APPENDIX C
OVERVIEW OF THE GLOBAL CHANGE OBSERVATION MISSION (GCOM)

1. Introduction

Comprehensive observation, understanding, assessment, and prediction of global climate change are common and important issues for all mankind. This is also identified as one of the important socio-economic benefits by the 10-year implementation plan for Earth Observation that was adopted by the Third Earth Observation Summit to achieve the Global Earth Observation System of Systems (GEOSS). International efforts to comprehensively monitor the Earth by integrating various satellites, in-situ measurements, and models are gaining importance. As a contribution to this activity, the Japan Aerospace Exploration Agency (JAXA) plans to develop the Global Change Observation Mission (GCOM). GCOM will take over the mission of the Advanced Earth Observing Satellite-II (ADEOS-II) and develop into long-term monitoring of the Earth.

As mentioned in the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC), warming of the climate system is unequivocal as is now evident from observations of increases in global average air and ocean temperatures and widespread melting of snow and ice. However, climate change signals are generally small and modulated by natural variability, and are not necessarily uniform over the Earth. Therefore, the observing system of the climate variability should be stable, and should cover a long term over the entire Earth.

To satisfy these needs, GCOM consists of two medium-size, polar-orbiting satellite series and multiple generations (e.g., three generations) with one-year overlaps between consecutive generations for inter-calibration. The two satellite series are GCOM-W (Water) and GCOM-C (Climate). Two instruments were selected to cover a wide range of geophysical parameters: the Advanced Microwave Scanning Radiometer-2 (AMSR2) on GCOM-W and the Second-generation Global Imager (SGLI) on GCOM-C. The AMSR2 instrument will perform observations related to the global water and energy cycle, while the SGLI will conduct surface and atmospheric measurements related to the carbon cycle and radiation budget. This chapter presents an overview of the mission objectives, observing systems, and data products of GCOM.

2. Mission Objectives

The major objectives of GCOM can be summarized as follows.

- Establish and demonstrate a global, long-term Earth-observing system for understanding climate variability and the water-energy cycle.
- Enhance the capability of climate prediction and provide information to policy makers through process studies and model improvements in concert with climate model research institutions.
- Construct a comprehensive data system integrating GCOM products, other satellite data, and in-situ measurements.
- Contribute to operational users including weather forecasting, fishery, and maritime agencies by providing near-real-time data.
- Investigate and develop advanced products valuable for understanding of climate change and water cycle studies.

Detailed explanations of the objectives are as follows.

(1) Understanding global environment changes

A) Establish and demonstrate a global, long-term Earth-observing system that is able to observe valuable geophysical parameters for understanding global climate variability and

water cycle mechanisms.
B) Contribute to improving climate prediction models by providing accurate values of model parameters.
C) Clarify sinks and sources of greenhouse gases.
D) Contribute to validating and improving climate prediction models by forming a collaborative framework with climate model institutions and providing long-term geophysical datasets to them.
E) Detect trends of global environment changes (e.g., global warming, vegetation changes, desertification, variation of atmospheric constituents, wide area air pollution, and depletion of ozone layers) from long-term variability of geophysical parameters by extracting short-term (three- to six-year) natural variability.
F) Advance process studies of Earth environmental changes using observation data.
G) Estimate radiative forcing, energy and carbon fluxes, and albedo by combining satellite geophysical parameters, ground in-situ measurements, and models.
H) Advance the understanding of the Earth's system through the activities above.
I) Contribute to an international environmental strategy utilizing the results above.

(2) Direct contribution to improving people's lives
A) Improvement of weather forecast accuracy (particularly typhoon track prediction, localized severe rain, etc.).
B) Improvement of forecast accuracy for unusual weather and climate.
C) Improvement of water-route and maritime information.
D) Provision of fishery information.
E) Efficient coastal monitoring.
F) Improved yield prediction of agricultural products.
G) Monitoring and forecasting air pollution including yellow dust.
H) Observation of volcanic smoke and prediction of the extent of the impact.
I) Detection of forest fires.

3. Observing Systems

3.1. Overall concept

As mentioned in the previous section, the entire GCOM will consist of two satellite series spanning three generations. However, a budget will be approved for each satellite. Currently, only the GCOM-W1 satellite has been approved for actual development as the first satellite in the GCOM series. Both GCOM-W1 and GCOM-C1 satellites will be medium-size platforms that are smaller than the ADEOS-II satellite. This is to reduce the risk associated with large platforms having valuable and multiple observing instruments. Also, since the ADEOS-II problem was related to the solar paddle, a dual solar-paddle design was adopted for both satellites. To assure data continuity and consistent calibration, follow-on satellites will be launched so as to overlap the preceding satellite by one year. The concept is summarized in Fig. 1.

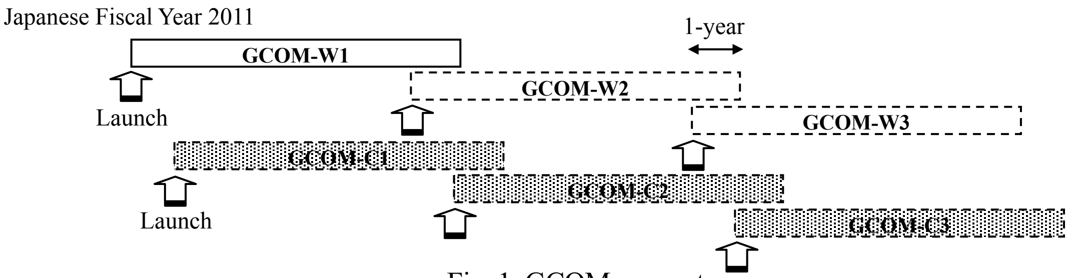

Fig. 1. GCOM concept

3.2. GCOM-W1 and AMSR2 instrument

Figure 2 presents an overview of the GCOM-W1 satellite; its major characteristics are listed in Table 1. GCOM-W1 will carry AMSR2 as the sole onboard mission instrument. The satellite will orbit at an altitude of about 700km and will have an ascending node local time of 1330, to maintain consistency with Aqua/AMSR-E observations.

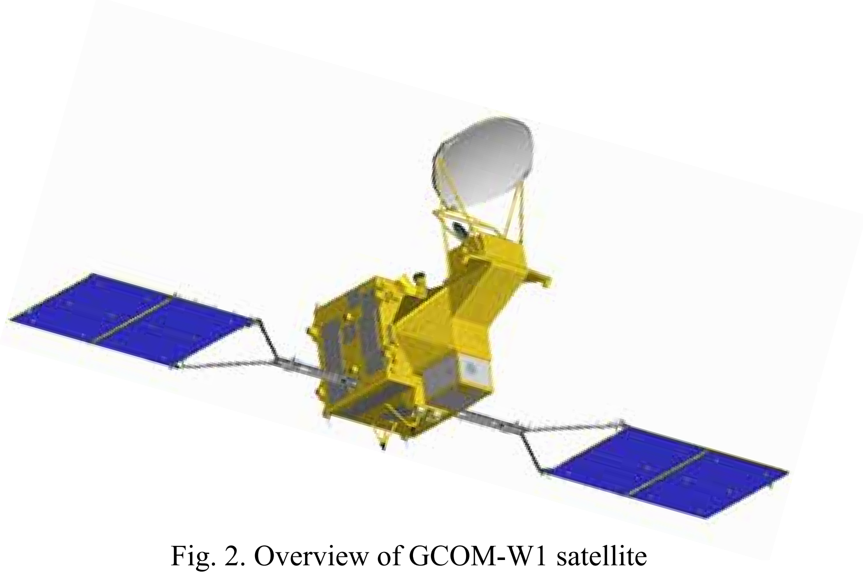

Fig. 2. Overview of GCOM-W1 satellite

TABLE 1
MAJOR CHARACTERISTICS OF GCOM-W1 SATELLITE

Instrument	Advanced Microwave Scanning Radiometer-2 (AMSR2)
Orbit	Sun-synchronous orbit Altitude: 700km (over the equator)
Size	5.1m (X) * 17.5m (Y) * 3.4m (Z) (on-orbit)
Mass	1991kg
Power	More than 3880W (EOL)
Launch	JFY2001 by H-IIA Rocket
Design Life	5 years
Status	Phase-D

Figure 1 presents an overview of the AMSR2 instrument in two different conditions. Also, basic characteristics including center frequency, bandwidth, polarization, instantaneous field of view (FOV), and sampling interval are indicated in Table 2. The basic concept is almost identical to that of AMSR-E: a conical scanning system with a large offset parabolic antenna, feed horn cluster to realize multi-frequency observation, external calibration with two temperature standards, and total-power radiometer systems. The 2.0m diameter antenna, which is larger than that of AMSR-E, provides better spatial resolution at the same orbit altitude of around 700km. The antenna will be developed based on the experience gained from the 2.0m diameter antenna for ADEOS-II AMSR except the deployment mechanism. For the C-band receiver, we adopted additional 7.3GHz channels for possible mitigation of radio-frequency interference. An incidence angle of 55 degrees (over the equator) was selected to maintain consistency with AMSR-E. The swath width of 1450km and the selected satellite orbit will provide almost complete coverage of the entire Earth's surface within two days independently for ascending and descending observations.

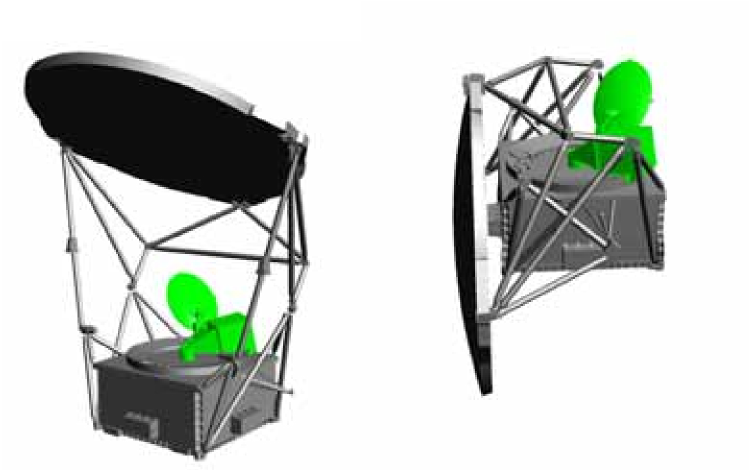

Fig. 3. Sensor unit of AMSR2 instrument in deployed (left) and stowed (right) conditions.

TABLE 2
MAJOR CHARACTERISTICS OF AMSR2 INSTRUMENT

Parameter	Performance and characteristics					
Center Frequency (GHz)	6.925/7.3	10.65	18.7	23.8	36.5	89.0
Bandwidth (MHz)	350	100	200	400	1000	3000
Polarization	Vertical and Horizontal polarization					
NEΔT (K) [1]	< 0.34/0.43	< 0.70	< 0.70	< 0.60	< 0.70	< 1.20/1.40 [2]
Dynamic range (K)	2.7 to 340					
Nominal incidence angle (deg.)	55.0					55.0/54.5 [2]
Beam width (deg.)	1.8	1.2	0.65	0.75	0.35	0.15
IFOV (km) Cross-track x along-track	35x62	24x42	14x22	15x26	7x12	3x5
Approximate sampling interval (km)	10					5
Swath width (km)	> 1450					
Digital quantization (bits)	12					
Scan rate (rpm)	40					

3.3. GCOM-C1 and SGLI instrument

Figure 4 gives an overview of the GCOM-C1 satellite; its major characteristics are listed in Table 3. GCOM-C1 will carry SGLI as the sole mission onboard instrument. The satellite will orbit at an altitude of about 800km; the descending node local time will be 1030, to maintain a wide observation swath and reduce cloud interference over land.

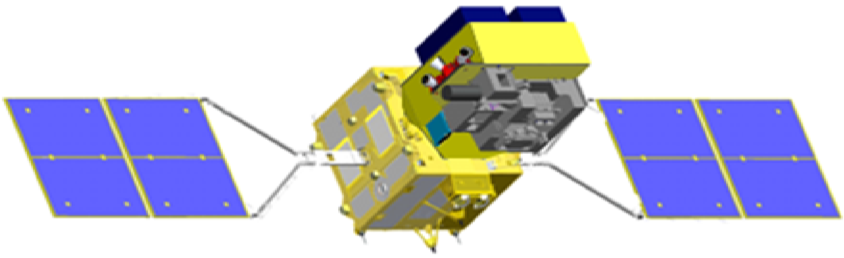

Fig. 4. Overview of GCOM-C1 satellite

TABLE 3
MAJOR CHARACTERISTICS OF GCOM-C1 SATELLITE

Instrument	Second-generation Global Imager (SGLI)
Orbit	Sun-synchronous orbit Altitude: 798km (over the equator)
Size	4.6m (X) * 16.3m (Y) * 2.8m (Z) (on orbit)
Mass	2093kg
Power	More than 4000W (EOL)
Launch	JFY2014 by H-IIA Rocket
Design Life	5 years
Status	Phase-C

The SGLI instrument has two major new features: 250m spatial resolution for most of the visible channels and polarization/multidirectional observation capabilities. The 250m resolution will provide enhanced observation capability over land and coastal areas where the influences of human activity are most obvious. The polarization and multidirectional observations will enable us to retrieve aerosol information over land. Precise observation of global aerosol distribution is a key for improving climate prediction models.

SGLI consists of two major components: the Infrared Scanner (IRS) and the Visible and Near-infrared Radiometer (VNR). An overview of the SGLI instrument is shown in Fig. 5 for the entire radiometer layout, IRS, and VNR components. Also, requirements for sensor performance are listed in Tables 4 and 5. VNR can be further divided into two components: VNR-Non Polarized (VNR-NP) and VNR-Polarized (VNR-P). VNR-NP and VNR-P are the 11-channel multi-band radiometer and the polarimeter with three polarization angles (0, 60, and 120 degrees). VNR-P has a tilting function to meet the scatter angle requirement from aerosol observation. The IRS is an infrared radiometer covering wavelengths from 1μm to 12μm. It consists of short infrared (SWI; 1.05 to 2.21μm) and thermal infrared (TIR 10.8 and 12.0μm) sensors. It employs a scanning mirror system with a 45-degree tilted flat mirror rotating continuously to realize an 80-degree observation swath and calibration measurement in every scan.

Through intensive discussions and optimizing studies, the number of SGLI channels was decreased from the 36 channels of GLI aboard ADEOS-II to 19 channels, while the number of SGLI standard products will increase compared to those of GLI.

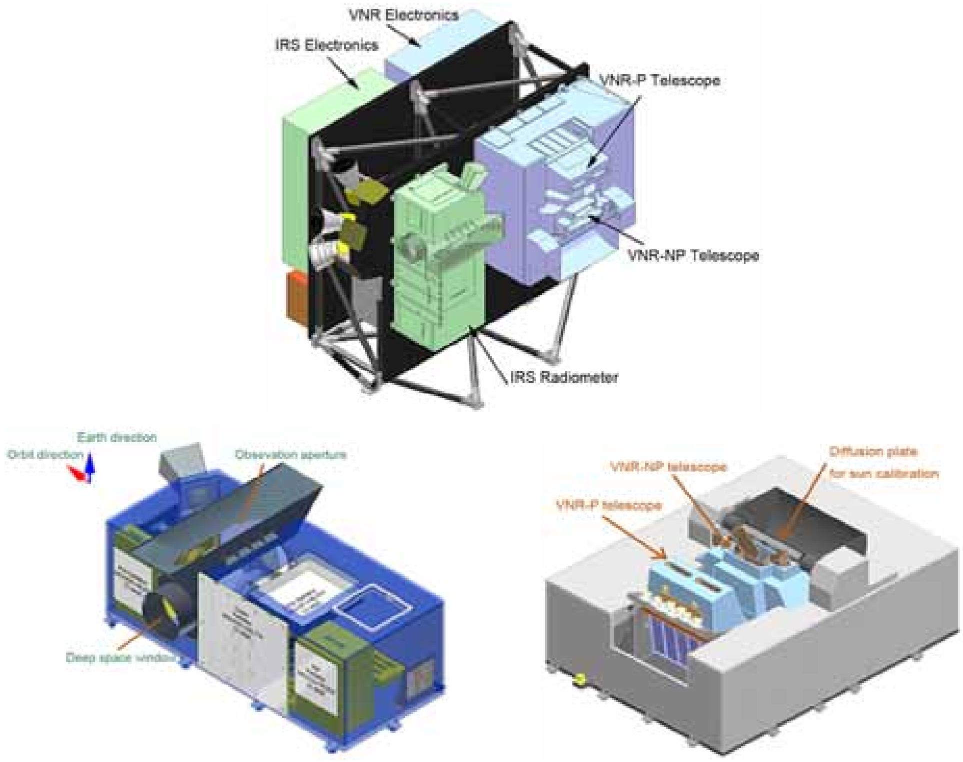

Fig. 5. Overview of SGLI radiometer layout (upper), IRS instrument (lower-left), and VNR radiometers (lower-right).

TABLE 4

SGLI MAJOR PERFORMANCE REQUIREMENTS

Item	Requirement
Spectral Bands	VNR-NP : 11CH 380-865nm VNR-P : 2CH 673.5, 868.5nm / 0, 60, 120deg Polarization IRS SWI : 4CH 1.05-2.21μm IRS TIR : 2CH 10.8, 12.0μm
Scan Angle	VNR-NP : 70deg (Push broom scanning) VNR-P : 55deg (Push broom scanning) IRS SWI/TIR : 80deg (45deg rotation mirror scanning)
Swath width	1150km for VNR-NP/P 1400km for IRS SWI/TIR
Instantaneous field of view (IFOV) at nadir	VNR-NP : 1000m(VN9CH), 250m VNR-P : 1000m IRS SWI : 250m(SW3CH), 1000m(SW1,2,4CH) IRS TIR : 500m
Observing direction	±45 degrees in along track direction for VNR-P Nadir for VNR-NP, IRS SWI, and IRS TIR
Quantization	12bit
Absolute Calibration Accuracy	VNR : ≤3% IRS : ≤5% TIR : ≤0.5K
Lifetime	5 Years

TABLE 5
SGLI OBSERVATION REQUIREMENT DETAILS

	CH	λ	Δλ	IFOV	SNR	L (for SNR)
		nm: VNR, IRS SWI μm: IRS TIR		m	SNR: VNR, IRS SWI NEΔT(K): IRS TIR	$W/m^2/sr/\mu m$
VNR-NP	VN1	380	10	250	250	60
	VN2	412	10	250	400	75
	VN3	443	10	250	300	64
	VN4	490	10	250	400	53
	VN5	530	20	250	250	41
	VN6	565	20	250	400	33
	VN7	673.5	20	250	400	23
	VN8	673.5	20	250	250	25
	VN9	763	12	1000	1200	40
	VN10	868.5	20	250	400	8
	VN11	868.5	20	250	200	30
VNR-P	P1	673.5	20	1000	250	25
	P2	868.5	20	1000	250	30
IRS SWI	SW1	1050	20	1000	500	57
	SW2	1380	20	1000	150	8
	SW3	1630	200	250	57	3
	SW4	2210	50	1000	211	1.9
IRS TIR	T1	10.8	0.74	500	0.2	300 (K)
	T2	12.0	0.74	500	0.2	300 (K)

4. Products

Geophysical products made available by GCOM-W1 and GCOM-C1 are listed in Tables 6 and 7. There are two categories of data products: standard product and research product. A “standard” product is defined as a product with proven accuracy that is to be operationally processed and distributed. In contrast, a “research” product is a prototype for a standard product and is processed on a research basis. Both tables indicate standard products with shading.

TABLE 6
GEOPHYSICAL PRODUCTS OF GCOM-W1

Product	Areas	Grid (km)	Accuracy [1]			Range	
			Data release threshold	Standard	Goal		
Integrated water vapor	Global, over ocean	15	±3.5 kg/m^2	±3.5 kg/m^2	±2.0 kg/m^2	0-70 kg/m^2	Vertically integrated (columnar) water vapor amount. Except sea ice and precipitating areas.
Integrated cloud liquid water	Global, over ocean	15	±0.10 kg/m^2	±0.05 kg/m^2	±0.02 kg/m^2	0-1.0 kg/m^2	Vertically integrated (columnar) cloud liquid water. Except sea ice and precipitating areas.
Precipitation	Global, except cold latitudes	15	Ocean ±50 % Land ±120 %	Ocean ±50% Land ±120 %	Ocean ±20% Land ±80 %	0-20 mm/h	Surface precipitation rate. Accuracy is defined as relative error (ratio of root-mean-square error to average precipitation rate) in 50km grid average.
Sea surface temperature	Global, over ocean	50	±0.5 °C	±0.5 °C	±0.2 °C	-2-35 °C	Except sea ice and precipitating areas. Goal accuracy is defined as monthly mean bias error in 10 degrees latitudes.
Sea surface wind speed	Global, over ocean	15	±1.5 m/s	±1.0 m/s	±1.0 m/s	0-30 m/s	Except sea ice and precipitating areas.
Sea ice concentration	Polar region, over ocean	15	±10 %	±10 %	±5 %	0-100 %	Accuracy is expressed in absolute value of sea ice concentration (%).
Snow depth	Land	30	±20 cm	±20 cm	±10 cm	0-100 cm	Except ice sheets and dense forest areas. Accuracy is expressed in snow depth and defined as mean absolute error of instantaneous observations.
Soil moisture	Land	50	±10 %	±10 %	±5 %	0-40 %	Volumetric water content over global land areas including arid and cold regions, except areas covered by vegetation with 2kg/m^2 water equivalent. Accuracy is defined as mean absolute error of instantaneous observations.

1 Accuracy is defined as root-mean-square error of instantaneous values unless otherwise stated. Assumed validation methodologies are not explained here.

TABLE 7
GEOPHYSICAL PRODUCTS OF GCOM-C1 (1/3)

Area	*Group*	*Product*	*Category*	*GLI heritage*1*	*Day/night*	*Production unit*	*Grid size*	*Release threshold*2*	*Standard accuracy*2*	*Target accuracy*2*
common	Radiance	TOA radiance (including system geometric correction)	Standard	A(non-Pol) B(Pol)	TIR and land 2.2μm: both, Other VNR, SWI: daytime (+special operation)	Scene	VNR,SWI Land/coast: 250m, offshore: 1km, polarimetory:1km TIR Land/coast: 500m, offshore: 1km	Radiometric 5% (absolute)*3 Geometric<1 pixel	VNR,SWI: 5% (absolute), 1% (relative) *3 TIR: 0.5K (@300K) Geometric<0.5 pixel	VNR,SWI: 3% (absolute), 0.5% (relative) *3 TIR: 0.5K (@300K) Geometric<0.3 pixel
Land	Surface reflectance	Precise geometric correction	Standard	A	Both	Scene, Global (mosaic 1, 16 days, month)	250m	<1pixel	<0.5pixel	<0.25pixel
		Atmospheric corrected reflectance (incl. cloud detection)	Standard	B	Daytime	Scene, Global (1, 16 days, month)	250m	0.3 (<=443nm), 0.2 (>443nm) (scene) *7	0.1 (<=443nm), 0.05 (>443nm) (scene) *7	0.05 (<=443nm), 0.025 (>443nm) (scene)*7
	Vegetation and carbon cycle	Vegetation index	Standard	A	Daytime	Scene, Global (1, 16 days, month)	250m	Grass: 25%, forest: 20% (scene)	Grass: 20%, forest: 15% (scene)	Grass: 10%, forest: 10% (scene)
		fAPAR	Standard	B				Grass: 50%, forest: 50%	Grass: 30%, forest:20%	Grass: 20%, forest: 10%
		Leaf area index	Standard	B				Grass: 50%, forest: 50%	Grass: 30%, forest:30%	Grass: 20%, forest: 20%
		Above-ground biomass	Standard	B	Daytime	Scene, Global (1, 16 days, month)	1km	Grass: 50%, forest: 100%	Grass: 30%, forest: 50%	Grass: 10%, forest: 20%
		Vegetation roughness index	Standard	B			1km	Grass and forest: 40% (scene)	Grass and forest: 20% (scene)	Grass and forest: 10% (scene)
		Shadow index	Standard	B			250m, 1km	Grass and forest: 30% (scene)	Grass and forest: 20% (scene)	Grass and forest: 10% (scene)
	Temperature	Surface temperature	Standard	B	Both	Scene, Global (1, 16 days, month)	500m	<3.0K (scene)	<2.5K (scene)	<1.5K (scene)
	Application	Land net primary production	Research	C	Daytime	Global (month, year)	1km	N/A	N/A	30% (yearly)
		Water stress trend	Research	C	N/A	Scene, Global (1, 16 days, month)	500m	N/A	N/A	10% *13 (error judgment rate)
		Fire detection index	Research	B	Both*12	Scene	500m	N/A	N/A	20% *14 (error judgment rate)
		Land cover type	Research	B	Daytime	Global (month, season)	250m	N/A	N/A	30% (error judgment rate)
		Land surface albedo	Research	B	N/A	Scene, Global (1, 16 days, month)	1km	N/A	N/A	10%
Atmosphere	Cloud	Cloud flag/Classification	Standard	A	Both	Scene, Global (1 day, month)	1km	10% (with whole-sky camera)	Incl. below cloud amount	Incl. below cloud amount
		Classified cloud fraction	Standard	A	Daytime	Global (1 day, month)	1km (scene), 0.1deg (global)	20% (on solar irradiance)*9	15% (on solar irradiance)*9	10% (on solar irradiance)*9
		Cloud top temp/height	Standard	A	Both	Scene, Global (1 day, month)		1K*4	3K/2km (top temp/height)*5	1.5K/1km (temp/height)*5
		Water cloud OT/effective radius	Standard	B	Daytime	Scene, Global (1 day, month)		10%/30% (Cloud OT/radius)*6	100% as CLW*7	50%*7 / 20%*8
		Ice cloud optical thickness	Standard	B	Daytime	Scene, Global (1 day, month)		30%*6	70%*8	20%*8
		Water cloud geometrical thickness	Research	C	Daytime	Scene, Global (1 day, month)		N/A	N/A	300m
	Aerosol	Aerosol over the ocean	Standard	A	Daytime	Scene, Global (1 day, month)		0.1 (Monthly τa_670,865)*10	0.1(scene τa_670,865)*10	0.05 (scene τa_670,865)
		Land aerosol by near UV	Standard	B	Daytime	Scene, Global (1 day, month)		0.15 (Monthly τa_380)*10	0.15 (scene τa_380)*10	0. 1(scene τa_380)
		Aerosol by Polarization	Standard	B	Daytime	Scene, Global (1 day, month)		0.15 (Monthly τa_670,865)*10	0.15 (scene τa_670,865)*10	0.1 (scene τa_670,865)
	Radiation budget	Long-wave radiation flux	Research	C	Daytime	Scene, Global (1 day, month)		N/A	N/A	Downward 10W/m2, upward 15W/m2 (monthly)
		Short-wave radiation flux	Research	B	Daytime	Scene, Global (1 day, month)		N/A	N/A	Downward 13W/m2, upward 10W/m2

TABLE 7
GEOPHYSICAL PRODUCTS OF GCOM-C1 (2/3)

Area	*Group*	*Product*	*Category*	*GLI heritage*1*	*Day/night*	*Production unit*	*Grid size*	*Release threshold*2*	*Standard accuracy*2*	*Target accuracy*2*
Ocean	Ocean color	Normalized water-leaving radiance (incl. cloud detection)	Standard	B	Daytime	Scene, Global (1, 8 days, month)	Coast: 250m Offshore: 1km Global: 4-9km	60% (443~565nm)	50% (<600nm) 0.5W/m^2/str/um (>600nm)	30% (<600nm) 0.25W/m^2/str/um (>600nm)
		Atmospheric correction parameter	Standard	A				80% (AOT@865nm)	50% (AOT@865nm)	30% (AOT@865nm)
		Photosynthetically available radiation	Standard	A	Daytime	Scene, Global (1, 8 days, month)		20% (10km/month)	15% (10km/month)	10% (10km/month)
		Euphotic zone depth	Research	B	Daytime	Scene, Global (1, 8 days, month)		N/A	N/A	30%
	In-water	Chlorophyll-a concentration	Standard	A	Daytime	Scene, Global (1, 8 days, month)		−60 to +150% (offshore)	−60 to +150%	−35 to +50% (offshore), −50 to +100% (coast)
		Suspended solid concentration	Standard	A				−60 to +150% (offshore)	−60 to +150%	−50 to +100%
		Colored dissolved organic matter	Standard	A				−60 to +150% (offshore)	−60 to +150%	−50 to +100%
		Inherent optical properties	Research	C	Daytime	Scene, Global (1, 8 days, month)		N/A	N/A	a (440): RMSE<0.25, bbp (550): RMSE<0.25
	Temperature	Sea-surface temperature	Standard	A	Both	Scene, Global (1, 8 days, month)	Coast: 500m Others: Same as above	0.8K (daytime)	0.8K (day & night time)	0.6K (day and night time)
	Application	Ocean net primary productivity	Research	C	Daytime	Scene, Global (1, 8 days, month)	Coast: 500m Others: Same as above	N/A	N/A	70% (monthly)
		Phytoplankton functional type	Research	C	Daytime	Scene, Global (1, 8 days, month)	Coast: 250m Others: Same as above	N/A	N/A	error judgment rate of large/ small phytoplankton dominance<20%; or error judgment rate of the dominant phytoplankton functional group <40%
		Red tide	Research	B	Daytime	Scene, Global (1, 8 days, month)		N/A	N/A	error judgment rate <20%
		multi sensor merged ocean color	Research	B	Daytime	Area, Global (1, 8 days, month)	Coast: 250m Offshore: 1km	N/A	N/A	−35 to +50% (offshore), −50 to +100% (coast)
		multi sensor merged SST	Research	A	Both			N/A	N/A	0.8K (day & night time)
Cryosphere	Area/ distribution	Snow and Ice covered area (incl. cloud detection)	Standard	A	Daytime	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)	10% (vicarious val with other sat. data)	7%	5%
		Okhotsk sea-ice distribution	Standard	A	Daytime	Area (1day)	250m	10%	5%	3%
		Snow and ice classification	Research	B	Daytime	Global (16 days, month)	1km	N/A	N/A	10%
		Snow covered area in forests and mountains	Research	B	Daytime	Area (1, 8 days)	250m	N/A	N/A	30%
	Surface properties	Snow and ice surface Temperature	Standard	A	Daytime	Scene, Global (1, 16 days, month)	500m (scene), 1km (global)	5K (vicarious val with other sat. data and climatology)	2K	1K
		Snow grain size of shallow layer	Standard	B	Daytime	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)	100% (vicarious val. with climatology between temp-size)	50%	30%
		Snow grain size of subsurface layer	Research	B	Daytime	Scene, Global (1, 16 days, month)	1km	N/A	N/A	50%
		Snow grain size of top layer	Research	C	Daytime	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)	N/A	N/A	50%
		Snow and ice albedo	Research	B	Daytime	Global (1, 16 days, month)	1km	N/A	N/A	7%

TABLE 7

GEOPHYSICAL PRODUCTS OF GCOM-C1 (3/3)

Area	*Group*	*Product*	*Category*	*GLI heritage*1*	*Day/night*	*Production unit*	*Grid size*	*Release threshold*2*	*Standard accuracy*2*	*Target accuracy*2*
Cryosphere	Surface properties	Snow impurity	Research	B	Daytime	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)	N/A	N/A	50%
		Ice sheet surface roughness	Research	C	Daytime	Area (Season)	1km	N/A	N/A	0.05 *15
	Boundary	Ice sheet boundary monitoring	Research	B	Daytime	Area (Season)	250m	N/A	N/A	<500m

Common notes:
*1. Heritage levels from ADEOS-II/GLI study are shown by A-C; A: high heritage, B: Remaining issues, C: new or many issues remaining to be resolved
*2. The “release threshold” is minimum levels for the first data release at one year from launch. The "standard" and "research" accuracies correspond to full and extra success criteria of the mission. Accuracies are basically shown by RMSE.

Radiance data notes:
*3. Absolute error is defined as offset + noise; relative error is defined as relative errors among channels, FOV, and so on. Release threshold of radiance is defined as estimated errors from vicarious, onboard solar diffuser, and onboard blackbody calibration because of lack of long-term moon samples

Atmosphere notes:
*4. Vicarious val. on sea-surface temperature and comparison with objective analysis data
*5. Inter comparison with airplane remote sensing on water clouds of middle optical thickness
*6. Release threshold is defined by vicarious val. with other satellite data (e.g., global monthly statistics in the mid-low latitudes)
*7. Comparison with cloud liquid water by in-situ microwave radiometer
*8. Comparison with optical thickness by sky-radiometer (the difference can be large due to time-space inconsistence and large error of the ground measurements)
*9. Comparison with in-situ observation on monthly 0.1-degree
*10. Estimated by experience of aerosol products by GLI and POLDER

Land data notes:
*11. Defined with land reflectance~0.2, solar zenith<30deg, and flat surface. Release threshold is defined with AOT@500nm<0.25
*12. Night time 250m product can be produced by special observation requests of 1.6μm channel
*13. Evaluate in semiarid regions (steppe climate, etc.)
*14. Fires >1000K occupying >1/1000 on 1km pixel at night (using 2.2um of 1 km and thermal infrared channels)

Cryosphere notes:
*15. Defined as height/width of the surface structures