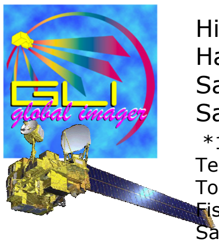
Validation and Applications of GLI Ocean Product



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Abstract

After ADEOS-2 launch on 14 December 2002, GLI ocean group has investigated vicarious calibration, algorithm improvement and product validation, and released version-1 products on 24 December 2003. Although we lost ADEOS-2/GLI on 24 October 2003, we continue product evaluation and algorithm revisions toward the future product updates. For example, we are investigating absorptive aerosol correction and 250-m ocean color image processing. These new techniques will contribute to coastal research and monitoring in future missions.

1. Design of the Global Imager

The GLI is a cross-track scan radiometer with 1600-km swath. The orbit is sun synchronous: recurrent period: 4 days, inclination: 98.6, descending local time: 10:30am, altitude: 803km, and period: 101min. GLI also has a tilting function (±18.5° in the along-track direction). GLI 36 channels are designed as follows.

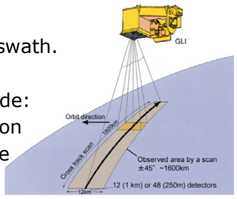


Table 1 Characteristics of GLI channels

Ch	WL[*4] [nm]	Width[*4] [nm]	Dynamic range [W/m²/str/μm]	SNR[*5] (input level)	IFOV [m]	Ch	WL[*4] [nm]	Width[*4] [nm]	Dynamic range [W/m²/str/μm]	SNR[*5] (input level)	IFOV [m]
1	380.7	10	683	467 (59)	1000	20	462.4	62	691	241 (36)	250
2	399.6	9	162	1286 (70)	1000	21	542.1	48	585	141 (25)	250
3	412.3	10	130	1402 (65)	1000	22	661.3	59	107	255 (14)	250
4	442.5	9	110[*1] /680	893 (54)	1000	23	824.1	103	235 (210[*3])	218 (21)	250
5	459.3	9	124[*1] /769	880 (54)	1000	24	1048.6	20	227	381 (8)	1000
6	489.5	11	64	1212 (43)	1000	25	1136.6	69	184	412 (8)	1000
7	519.2	10	92[*1] /569	627 (31)	1000	26	1241.0	18	208	303 (5.4)	1000
8	544.0	10	96[*1] /596	611 (28)	1000	27	1380.6	36	153	192 (1.5)	1000
9	564.8	10	39	1301 (23)	1000	28	1644.9	203	76	298 (5)	250[*2]
10	624.7	10	32 (28[*3])	1370 (17)	1000	29	2193.8	220	32	160 (1.3)	250[*2]
11	666.7	10	21	1342 (13)	1000	Ch	WL[*4] [nm]	width [nm]	Dynamic range [Kelvin]	NEΔT [K] at 300K	IFOV [m]
12	679.9	10	22	1293 (12)	1000						
13	678.6	10	342[*3]	235 (12)	1000	30	3721.1	336	345	0.07	1000
14	710.5	11	16	1404 (10)	1000	31	6737.5	531	307	0.03 (at 285K)	1000
15	710.1	11	233[*3]	300 (10)	1000	32	7332.6	502	322	0.03	1000
16	749.0	11	11	991 (7)	1000	33	7511.4	526	324	0.02	1000
17	762.0	8	246[*3]	293 (6)	1000	34	8626.3	519	350	0.05	1000
18	866.1	20	8	1309 (5)	1000	35	10768.0	955	354	0.05	1000
19	865.7	10	211[*3]	386 (5)	1000	36	12001.3	1020	358	0.06	1000

*1 Knee points of the piece-wise linear gain channels 4, 5, 7, and 8.
*2 Channels 28 and 29 are re-sampled for each 2-km (1/8) on board and stored in the 1-km level-1B product.
*3 Maximum radiance for linear response.
*4 Channel center and width are derived from GLI spectral response.
*5 SNR at the standard input level (W/m2/sr/μm) was mesured in pre-launch evaluation tests.

2. Vicarious Calibration

GLI calibration team derived several vicarious calibration coefficients (Fig. 1). GLI ocean-color algorithm uses the coefficients derived from GLI global data, SeaWiFS Level-3 products, and a radiative transfer model. The coefficients include scan-mirror incident angle and temporal changes (Fig. 2).

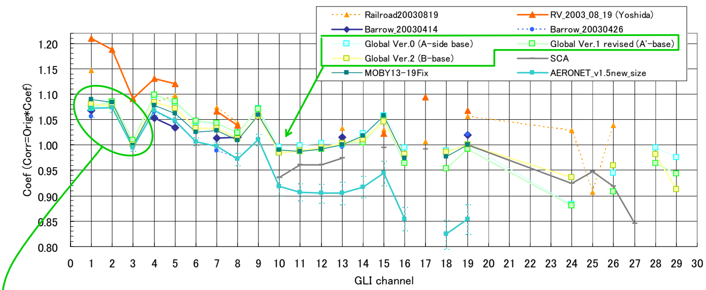


Fig. 1 GLI vicarious calibration coefficients by several ways

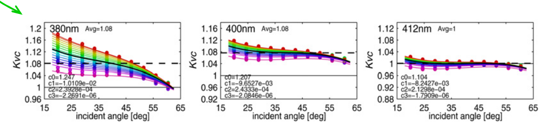


Fig. 2 Vicarious calibration coefficients in channels 1-3 for each scan-mirror incident angle and observation date based on CH13 and 19. Colors indicate sample dates from 6 Feb. to 24 Oct.; circles, averages for each 5-degree incident-angle bin and sample date.

3. Match Up Analysis

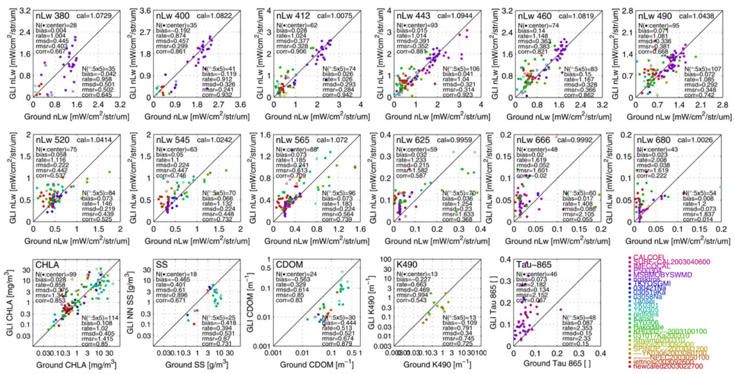
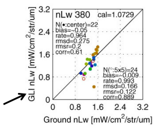


Fig. 3 Scatter diagrams between in-situ and GLI ocean color products. GLI Suspended Solid concentration (SS) is retrieved by the neural network algorithm. Match ups of Tau_865 include CalCOFI SIMBAD and Lanai AERONET observations. nLw380 can be improved by considering the scan-mirror angle dependencies.



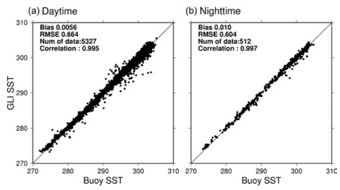


Fig. 4 Scatter diagrams between in-situ (buoy) and GLI sea-surface temperature products.

(a) daytime, (b) nighttime

They show good agreement (RMSE=0.66K and 0.60K).

4. Next Steps for Further Applications

The absorptive aerosol correction is very important especially in the East Asia where is surrounded by the fast developing countries and influenced frequently by a kind of carbon aerosols. GLI version 2 algorithm tries to correct the absorption using the GLI 380nm channel and an in-water model.

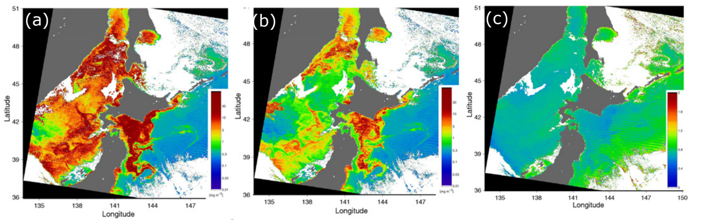


Fig. 5 Absorptive-aerosol correction around north Japan on 10 April 2003.

(a) shows version 1 (not corrected) chlorophyll-a, (b) version 2 (corrected), and (c) aerosol albedo (aalb) (correction is on if aalb is less than 1.0).

Ocean color products made by GLI 250-m channels show a possibility of 250m coastal observations which enable to detect fine spatial structures in the coastal areas such as red tide, river outflow, and so on.

Fig. 6 250-m ocean-color processing

Around Ariake-kai, Japan on 17 October 2003.