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Jet Propulsion Laboratory
California Institute of Technology

Comparison of GHRSST SST analysis in the Arctic Ocean and Alaskan coastal waters using saildrones

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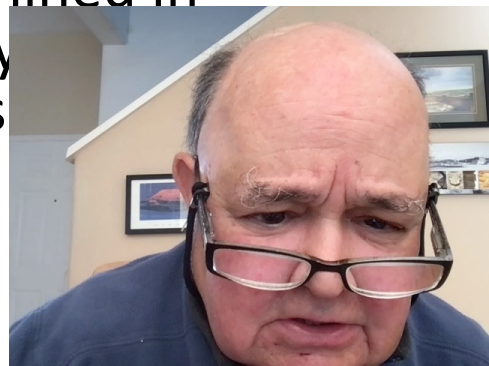
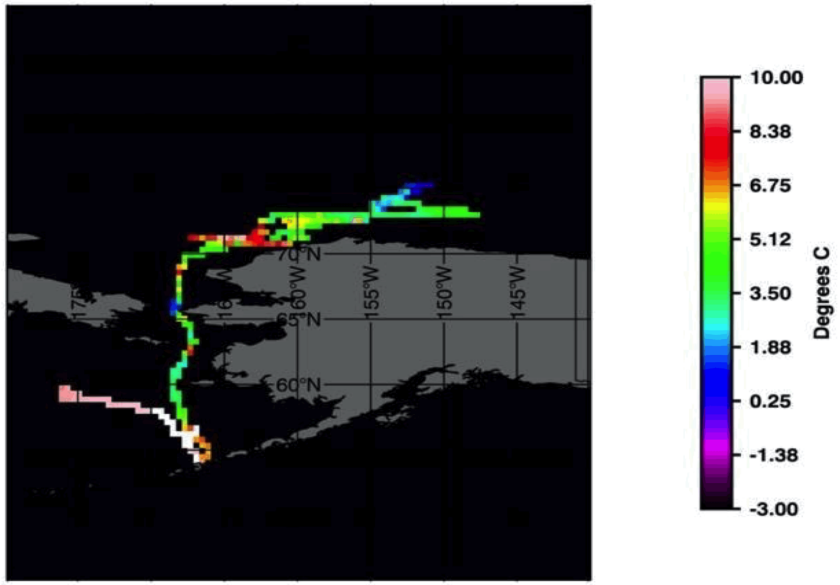
Introduction and Methodology

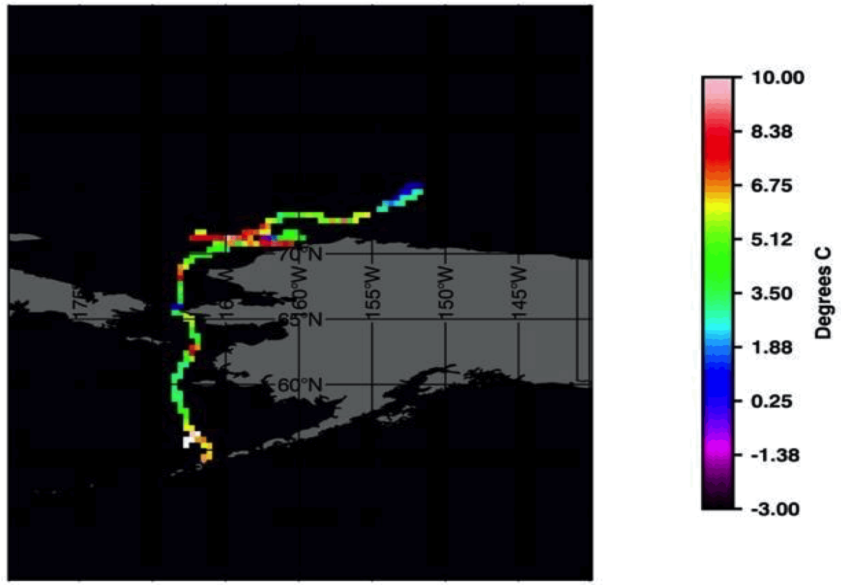
- There is high demand for complete satellite SST maps (or L4 SST analyses) of the Arctic regions to monitor the rapid environmental changes occurring at high latitudes. Although there is a plethora of L4 SST products to choose from, satellite-based products evolve constantly with the advent of new satellites and frequent changes in SST algorithms with the intent of improving absolute accuracies. The constant change of these products, as reflected by the version product, make it necessary to do periodic validations against in situ data.
- Eight of these L4 products are compared here against saildrone data from two 2019 campaigns in the western Arctic, as part of the MISST project. The accuracy of the different products is estimated using different statistical methods, from standard and robust statistics to Taylor diagrams. Results are also examined in terms of spatial scales of variability using auto- and cross-spectral analy three products with the best performance at this point and time are us case study of the thermal features of the Yukon-Kuskokwim delta.



(a) SD1036_SBE37



(b) SD1037_WING



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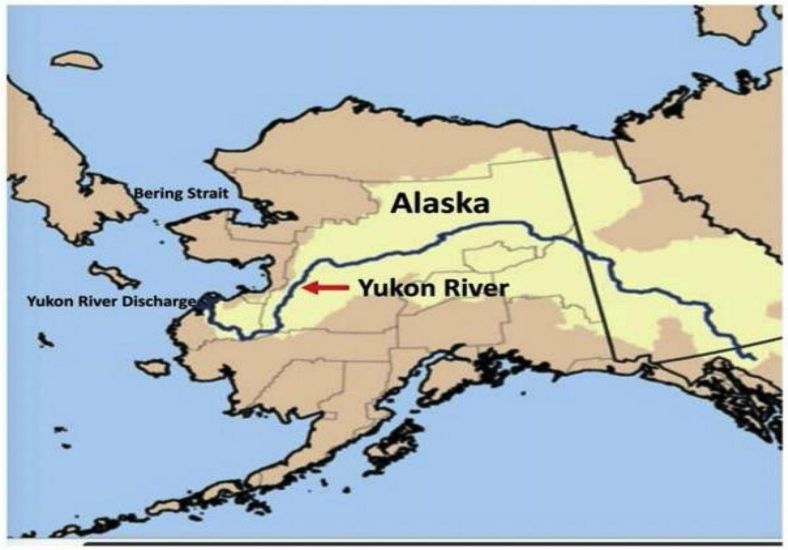
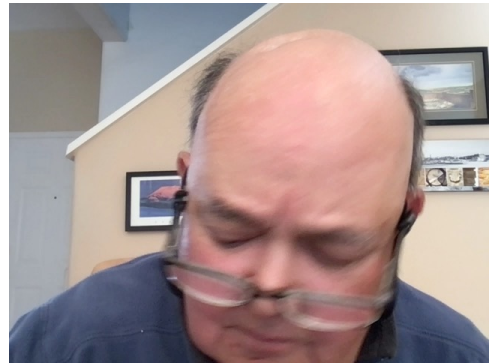
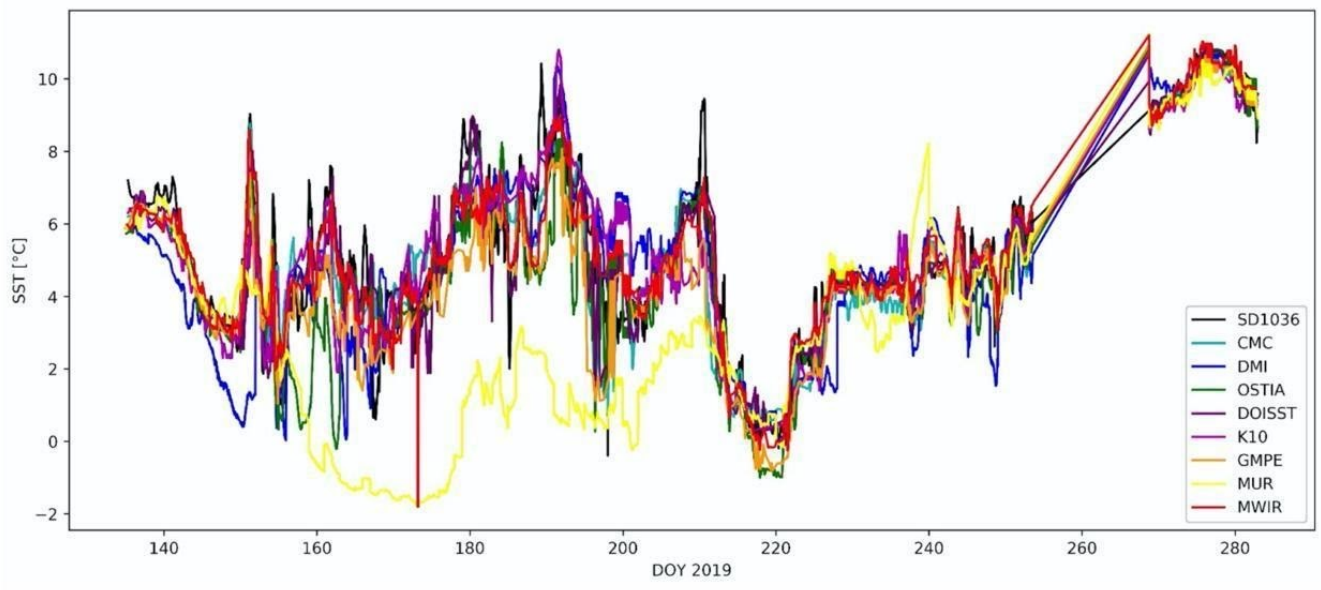
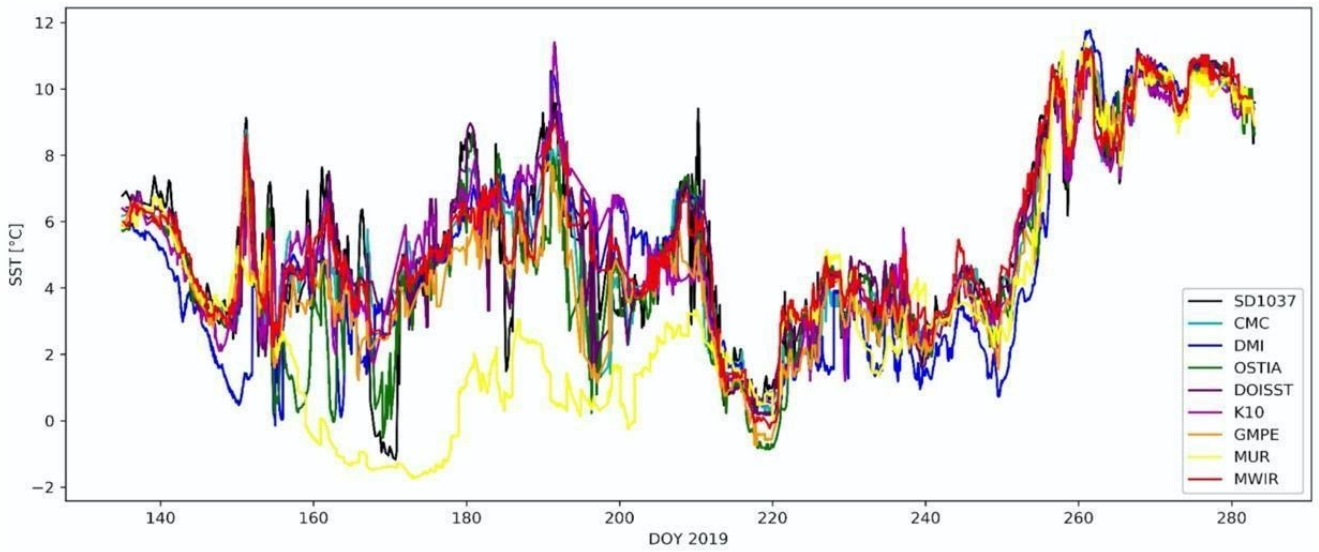


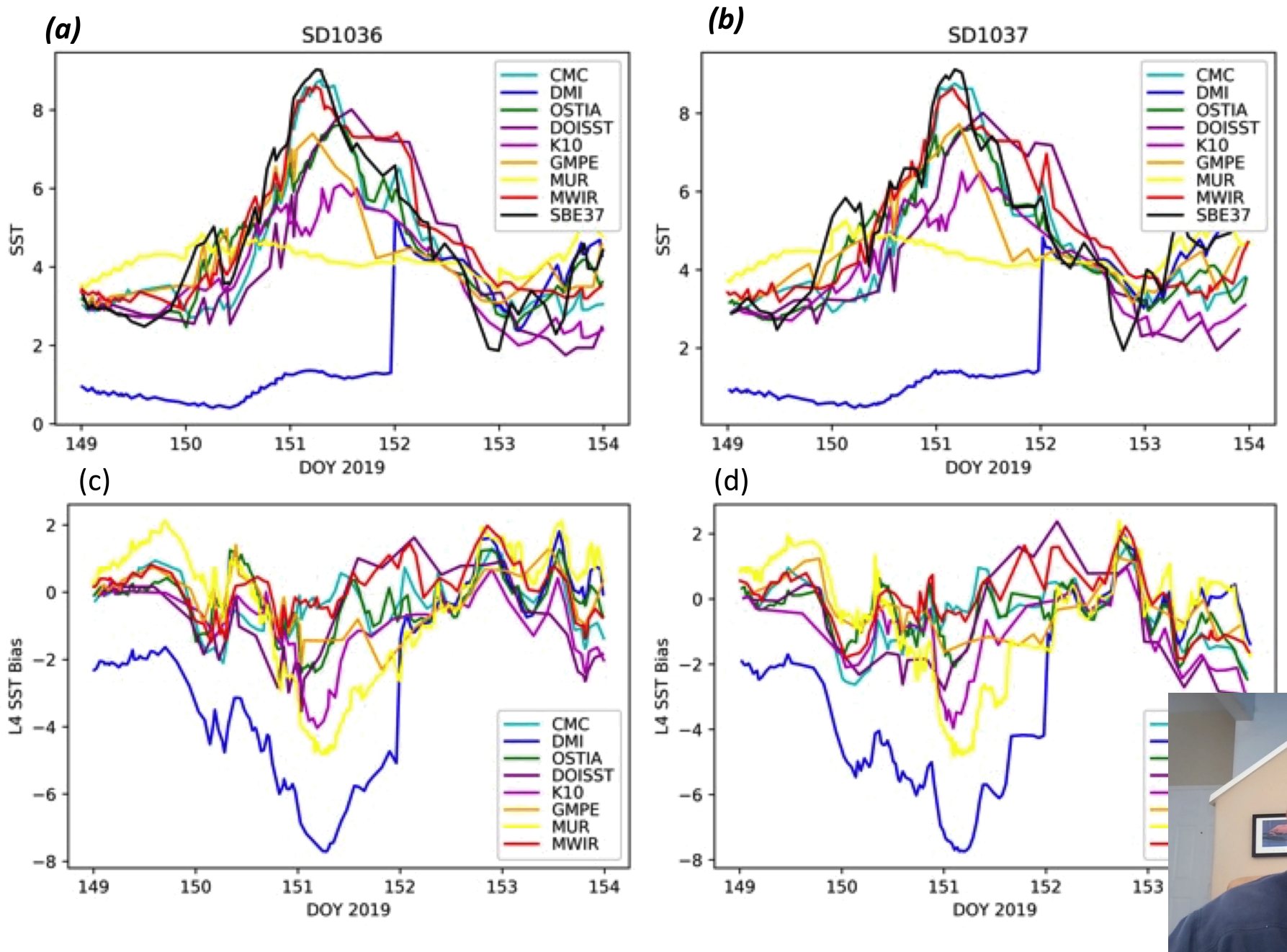


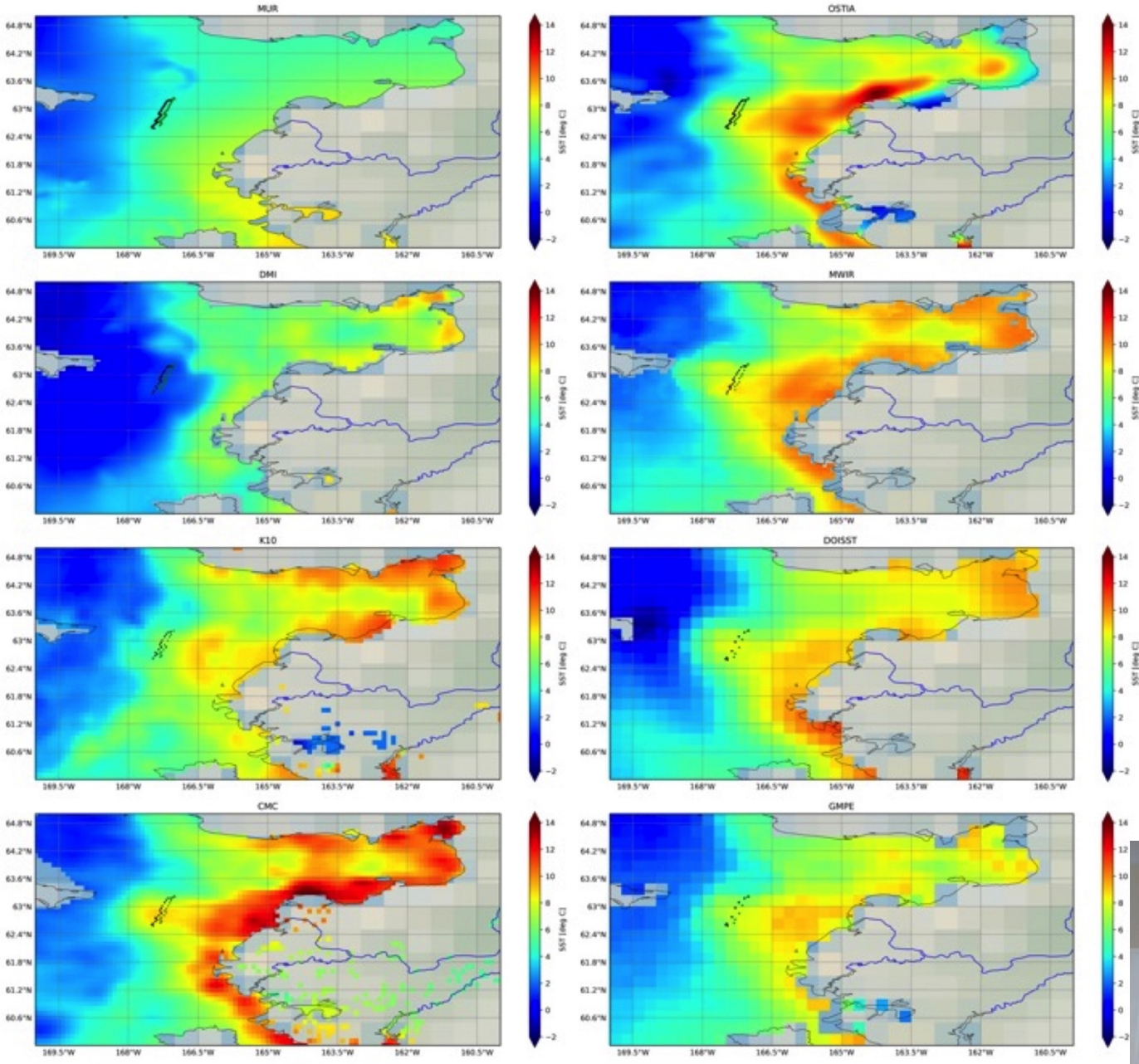
(a)

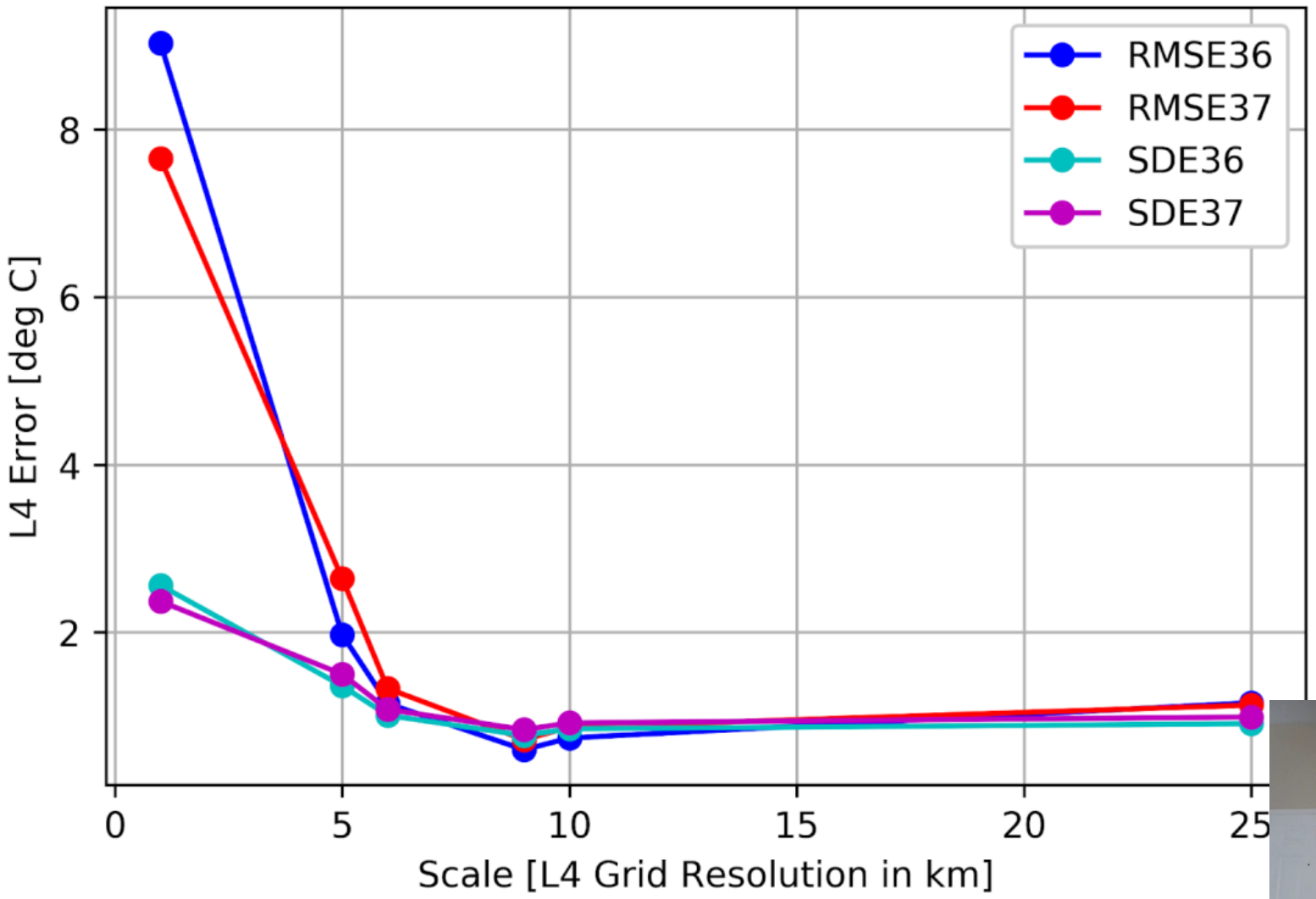

SST [°C]
DOY 2019
SD1036
CMC
DMI
OSTIA
DOISST
K10
GMPE
MUR
MWIR

(b)


SST [°C]
DOY 2019
SD1037
CMC
DMI
OSTIA
DOISST
K10
GMPE
MUR
MWIR

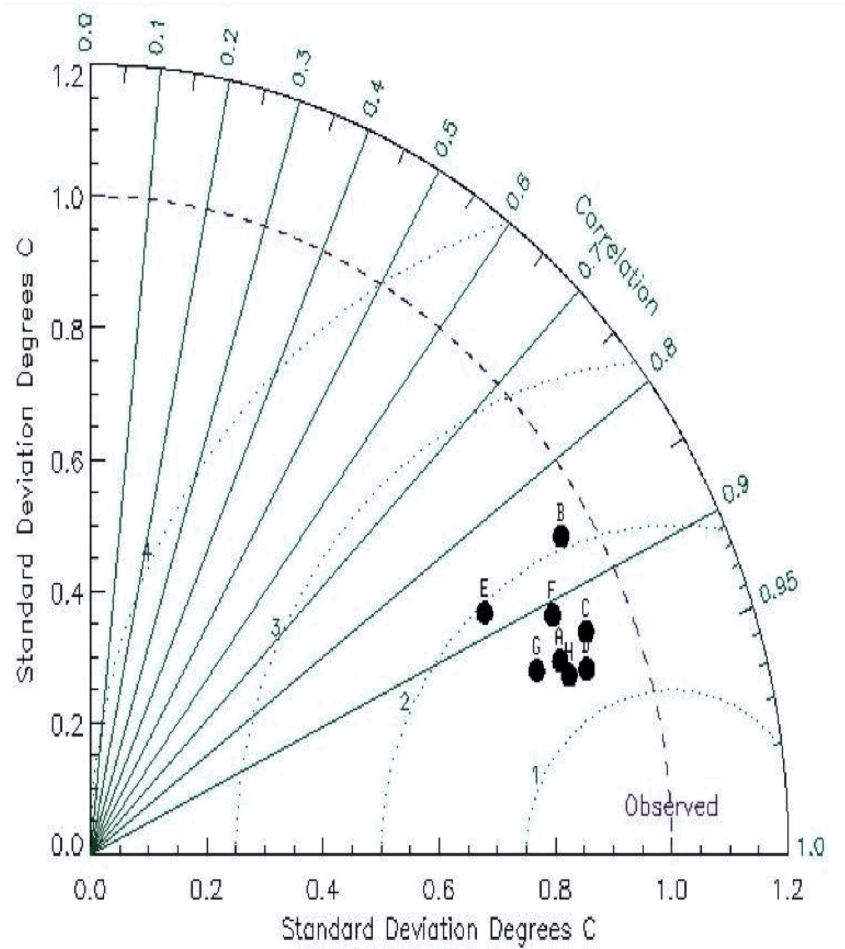

(a)
SD1036
SST
DOY 2019
(b)
SD1037
SST
DOY 2019
CMC
DMI
OSTIA
DOISST
K10
GMPE
MUR
MWIR
SBE37
(c)
L4 SST Bias
DOY 2019
(d)
L4 SST Bias
DOY 2019


MUR
OSTIA
DMI
MWIR
K10
DOISST
CMC
GMPE
64.8°N
64.2°N
63.6°N
63°N
62.4°N
61.8°N
61.2°N
60.6°N
169.5°W
168°W
166.5°W
165°W
163.5°W
162°W
160.5°W
SST [deg C]
14
12
10
8
6
4
2
0
−2


RMSE36
RMSE37
SDE36
SDE37
L4 Error [deg C]
8
6
4
2
0
5
10
15
20
25
Scale [L4 Grid Resolution in km]

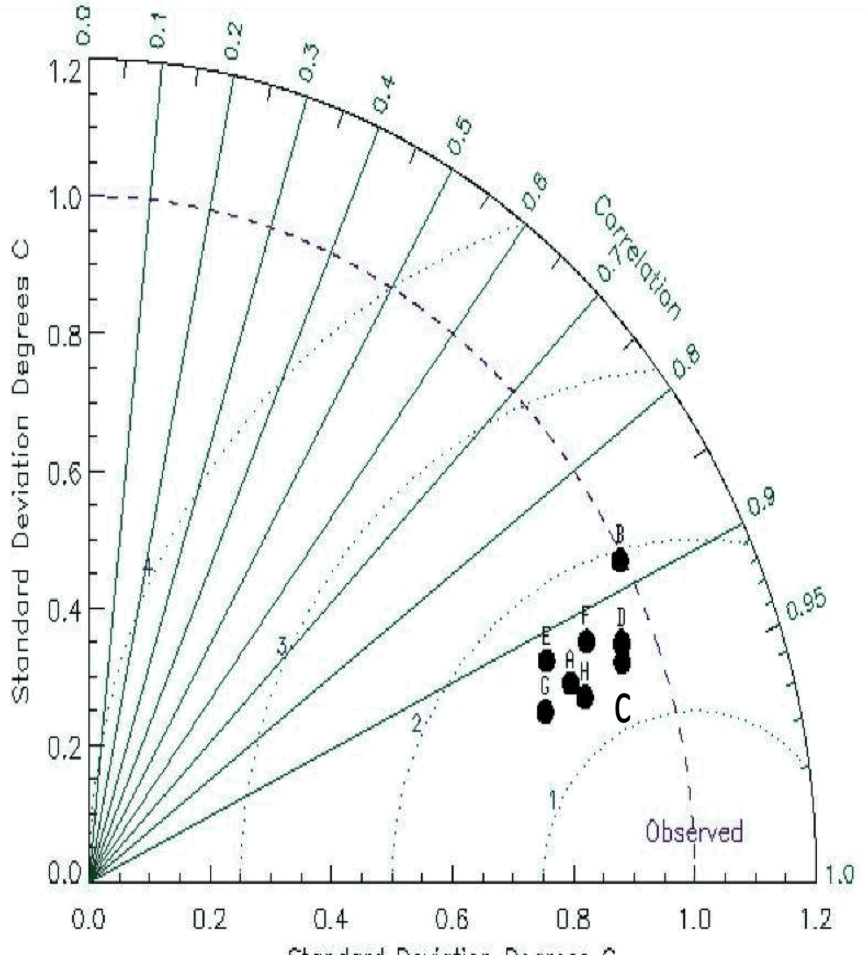
SBE37 SD1036

(a)

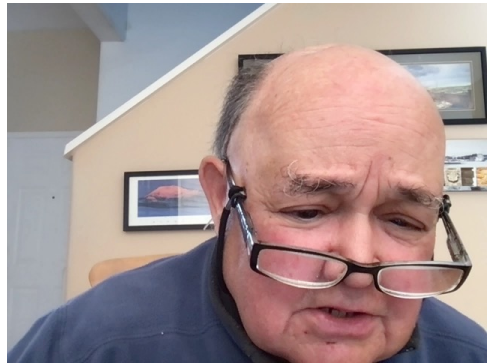


SBE37 SD1037

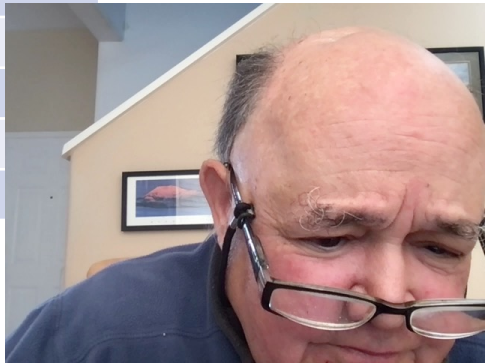
(b)



A=CMC
B=DMI
C=GMPE
D=MUR
E=NAVO
F=OSTIA
G=REMSS
H=DOISST



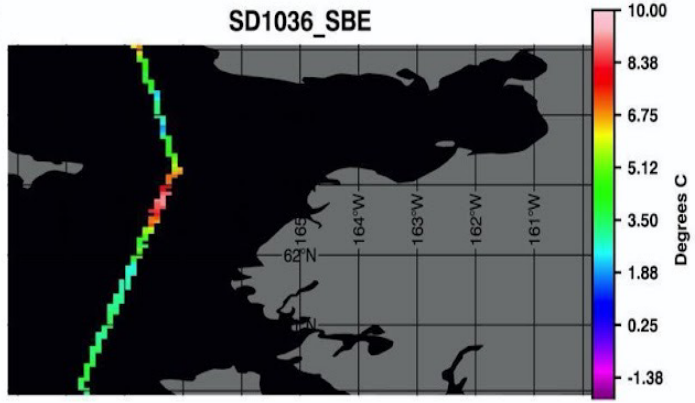
SD1036	Slope SBE37	Slope L4
MUR (1 km)	-1.83	-2.27
DMI (5 km)	-1.85	-2.00
OSTIA (6 km)	-1.79	-1.78
MWIR (9 km)	-1.88	-2.22
CMC (10 km)	-1.81	-2.14
K10 (10 km)	-1.78	-2.06
DOISST (25 km)	-1.90	-2.28
GMPE (25 km)	-1.86	-2.19
SD1037	Slope SBE37	Slope L4
MUR (1 km)	-1.75	-2.34
DMI (5 km)	-1.81	-2.35
OSTIA (6 km)	-1.77	-1.82
MWIR (9 km)	-1.81	-2.26
CMC (10 km)	-1.87	-2.17
K10 (10 km)	-1.86	-2.19
DOISST (25 km)	-1.93	-2.39
GMPE (25 km)	-1.94	-2.29



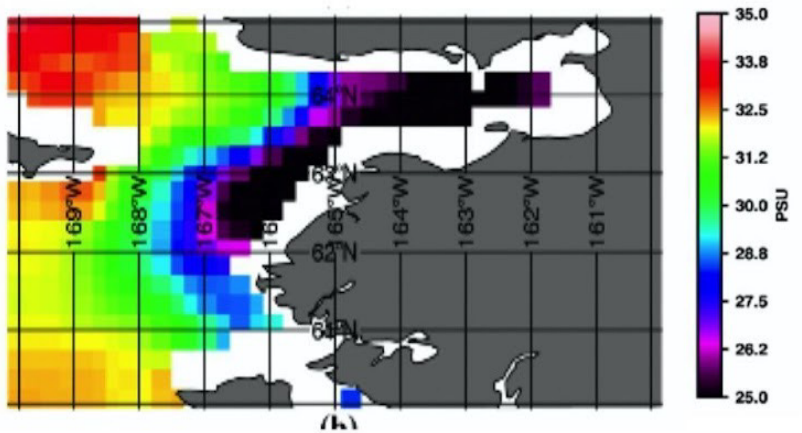
(a)


Bering Strait
Alaska
Yukon River
Yukon River Discharge

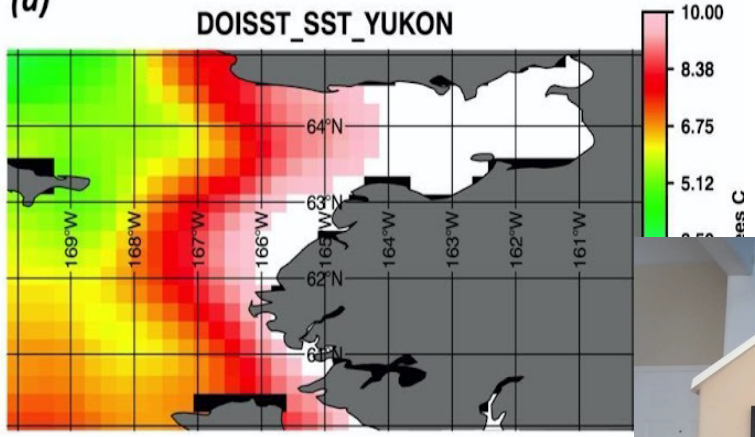
(b)


SD1036_SBE
10.00
8.38
6.75
5.12
3.50
1.88
0.25
-1.38
Degrees C
62°N
164°W
163°W
162°W
161°W

(c)

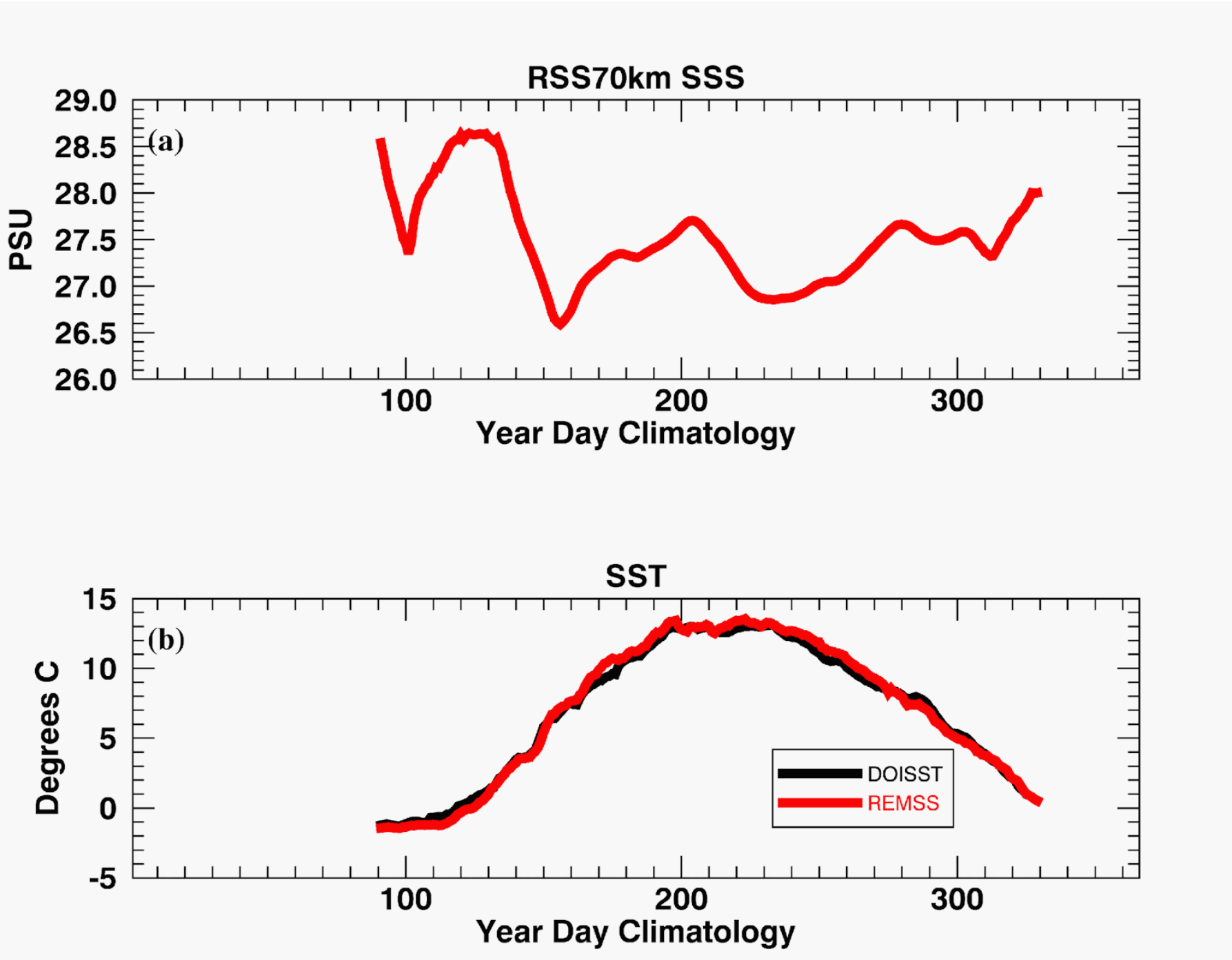

35.0
33.8
32.5
31.2
30.0
28.8
27.5
26.2
25.0
PSU
64°N
62°N
169°W
168°W
167°W
164°W
163°W
162°W
161°W

(d)


DOISST_SST_YUKON
10.00
8.38
6.75
5.12
64°N
63°N
62°N
169°W
168°W
167°W
166°W
164°W
163°W
162°W
161°W

Conclusions

- The statistical analyses show that two L4 SST products had consistently better relative accuracy when compared to the saildrone subsurface temperatures. Those are the NOAA/NCEI DOISST and the RSS MWOI SSTs.
- In terms of the spectral variance and feature resolution, the UK Met Office OSTIA product appears to outperform all others at reproducing the fine scale features, especially in areas of high spatial variability such as the Alaska coast. It is known that L4 analyses generate small-scale features that get smoothed out as the SSTs are interpolated onto spatially complete grids. However, when the high-resolution satellite coverage is sparse, which is the case in the Arctic regions, the analyses tend to produce more spurious small-scale features.
- The analyses here indicate that the high-resolution coverage, attainable with current satellite infrared technology, is too sparse due to cloud cover to support very high resolution L4 SST products in high latitudinal regions. Only for grid resolutions of ~9-10 km or greater, does the smoothing of the gridding process balance out the sm noise resulting from the lack of high-resolution infrared data. This scale, incid agrees with the Rossby deformation radius in the Arctic Ocean (~10 km).


RSS70km SSS
(a)
PSU
29.0
28.5
28.0
27.5
27.0
26.5
26.0
100
200
300
Year Day Climatology
SST
(b)
Degrees C
15
10
5
0
-5
DOISST
REMSS
100
200
300
Year Day Climatology