GHRSST XXI, Session: Calibration and Validation-015, online, 1-4 June 2020

Comparison of SGLI SST and M-AERI skin SST

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1 Introduction

SGLI SSTs are skin SSTs retrieved from the split-window data of GCOM-C/SGLI. The SST method is based on the quasi-physical method developed for the Himawari-8 SST product of JAXA. A validation result derived by comparison with buoy data shows the bias and RSD (SD) of -0.19 and 0.28 K (0.35 K) for the SGLI SSTs for daytime and -0.17 K and 0.28 K (0.62 K) for nighttime, respectively (Retrieval Algorithms-014, GHRSST XXI). As another validation, I compared SGLI SSTs with the Marine-Atmospheric Emitted Radiance Interferometer (M-AERI) skin SST data.

2 Data

2.1 M-AERI

The M-AERI is an interferometric Fourier-transform IR spectroradiometer developed at SSEC at the University of Wisconsin Madison (P. J. Minnett, et. al. 2001). Skin SSTs are determined with uncertainties of less than 0.1 K using spectra obtained with the M-AERI. The M-AERI skin SSTs were provided by Professor Minnett in June 2019 (Table 1, Fig. 1).

2.2 SGLI SST

SGLI SSTs are determined using the split-window data obtained by GCOM-C/SGLI. I used SGLI SSTs with the associated QA flag of good. Details on the SGLI SST product and its validation result, that was derived using buoys data, are introduced at Retrieval Algorithms-014, GHRSST XXI (hereinafter RA-014).

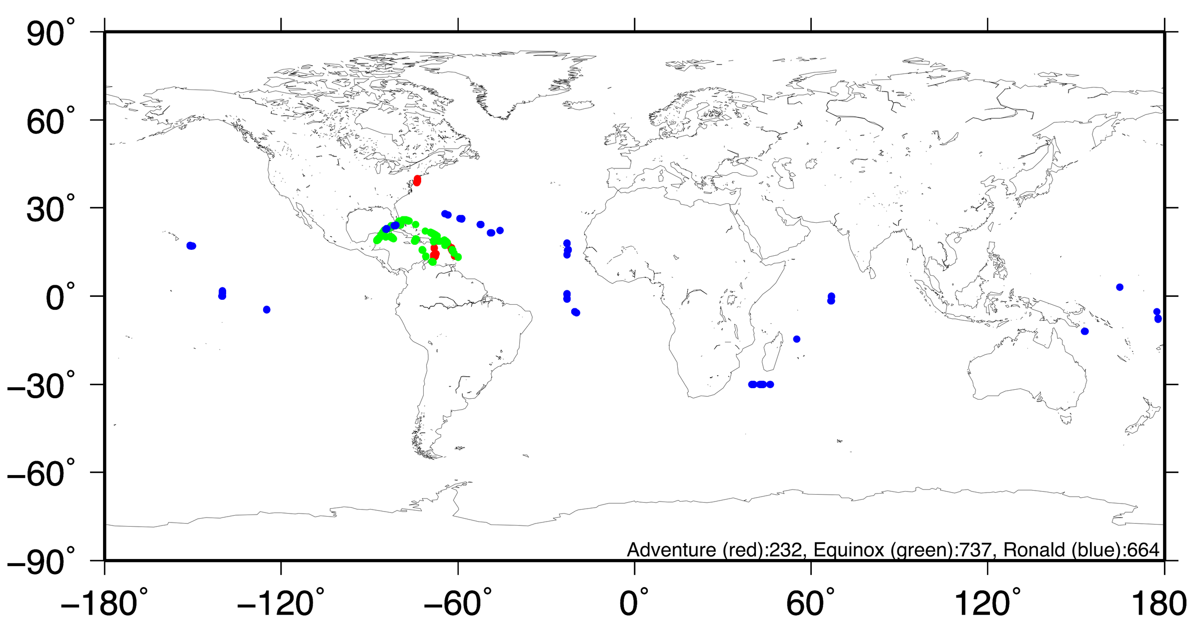

Fig. 1 M-AERI locations.

Table 1 M-AERI

Ship	Period	N
Adventure	Feb. - May 2018	232
Celebrity Equinox	Jan. - Sep. 2018	737
Ronald H. Brown	Mar. - Oct. 2018, Feb. - Mar. 2019	664

Table 2 SGLI vs M-AERI

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	0.07	0.09	0.31	0.24	168	3 hr x 250/4 m
	night	0.04	0.04	0.33	0.34	212	
1 km	day	0.05	0.11	0.31	0.28	110	3 hr x 1/4 km
	night	0.03	0.00	0.29	0.25	144	

SGLI vs M-AERI (Adventure)

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	0.12	0.12	0.11	0.10	20	3 hr x 250/4 m
	night	0.20	0.30	0.43	0.50	31	
1 km	day	0.20	0.18	0.13	0.08	14	3 hr x 1/4 km
	night	0.17	0.17	0.34	0.42	32	

SGLI vs M-AERI (Celebrity Equinox)

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	0.13	0.11	0.27	0.25	91	3 hr x 250/4 m
	night	-0.01	0.03	0.31	0.26	139	
1 km	day	0.15	0.17	0.26	0.22	49	3 hr x 1/4 km
	night	-0.01	-0.01	0.28	0.18	66	

SGLI vs M-AERI (Ronald H. Brown)

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	-0.05	0.01	0.39	0.39	57	3 hr x 250/4 m
	night	0.07	0.10	0.30	0.32	42	
1 km	day	-0.10	-0.11	0.34	0.39	47	3 hr x 1/4 km
	night	-0.02	-0.01	0.25	0.23	46	

3 QC and Comparison

I chose M-AERI skin SSTs with the associated SD of <0.2 K and compared with the nearest SGLI SST within a collocation window centered on each M-AERI skin SST. The threshold of 0.2 K was arrived at empirically. To avoid cloud contaminations, I excluded SGLI SSTs more than 1.2 K below the M-AERI skin SSTs. The threshold of 1.2 K was arrived at empirically.

4 Result and discussion

The result is shown in Table 2. Biases are lower than those in RA-014, meanwhile SD/RSDs are slightly larger than RA-014.

Fig. 2 shows differences between SGLI (1km) and M-AERI as a function of the observation-time difference. A clear upward trend is found in the differences between the SGLI and the M-AERI from Ronald H. Brown in the daytime. Although trends are not clear except for this, the upward trend suggests rising SSTs with time, and this is reasonable in consideration of the local observation time of around 10:30 a.m. of GCOM-C.

Fig. 3-A shows the RSDs for each time scale of the collocation-window. The figure shows upward trends also in RSDs. These trends are possibly generated by SSTs changing over time. To assess the influence of the trends in Fig. 2 on those in Fig. 3-A, RSDs and other statistics are recalculated using the detrended data. The result is shown in Table 3 and Fig. 3-B. There was almost no significant difference, however the RSD for Ronald H. Brown in the daytime was highly improved by the detrending (Table 3). Meanwhile, slight trends remained in RSDs (Figs. 3-A and B). This is possibly caused simply by the difference of the observation time. It will be possible to estimate an effective RSD using the trend ((b) in Fig. 3-B). The result suggests the effective RSD of <0.2 K for SGLI SST. Large RSDs for SGLI (250m) at nighttime ((a) in Fig. 3-A) are possibly generated by cloud contaminations.

On the other hand, relatively high biases against M-AERI (Adventure, Table 3) are possibly generated by the atmospheric water vapor. We need further investigation into the impact of the water vapor.

Table 3 SGLI vs M-AERI (detrended)

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	0.06	0.07	0.30	0.25	168	3 hr x 250/4 m
	night	0.03	0.02	0.33	0.33	212	
1 km	day	0.04	0.05	0.26	0.24	110	3 hr x 1/4 km
	night	0.03	0.00	0.29	0.23	144	

SGLI vs M-AERI (Adventure, detrended)

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	0.10	0.09	0.11	0.06	20	3 hr x 250/4 m
	night	0.19	0.22	0.43	0.52	31	
1 km	day	0.17	0.16	0.11	0.05	14	3 hr x 1/4 km
	night	0.21	0.25	0.33	0.44	32	

SGLI vs M-AERI (Celebrity Equinox, detrended)

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	0.12	0.09	0.27	0.26	91	3 hr x 250/4 m
	night	-0.02	0.00	0.30	0.28	139	
1 km	day	0.14	0.18	0.24	0.16	49	3 hr x 1/4 km
	night	0.00	-0.02	0.27	0.15	66	

SGLI vs M-AERI (Ronald H. Brown, detrended)

SGLI	day/night	bias	median	SD	RSD	N	Collocation window
250 m	day	-0.04	0.01	0.36	0.29	57	3 hr x 250/4 m
	night	0.08	0.13	0.30	0.31	42	
1 km	day	-0.06	-0.05	0.21	0.15	47	3 hr x 1/4 km
	night	-0.02	-0.01	0.25	0.23	46	

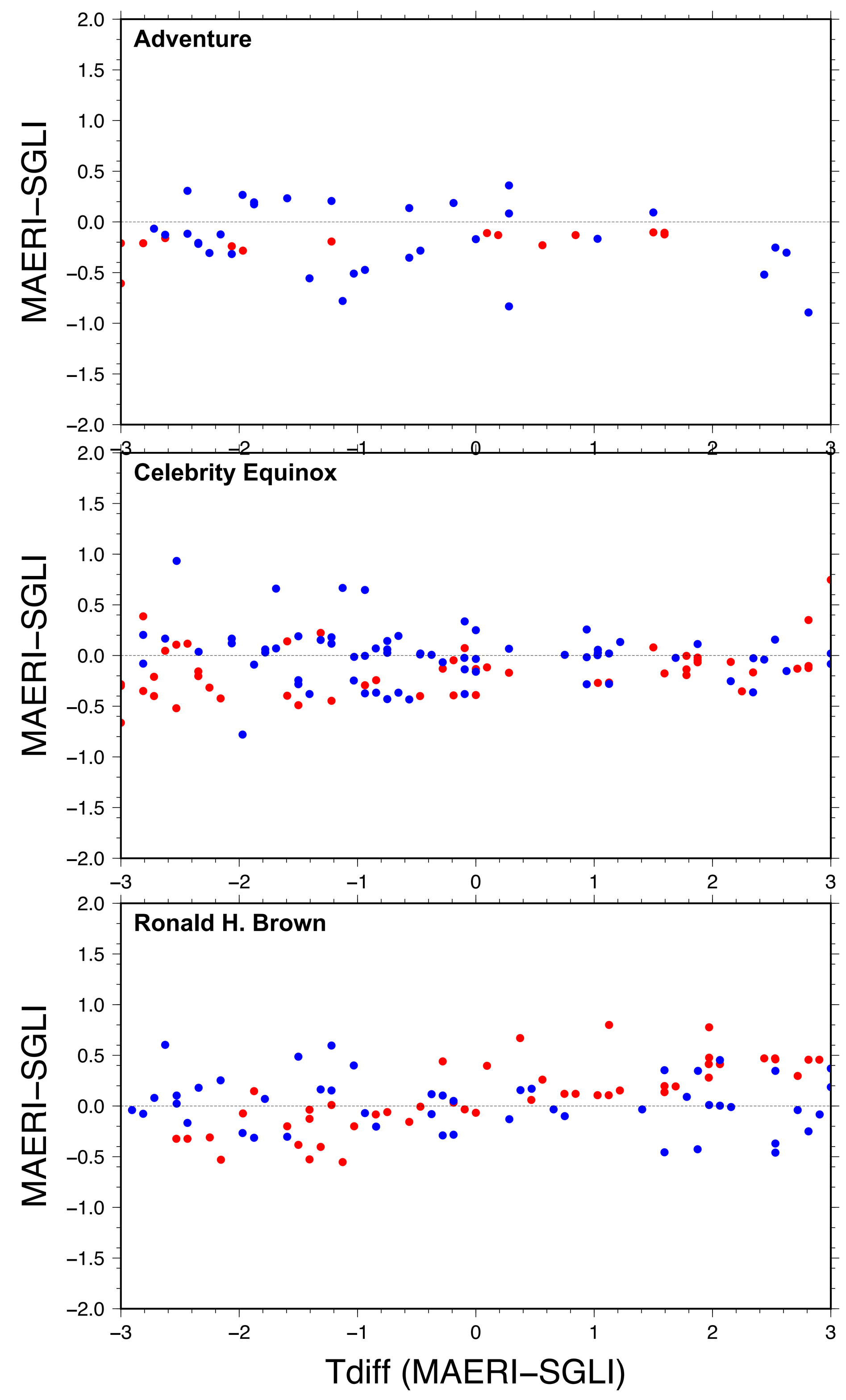

Fig. 3 M-AERI minus SGLI as a function of the observation time difference (red: daytime, blue: nighttime)

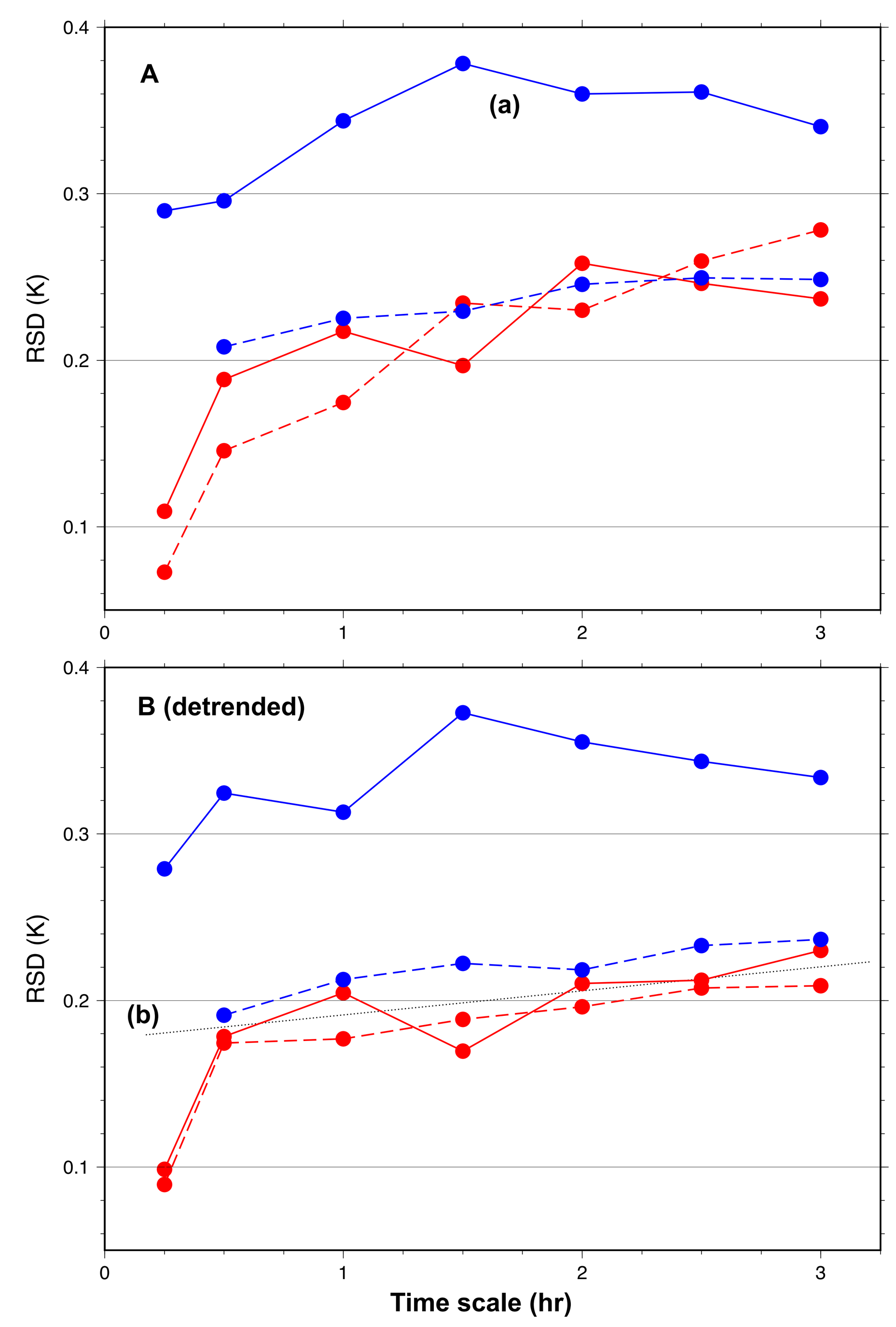

Fig. 3 RSD vs colocation window (time scale). Solid lines: SGLI (250m), dashed lines: SGLI (1km), red: daytime, blue : nighttime

5 Summary

SGLI SSTs were compared with M-AERI skin SSTs. The comparison result shows good agreements between them, almost no bias and RSDs of 0.2-0.3 K, meanwhile trends in RSDs suggest effective RSD of < 0.2 K of SGLI SST.

Acknowledgement

I would like to thank Professor Minnett for sharing M-AERI skin SSTs.

Reference:

P. J. Minnett, et. al., The Marine-Atmospheric Emitted Radiance Interferometer: A High-Accuracy, Seagoing Infrared Spectroradiometer, Journal of Atmospheric and Oceanic Technology, 2001