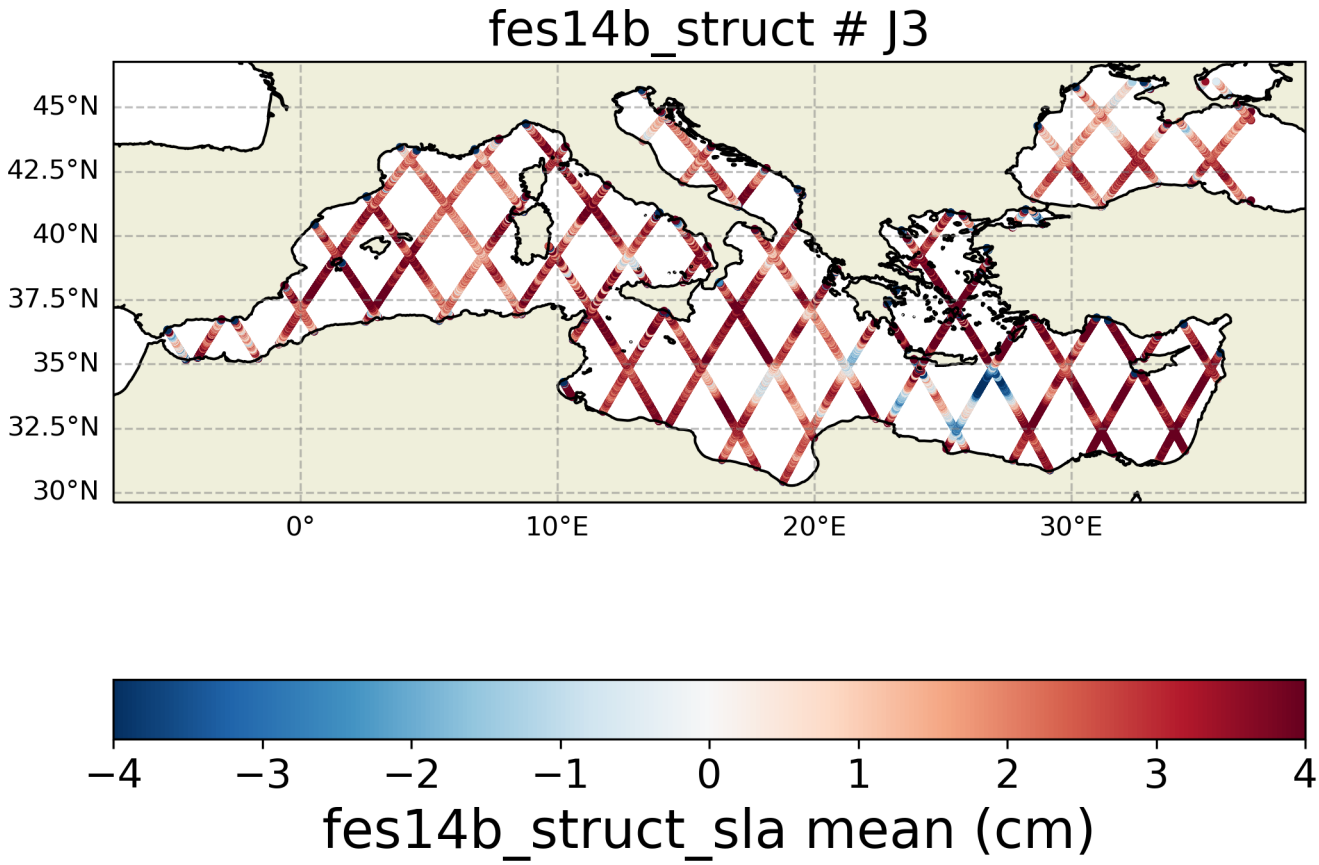

FIGURE 21 – Spatial coherence analysis of the mean of the fes14b_struct version of sla variable

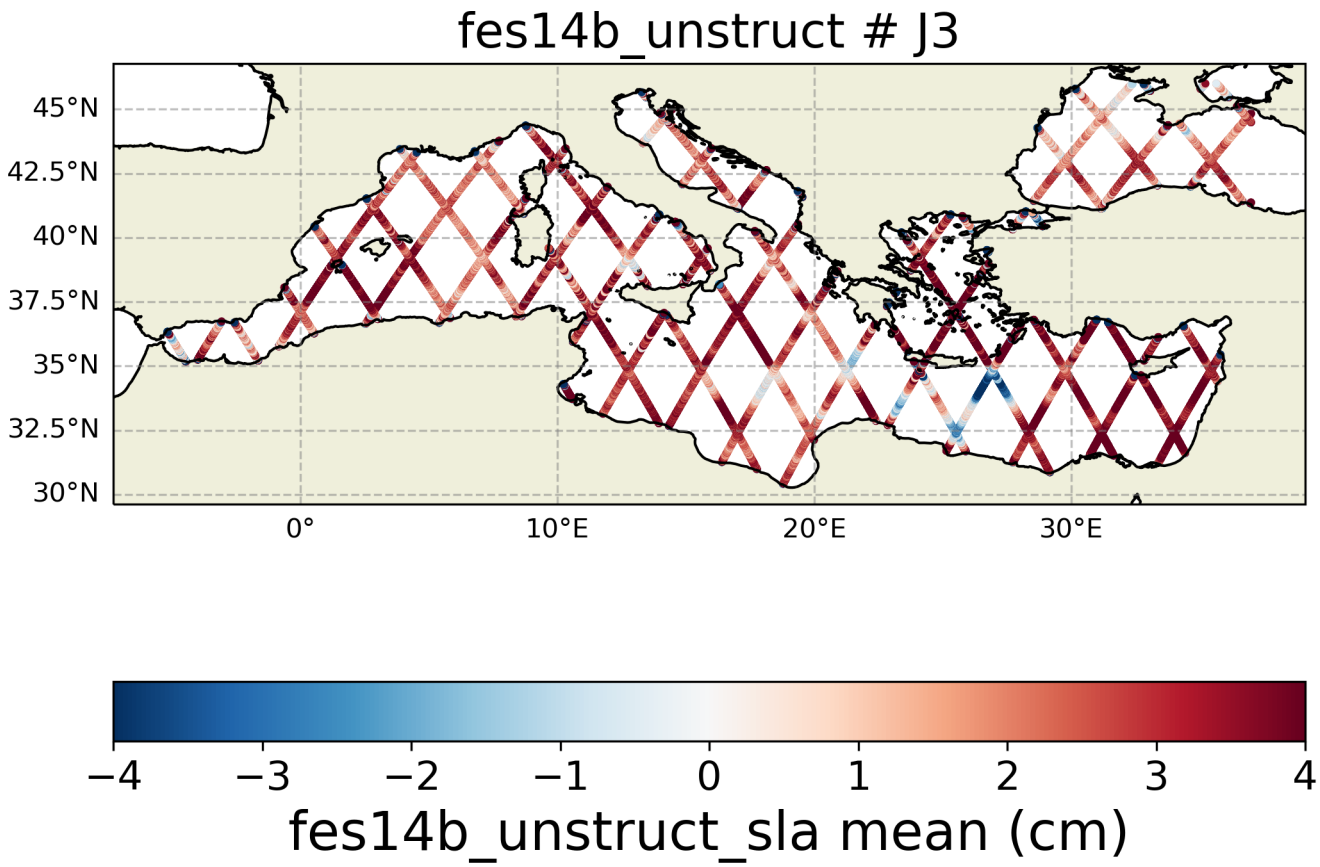

FIGURE 22 – Spatial coherence analysis of the mean of the fes14b_unstruct version of sla variable

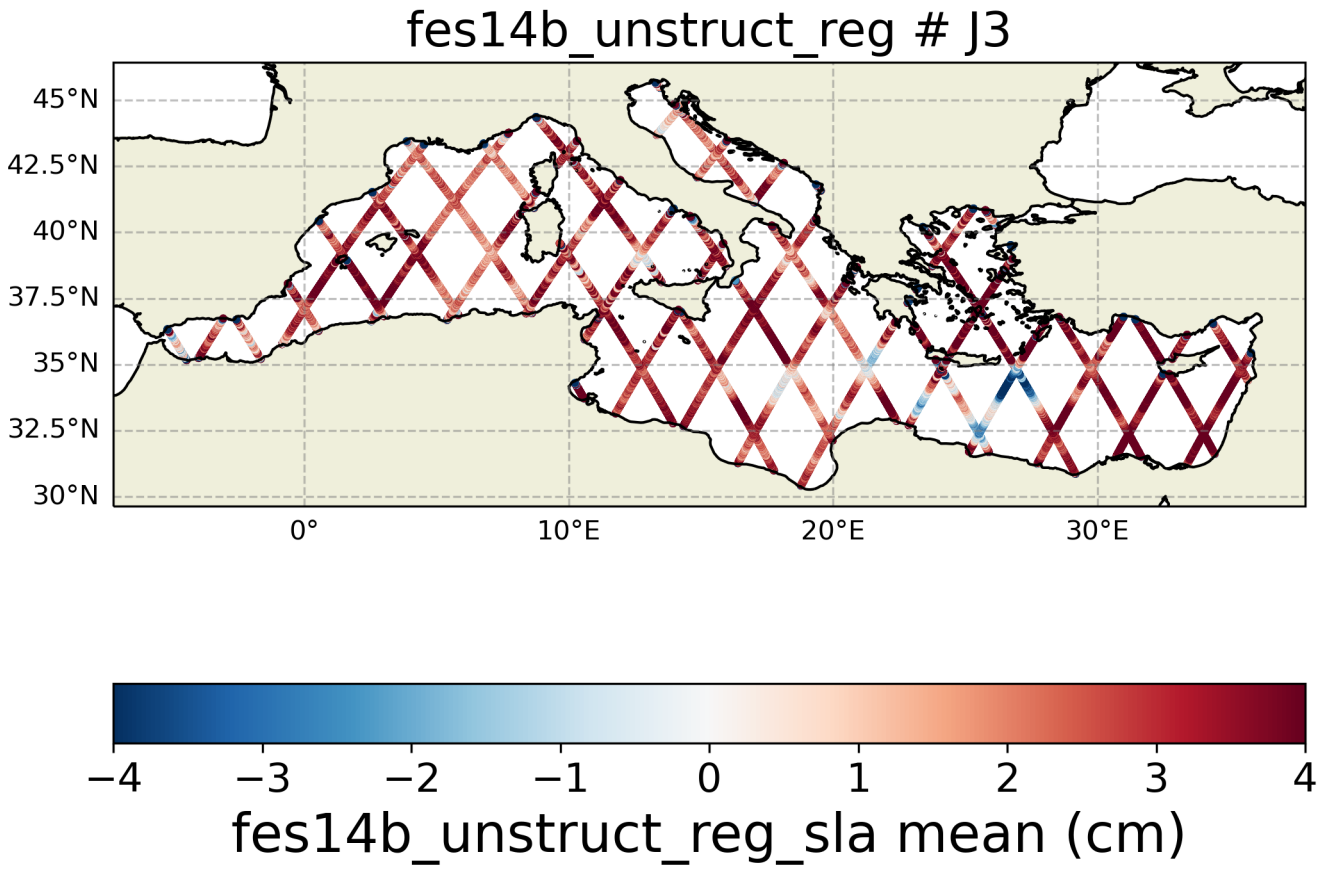

FIGURE 23 – Spatial coherence analysis of the mean of the fes14b_unstruct_reg version of sla variable

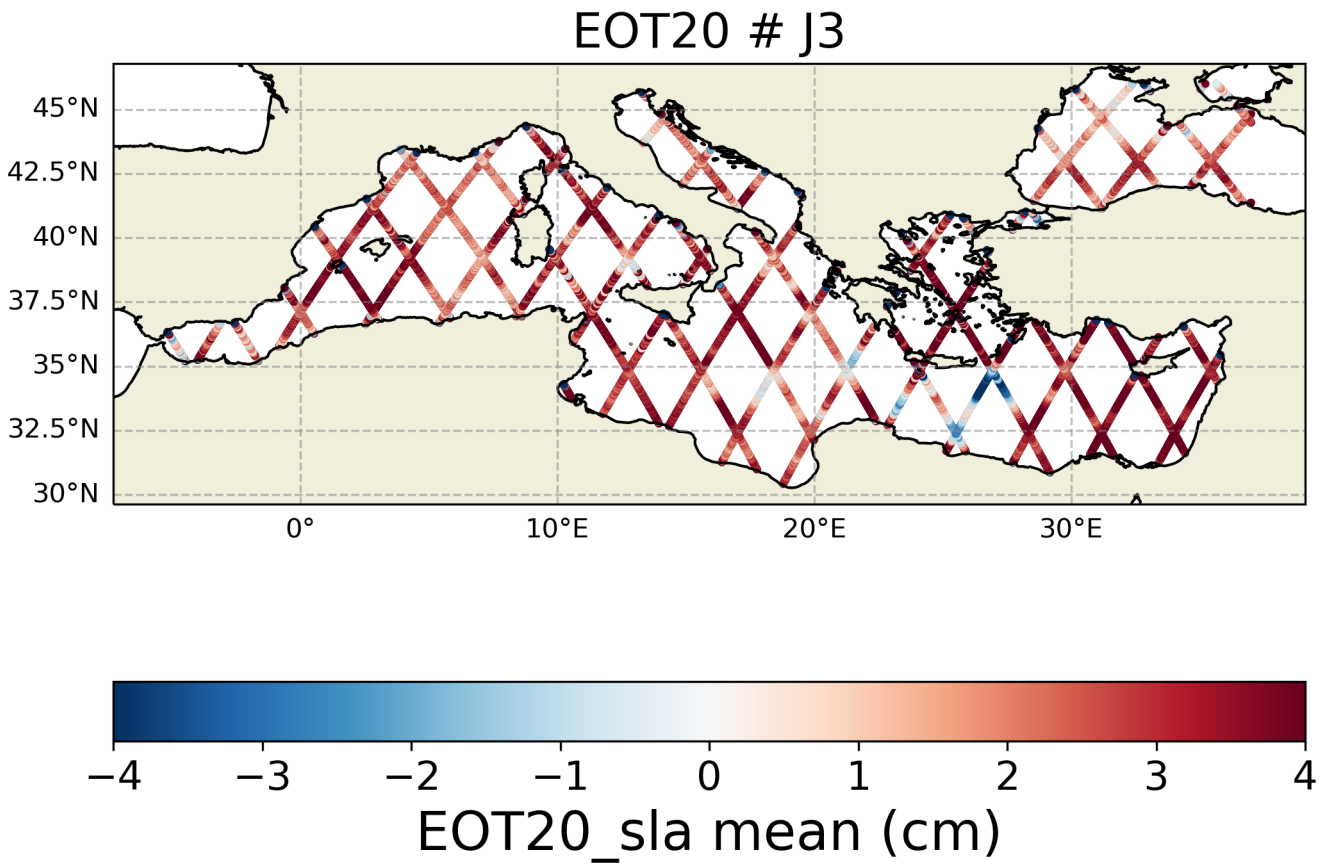

FIGURE 24 – Spatial coherence analysis of the mean of the EOT20 version of sla variable

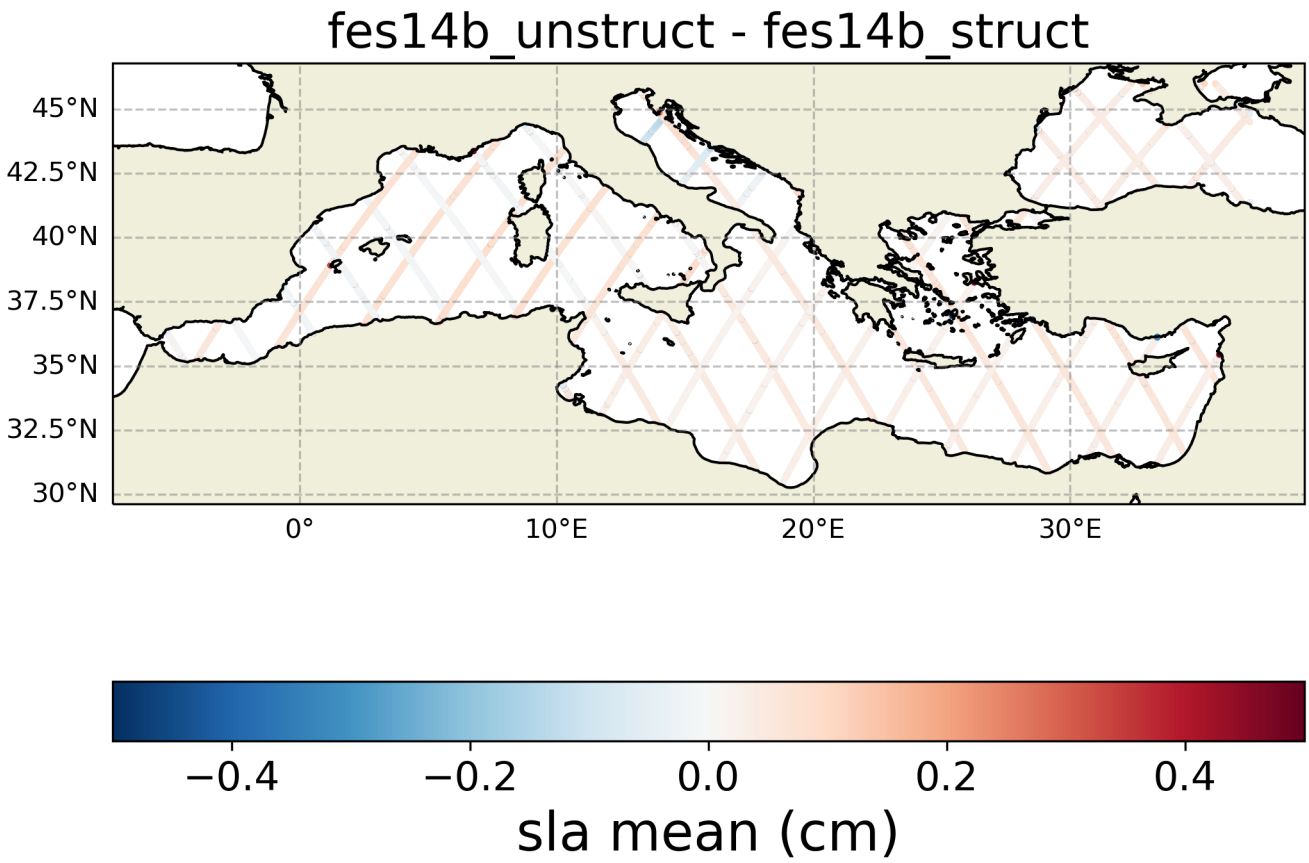

FIGURE 25 – Spatial coherence analysis of the Difference in sla 's mean between fes14b_unstruct and fes14b_struct

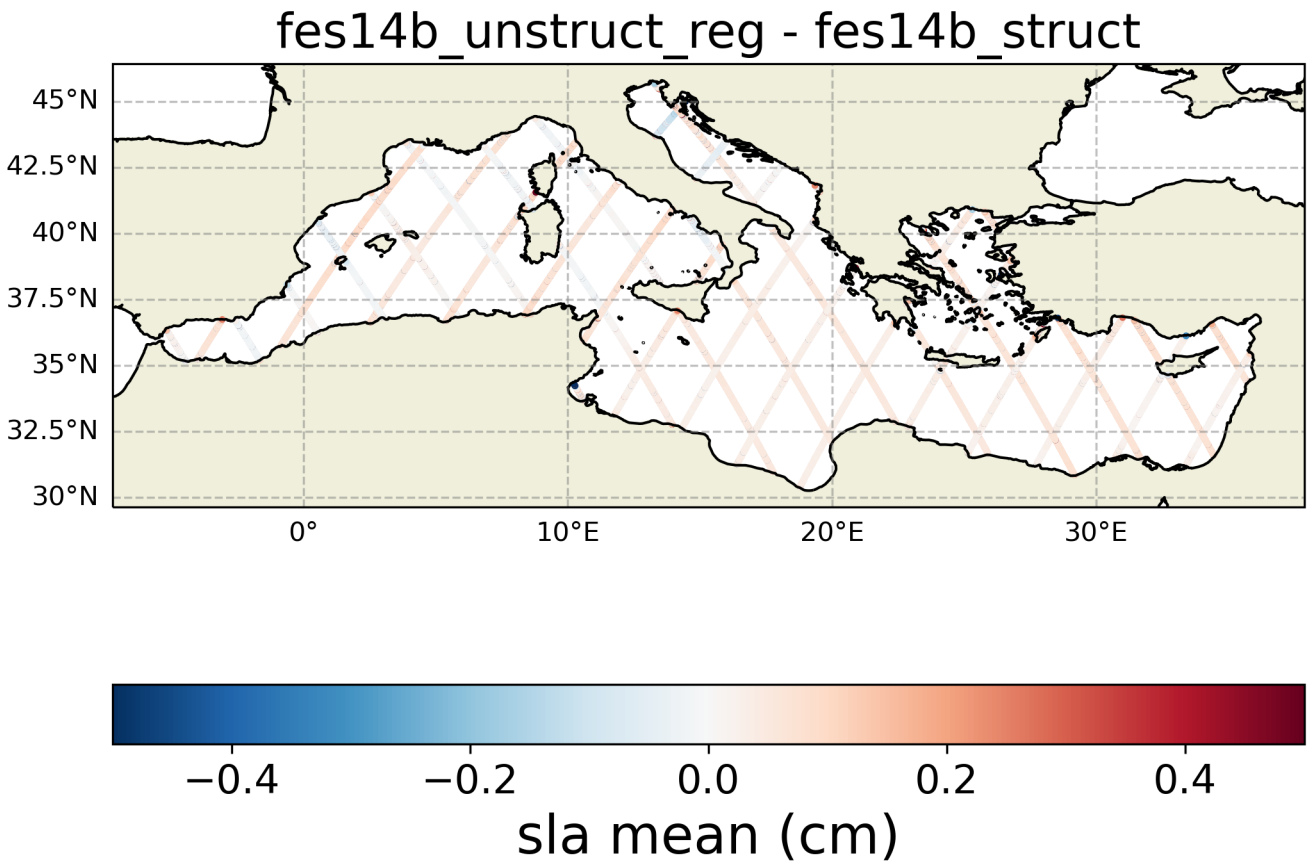

FIGURE 26 – Spatial coherence analysis of the Difference in sla 's mean between fes14b_unstruct_reg and fes14b_struct

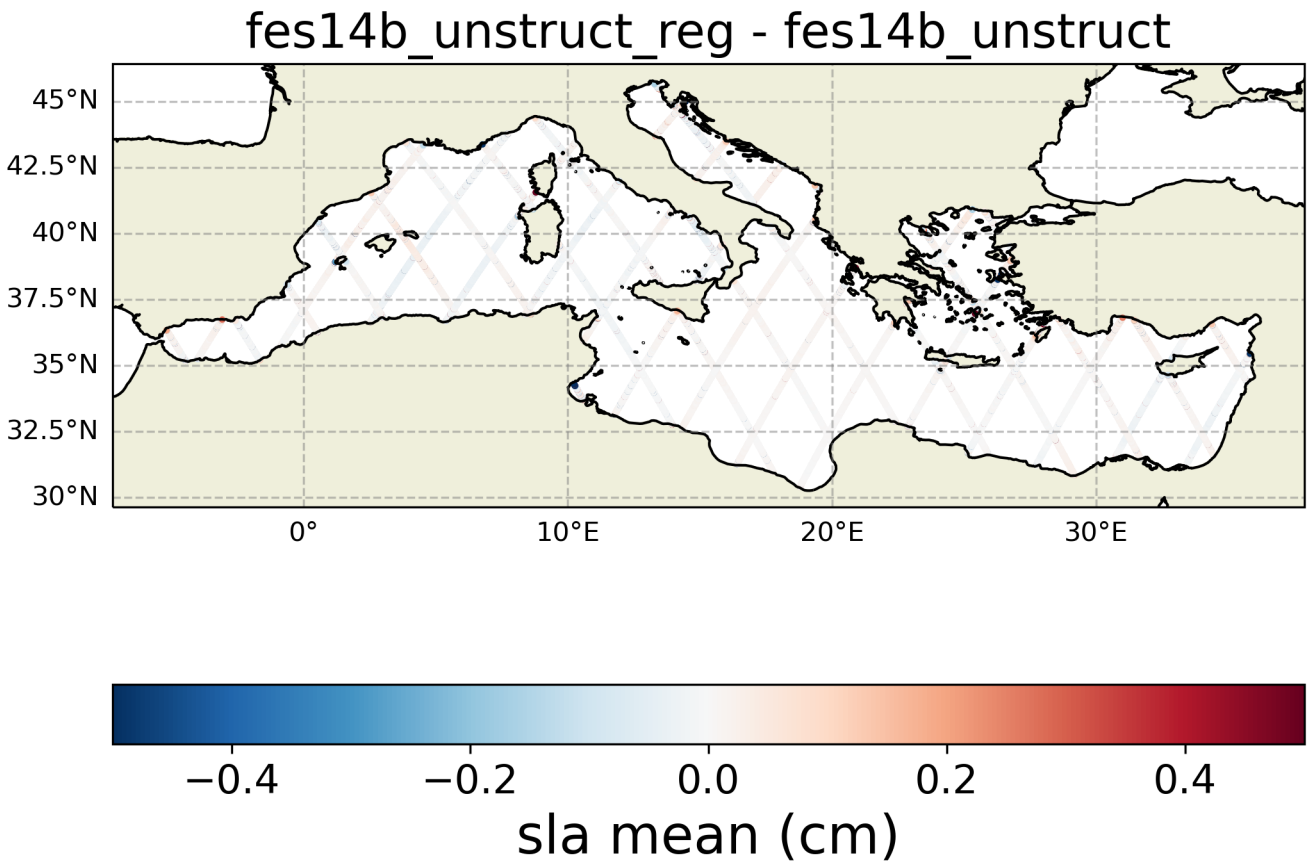

FIGURE 27 – Spatial coherence analysis of the Difference in sla 's mean between fes14b_unstruct_reg and fes14b_unstruct

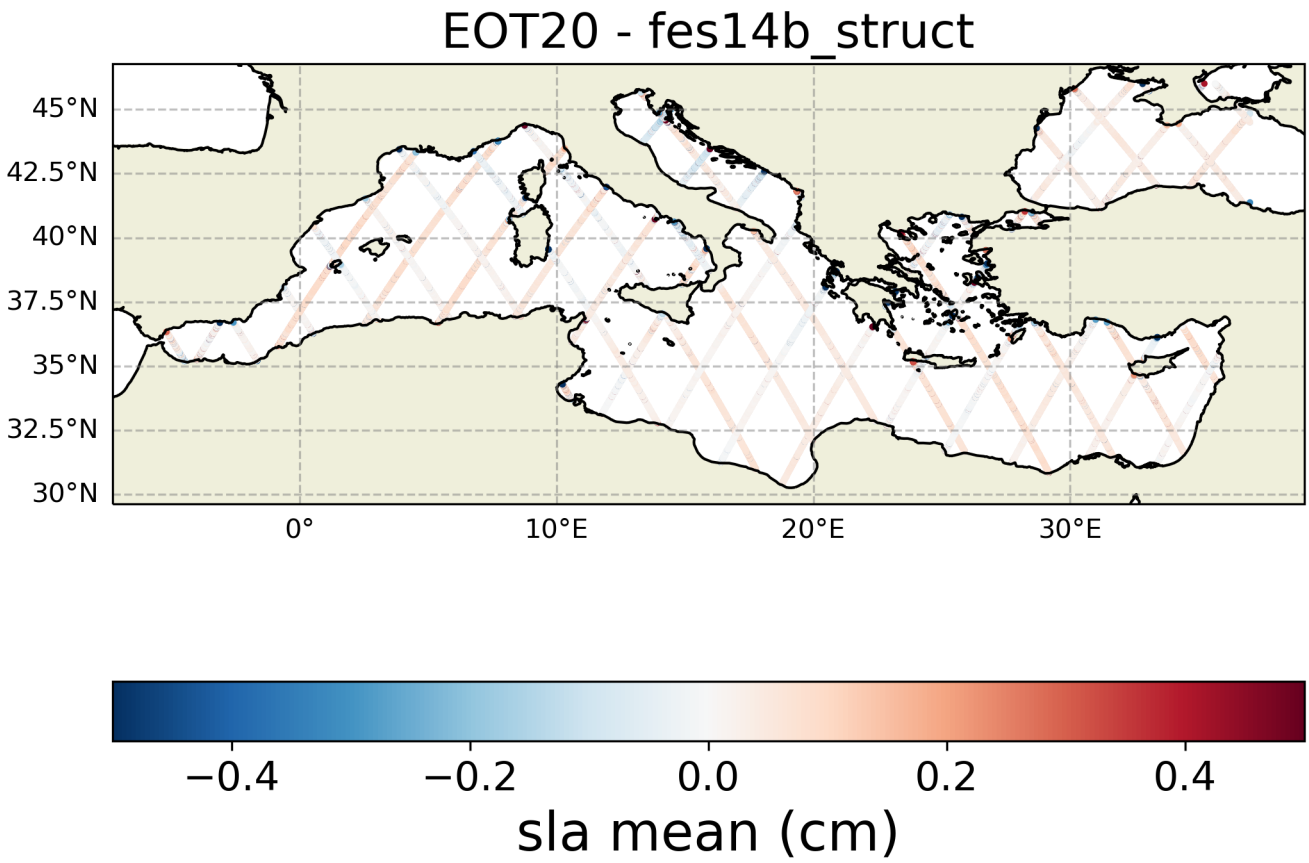

FIGURE 28 – Spatial coherence analysis of the Difference in sla 's mean between EOT20 and fes14b_struct

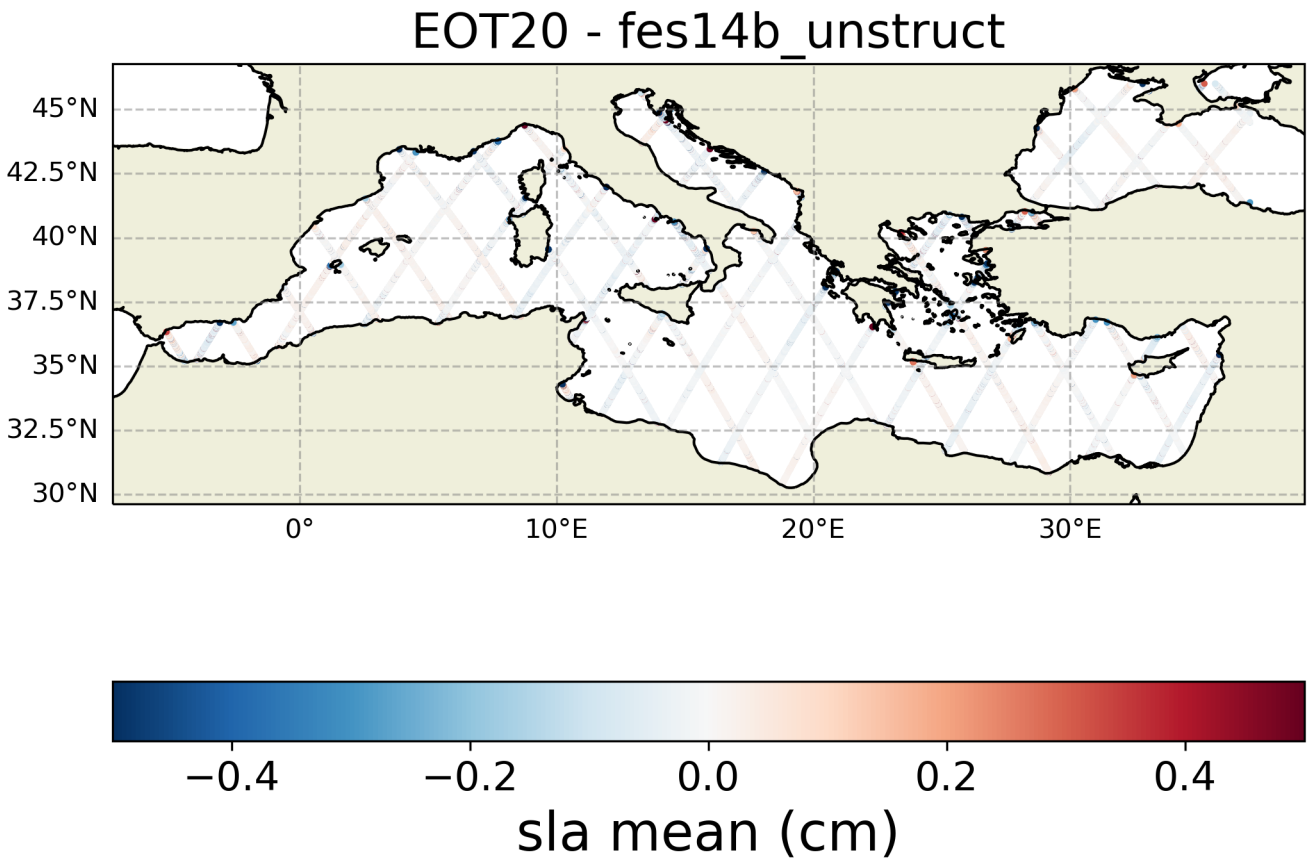

Figure 29 – Spatial coherence analysis of the Difference in sla 's mean between EOT20 and fes14b_unstruct

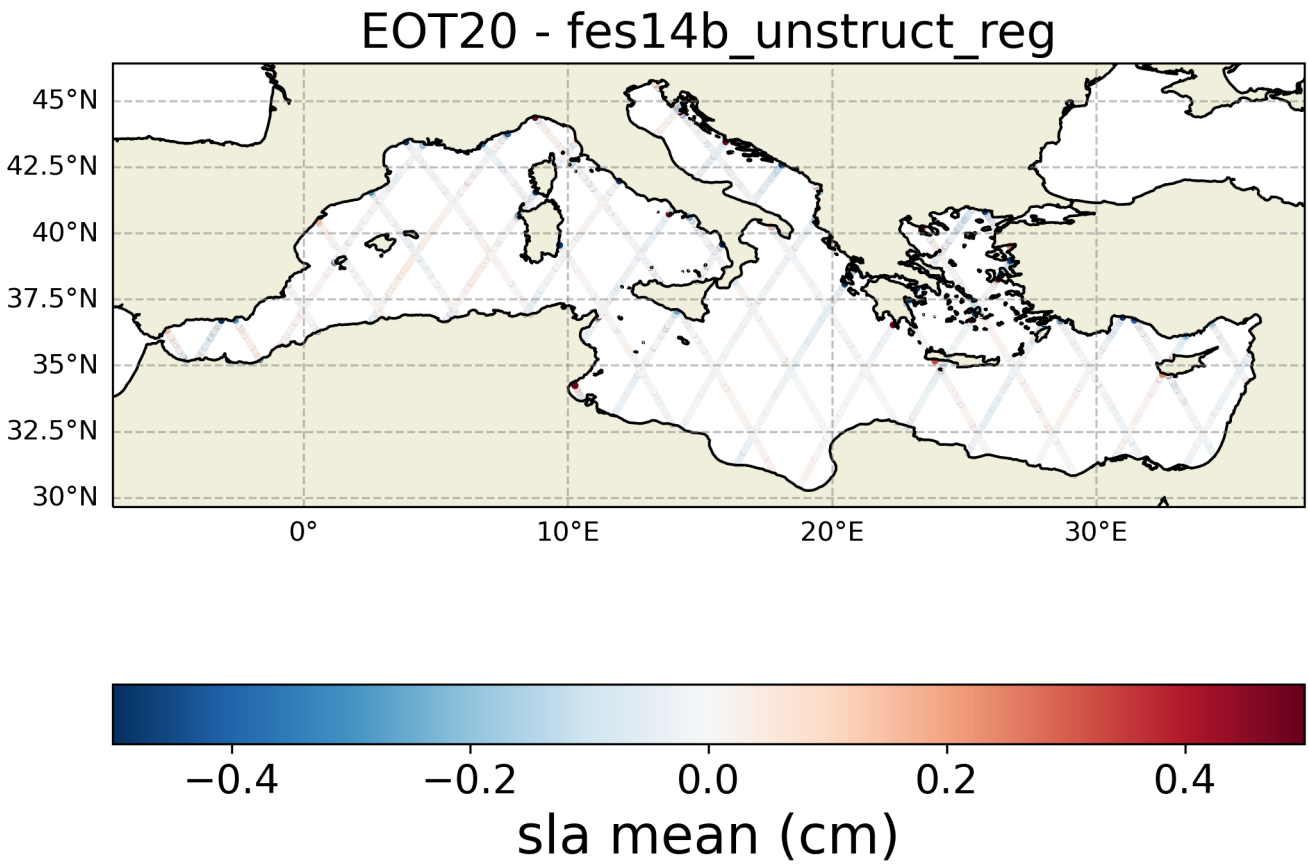

FIGURE 30 – Spatial coherence analysis of the Difference in sla 's mean between EOT20 and fes14b_unstruct_reg

3.2 Tide

3.2.1 Tide 's count

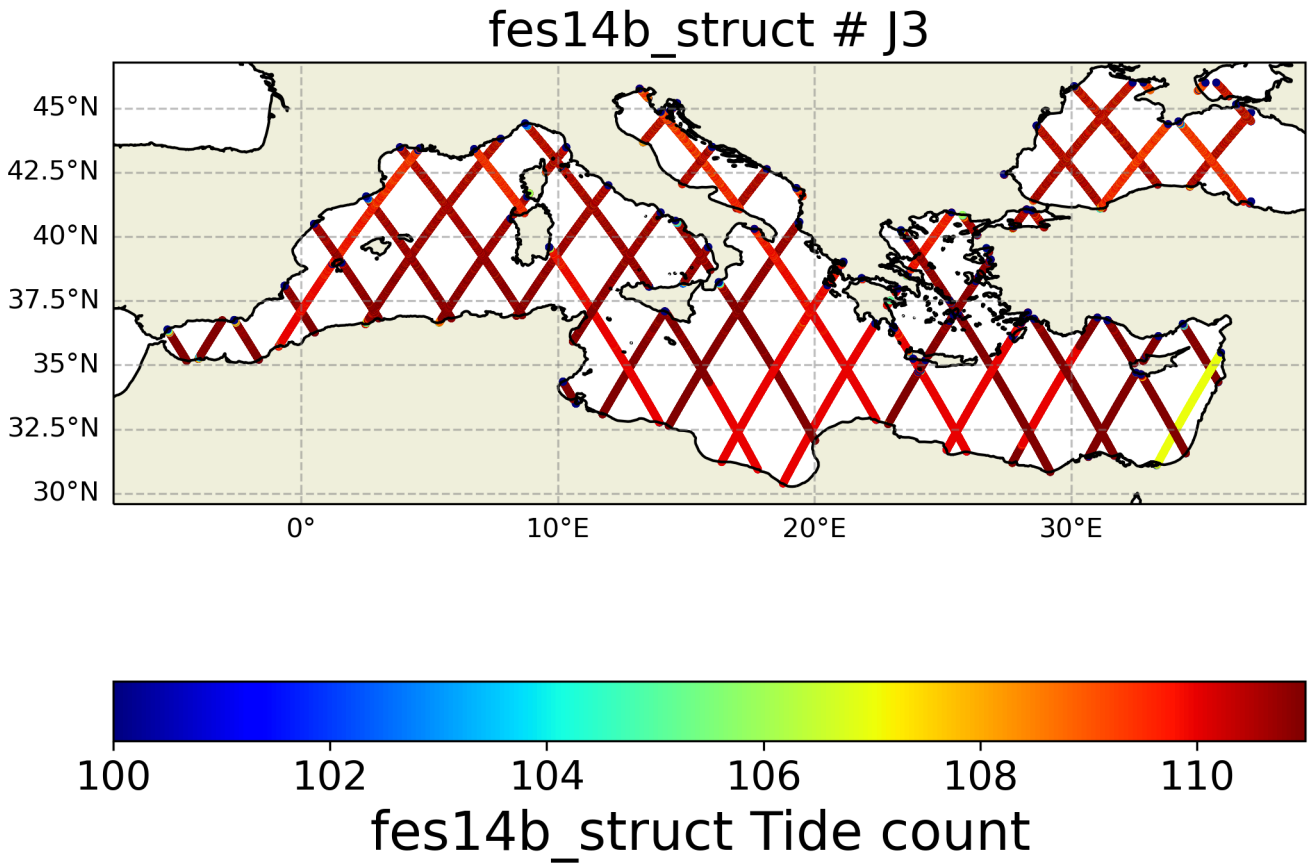

FIGURE 31 – Spatial coherence analysis of the count of the fes14b_struct version of Tide variable

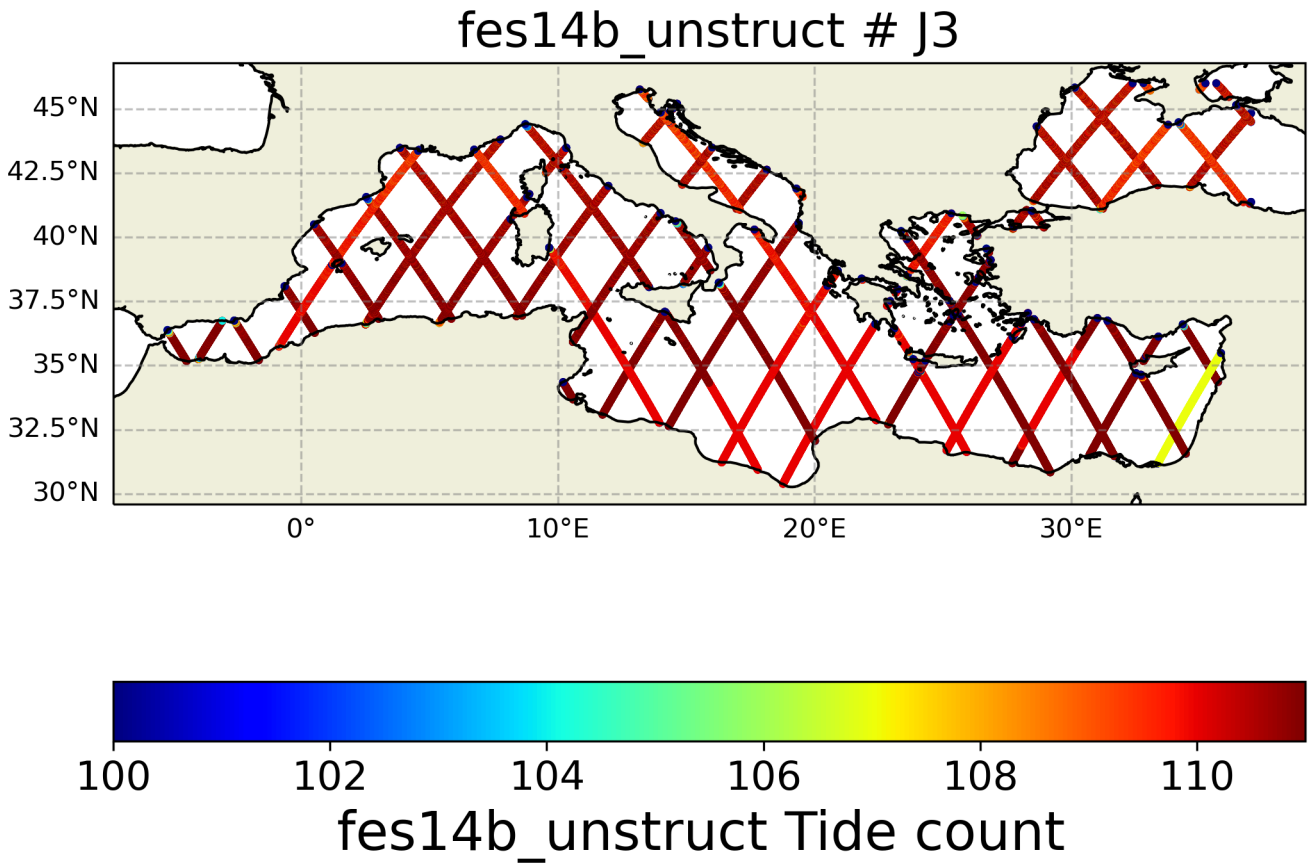

FIGURE 32 – Spatial coherence analysis of the count of the fes14b_unstruct version of Tide variable

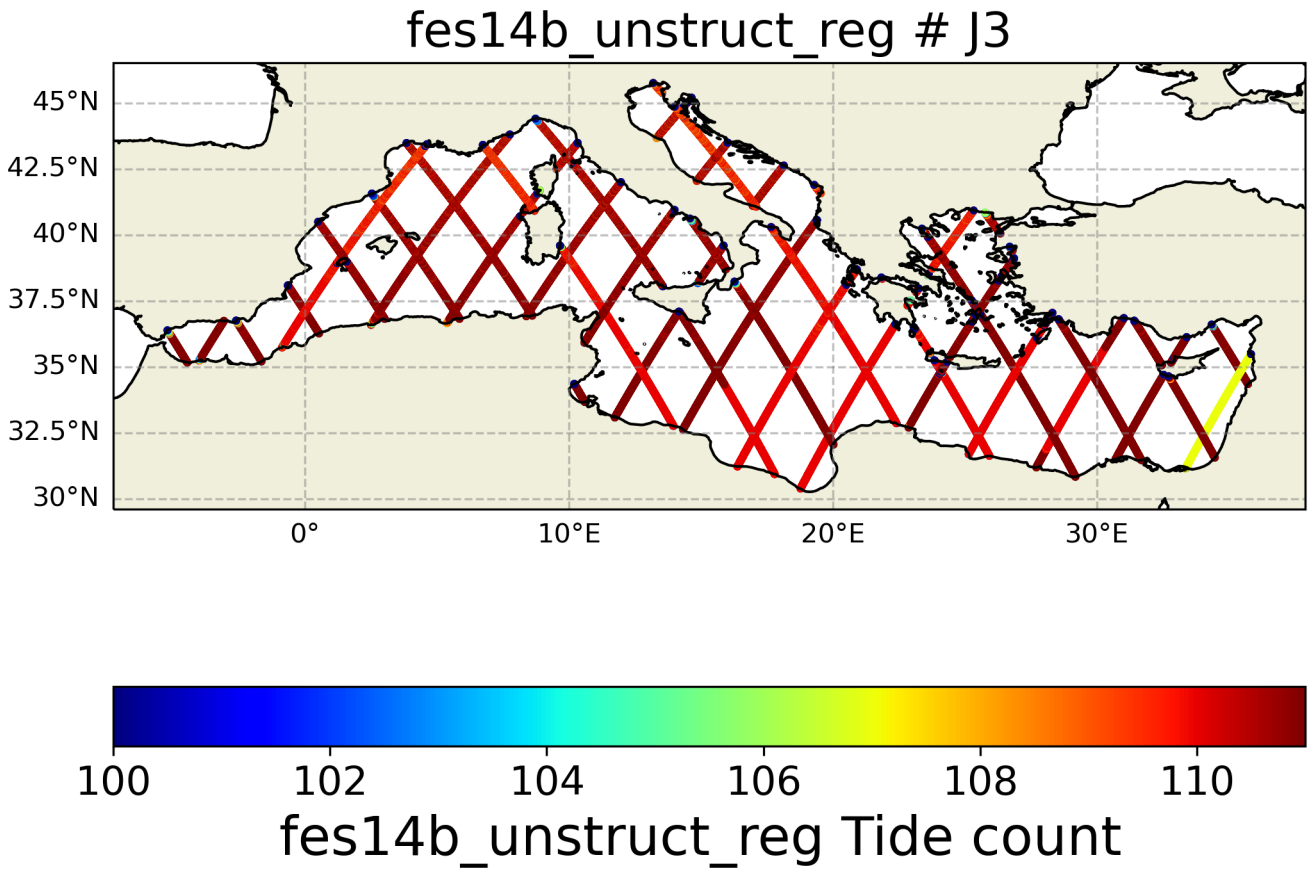

FIGURE 33 – Spatial coherence analysis of the count of the fes14b_unstruct_reg version of Tide variable

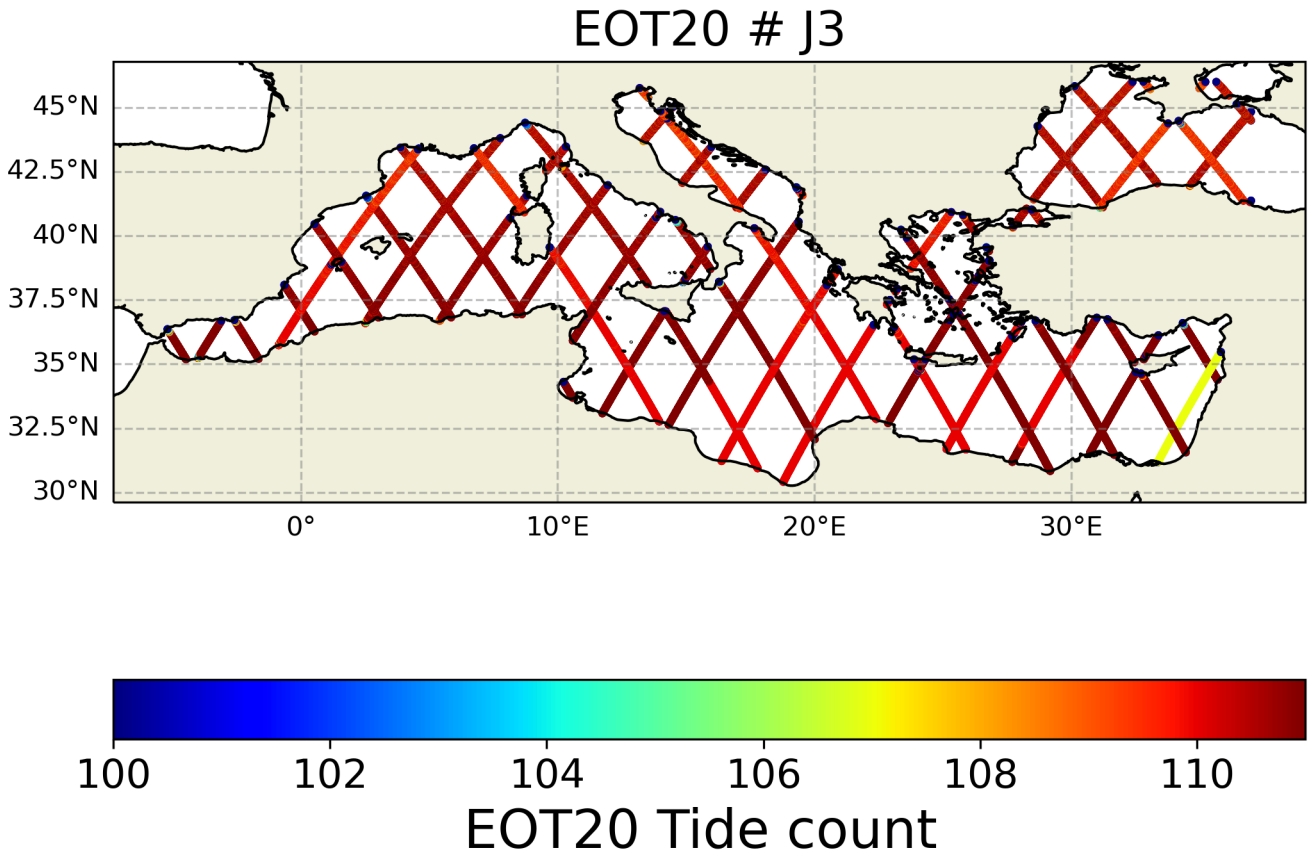

FIGURE 34 – Spatial coherence analysis of the count of the EOT20 version of Tide variable

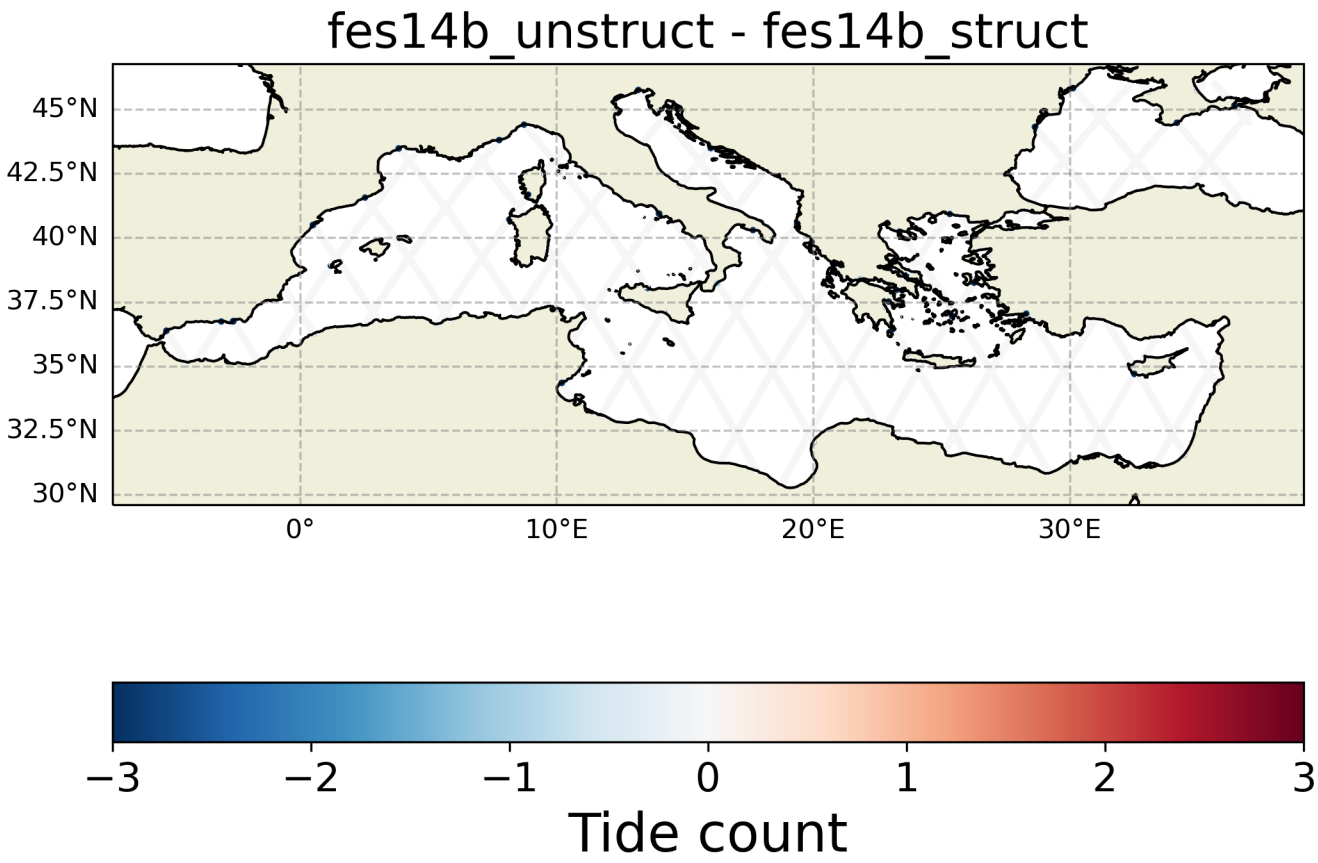

Figure 35 – Spatial coherence analysis of the Difference in Tide 's count between fes14b_unstruct and fes14b_struct

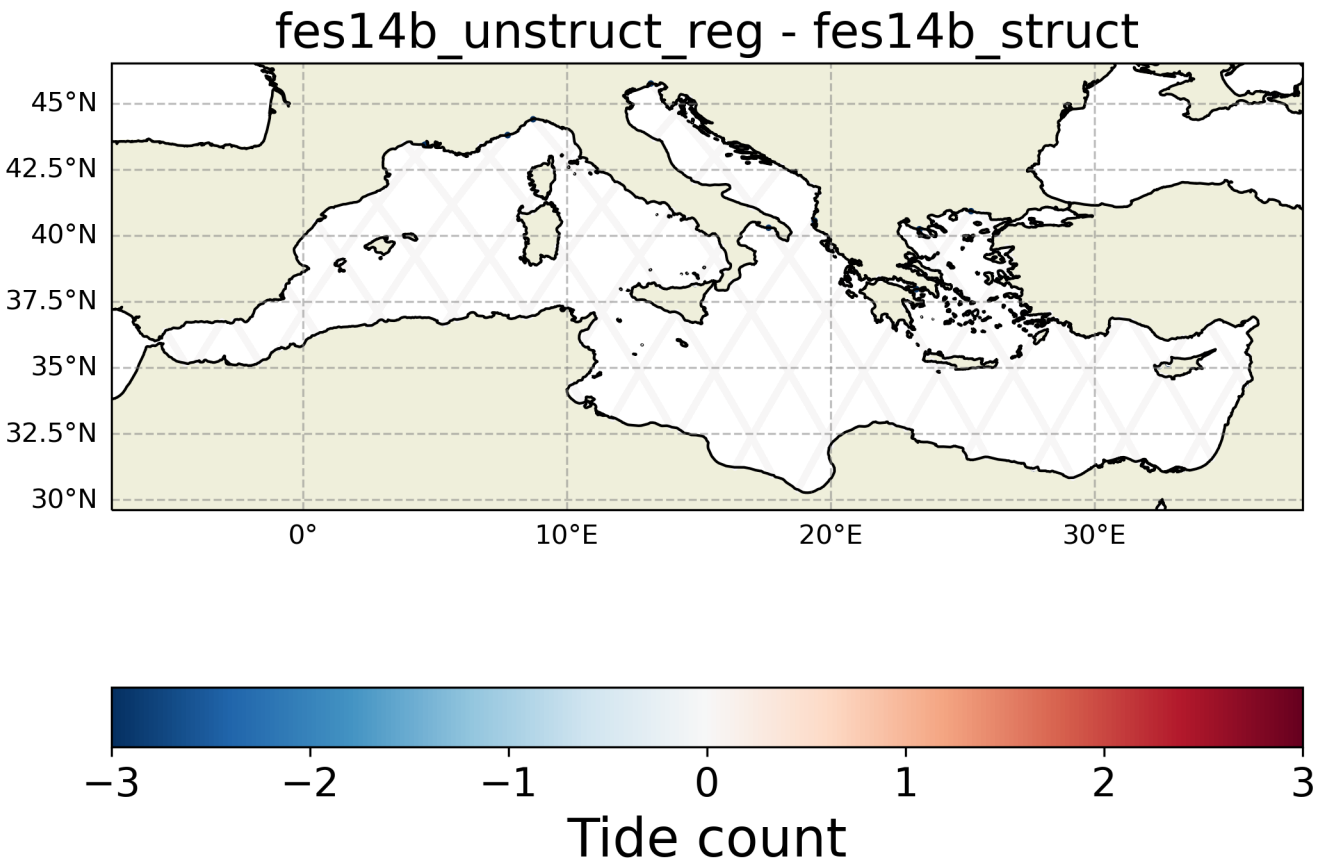

FIGURE 36 – Spatial coherence analysis of the Difference in Tide 's count between fes14b_unstruct_reg and fes14b_struct

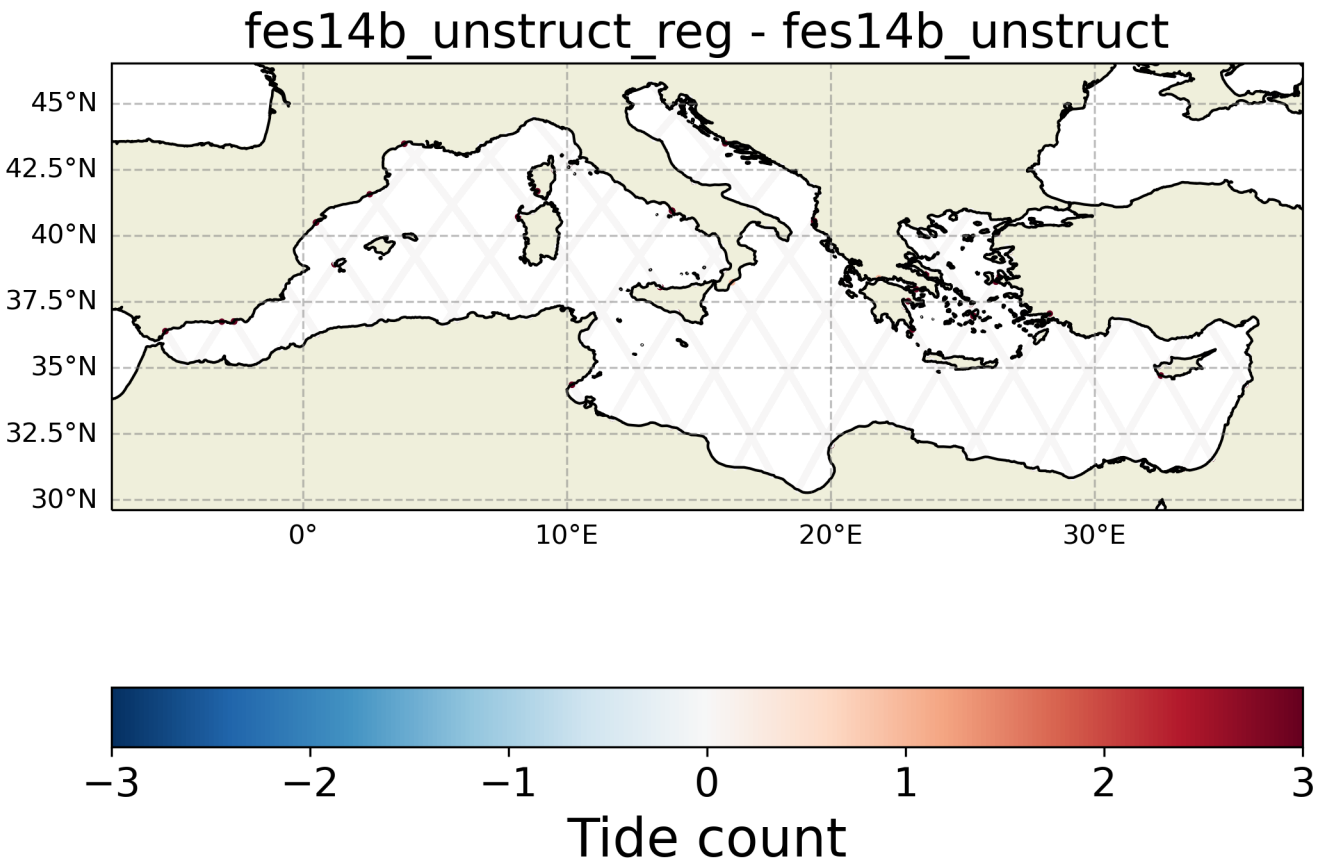

FIGURE 37 – Spatial coherence analysis of the Difference in Tide 's count between fes14b_unstruct_reg and fes14b_unstruct

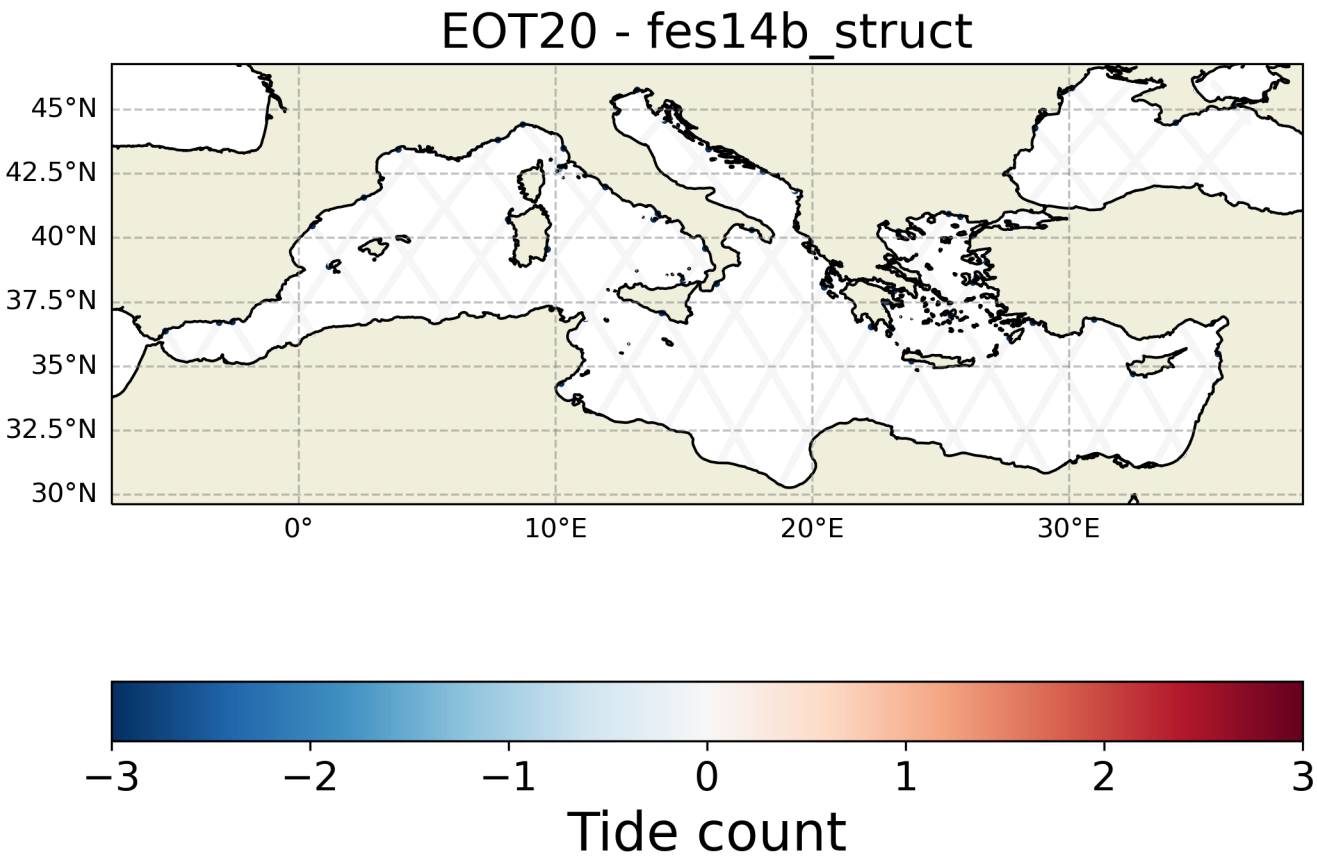

Figure 38 – Spatial coherence analysis of the Difference in Tide 's count between EOT20 and fes14b_struct

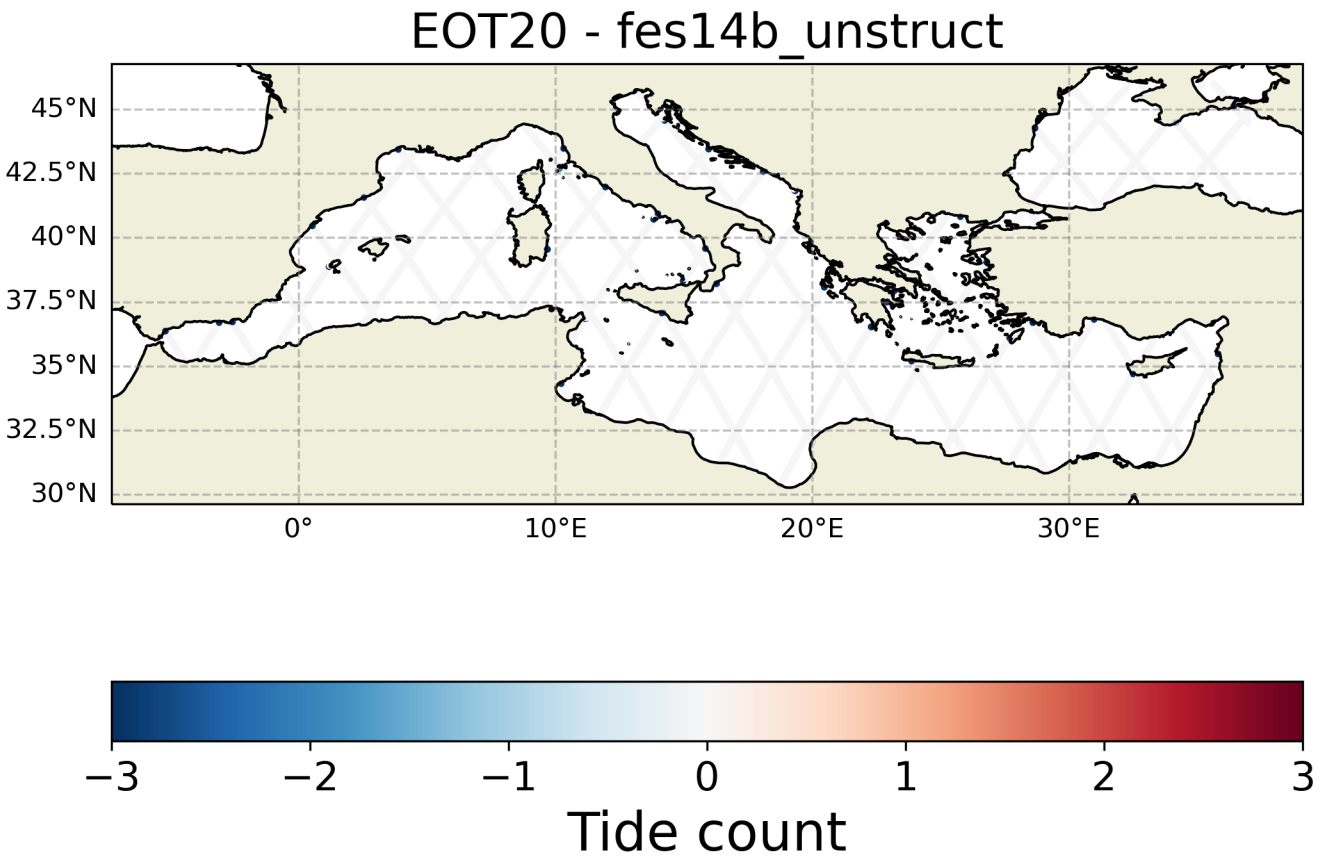

Figure 39 – Spatial coherence analysis of the Difference in Tide 's count between EOT20 and fes14b_unstruct

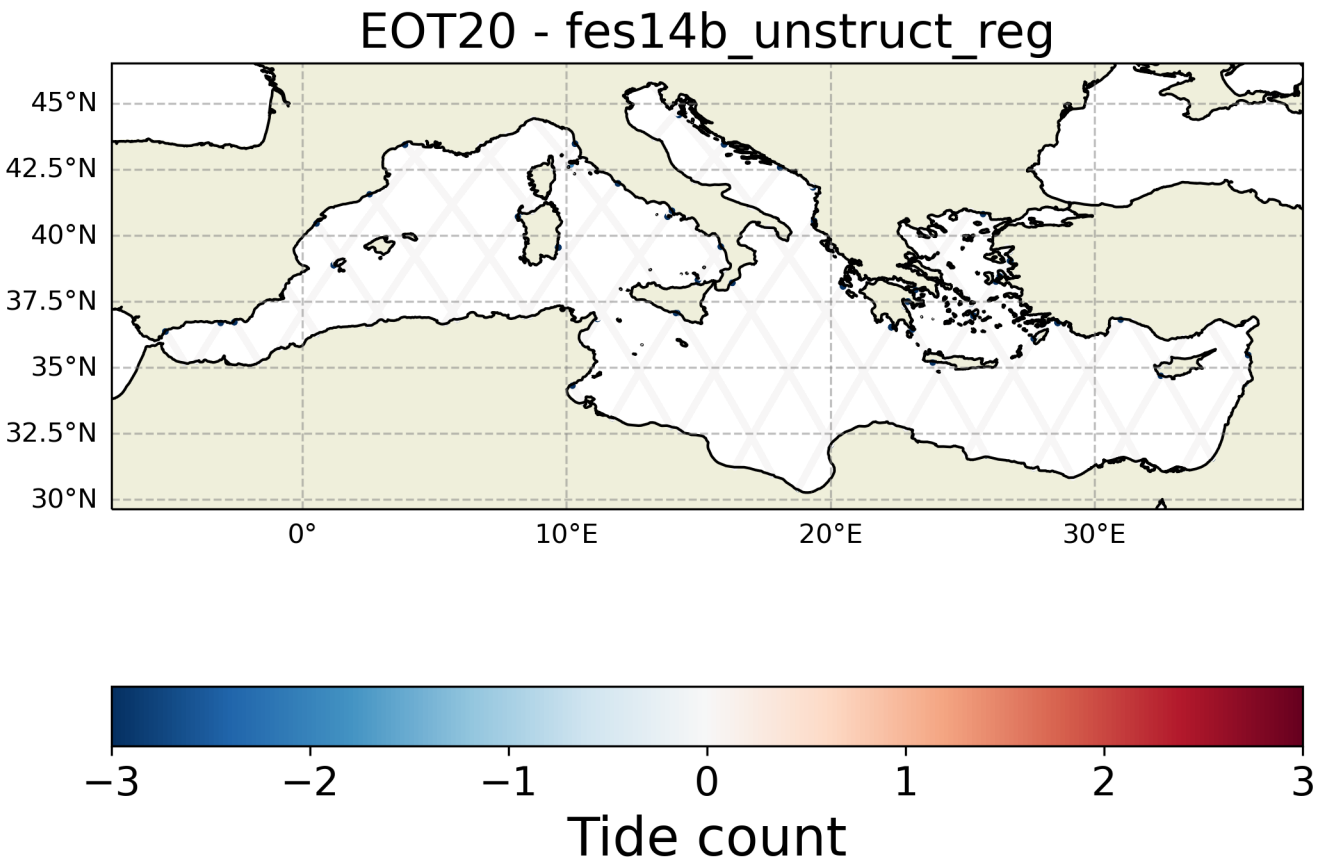

Figure 40 – Spatial coherence analysis of the Difference in Tide 's count between EOT20 and fes14b_unstruct_reg

3.2.2 Tide 's std

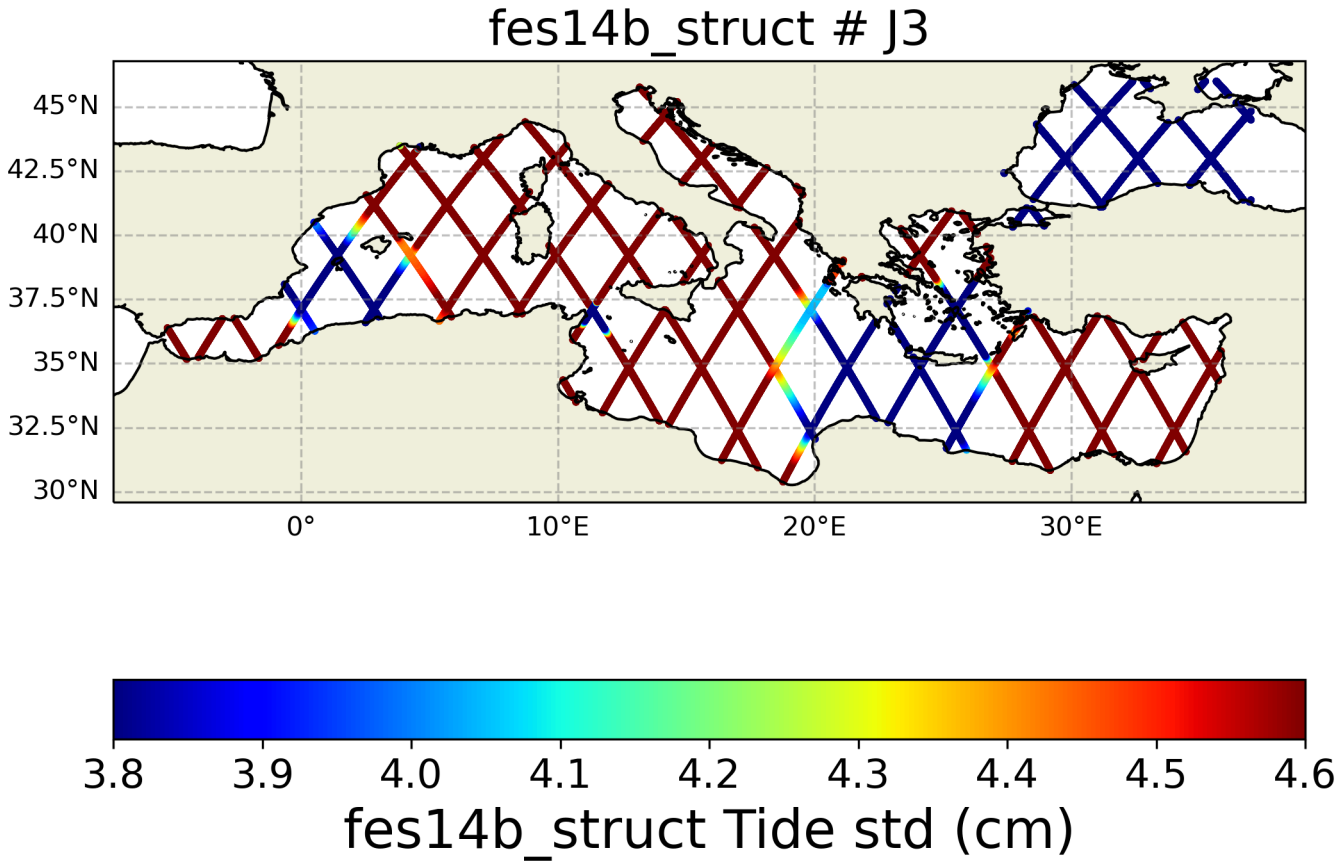

FIGURE 41 – Spatial coherence analysis of the std of the fes14b_struct version of Tide variable

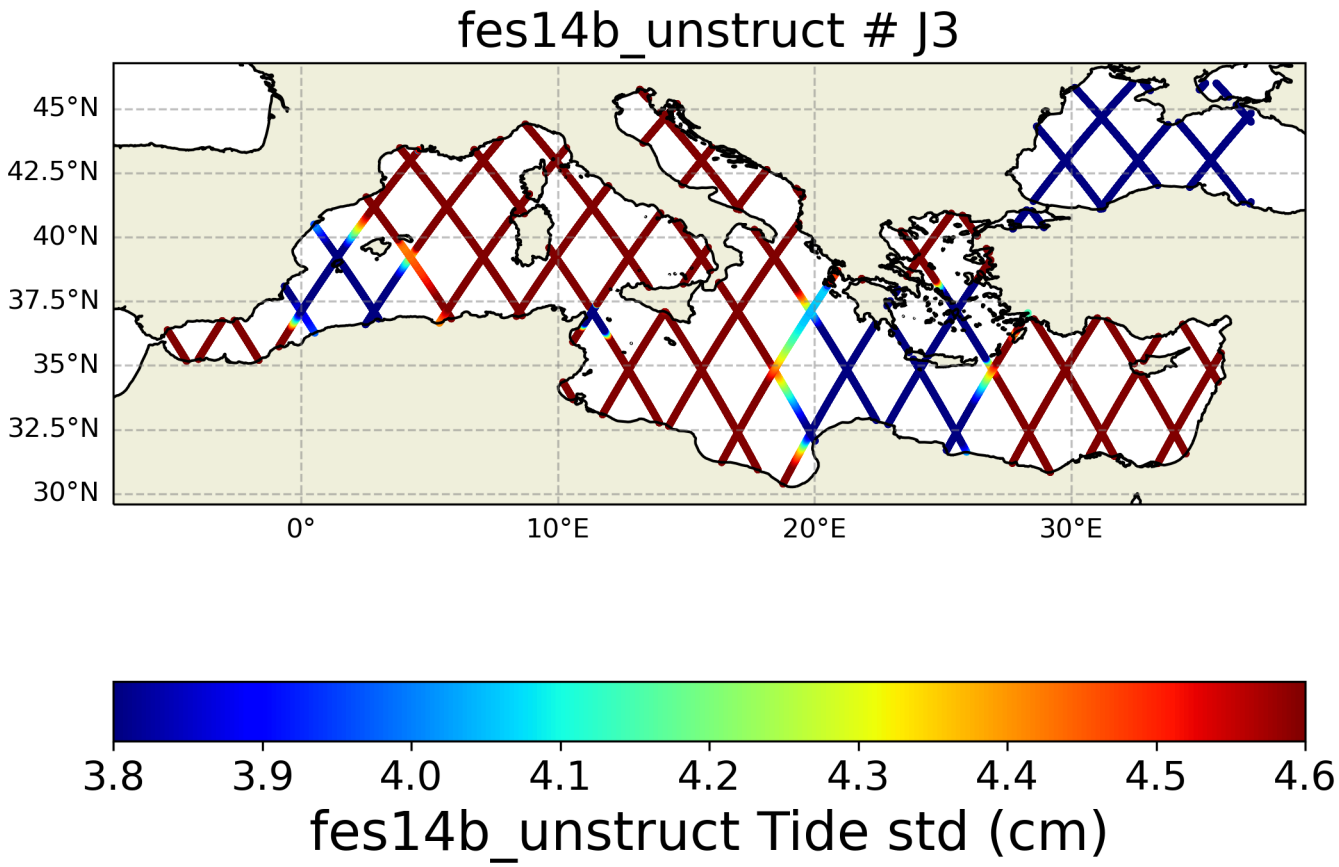

FIGURE 42 – Spatial coherence analysis of the std of the fes14b_unstruct version of Tide variable

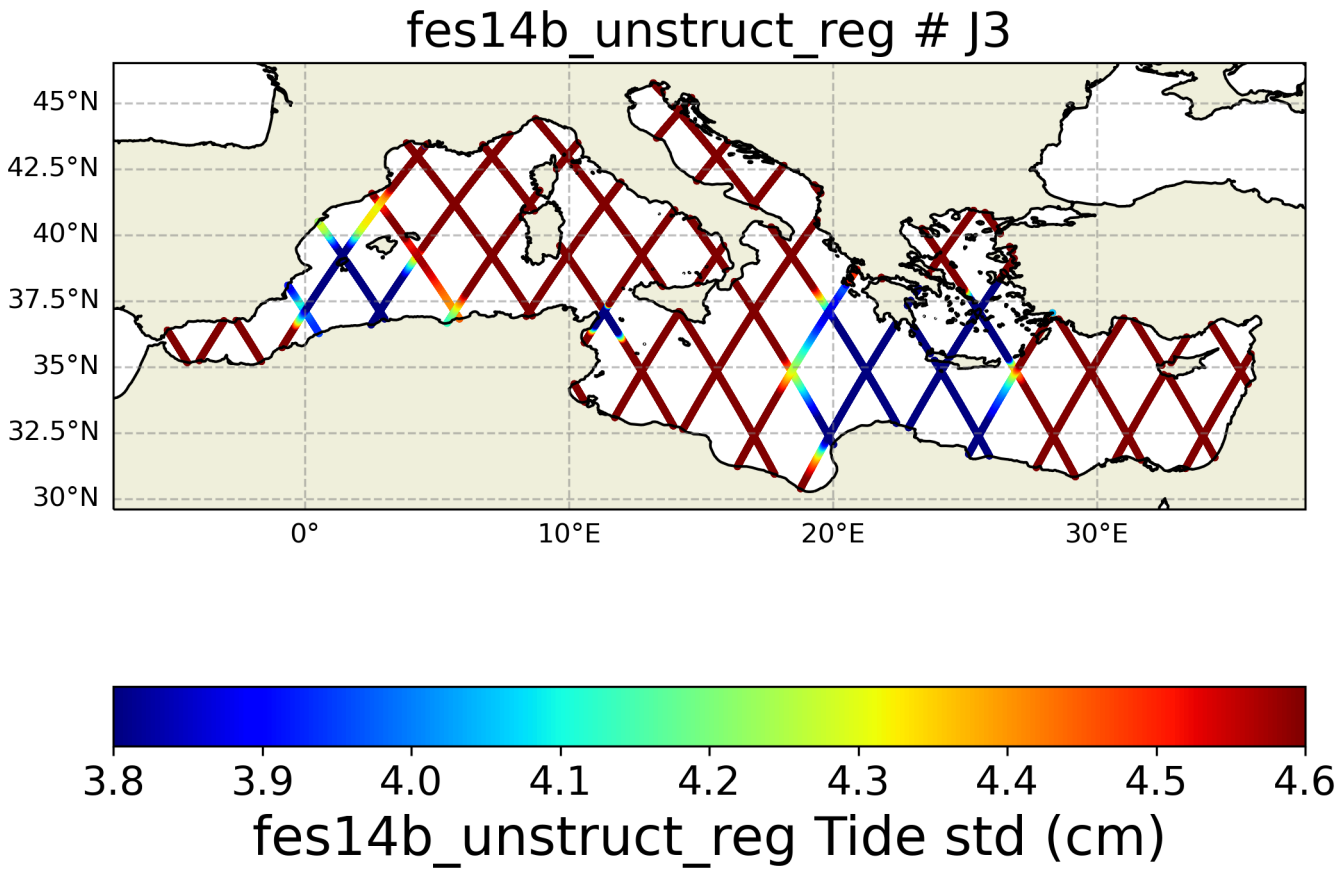

FIGURE 43 – Spatial coherence analysis of the std of the fes14b_unstruct_reg version of Tide variable

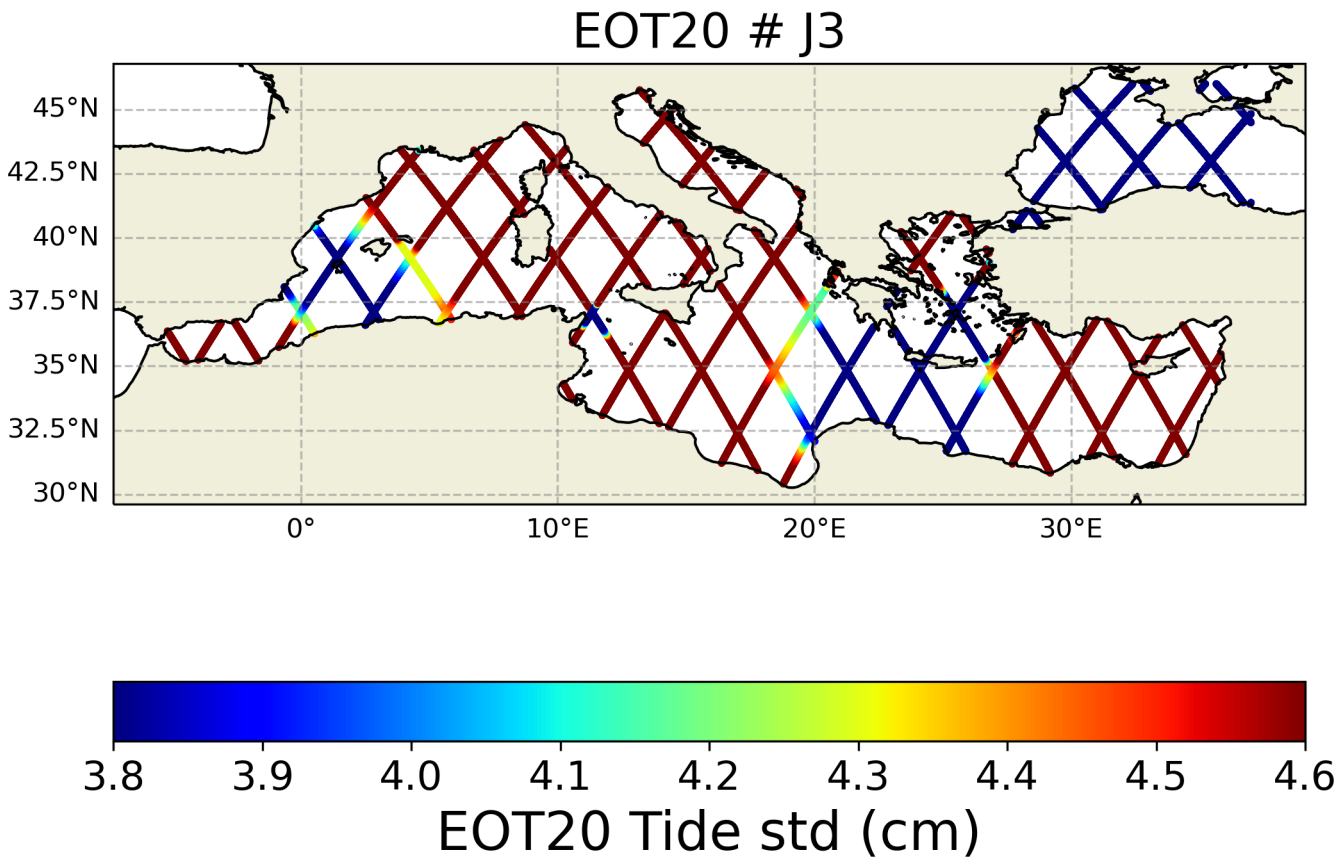

FIGURE 44 – Spatial coherence analysis of the std of the EOT20 version of Tide variable

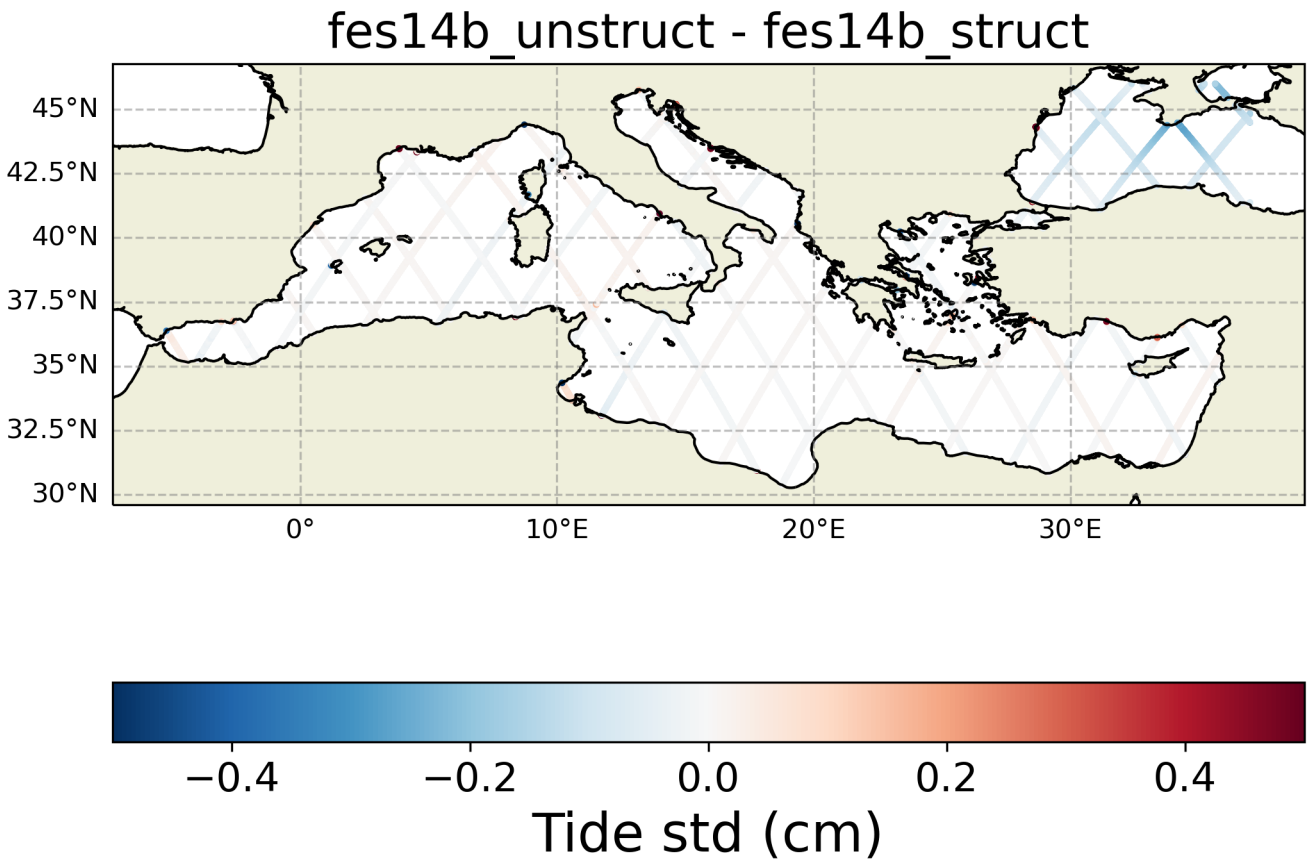

FIGURE 45 – Spatial coherence analysis of the Difference in Tide 's std between fes14b_unstruct and fes14b_struct

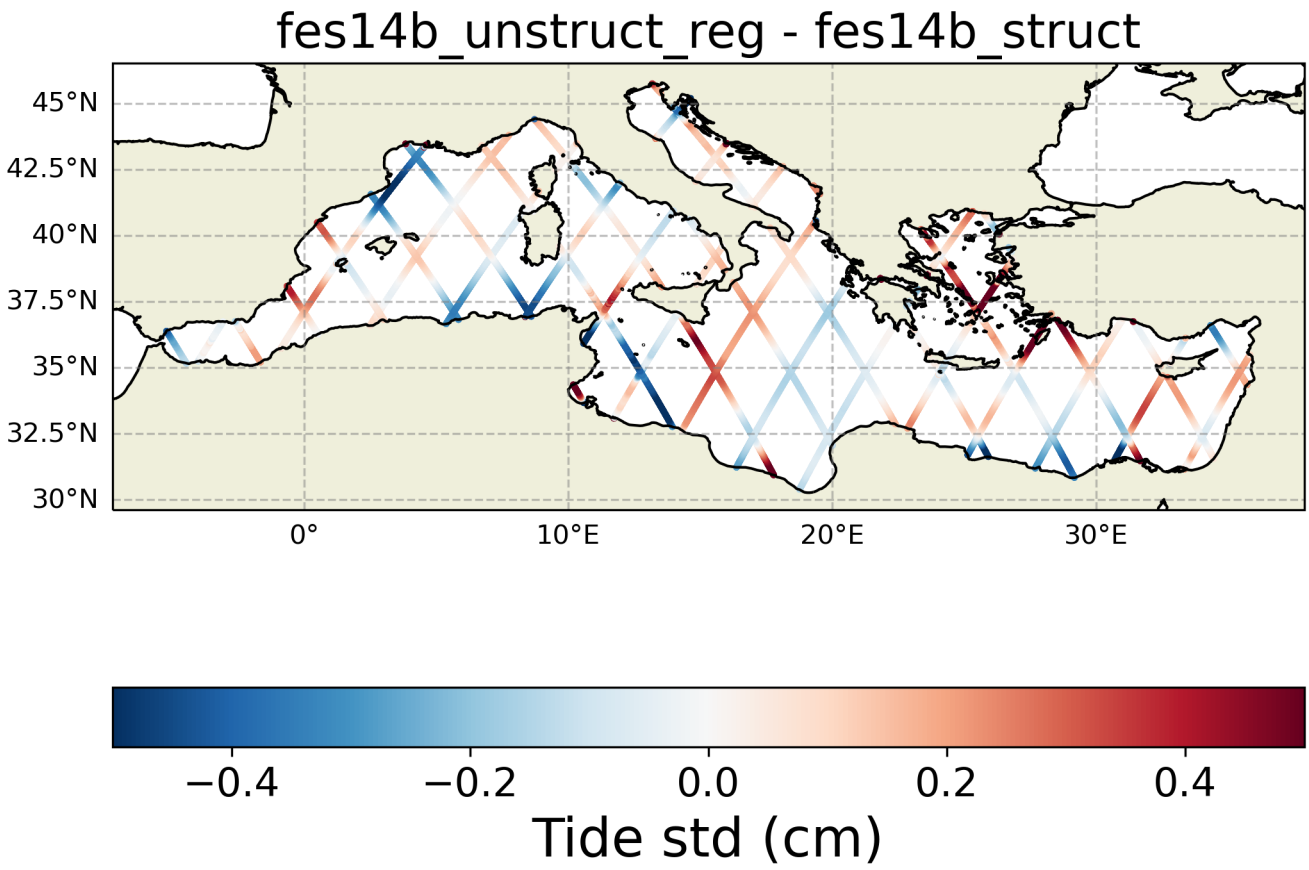

FIGURE 46 – Spatial coherence analysis of the Difference in Tide 's std between fes14b_unstruct_reg and fes14b_struct

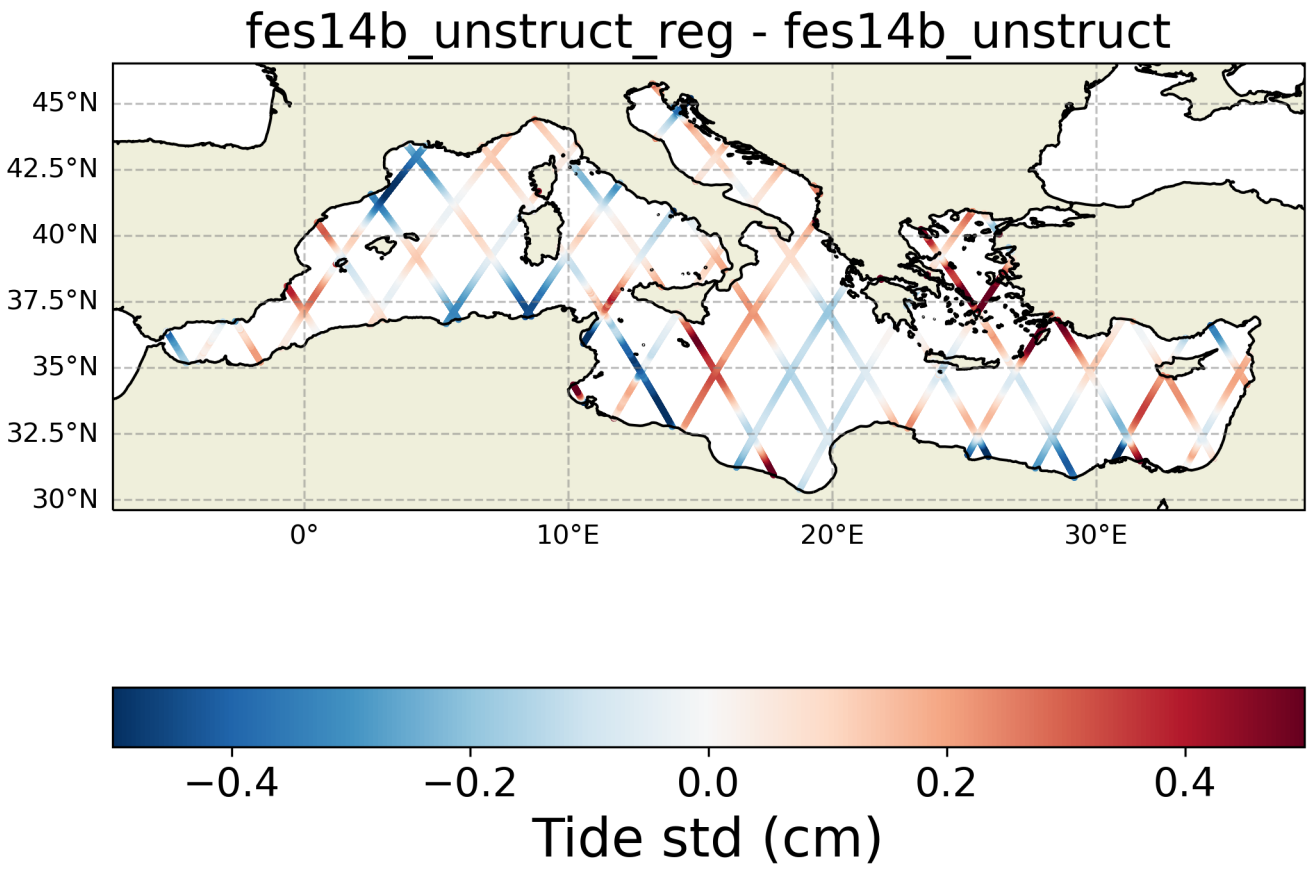

FIGURE 47 – Spatial coherence analysis of the Difference in Tide 's std between fes14b_unstruct_reg and fes14b_unstruct

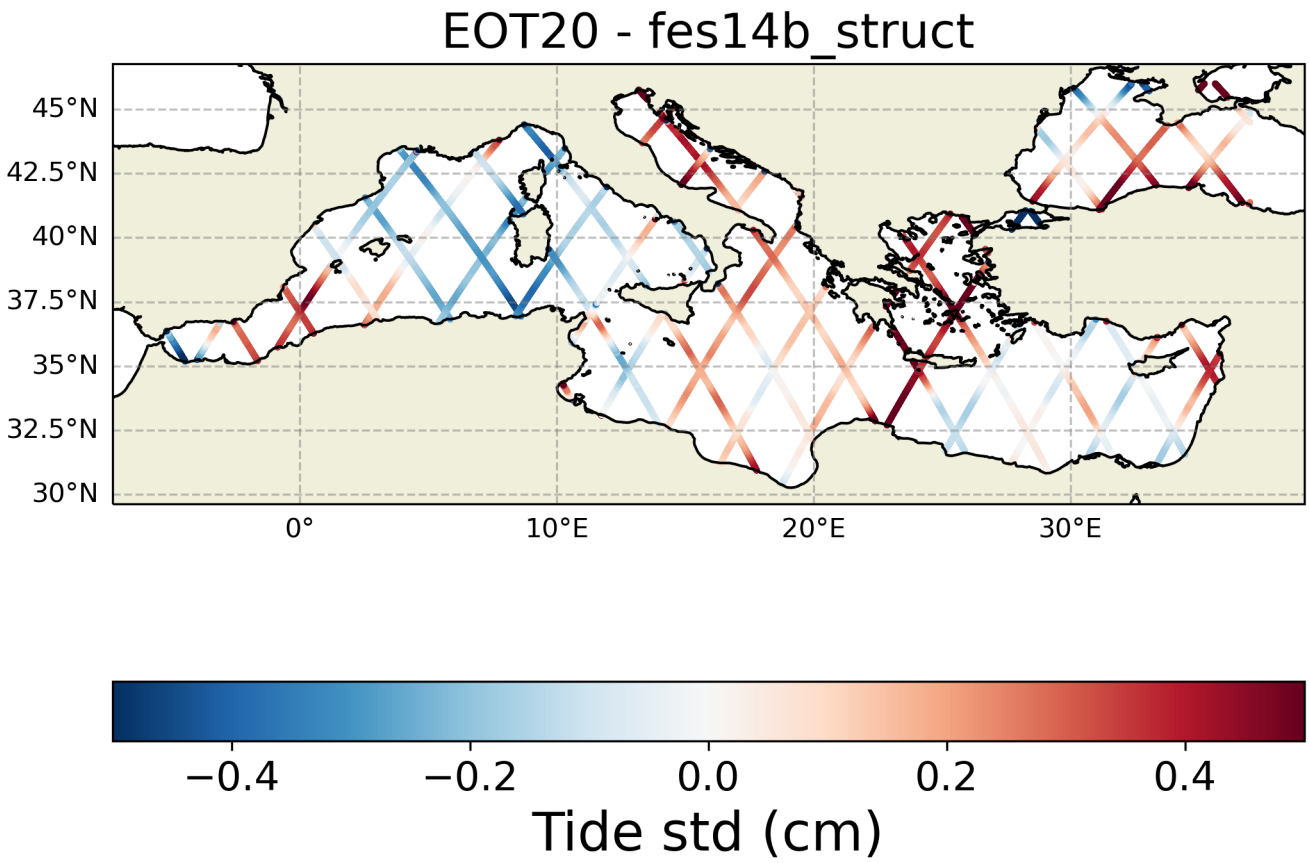

FIGURE 48 – Spatial coherence analysis of the Difference in Tide 's std between EOT20 and fes14b_struct

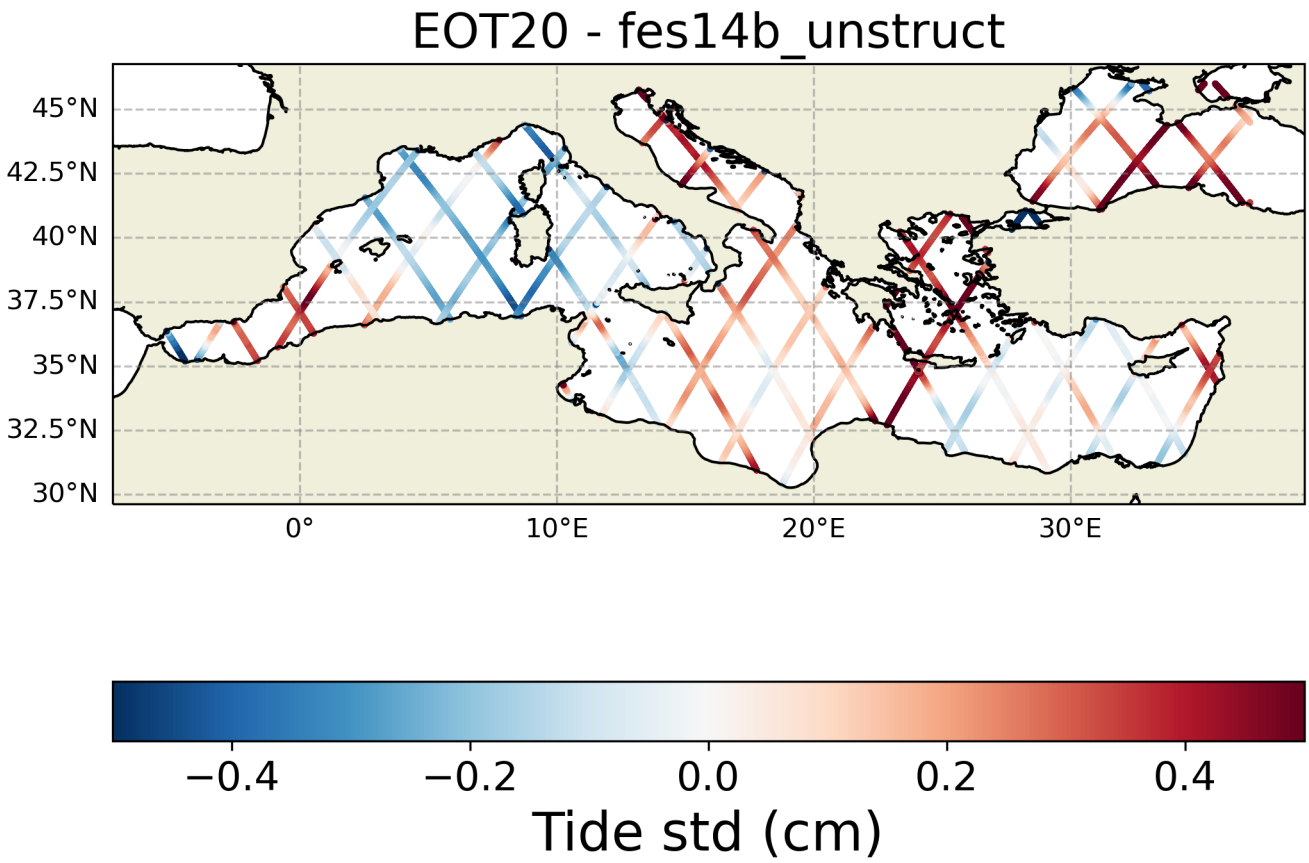

Figure 49 – Spatial coherence analysis of the Difference in Tide 's std between EOT20 and fes14b_unstruct

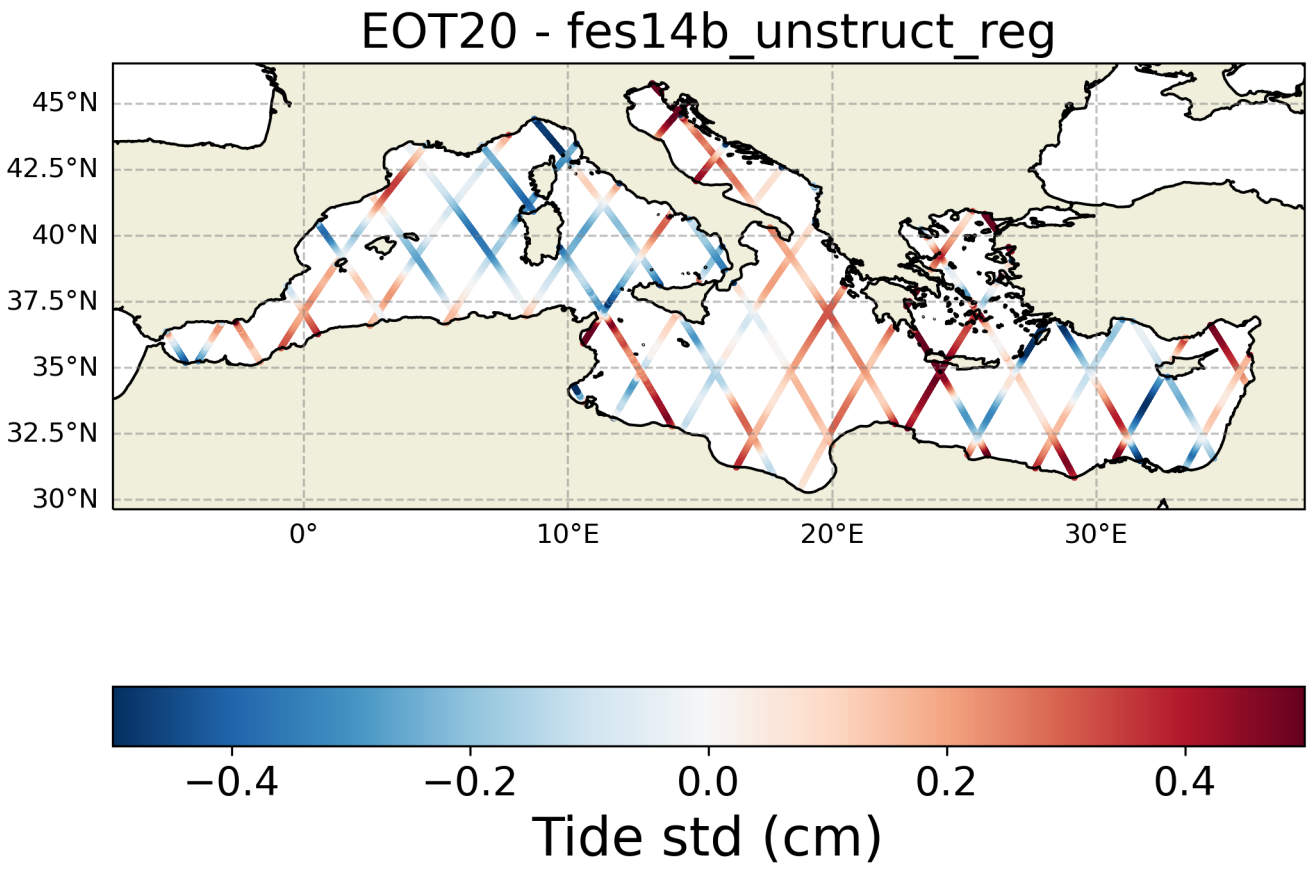

FIGURE 50 – Spatial coherence analysis of the Difference in Tide 's std between EOT20 and fes14b_unstruct_reg

3.2.3 Tide 's mean

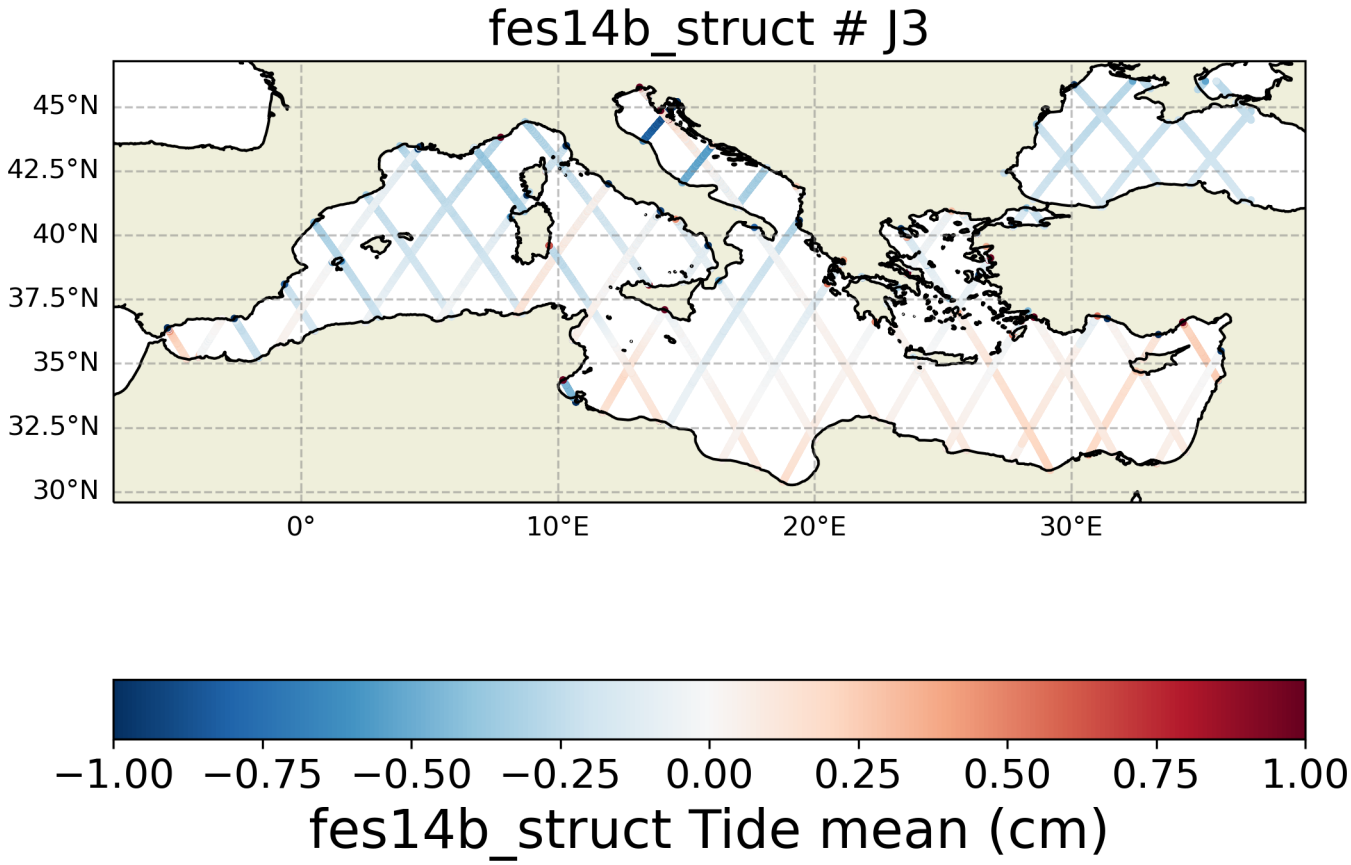

FIGURE 51 – Spatial coherence analysis of the mean of the fes14b_struct version of Tide variable

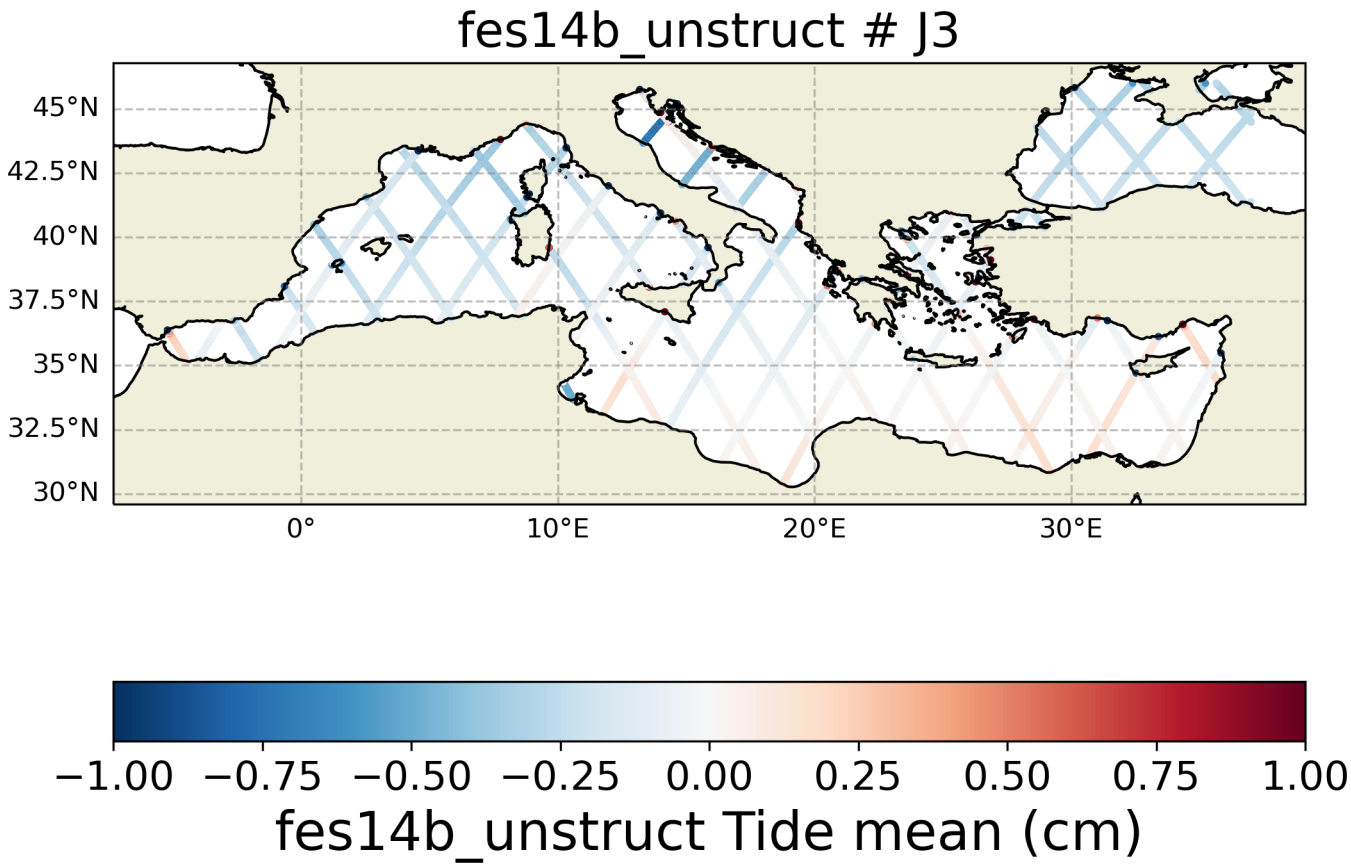

FIGURE 52 – Spatial coherence analysis of the mean of the fes14b_unstruct version of Tide variable

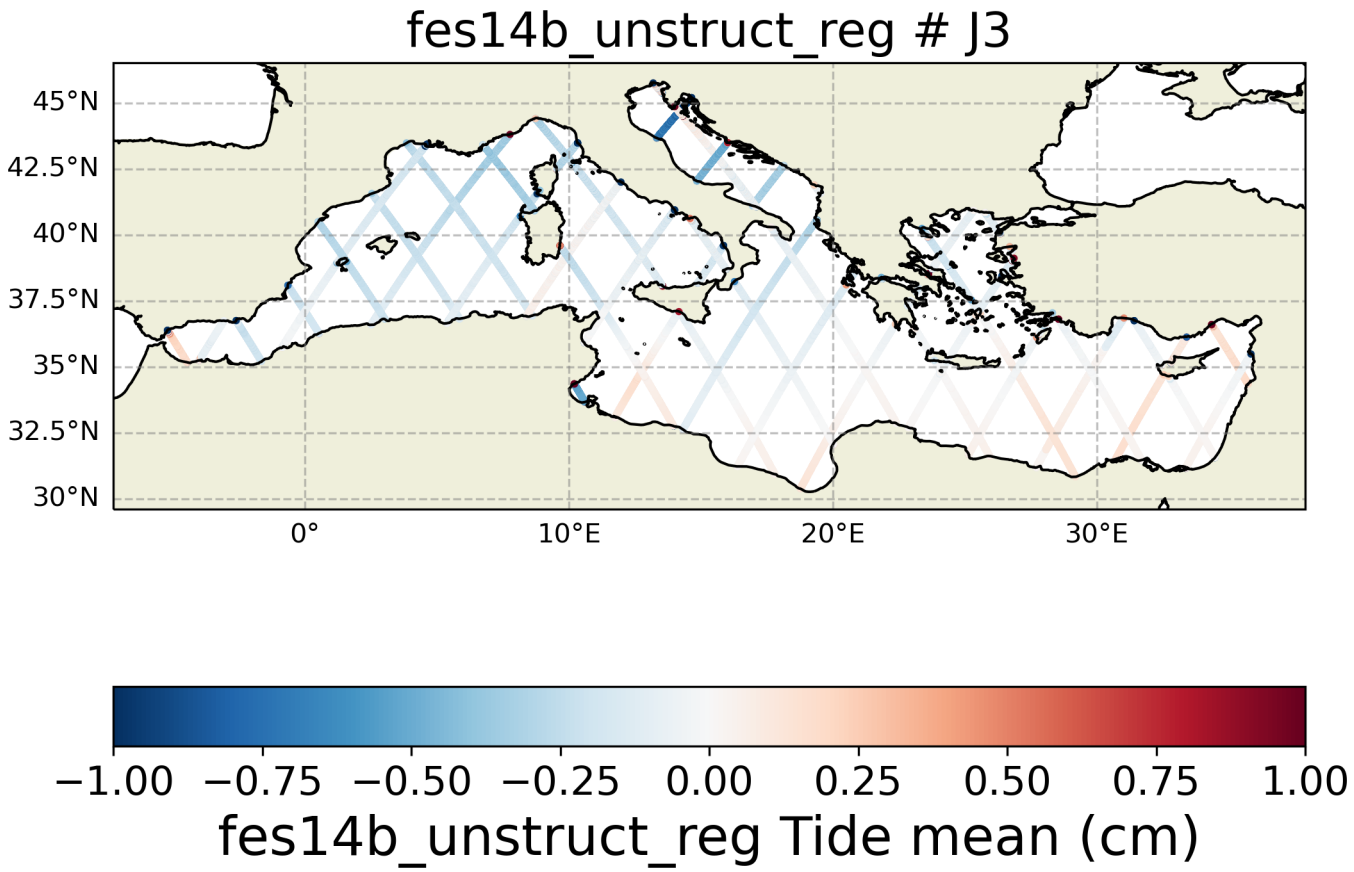

FIGURE 53 – Spatial coherence analysis of the mean of the fes14b_unstruct_reg version of Tide variable

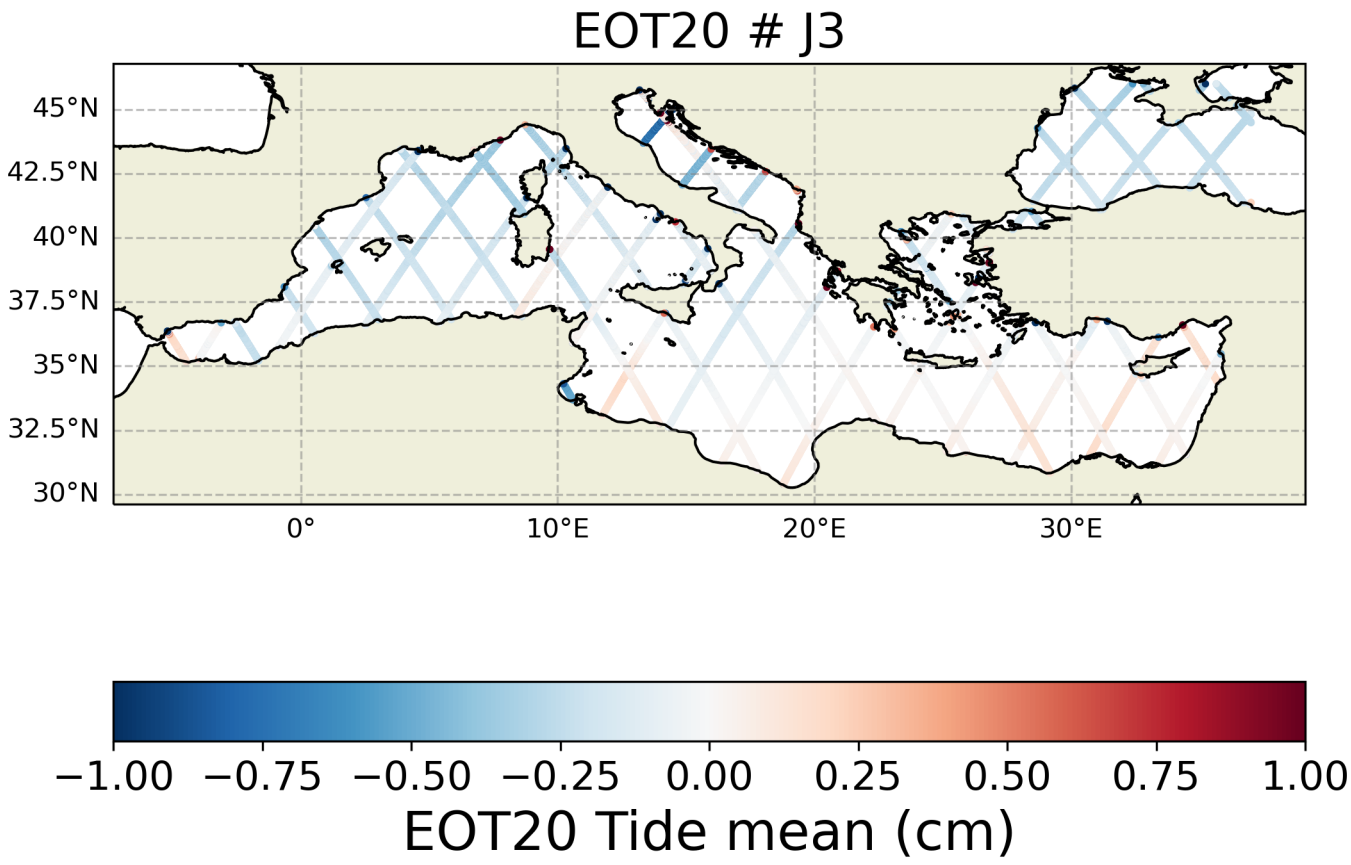

Figure 54 – Spatial coherence analysis of the mean of the EOT20 version of Tide variable

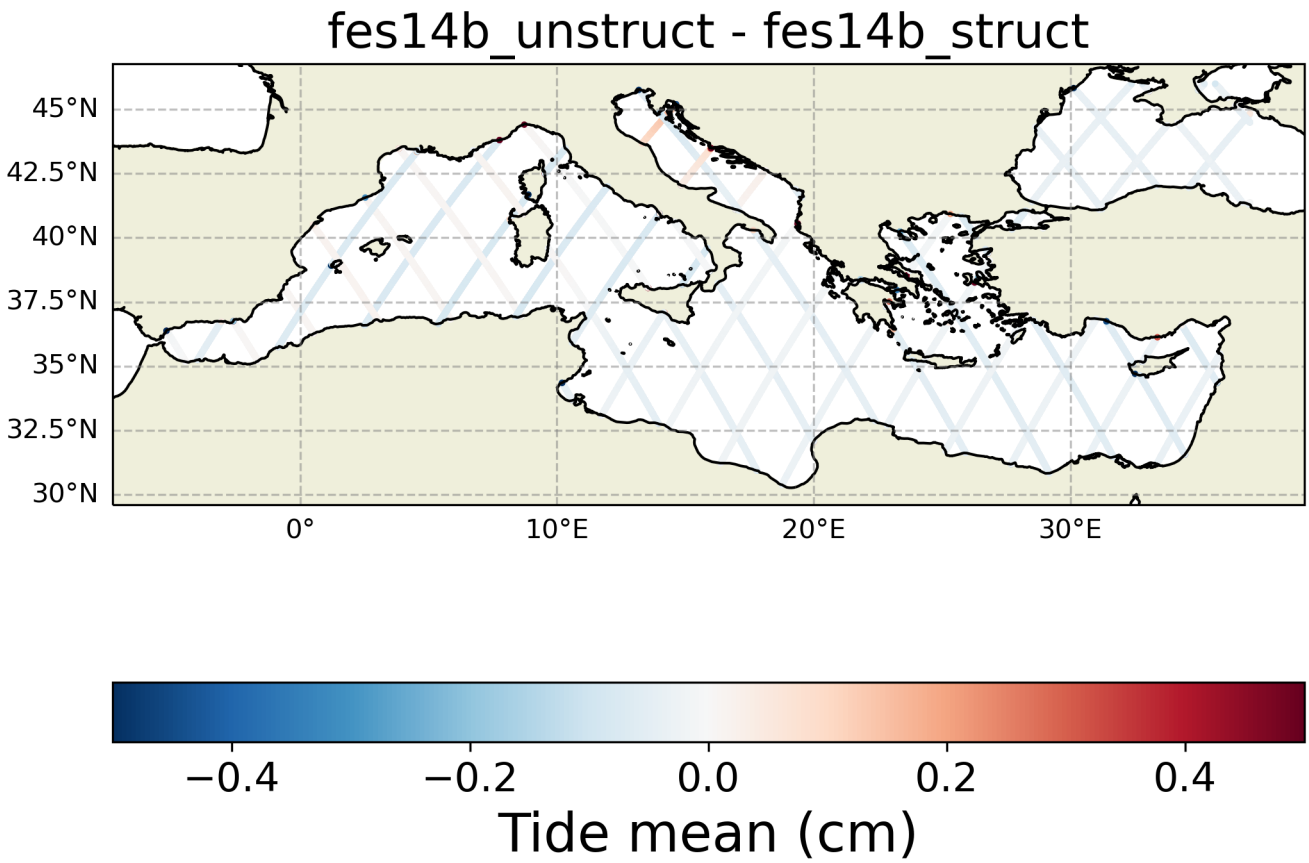

FIGURE 55 – Spatial coherence analysis of the Difference in Tide 's mean between fes14b_unstruct and fes14b_struct

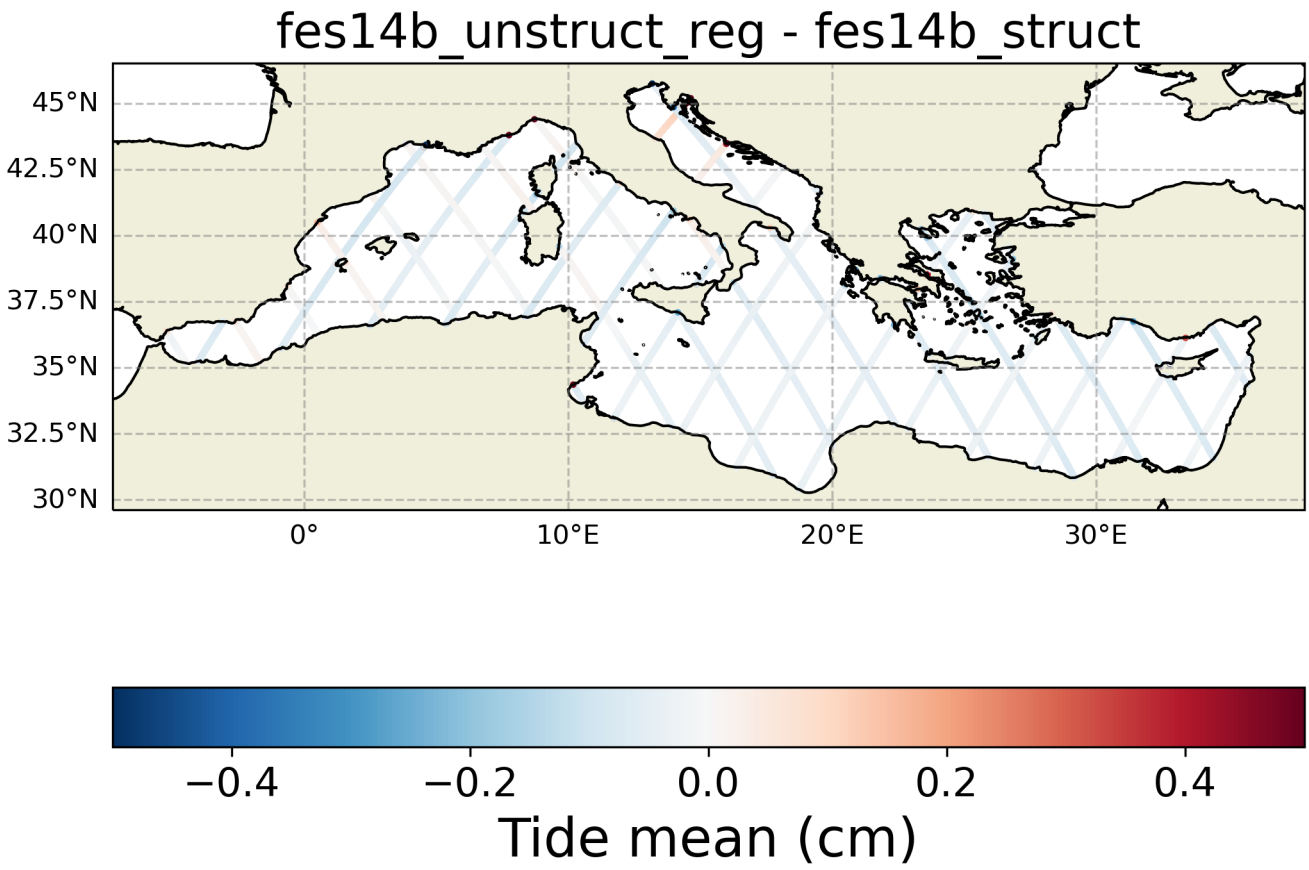

FIGURE 56 – Spatial coherence analysis of the Difference in Tide 's mean between fes14b_unstruct_reg and fes14b_struct

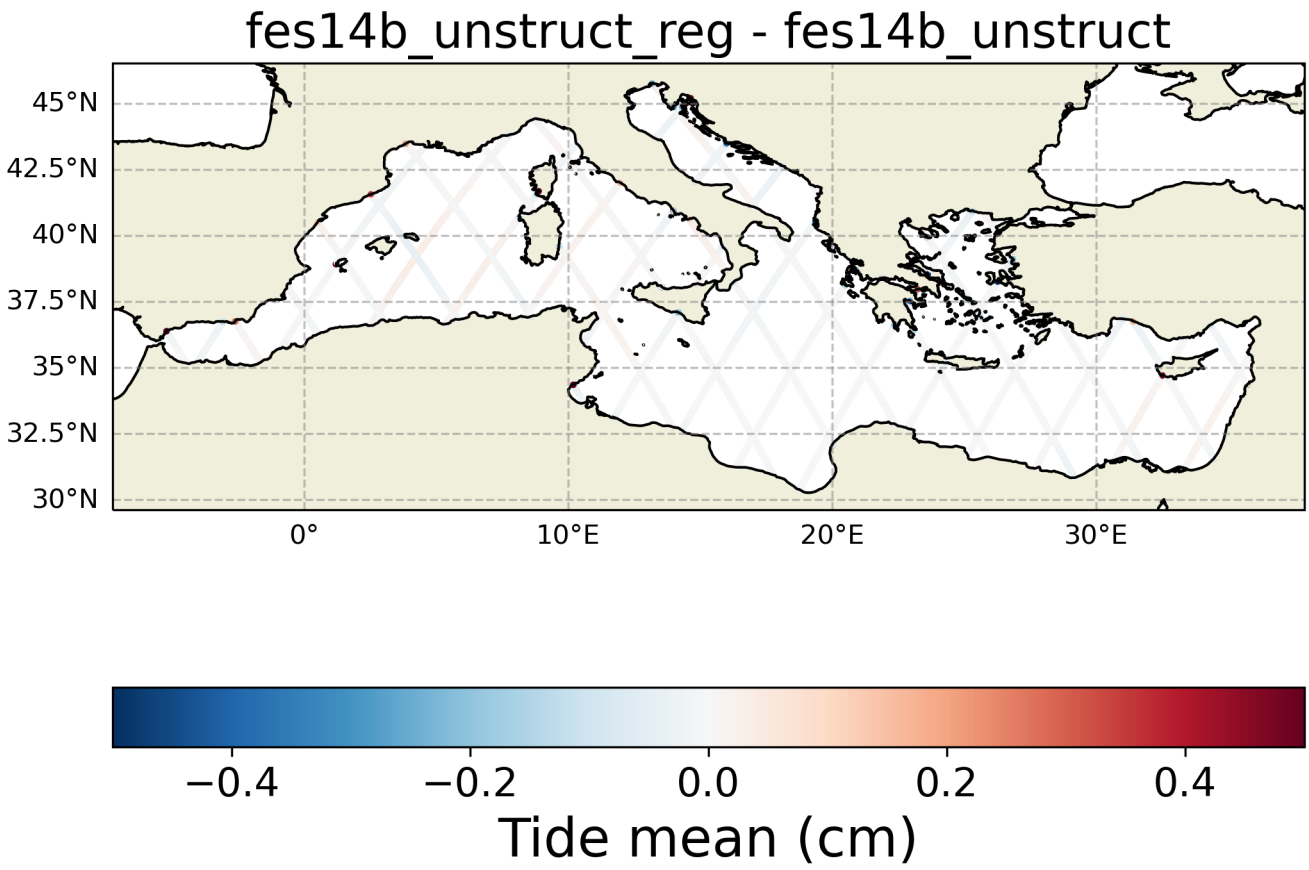

FIGURE 57 – Spatial coherence analysis of the Difference in Tide 's mean between fes14b_unstruct_reg and fes14b_unstruct

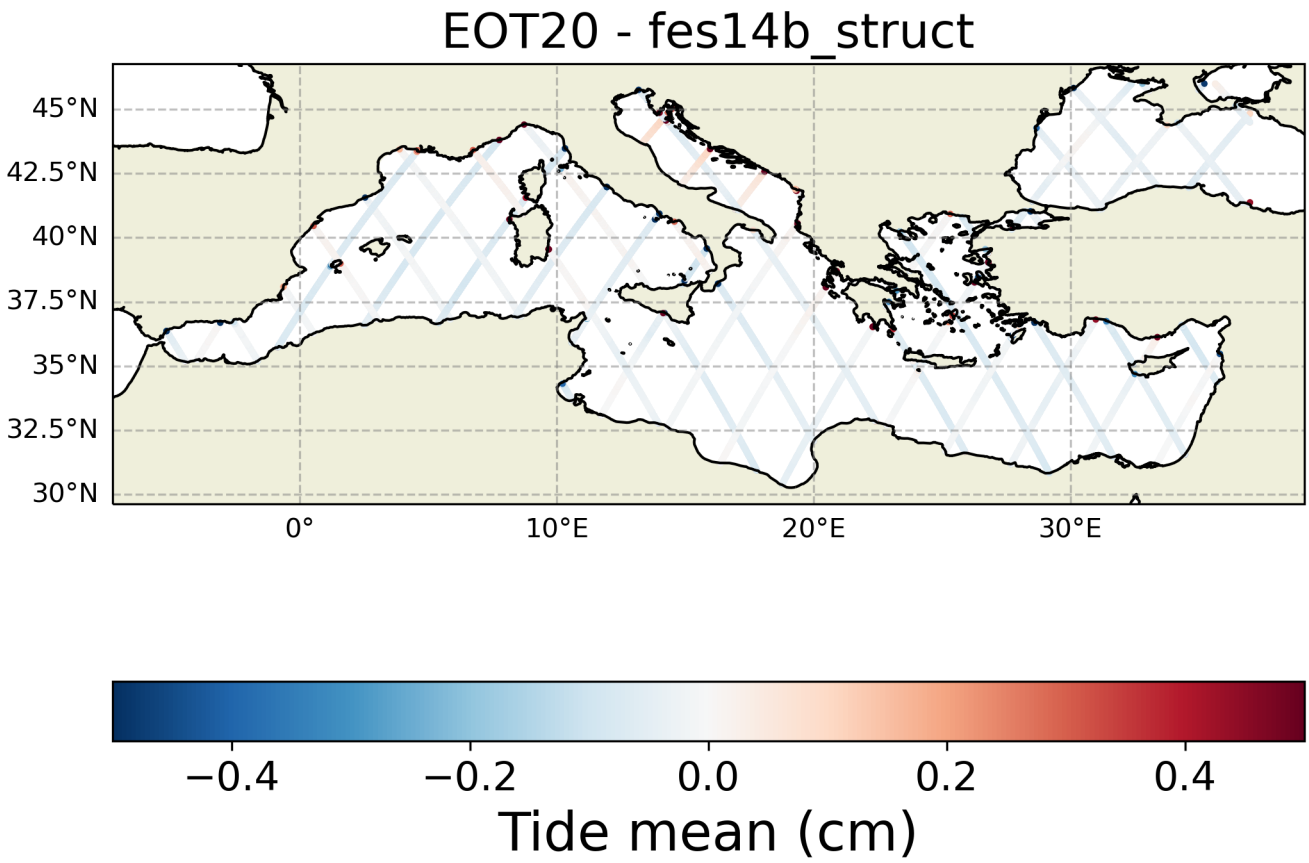

Figure 58 – Spatial coherence analysis of the Difference in Tide 's mean between EOT20 and fes14b_struct

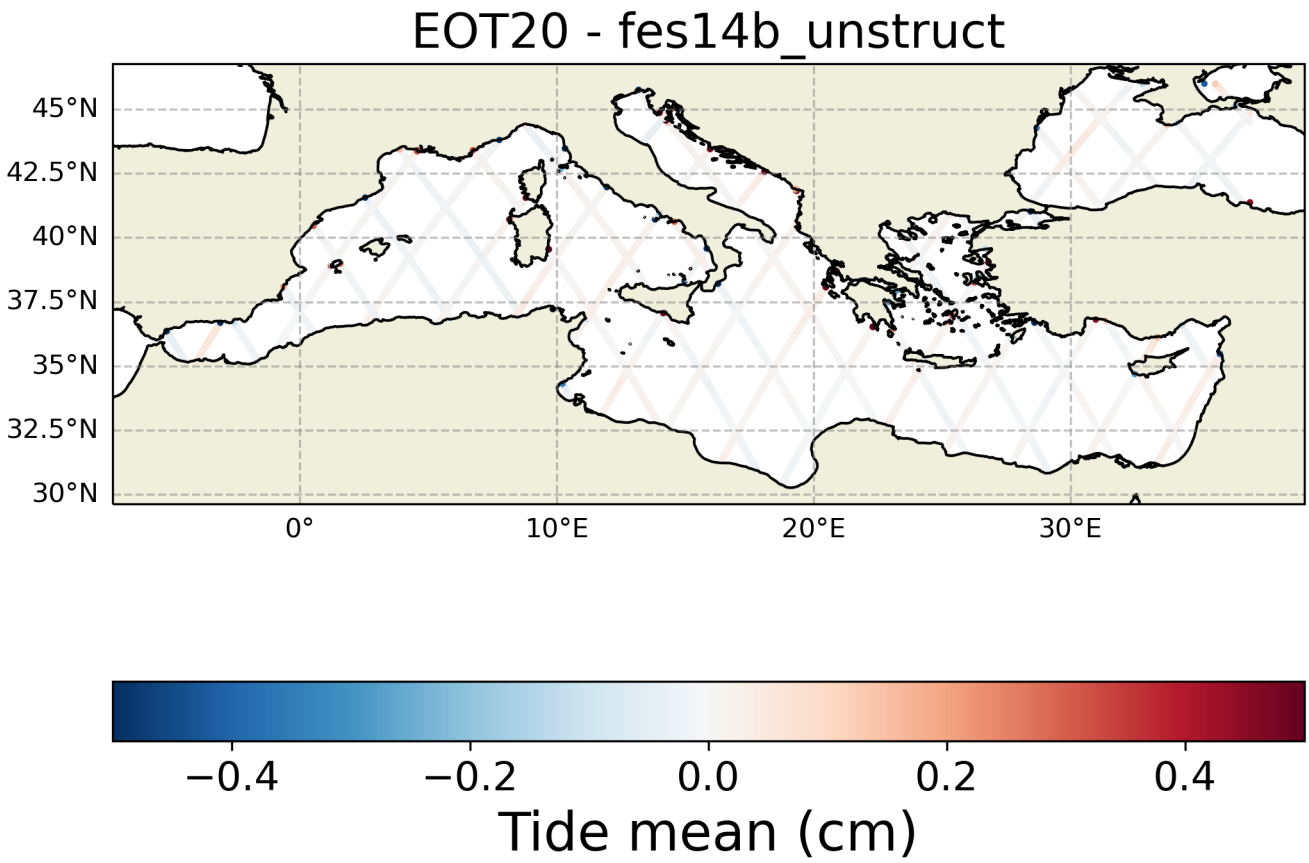

Figure 59 – Spatial coherence analysis of the Difference in Tide 's mean between EOT20 and fes14b_unstruct

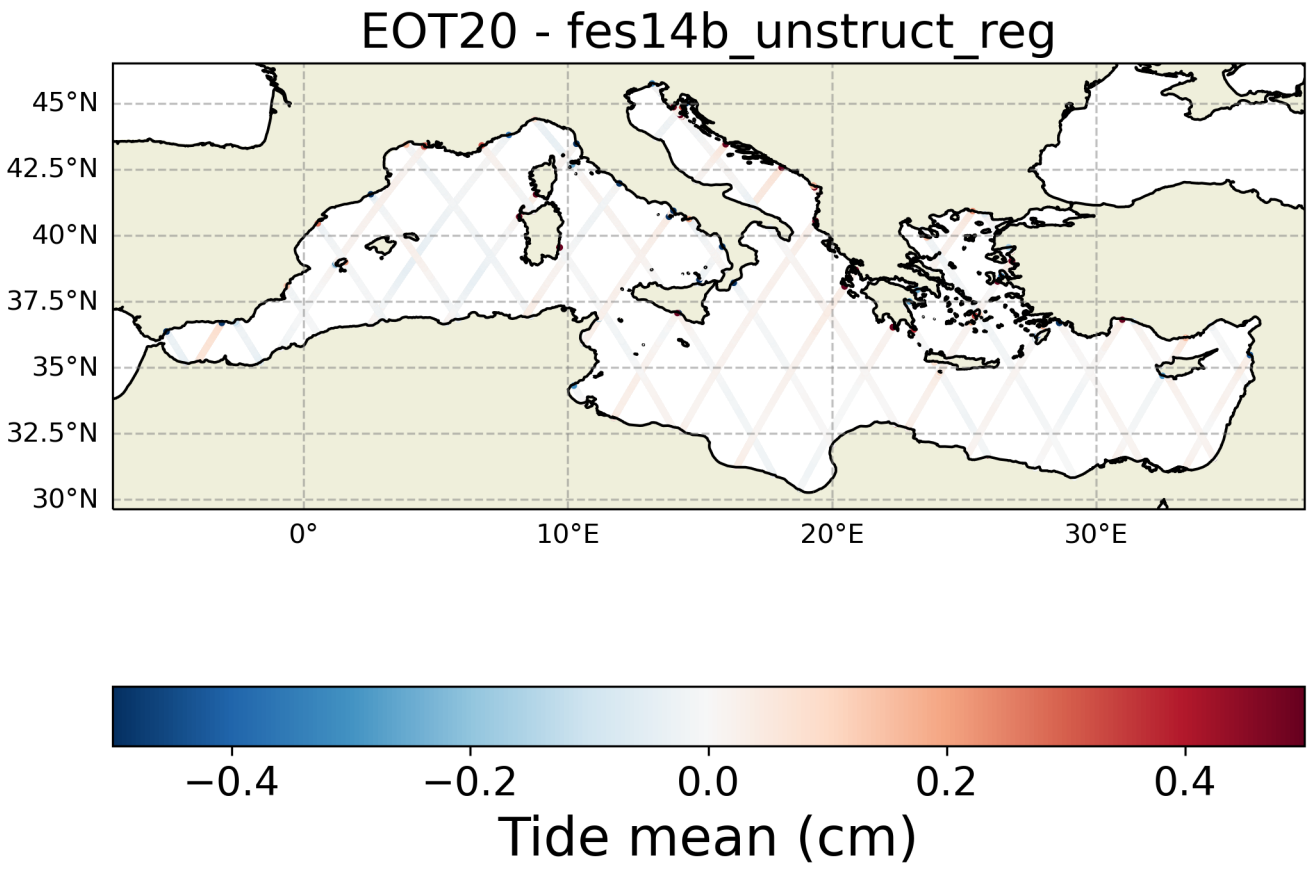

Figure 60 – Spatial coherence analysis of the Difference in Tide 's mean between EOT20 and fes14b_unstruct_reg

4 Histograms

4.1 Tide

	min (cm)	max (cm)	mean (cm)	std (cm)
fes14b_struct	-79.53	85.66	-0.072	7.103
fes14b_unstruct	-80.68	87.432	-0.105	7.094
fes14b_unstruct_reg	-82.601	87.657	-0.101	7.602
EOT20	-79.775	83.687	-0.103	7.06

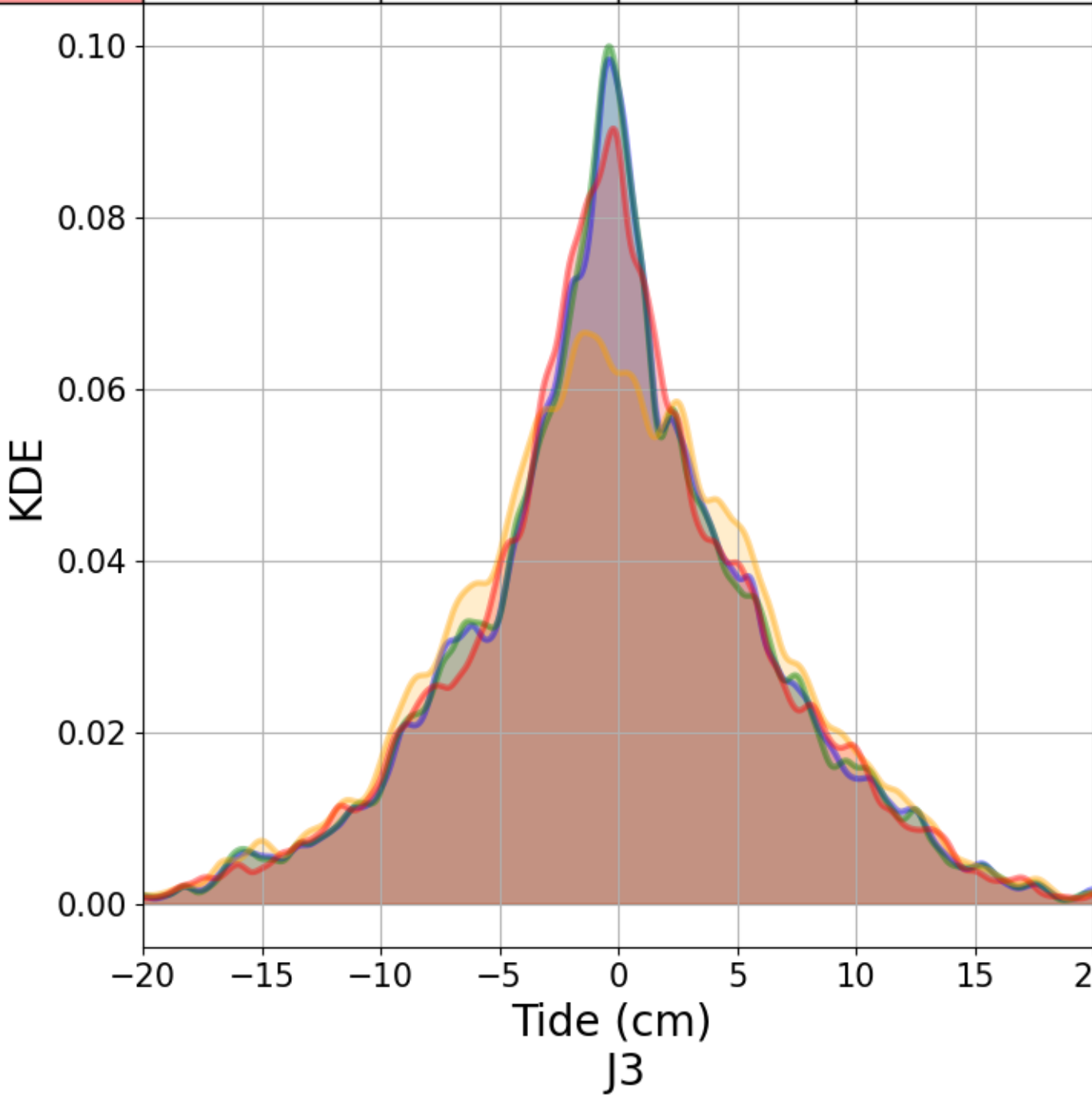

FIGURE 61 – Histogram of each of Tide version

	min (cm)	max (cm)	mean (cm)	std (
14b_unstruct - fes14b_struct	-12.758	18.508	-0.034	
14b_unstruct_reg - fes14b_struct	-16.939	17.219	-0.036	
T20 - fes14b_struct	-12.335	10.109	-0.032	
14b_unstruct_reg - fes14b_unstruct	-16.765	16.828	-0.002	
T20 - fes14b_unstruct	-9.624	7.051	0.002	
T20 - fes14b_unstruct_reg	-14.195	11.879	0.005	

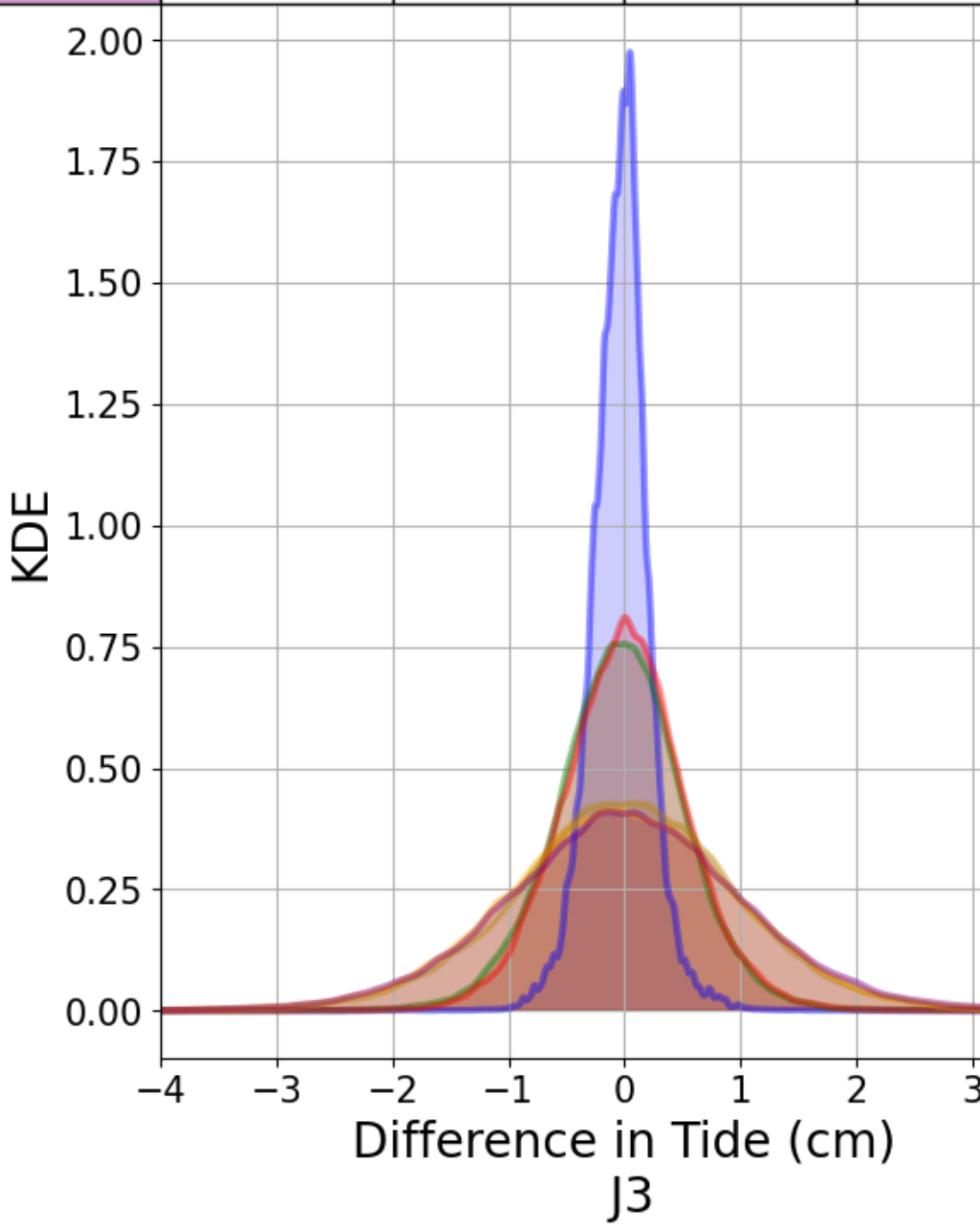

FIGURE 62 – Histograms of difference of each Tide version and reference one

	min (cm)	max (cm)	mean (cm)	std (cm)
fes14b_struct	0.479	48.1	5.716	3.839
fes14b_unstruct	0.229	47.733	5.701	3.833
fes14b_unstruct_reg	0.802	47.597	6.342	3.712
EOT20	0.627	45.298	5.747	3.722

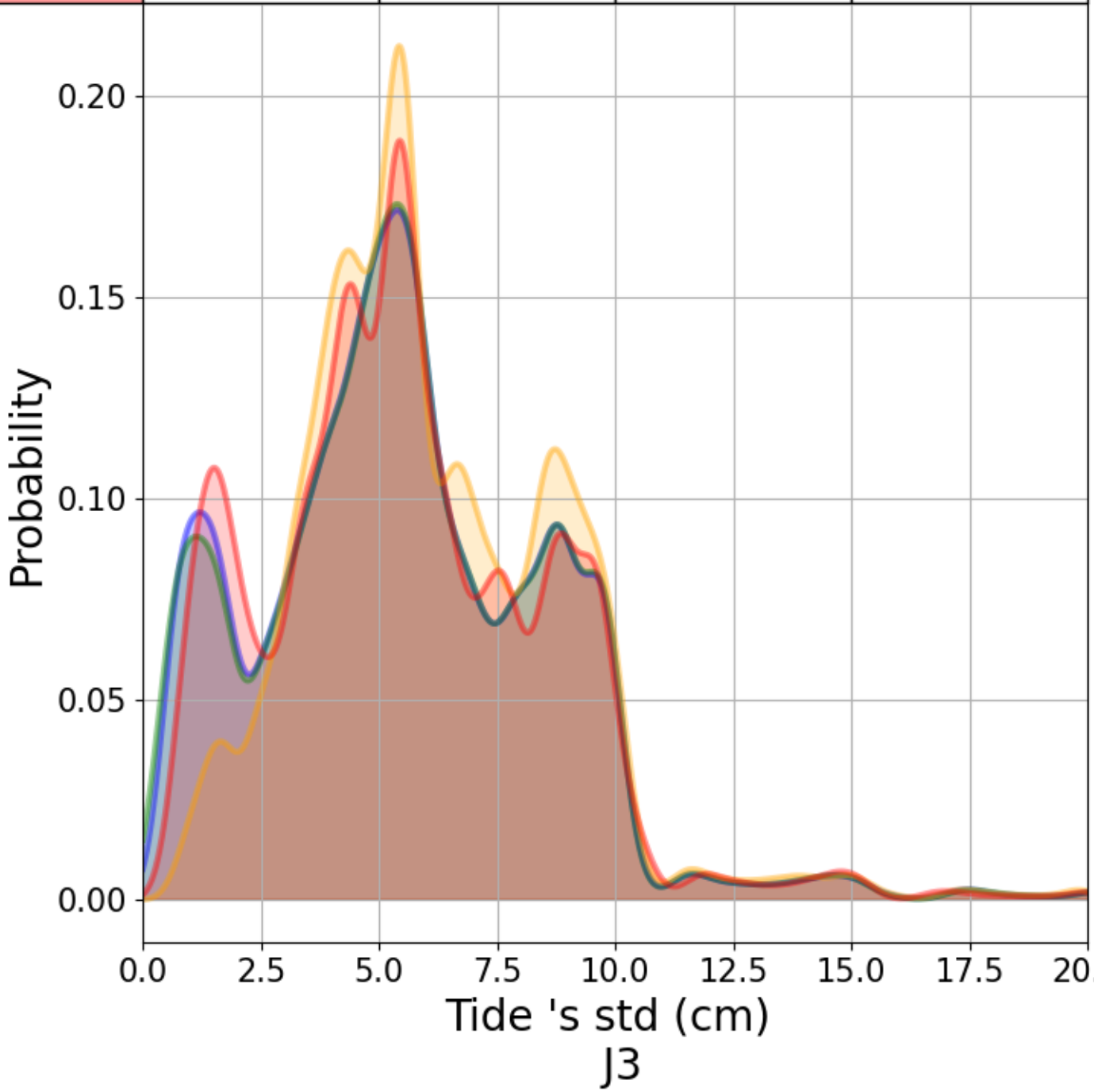

FIGURE 63 – Histograms of the standard deviation of each Tide version

4.2 sla

	min (cm)	max (cm)	mean (cm)	std (cm)
fes14b_struct	7.863	51.892	12.234	2.002
fes14b_unstruct	7.866	51.887	12.23	1.987
fes14b_unstruct_reg	7.863	51.883	12.137	2.01
EOT20	7.75	51.877	12.217	1.915

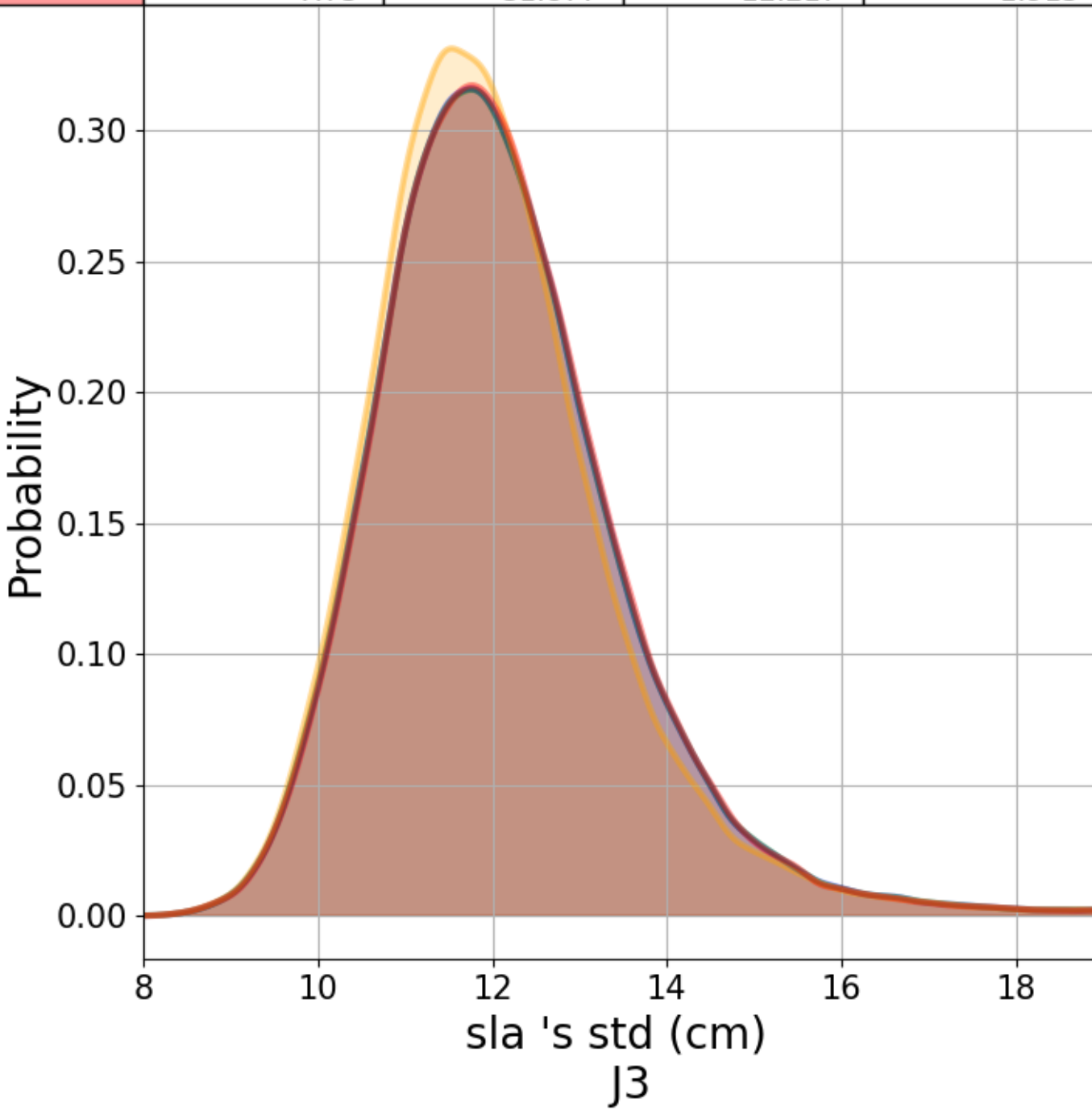

FIGURE 64 – Histograms of the standard deviation of each sla version

5 Along-track analysis

5.1 Tide

5.1.1 Tide 's count

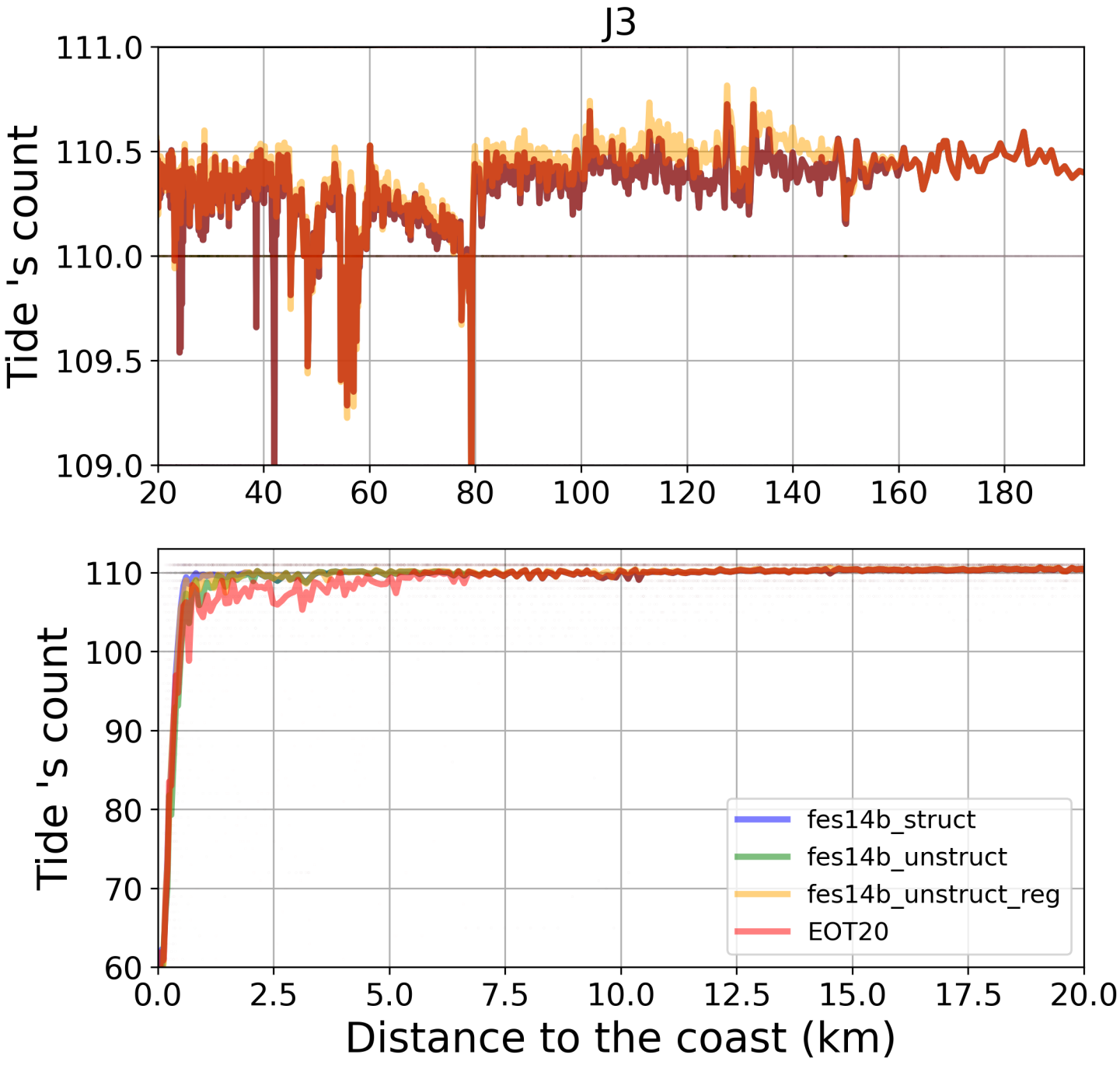

FIGURE 65 – Along-track analysis of Tide 's count

5.1.2 Tide 's std

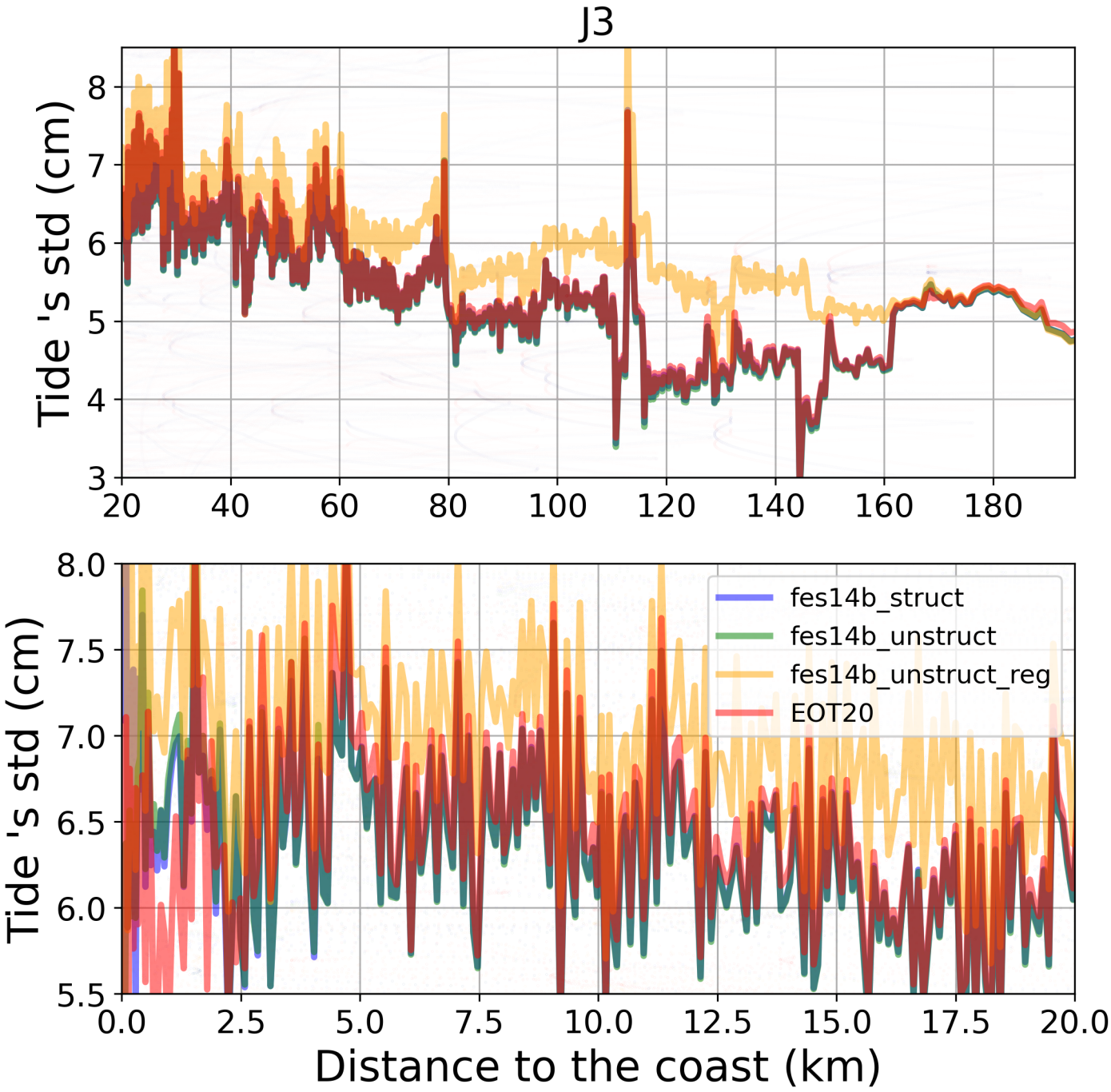

FIGURE 66 – Along-track analysis of Tide 's std

5.1.3 Tide 's mean

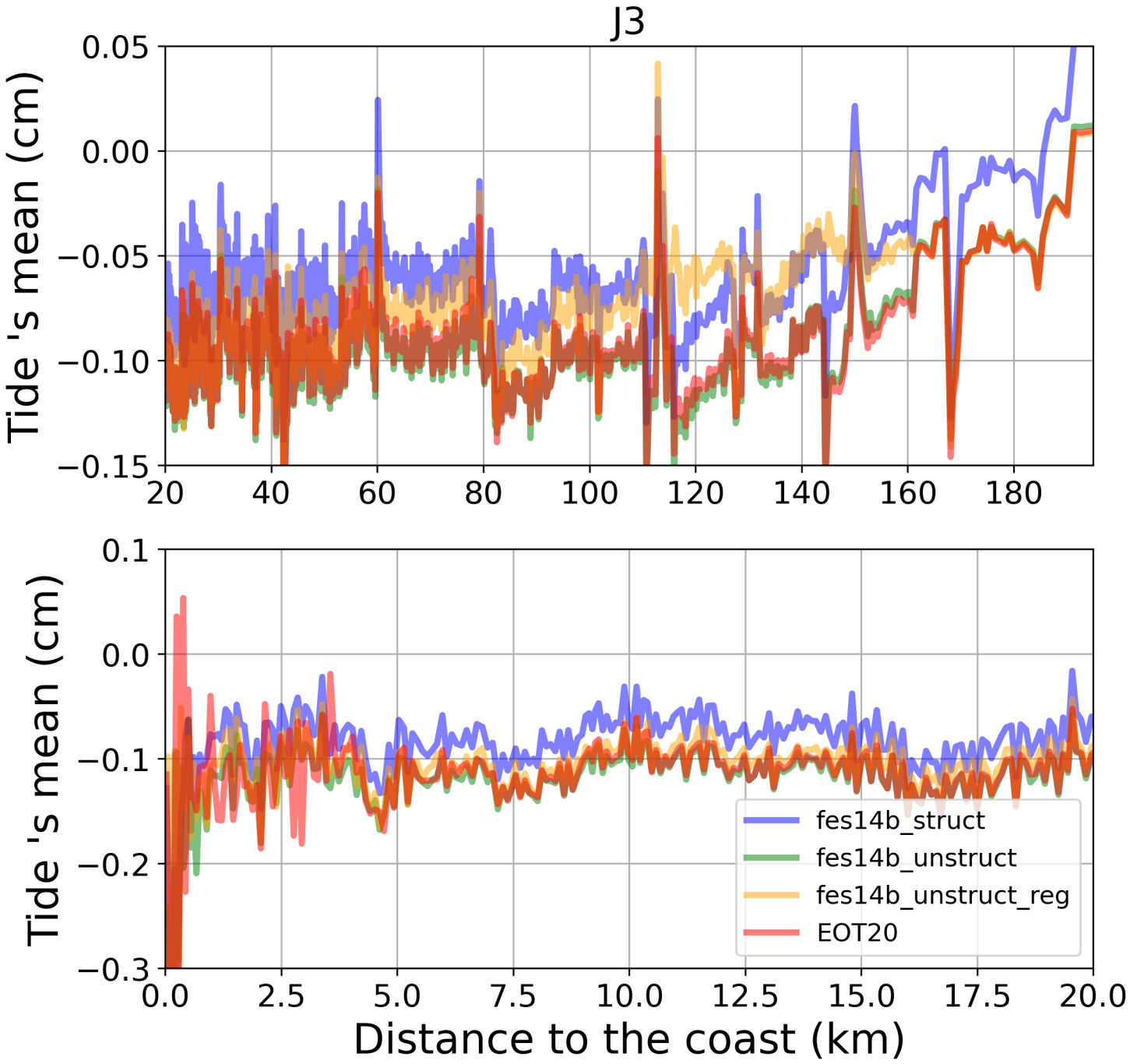

FIGURE 67 – Along-track analysis of Tide 's mean

5.2 sla

5.2.1 sla 's count

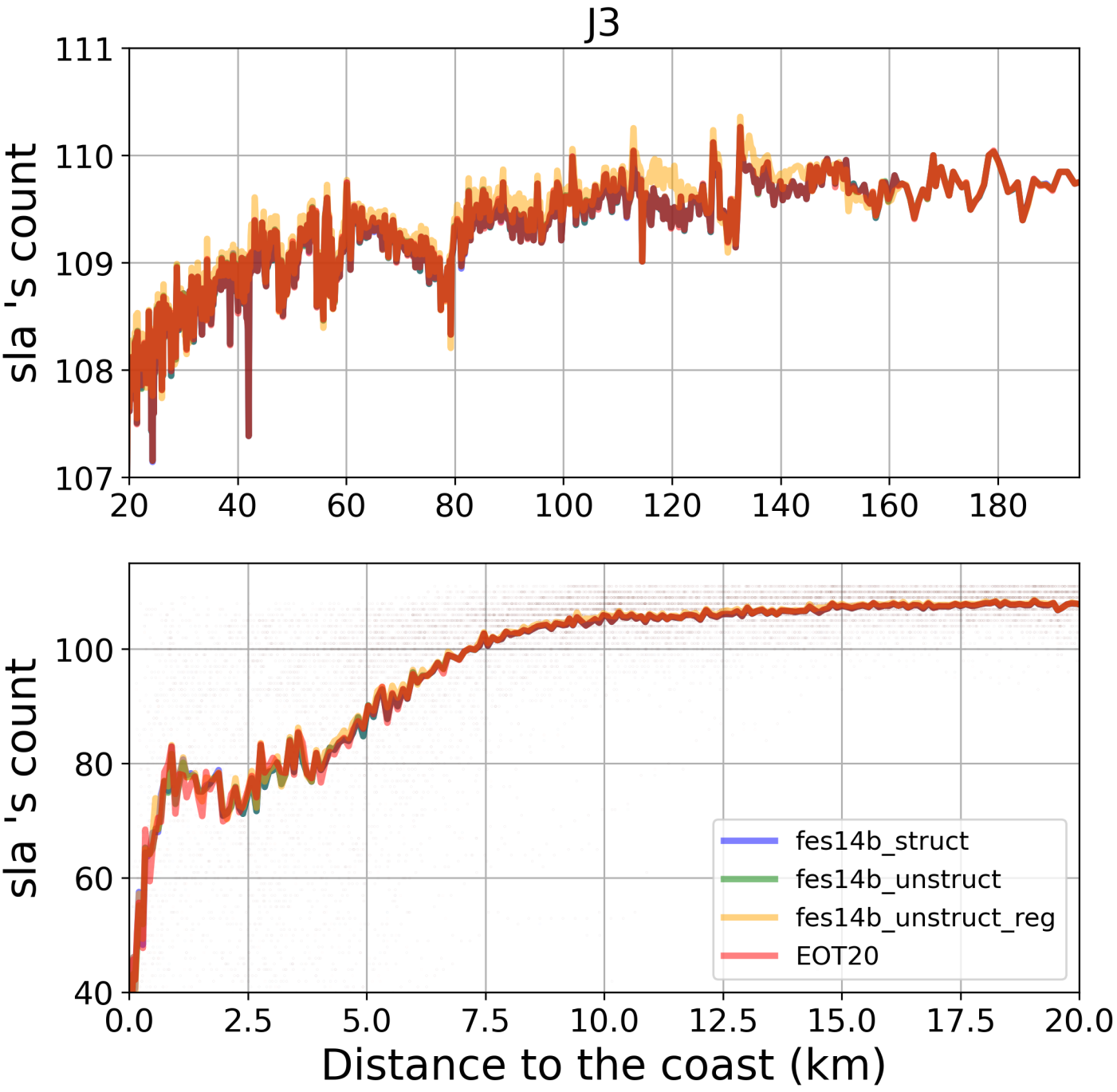

FIGURE 68 – Along-track analysis of sla 's count

5.2.2 sla 's std

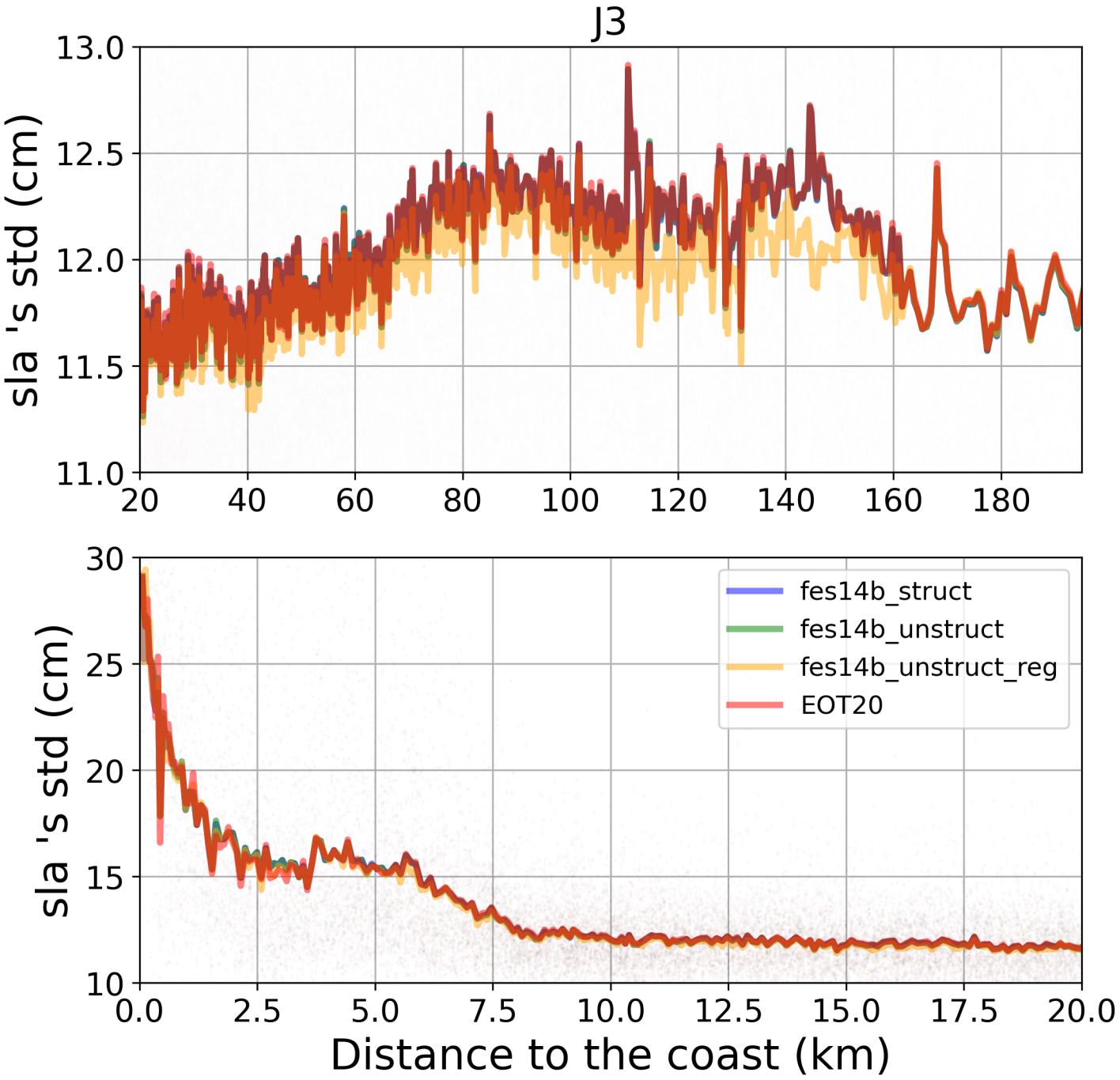

FIGURE 69 – Along-track analysis of sla 's std

5.2.3 sla 's mean

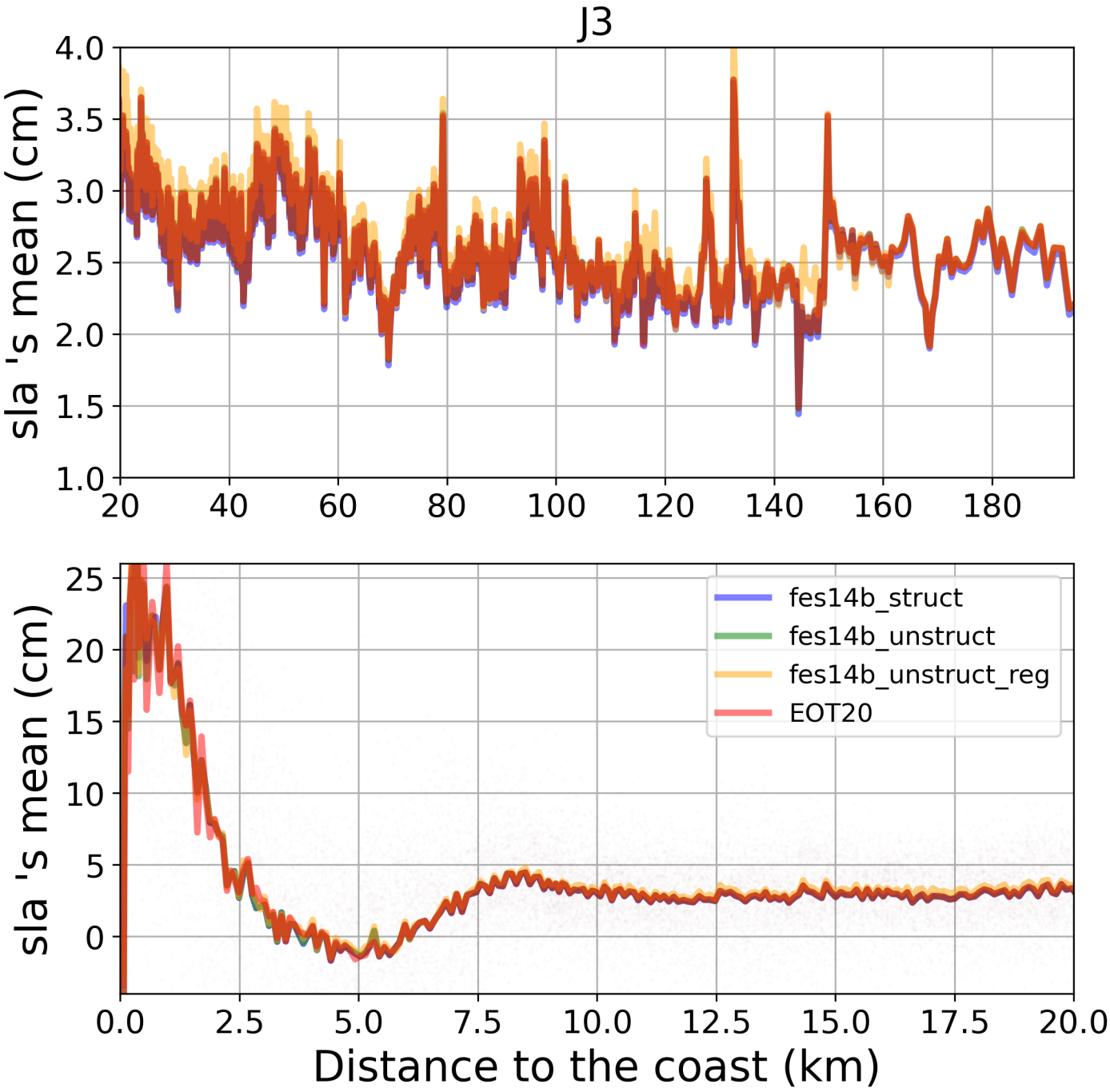

FIGURE 70 – Along-track analysis of sla 's mean

6 Comparison with Insitu Data (Tide Gauge)

The size of the marker representing each point in the figures below increase by getting closer to the coast

6.1 Station : SETE

- Nearest track to SETE station is the track number track146
- The area of interest is limited by :
  - A circle which it's center is the SETE tide gauge station location and has a Raduis of 40 Km
  - Maximum distance to the coast : 20 Km

6.1.1 correlation visualization in maps view % SETE tide gauge

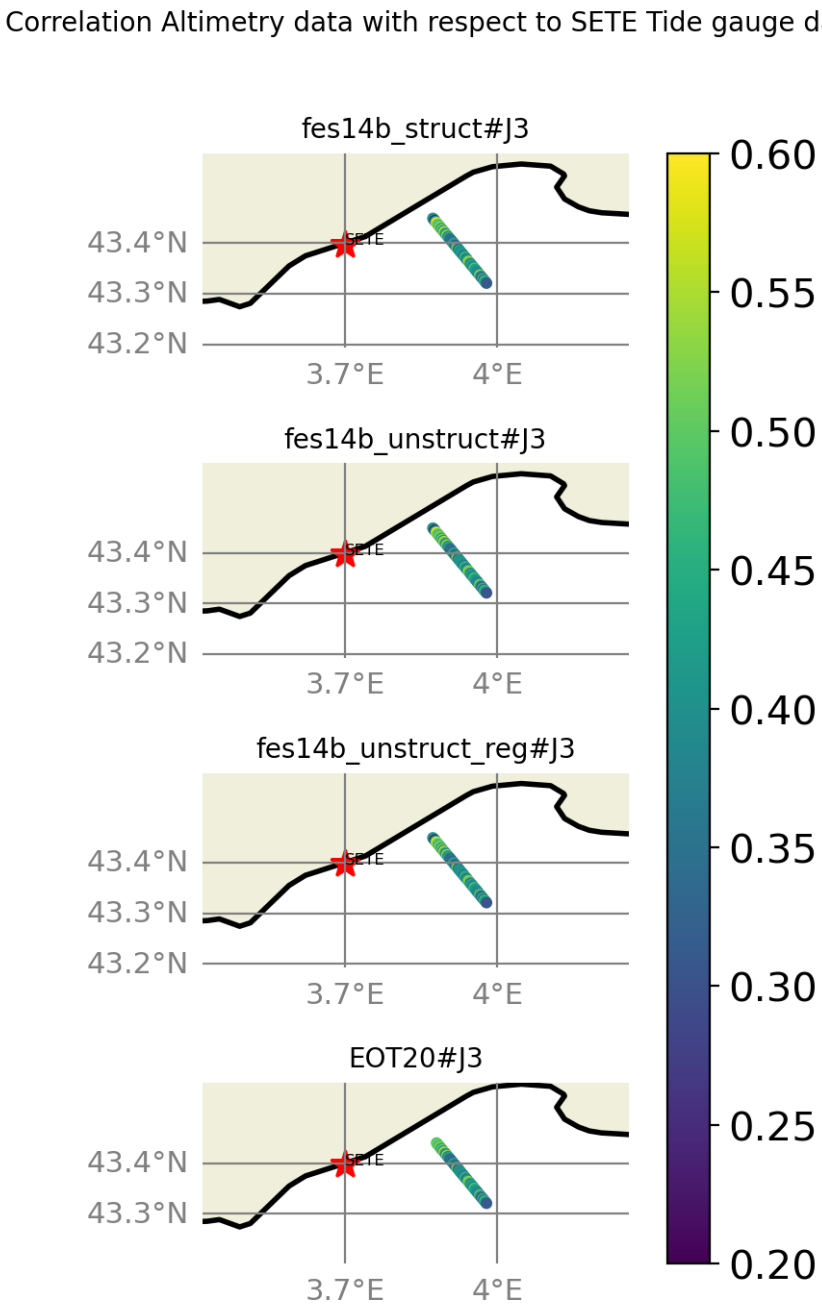

FIGURE 71 – correlation visualization in maps view % SETE tide gauge

6.1.2 rmsd visualization in maps view % SETE tide gauge

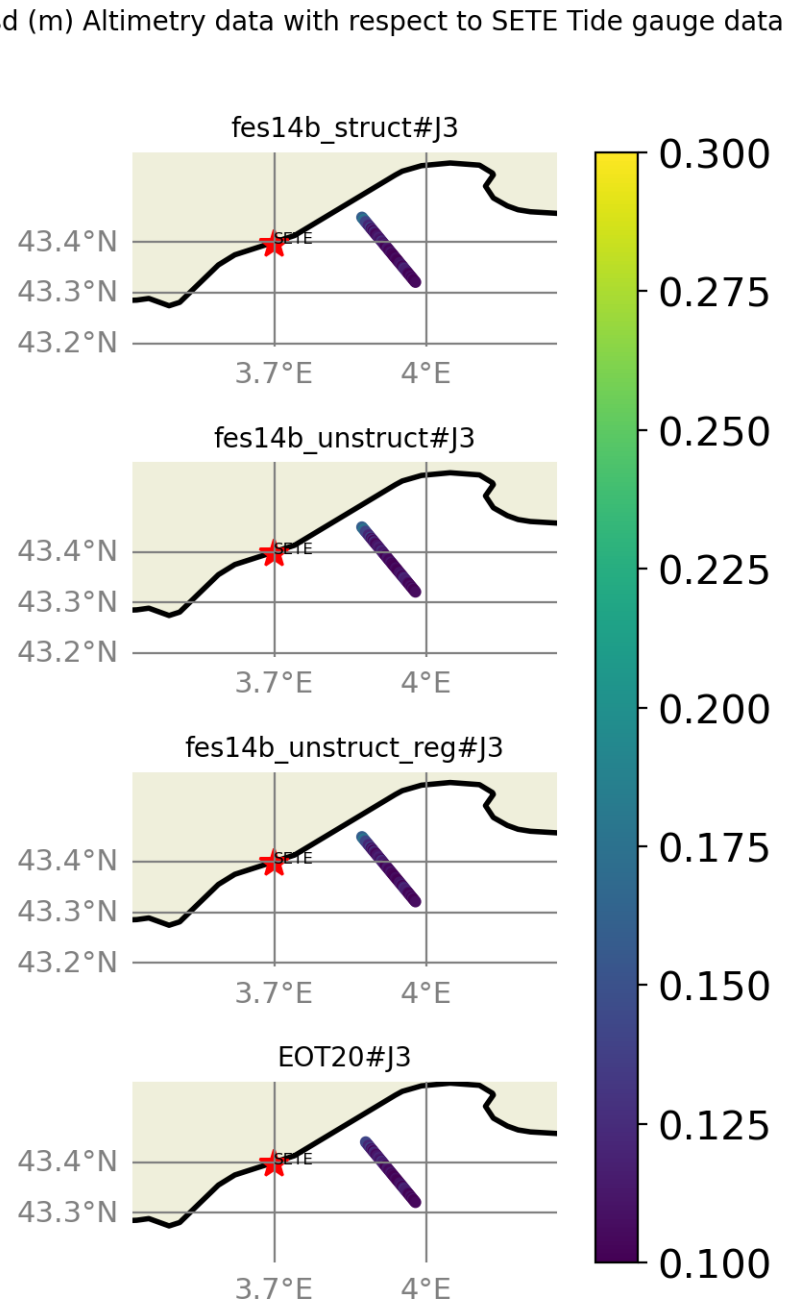

FIGURE 72 – rmsd visualization in maps view % SETE tide gauge

6.1.3 std visualization in maps view % SETE tide gauge

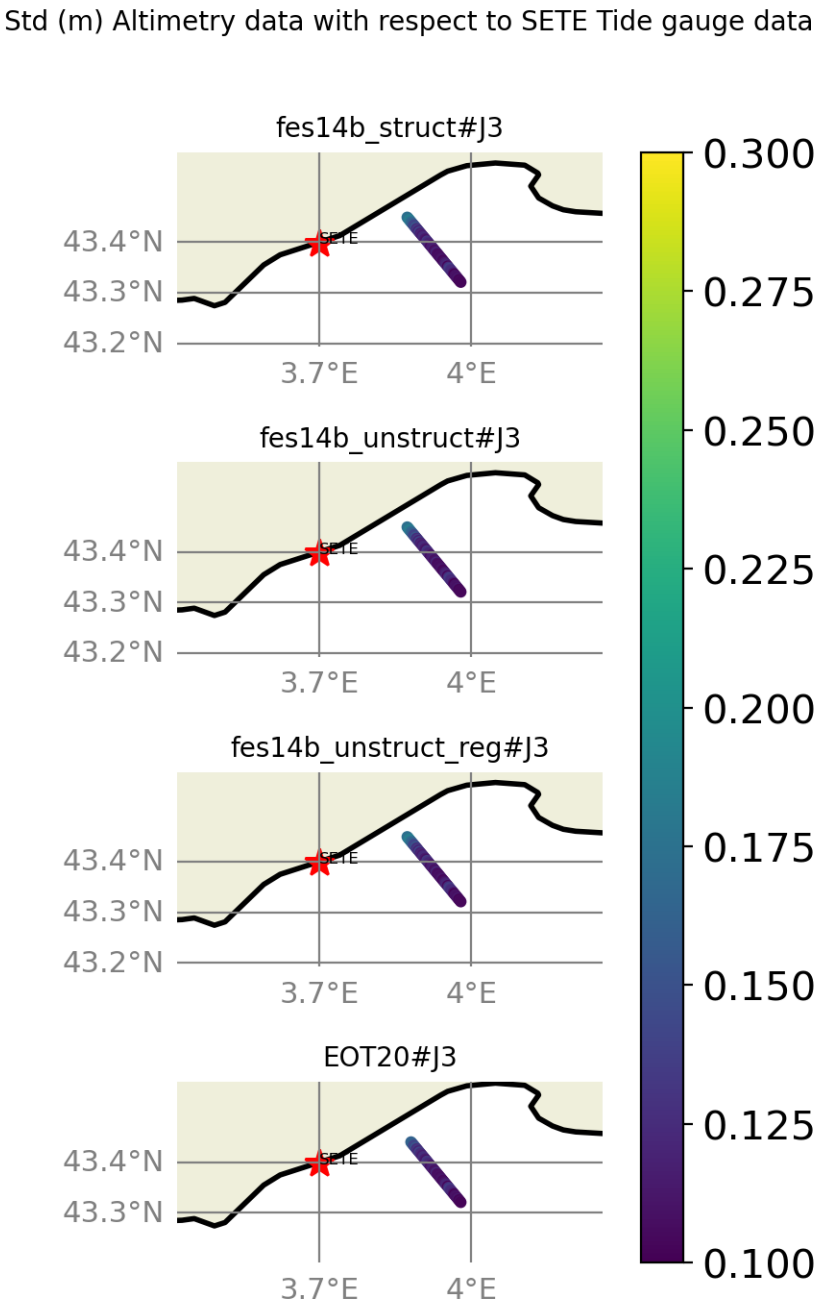

Figure 73 – std visualization in maps view % SETE tide gauge

6.1.4 valid_data_percent visualization in maps view % SETE tide gauge

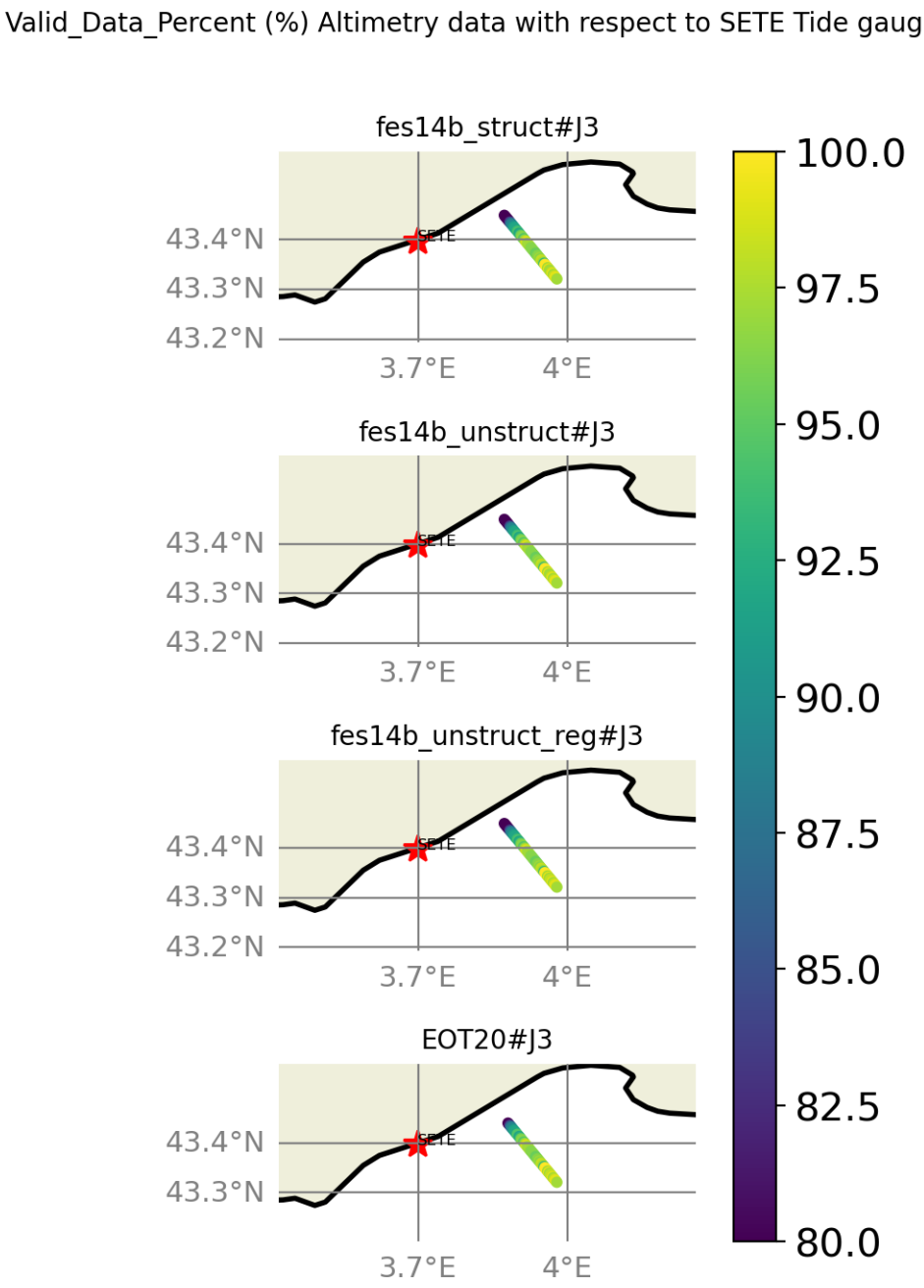

FIGURE 74 – valid_data_percent visualization in maps view % SETE tide gauge

6.1.5 Valid data (%) in function of distance to coast/SETE station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 109$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

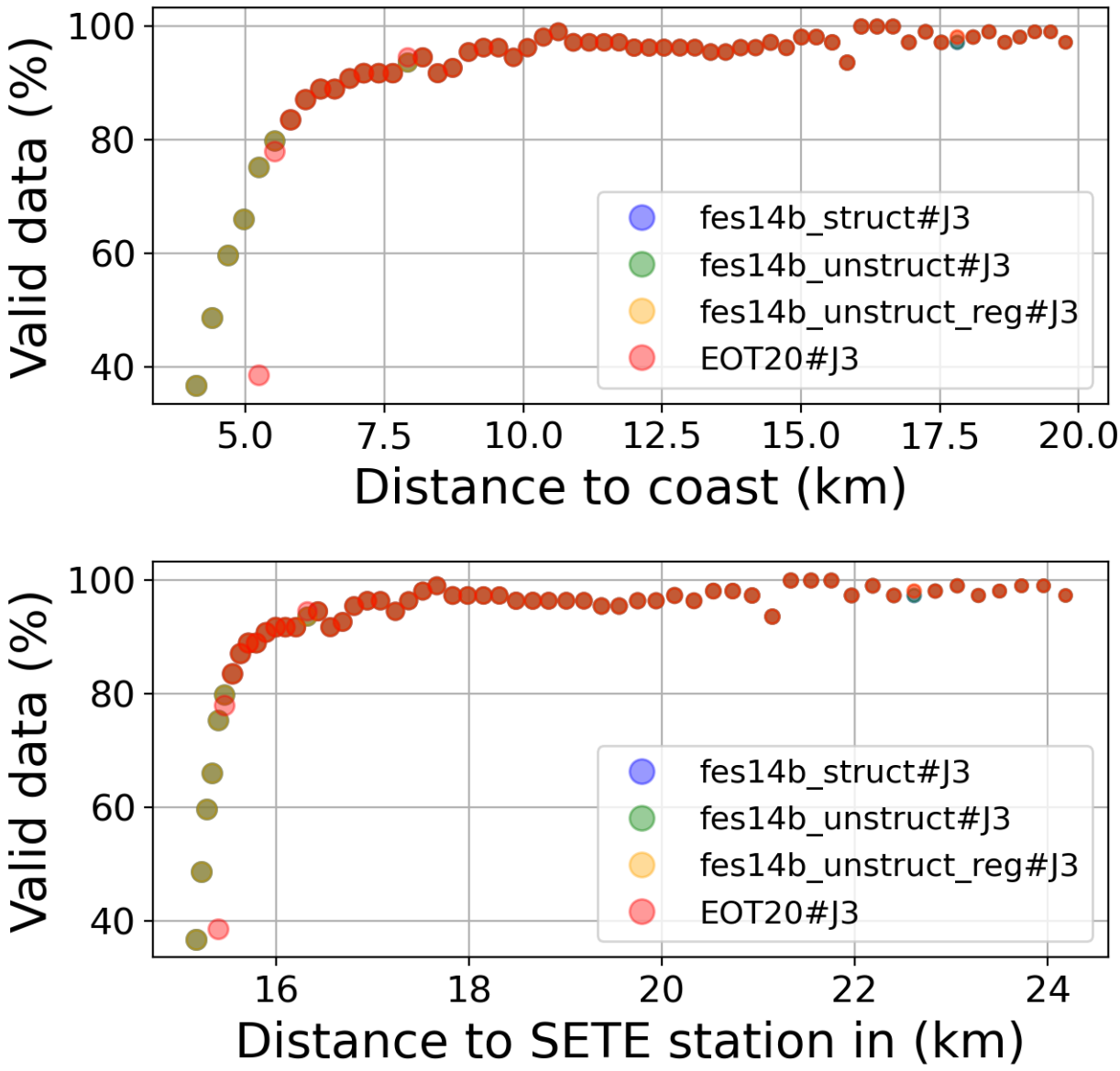

Figure 75 – Valid data (%) in function of distance to coast/SETE station

6.1.6 Std in function of distance to coast/SETE station

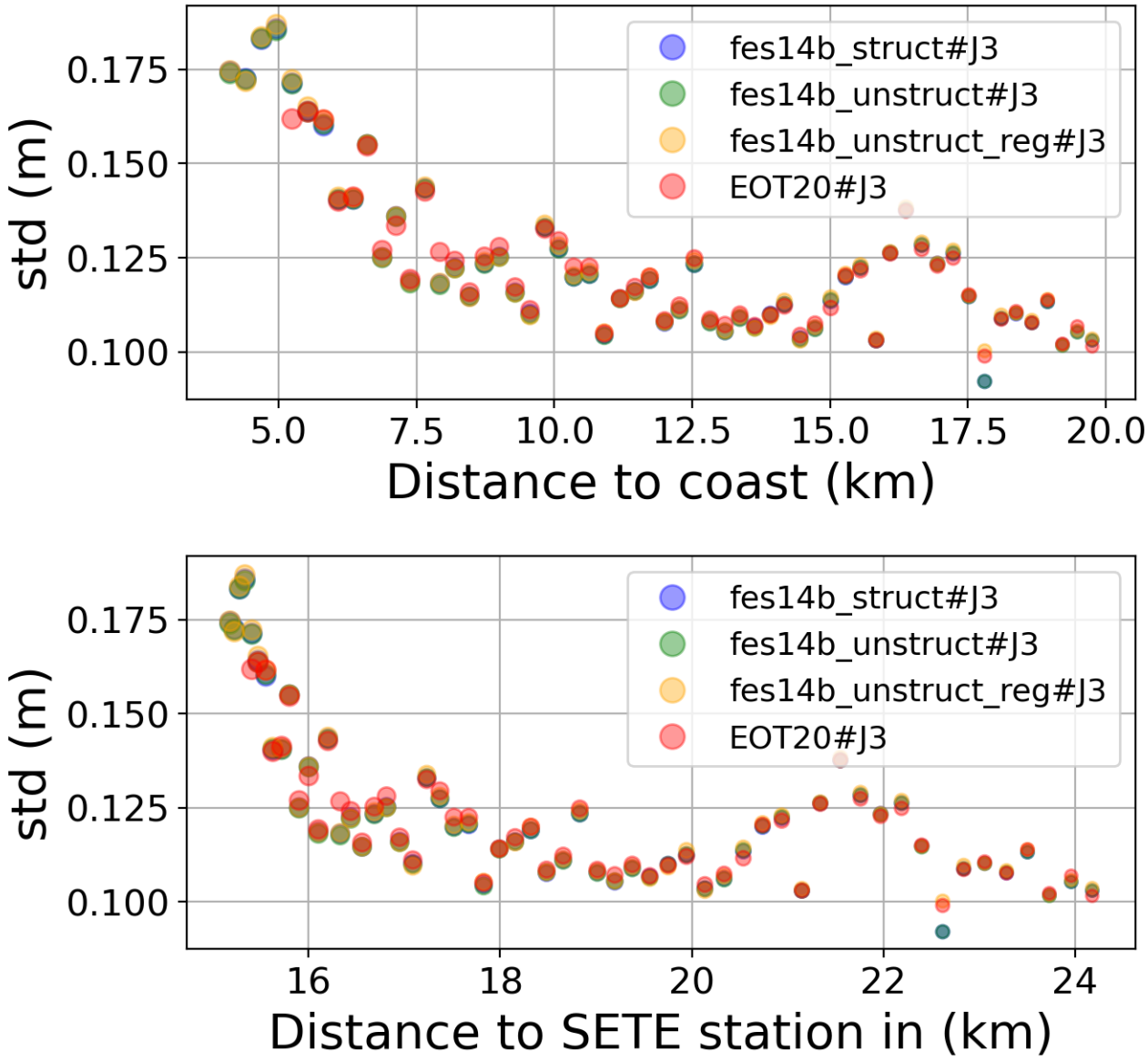

FIGURE 76 – Std in function of the distance to the coast/SETE station

6.1.7 Correlation in function of distance to coast/SETE station

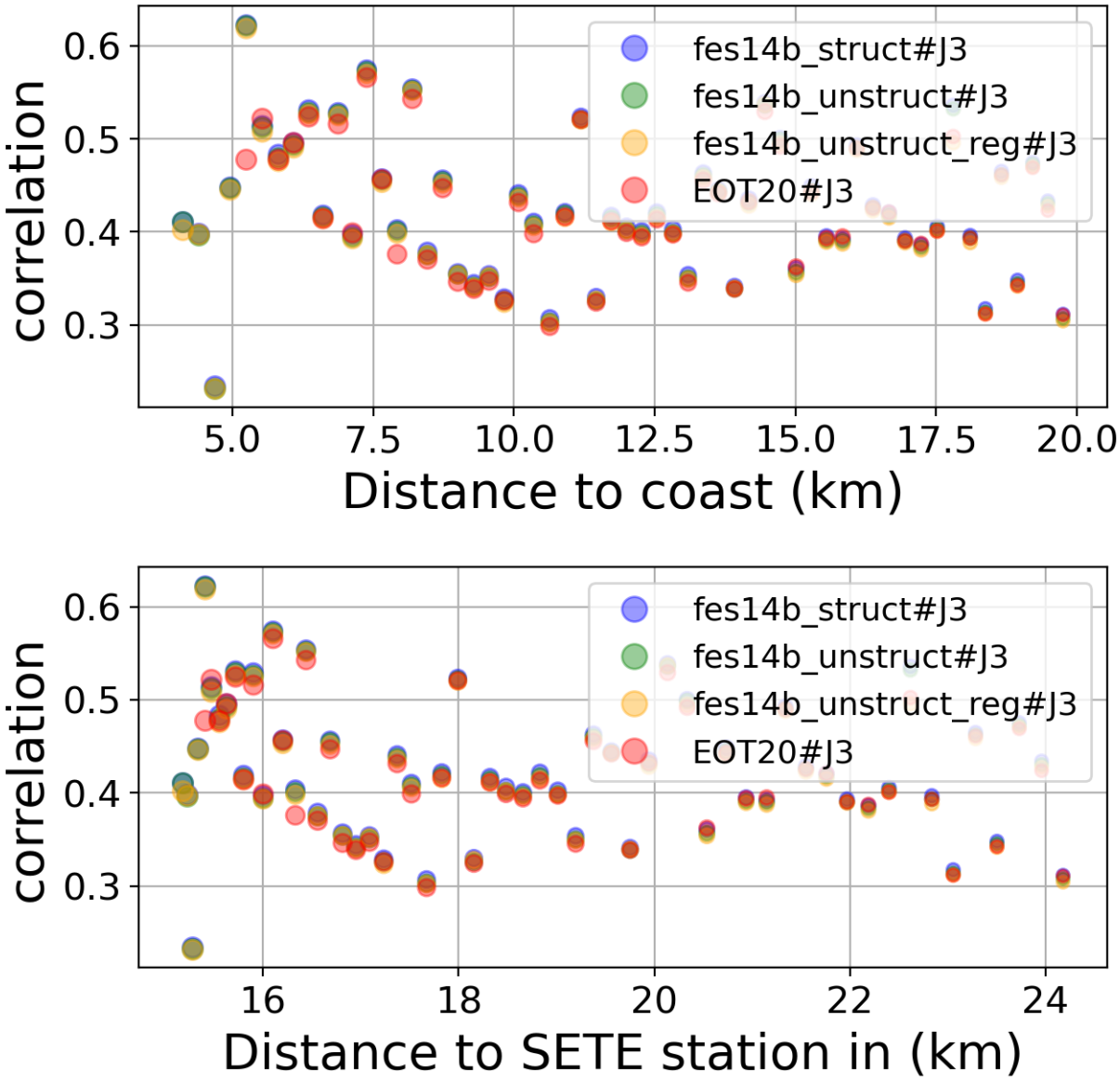

FIGURE 77 – Correlation in function of the distance to the coast/SETE station

6.1.8 Taylor Diagram

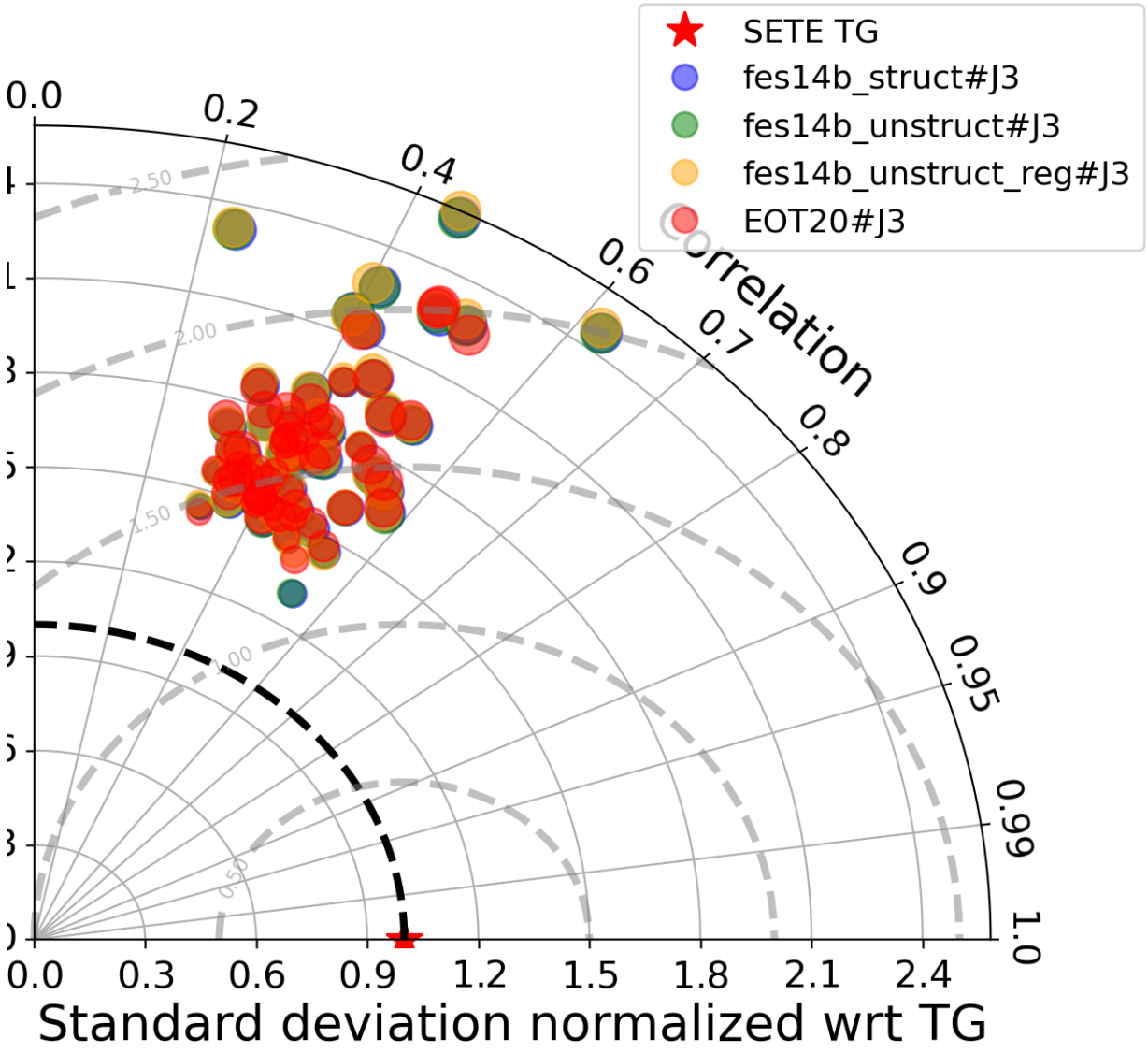

FIGURE 78 – Taylor diagram

6.1.9 Mean statistics table of products comparison with SETE tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	95.039	0.429	0.12	0.111
fes14b_unstruct#J3	95.039	0.426	0.12	0.111
fes14b_unstruct_reg#J3	95.056	0.424	0.121	0.112
EOT20#J3	94.359	0.421	0.121	0.112

FIGURE 79 – Mean statistics table of the common points in the altimetry products

6.1.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 109 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.07
fes14b_struct#J3	15.402	5.242	75.229	0.623	0.171
fes14b_unstruct#J3	15.402	5.242	75.229	0.622	0.171
fes14b_unstruct_reg#J3	15.402	5.242	75.229	0.619	0.172
EOT20#J3	15.402	5.242	38.532	0.478	0.162

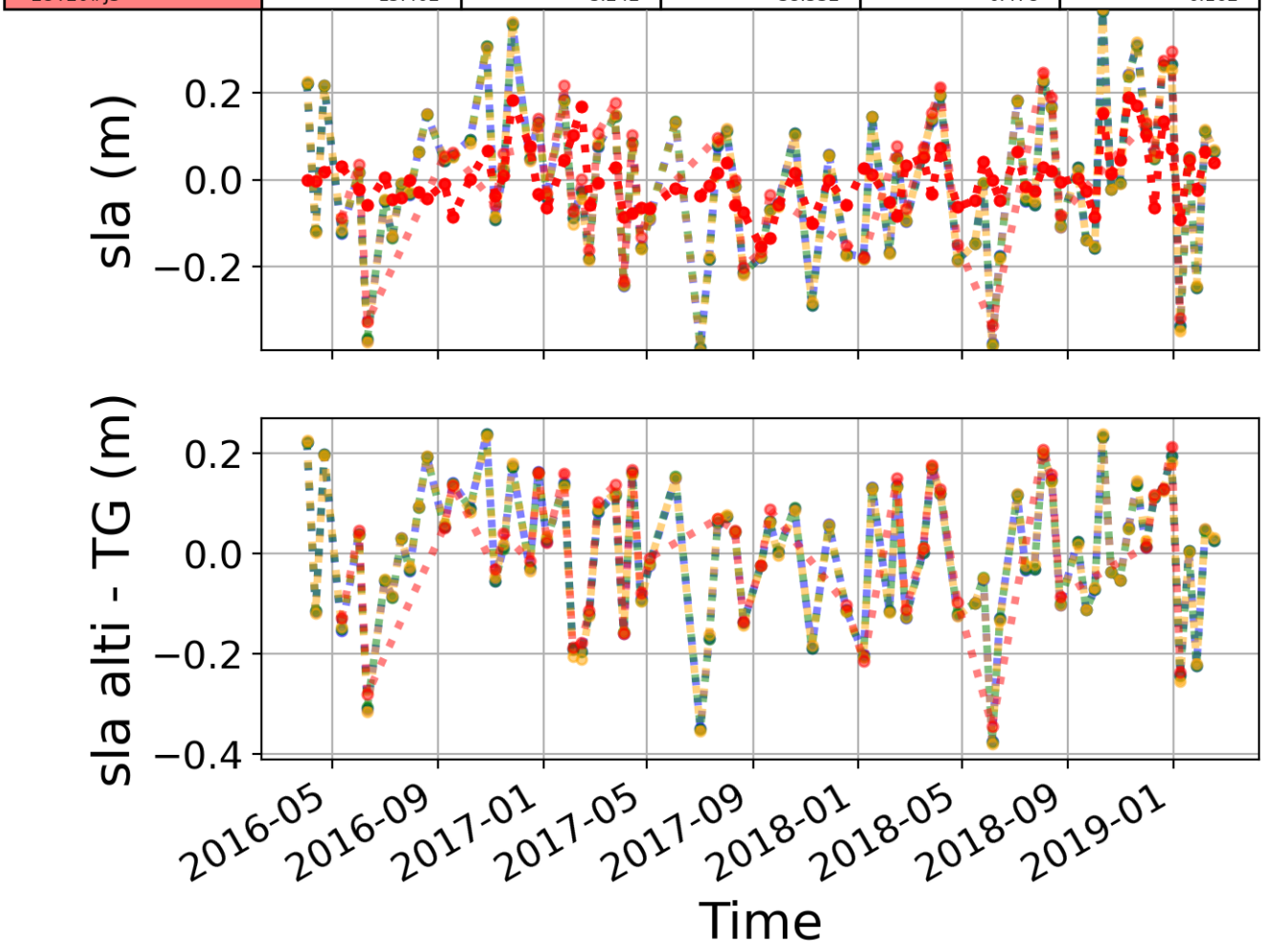

FIGURE 80 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.072
fes14b_struct#J3	16.099	7.386	91.743	0.574	0.119
fes14b_unstruct#J3	16.099	7.386	91.743	0.573	0.118
fes14b_unstruct_reg#J3	16.099	7.386	91.743	0.57	0.119
EOT20#J3	16.099	7.386	91.743	0.566	0.119

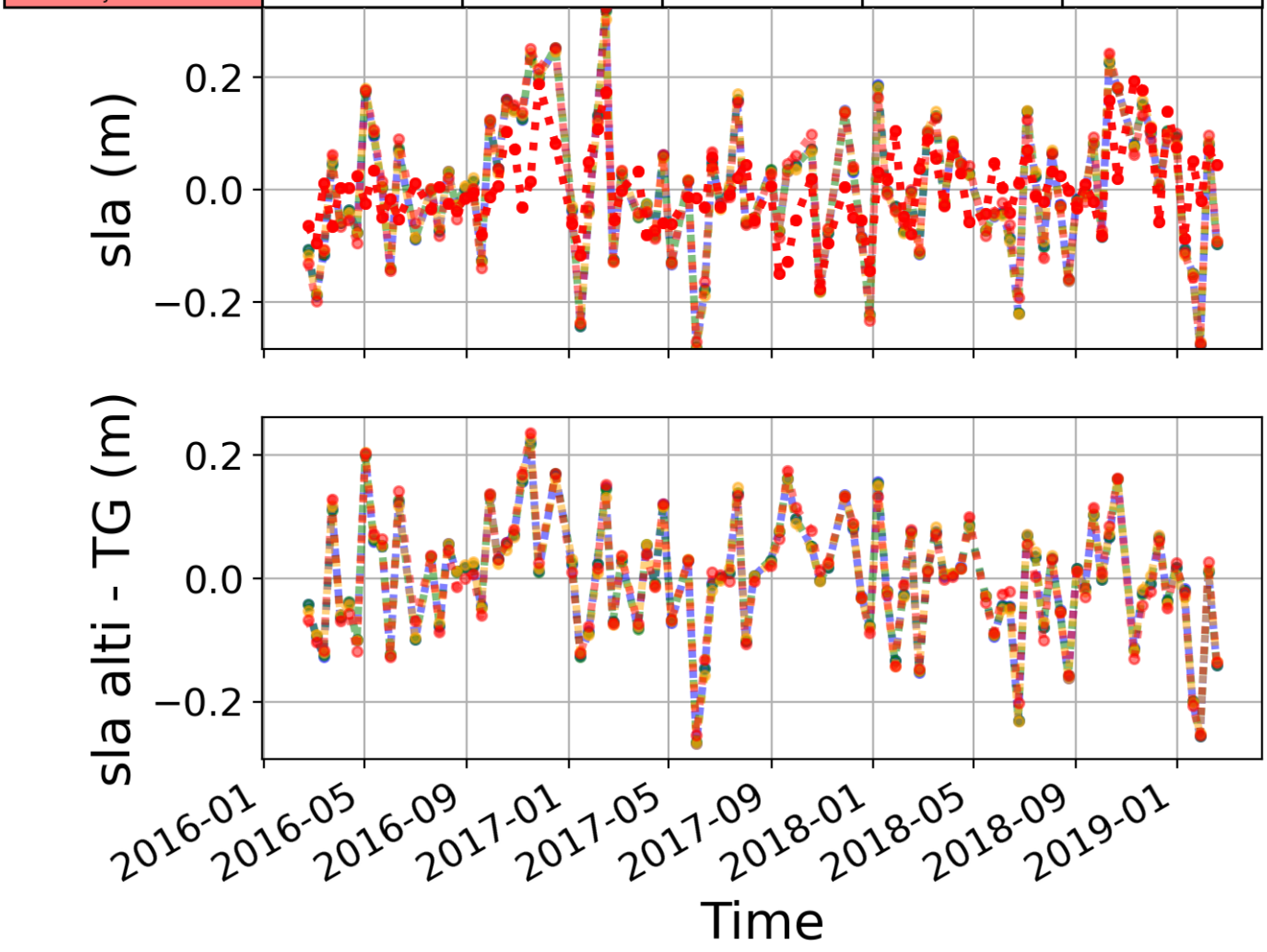

FIGURE 81 – The 2nd most correlated sla altimetry Time serie with tide gauge sla time serie

6.2 Station : Mentes

- Nearest track to Mentes station is the track number track109
- The area of interest is limited by :
  - A circle which it's center is the Mentes tide gauge station location and has a Raduis of 40 Km
  - Maximum distance to the coast : 20 Km
  - Latitude limits : [38.5, 39] °

6.2.1 correlation visualization in maps view % Mentes tide gauge

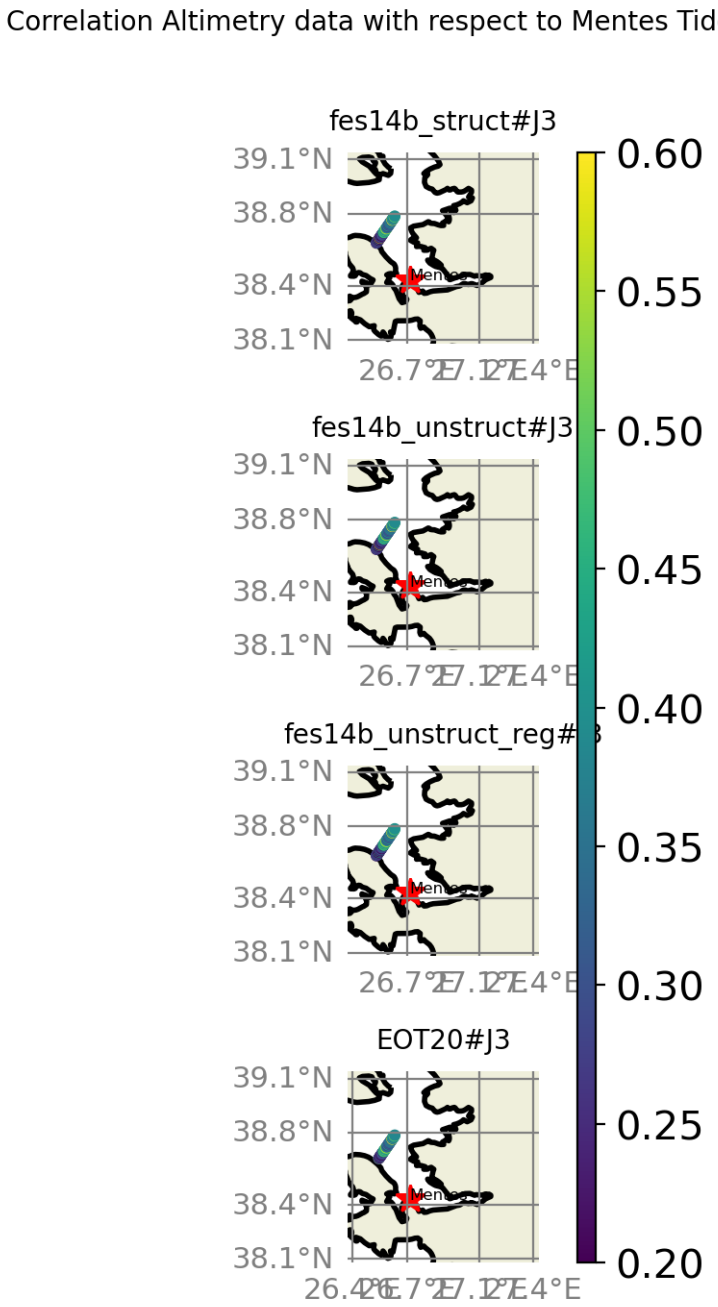

Figure 82 – correlation visualization in maps view % Mentes tide gauge

6.2.2 rmsd visualization in maps view % Mentes tide gauge

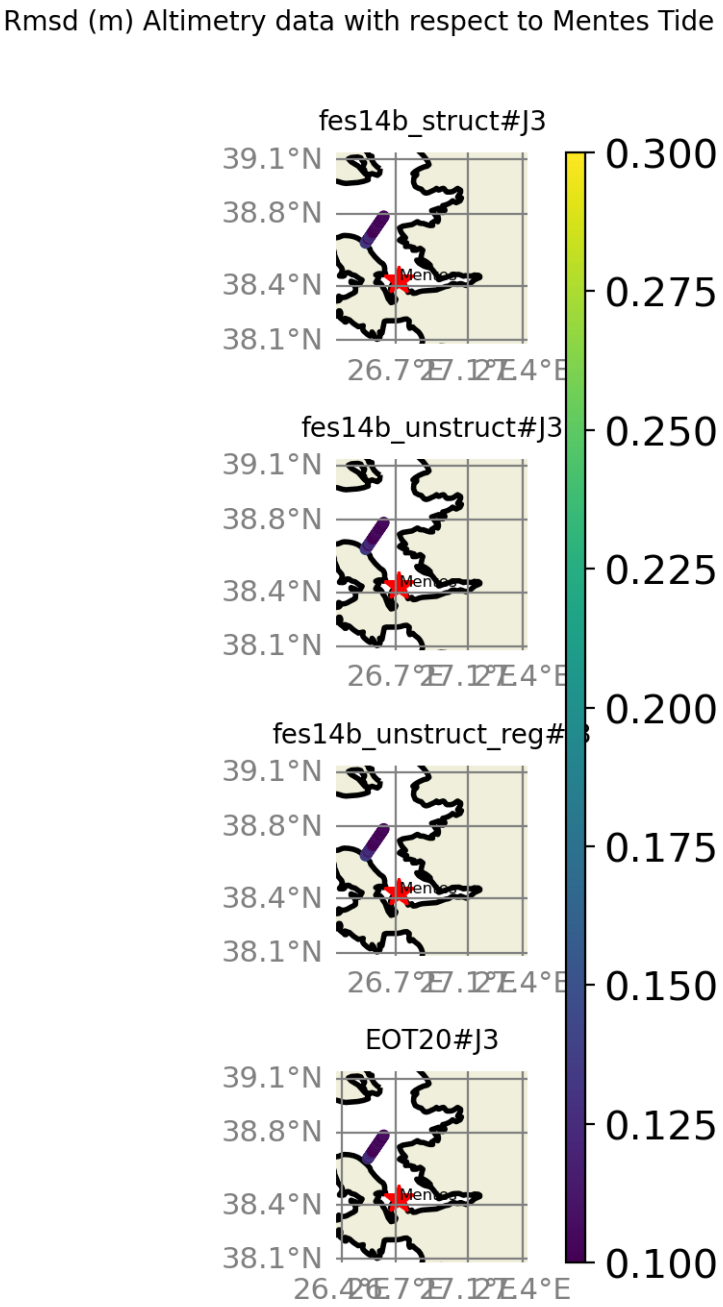

Figure 83 – rmsd visualization in maps view % Mentes tide gauge

6.2.3 std visualization in maps view % Mentes tide gauge

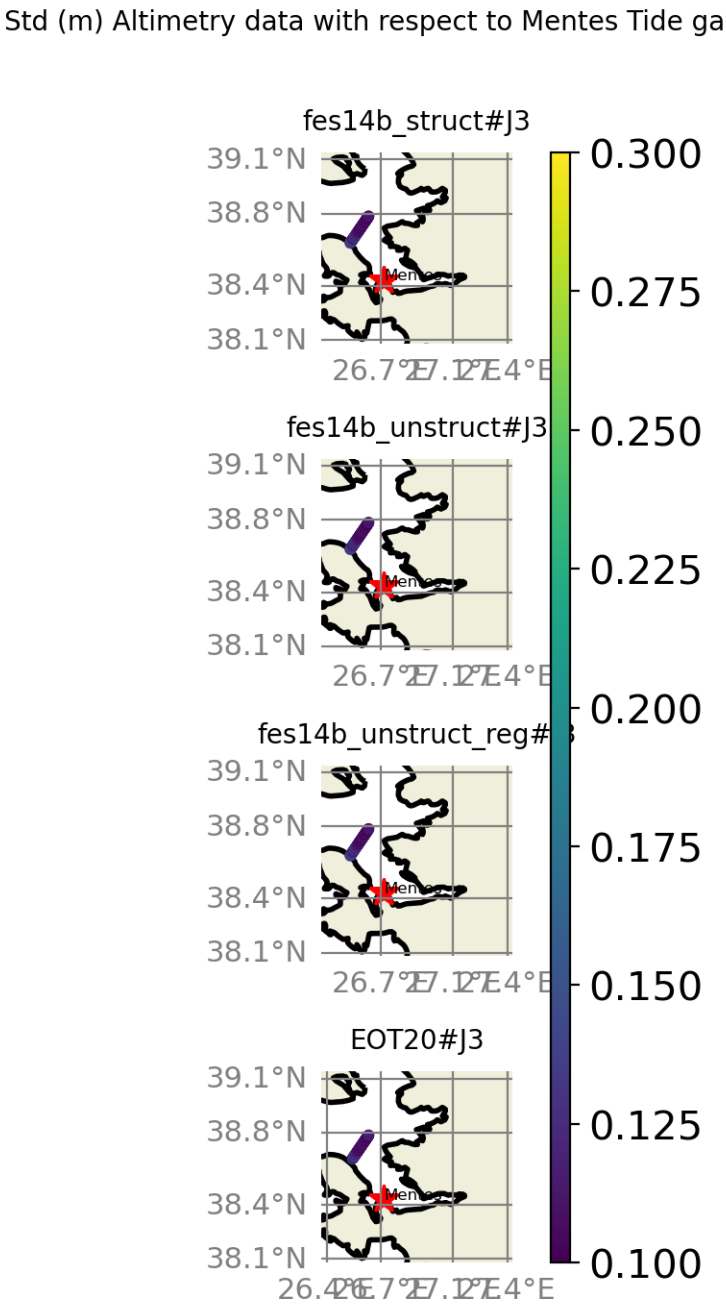

FIGURE 84 – std visualization in maps view % Mentes tide gauge

6.2.4 valid_data_percent visualization in maps view % Mentes tide gauge

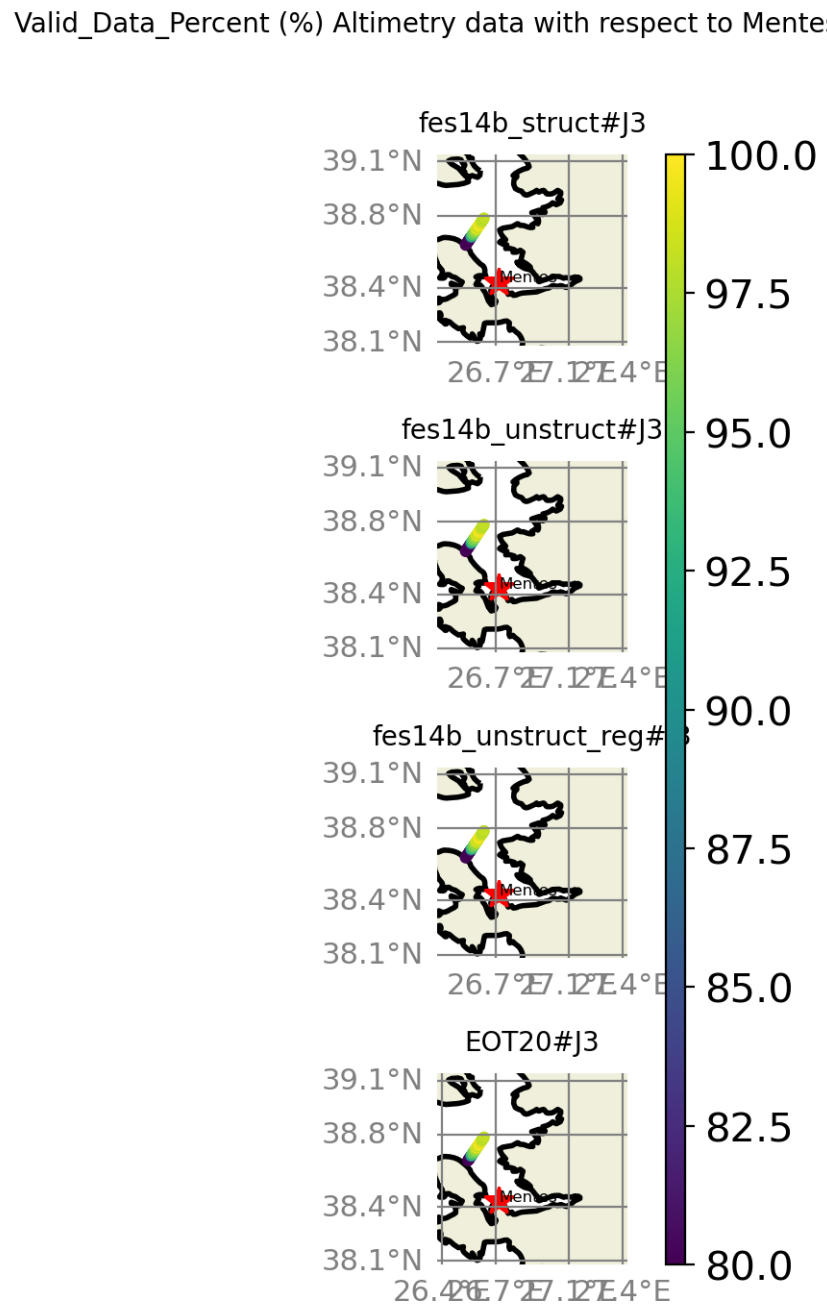

FIGURE 85 – valid_data_percent visualization in maps view % Mentes tide gauge

6.2.5 Valid data (%) in function of distance to coast/Mentes station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 110$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

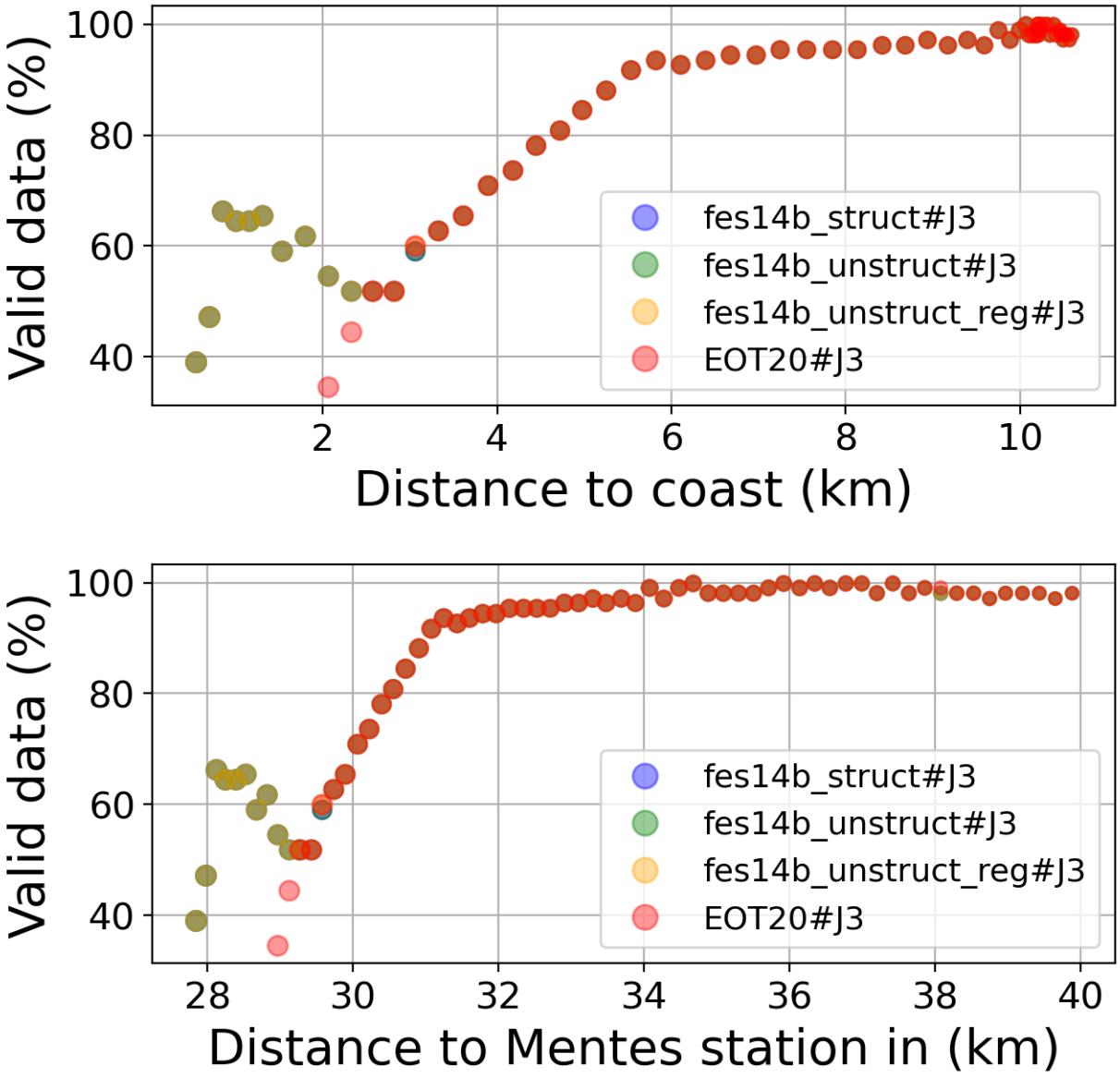

FIGURE 86 – Valid data (%) in function of distance to coast/Mentes station

6.2.6 Std in function of distance to coast/Mentes station

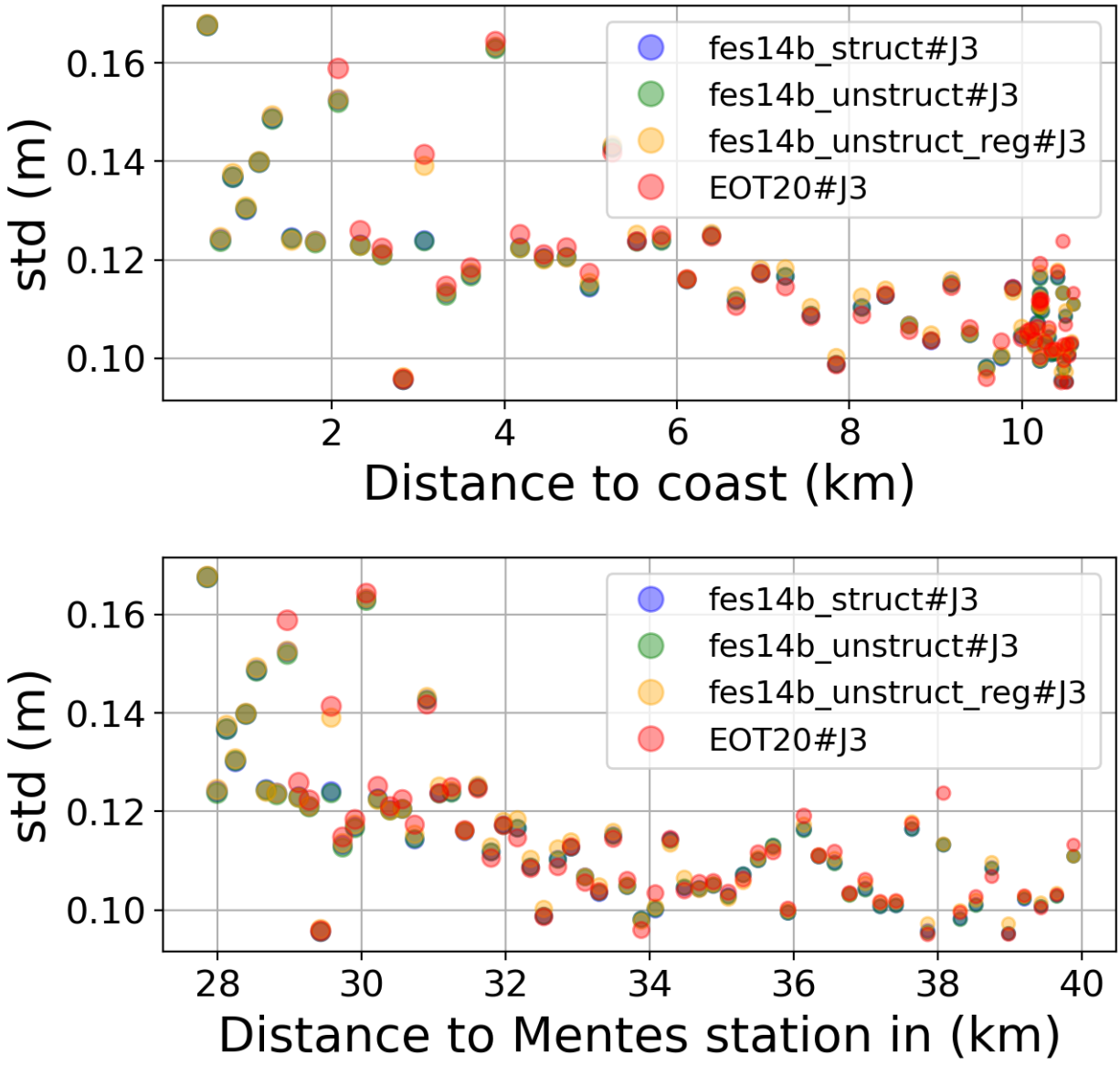

FIGURE 87 – Std in function of the distance to the coast/Mentes station

6.2.7 Correlation in function of distance to coast/Mentes station

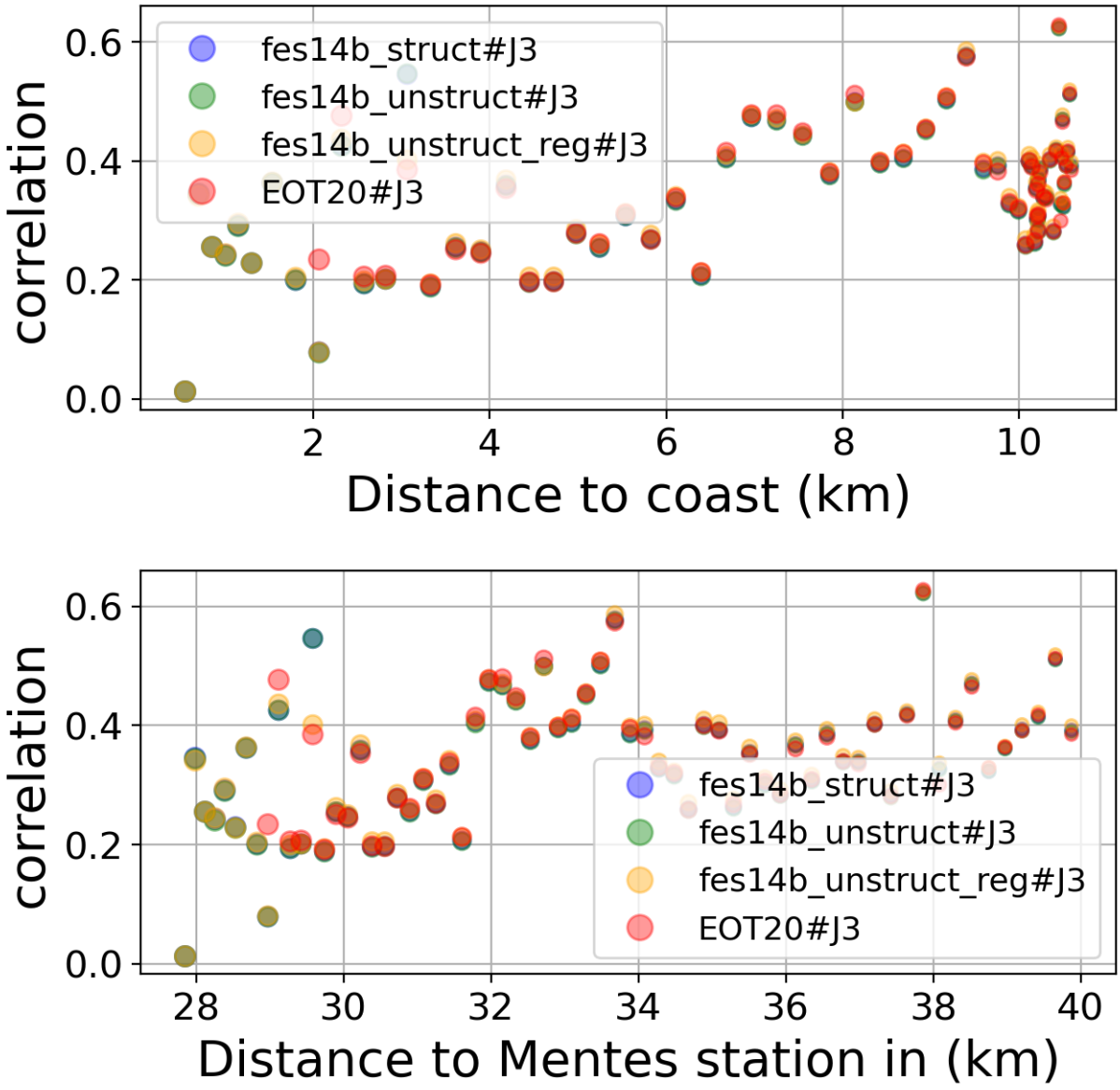

FIGURE 88 – Correlation in function of the distance to the coast/Mentes station

6.2.8 Taylor Diagram

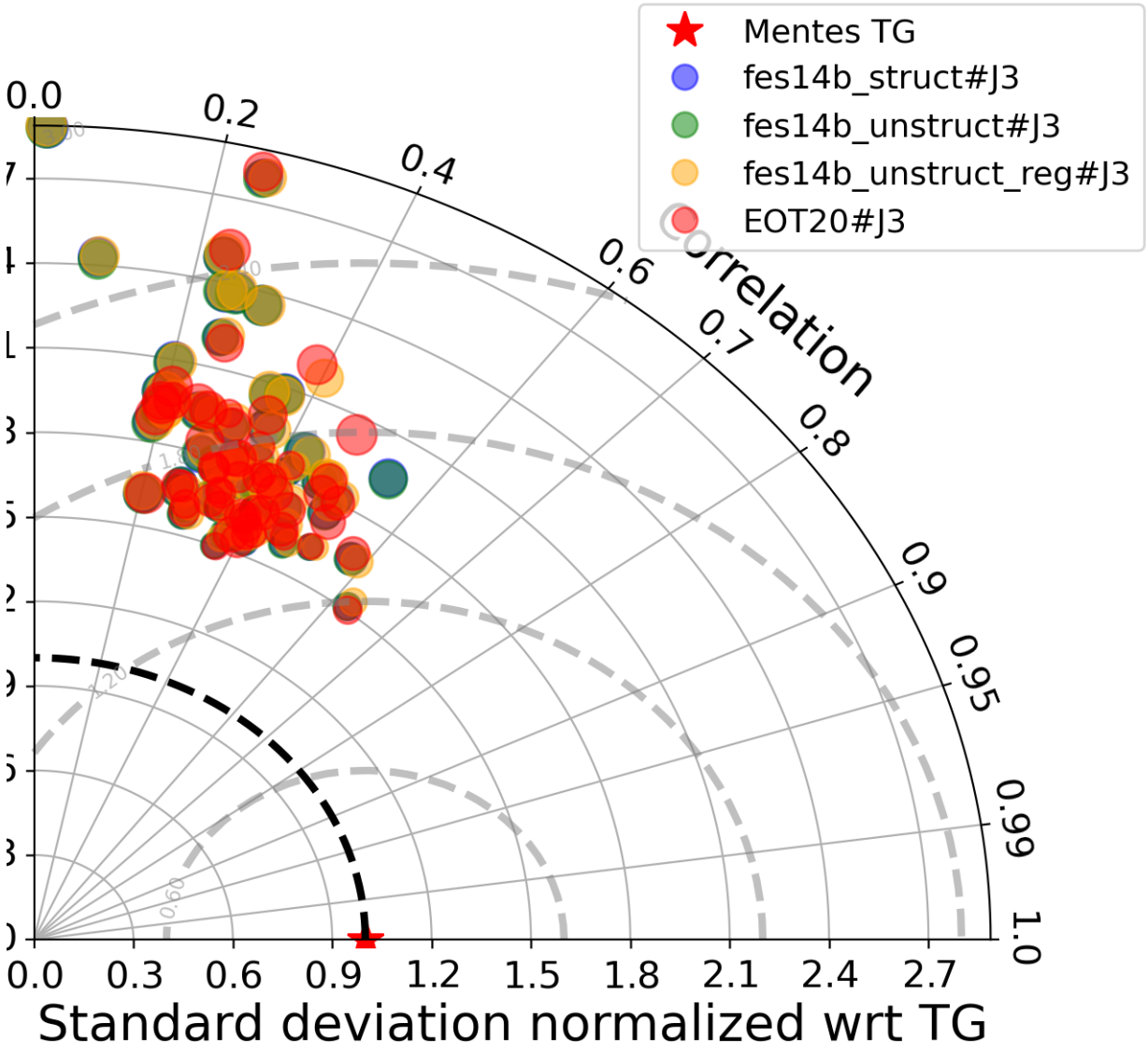

FIGURE 89 – Taylor diagram

6.2.9 Mean statistics table of products comparison with Mentes tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	90.51	0.357	0.112	0.107
fes14b_unstruct#J3	90.51	0.355	0.112	0.107
fes14b_unstruct_reg#J3	90.526	0.361	0.113	0.108
EOT20#J3	90.064	0.358	0.113	0.108

FIGURE 90 – Mean statistics table of the common points in the altimetry products

6.2.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 110 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.063
fes14b_struct#J3	37.853	10.446	99.091	0.624	0.096
fes14b_unstruct#J3	37.853	10.446	99.091	0.623	0.096
fes14b_unstruct_reg#J3	37.853	10.446	99.091	0.625	0.097
EOT20#J3	37.853	10.446	99.091	0.629	0.095

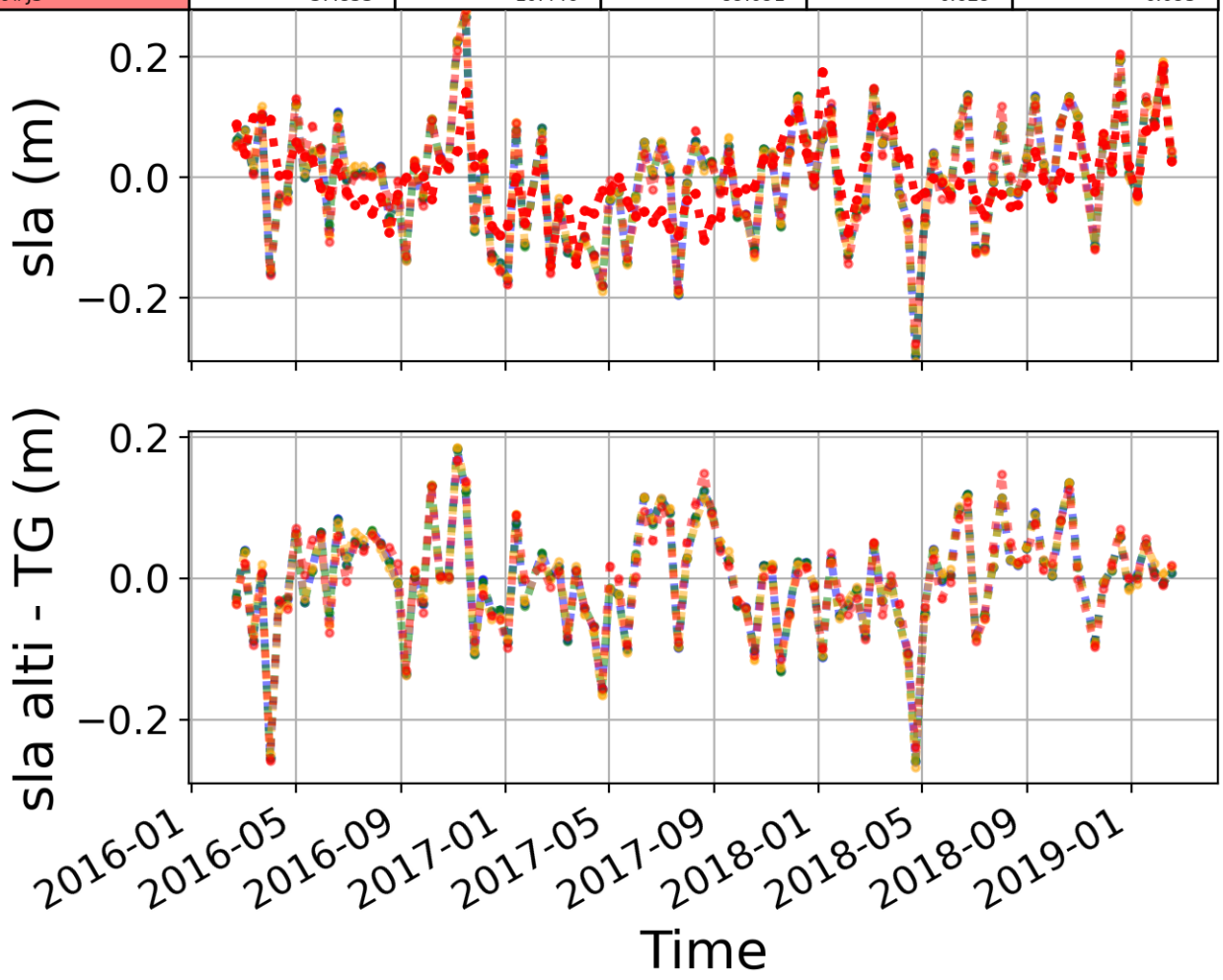

FIGURE 91 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.3 Station : Ibiza

- Nearest track to Ibiza station is the track number track248
- The area of interest is limited by :
  - A circle which it's center is the Ibiza tide gauge station location and has a Raduis of 40 Km
  - Maximum distance to the coast : 20 Km
  - Latitude limits : [38.6, 39.05] °

6.3.1 correlation visualization in maps view % Ibiza tide gauge

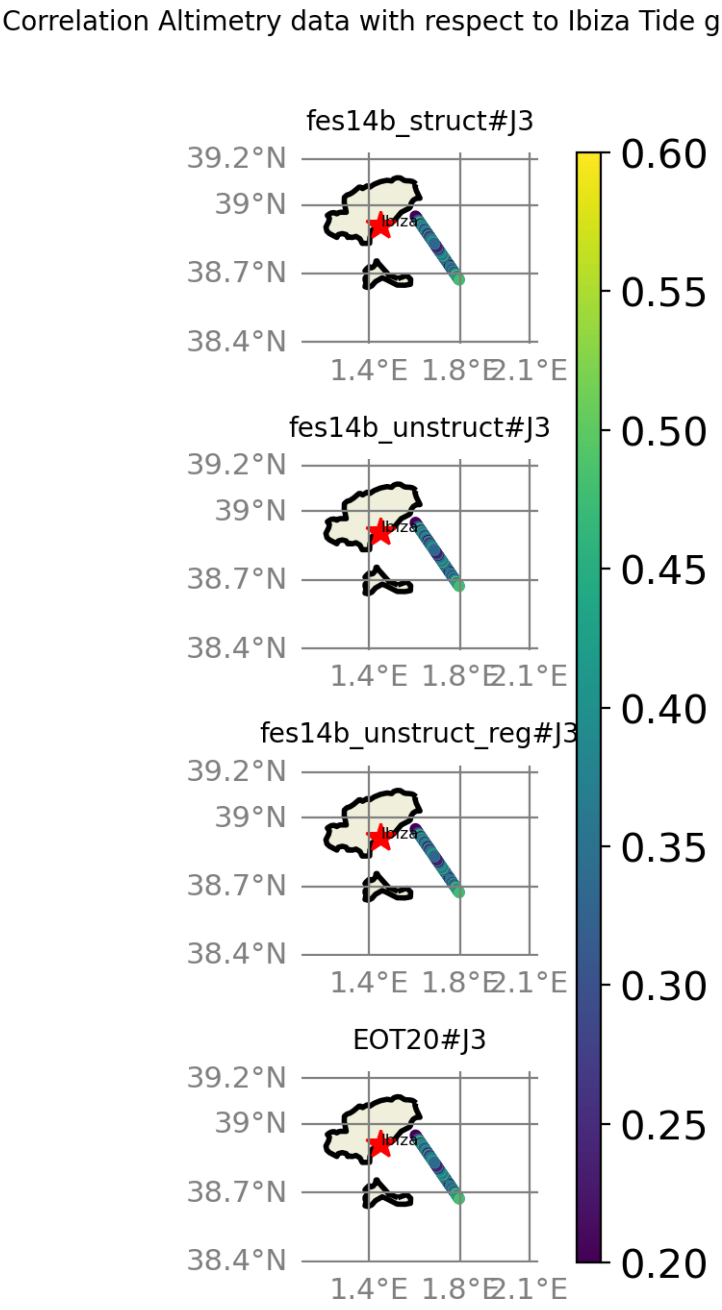

FIGURE 92 – correlation visualization in maps view % Ibiza tide gauge

6.3.2 rmsd visualization in maps view % Ibiza tide gauge

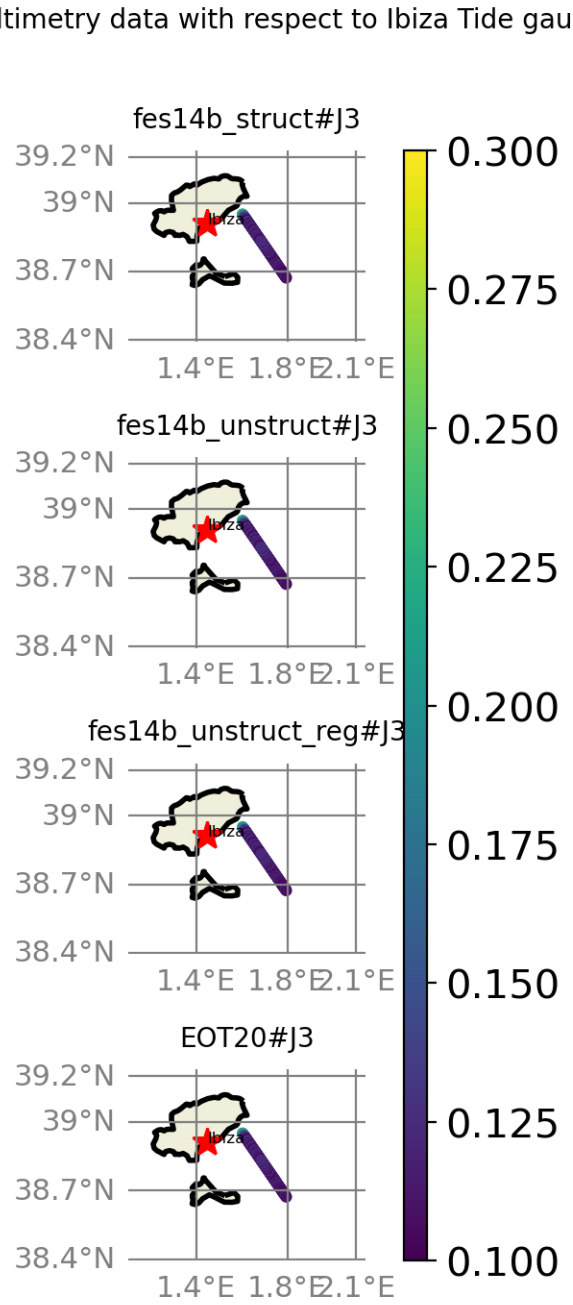

FIGURE 93 – rmsd visualization in maps view % Ibiza tide gauge

6.3.3 std visualization in maps view % Ibiza tide gauge

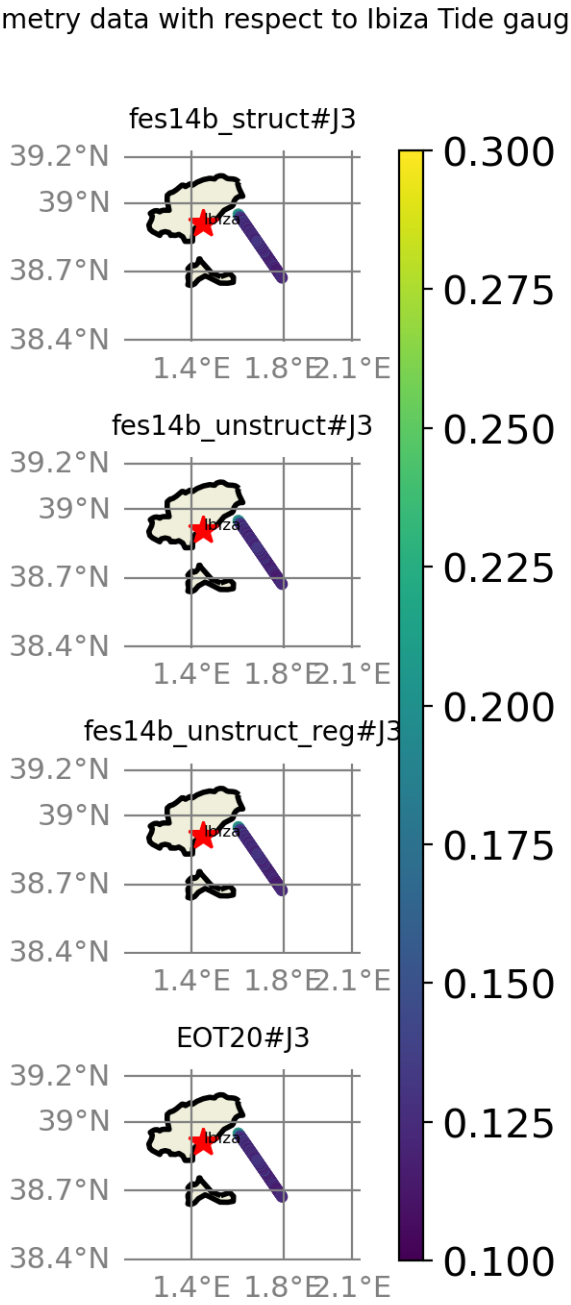

Figure 94 – std visualization in maps view % Ibiza tide gauge

6.3.4 valid_data_percent visualization in maps view % Ibiza tide gauge

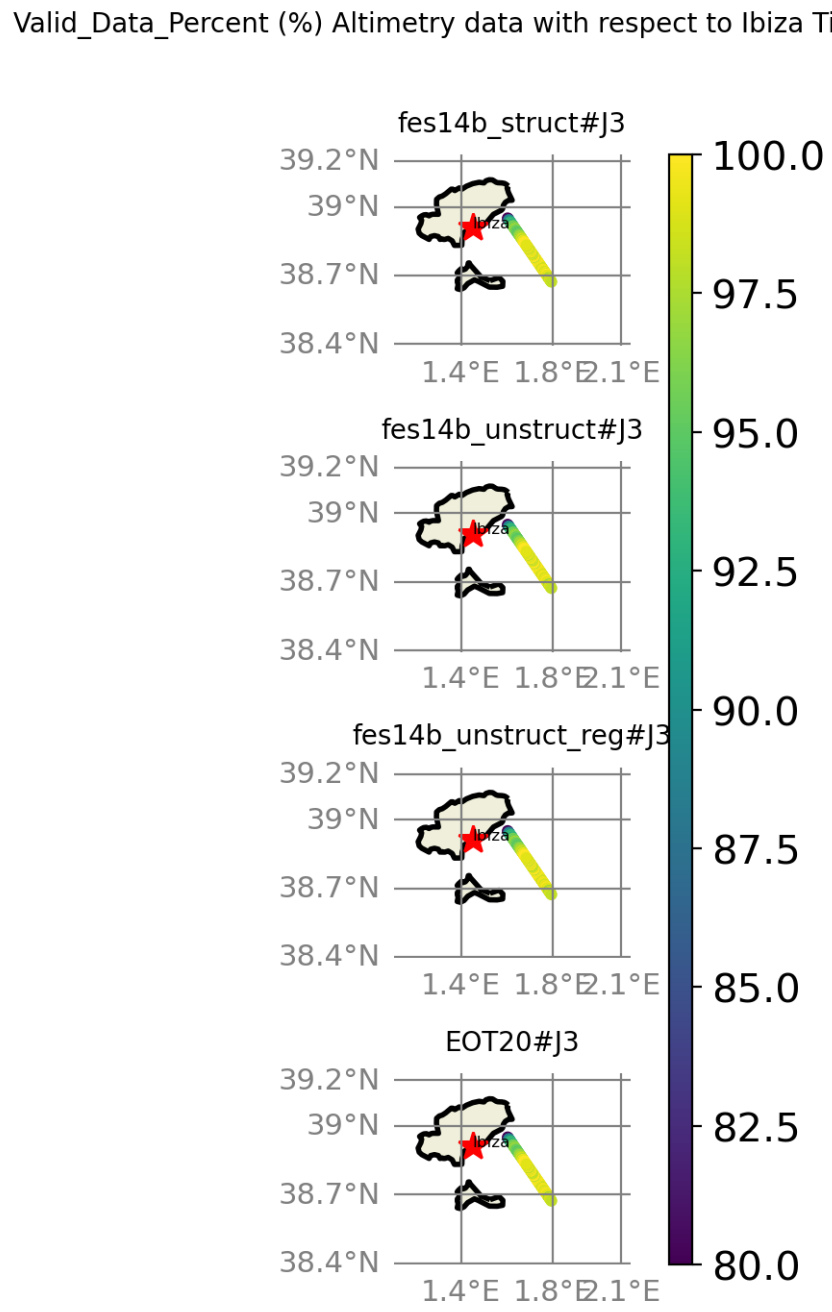

FIGURE 95 – valid_data_percent visualization in maps view % Ibiza tide gauge

6.3.5 Valid data (%) in function of distance to coast/Ibiza station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where pvd and nvd are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 110$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

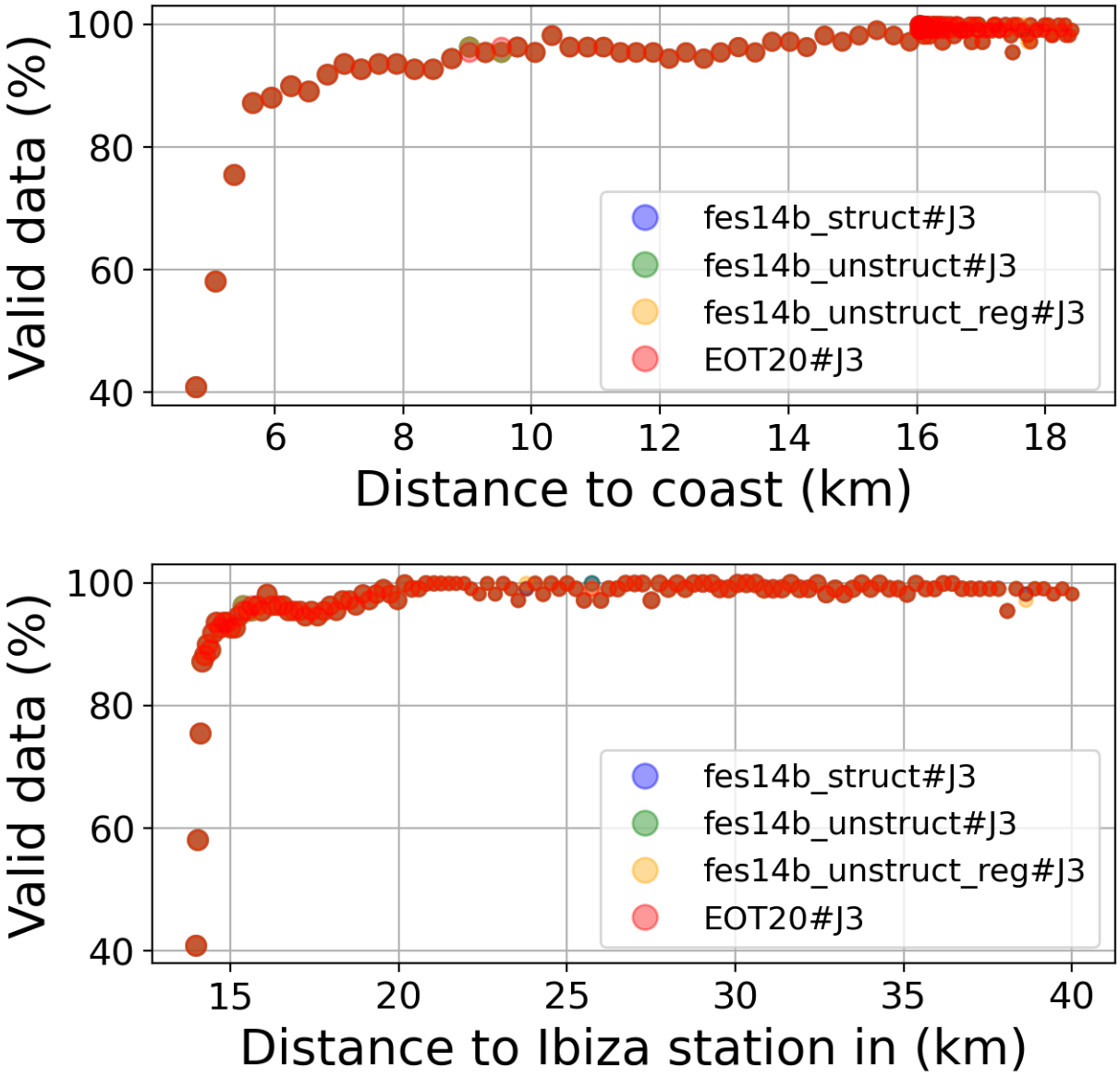

FIGURE 96 – Valid data (%) in function of distance to coast/Ibiza station

6.3.6 Std in function of distance to coast/Ibiza station

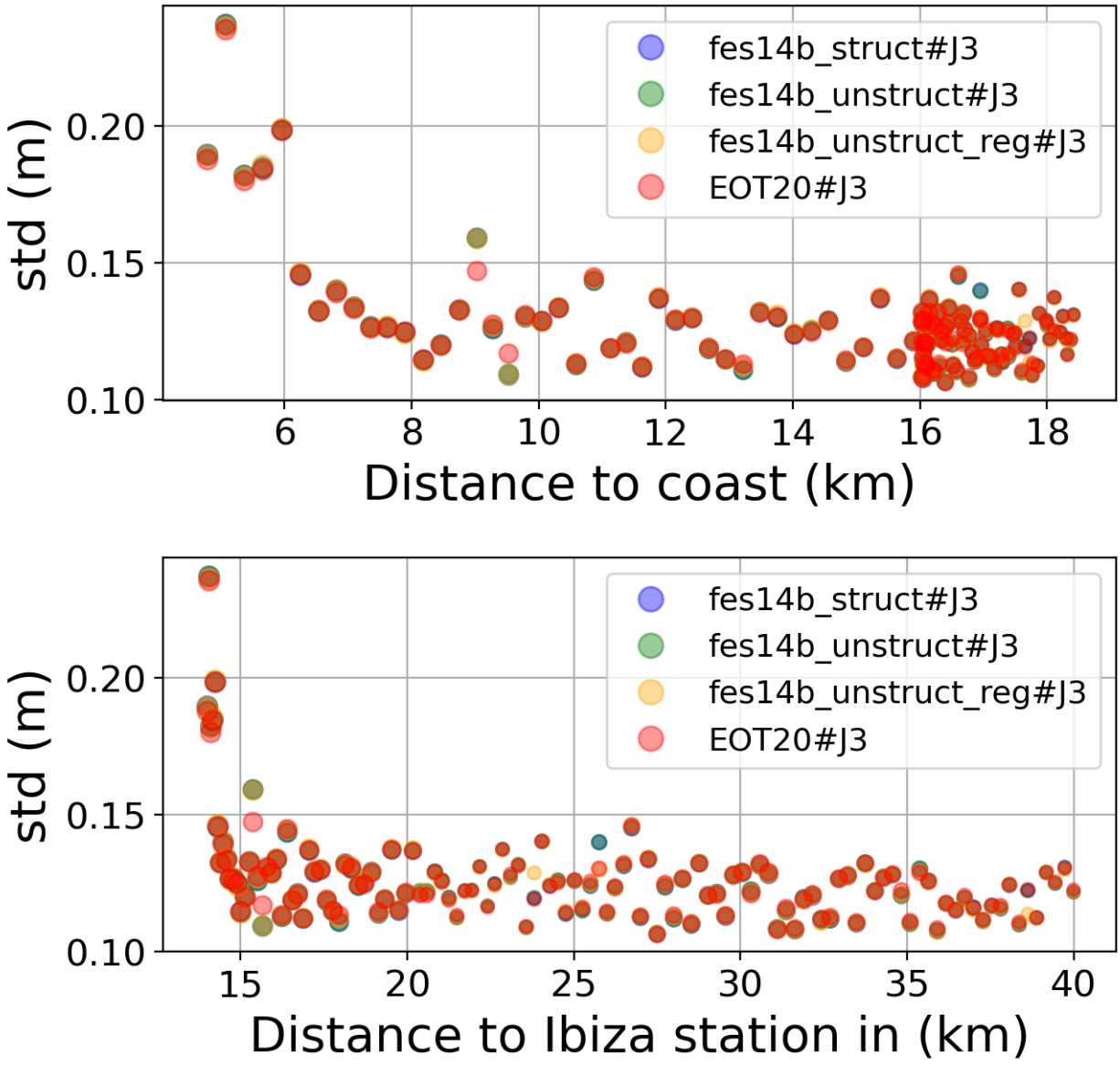

FIGURE 97 – Std in function of the distance to the coast/Ibiza station

6.3.7 Correlation in function of distance to coast/Ibiza station

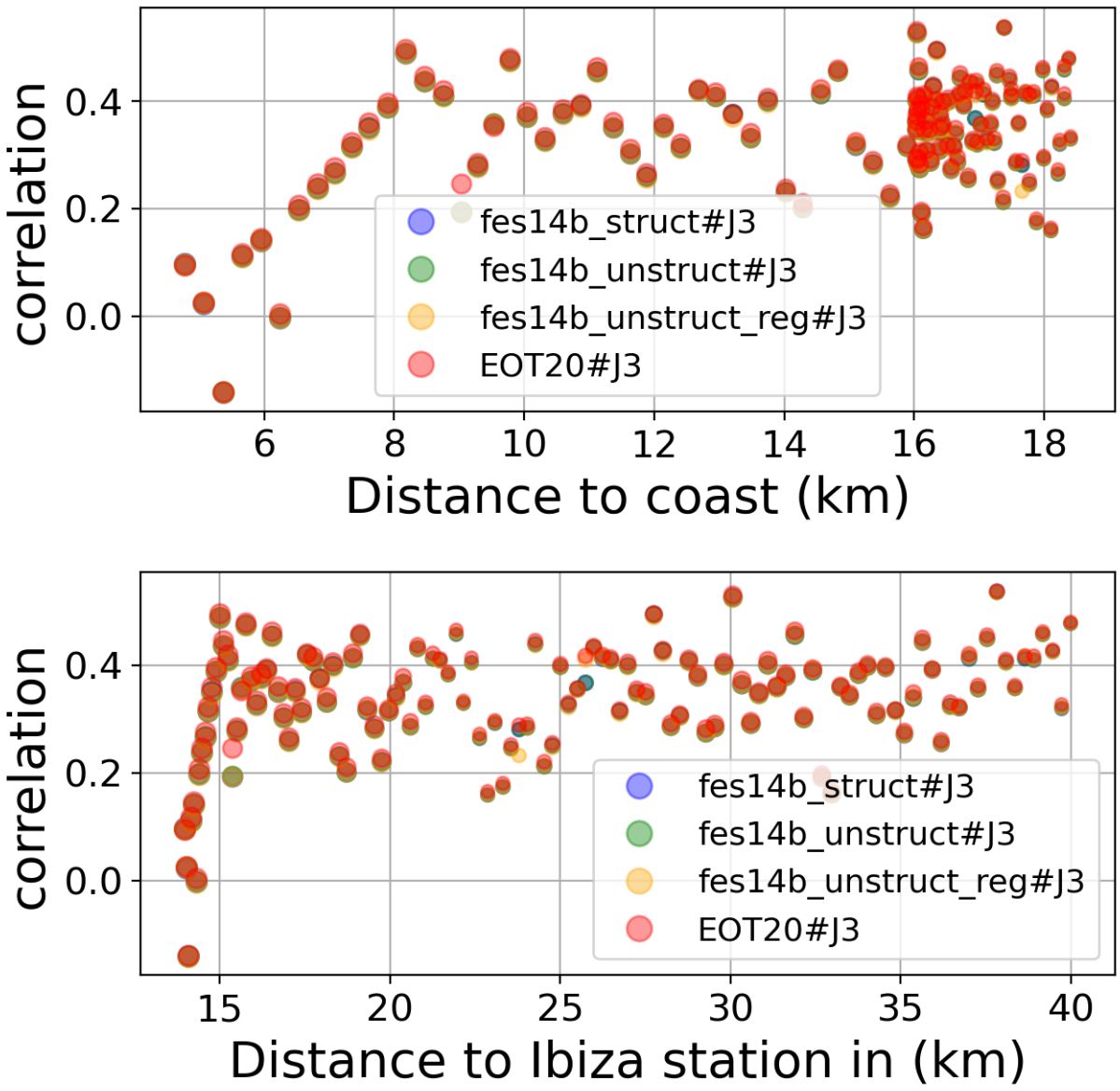

Figure 98 – Correlation in function of the distance to the coast/Ibiza station

6.3.8 Taylor Diagram

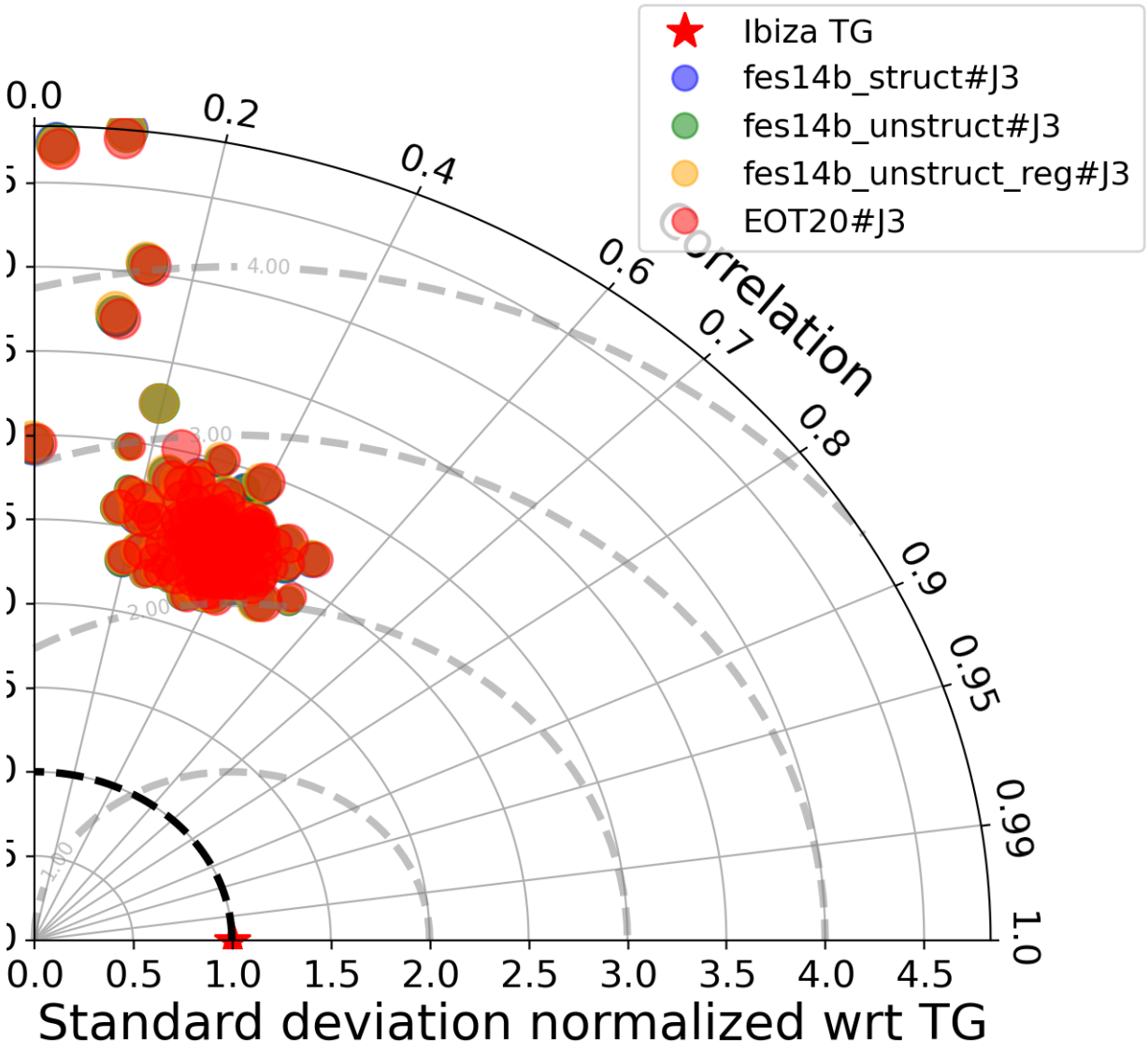

FIGURE 99 – Taylor diagram

6.3.9 Mean statistics table of products comparison with Ibiza tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	96.822	0.336	0.127	0.119
fes14b_unstruct#J3	96.822	0.336	0.127	0.12
fes14b_unstruct_reg#J3	96.814	0.336	0.127	0.12
EOT20#J3	96.814	0.343	0.127	0.119

FIGURE 100 – Mean statistics table of the common points in the altimetry products

6.3.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 110 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.049
fes14b_struct#J3	37.802	17.38	99.091	0.538	0.116
fes14b_unstruct#J3	37.802	17.38	99.091	0.538	0.116
fes14b_unstruct_reg#J3	37.802	17.38	99.091	0.536	0.116
EOT20#J3	37.802	17.38	99.091	0.539	0.117

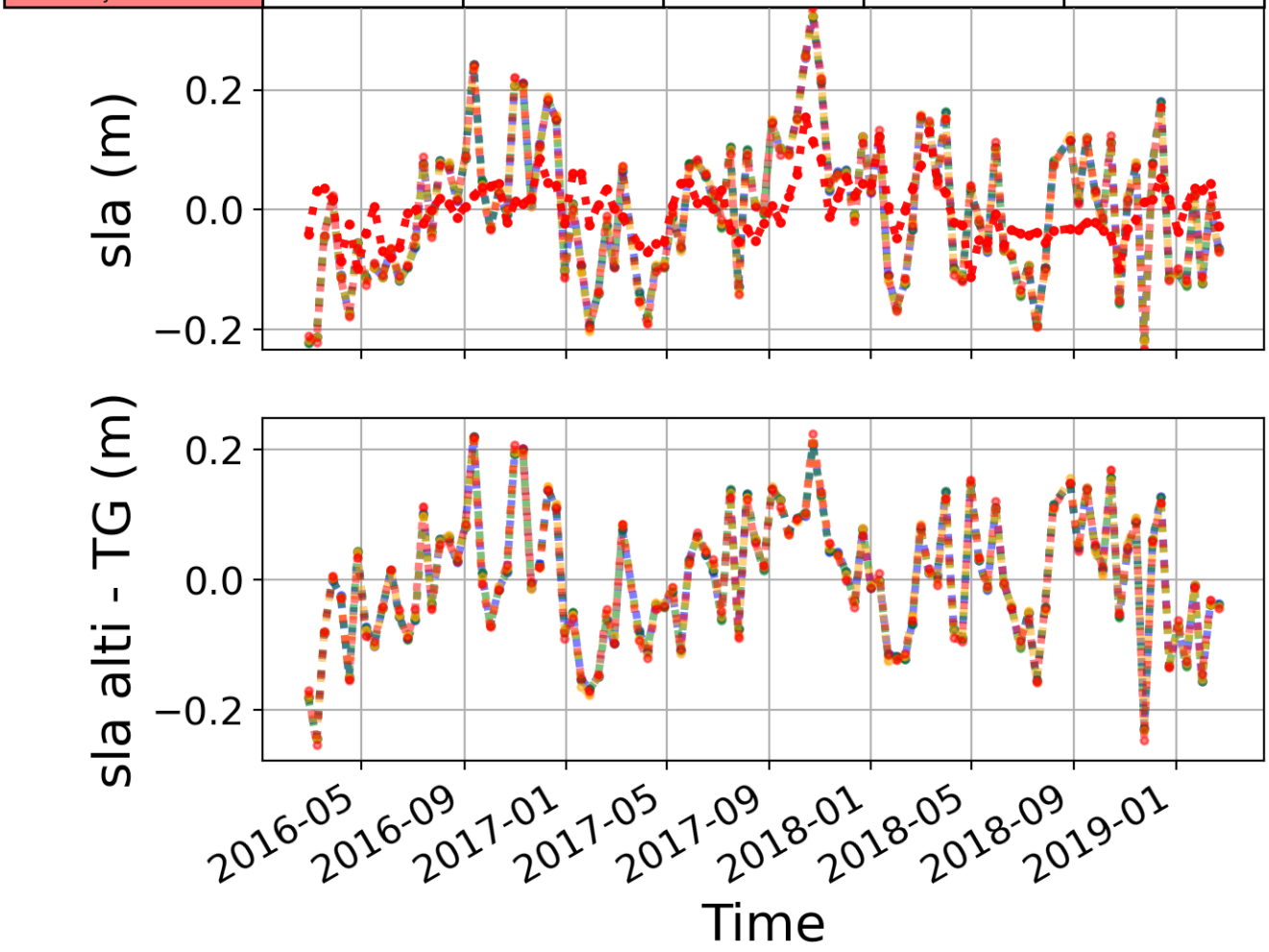

FIGURE 101 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.4 Station : LA_FIGUEIRETTE

- Nearest track to LA_FIGUEIRETTE station is the track number track222
- The area of interest is limited by :
  - A circle which it's center is the LA_FIGUEIRETTE tide gauge station location and has a Raduis of 40 Km
  - Maximum distance to the coast : 20 Km

6.4.1 correlation visualization in maps view % LA_FIGUEIRETTE tide gauge

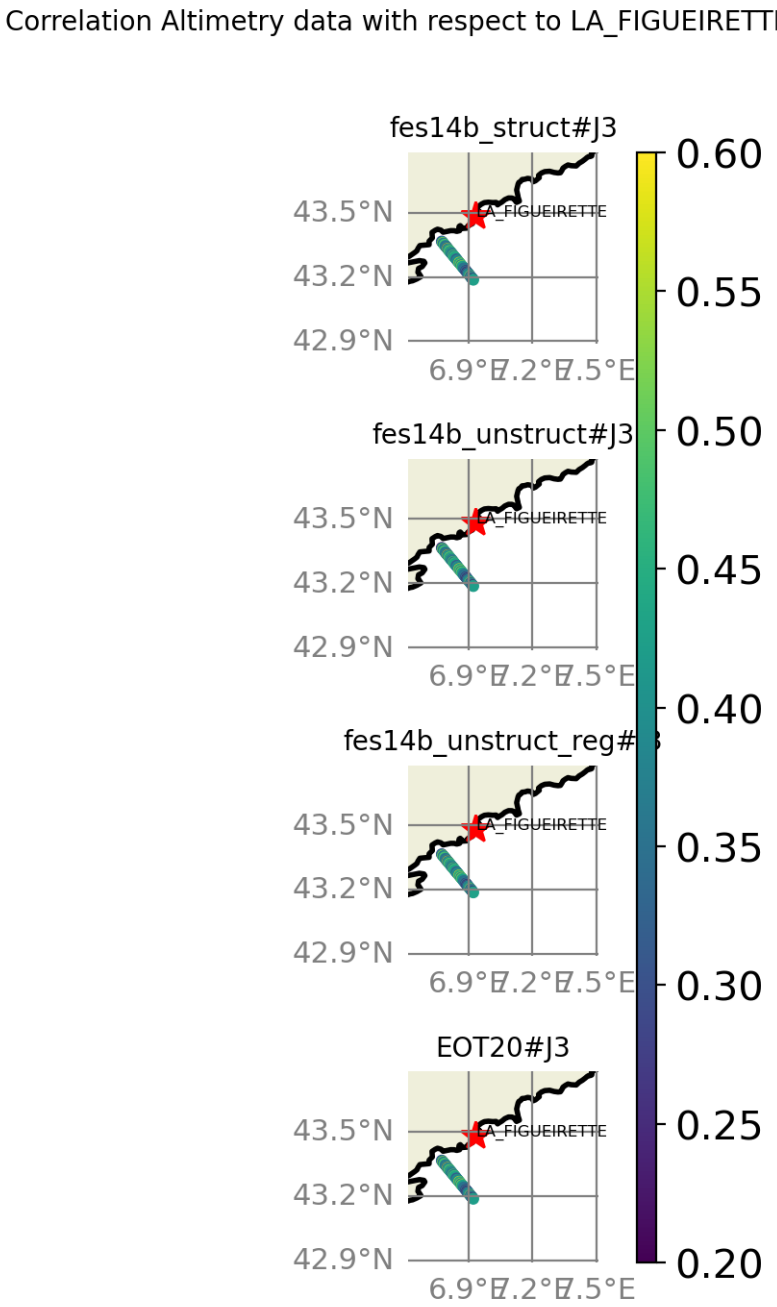

FIGURE 102 – correlation visualization in maps view % LA_FIGUEIRETTE tide gauge

6.4.2 rmsd visualization in maps view % LA_FIGUEIRETTE tide gauge

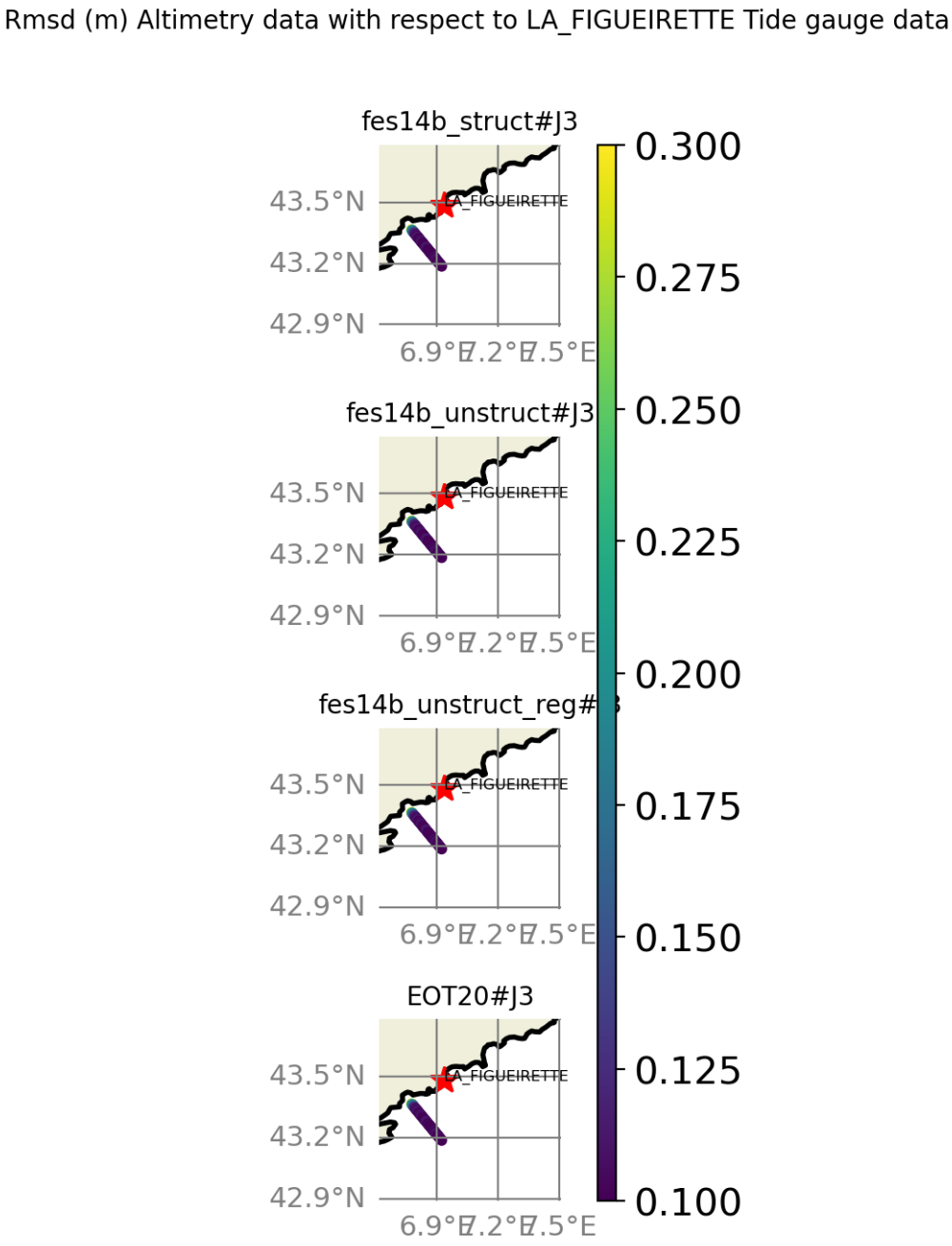

Figure 103 – rmsd visualization in maps view % LA_FIGUEIRETTE tide gauge

6.4.3 std visualization in maps view % LA_FIGUEIRETTE tide gauge

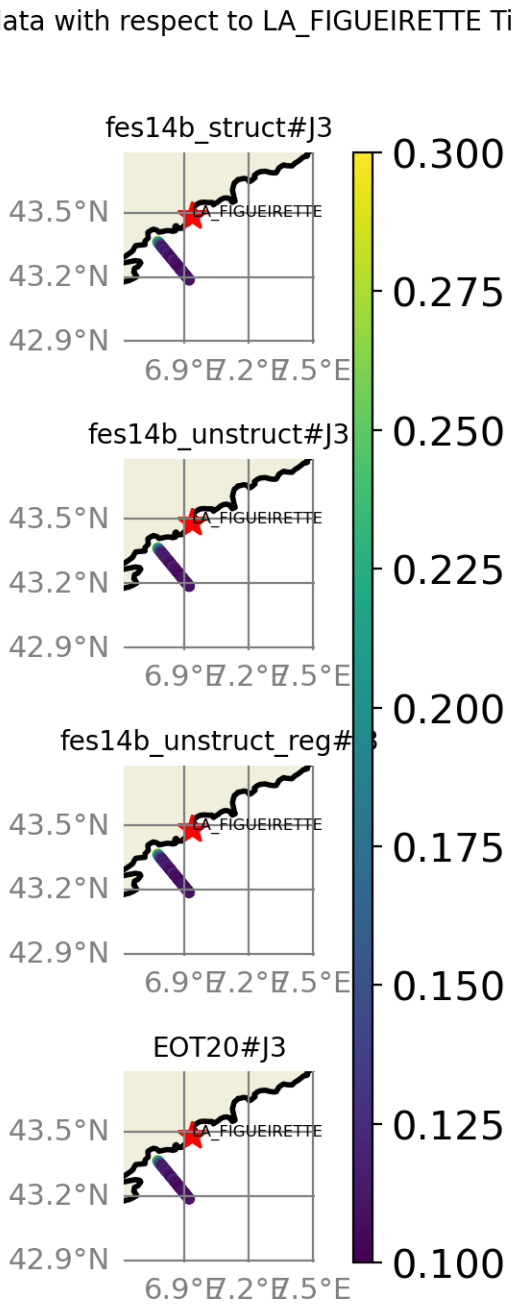

Figure 104 – std visualization in maps view % LA_FIGUEIRETTE tide gauge

6.4.4 valid_data_percent visualization in maps view % LA_FIGUEIRETTE tide gauge

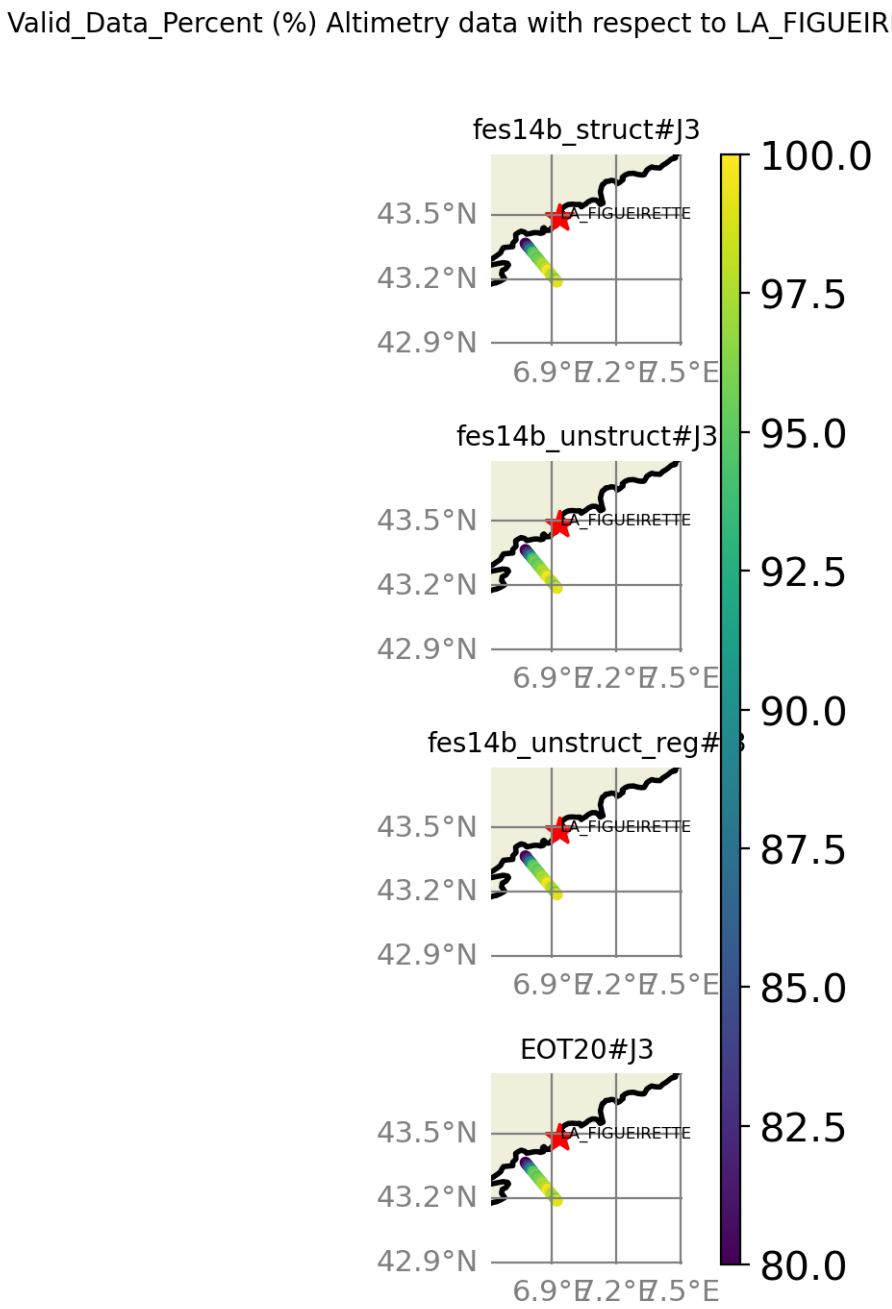

FIGURE 105 – valid_data_percent visualization in maps view % LA_FIGUEIRETTE tide gauge

6.4.5 Valid data (%) in function of distance to coast/LA_FIGUEIRETTE station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 110$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

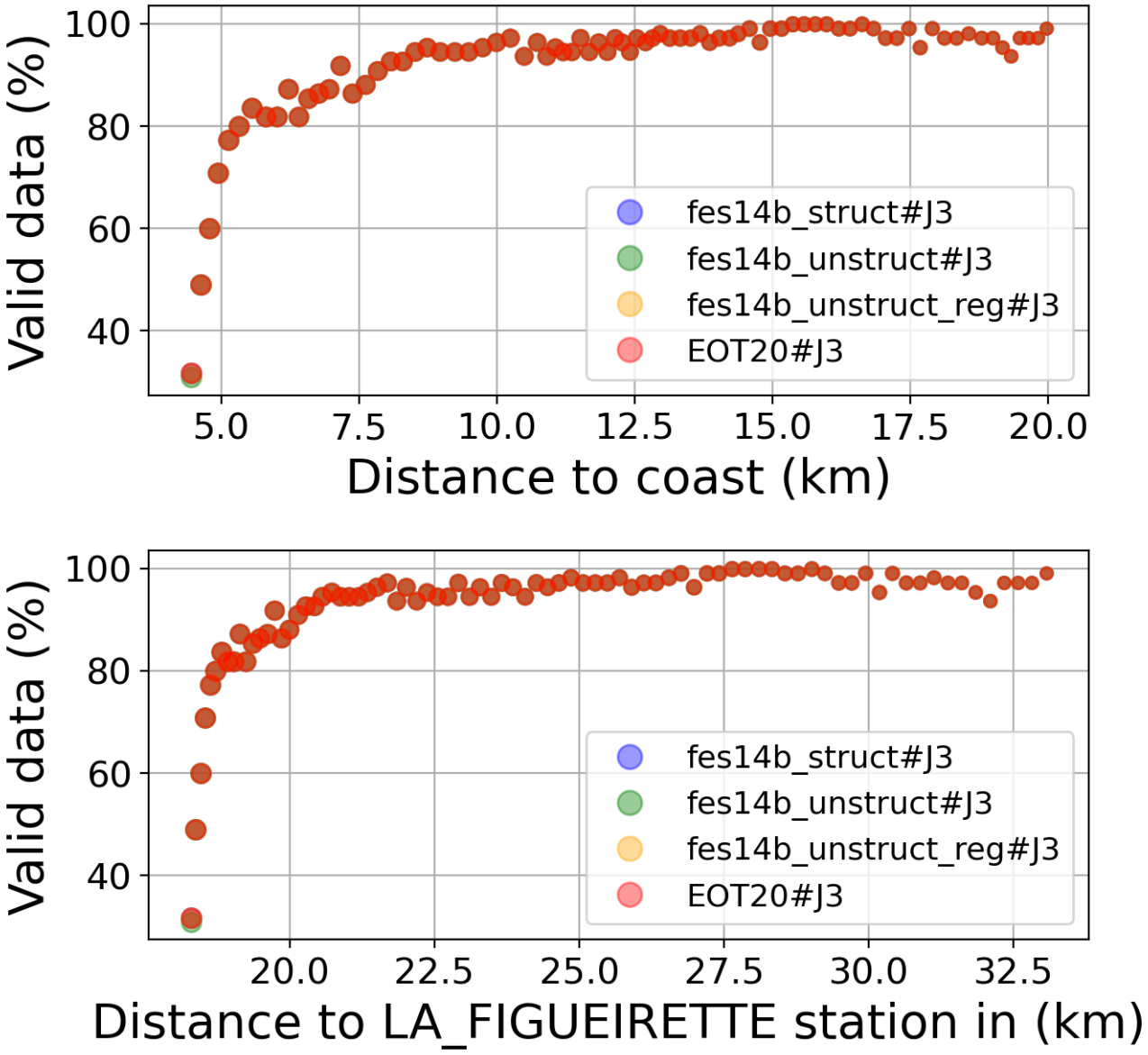

Figure 106 – Valid data (%) in function of distance to coast/LA_FIGUEIRETTE station

6.4.6 Std in function of distance to coast/LA_FIGUEIRETTE station

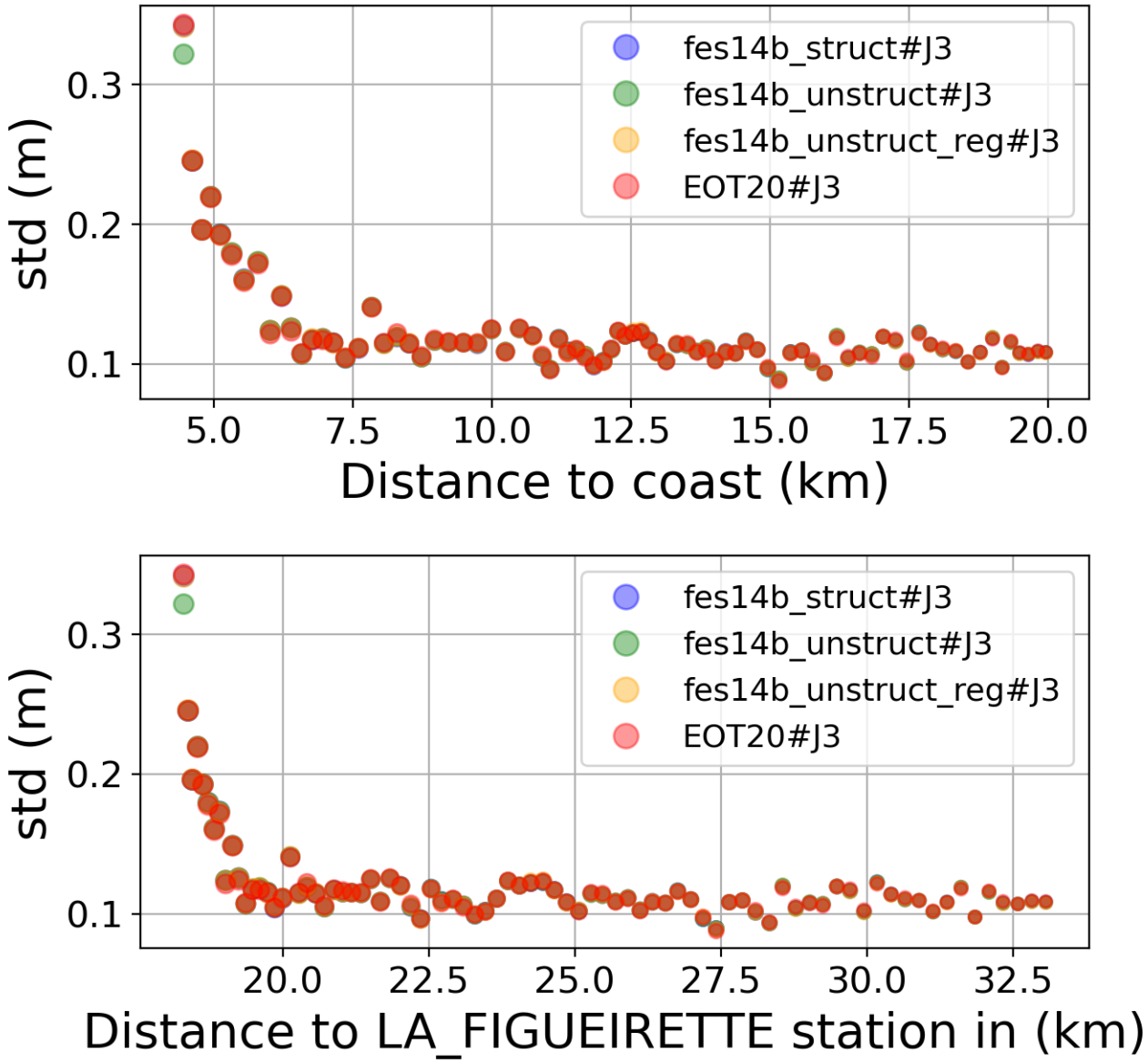

FIGURE 107 – Std in function of the distance to the coast/LA_FIGUEIRETTE station

6.4.7 Correlation in function of distance to coast/LA_FIGUEIRETTE station

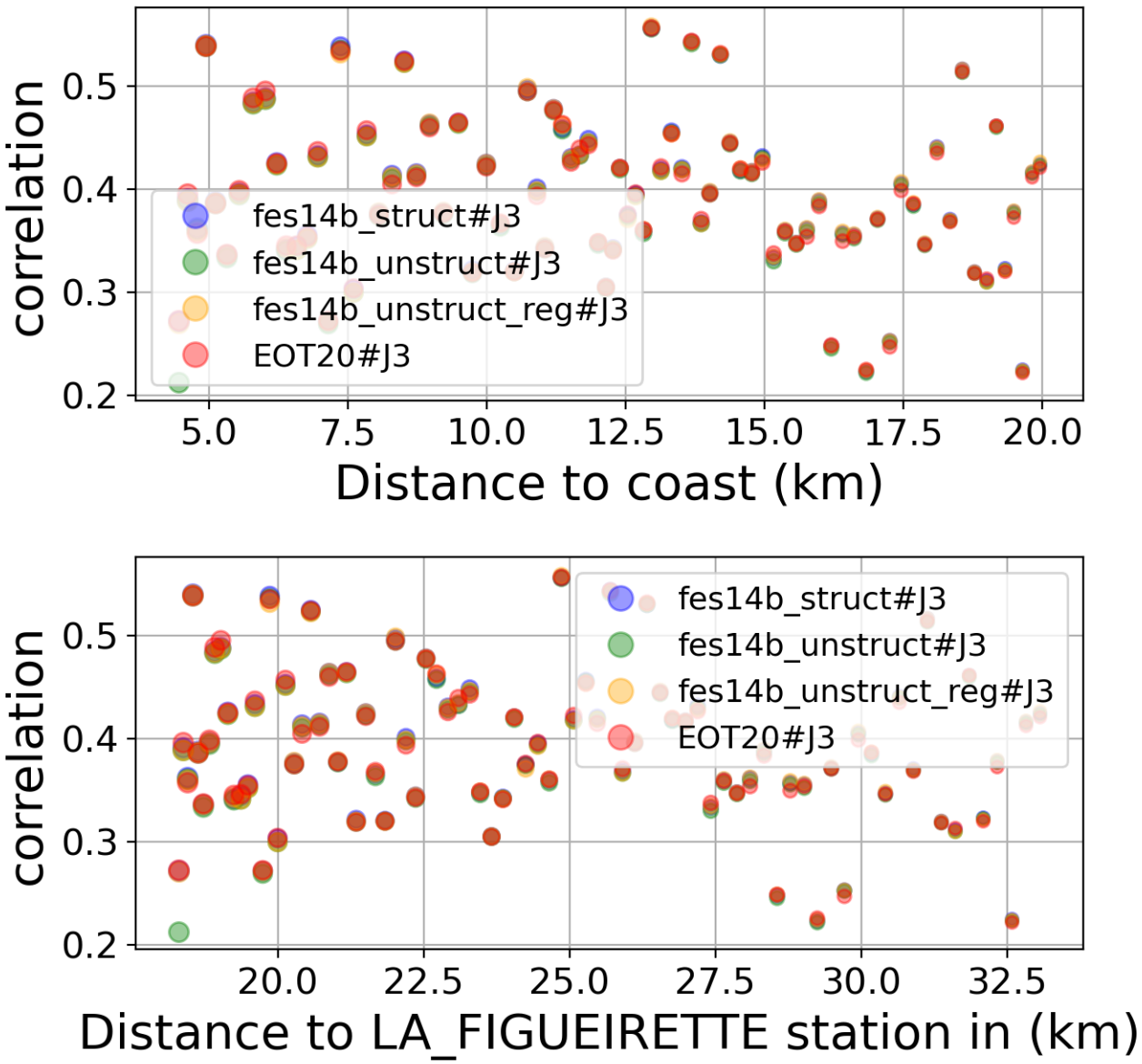

FIGURE 108 – Correlation in function of the distance to the coast/LA_FIGUEIRETTE station

6.4.8 Taylor Diagram

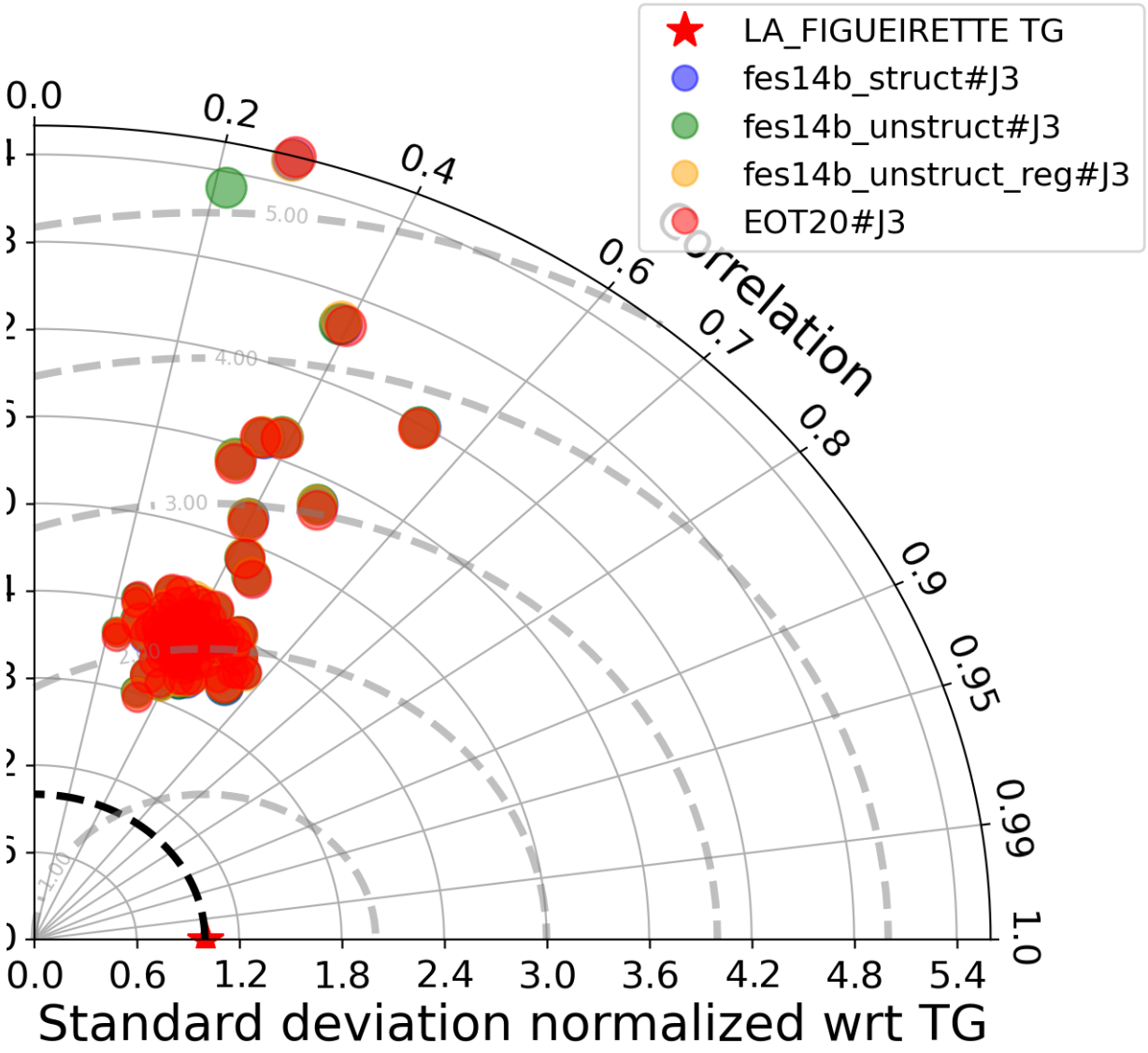

Figure 109 – Taylor diagram

6.4.9 Mean statistics table of products comparison with LA_FIGUEIRETTE tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	92.637	0.395	0.122	0.113
fes14b_unstruct#J3	92.626	0.392	0.122	0.113
fes14b_unstruct_reg#J3	92.637	0.394	0.122	0.113
EOT20#J3	92.637	0.394	0.122	0.113

FIGURE 110 – Mean statistics table of the common points in the altimetry products

6.4.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 110 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.049
fes14b_struct#J3	24.854	12.958	98.182	0.556	0.109
fes14b_unstruct#J3	24.854	12.958	98.182	0.556	0.108
fes14b_unstruct_reg#J3	24.854	12.958	98.182	0.559	0.108
EOT20#J3	24.854	12.958	98.182	0.557	0.109

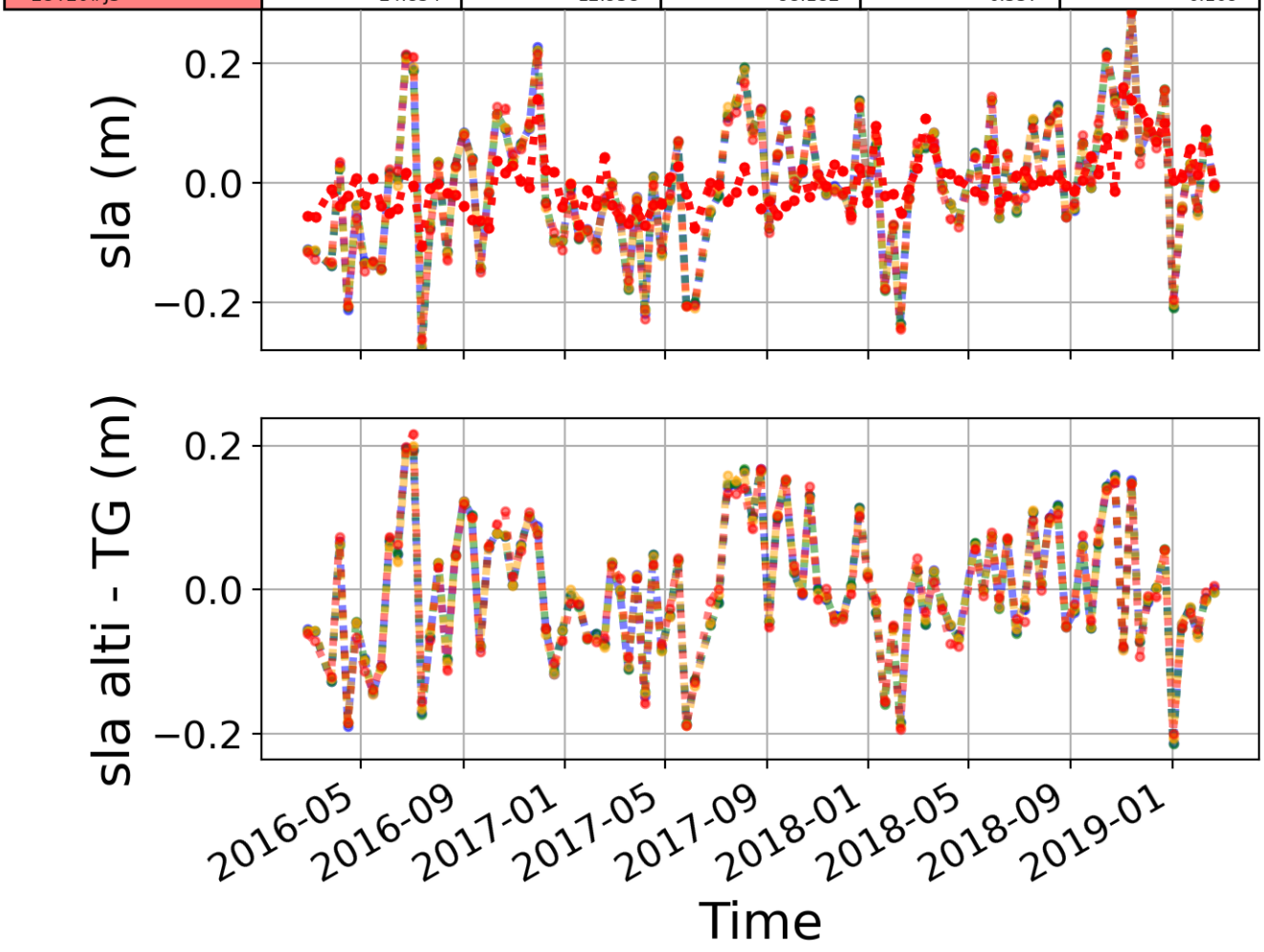

FIGURE 111 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.5 Station : Ancona

- Nearest track to Ancona station is the track number track161
- The area of interest is limited by :
  - A circle which it's center is the Ancona tide gauge station location and has a Raduis of 40 Km
  - Maximum distance to the coast : 20 Km

6.5.1 correlation visualization in maps view % Ancona tide gauge

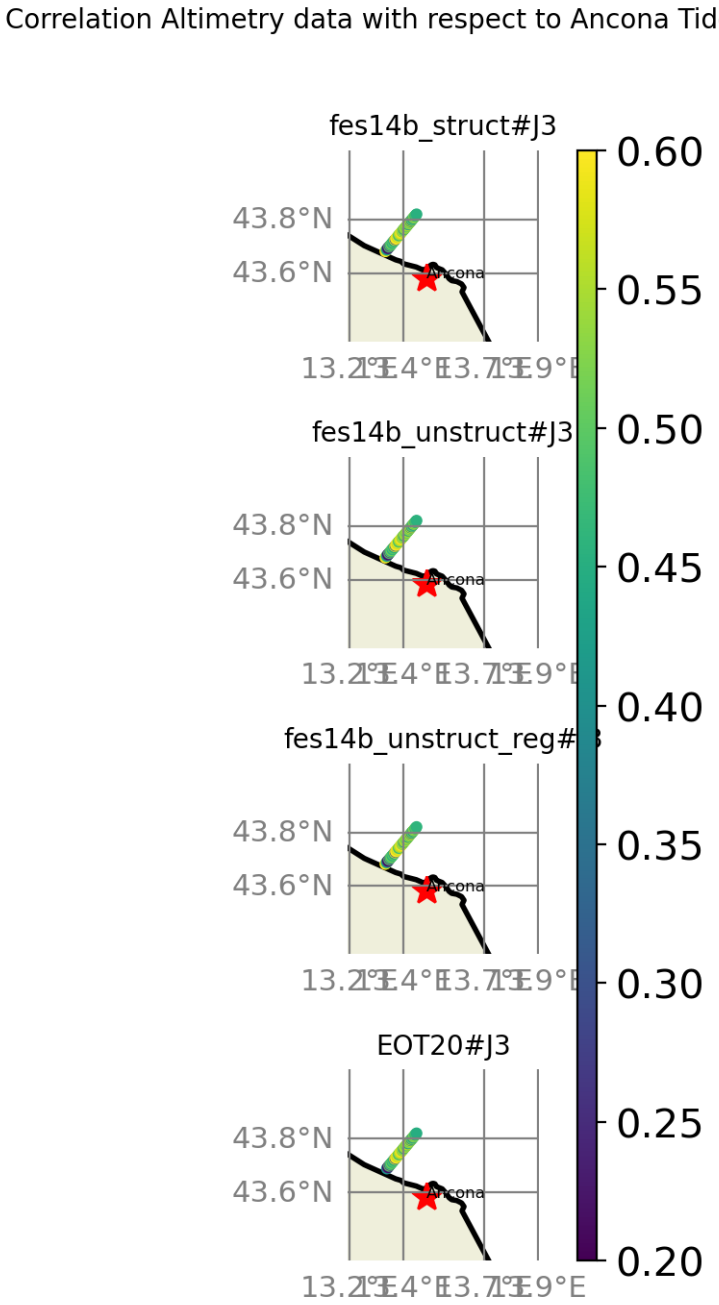

FIGURE 112 – correlation visualization in maps view % Ancona tide gauge

6.5.2 rmsd visualization in maps view % Ancona tide gauge

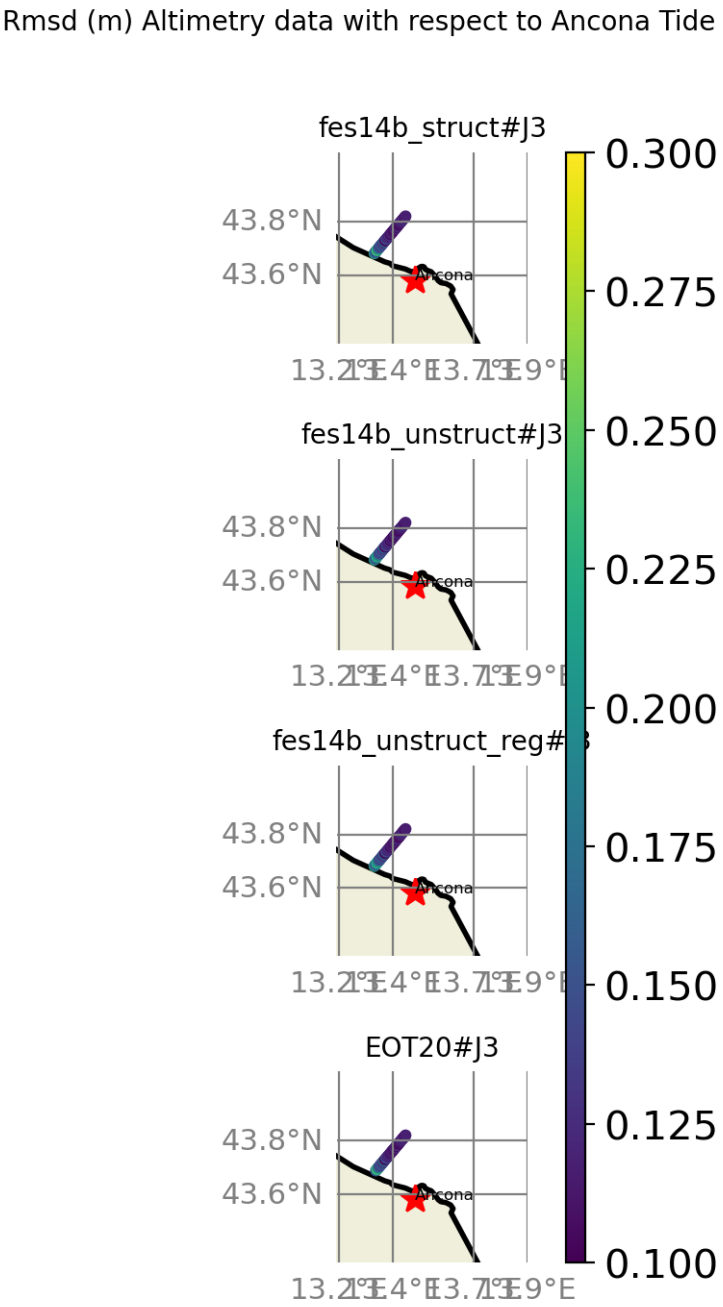

Figure 113 – rmsd visualization in maps view % Ancona tide gauge

6.5.3 std visualization in maps view % Ancona tide gauge

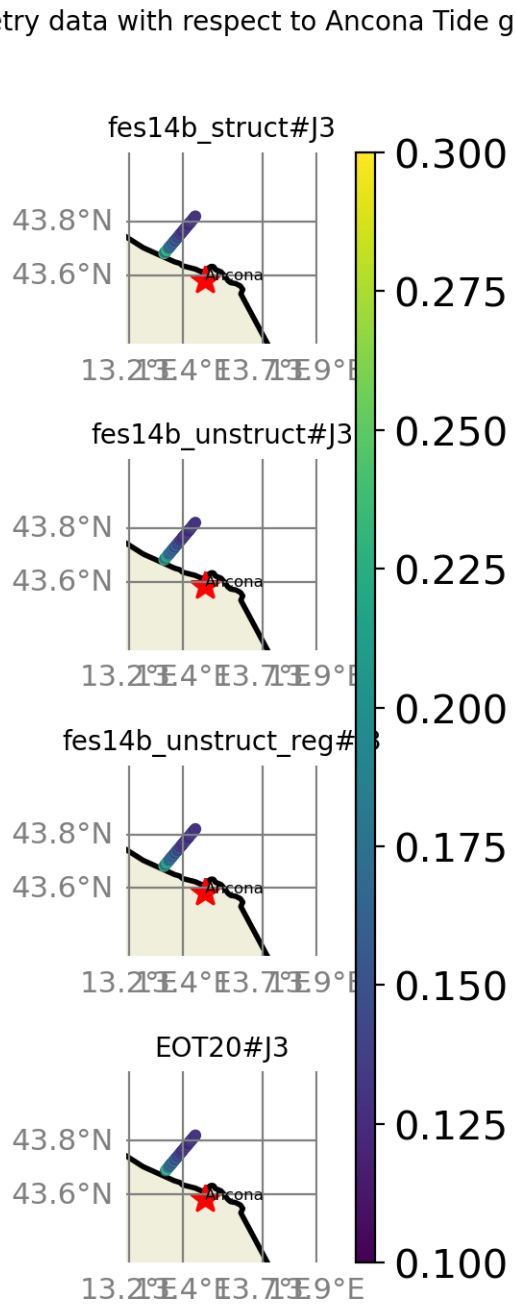

FIGURE 114 – std visualization in maps view % Ancona tide gauge

6.5.4 valid_data_percent visualization in maps view % Ancona tide gauge

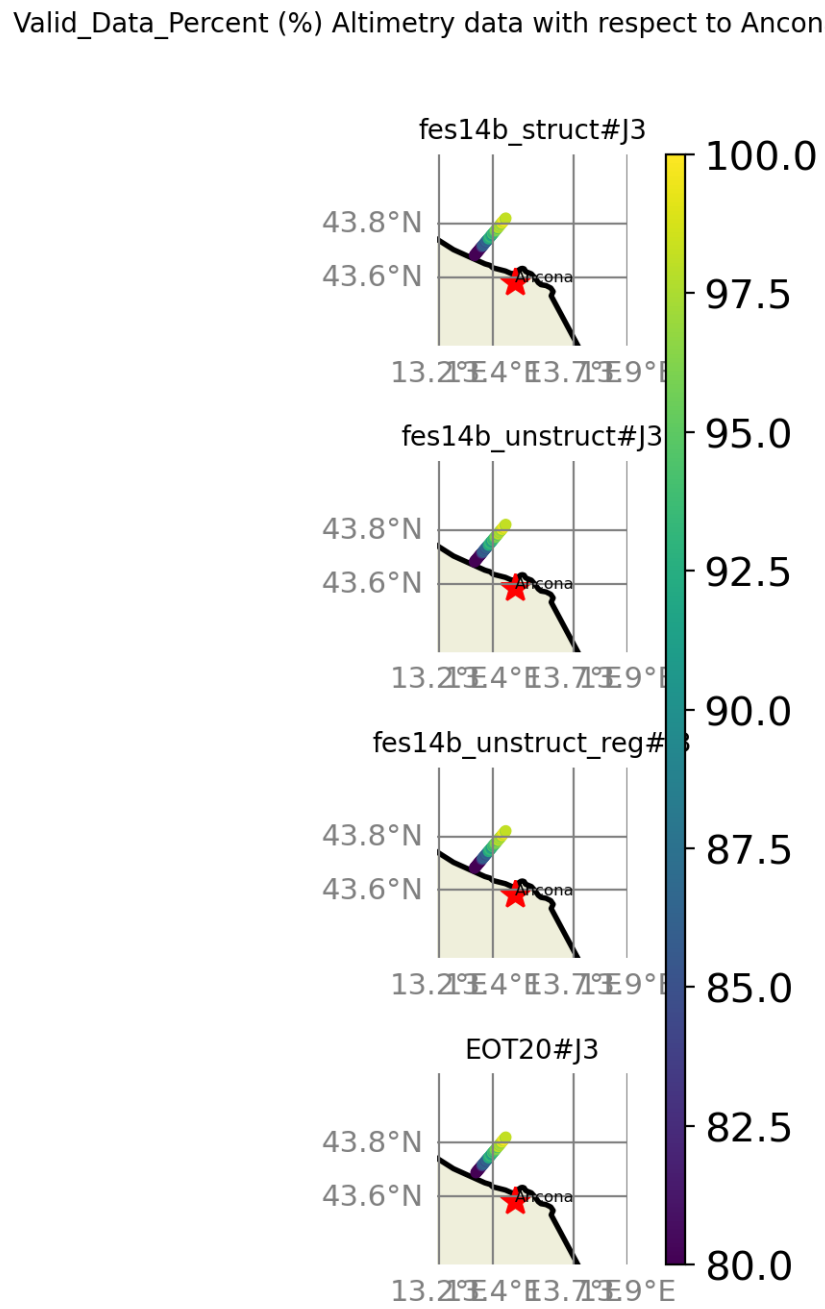

FIGURE 115 – valid_data_percent visualization in maps view % Ancona tide gauge

6.5.5 Valid data (%) in function of distance to coast/Ancona station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 110$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

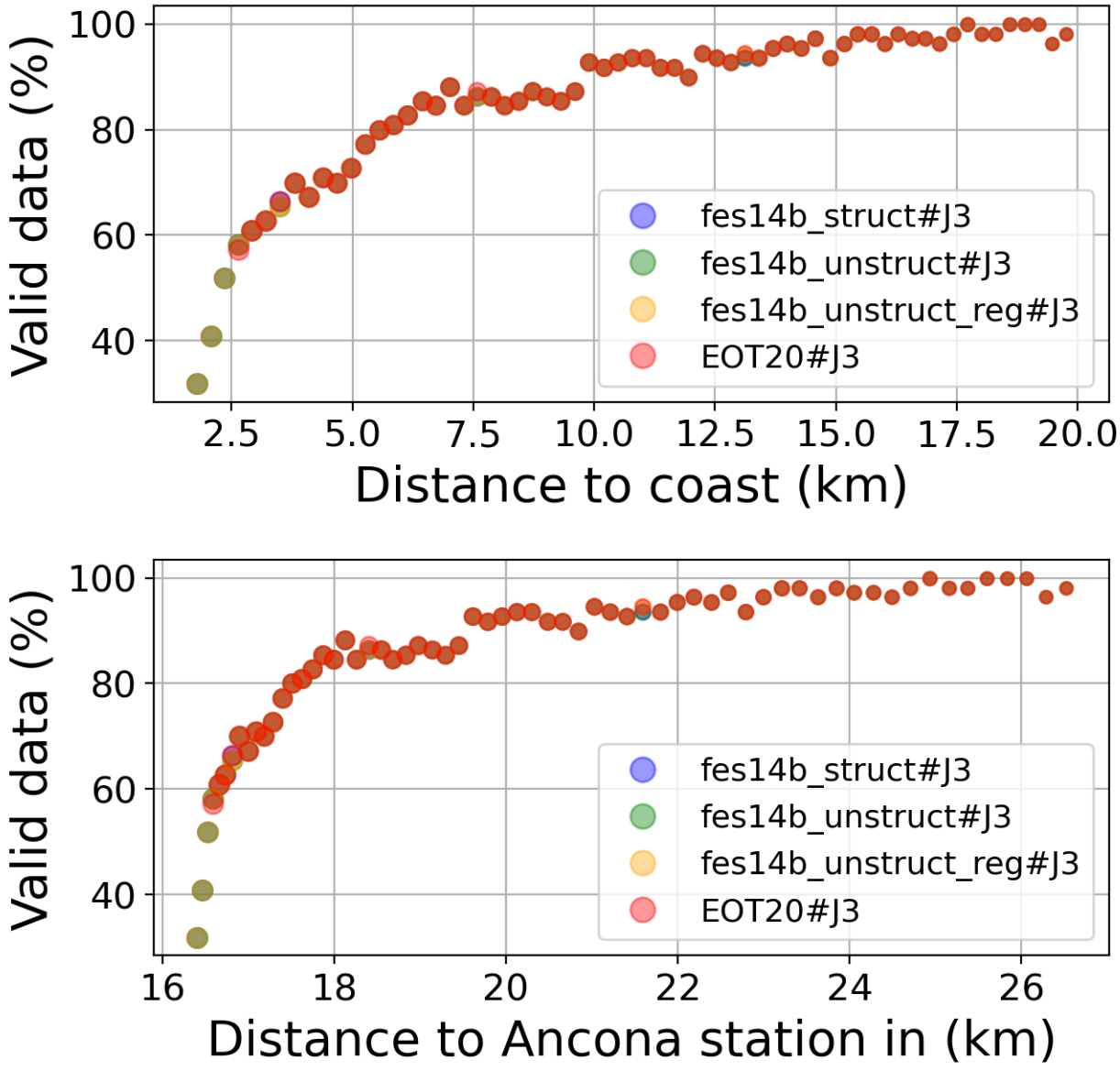

Figure 116 – Valid data (%) in function of distance to coast/Ancona station

6.5.6 Std in function of distance to coast/Ancona station

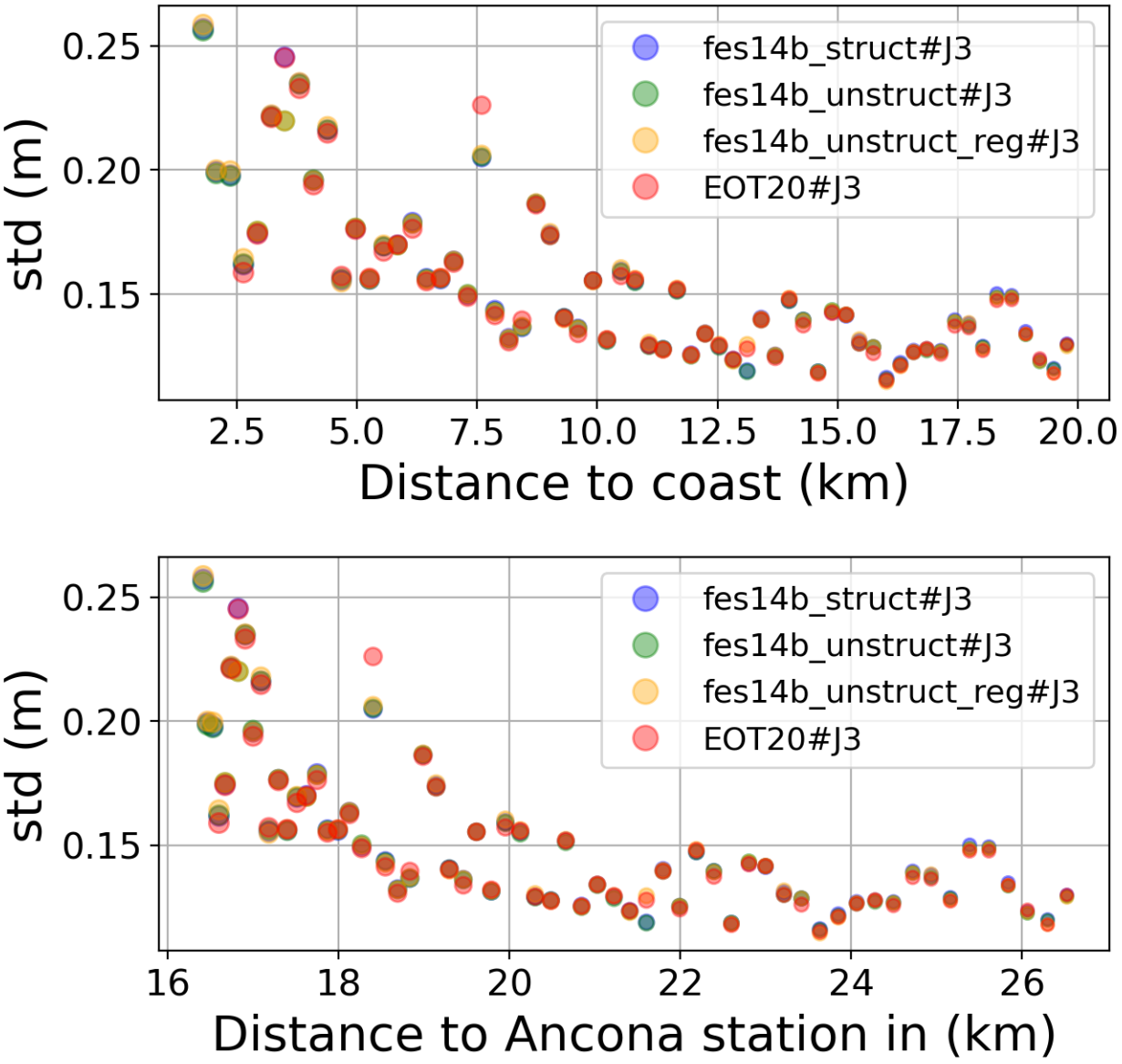

FIGURE 117 – Std in function of the distance to the coast/Ancona station

6.5.7 Correlation in function of distance to coast/Ancona station

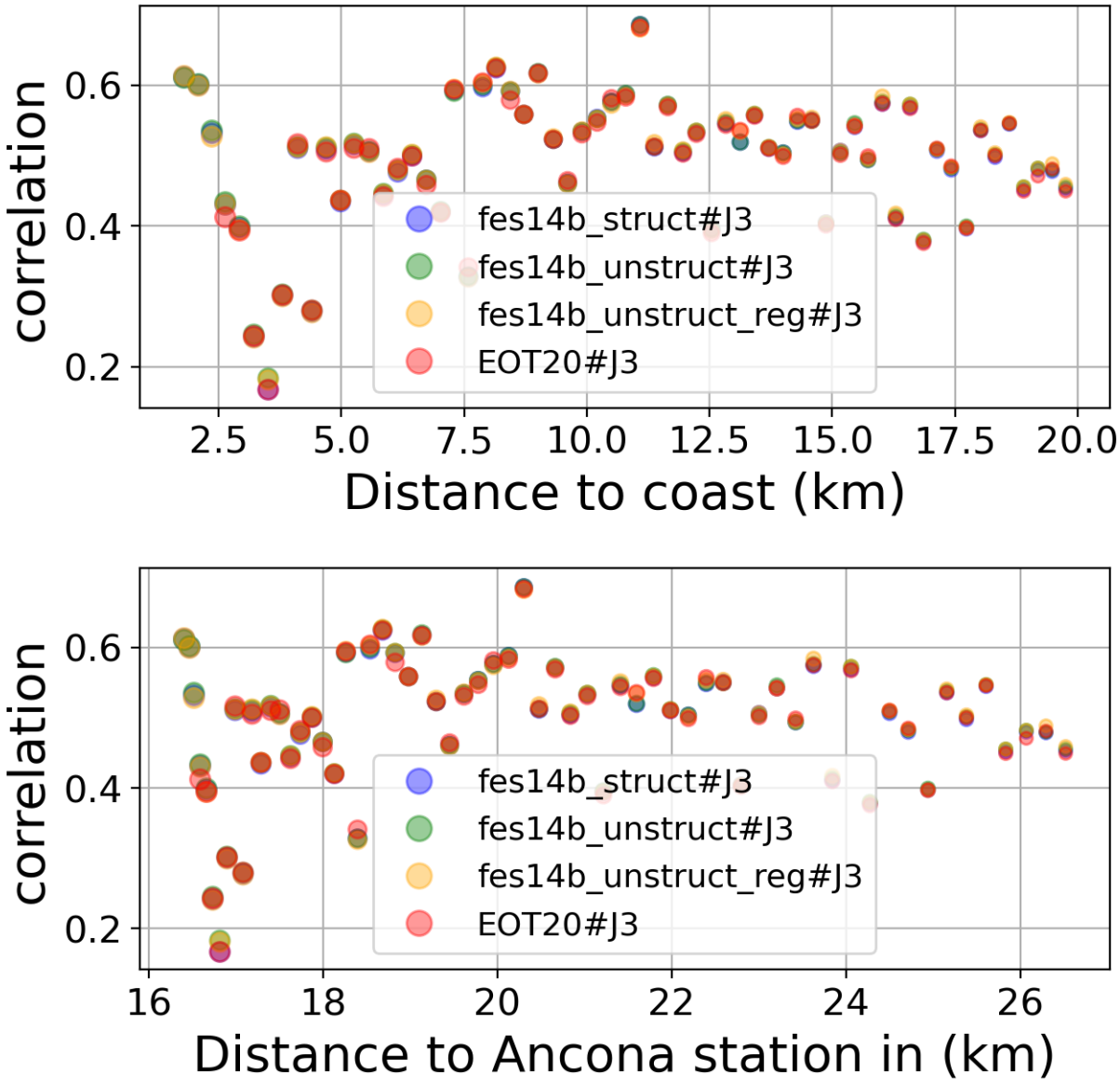

FIGURE 118 – Correlation in function of the distance to the coast/Ancona station

6.5.8 Taylor Diagram

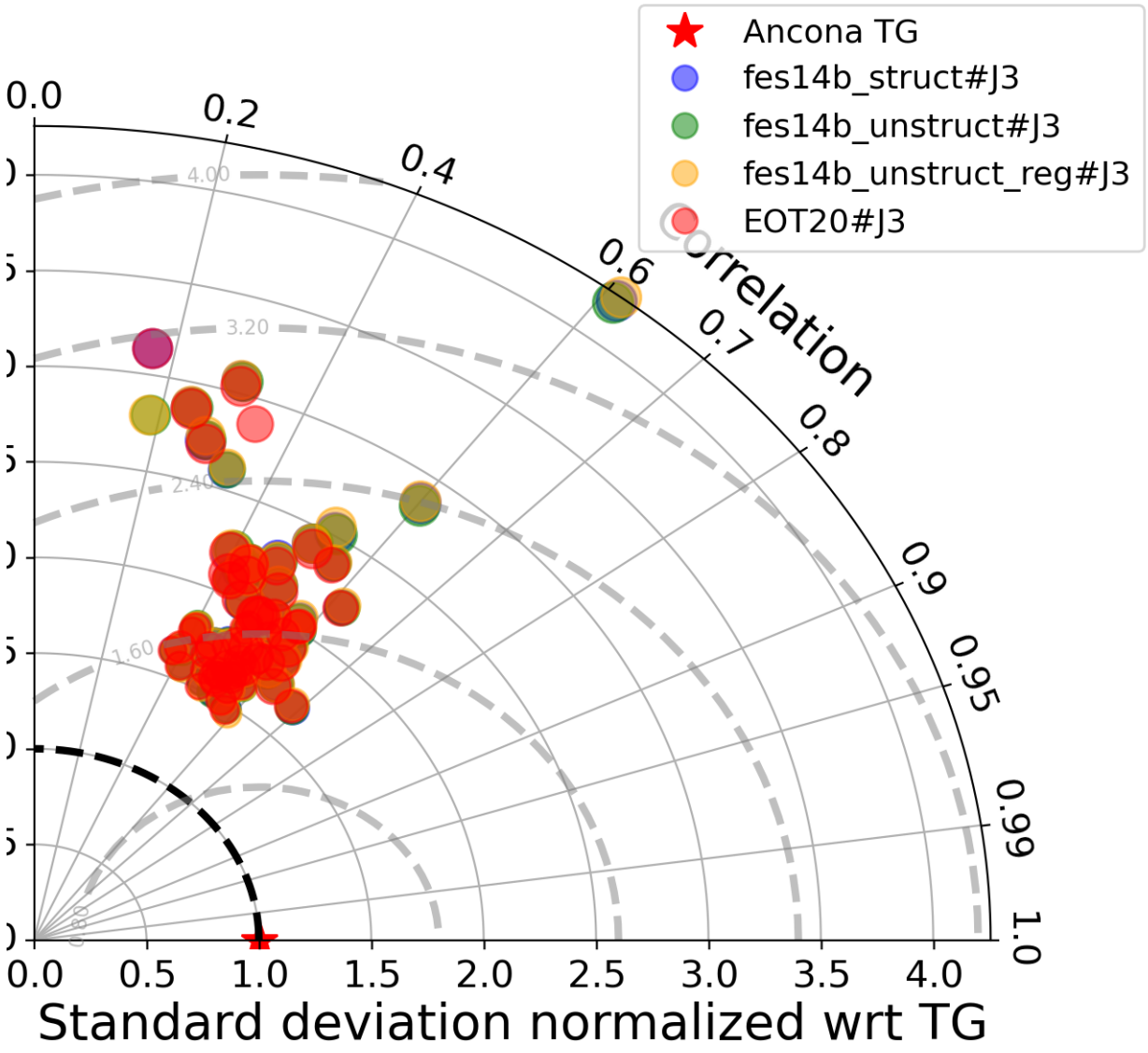

Figure 119 – Taylor diagram

6.5.9 Mean statistics table of products comparison with Ancona tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	88.394	0.49	0.151	0.132
fes14b_unstruct#J3	88.379	0.492	0.15	0.131
fes14b_unstruct_reg#J3	88.394	0.492	0.15	0.131
EOT20#J3	88.409	0.49	0.15	0.132

FIGURE 120 – Mean statistics table of the common points in the altimetry products

6.5.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 110 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.077
fes14b_struct#J3	20.3	11.071	93.636	0.686	0.129
fes14b_unstruct#J3	20.3	11.071	93.636	0.686	0.129
fes14b_unstruct_reg#J3	20.3	11.071	93.636	0.682	0.131
EOT20#J3	20.3	11.071	93.636	0.683	0.13

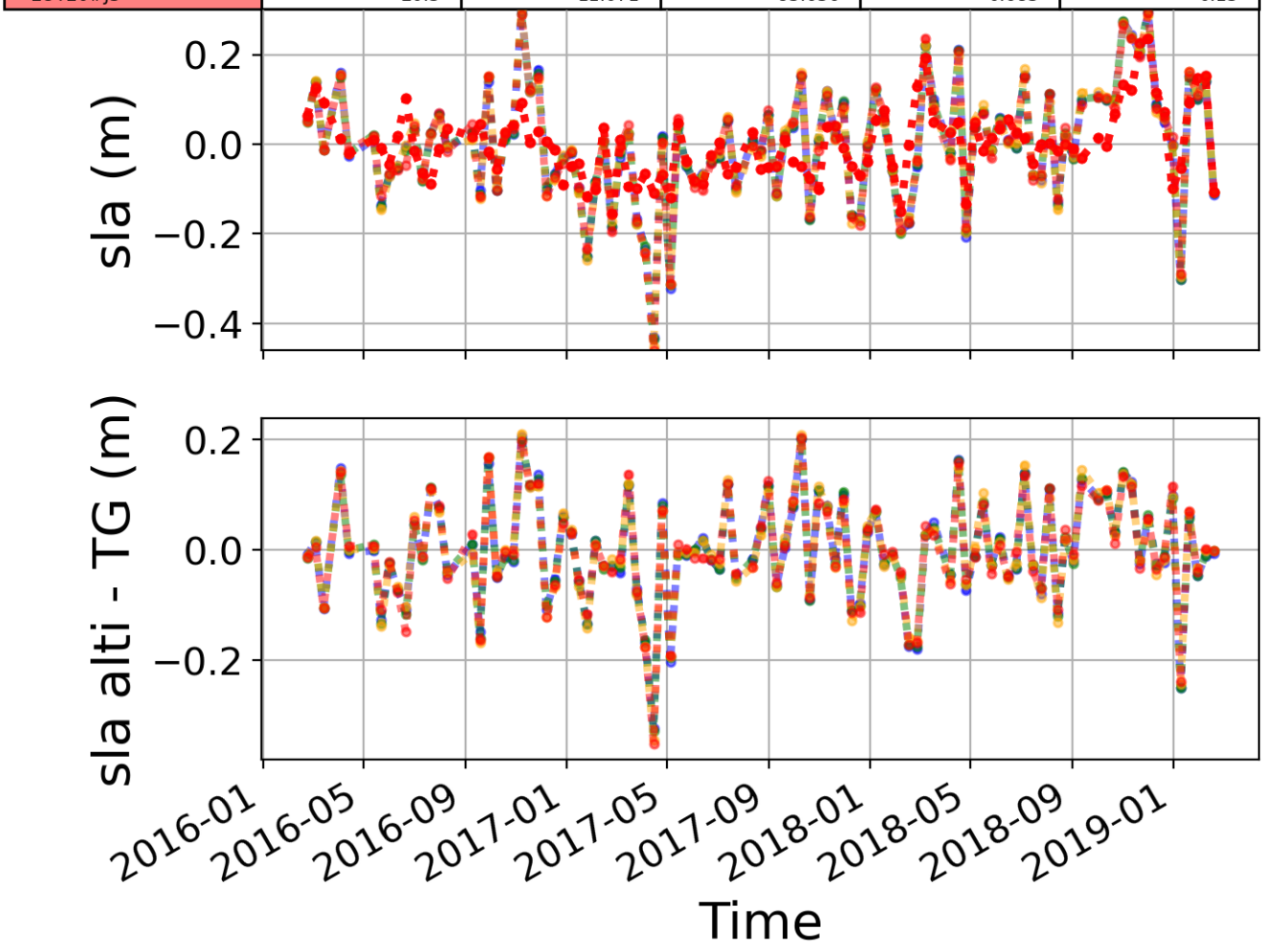

FIGURE 121 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.6 Station : Livourne

- Nearest track to Livourne station is the track number track85
- The area of interest is limited by :
  - A circle which it's center is the Livourne tide gauge station location and has a Raduis of 40 Km
  - Maximum distance to the coast : 20 Km

6.6.1 correlation visualization in maps view % Livourne tide gauge

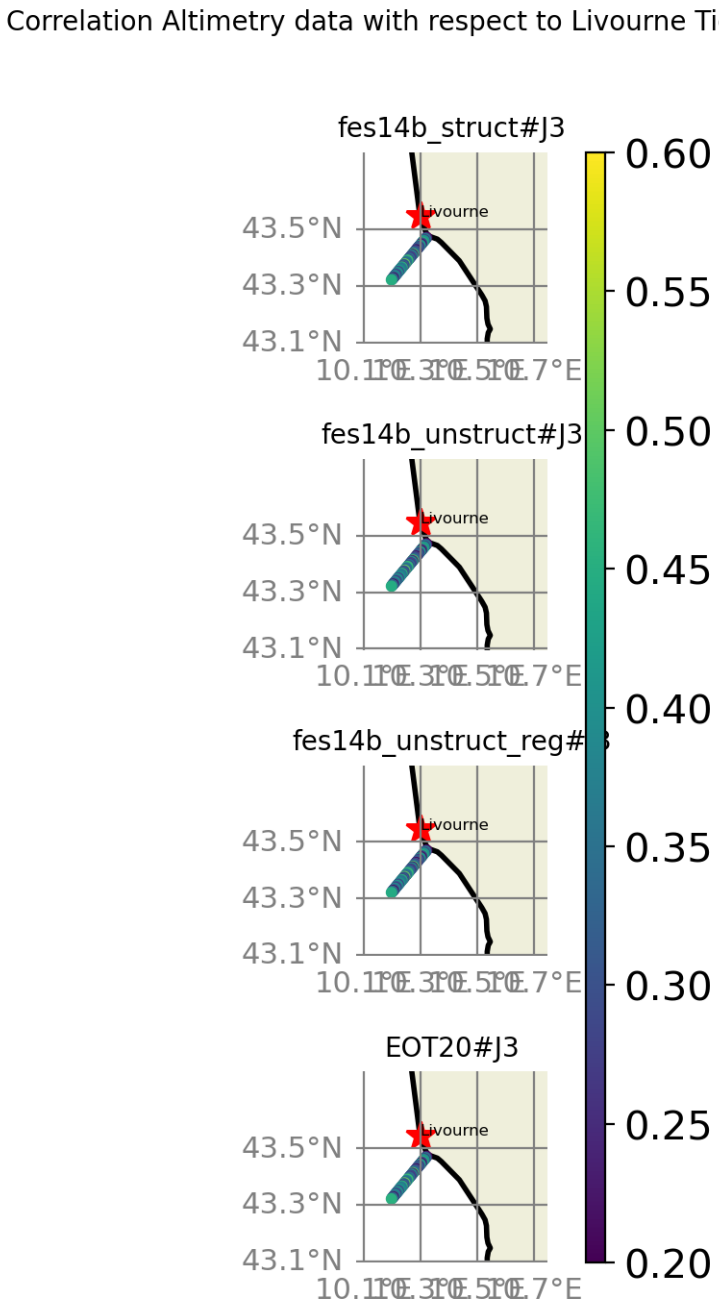

FIGURE 122 – correlation visualization in maps view % Livourne tide gauge

6.6.2 rmsd visualization in maps view % Livourne tide gauge

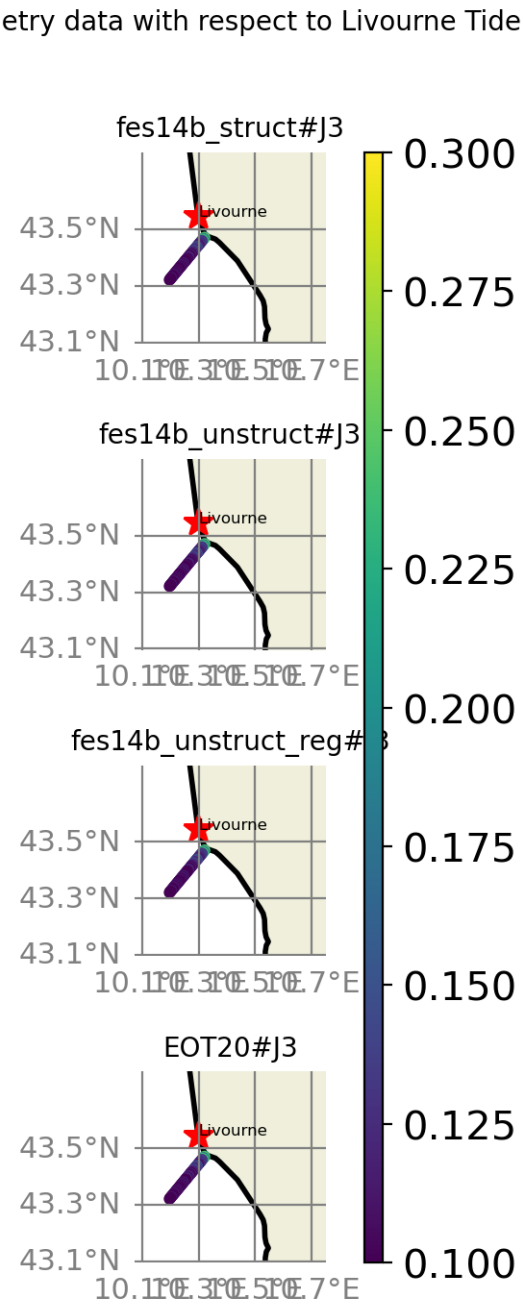

FIGURE 123 – rmsd visualization in maps view % Livourne tide gauge

6.6.3 std visualization in maps view % Livourne tide gauge

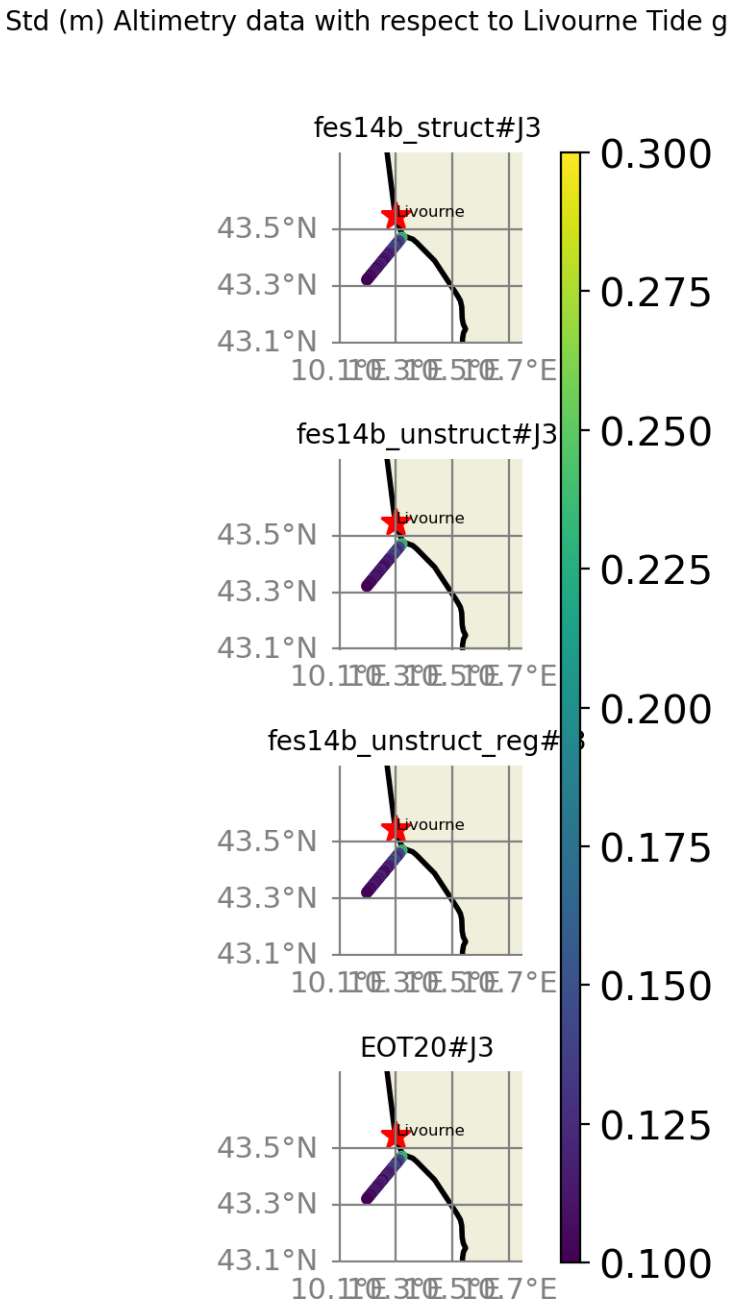

Figure 124 – std visualization in maps view % Livourne tide gauge

6.6.4 valid_data_percent visualization in maps view % Livourne tide gauge

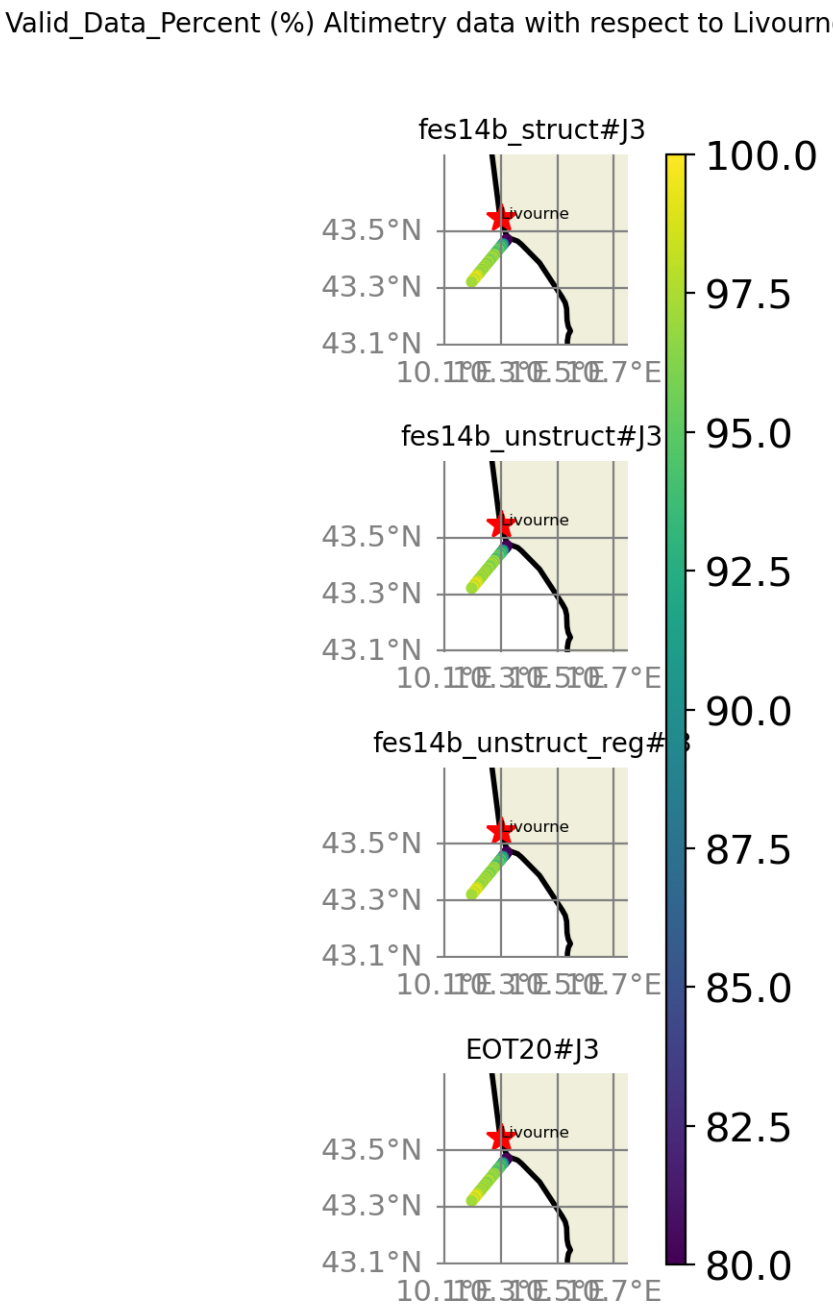

FIGURE 125 – valid_data_percent visualization in maps view % Livourne tide gauge

6.6.5 Valid data (%) in function of distance to coast/Livourne station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where pvd and nvd are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 109$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

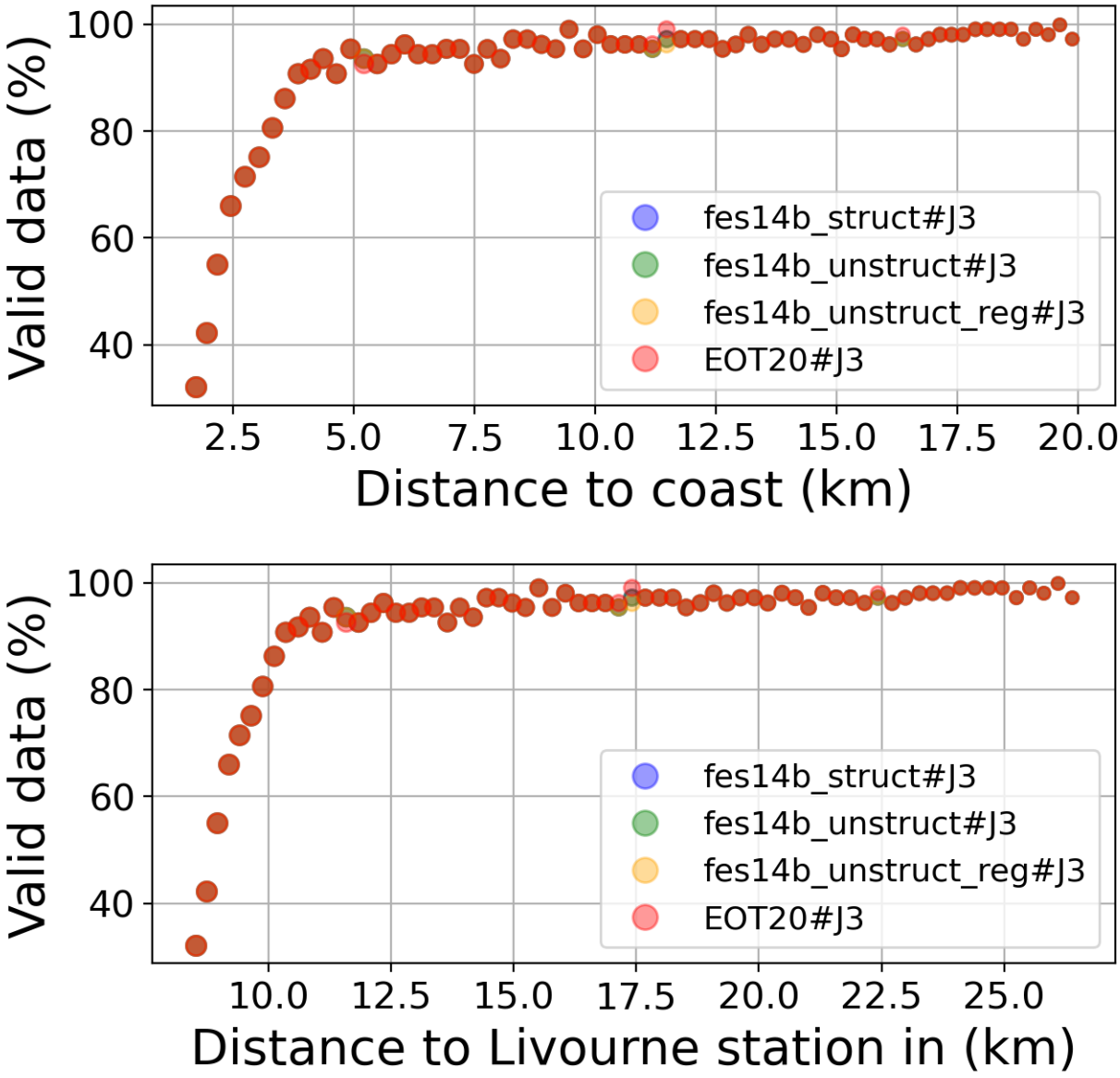

FIGURE 126 – Valid data (%) in function of distance to coast/Livourne station

6.6.6 Std in function of distance to coast/Livourne station

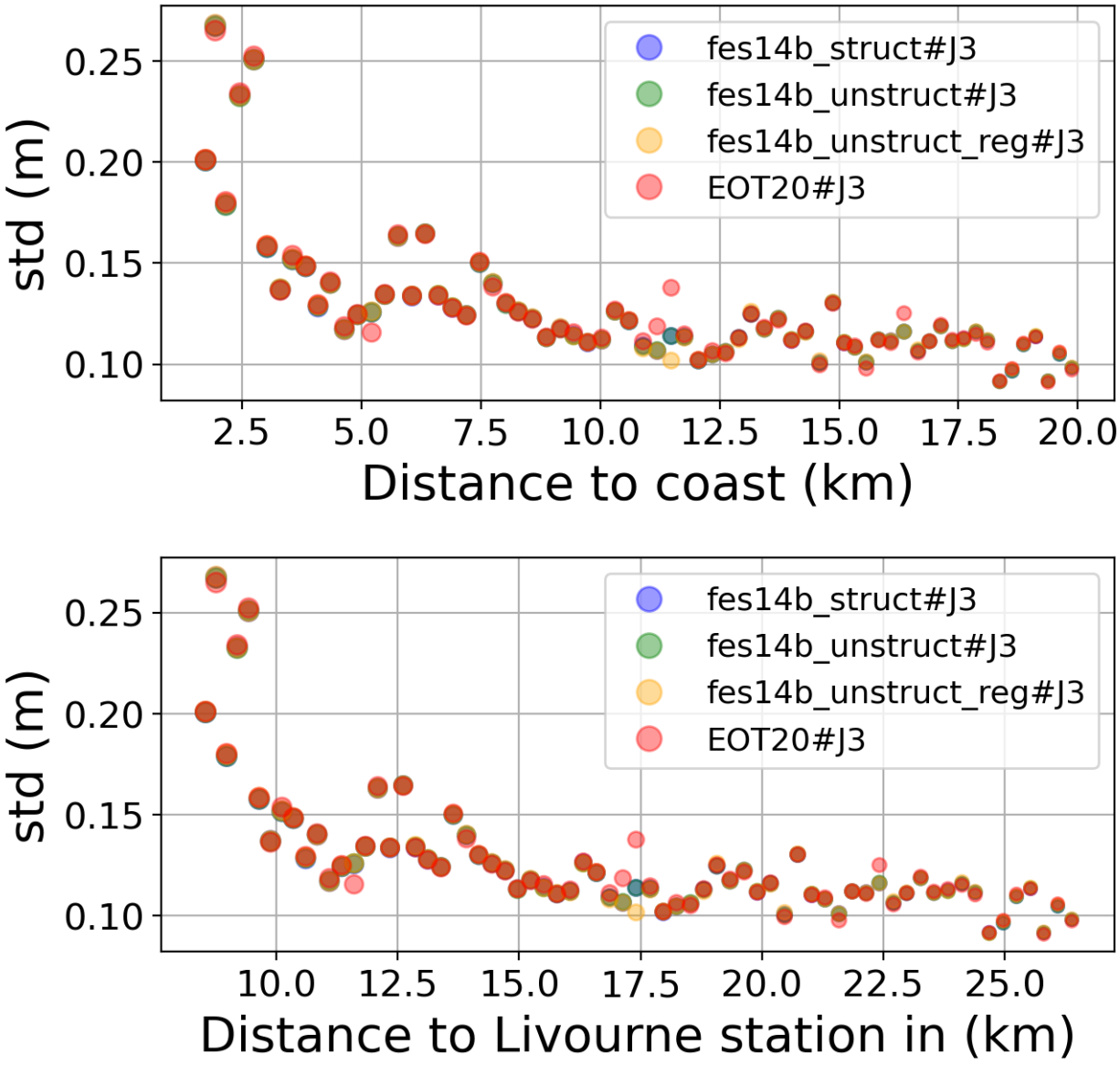

FIGURE 127 – Std in function of the distance to the coast/Livourne station

6.6.7 Correlation in function of distance to coast/Livourne station

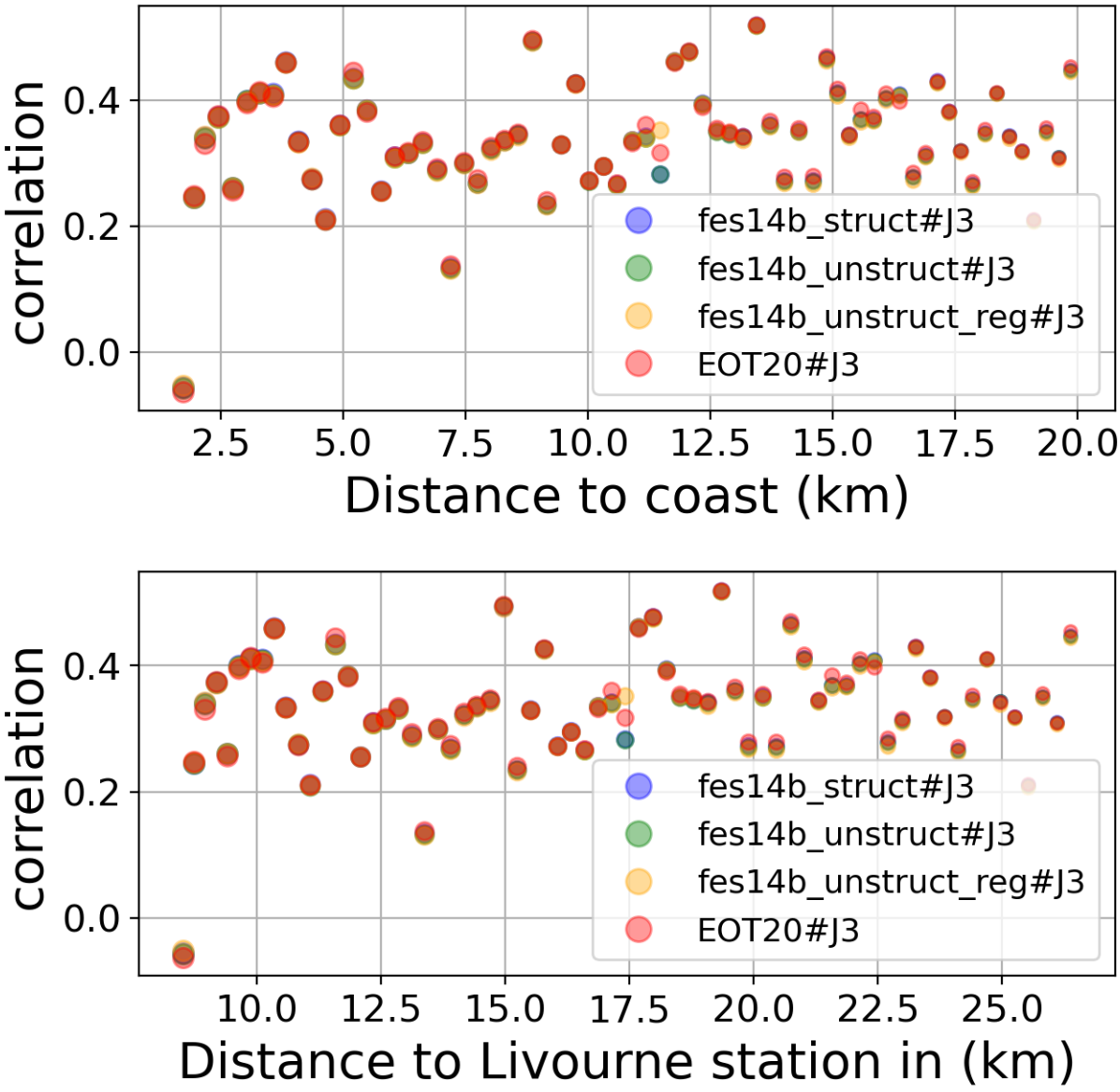

Figure 128 – Correlation in function of the distance to the coast/Livourne station

6.6.8 Taylor Diagram

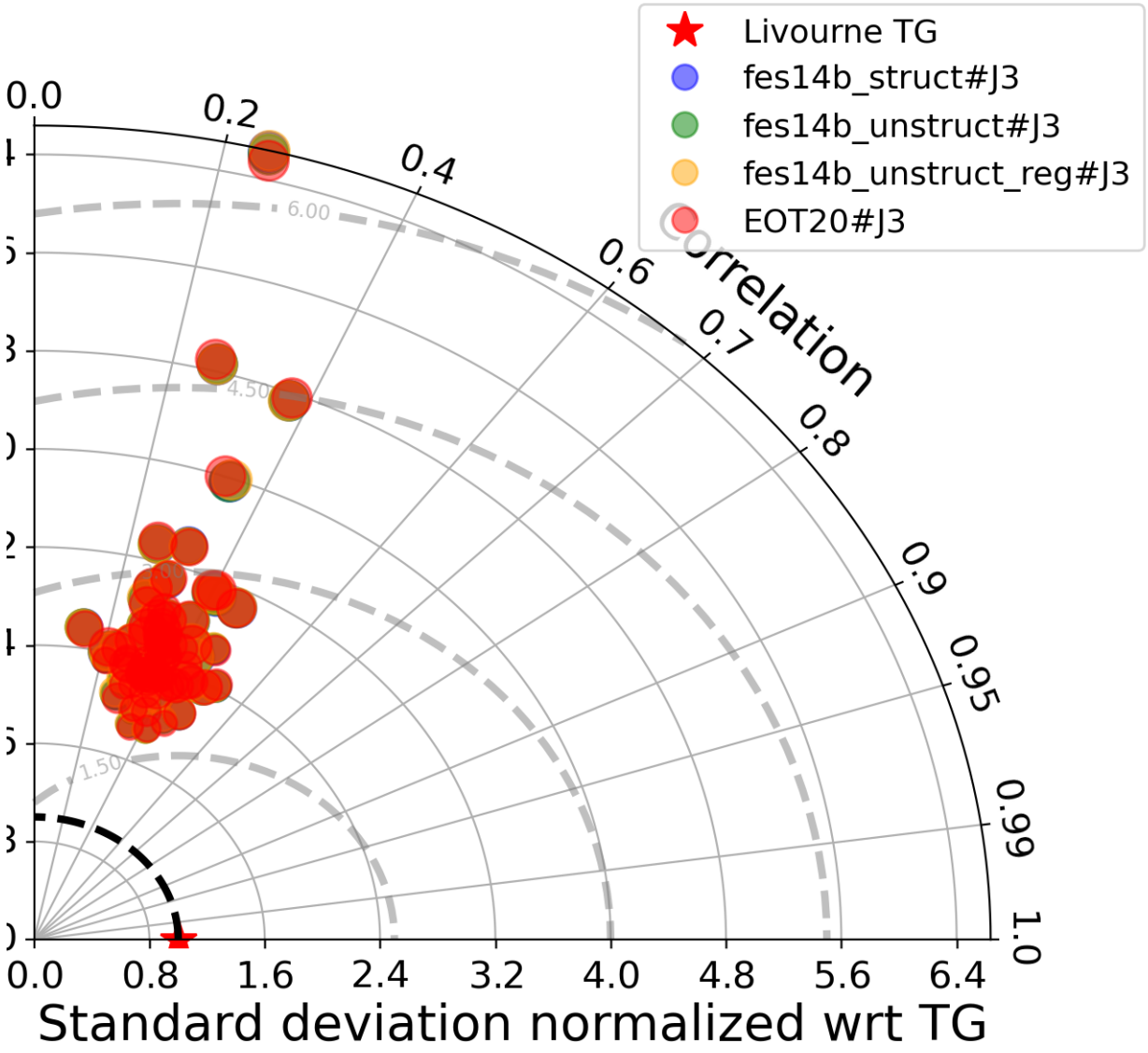

Figure 129 – Taylor diagram

6.6.9 Mean statistics table of products comparison with Livourne tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	92.539	0.338	0.128	0.121
fes14b_unstruct#J3	92.539	0.337	0.128	0.121
fes14b_unstruct_reg#J3	92.526	0.337	0.128	0.121
EOT20#J3	92.58	0.34	0.128	0.121

FIGURE 130 – Mean statistics table of the common points in the altimetry products

6.6.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 109 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.049
fes14b_struct#J3	19.343	13.432	96.33	0.52	0.118
fes14b_unstruct#J3	19.343	13.432	96.33	0.518	0.118
fes14b_unstruct_reg#J3	19.343	13.432	96.33	0.518	0.117
EOT20#J3	19.343	13.432	96.33	0.519	0.118

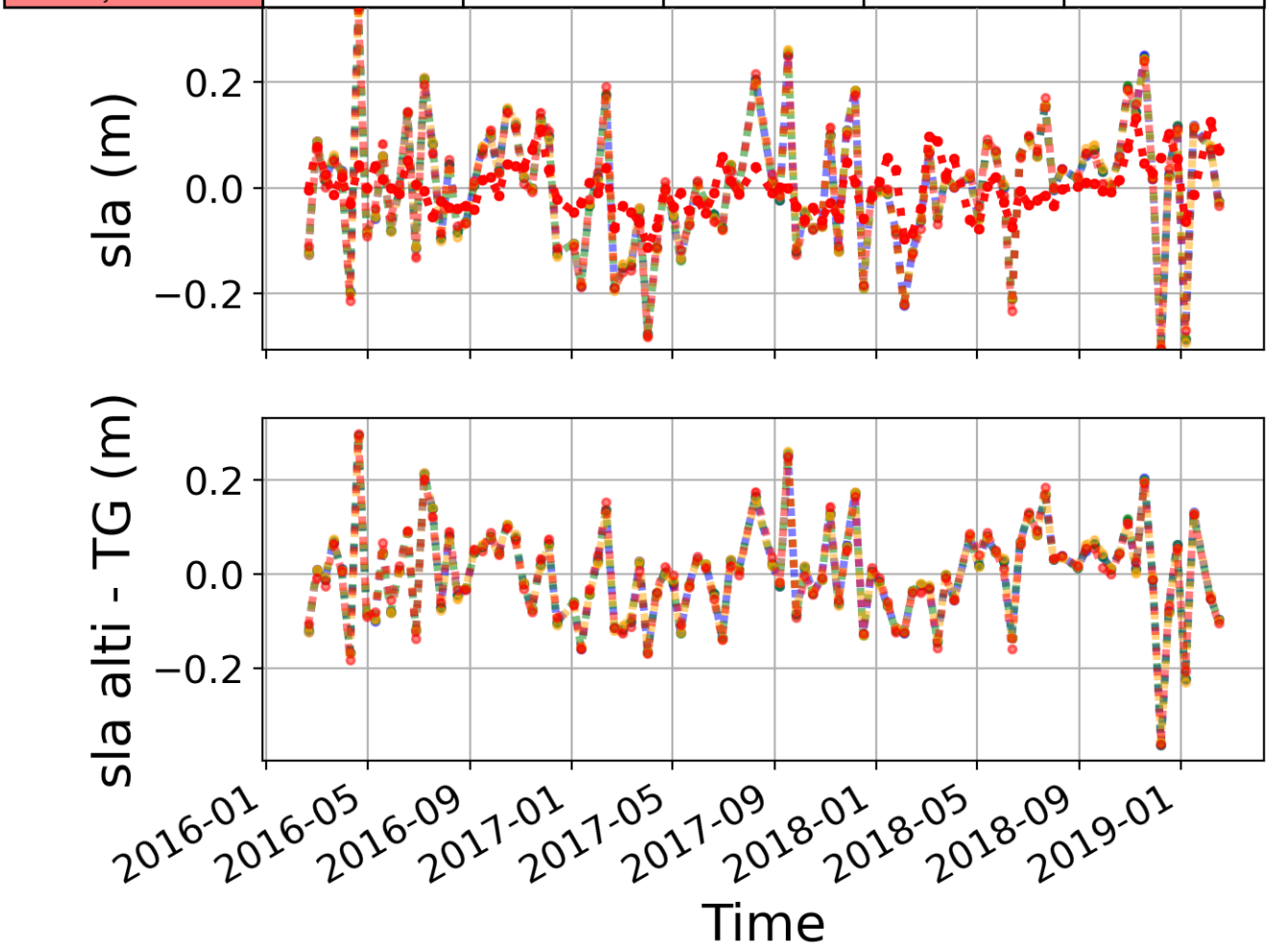

Figure 131 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.7 Station : MONACO_FONTVIEILLE

- Nearest track to MONACO_FONTVIEILLE station is the track number track9
- The area of interest is limited by :
  - A circle which it's center is the MONACO_FONTVIEILLE tide gauge station location and has a Raduis of 40 Km

6.7.1 correlation visualization in maps view % MONACO_FONTVIEILLE tide gauge

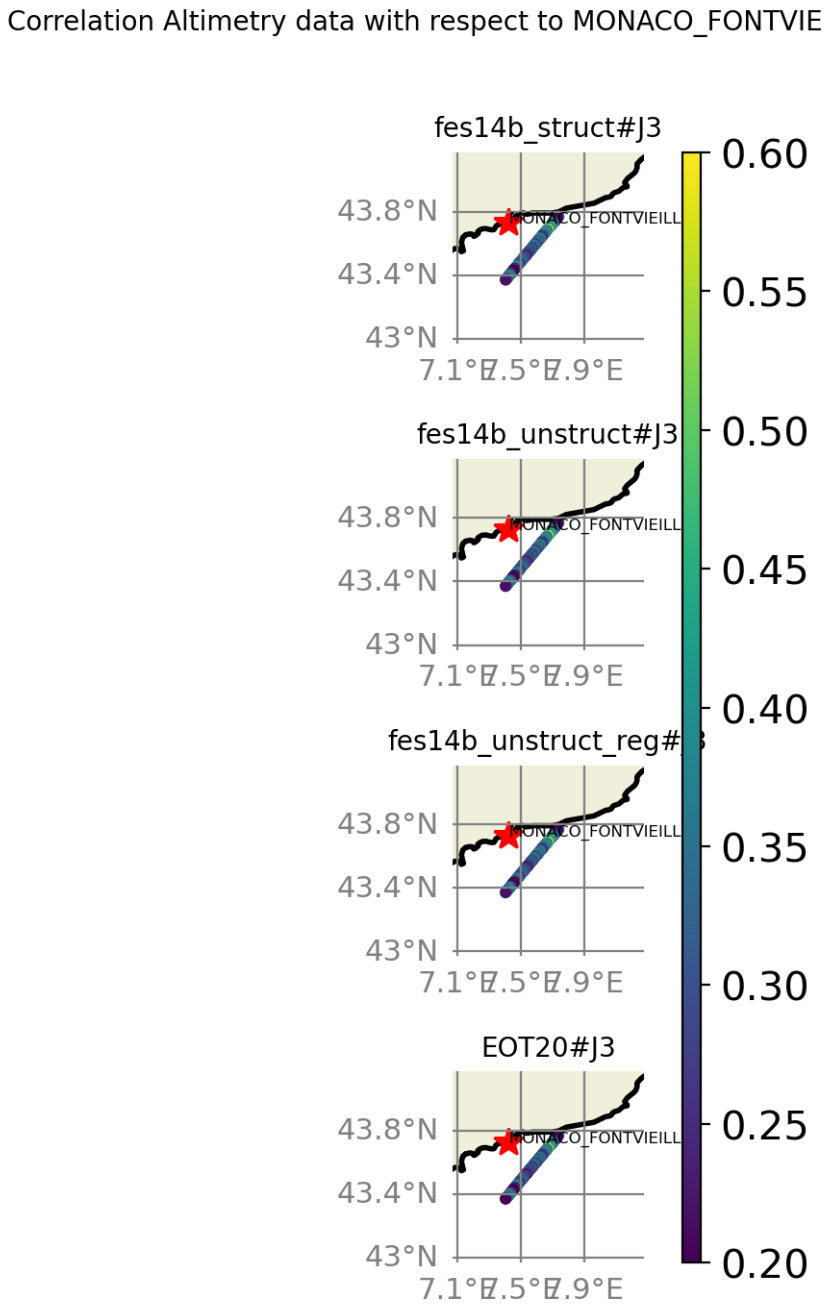

Figure 132 – correlation visualization in maps view % MONACO_FONTVIEILLE tide gauge

6.7.2 rmsd visualization in maps view % MONACO_FONTVIEILLE tide gauge

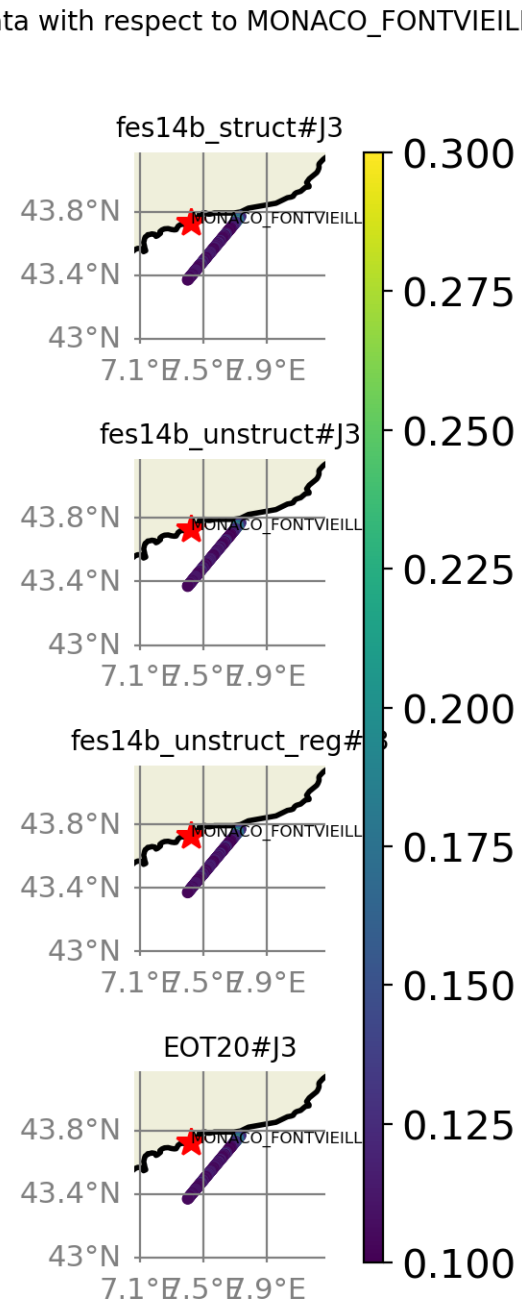

FIGURE 133 – rmsd visualization in maps view % MONACO_FONTVIEILLE tide gauge

6.7.3 std visualization in maps view % MONACO_FONTVIEILLE tide gauge

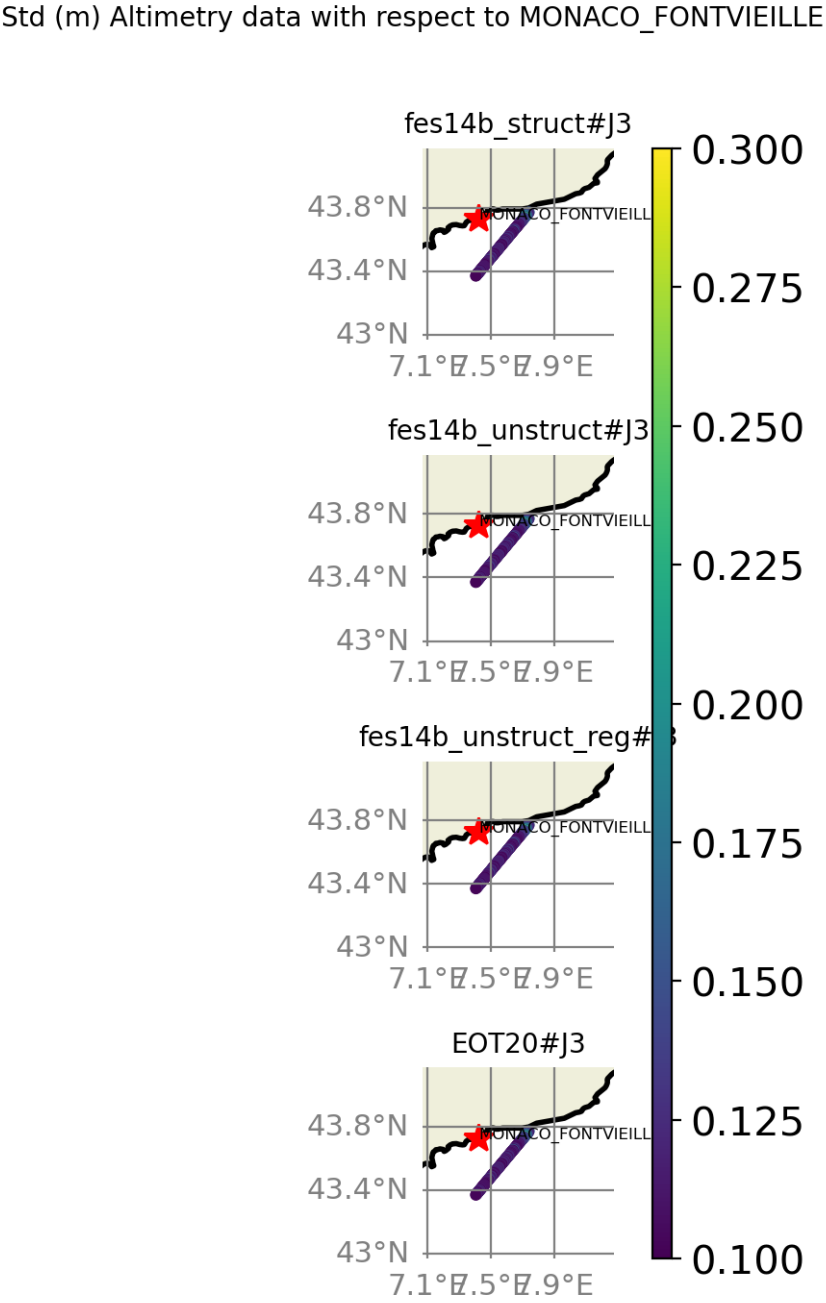

Figure 134 – std visualization in maps view % MONACO_FONTVIEILLE tide gauge

6.7.4 valid_data_percent visualization in maps view % MONACO_FONTVIEILLE tide gauge

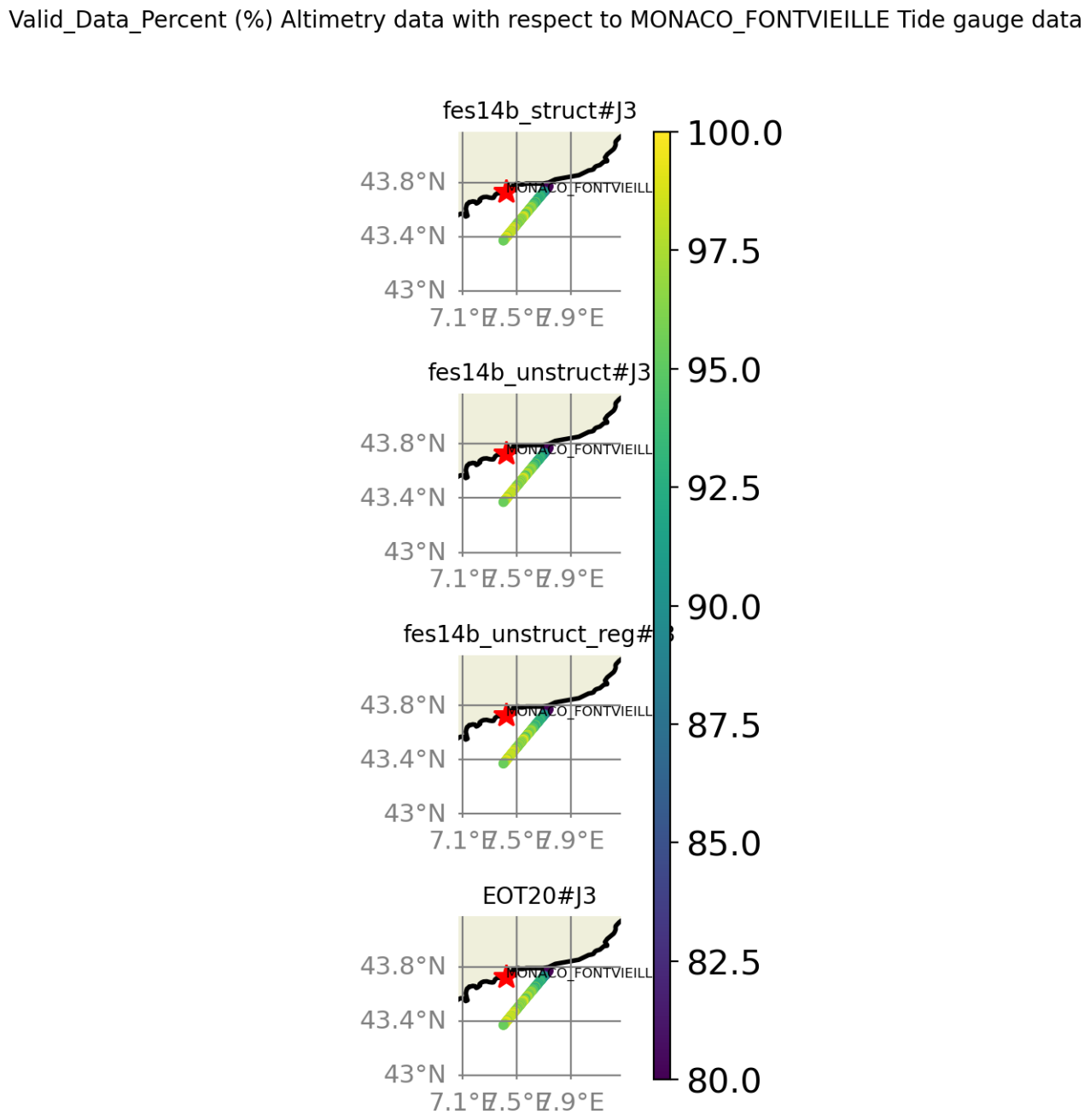

FIGURE 135 – valid_data_percent visualization in maps view % MONACO_FONTVIEILLE tide gauge

6.7.5 Valid data (%) in function of distance to coast/MONACO_FONTVIEILLE station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 110$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

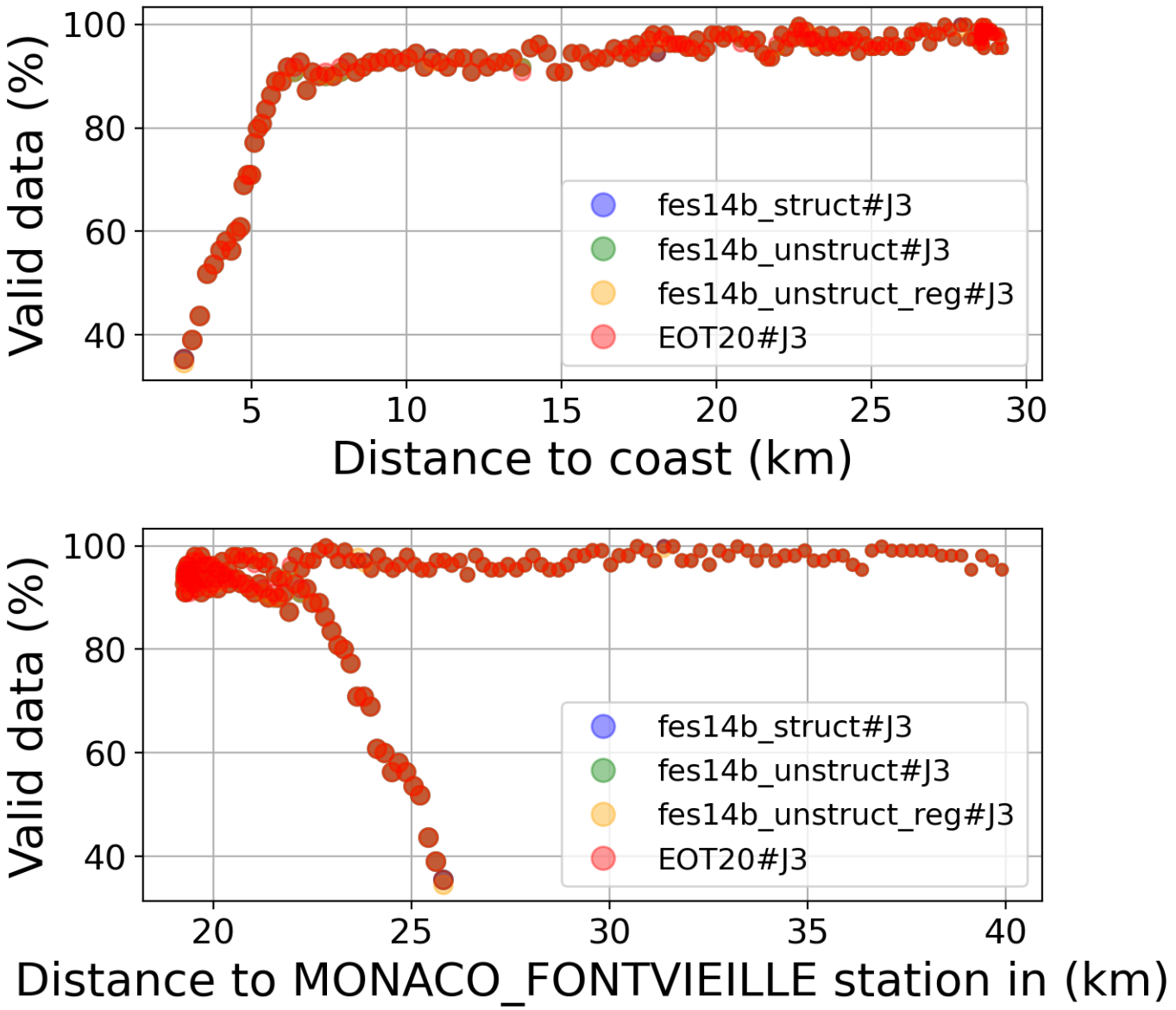

FIGURE 136 – Valid data (%) in function of distance to coast/MONACO_FONTVIEILLE station

6.7.6 Std in function of distance to coast/MONACO_FONTVIEILLE station

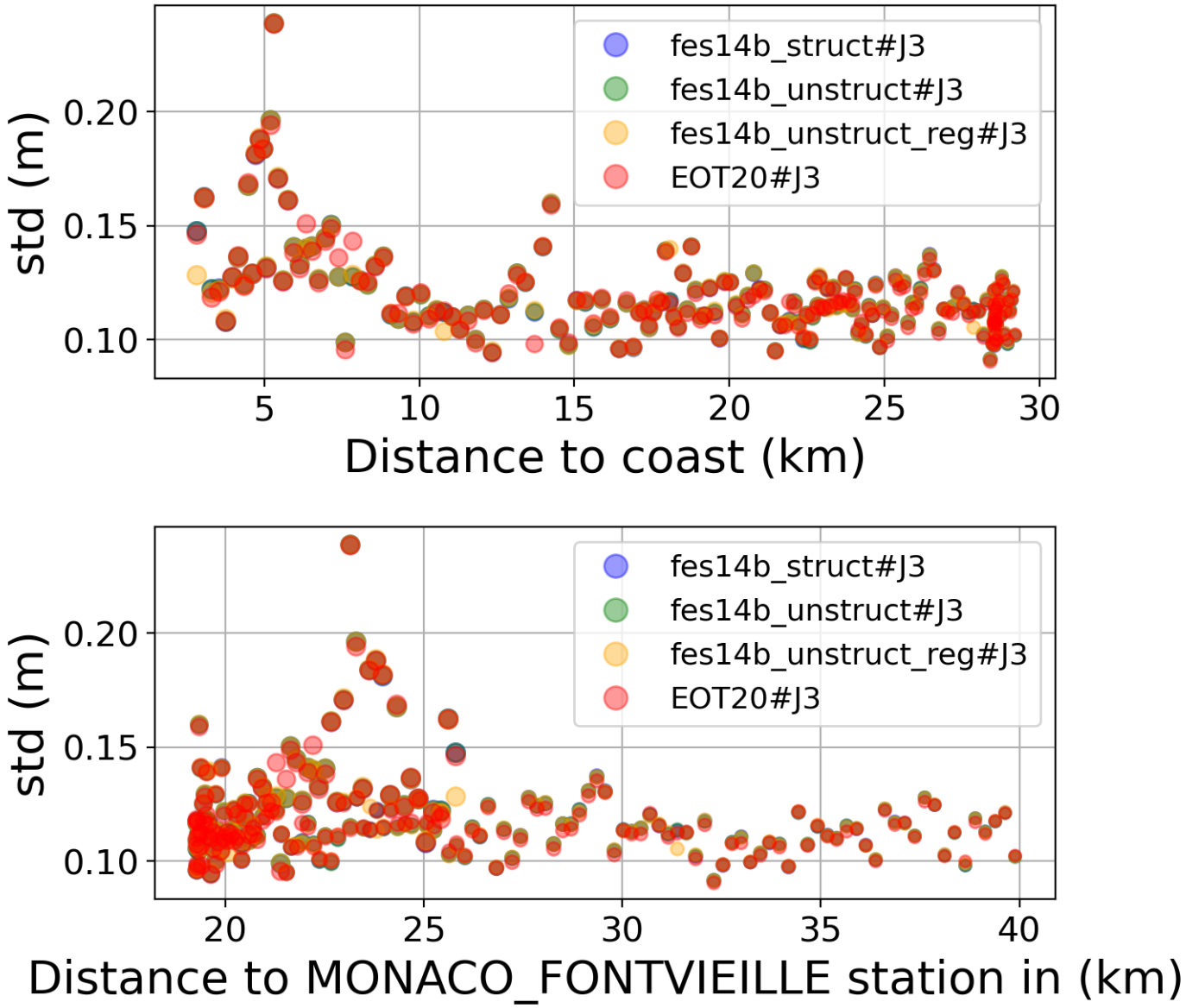

FIGURE 137 – Std in function of the distance to the coast/MONACO_FONTVIEILLE station

6.7.7 Correlation in function of distance to coast/MONACO_FONTVIEILLE station

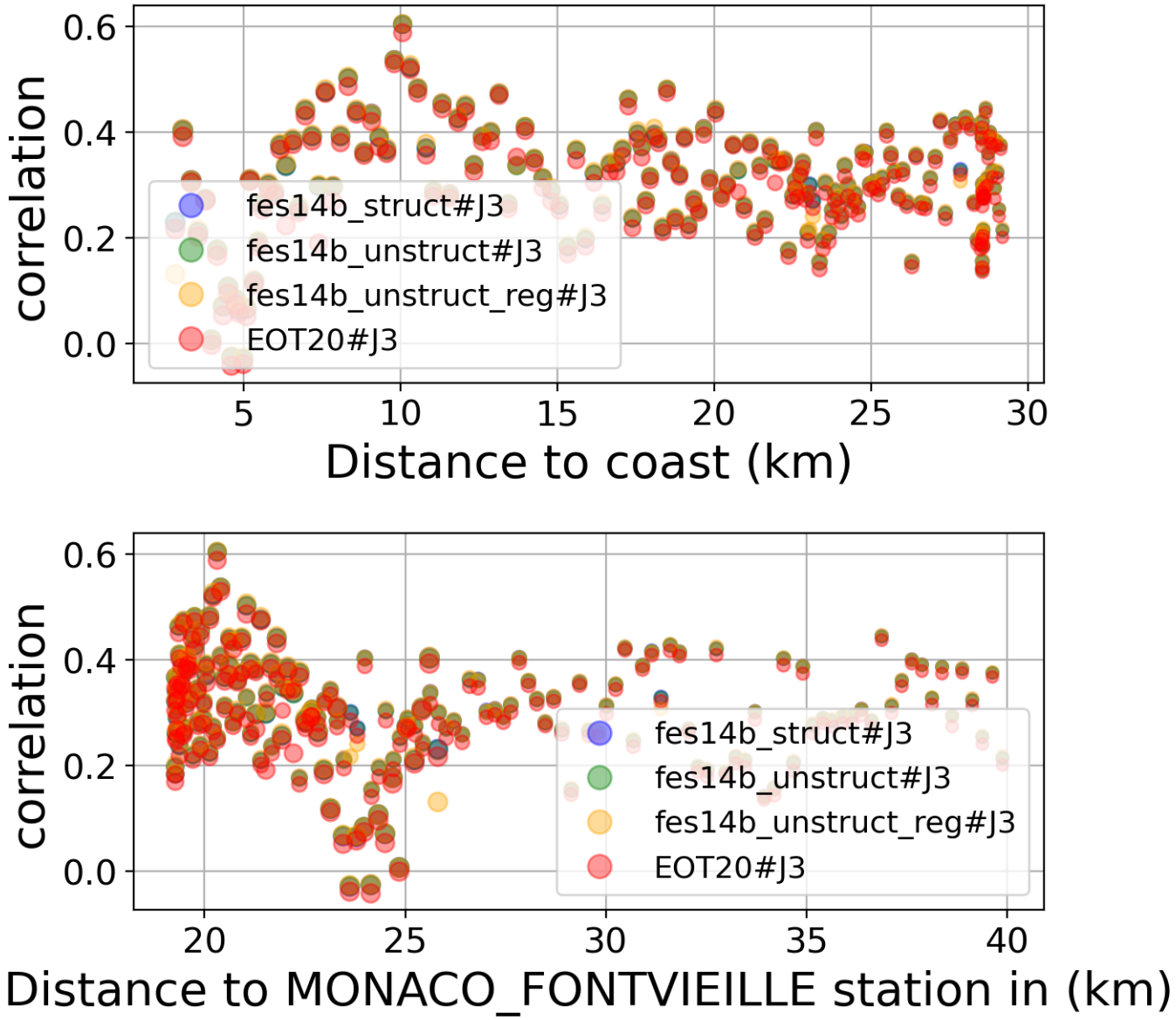

FIGURE 138 – Correlation in function of the distance to the coast/MONACO_FONTVIEILLE station

6.7.8 Taylor Diagram

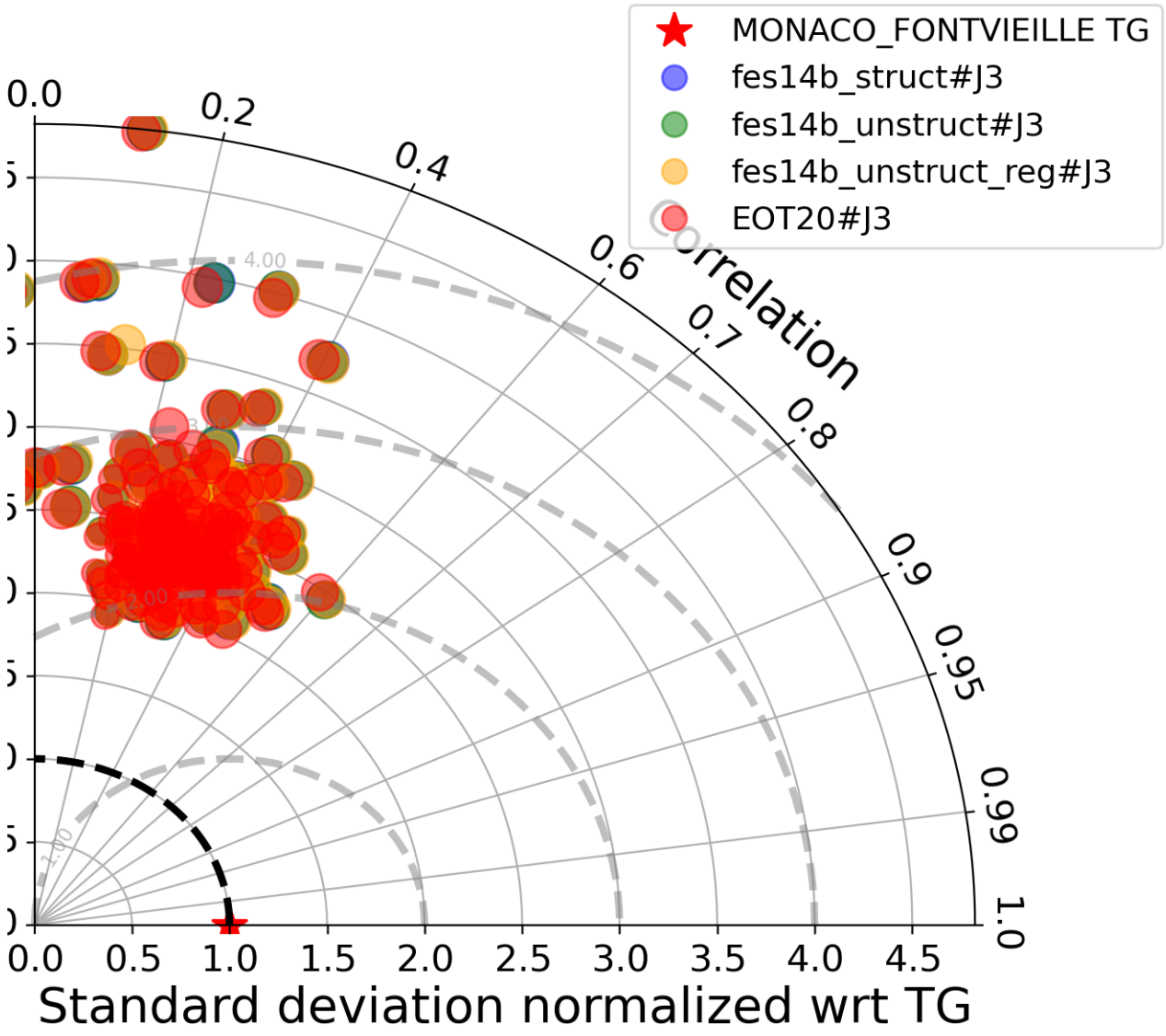

Figure 139 – Taylor diagram

6.7.9 Mean statistics table of products comparison with MONACO_FONTVIEILLE tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	92.586	0.311	0.12	0.114
fes14b_unstruct#J3	92.586	0.31	0.12	0.114
fes14b_unstruct_reg#J3	92.581	0.311	0.12	0.114
EOT20#J3	92.596	0.298	0.119	0.115

FIGURE 140 – Mean statistics table of the common points in the altimetry products

6.7.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 110 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.049
fes14b_struct#J3	20.296	10.045	93.636	0.605	0.12
fes14b_unstruct#J3	20.296	10.045	93.636	0.605	0.12
fes14b_unstruct_reg#J3	20.296	10.045	93.636	0.607	0.12
EOT20#J3	20.296	10.045	93.636	0.589	0.121

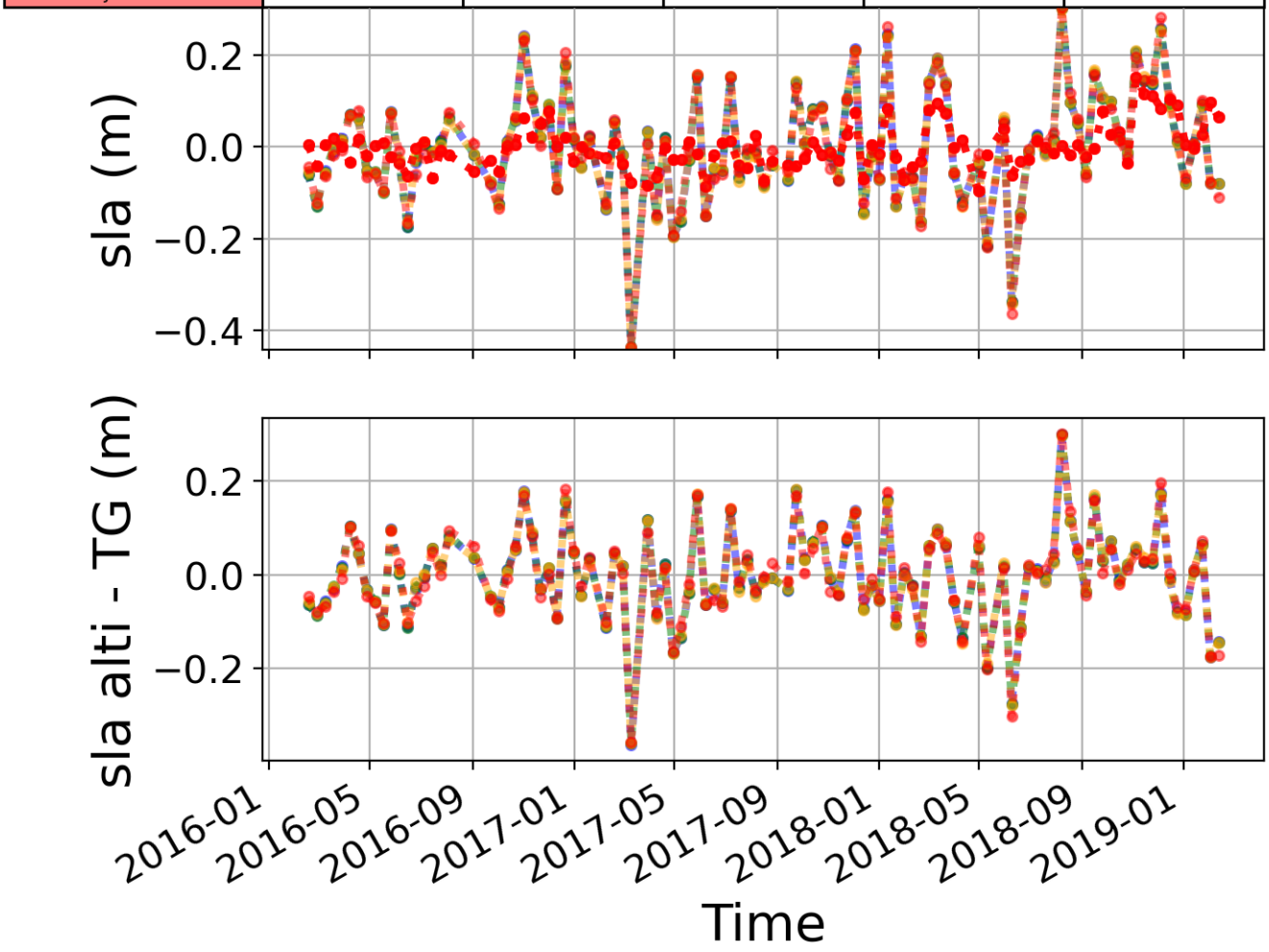

Figure 141 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.8 Station : Erdemli

- Nearest track to Erdemli station is the track number track68
- The area of interest is limited by :
  - A circle which it's center is the Erdemli tide gauge station location and has a Raduis of 40 Km

6.8.1 correlation visualization in maps view % Erdemli tide gauge

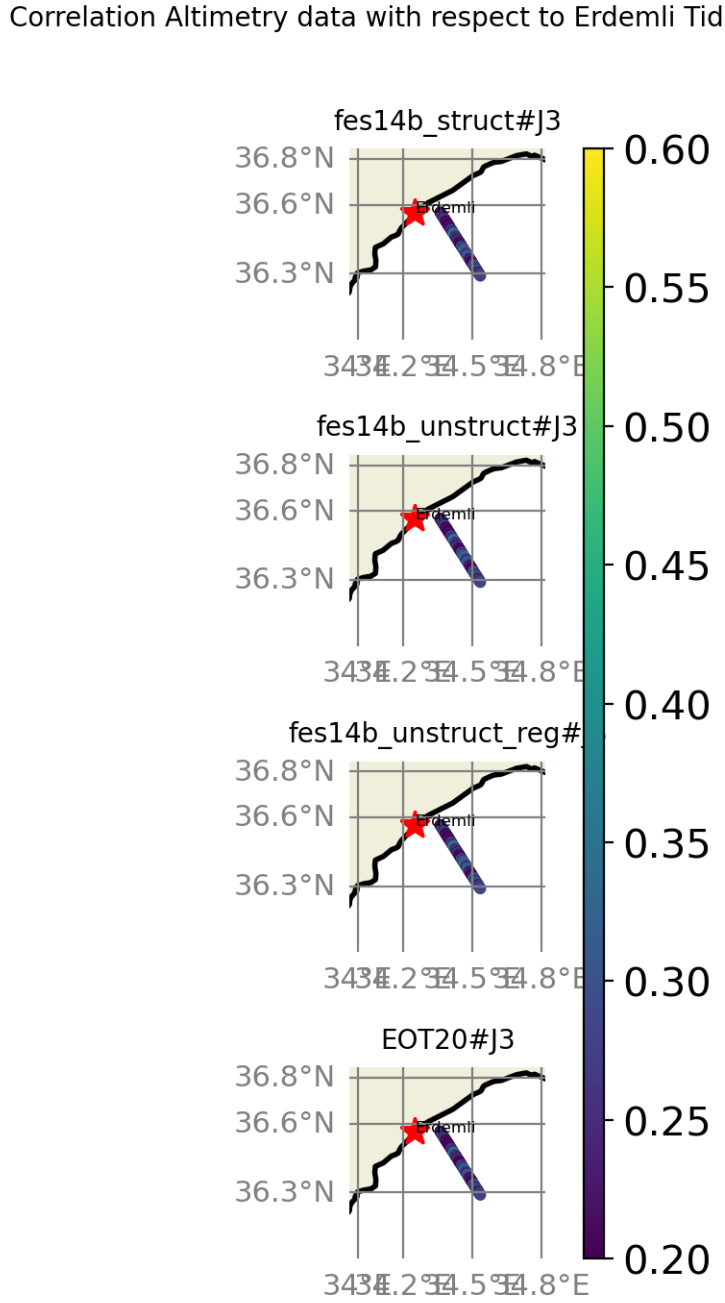

Figure 142 – correlation visualization in maps view % Erdemli tide gauge

6.8.2 rmsd visualization in maps view % Erdemli tide gauge

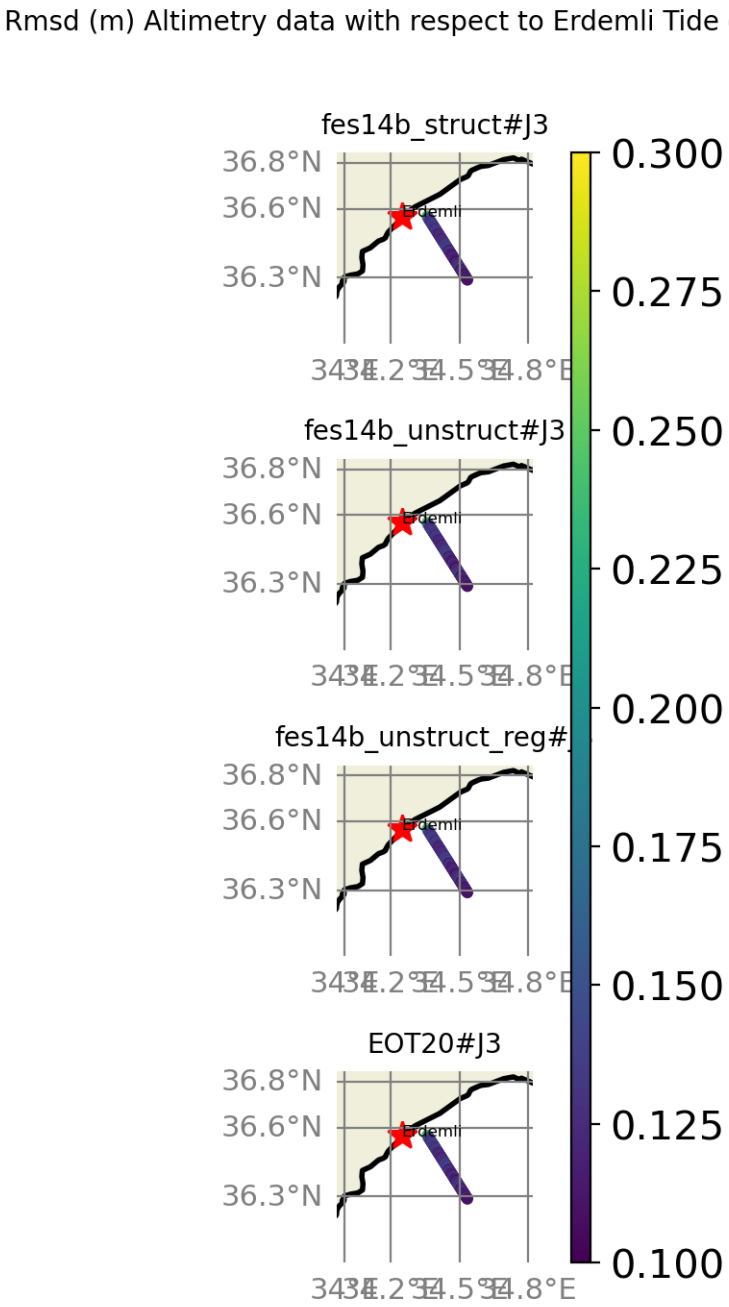

Figure 143 – rmsd visualization in maps view % Erdemli tide gauge

6.8.3 std visualization in maps view % Erdemli tide gauge

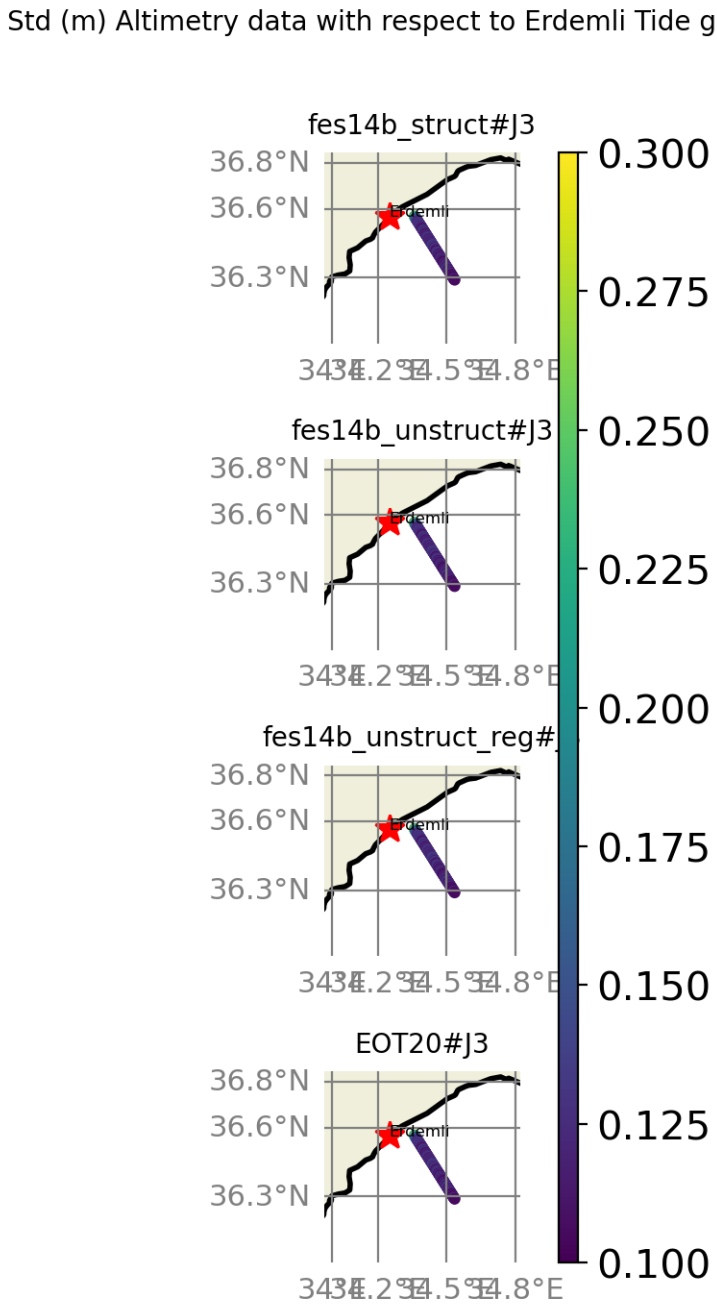

Figure 144 – std visualization in maps view % Erdemli tide gauge

6.8.4 valid_data_percent visualization in maps view % Erdemli tide gauge

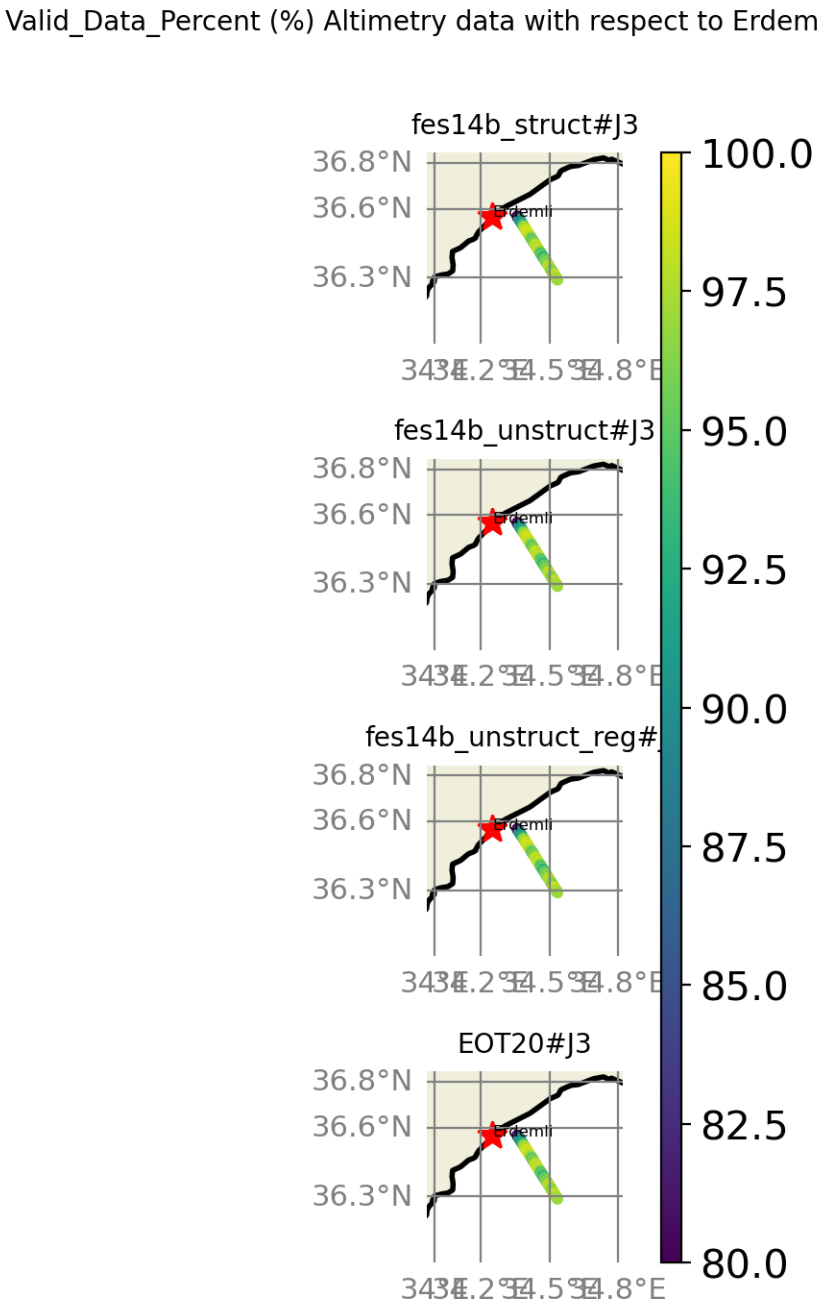

FIGURE 145 – valid_data_percent visualization in maps view % Erdemli tide gauge

6.8.5 Valid data (%) in function of distance to coast/Erdemli station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 99$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

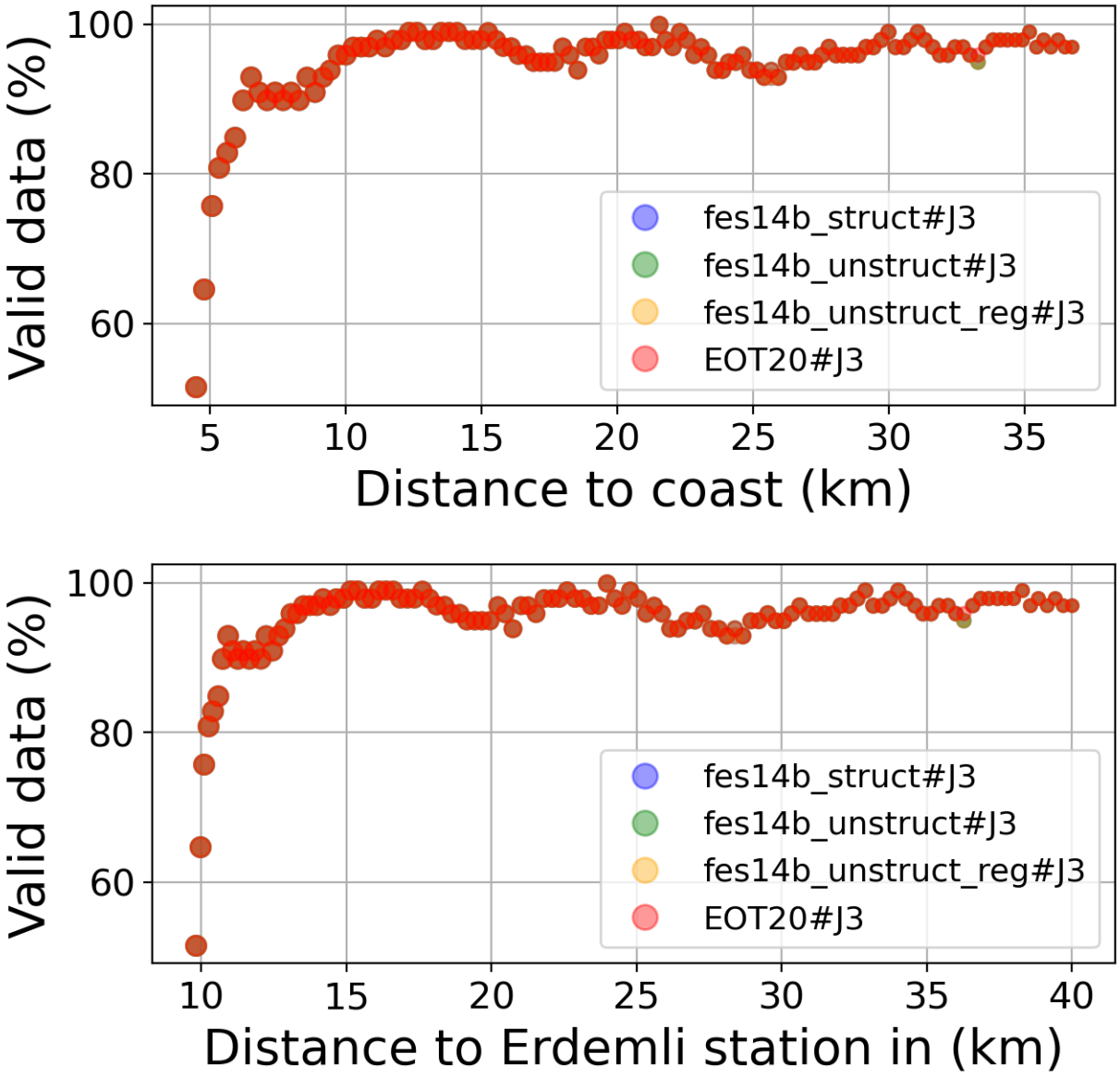

FIGURE 146 – Valid data (%) in function of distance to coast/Erdemli station

6.8.6 Std in function of distance to coast/Erdemli station

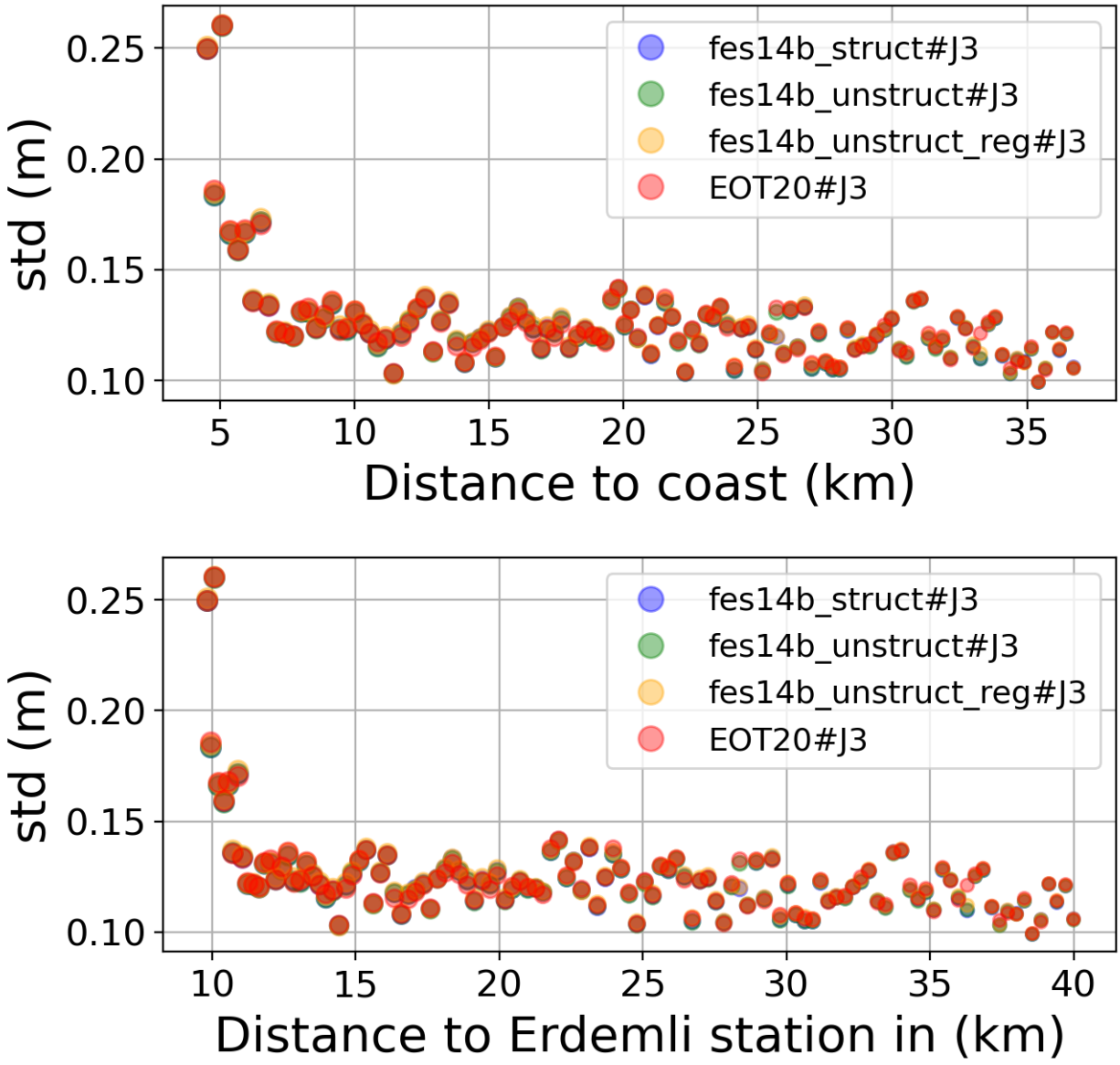

FIGURE 147 – Std in function of the distance to the coast/Erdemli station

6.8.7 Correlation in function of distance to coast/Erdemli station

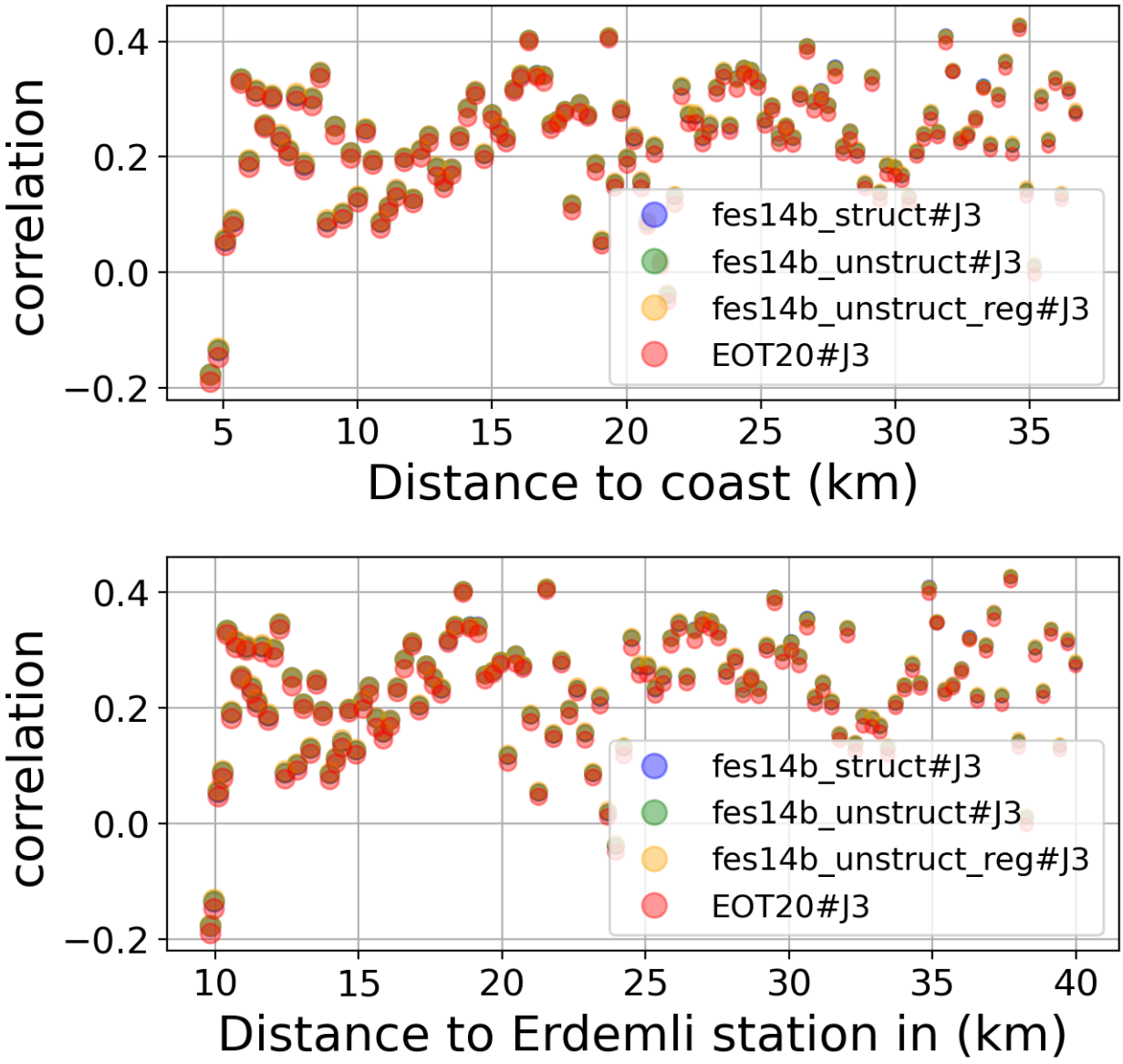

FIGURE 148 – Correlation in function of the distance to the coast/Erdemli station

6.8.8 Taylor Diagram

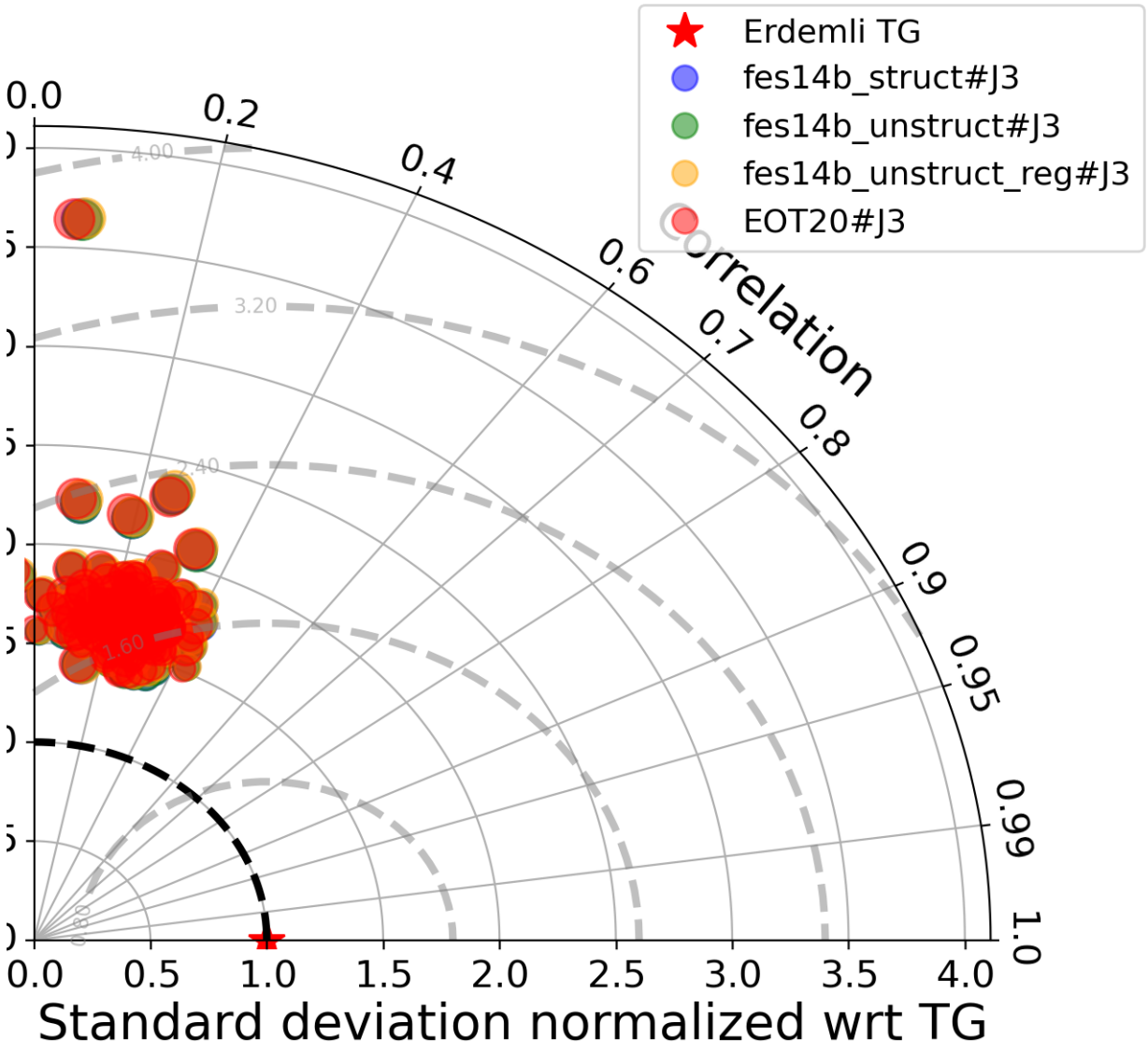

Figure 149 – Taylor diagram

6.8.9 Mean statistics table of products comparison with Erdemli tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	95.077	0.233	0.125	0.129
fes14b_unstruct#J3	95.085	0.233	0.125	0.129
fes14b_unstruct_reg#J3	95.077	0.236	0.126	0.13
EOT20#J3	95.094	0.224	0.126	0.131

FIGURE 150 – Mean statistics table of the common points in the altimetry products

6.8.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 99 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.072
fes14b_struct#J3	37.695	34.618	97.98	0.427	0.11
fes14b_unstruct#J3	37.695	34.618	97.98	0.428	0.11
fes14b_unstruct_reg#J3	37.695	34.618	97.98	0.43	0.11
EOT20#J3	37.695	34.618	97.98	0.421	0.109

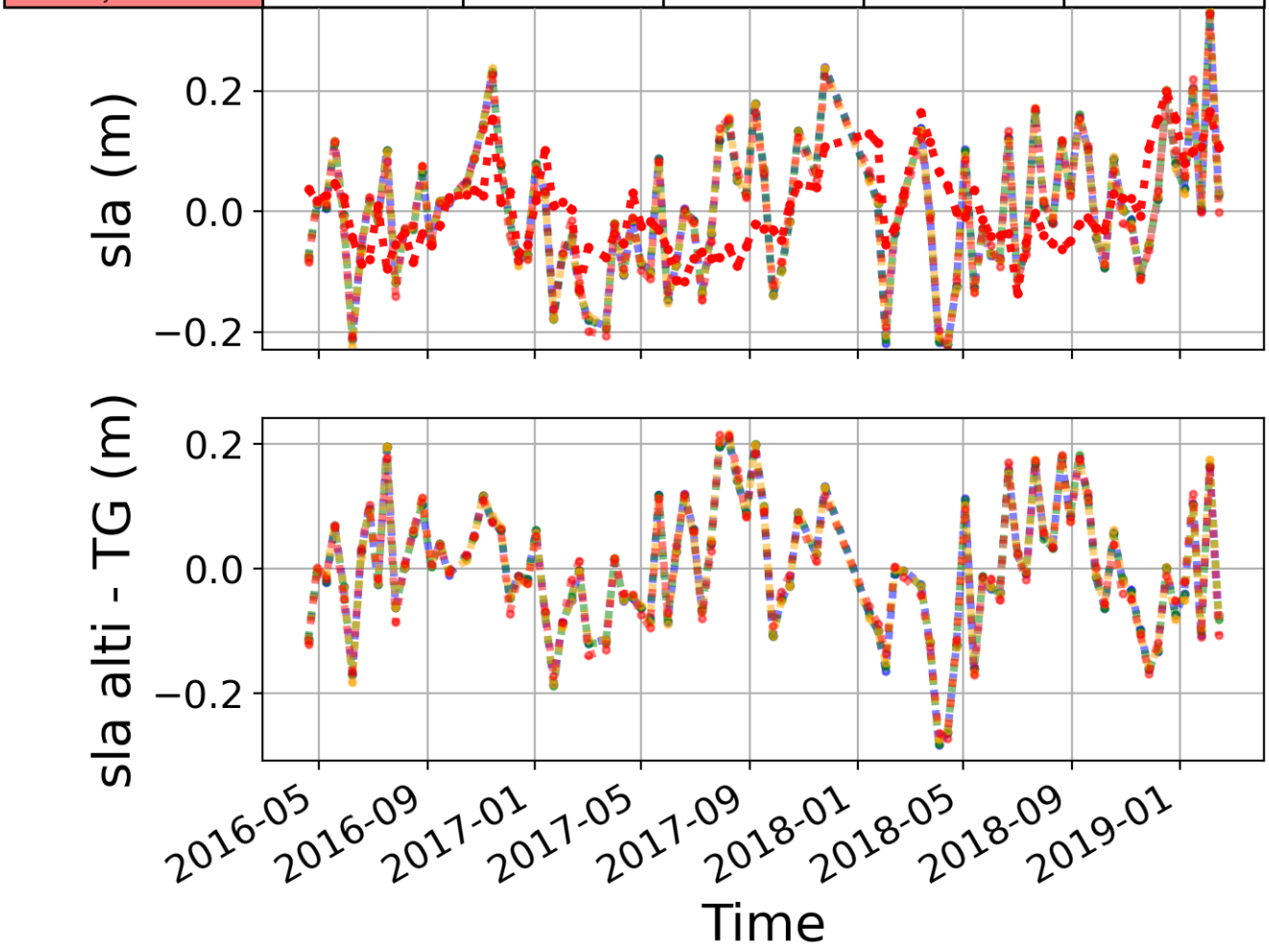

FIGURE 151 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.9 Station : Almeria

- Nearest track to Almeria station is the track number track96
- The area of interest is limited by :
  - A circle which it's center is the Almeria tide gauge station location and has a Raduis of 40 Km

6.9.1 correlation visualization in maps view % Almeria tide gauge

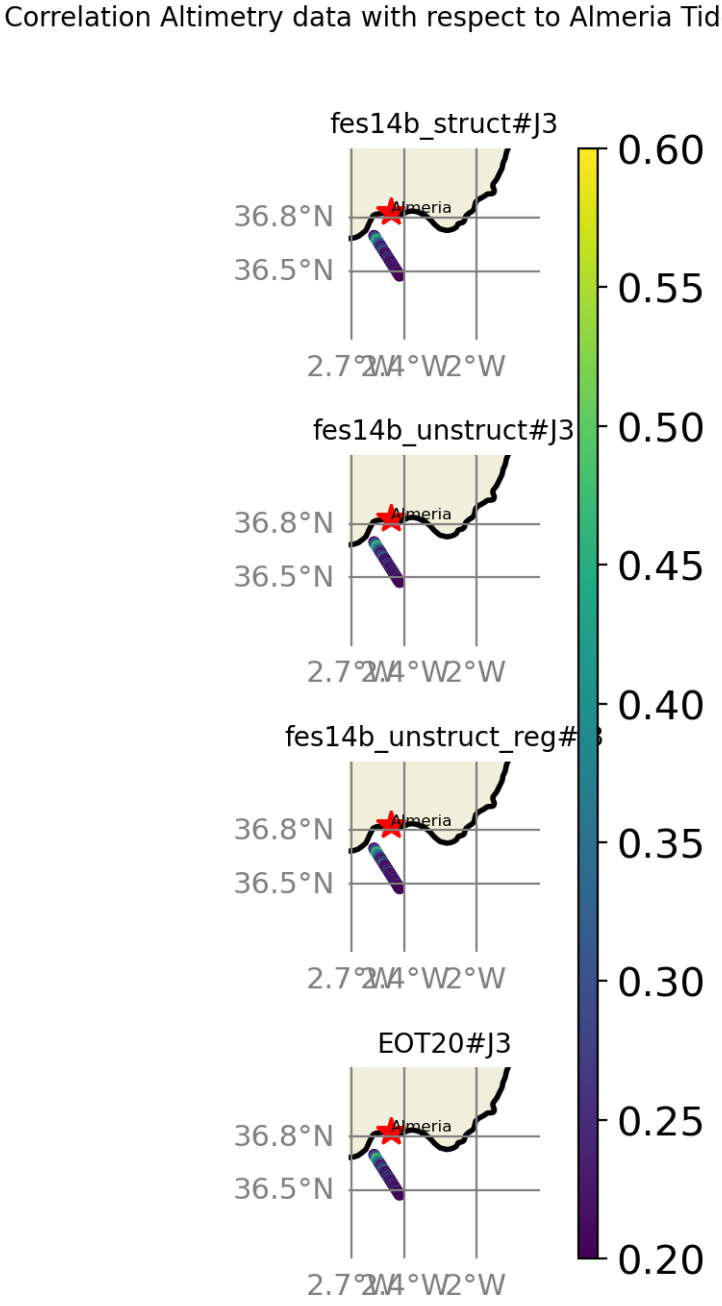

FIGURE 152 – correlation visualization in maps view % Almeria tide gauge

6.9.2 rmsd visualization in maps view % Almeria tide gauge

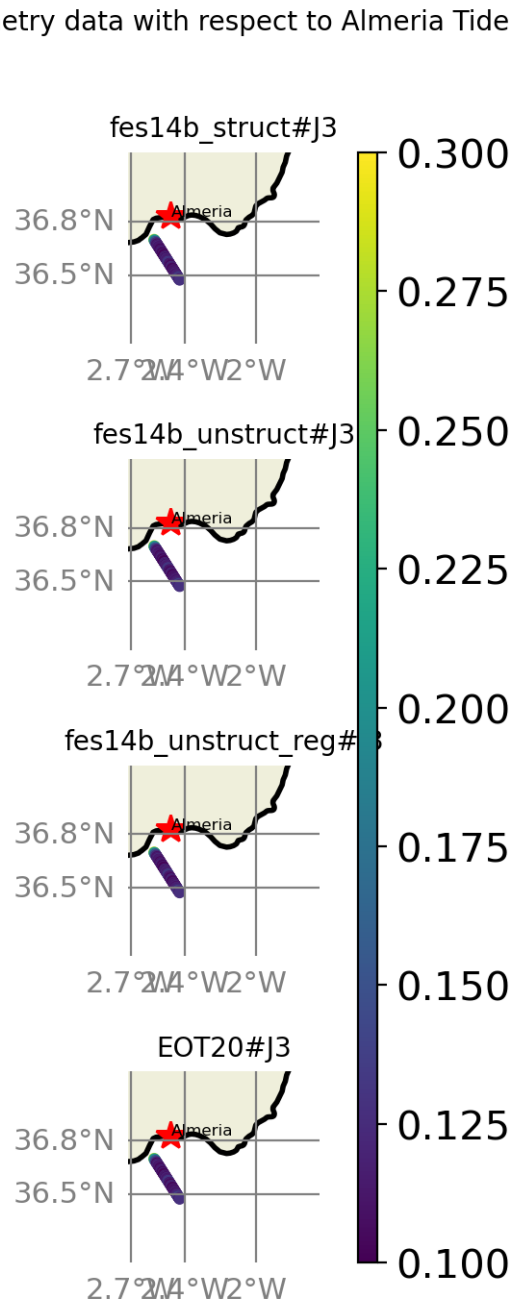

Figure 153 – rmsd visualization in maps view % Almeria tide gauge

6.9.3 std visualization in maps view % Almeria tide gauge

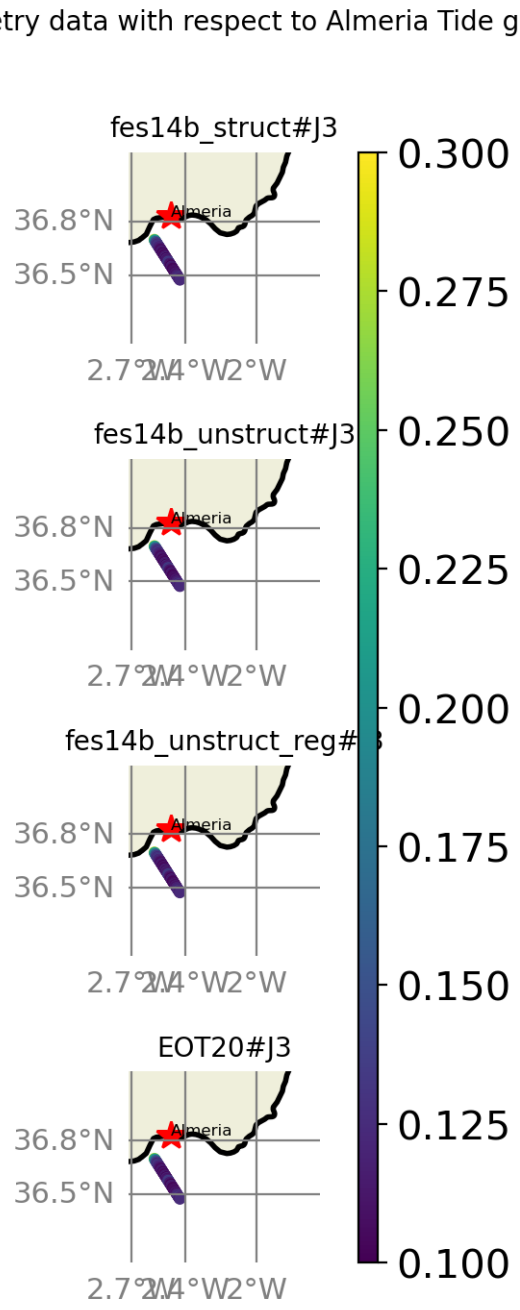

Figure 154 – std visualization in maps view % Almeria tide gauge

6.9.4 valid_data_percent visualization in maps view % Almeria tide gauge

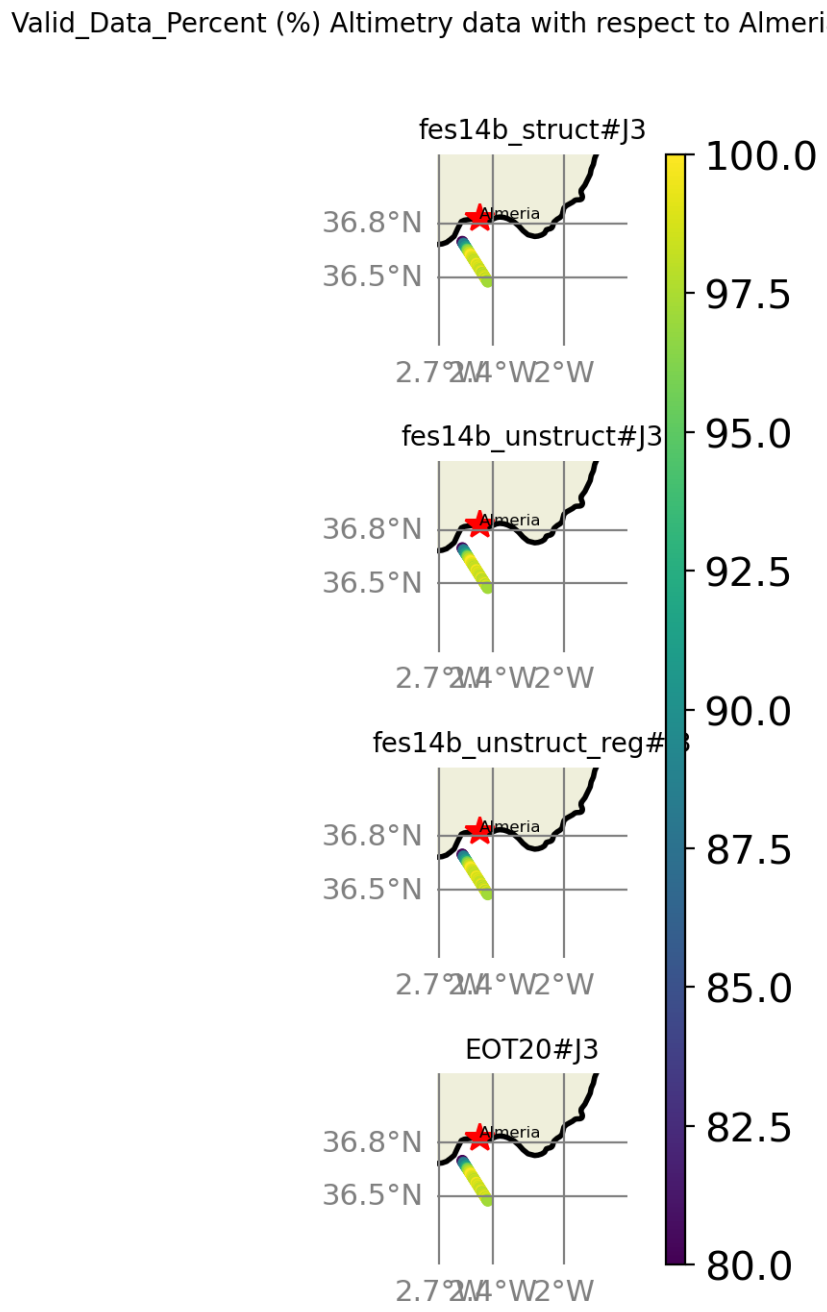

FIGURE 155 – valid_data_percent visualization in maps view % Almeria tide gauge

6.9.5 Valid data (%) in function of distance to coast/Almeria station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 109$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

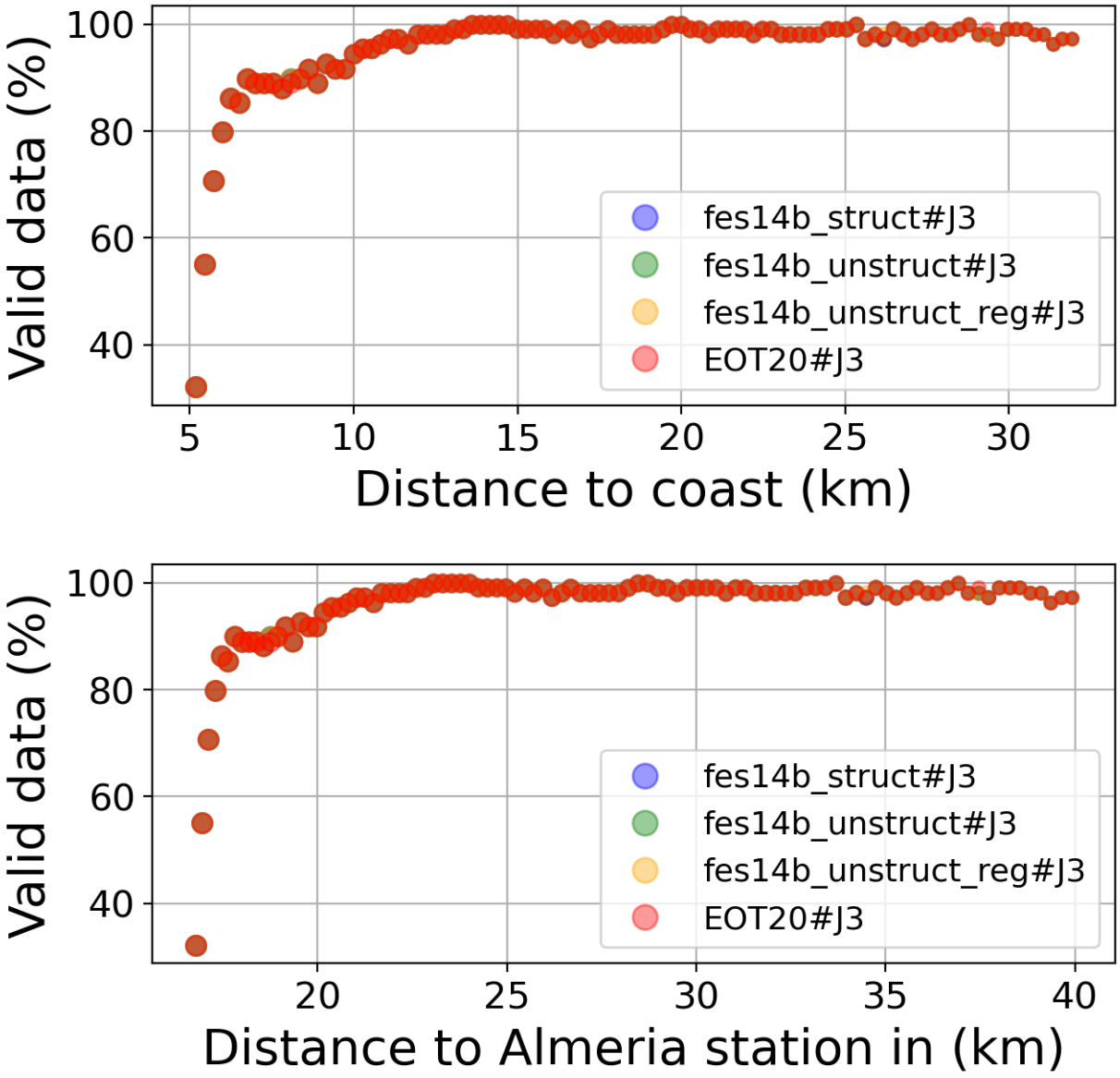

FIGURE 156 – Valid data (%) in function of distance to coast/Almeria station

6.9.6 Std in function of distance to coast/Almeria station

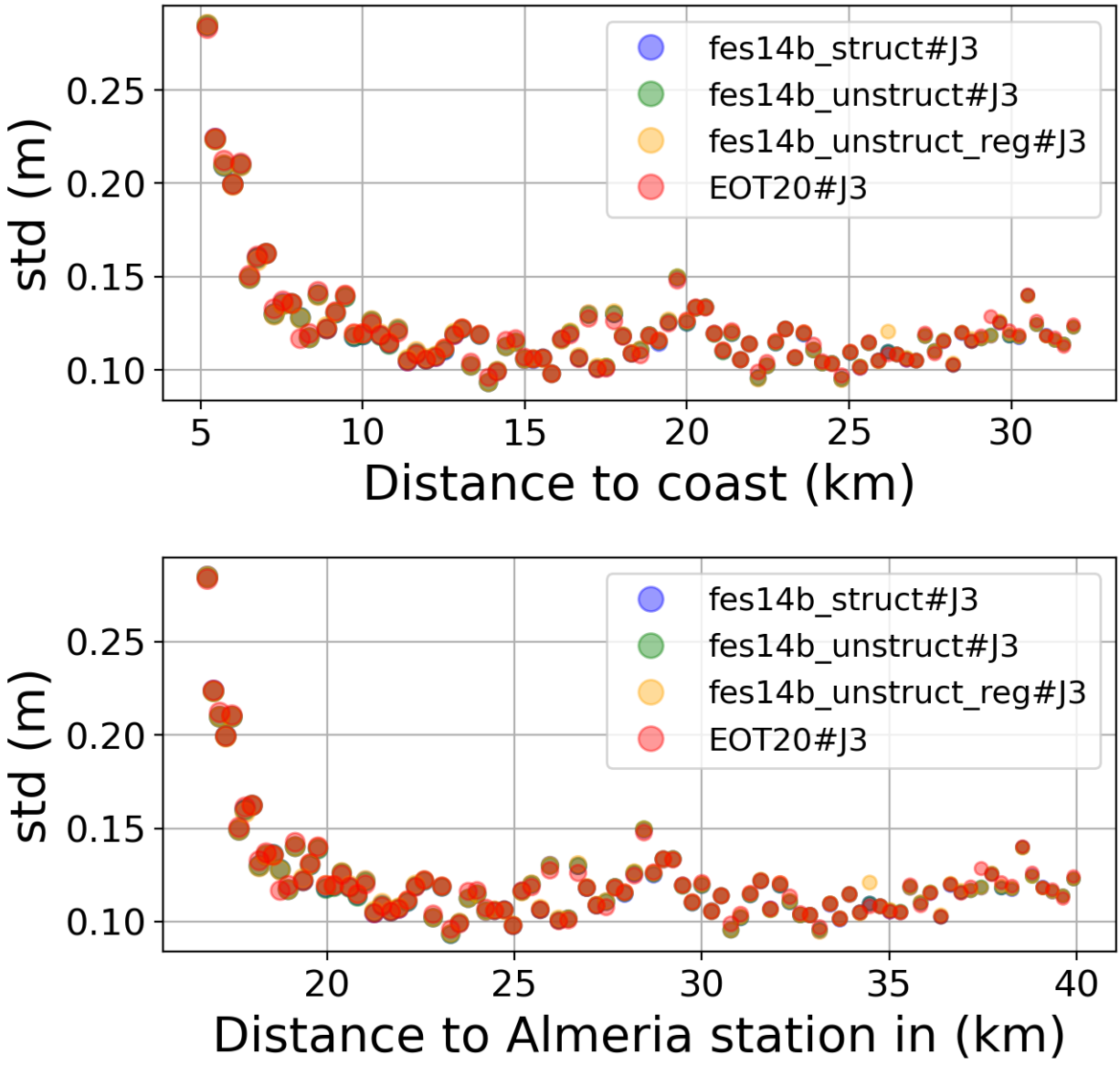

Figure 157 – Std in function of the distance to the coast/Almeria station

6.9.7 Correlation in function of distance to coast/Almeria station

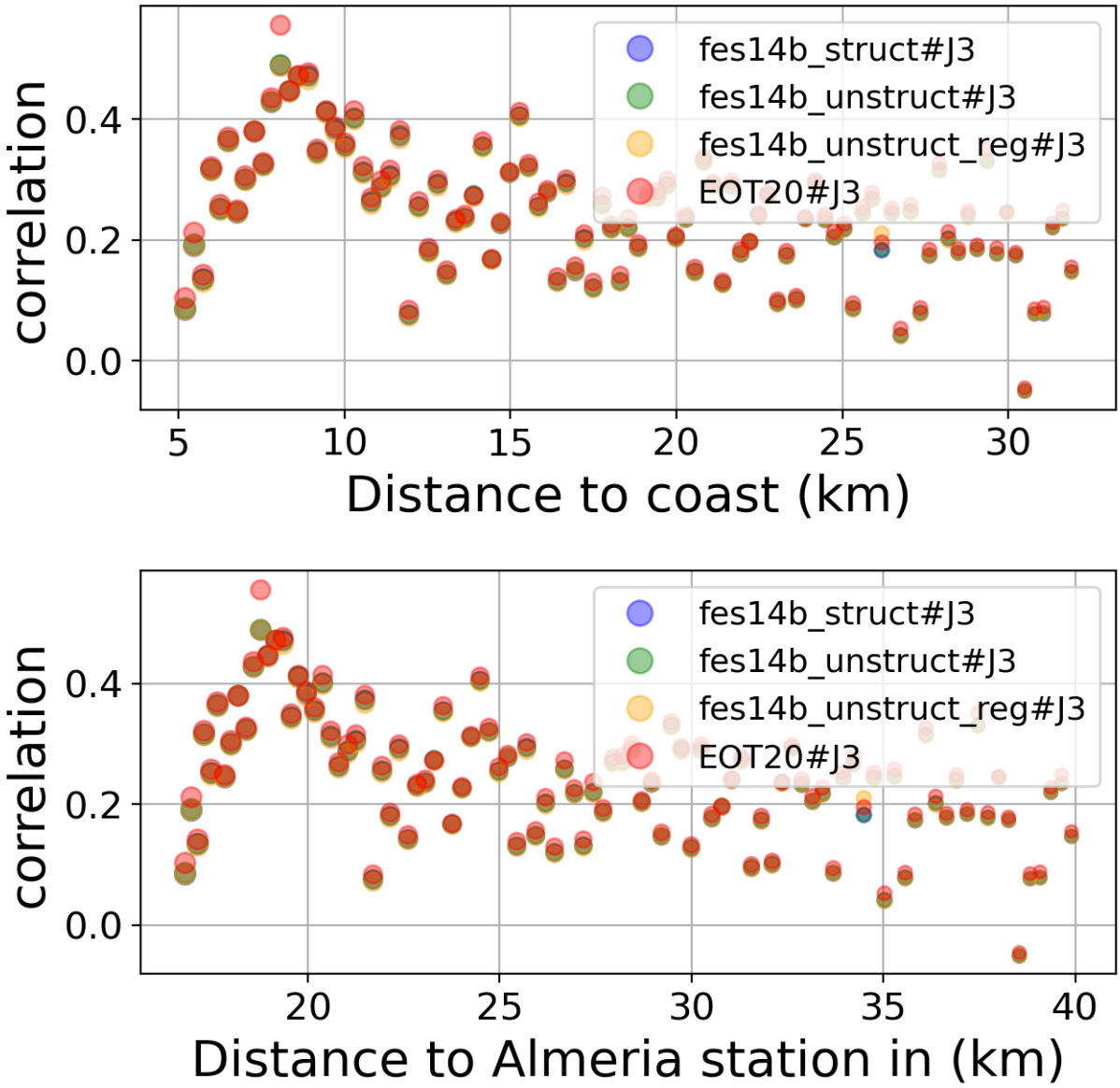

FIGURE 158 – Correlation in function of the distance to the coast/Almeria station

6.9.8 Taylor Diagram

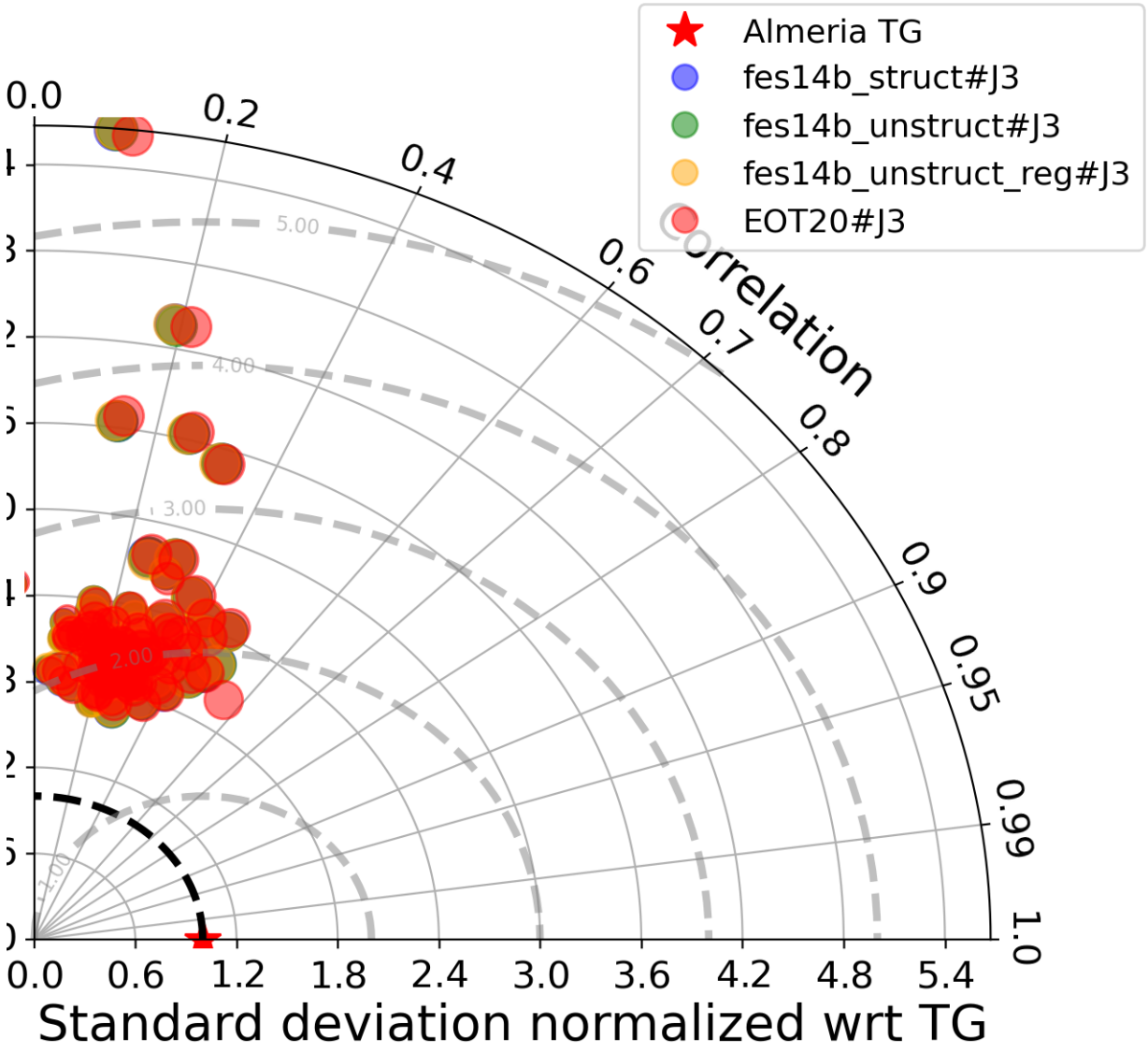

Figure 159 – Taylor diagram

6.9.9 Mean statistics table of products comparison with Almeria tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	95.507	0.242	0.123	0.122
fes14b_unstruct#J3	95.507	0.243	0.123	0.122
fes14b_unstruct_reg#J3	95.517	0.241	0.123	0.123
EOT20#J3	95.507	0.251	0.123	0.122

FIGURE 160 – Mean statistics table of the common points in the altimetry products

6.9.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 109 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.058
fes14b_struct#J3	18.754	8.069	89.908	0.49	0.128
fes14b_unstruct#J3	18.754	8.069	89.908	0.491	0.128
fes14b_unstruct_reg#J3	18.754	8.069	89.908	0.489	0.128
EOT20#J3	18.754	8.069	88.991	0.557	0.117

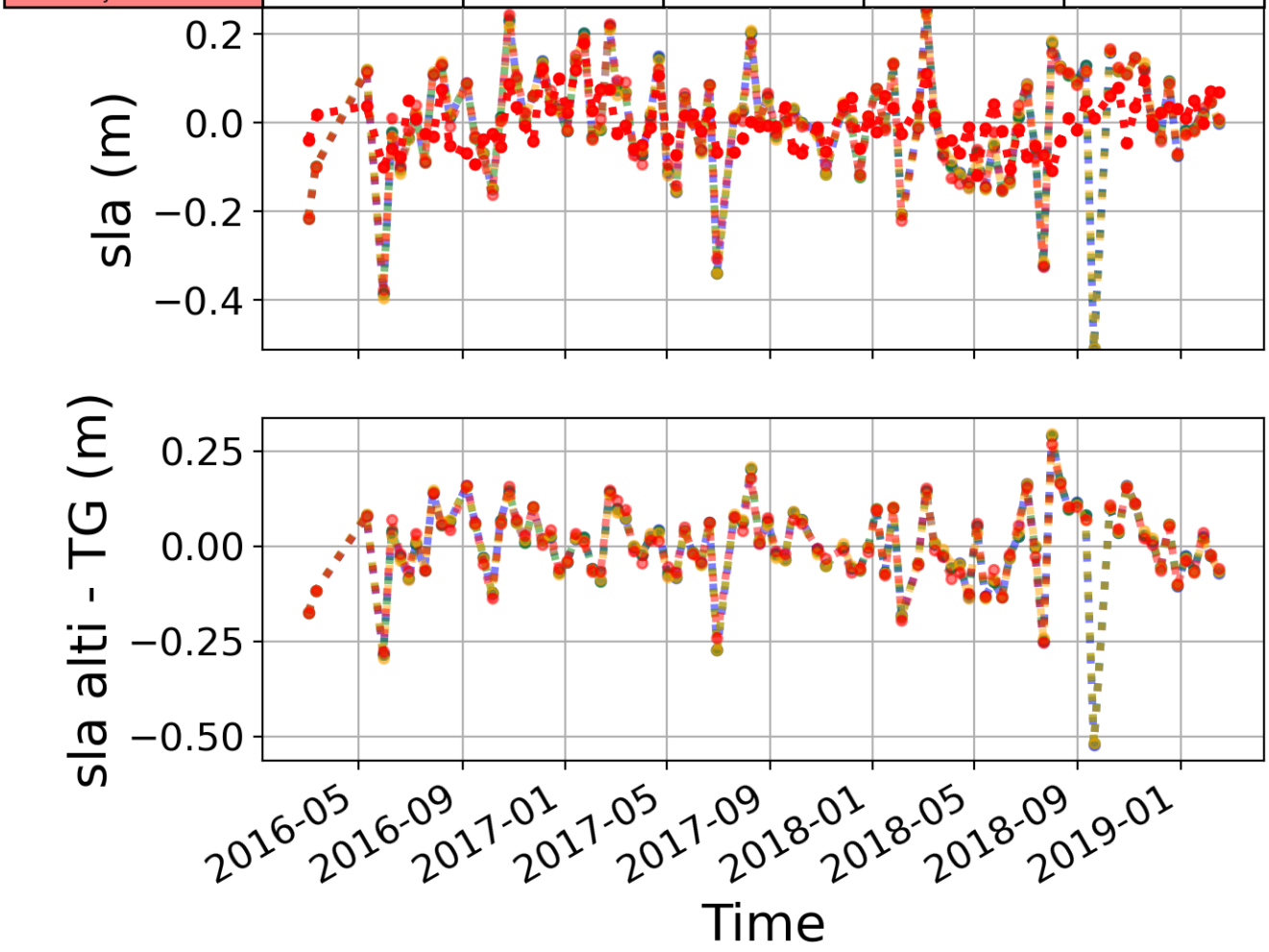

FIGURE 161 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.10 Station : Civitavecchia

- Nearest track to Civitavecchia station is the track number track161
- The area of interest is limited by :
  - A circle which it's center is the Civitavecchia tide gauge station location and has a Raduis of 40 Km

6.10.1 correlation visualization in maps view % Civitavecchia tide gauge

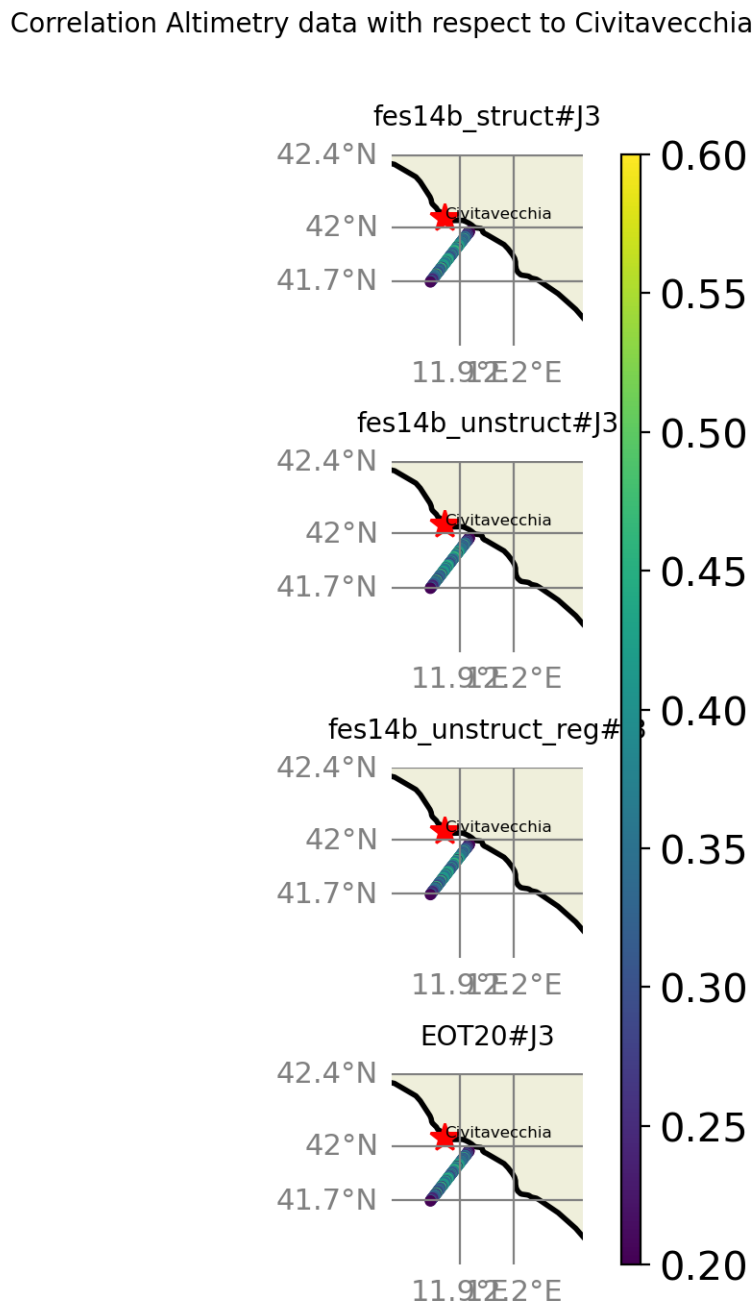

FIGURE 162 – correlation visualization in maps view % Civitavecchia tide gauge

6.10.2 rmsd visualization in maps view % Civitavecchia tide gauge

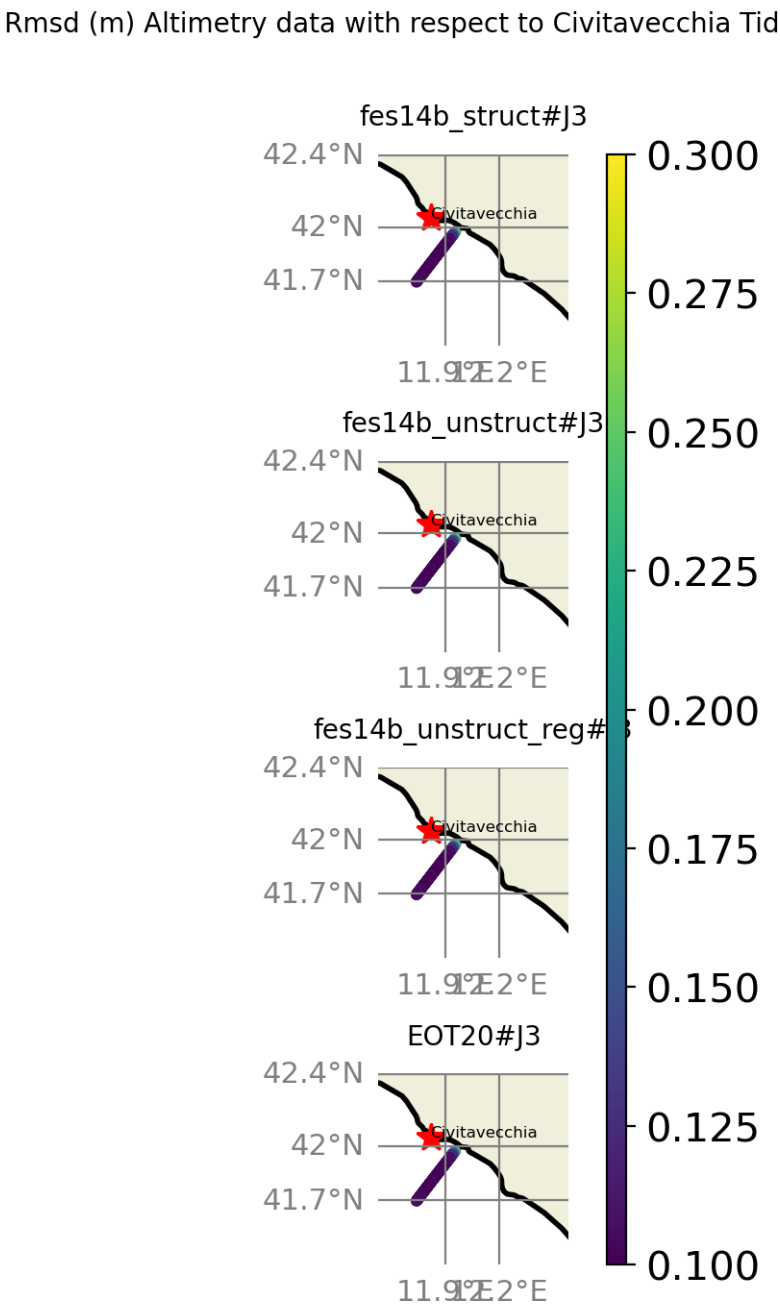

FIGURE 163 – rmsd visualization in maps view % Civitavecchia tide gauge

6.10.3 std visualization in maps view % Civitavecchia tide gauge

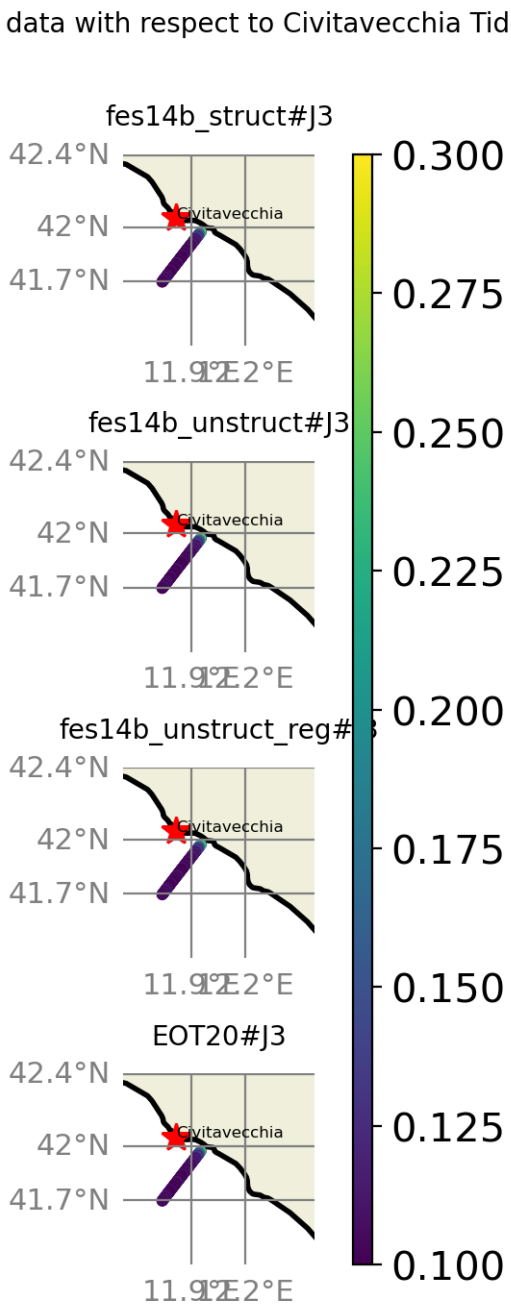

Figure 164 – std visualization in maps view % Civitavecchia tide gauge

6.10.4 valid_data_percent visualization in maps view % Civitavecchia tide gauge

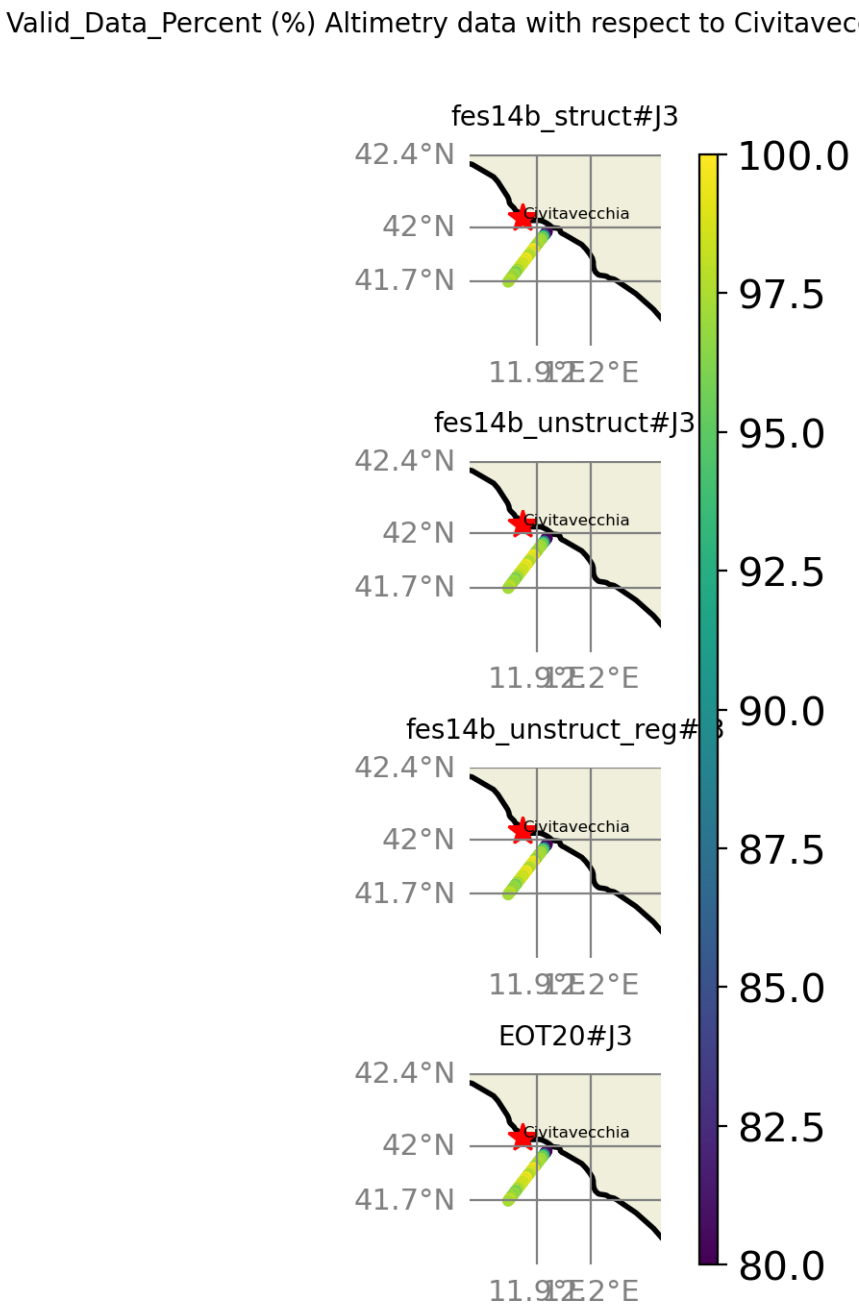

FIGURE 165 – valid_data_percent visualization in maps view % Civitavecchia tide gauge

6.10.5 Valid data (%) in function of distance to coast/Civitavecchia station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 110$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

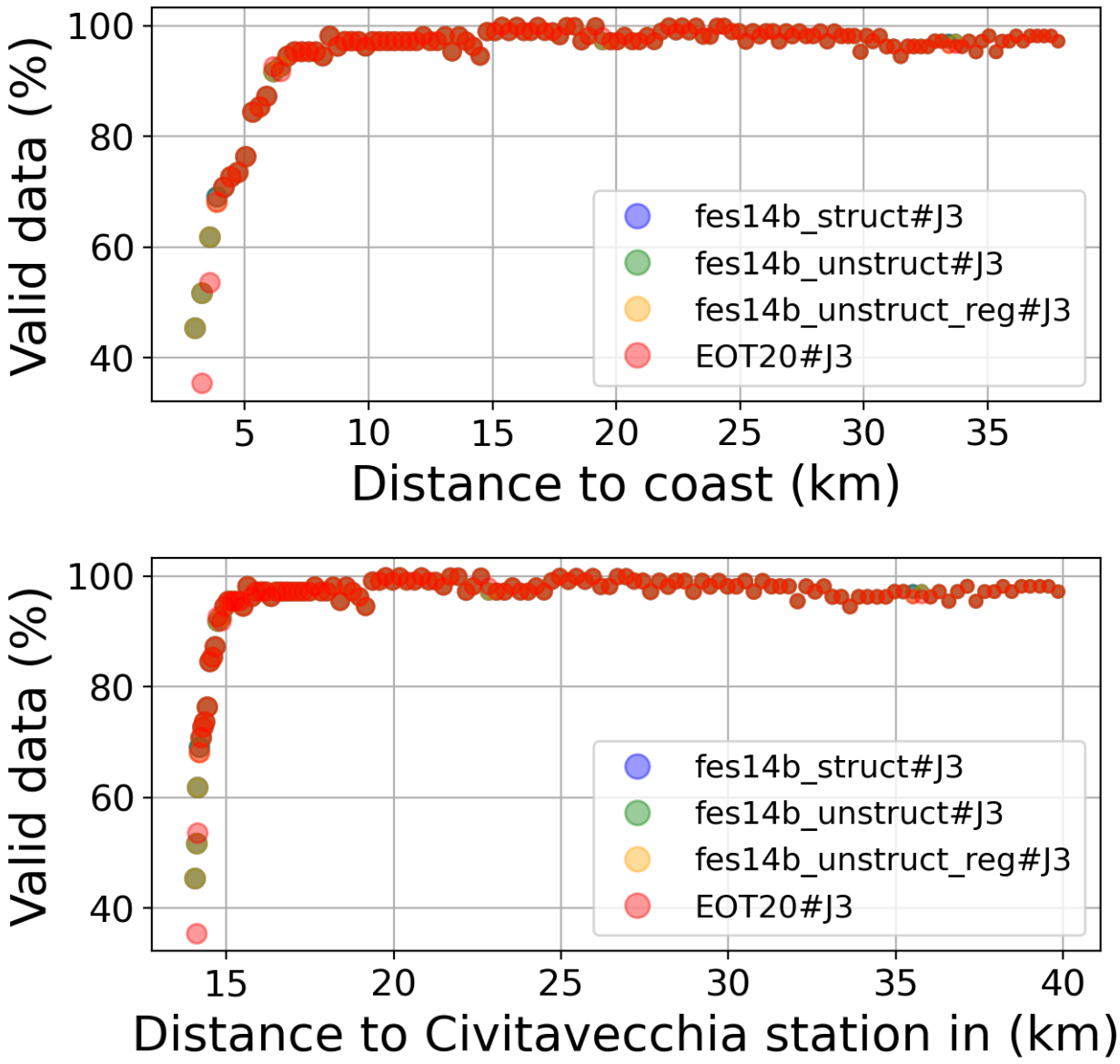

FIGURE 166 – Valid data (%) in function of distance to coast/Civitavecchia station

6.10.6 Std in function of distance to coast/Civitavecchia station

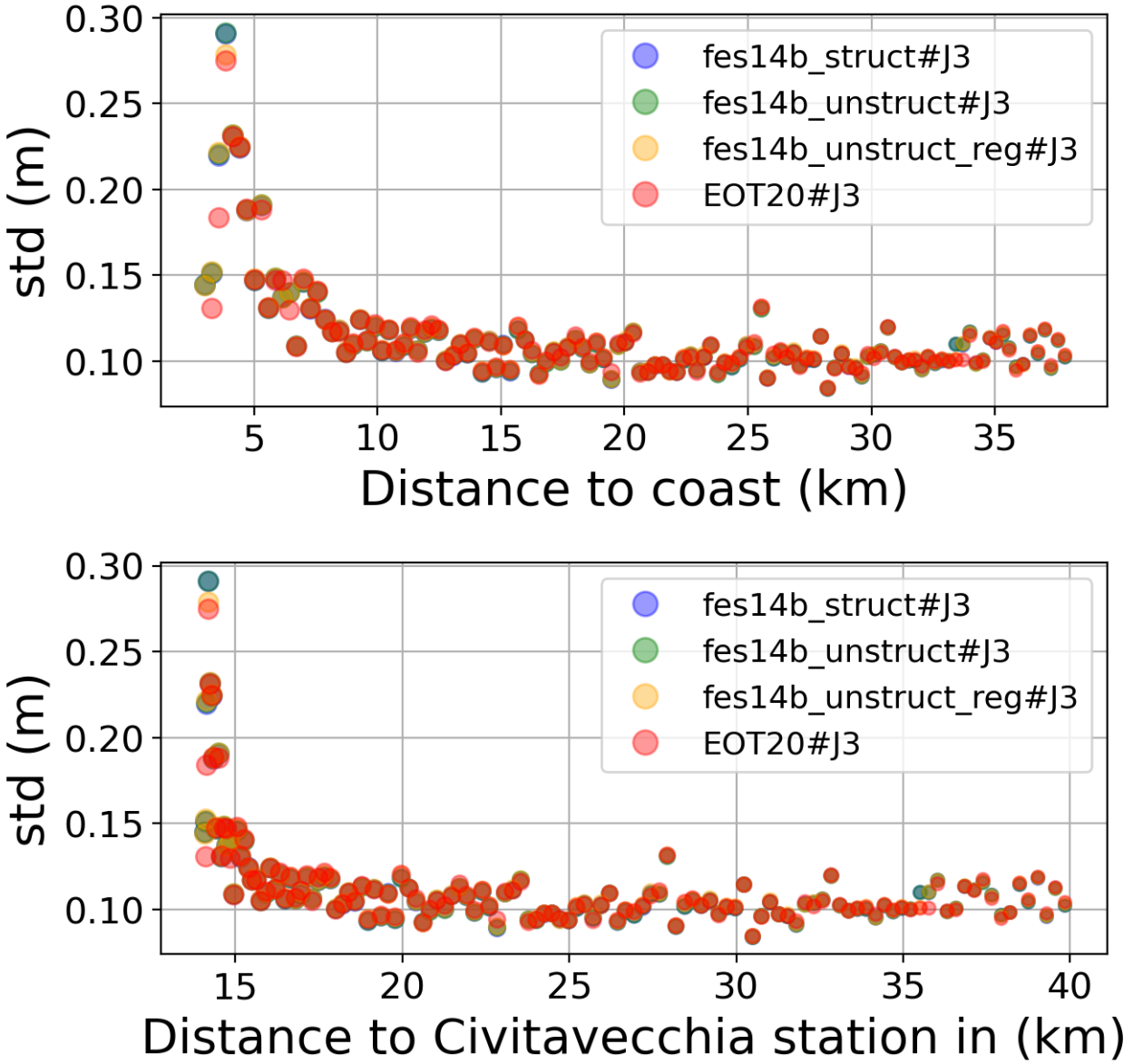

FIGURE 167 – Std in function of the distance to the coast/Civitavecchia station

6.10.7 Correlation in function of distance to coast/Civitavecchia station

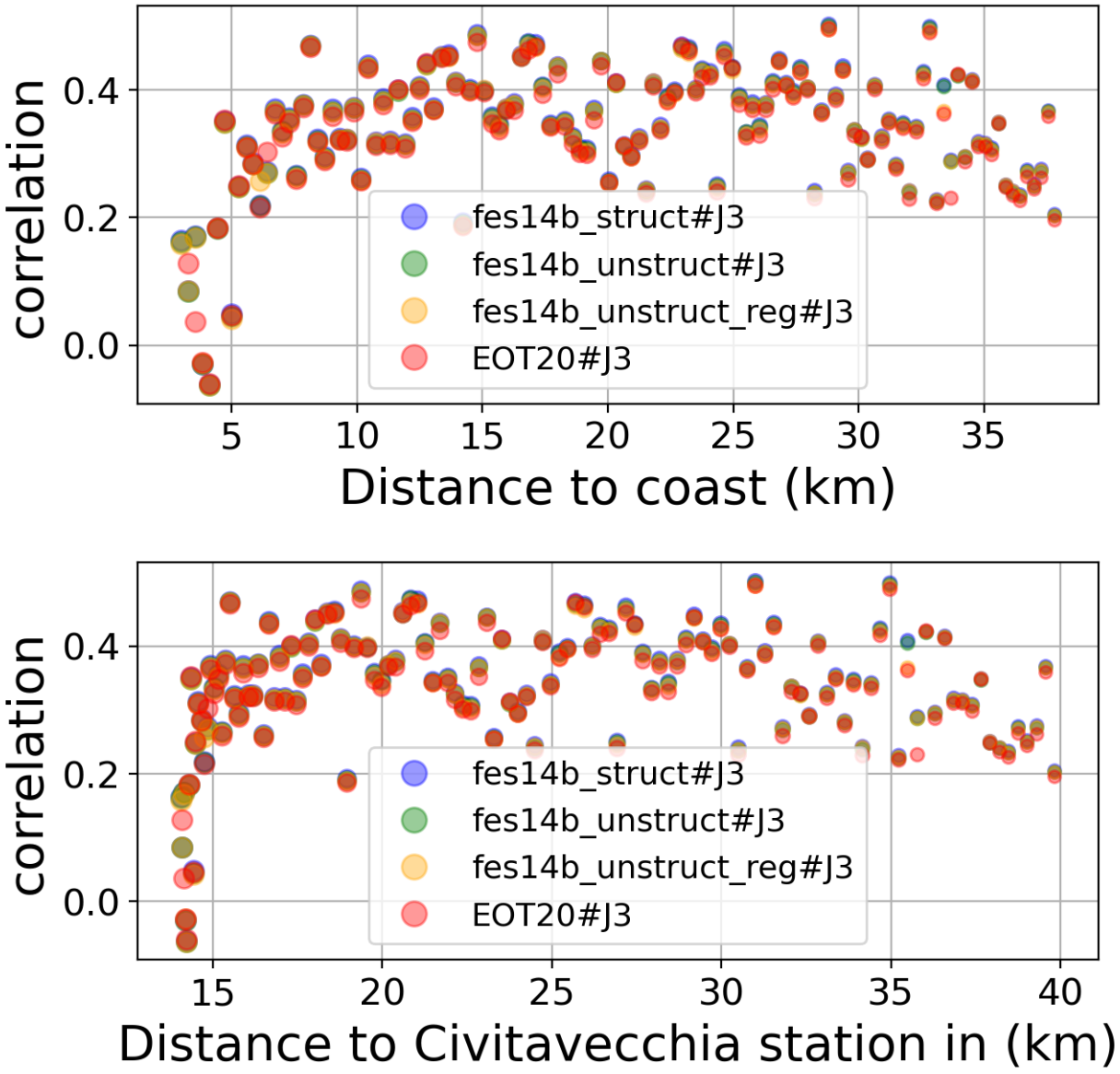

FIGURE 168 – Correlation in function of the distance to the coast/Civitavecchia station

6.10.8 Taylor Diagram

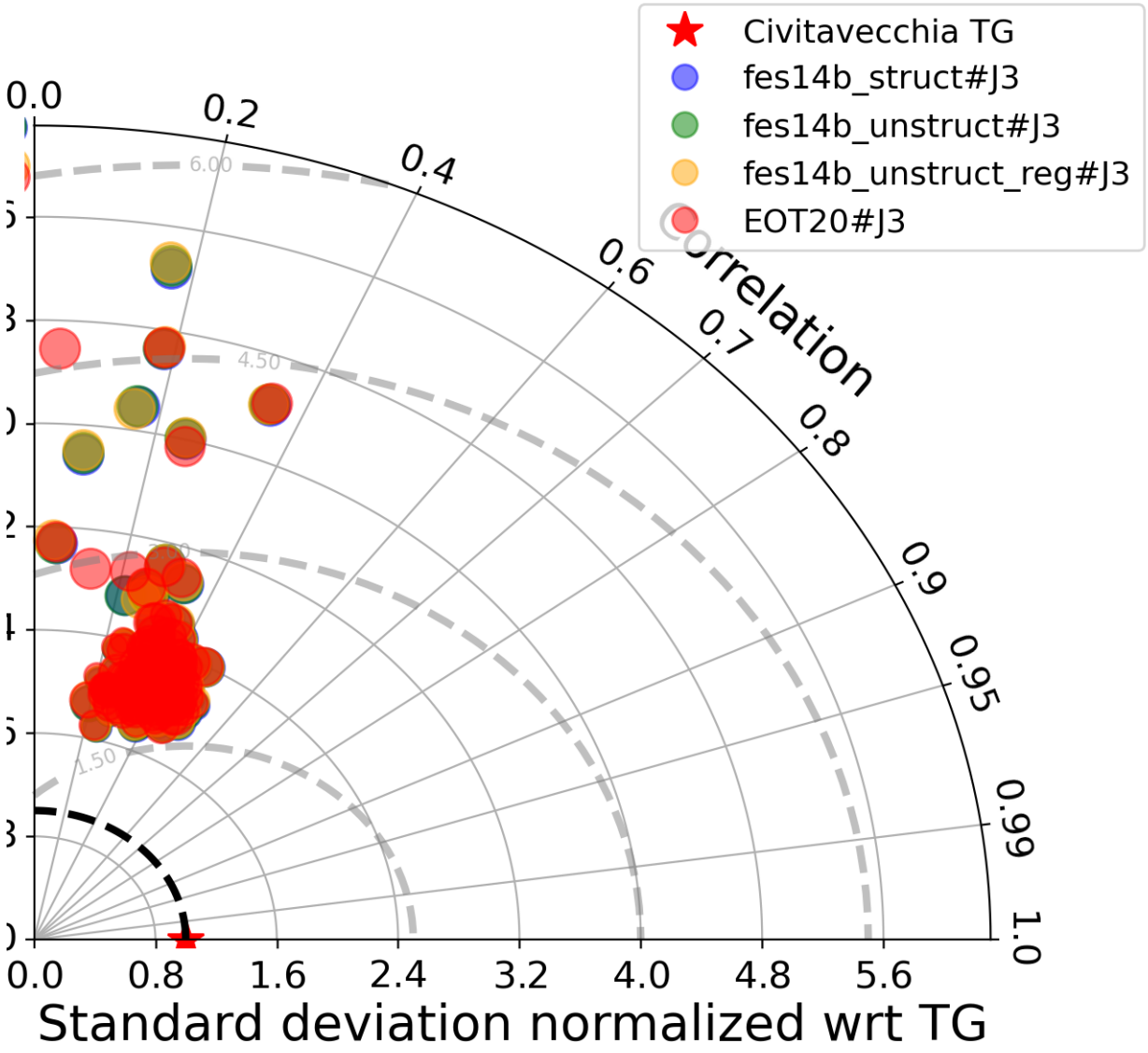

Figure 169 – Taylor diagram

6.10.9 Mean statistics table of products comparison with Civitavecchia tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	95.676	0.344	0.114	0.108
fes14b_unstruct#J3	95.676	0.341	0.114	0.108
fes14b_unstruct_reg#J3	95.661	0.34	0.114	0.108
EOT20#J3	95.462	0.336	0.113	0.108

FIGURE 170 – Mean statistics table of the common points in the altimetry products

6.10.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 110 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.05
fes14b_struct#J3	31.002	28.791	99.091	0.503	0.104
fes14b_unstruct#J3	31.002	28.791	99.091	0.5	0.104
fes14b_unstruct_reg#J3	31.002	28.791	99.091	0.495	0.106
EOT20#J3	31.002	28.791	99.091	0.495	0.105

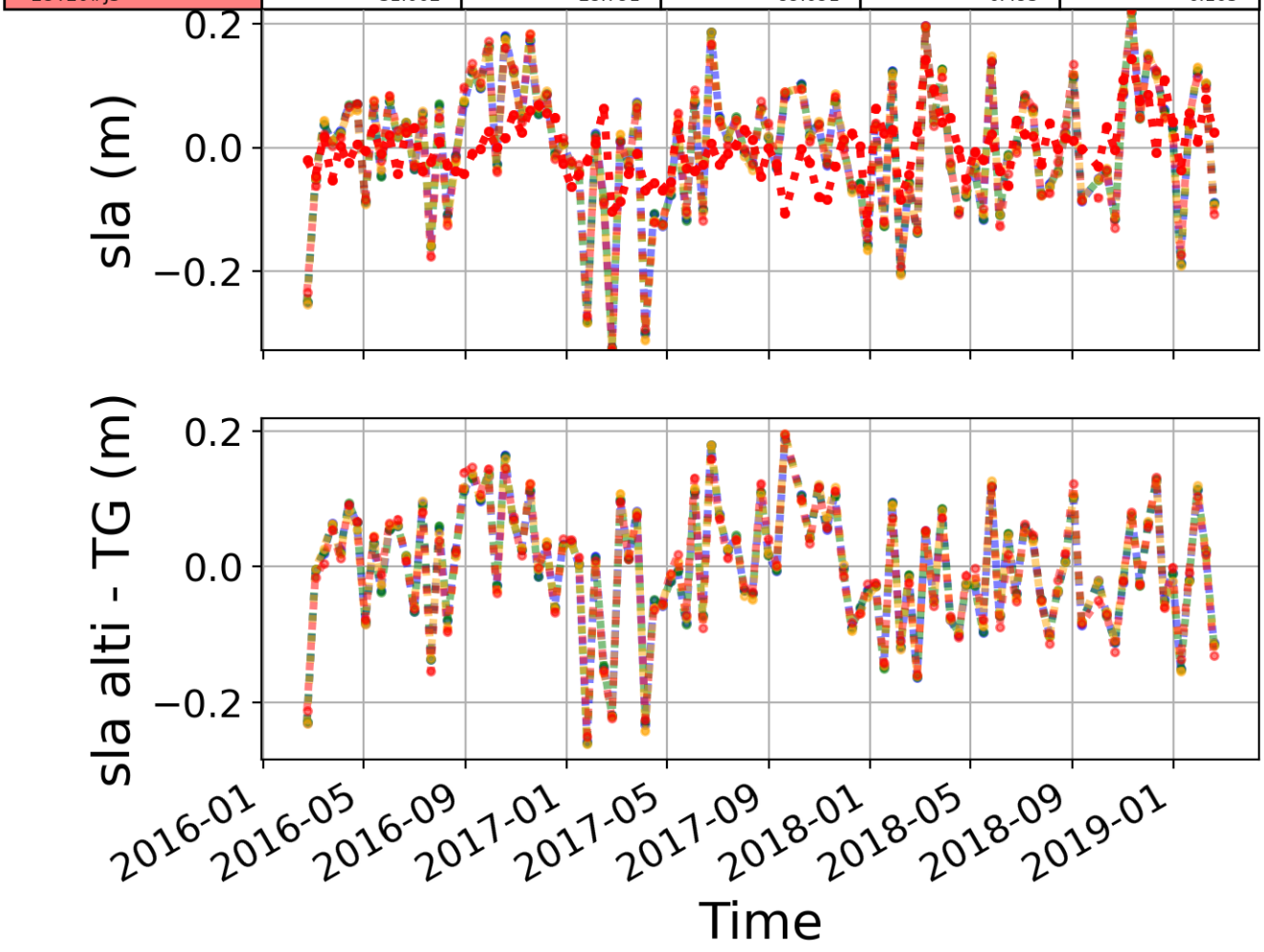

Figure 171 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie

6.11 Station : FOS-SUR-MER

- Nearest track to FOS-SUR-MER station is the track number track187
- The area of interest is limited by :
  - A circle which it's center is the FOS-SUR-MER tide gauge station location and has a Raduis of 40 Km

6.11.1 correlation visualization in maps view % FOS-SUR-MER tide gauge

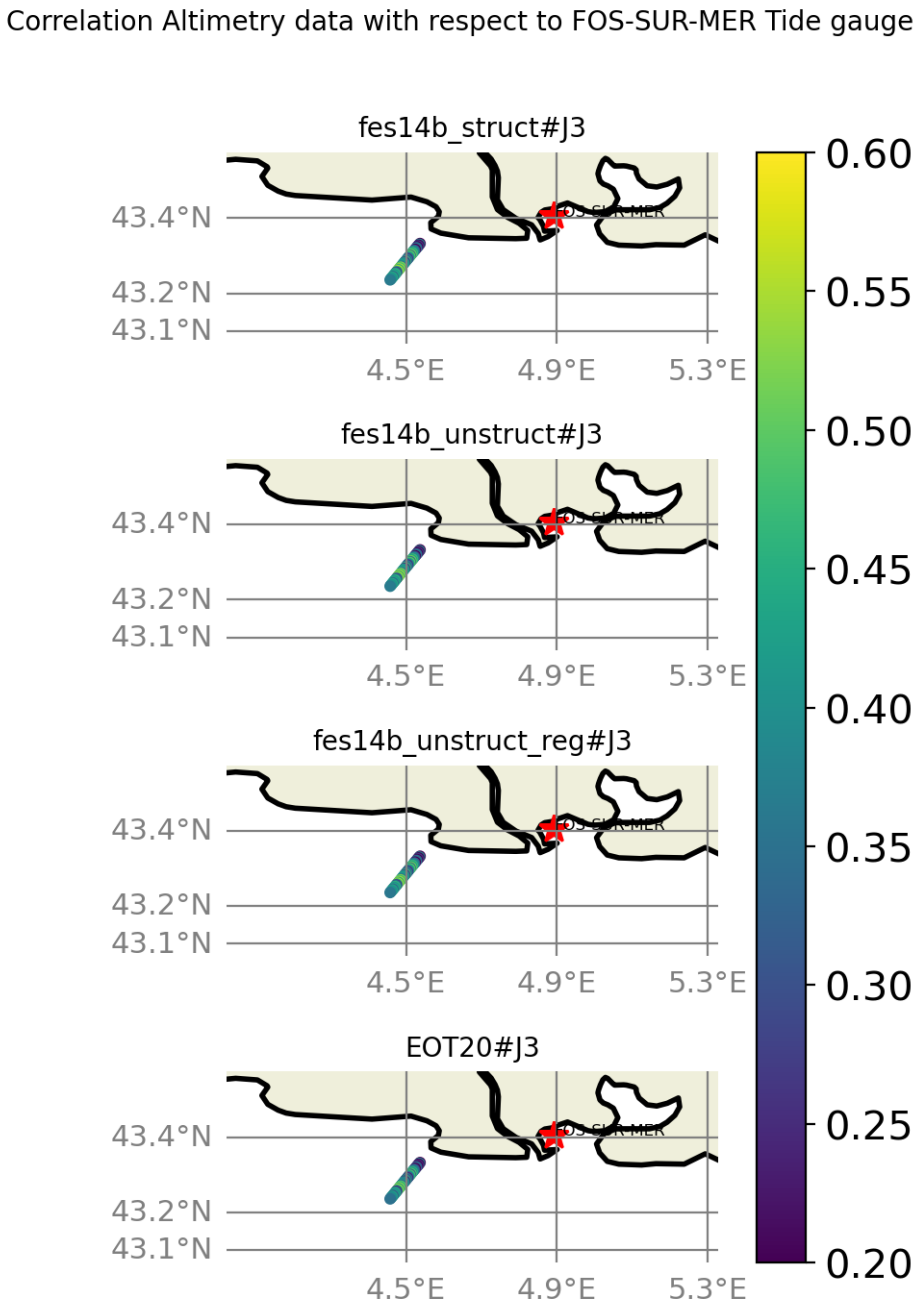

Figure 172 – correlation visualization in maps view % FOS-SUR-MER tide gauge

6.11.2 rmsd visualization in maps view % FOS-SUR-MER tide gauge

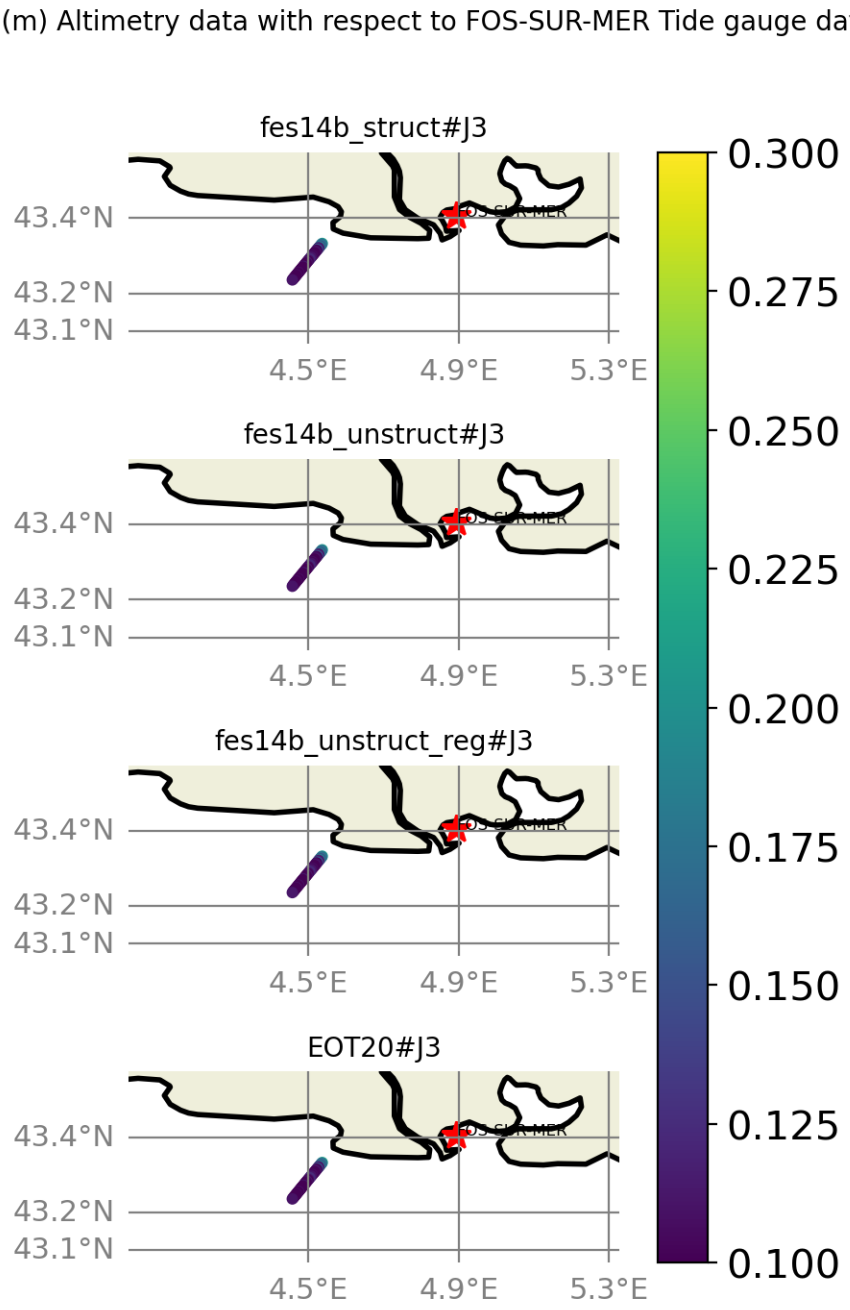

FIGURE 173 – rmsd visualization in maps view % FOS-SUR-MER tide gauge

6.11.3 std visualization in maps view % FOS-SUR-MER tide gauge

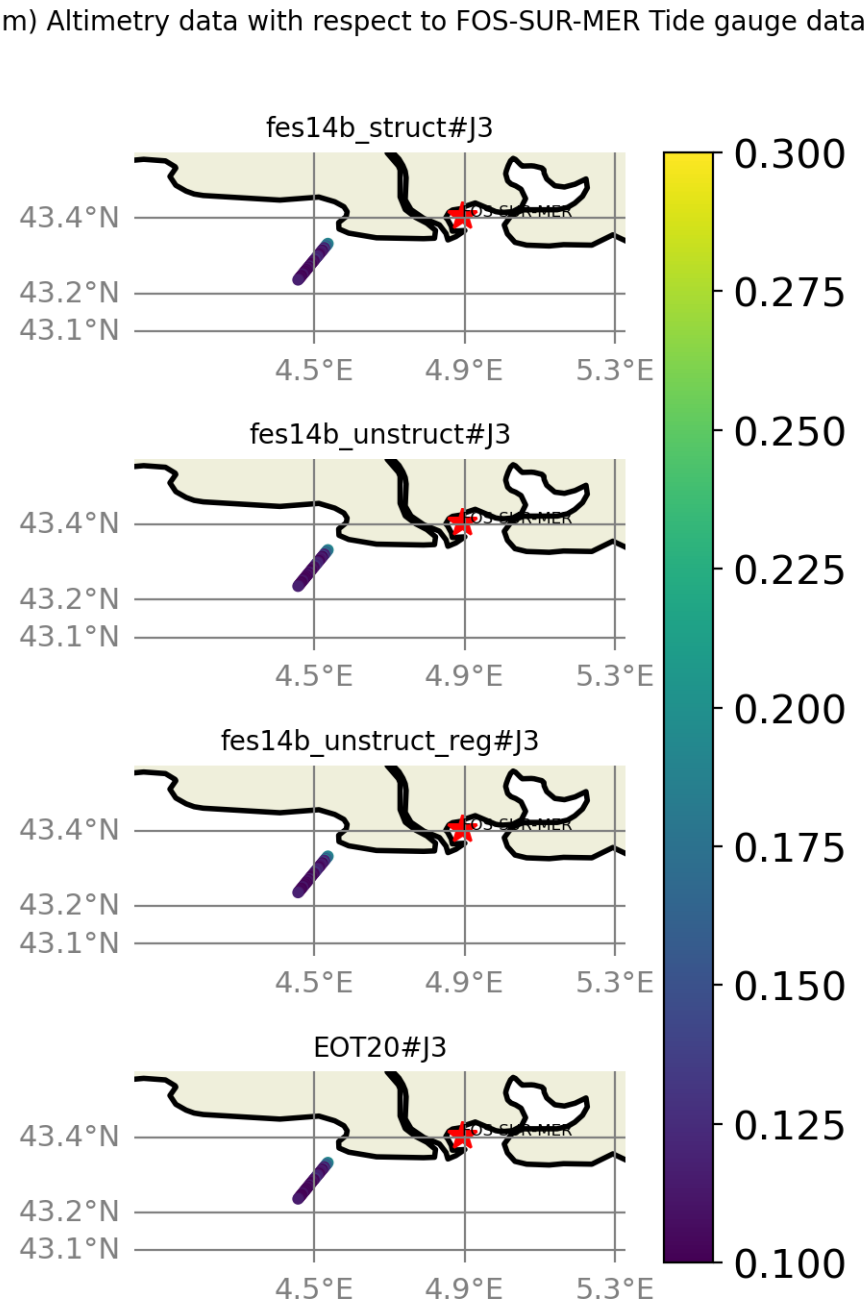

Figure 174 – std visualization in maps view % FOS-SUR-MER tide gauge

6.11.4 valid_data_percent visualization in maps view % FOS-SUR-MER tide gauge

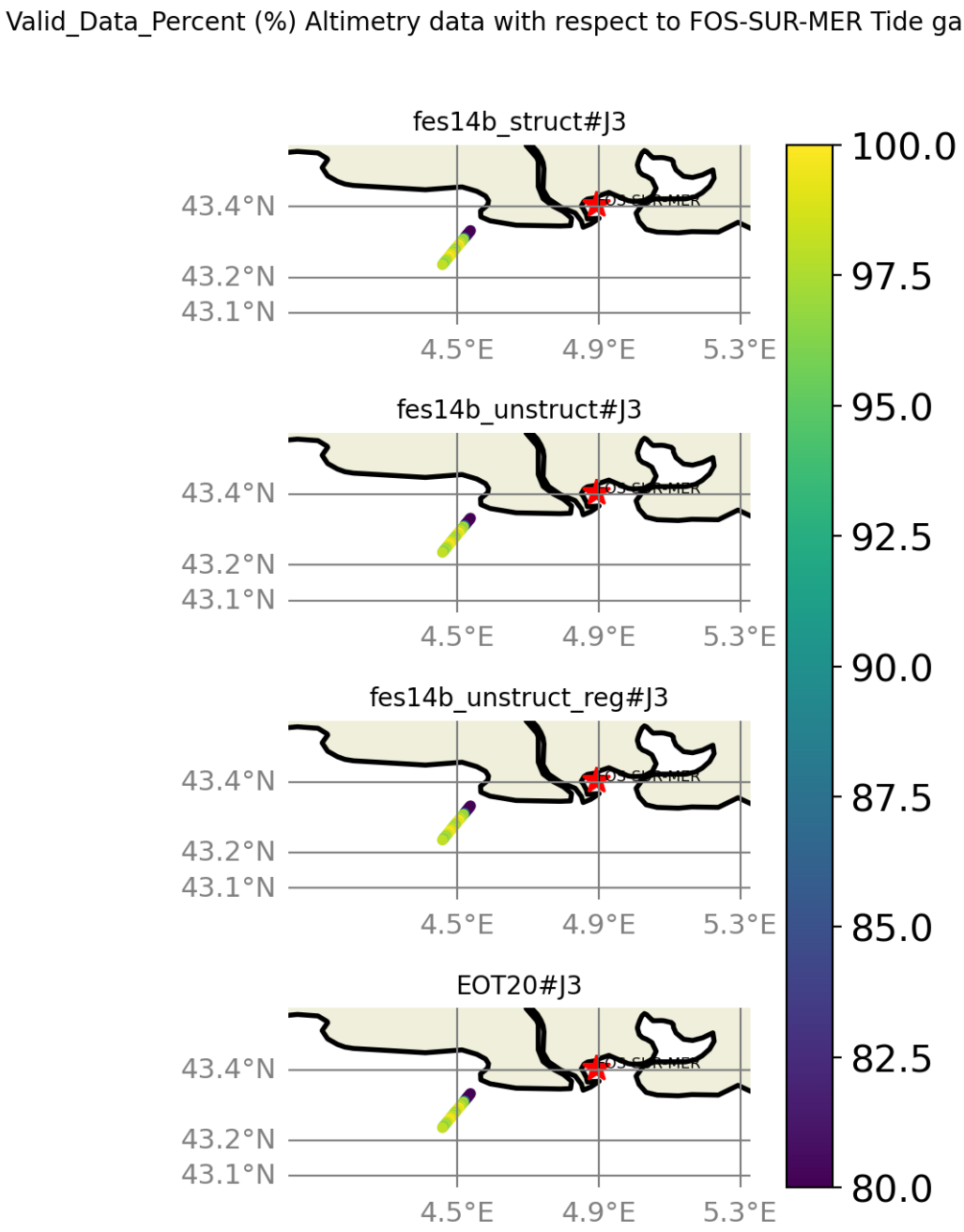

FIGURE 175 – valid_data_percent visualization in maps view % FOS-SUR-MER tide gauge

6.11.5 Valid data (%) in function of distance to coast/FOS-SUR-MER station

The formula to calculate the percentage of valid data in each time serie is;

$$pvd_i = \frac{nvd_i}{maxNB}, i = 1, np$$

Where *pvd* and *nvd* are the percentage of data and the number of altimetry data in the period covered by the tide gauge sla time serie, respectively in the time serie, i is the index of the time serie, np is the number of the selected altimetry time series. $maxNB = 106$ point is the maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie.

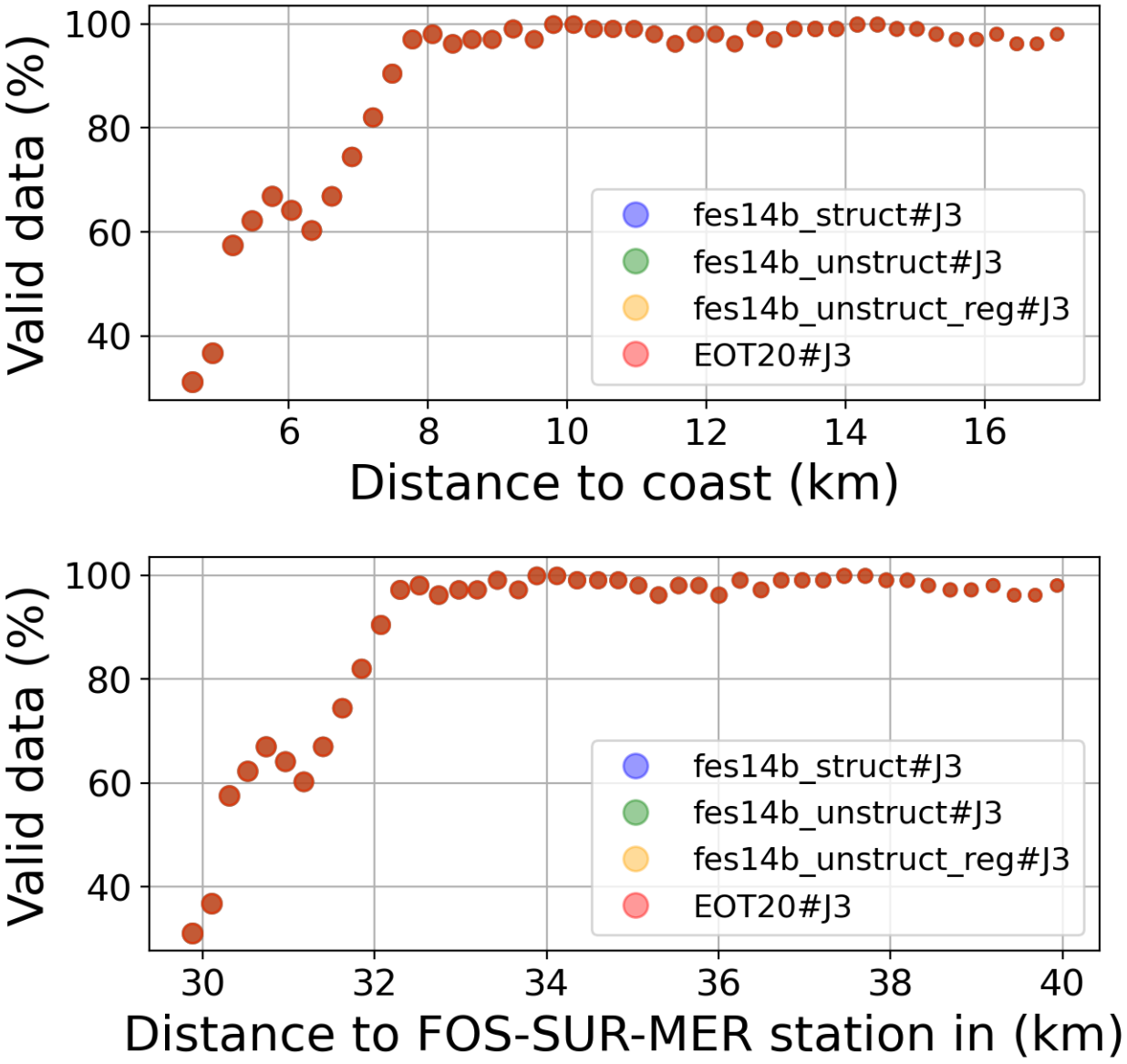

Figure 176 – Valid data (%) in function of distance to coast/FOS-SUR-MER station

6.11.6 Std in function of distance to coast/FOS-SUR-MER station

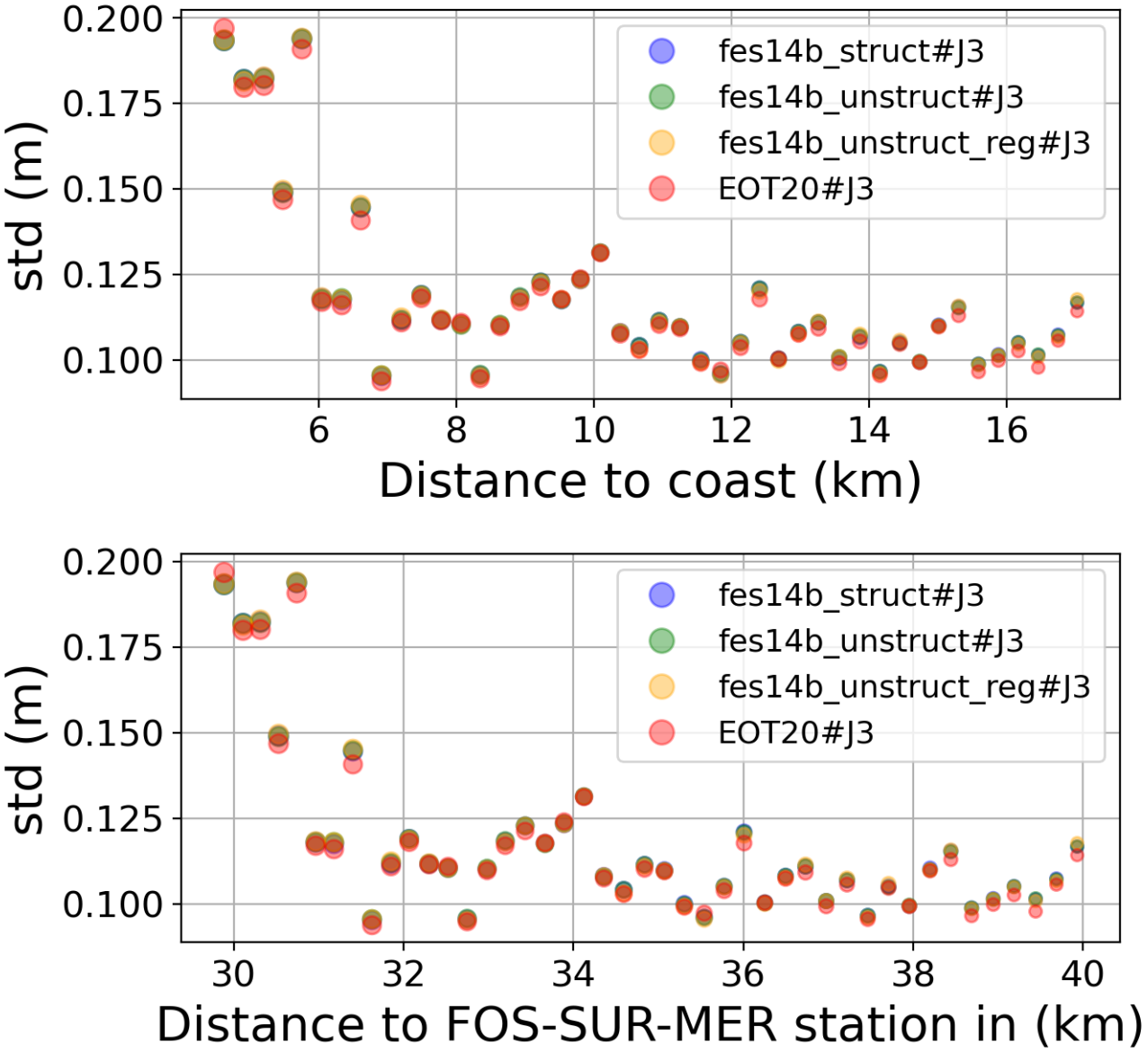

Figure 177 – Std in function of the distance to the coast/FOS-SUR-MER station

6.11.7 Correlation in function of distance to coast/FOS-SUR-MER station

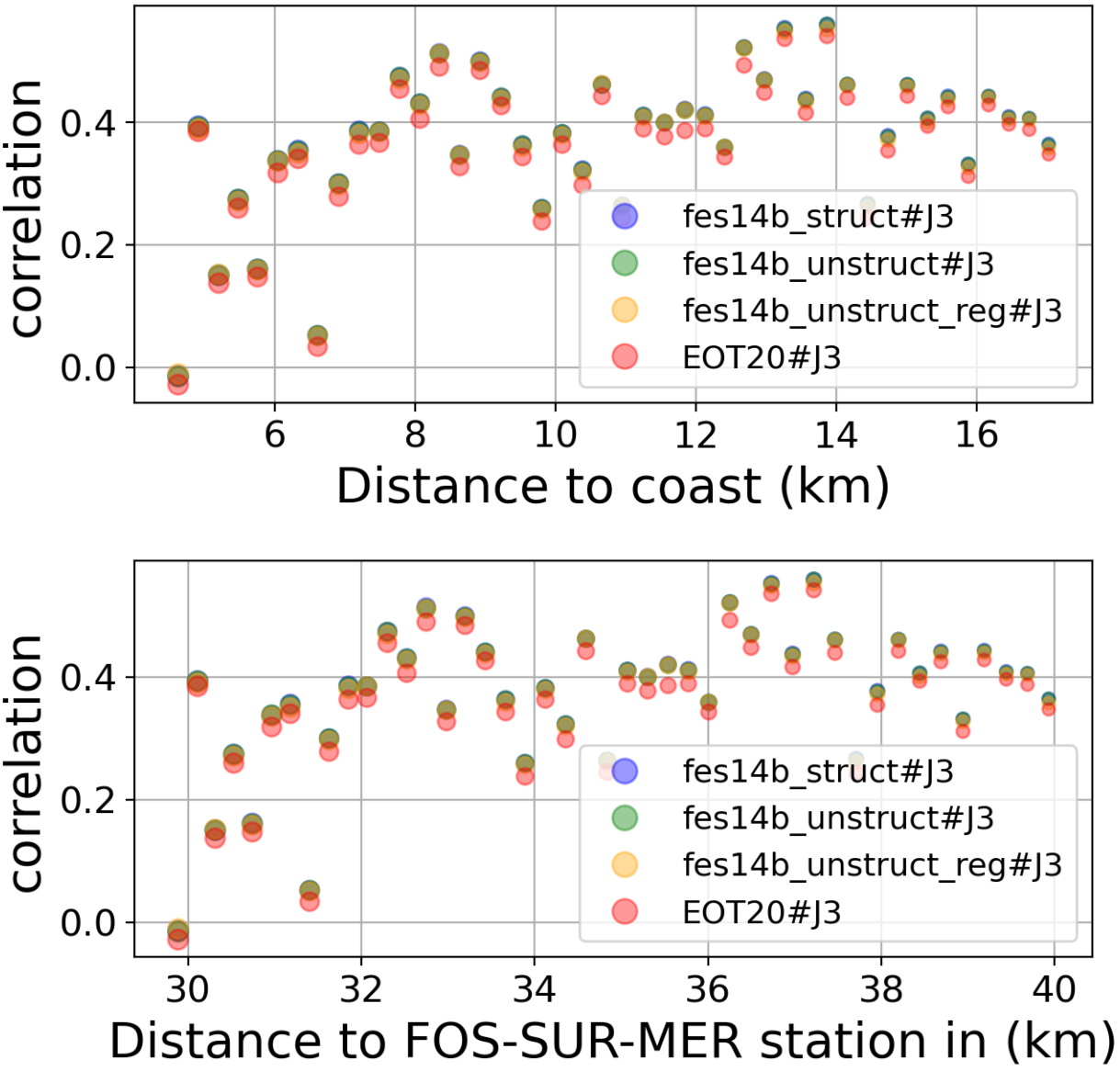

FIGURE 178 – Correlation in function of the distance to the coast/FOS-SUR-MER station

6.11.8 Taylor Diagram

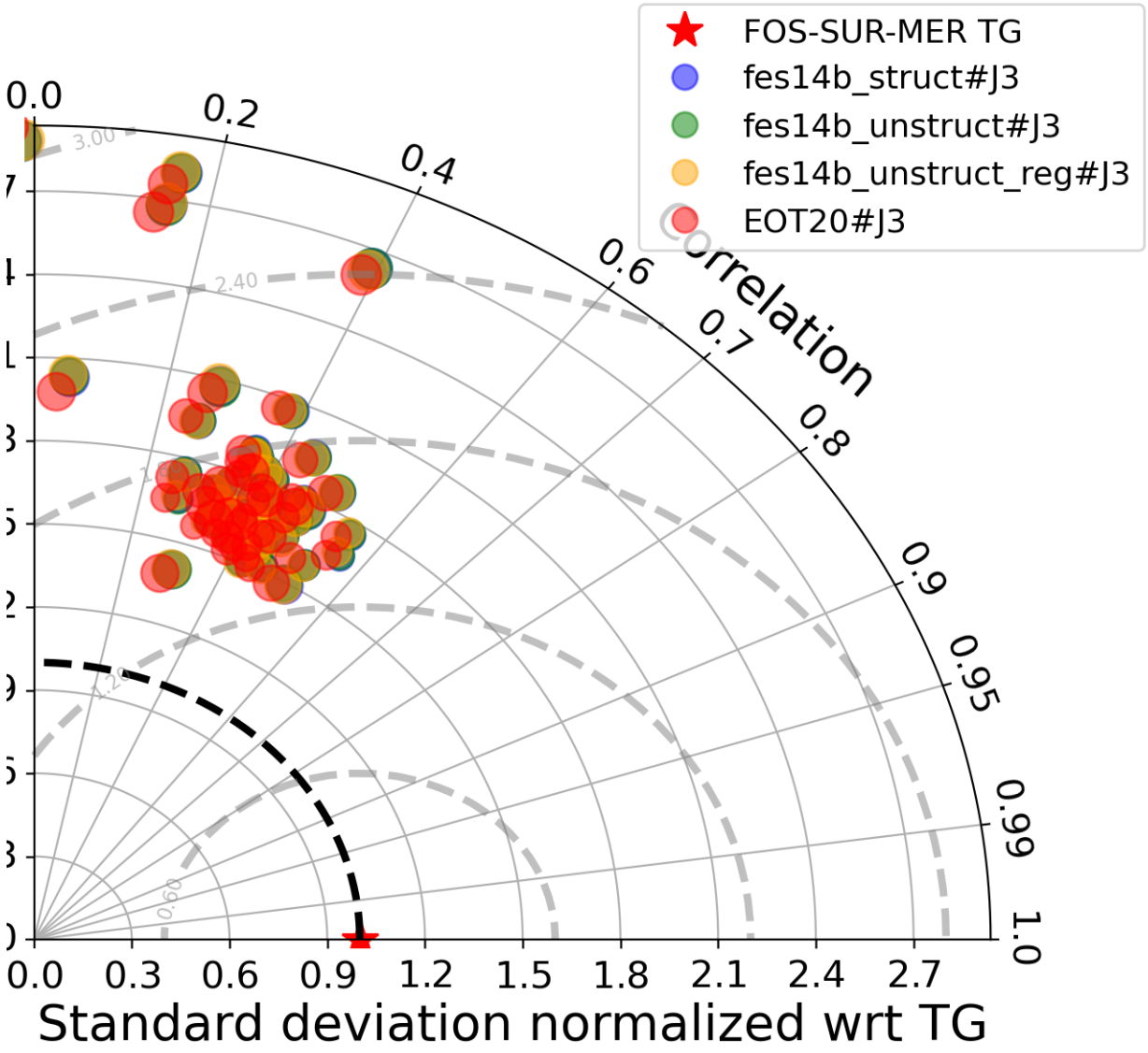

Figure 179 – Taylor diagram

6.11.9 Mean statistics table of products comparison with FOS-SUR-MER tide gauge data

The table below contains the mean statistics of the common points between the different products in the selected area.

Product	Valid data (%)	Correlation	std (m)	rmsd (m)
fes14b_struct#J3	89.365	0.375	0.118	0.112
fes14b_unstruct#J3	89.365	0.374	0.118	0.112
fes14b_unstruct_reg#J3	89.365	0.372	0.118	0.112
EOT20#J3	89.365	0.355	0.117	0.112

FIGURE 180 – Mean statistics table of the common points in the altimetry products

6.11.10 The most correlated sla altimetry Time series with the tide gauge sla time serie

The maximum number of valid altimetry points in the set of all the altimetry sla time series covered by the period of time of the Tide gauge sla time serie is 106 point.

	Dist2station (km)	Dist2coast (km)	Valid data (%)	Correlation	std (m)
TG	-	-	-	-	0.064
fes14b_struct#J3	37.214	13.865	99.057	0.56	0.107
fes14b_unstruct#J3	37.214	13.865	99.057	0.559	0.107
fes14b_unstruct_reg#J3	37.214	13.865	99.057	0.553	0.107
EOT20#J3	37.214	13.865	99.057	0.542	0.106

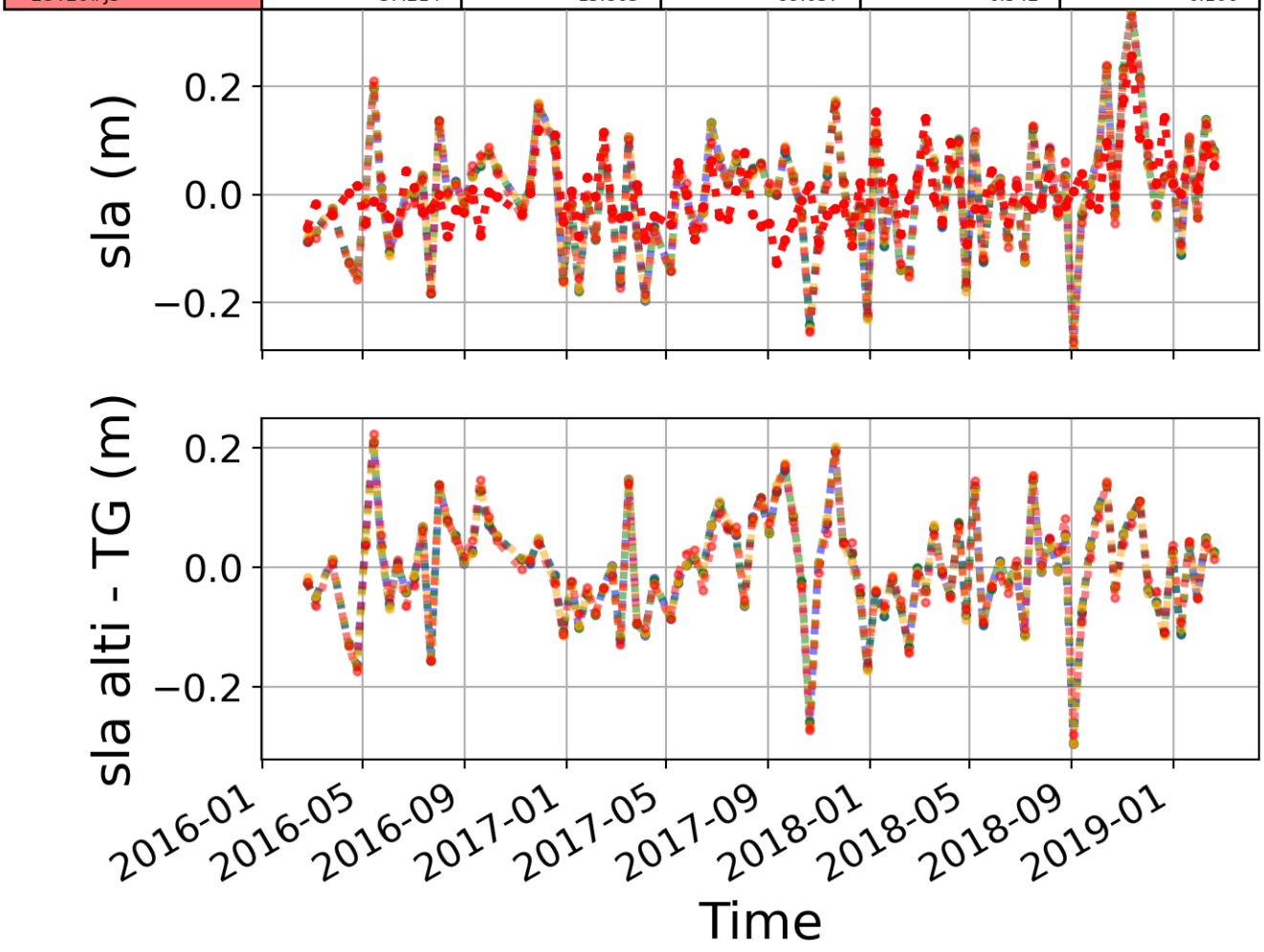

FIGURE 181 – The 1st most correlated sla altimetry Time serie with tide gauge sla time serie