

# Supplementary Material for Comparison of SMOS, SMAP and in situ sea surface salinity in the Gulf of St. Lawrence

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Table 1 gives the correlation coefficient (r value) for various error filters for each satellite SSS product. A dash means that there were less than 4 grid points of data. In bold are the greatest r values for each SSS product. When there are two filters that tied for the greatest correlation, the larger of the two filters was chosen to maximize the amount of data available for our study.

Table 1: Correlation coefficients between anomalies of satellite SSS and anomalies of in situ SSS from CTD data for points with colocations over the entire area of study. All correlations are significant at the 99% significance level or greater. Values in bold are the greatest r value for each SSS dataset.

Filters	CATDS	BEC	JPL	RSS
0.1	0.69	-	-	-
0.2	0.78	-	-	-
0.3	0.80	<b>0.87</b>	0.88	-
0.4	<b>0.83</b>	0.84	0.89	-
0.5	<b>0.83</b>	0.84	<b>0.90</b>	-
0.6	0.82	0.84	<b>0.90</b>	<b>0.84</b>
0.7	0.80	0.85	0.88	<b>0.84</b>
0.8	0.79	0.86	0.88	0.82
0.9	0.79	<b>0.87</b>	0.88	0.80
1.0	0.79	0.86	0.86	0.82
1.2	0.77	0.85	0.84	0.82
1.5	0.76	0.84	0.83	0.81
None	0.75	0.81	0.62	0.76

To ensure that ice presence does not lead to errors if not properly detected by satellite SSS, we used data from the Canadian Ice Service (CIS) to determine when ice is present within each satellite’s grid. If there is any amount of ice within the grid, the SSS is removed from our study. The following table demonstrates the amount of grid points removed due to ice presence and the corresponding correlation coefficients. It is evident from this table that the largest impact of removing data when ice is present was seen for CATDS satellite SSS. Seventeen monthly means were removed for CATDS which resulted in a slightly improved correlation coefficient. JPL has one monthly mean removed due to ice presence.

Table 2: Correlation coefficients between anomalies of satellite SSS and anomalies of in situ SSS from CTD data for points with colocations over the entire area of study, when correcting for sea ice presence and without the correction. The amount of data used with and without ice correction is reflected in the column ‘Num’

Dataset	with correction			without correction		
	r val	p val	Num	r val	p val	Num
CATDS	0.83	<0.001	495	0.82	<0.001	512
BEC	0.87	<0.001	1713	0.87	<0.001	1713
JPL	0.90	<0.001	720	0.90	<0.001	721
RSS	0.84	<0.001	499	0.84	<0.001	499

Each satellite SSS is available for a different time period with only 4.5 years common to all 4 satellite SSS products. Table 3 shows correlation coefficients when the same time period (2015-2019) is used for all SSS products.

Table 3: Correlations between anomalies of satellite SSS and anomalies of in situ SSS from CTD data for points with collocations in the three regions; North, South and NWGSL from 2015-2019. Results presented here are for the chosen filters; 0.5 CATDS, 0.9 BEC, 0.6 JPL and 0.7 RSS. Correlations are significant at the 99% significance level or greater, except for CATDS in the NWGSL.

Dataset	North			South			NWGSL		
	r val	p val	N	r val	p val	N	r val	p val	N
CATDS	0.30	0.01	68	0.89	<0.001	106	0.80	0.10	5
BEC	0.73	<0.001	221	0.83	<0.001	795	0.74	<0.001	29
JPL	0.78	<0.001	166	0.85	<0.001	436	N/A	N/A	N/A
RSS	0.72	<0.001	82	0.77	<0.001	343	N/A	N/A	N/A

Figures 1 to 4 show the number of years with SSS collocations between each satellite product and CTD at each grid point. Figure 5 shows a timeseries of SSS common to both satellite and Viking Buoy data, as well as satellite and in situ CTD data at the high-frequency Shediac Valley Station.

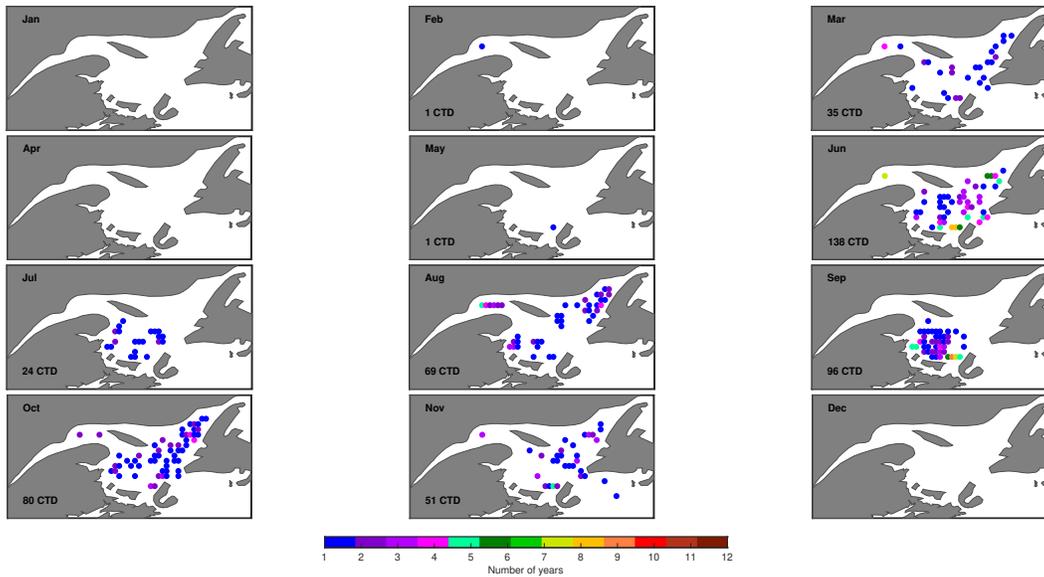


Figure 1: Number of years with CATDS SSS for grid points with CTD SSS collocations from January 2010 to December 2020. A 0.7 psu filter was used to flag uncertain data.

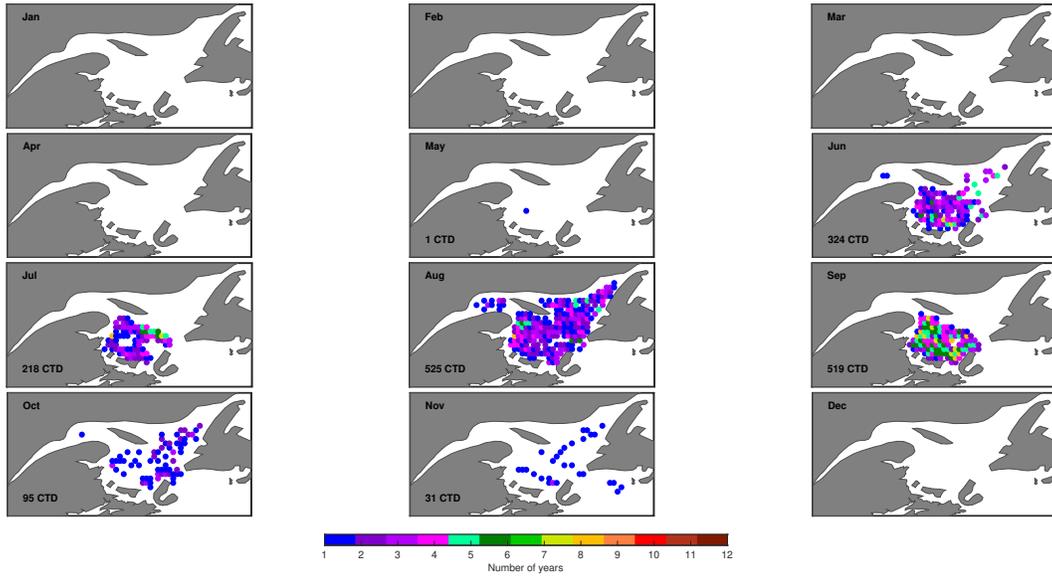


Figure 2: Number of years with BEC SSS for grid points with CTD SSS collocations from January 2011 to December 2019. A 0.9 psu filter was used to flag uncertain data.

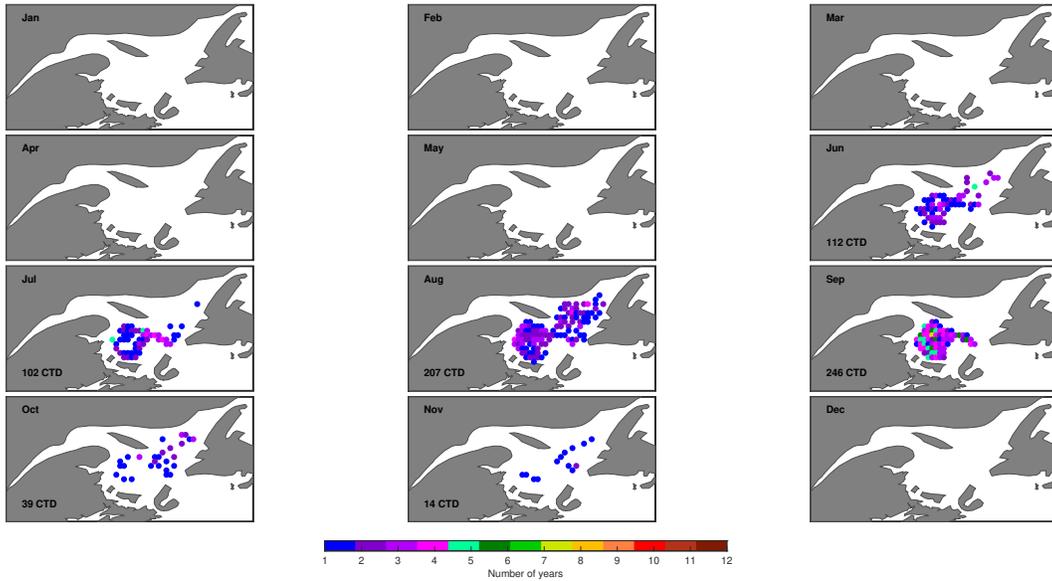


Figure 3: Number of years with JPL SSS for grid points with CTD SSS collocations from September 2015 to September 2021. A 0.6 psu filter was used to flag uncertain data.

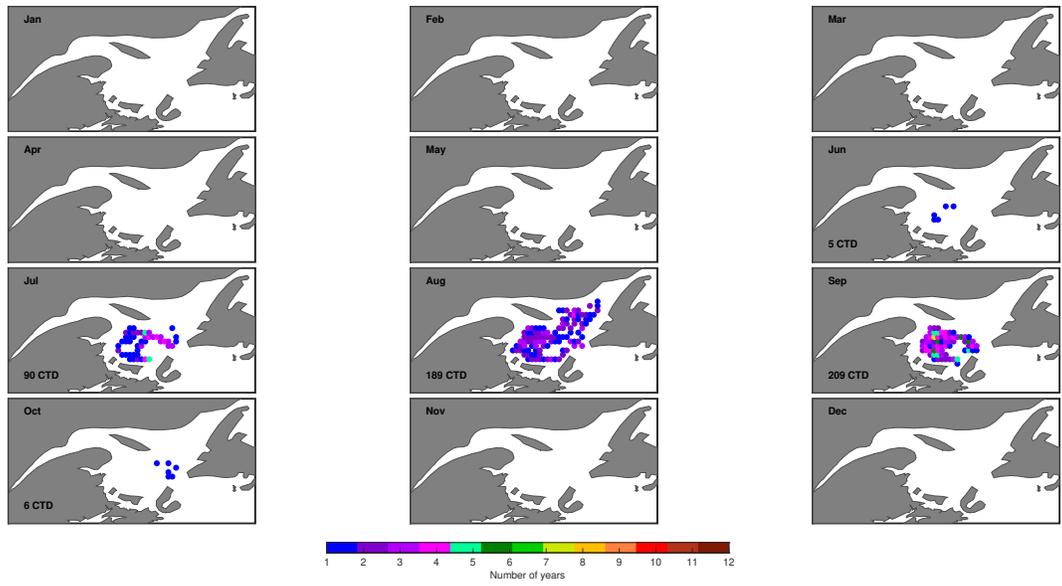


Figure 4: Number of years with RSS SSS for grid points with CTD SSS colocations from September 2015 to September 2021. A 0.7 psu filter was used to flag uncertain data.

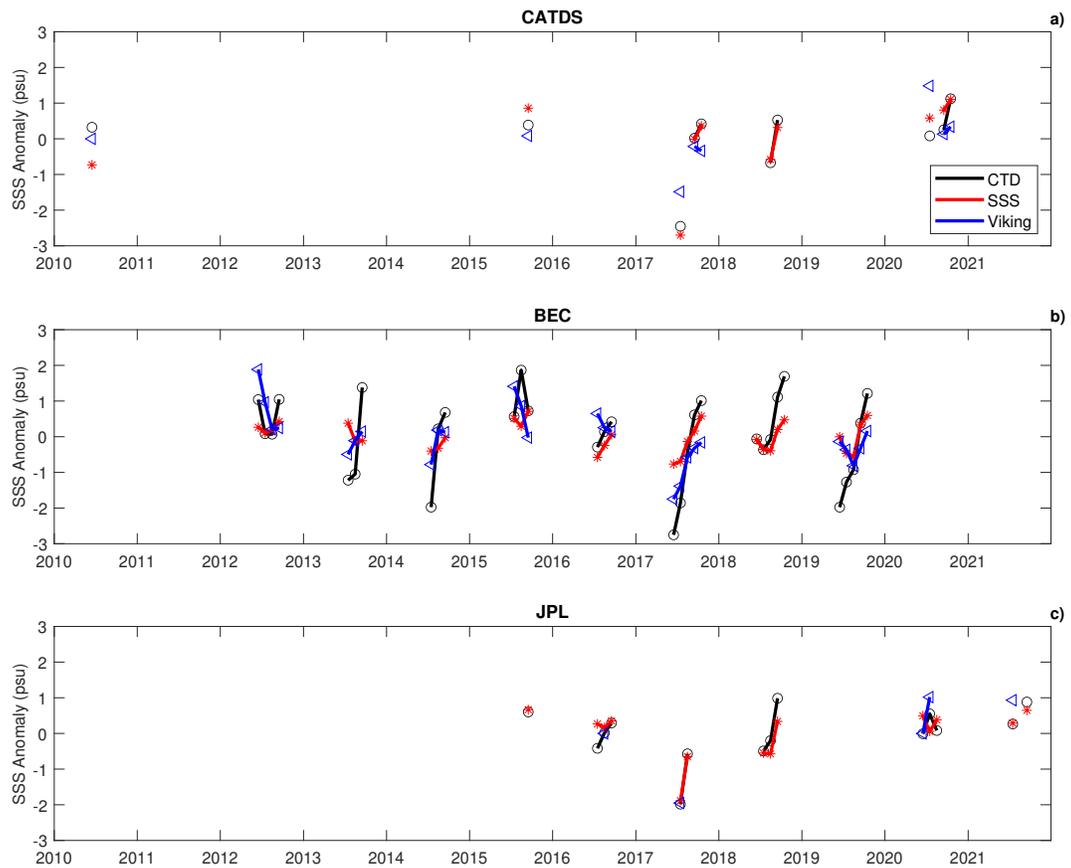


Figure 5: Monthly anomaly at Shediac Valley for CTD and Viking buoy data collocated to each satellite SSS data. Note that no data is available at this location for RSS.