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SGLI SST Ver. 2.00

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1. Introduction

The GCOM-C is a polar-orbiting satellite of JAXA. GCOM-C carries an optical sensor, SGLI, and observes the Earth with spatial resolutions of 250m/1km. JAXA produces the SGLI SST product since Dec. 2018. The SGLI SST product is planned to be updated to version 2 at the end of June, 2020. In the V2.00, cloud masking and the quality flag are improved. A new method is introduced for the cloud masking for the near land seas and inland waters. SGLI SST is available at the G-Portal and the GHRSST server both operated by JAXA. The GHRSST server provides SGLI SSTs in the GDS format 2.0.

2. SGLI SST

SGLI SSTs are retrieved from the split window data (10.8 and 12.0 um) of SGLI. The SST method for Himawari-8 SST[(1)] was modified for SGLI. The SST formula is

$$I_s = I_{s0} + \mathbf{a}\,(\mathbf{I} - \mathbf{I}_0).$$

The $\mathbf{I}$ is a vector of the split window data. The I_{s0}, $\mathbf{I}_0$ (initial data), and the $\mathbf{a}$ (a coefficient vector) are generated for each two-dimensional bin defined by BT x BTD of 1.0 K x 0.1 K at the satellite zenith angles:0, 10, …, 50, 52, …, and 60 degrees. The SST formula is derived mathematically from the radiative transfer equation (RTE) and gives approximate solutions to RTE. SST is derived from the Is by performing the inverse of Planck function that is modified to take the RSR of SGLI into account. Determined SSTs are regarded as skin SSTs. The SST method is not changed by the update from V1 to V2.

Table 3a Statistics for each QA level (2018-2019)

Daytime	Bias	RSD	SD	N	Clear
≧ Possibly	-0.31	0.43	0.98	287,673	47.9
≧ Acceptable	-0.15	0.27	0.40	120,479	20.0
Good	-0.12	0.26	0.35	91,750	15.3

Nighttime	Bias	RSD	SD	N	Clear
≧ Possibly	-0.39	0.43	0.60	302,754	45.8
≧ Acceptable	-0.18	0.28	0.59	96,371	14.6
Good	-0.19	0.28	0.62	81,787	12.4

Table 3b Arctic area (Latitude > 60 deg. N)

Daytime	Bias	RSD	SD	N	Clear
≧ Possibly	-0.34	0.32	0.61	10,185	28.2
≧ Acceptable	-0.18	0.20	0.29	3,812	10.5
Good	-0.17	0.20	0.25	3,262	9.0

Nighttime	Bias	RSD	SD	N	Clear
≧ Possibly	-0.55	0.38	0.60	11,244	42.2
≧ Acceptable	-0.30	0.23	0.83	2,143	8.0
Good	-0.28	0.22	0.87	1,885	7.0

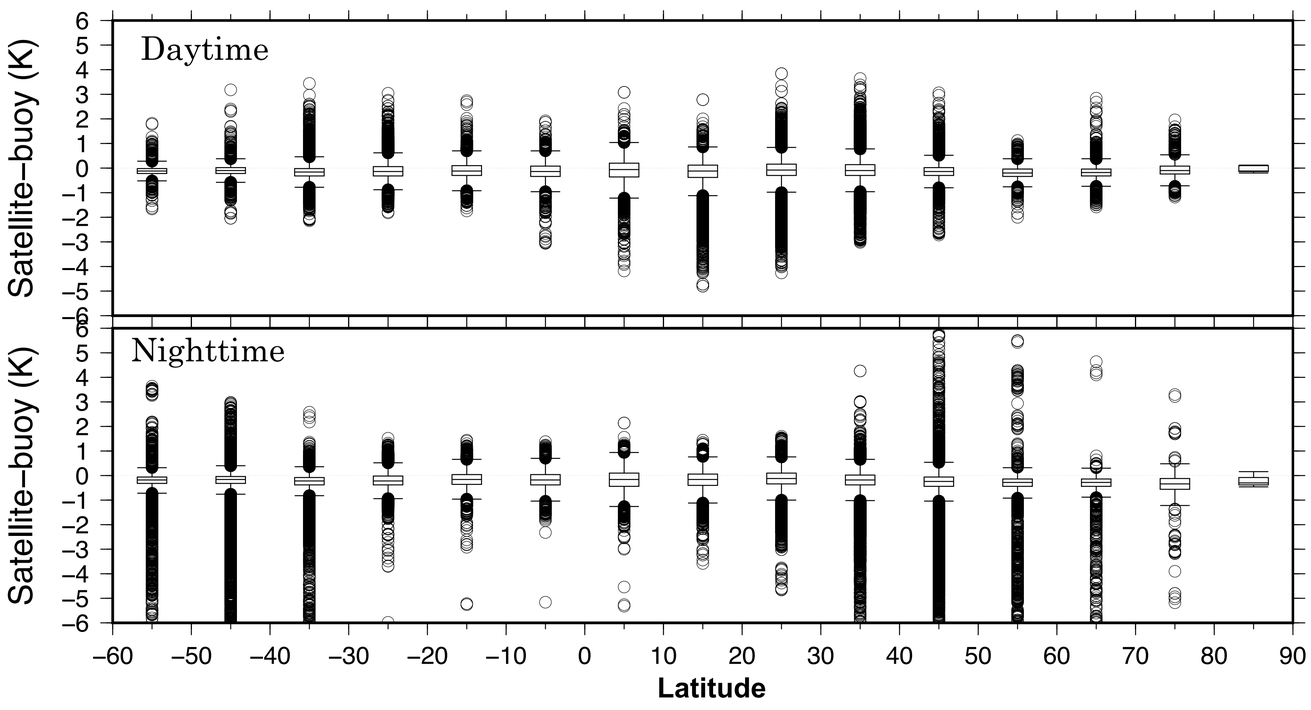

Fig. 2 Box plot

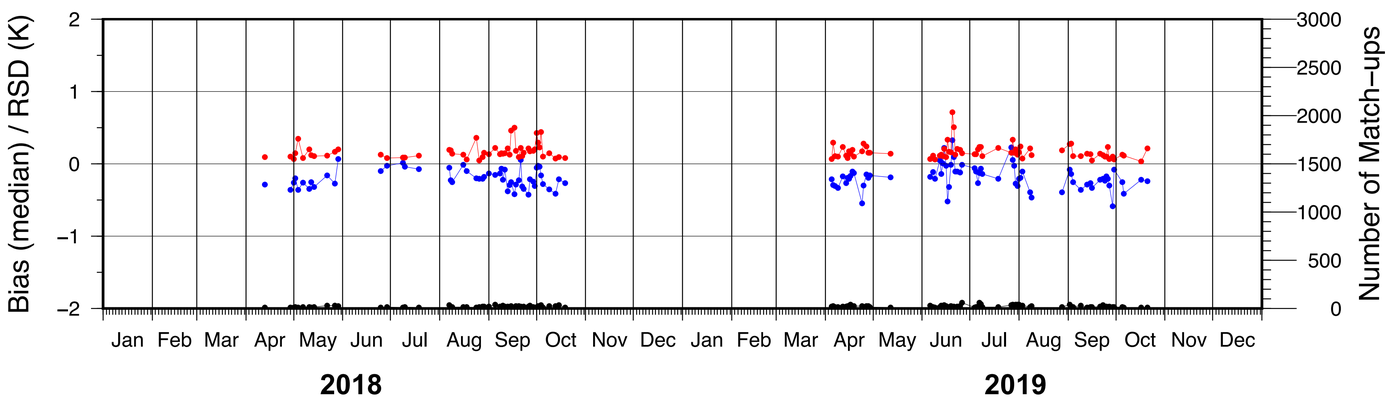

Fig. 3 Daily statistics. Blue: bias (median), red: RSD, black: N.

3. Cloud masking

Cloud masking consists of two steps shown in Fig. 1. In the first step, the SST field is divided into some groups based on the smoothness of the SST gradient. Then, in the second step, cloud probability is calculated for each SST. Results are translated into quality levels (10th to 15th bits of QA flag of V2 in Table 2) and provided with determined SSTs.

Coast test

The coast test was introduced in SGLI SST V. 2. The test is performed on the data near the land. The data is organized as a part of a smooth cell if a coastline is detected in the SGLI data (1.6 or 10.8 um) for the 3×3-pixel square centered on the data.

4. Accuracy

SGLI SST V2.00 was validated using moored and drifting buoys data[(2)]. For each buoy data, the nearest SGLI SST was chosen from those within a collocation window of 1hr x 1 km centered on the buoy data. Table 3 describes the calculated statistics at each QA level, Fig. 2 shows box plots for each latitude and Fig. 3 shows daily daytime statistics for Arctic seas (latitude>60 deg. N) from 2018 to 2019; an example of monthly SSTs in the Arctic seas is shown in Fig. 4.

5. Issues

The SD larger than RSD suggests the existence of cloud contaminations. The difference between SD and RSD is especially large for the Arctic area nighttime that prevents the SST retrieval with consistent high accuracy throughout a year.

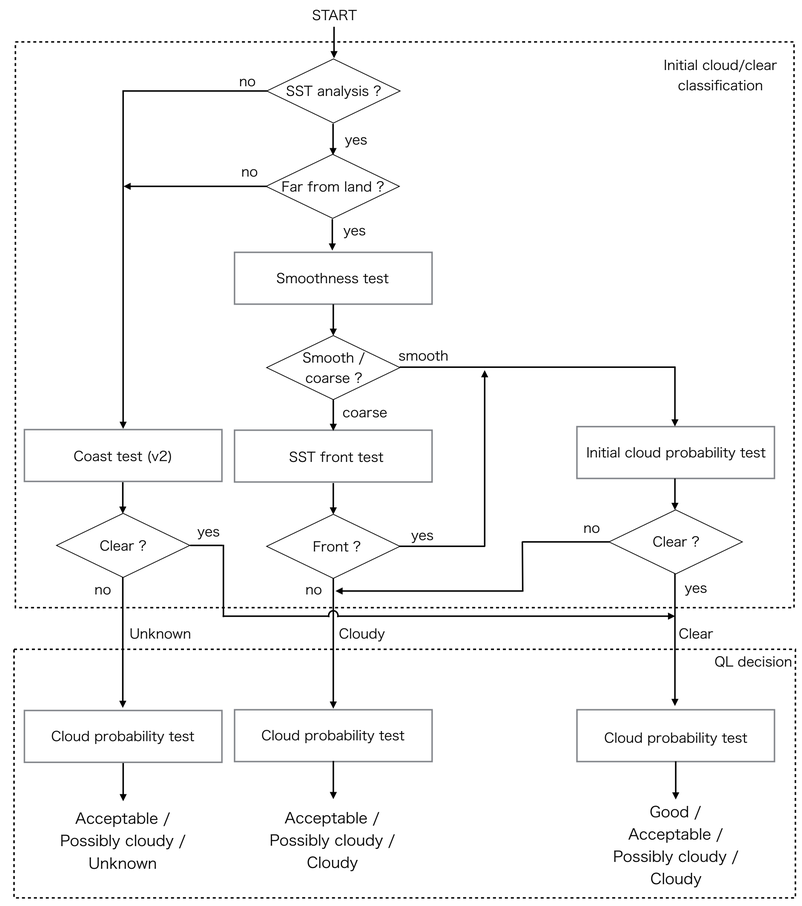

Fig. 1 Cloud masking flow

Table 2 QA flag

	V1.00	V2.00
Bit	Description	Description
0	no data	invalid data
1	land	land
2	rejected by QC	rejected by QC
3	retrieval error	retrieval error
4	no data (TIR1)	invalid data (TIR1)
5	no data (TIR2)	invalid data (TIR2)
6	no	reserved
7	no	reserved
8	0: nighttime or no visible data, 1: daytime	0: nighttime or no visible data, 1: daytime
9	no	near land
10	no	cloudy
11	unknown (clear/cloudy)	unknown clear/cloudy
12	cloudy	possibly cloudy
13	acceptable (possibly cloudy)	acceptable
14	good	good
15	0: unreliable (inland/too close to land), 1: reliable	reserved

Red : modified in V2.00

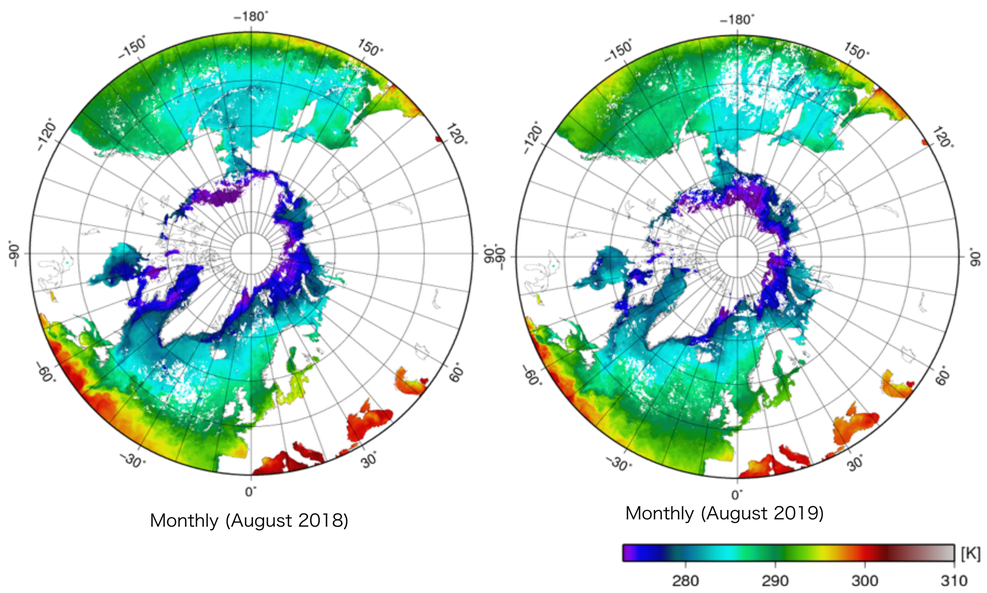

Fig. 4 Monthly composite of SGLI SST.

6. Summary

SGLI SST is going to be updated to V2.00 at the end of June, 2020. In V2.00, cloud masking is improved for near land seas and inland waters, and the QA flag will be modified. Accuracy of SGLI SST V2.00 was validated using buoys data. Cloud contamination is an important issue, especially for nighttime.

JAXA SGLI SST product

1) G-Portal (https://www.gportal.jaxa.jp/gp/top.html)
2) GHRSST server (https://suzaku.eorc.jp/GHRSST/)

Acknowledgment

Buoys data were downloaded from the in-situ SST quality monitor (iQuam) of NOAA[(2)].

References

(1) Y.Kurihara, H. Murakami, and M. Kachi. Sea surface temperature from the new Japanese geostationary meteorological himawari-8 satellite. GRL, 2016. dos: 10.1002/2015GL067159.
(2) NOAA in-situ SST quality monitor (iQuam), URL: https://www.star.nesdis.noaa.gov/socd/sst/iquam/