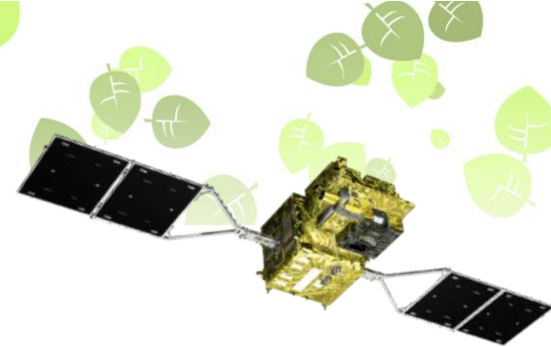




気候変動観測衛星

GCOM-C
Global Change Observation Mission-Climate



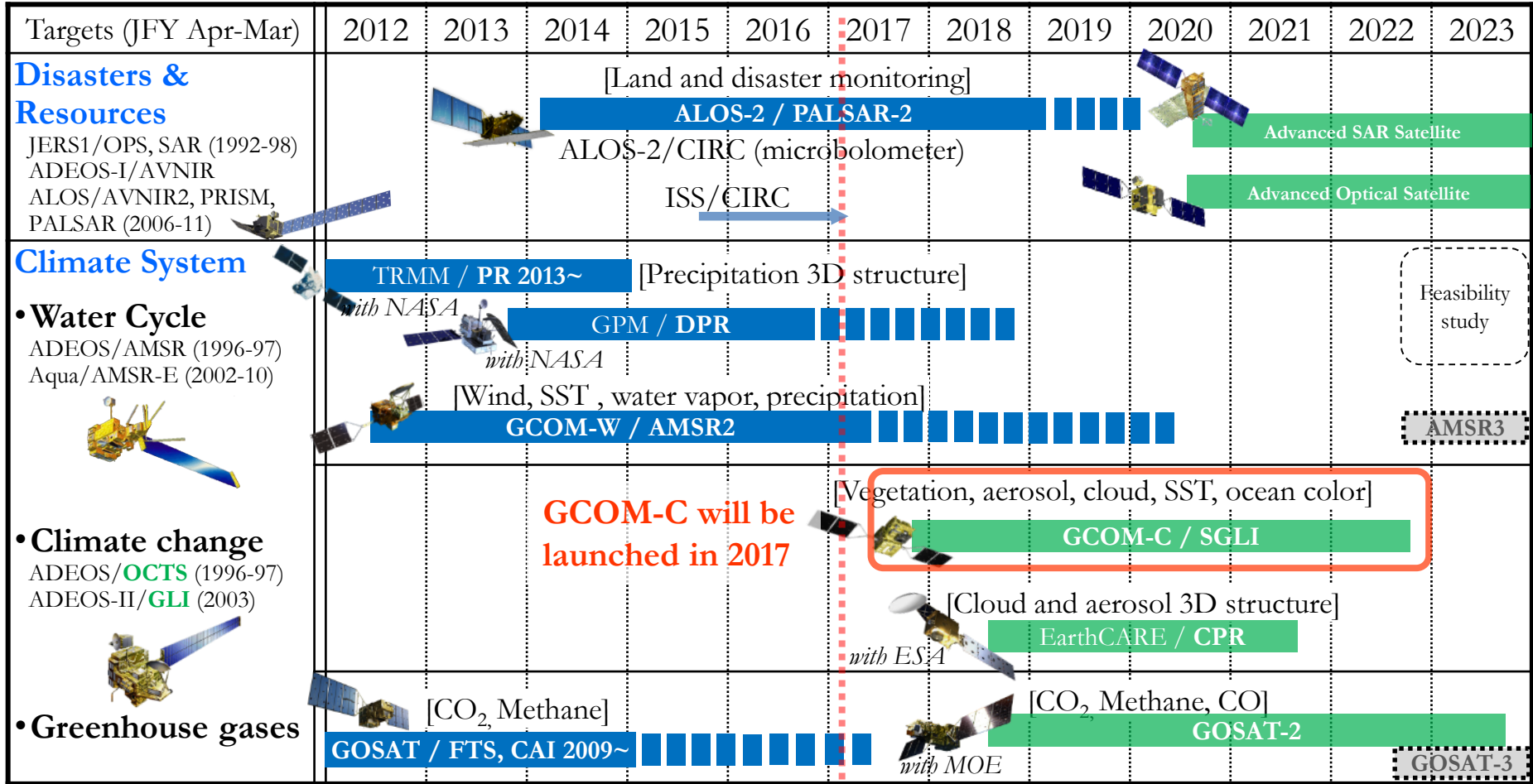
Update on JAXA GCOM-C

Hiroshi Murakami

JAXA/EORC



1. GCOM-C/SGLI: JAXA Earth observation satellite missions



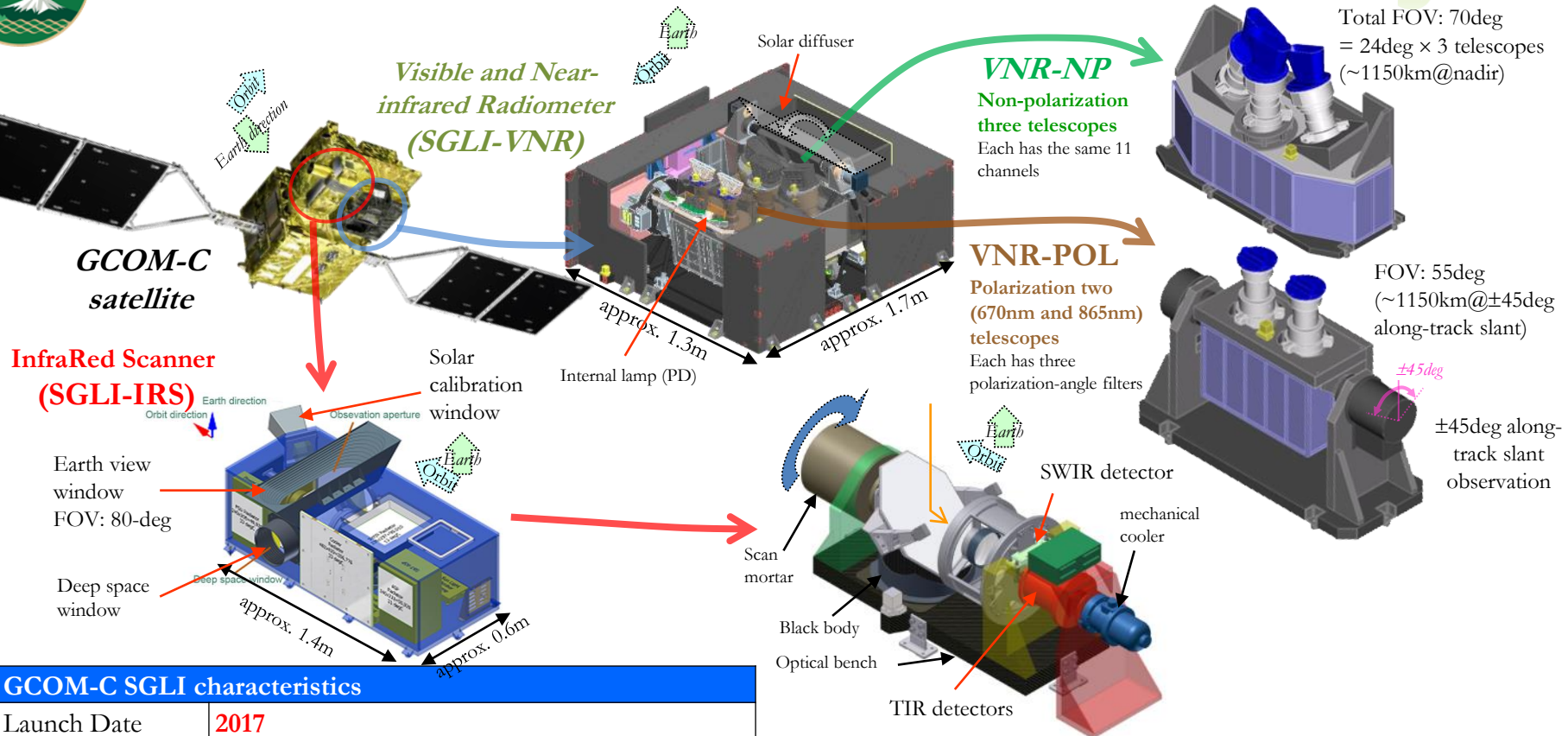
(ref.) JMA meteorological satellites



Mission status ■ On orbit ■ Development ■ Study Pre-phase-A



1. GCOM-C/SGLI



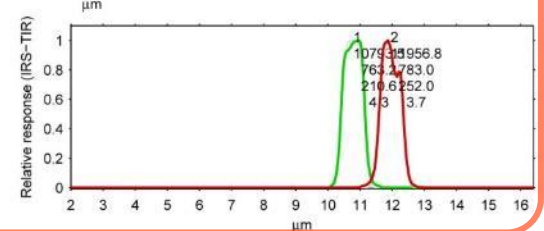
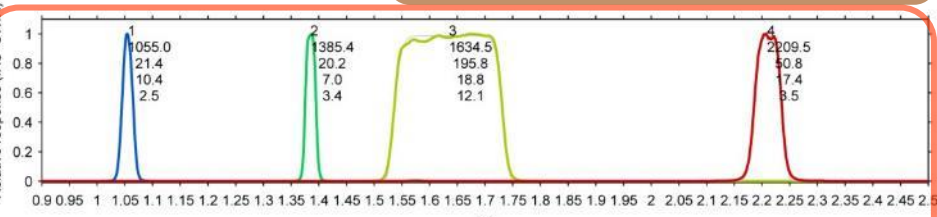
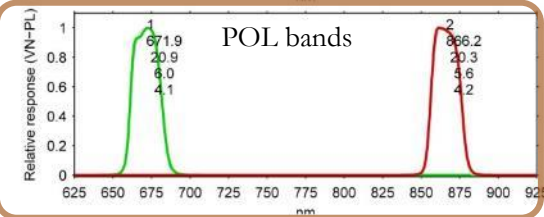
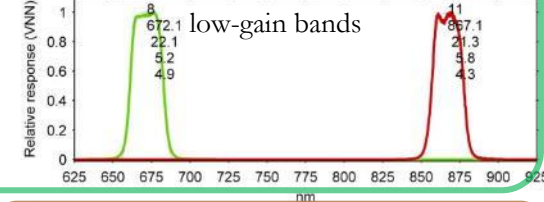
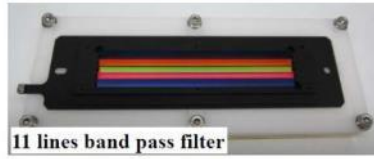
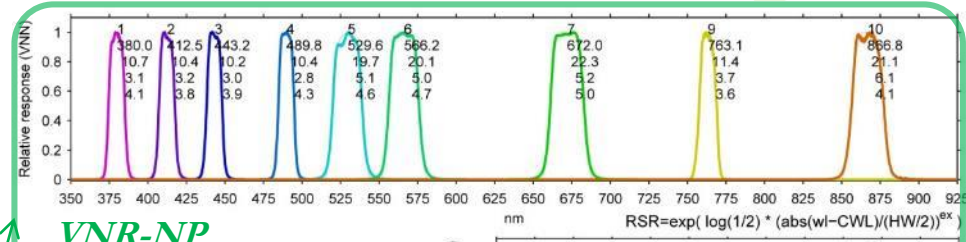
GCOM-C SGLI characteristics

Launch Date	2017
Weight	2,000kg
Orbit	Sun-synchronous (descending local time: 10:30), Altitude: 798km, Inclination: 98.6deg
Mission Life	5 years (3 satellites; total 13 years)
Scan	Push-broom electric scan (VNR: VN & P) Wisk-broom mechanical scan (IRS: SW & T)
Scan width	1150km cross track (VNR: NP & POL) 1400km cross track (IRS: SWIR & TIR)
Spatial resolution	250m, 500m, 1km
Polarization	3 polarization angles for POL
Along track tilt	Nadir for VN, SW and TIR, & +/-45 deg for POL



Multi-angle obs. for 674nm and 869nm

Specification of SGLI spectral bands						
CH	λ	$\Delta\lambda$	L_{std}	L_{max}	SNR@ L_{std}	IFOV
	nm		W/m ² /sr/ μ m K: Kelvin		- K: NEAT	m
VN1	380	10	60	210	250	250 /1000
VN2	412	10	75	250	400	250 /1000
VN3	443	10	64	400	300	250 /1000
VN4	490	10	53	120	400	250 /1000
VN5	530	20	41	350	250	250 /1000
VN6	565	20	33	90	400	250 /1000
VN7	673.5	20	23	62	400	250 /1000
VN8	673.5	20	25	210	250	250 /1000
VN9	763	12	40	350	1200*	250 /1000*
VN10	868.5	20	8	30	400	250 /1000
VN11	868.5	20	30	300	200	250 /1000
POL1	673.5	20	25	250	250	1000
POL2	868.5	20	30	300	250	1000
SW1	1050	20	57	248	500	1000
SW2	1380	20	8	103	150	1000
SW3	1630	200	3	50	57	250 /1000
SW4	2210	50	1.9	20	211	1000
TIR1	10800	700	300K	340K	0.2K	250/500/1000
TIR2	12000	700	300K	340K	0.2K	250/500/1000



Uchikawa, T., K. Tanaka, Y. Okamura, S. Tsuida, and T. Amano, "Proto Flight Model (PFM) performance and development status of Cisible and Near Infrared Radiometer (VNR) on the Second-generation Global Imager (SGLI)", SPIE Asia-Pacific Remote sensing, Beijing, China, 9264-27, 2014.

Tanaka, K., Y. Okamura, T. Amano, T. Hosokawa, and T. Uchikita, "The development status of Second Generation Global Imager Infrared Scanning Radiometer (SGLI-IRS)", SPIE Asia-Pacific Remote sensing, Beijing, China, 9264-15, October, 2014.

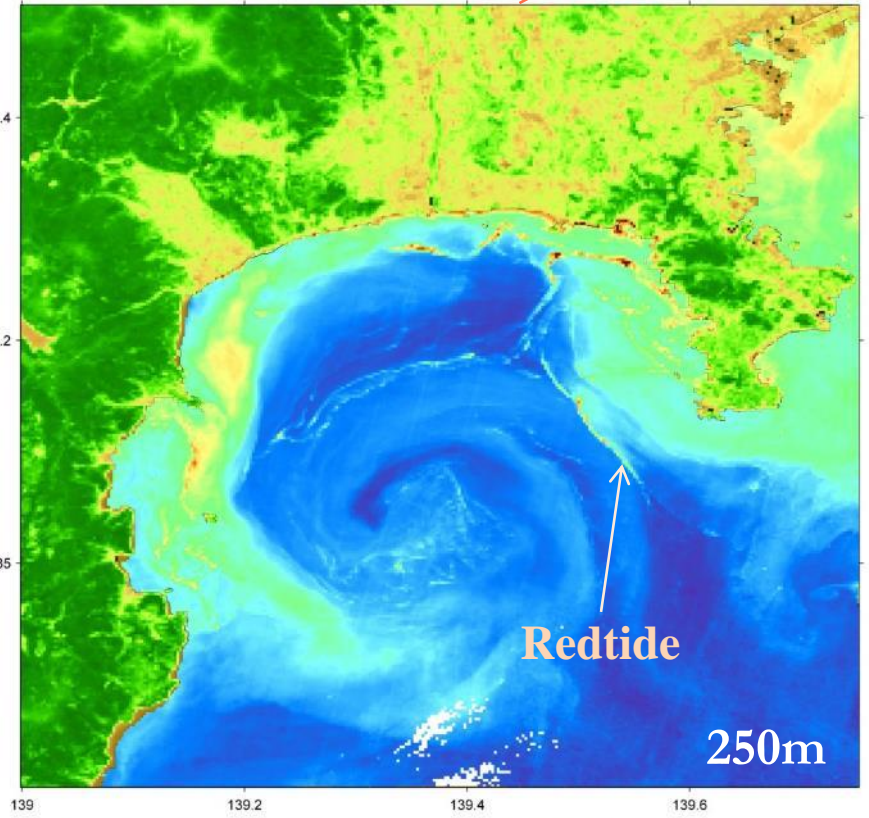
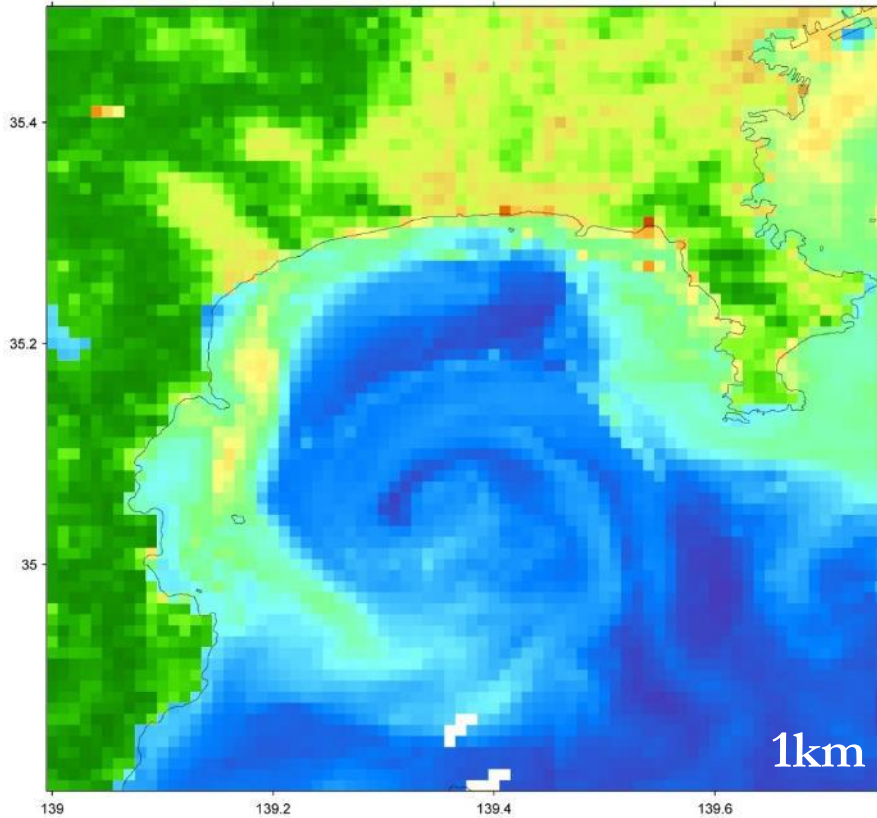
1. GCOM-C/SGLI:

SGLI 250m Visible-SWIR observation

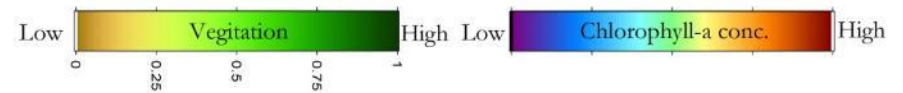
250m resolution to detect finer structure in the coastal area such as river outflow, regional blooms, small current, and redtide

1-km resolution

250-m resolution



simulated by Landsat image on 2 May 2015



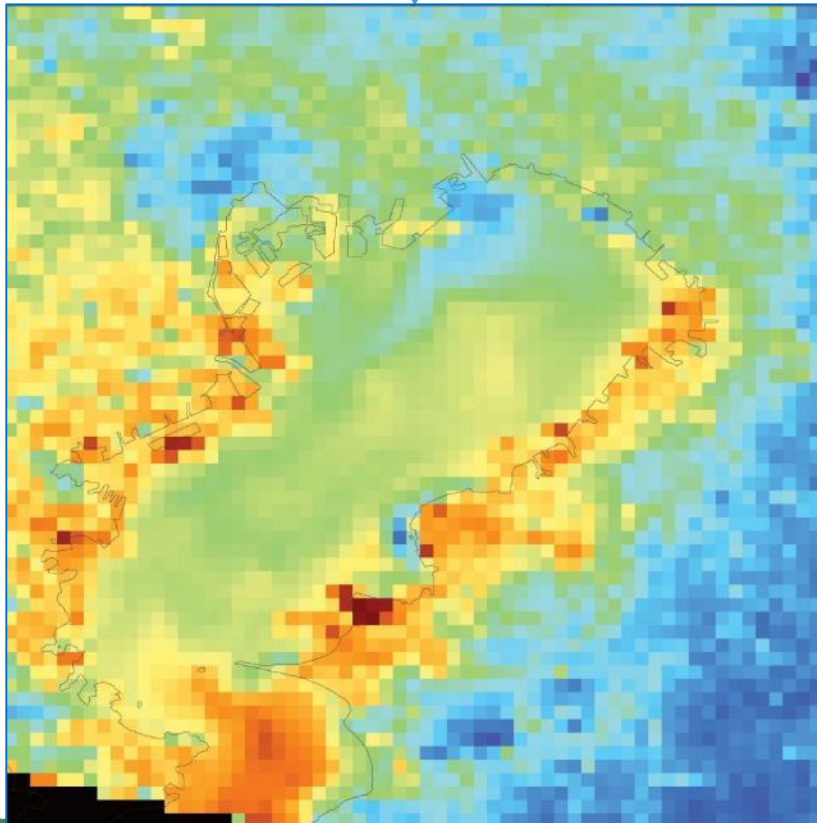
1. GCOM-C/SGLI:

SGLI 250m Thermal infrared observations

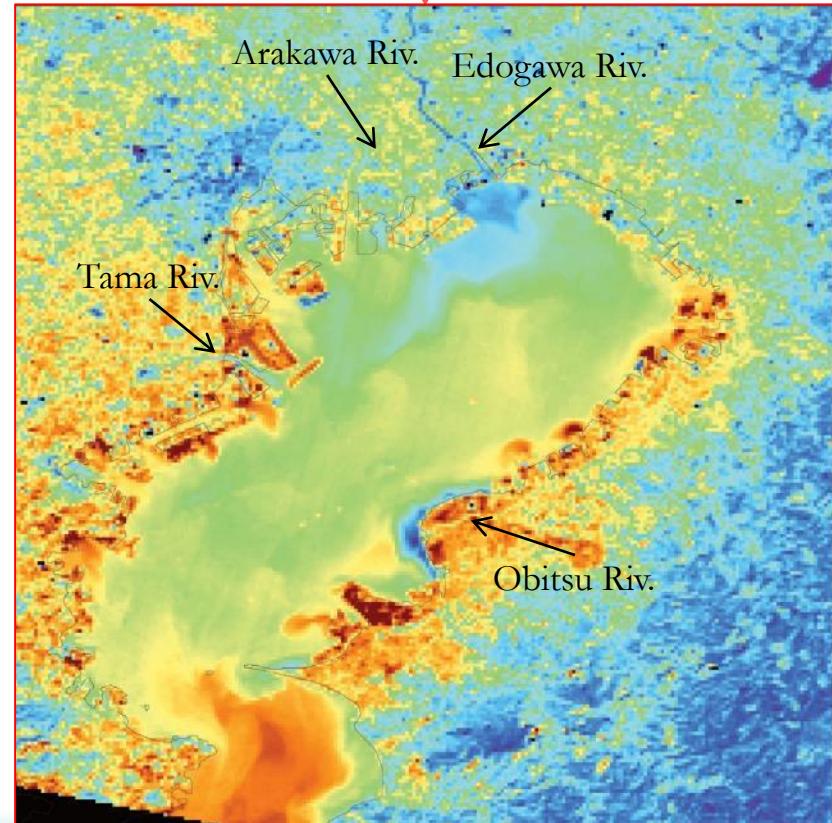
Simulated by LANDSAT-8/TIRS
11 μ m 100m data on 23 Jan. 2014



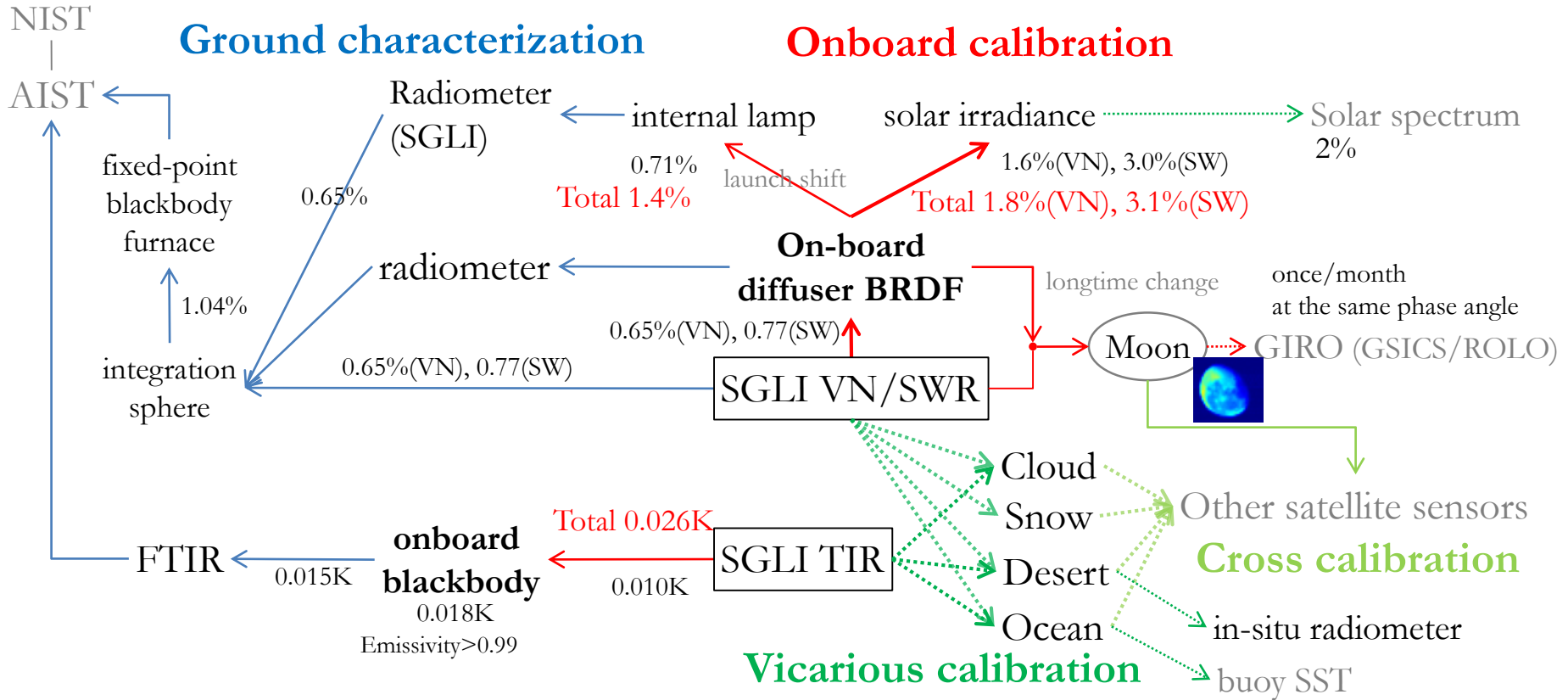
1-km resolution



250-m resolution

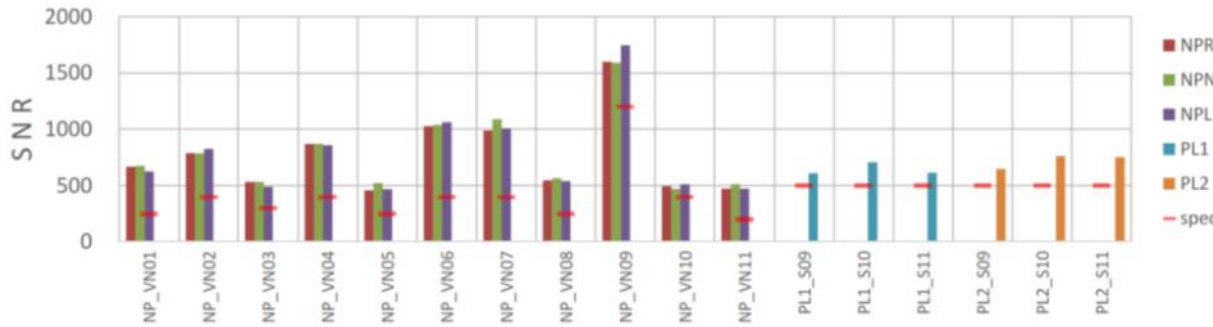


1. GCOM-C/SGLI: radiometric calibration system



- ✓ Post-launch Level-1 calibration will be based on the **onboard calibration** with sensor model developed by the **ground characterization**
- ✓ **Vicarious calibration** will be used for confirmation of the onboard calibration, and more accurate calibration (adjustment) required for the L2 algorithms

- SGLI proto-flight tests have been finished until 2016
 - ✓ spectral response, gain, linearity, SNR, stray light, polarization sensitivity
 - ✓ alignment, MTF

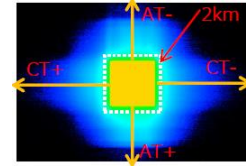


T. Sakashita, S. Tsuida, T. Amano, K. Shiratama, Kazuhiro Tanaka, “Proto Flight Model (PFM) performance of Visible and Near-Infrared Radiometer (VNR) on the Second-Generation Global Imager (SGLI)”, JAXA Joint PI Meeting of Global Environment Observation Mission 2016, Tokyo, Japan, 23-27 January 2017

- Satellite integration and operation tests will be finished until summer 2017
- **GCOM-C/SGLI will be launched in 2017**
- After the launch (L+0)
 - ✓ ~L+3M: three month commissioning phase
 - ✓ ~L+12M: nine-month initial Cal/Val phase
 - ✓ L+12M: public data release

See details:

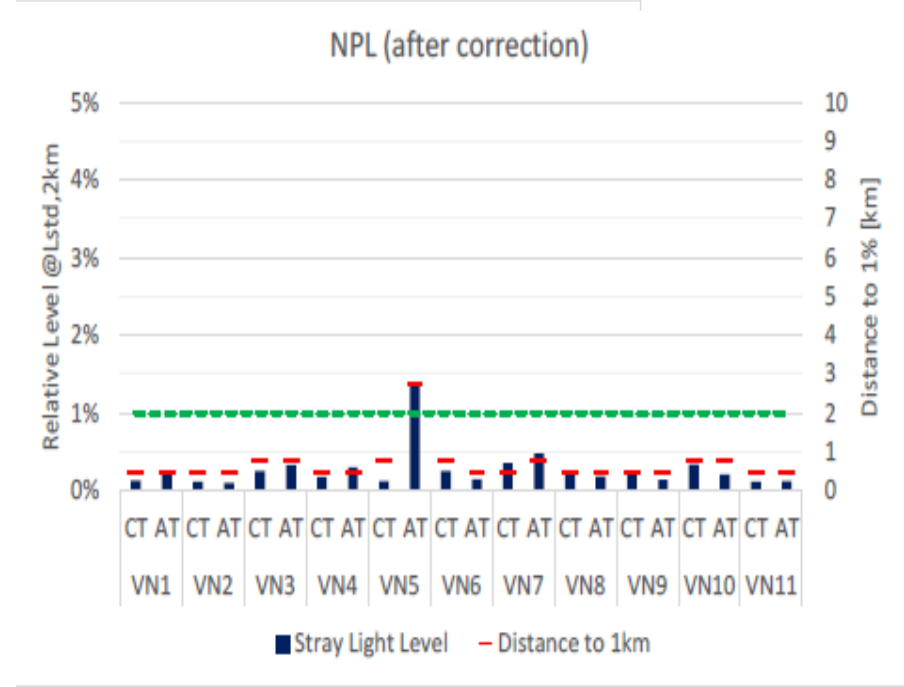
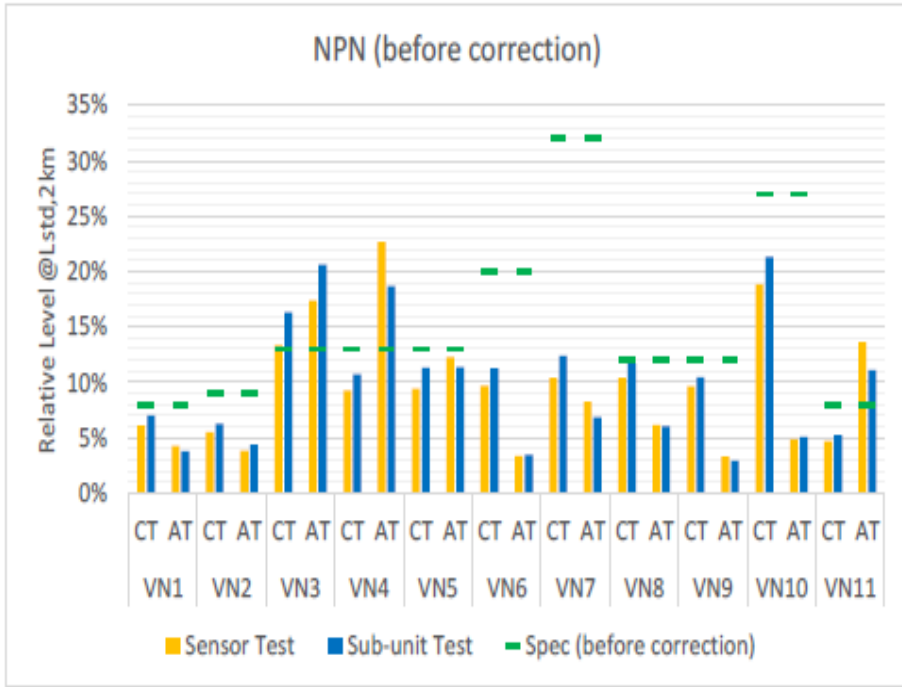
Hashiguchi et al., Radiometric performance of Second Generation Global Imager (SGLI) using integrating sphere, *SPIE Remote Sensing 2016 at Edinburgh, United Kingdom Sep. 26, 2016*



Conditions

Transfer function is derived from the pin-hole response data and the square chart data.

Correction process is used for the blind deconvolution method applying for the derived transfer function.



$$R_{\text{stray}} [\%] = L_{\text{stray}} / L_{\text{std}} \times 100 @ 2\text{km from } L_{\text{cloud}} \text{ input}$$

Results

- Stray Light Level after correction is almost less than 1%.
- Stray Light data was reviewed by Ocean Group users.
- Further improvement will be carried out by and after launch.

T. Sakashita et al., 2017,
JAXA Joint PI Meeting

3. GCOM-C ocean products: accuracy targets

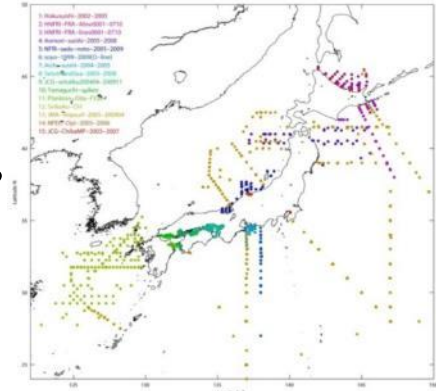
Cate gory	group	Product	Day/ night	Grid size	Release threshold	Standard accuracy	Target accuracy	
Standard	Ocean color	Normalized water leaving radiance (incl. cloud detection)	Daytime	250m (coast), 1km (offshore), 4km (global)	60% (443~565nm)	50% (<600nm), 0.5W/m ² /str/um (>600nm)	30% (<600nm), 0.25W/m ² /str/um (>600nm)	
		Atmospheric correction param			80% (AOT@865nm)	50% (AOT@865nm)	30% (AOT@865nm)	
		Photosynthetically available radiation			20% (10km/month)	15% (10km/month)	10% (10km/month)	
	In-water	Chlorophyll-a concentration			-60~+150% (offshore)	-60~+150%	-35~+50% (offshore), -50~+100% (coast)	
		Total suspended matter			-60~+150% (offshore)	-60~+150%	-50~+100%	
		Colored dissolved organic matter			-60~+150% (offshore)	-60~+150%	-50~+100%	
	tempera ture	Sea surface temperature	Both	250m or 500m (coast), 1km (offshore), 4km (global)	0.8K (daytime, 500m)	0.8K (day&night time, 500m)	0.6K (day&night time, 500m)	
Research	Ocean color	Euphotic zone depth		250m (coast), 1km (offshore), 4km (global)		NA	30%	
	In-water	Inherent optical properties				NA	a(440): RMSE<0.25, b _{bp} (550): RMSE<0.25	
	Applicat ion	Ocean net primary productivity		Daytime	500m (coast), 1km (offshore), 4km (global)		NA	70% (monthly)
						Phytoplankton functional type		NA
		Redtide		NA	error judgment rate <20%			
		multi sensor merged ocean color		NA	-35~+50% (offshore), -50~+100% (coast)			
		multi sensor merged SST	Both	500m (coast), 1km (offshore)		NA	0.8K (day&night time)	

3. GCOM-C ocean products: Validation

Plan of the post-launch in-situ measurements

- **Regular cruises**

- Univ. cruises around Japan: Funaka-bay, Ariake-bay, Tokyo-bay, Toyama-bay, Ise-Bay, Seto-inland sea, Akkeshi..
- Fishery agency ships (JAXA's optical instruments)
- Japanese in-land waters by Univ. and institutes



- **Offshore campaigns**

- Hakuho-maru in the north western Pacific in Nov.- 2017
- JAMSTEC Shinsei-maru in offshore Fukushima
- University ships (Nagasaki-maru (East China Sea), Kakuyo-maru (East China Sea), Osyoro-maru, Ushio-maru, Umitaka-maru, Bousei-maru)



- **International database/possible collaboration**

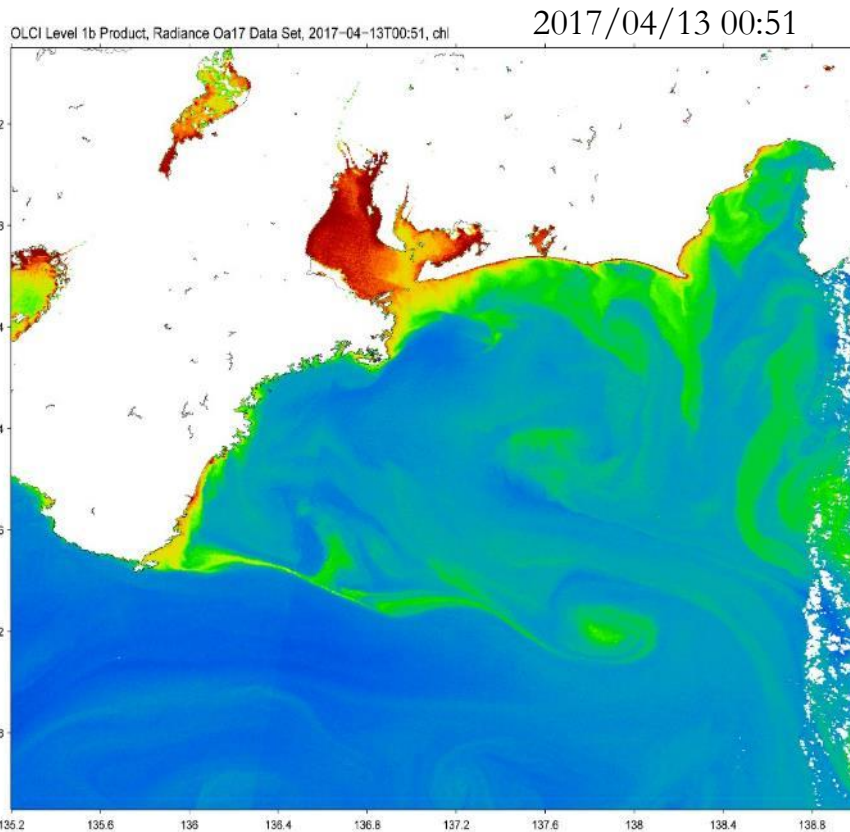
- Collaboration with Korea and Asian communities (e.g., AWOC)
- (Vical) MOBY, BOUSSOLE
- Aeronet-OC, SeaBASS, Sentinel-3, NASA/PACE mission..

- **Cross validation with other sensors:** AHI, GOSAT-2, MODIS, VIIRS, OLCI, GOCI,..



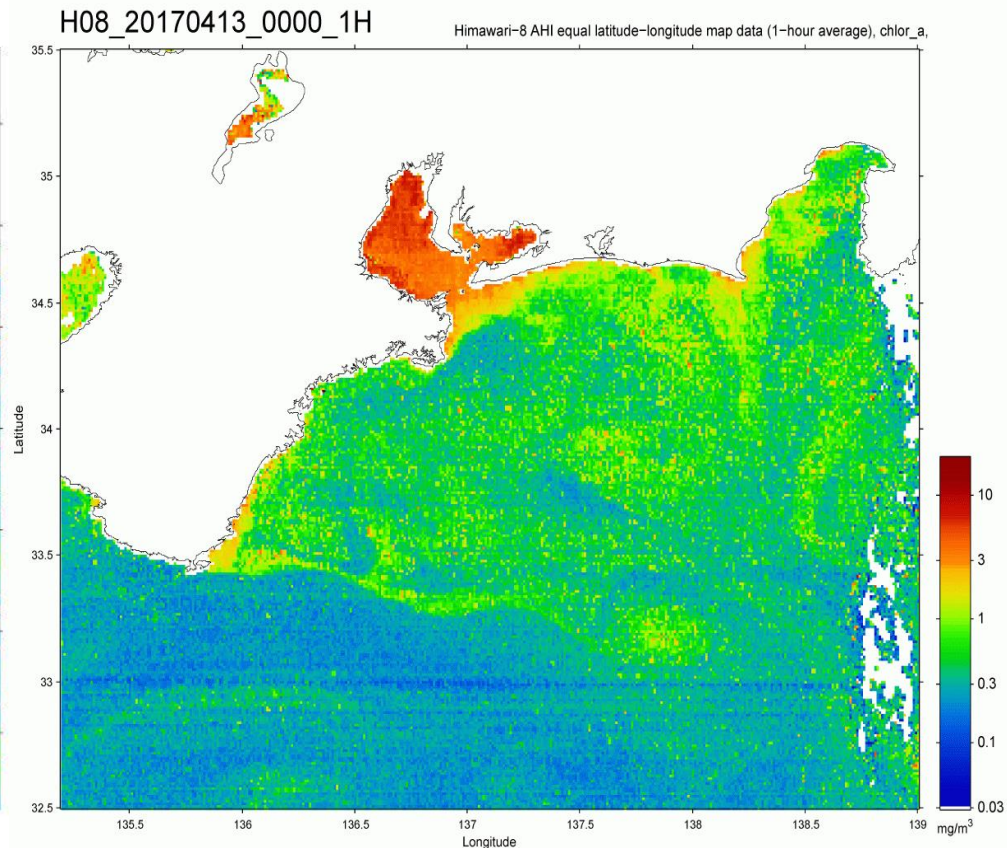
3. GCOM-C ocean products: Synthetic analysis of GEO-LEO data

Higher spatial resolution Chl-*a*



S3A/OLCI 300m Chl-*a*

Geostationary satellite Chl-*a*



Himawari-8/AHI 1km hourly Chl-*a*

4. Summary

1. GCOM-C/SGLI

– to be launched in 2017

- 380nm-12 μ m, 250-m IFOV, polarization bands
- Calibration functions with monthly Lunar maneuvers

2. GCOM-C/SGLI PFT

- Spectral response, gain, linearity, SNR, alignment, MTF, stray light, polarization sensitivity, ... have been characterized
- Satellite integration and operation simulation tests (2017 Apr-)
- three-month commissioning phase and following nine-month initial Cal/Val phase

3. GCOM-C ocean products

- GCOM-C standard ocean products: SST, NWLR, Chl-a, TSM, aCDOM, and PAR
- research products: IOP, EZD, NPP, PFT, and redtide..
- Product accuracy targets
- All standard products will be freely open to the public one-year after the launch.
- Synergy with other satellite data (e.g., AHI, MODIS, VIIRS, OLCI, GOCI, etc.)
- In-situ data by Cal/Val-dedicated and regular cruises