Japan Aerospace Exploration Agency

AGENCY REPORT,

Update on GCOM-C1/SGLI

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JAXA/EORC

International Ocean Colour Science Meeting 2013

JAXA satellite missions

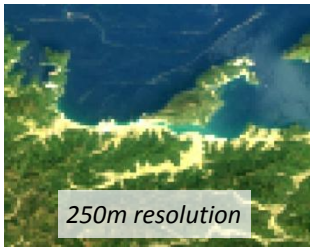
JFY	before 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Disaster/resource monitor	**SAR** JERS-1 (92~98), ALOS (06~11) **High res. optical imager** MOS-1(87~95), JERS-1(92~98), ADEOS(96~97), Terra/ASTER(99~), ALOS (06~11)	PALSAR ALOS(Daichi) PRISM, AVNIR2						ALOS-2/SAR SAR, Thermal camera				
		high-resolution land surface imaging Terra/ASTER (METI)						ALOS-3/Optical				
Climate change, global warming water cycle	**Precipitation Radar** TRMM/PR (97~) **Microwave imager** MOS-1(87~95) ADEOS2/AMSR(03) Aqua/AMSR-E (02-11)	TRMM/PR 3-D structure of precipitation						GPM/DPR				
		Aqua/AMSR-E			GCOM-W1(Shizuku)/AMSR2				GCOM-W2			
		wind speed, precipitation, water vapor, SST..										
	Wide-swath imager MOS-1(87~95), ADEOS/OCTS(96~97) ADEOS2/GLI (03)	Aerosol, cloud, vegetation, ocean color, SST, PAR..						GCOM-C1/SGLI				GCOM-C2
	Cloud radar/Aerosol LIDAR	3-D structure of cloud and aerosol radiation budget						EarthCARE/CPR				
	Spectrometer ADEOS/ILAS (96~97) ADEOS2/ILAS2 GOSAT (09.1~)	GOSAT (Ibuki)/TANSO								GOSAT-2		
		green house gases										
	…											

Finish | Under operation | Development | Study

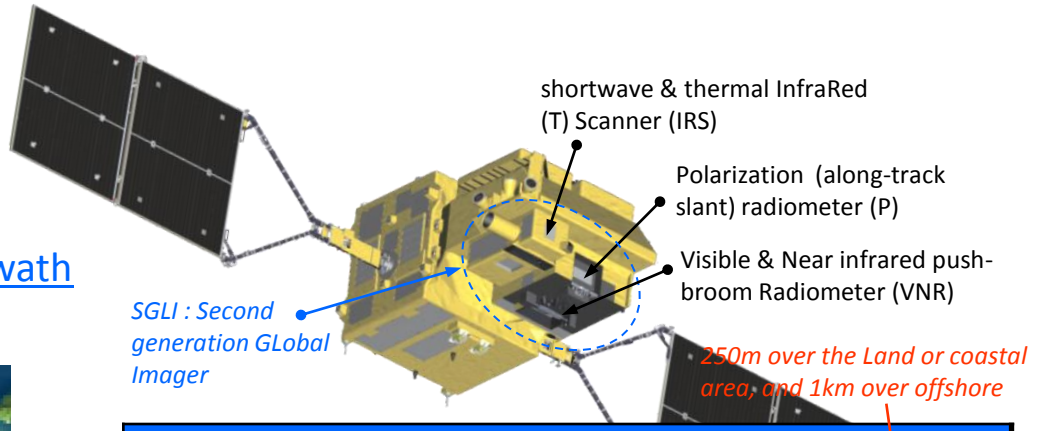
1. GCOM-C/ SGLI

Improvement of the land, coastal, and aerosol observations

- ✓ 250m spatial resolution with 1150~1400km swath
- ✓ Polarization/along-track slant view



GCOM-C SGLI characteristics (Current baseline)	
Orbit	Sun-synchronous (descending local time: 10:30), Altitude: 798km, Inclination: 98.6deg
Launch Date	JFY 2015 (TBD)
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: VN & P) 1400km cross track (IRS: SW & T)
Digitalization	12bit
Polarization	3 polarization angles for P
Along track tilt	Nadir for VN, SW and T, & +/-45 deg for P
On-board calibration	VN: Solar diffuser, Internal lamp (LED, halogen), Lunar by pitch maneuvers (~once/month), and dark current by masked pixels and nighttime obs. SW: Solar diffuser, Internal lamp, Lunar, and dark current by deep space window T: Black body and dark current by deep space window All: Electric calibration



250m over the Land or coastal area, and 1km over offshore

SGLI channels

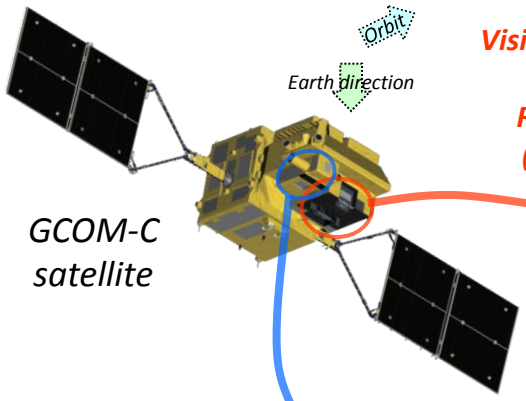
CH	λ	Δλ	L_{std}	L_{max}	SNR at Lstd	IFOV
	VN, P, SW: nm T: μm		VN, P: W/m²/sr/μm T: Kelvin		VN, P, SW: - T: NEΔT	m
VN1	380	10	60	210	250	250
VN2	412	10	75	250	400	250
VN3	443	10	64	400	300	250
VN4	490	10	53	120	400	250
VN5	530	20	41	350	250	250
VN6	565	20	33	90	400	250
VN7	673.5	20	23	62	400	250
VN8	673.5	20	25	210	250	250
VN9	763	12	40	350	1200(@1km)	250
VN10	868.5	20	8	30	400	250
VN11	868.5	20	30	300	200	250
P1	673.5	20	25	250	250	1000
P2	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
SW4	2210	50	1.9	20	211	1000
T1	10.8	0.7	300	340	0.2	500/250
T2	12.0	0.7	300	340	0.2	500/250

Multi-angle obs. for 674nm and 869nm

250m-mode possibility

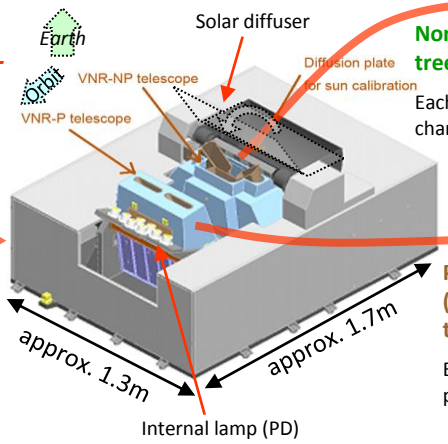
1. GCOM-C/ SGLI

Second generation global imager (SGLI)



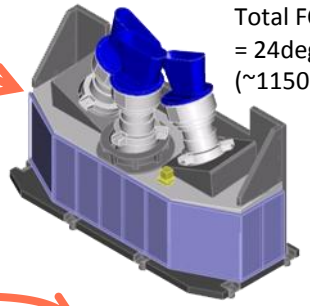
GCOM-C satellite

Visible and Near-infrared Radiometer (SGLI-VNR)



Non-polarization tree telescopes

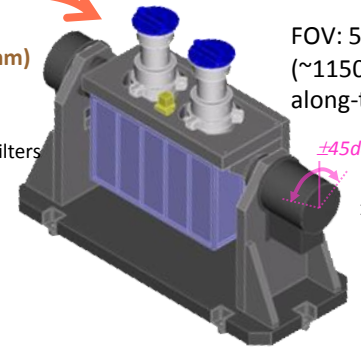
Each has the same 11 channels



Total FOV: 70deg
= 24deg × 3 telescopes
(~1150km@nadir)

Polarization two (670nm and 865nm) telescopes

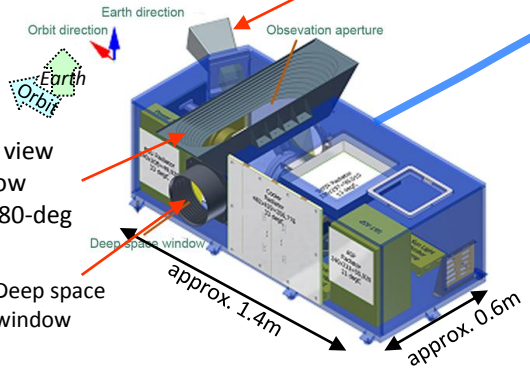
Each has tree polarization-angle filters



FOV: 55deg
(~1150km@±45deg along-track slant)

±45deg along-track slant observation

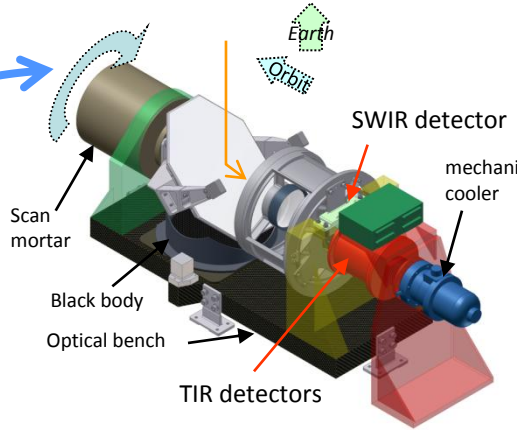
InfraRed Scanner (SGLI-IRS)

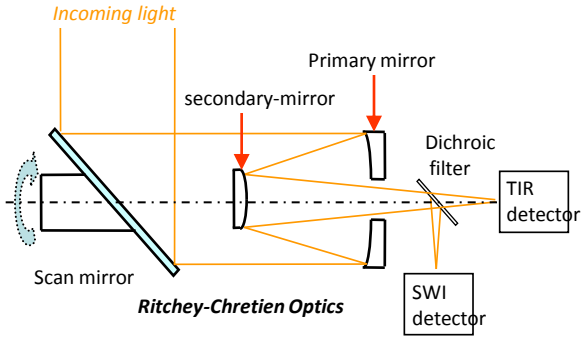


Solar calibration window

Earth view window FOV: 80-deg

Deep space window

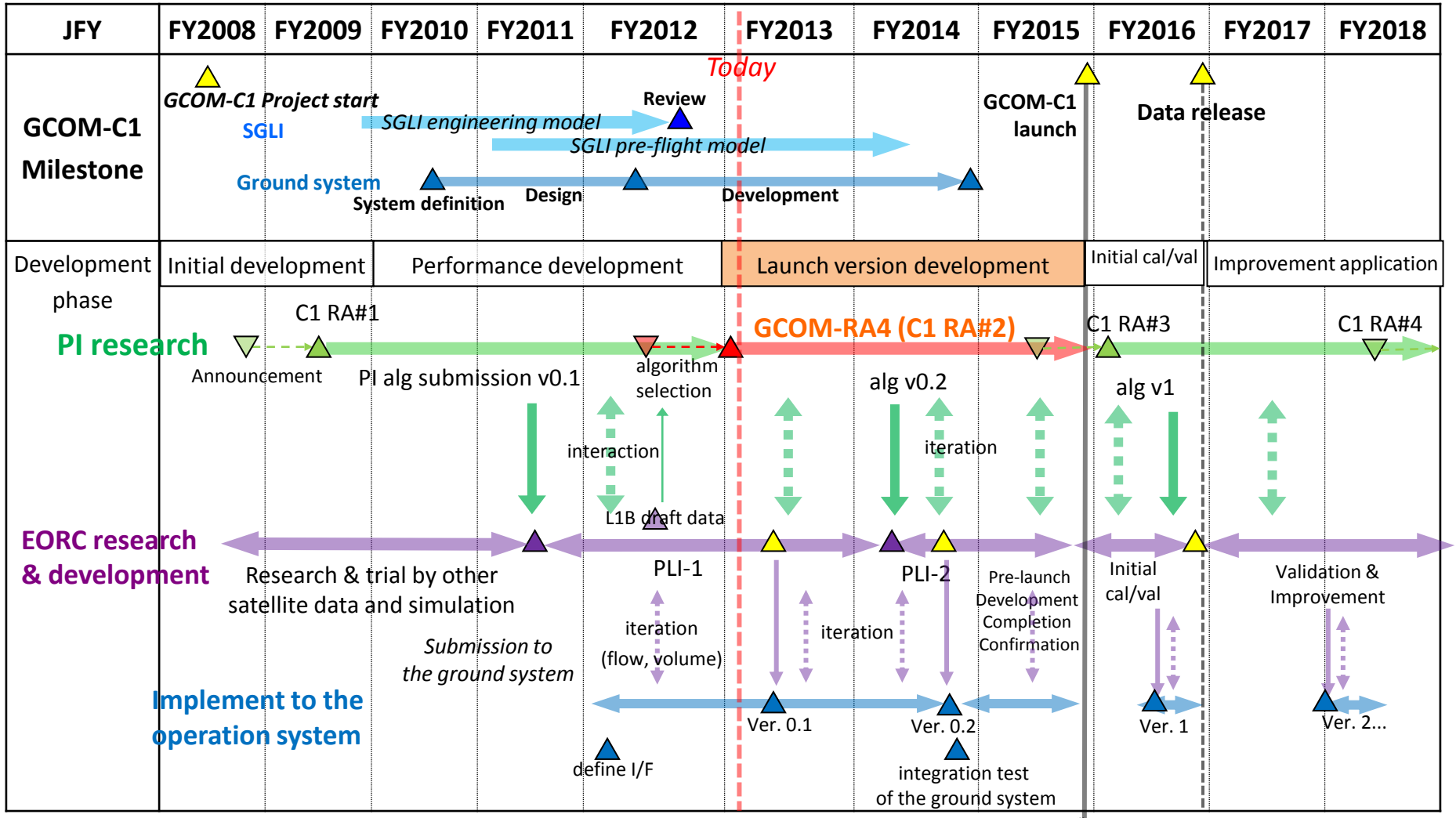


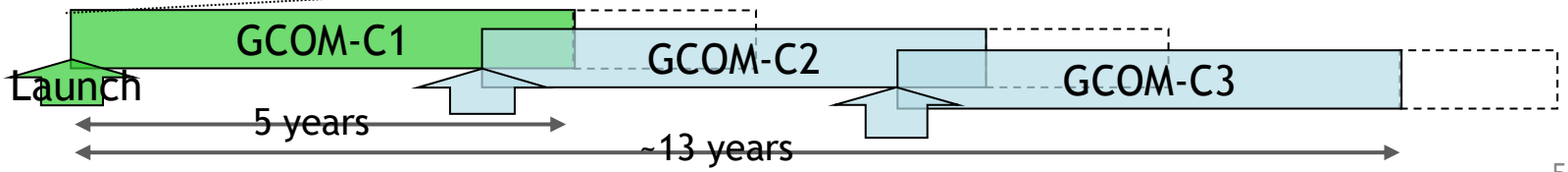


Engineering Model (EM) development & test

- Filters manufacturing: Spectral response of filters (uniformity of λc: 0.5-1.0nm in FOV, characterized by 0.1nm)
- CCD (EM) manufacturing: completed
- Stray Light : Telescope test with the CCD; Numerical correction method study with convolution technique
- Calibration : Integrating sphere calibration with national standards

2. GCOM-C1 development: *schedule*





GCOM-C1 PI list (RA#4: April 2013 - March 2016)

Land group (LOGCOM)	
Y. Honda (**PI team leader**; refl. val)	Chiba Univ.
K. Nasahara (NPP, LAI, Flux..)	Tsukuba Univ.
K. Kajiwara (biomass by BRF)	Chiba Univ.
M. Moriyama (LST, fire detection)	Nagasaki Univ.
K. Fukue (land cover)	Tokai Univ.
N. Soyama (land cover)	Tenri Univ.
K. Muramatsu (NPP)	Nara Women's Univ.
M. Tasumi (ET index)	Miyazaki Univ.
T. Kaneko (volcano)	Tokyo Univ. ERI
K. Nakau (fire detect., burned area)	Hokkaido Univ.
K. Ichii (model)	Fukushima Univ.
R. Suzuki (LAI, time series)	JAMSTEC
M. Takagi (local land cover, GCP)	Kochi Univ. of Tech.
K. Mabuchi (model)	Chiba Univ.

Atmosphere group	
Takashi Nakajima (**group leader**; cloud)	Tokai Univ.
I. Sano (pol aerosol, atm corr.)	Kinki Univ
T. Inoue (aerosol, model)	Tokyo Univ.
M. Kuji (cloud thickness)	Nara Women's Univ.
H. Ishimoto (particle simulation)	Meteorological Res.Inst.
A. Yamazaki (in-situ)	Meteorological Res.Inst.
H. Irie (SKYNET)	Chiba Univ
K. Aoki (SKYNET)	Toyama Univ.
T. Hayasaka (in-situ, radiation)	Tohoku Univ.
J. Riedi (pol cloud/aerosol)	LOA - Univ. Lille1/CNRS

Ocean group	
M. Toratani (**group leader**; atmos. corr)	Tokai Univ.
T. Hirata (IOP, PFT, model)	Hokkaido Univ.
J. Ishizaka (redtide)	Nagoya Univ.
T. Hirawake (NPP, PFT)	Hokkaido Univ.
F. Sakaida (SST)	Tohoku Univ.
R. Frouin (Atmos. Corr. functions)	Scripps Inst. of Oceanogr.
K. Suzuki (in-situ)	Hokkaido Univ.
H. Kobayashi (in-situ)	Yamanashi Univ.
S. Saitoh (fishery)	Hokkaido Univ.
A. Fujiwara (application, PFT)	National Inst.of Polar Res.
B. Franz (multi sensor)	NASA
M. Wang (atm. corr, appli.)	NOAA

Cryosphere group	
T. Aoki (**group leader**; snow, val)	Meteorological Res. Inst.
K. Stamnes (snow properties)	Stevens Inst. of Tech.

JAXA/EORC	
H. Murakami (Ocean, atm. corr., PAR)	JAXA/EORC
M. Hori (Cryos, Level-3, val)	JAXA/EORC
D. J. Rostand (Atmos)	JAXA/EORC
T. Tanikawa (Cryos)	JAXA/EORC
Y. Ono (LAI, FAPAR)	JAXA/EORC
H. Yamaguchi (Ocean)	JAXA/EORC
T. Hashimoto (Ortho, alignment)	Tokai Univ. (JAXA/EORC)
J. Takaku (System geo, GCP)	RESTEC (JAXA/EORC)

2. GCOM-C1 algorithm development

The second research period (Apr. 2013 – Mar. 2016)

Tasks for the product development:

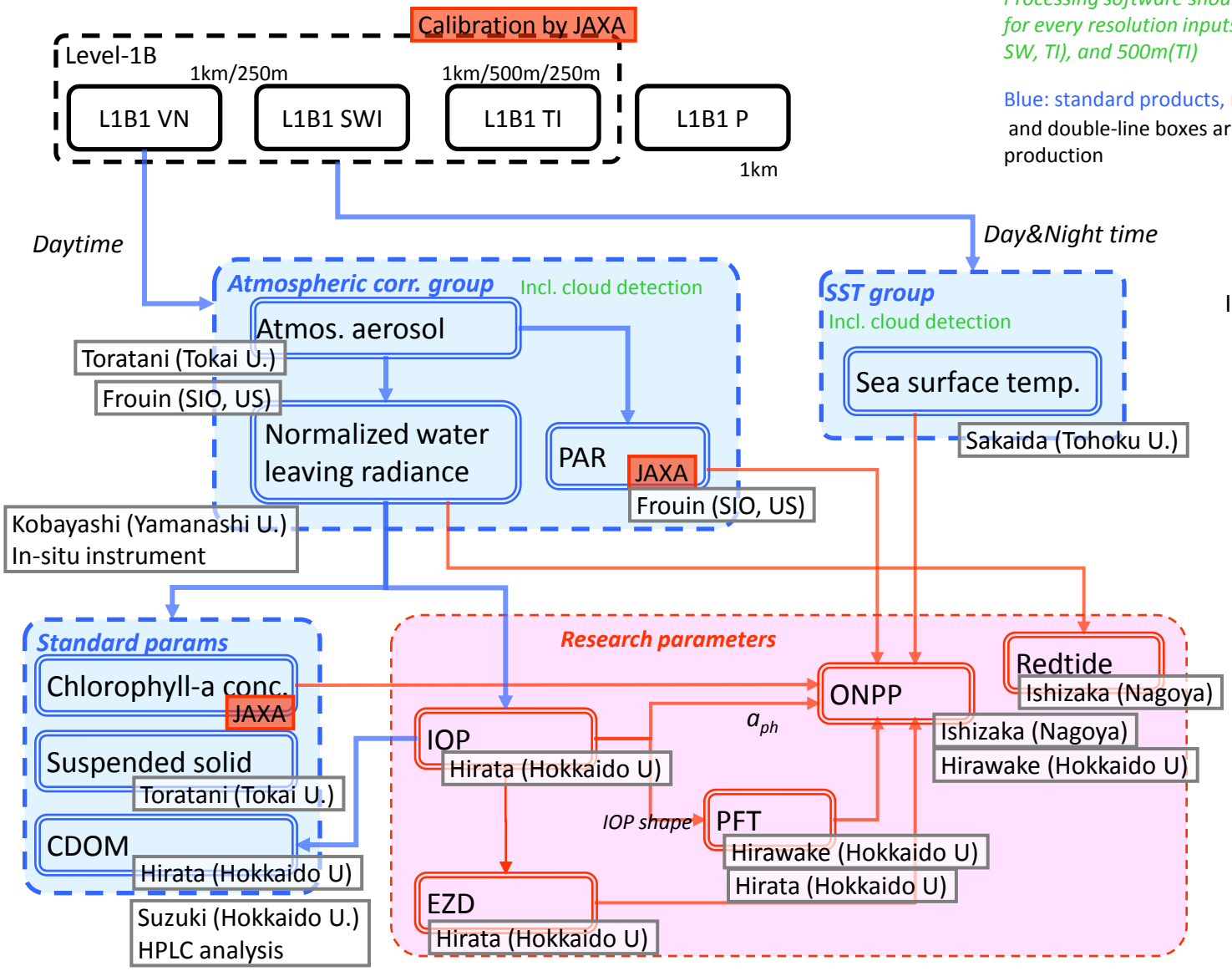
1. Development of the operation data flow (FY2013-)
2. The second submittion of codes and ATBD (~Summer. 2014)
3. Revision reflecting results of the operational tests
4. Practice of data application for monitoring, science, and model researches

Ocean group:

1. Characterization (data collection) of coastal IOPs (start from coasts around Japan)
2. Improvement of the candidate aerosol models (with Aerosol network groups)
3. Algorithm consideration with the SGLI sensor tests
4. Primary production algorithm/validation, and collaboration with ocean ecosystem models

2. GCOM-C1 algorithm development

GCOM-C Operation Flow (Ocean)



Processing software should be applicable for every resolution inputs, 250m/1km (VN, SW, TI), and 500m(TI)

Blue: standard products, red: research products
and double-line boxes are subject for level-3 production

International collaboration

- Bryan Franz (NASA) multi sensor
- M. Wang (NOAA) Atm.corr, VIIRS

Application

- Saitoh (Hokkaido U) Fishery
- Fujiwara (NPRI) Polar ecosystem

2. GCOM-C1 algorithm development

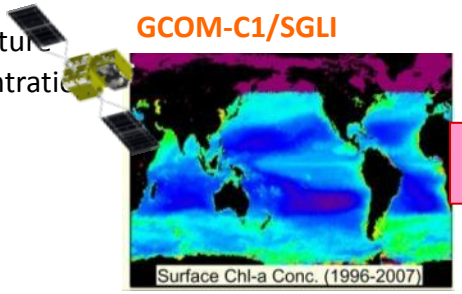
Collaboration for the GCOM-C research

- ✓ Development and distribution of GCOM-C1 products considering the SGLI 250-m resolution
- ✓ Contribution to monitoring and prediction of the ocean carbon budget and the coastal environment

Satellite — Tokai Univ., Nagoya Univ., JAMSTEC, Hokkaido Univ., Tohoku Univ., SIO (US), JAXA

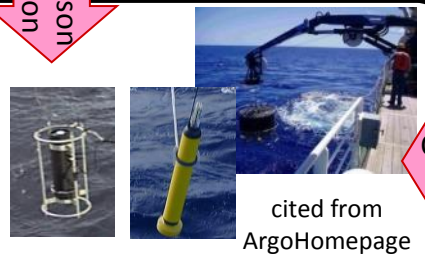
SGLI product
- Sea surface temperature
- Chlorophyll-a concentration
- CDOM, SS
- NPP
- PFT
- IOPs, EZD
- PAR

GCOM-C1/SGLI



Other satellite data
- Wind, current
- Sea ice
- Heat and water flux

In situ
- Chlorophyll-a conc.
- Plankton species
- temp, salinity, nutrient
- CO2
- IOPs



cited from ArgoHomepage

Hokkaido Univ., Nagoya Univ., JAMSTEC, FRA, NIPR, etc.

Product

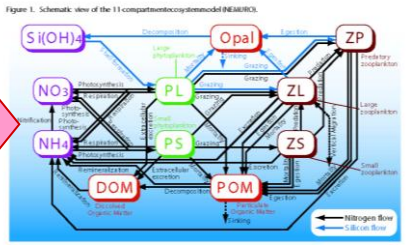
Comparison Validation

Comparison Validation

Comparison Validation

Model — JAMSTEC, Hokkaido Univ.

Ecosystem model (e.g., NEMURO)

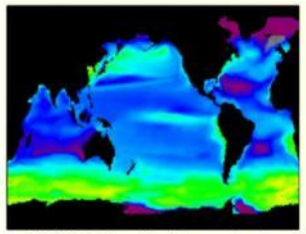


JAMSTEC Homepage

Target process
- phytoplankton growth
- animal plankton grazing
- Decomposition and sedimentation velocity
- Ocean current, temperature, and density
- Coastal environment

Improvement

Presuction results



Fe-NEMURO(Yasuhiro Yamanaka, Japan) *

Model outputs
- Net primary production (NPP)
- chlorophyll-a
- phytoplankton type, redtide
- suspended matter
- temperature, current, eddies,
- decomposition, sedimentation,
- dissolved oxygen, eutrophication

* Hashioka & Yamanaka, Seasonal and regional variations of phytoplankton groups by top-down and bottom-up controls obtained by a 3D ecosystem model, Ecological Modelling 202, 68-80, 2007.

3. Summary

- **GCOM-C/SGLI**
  - ✓ 250-m resolution and 1150-km (1400-km) swath for the land & coast
  - ✓ Near-UV (380nm) and polarization observation for the land aerosol
  - ✓ Nadir + slant-view observations for the biomass and land cover classification
  - ✓ Multiple Calibration functions (solar diffuser, LED, Moon, and vical)
  - ✓ Manufacturing of the SGLI flight model is starting
- **Algorithm development**
  - ✓ The first draft algorithm has been provided to JAXA by PIs in autumn 2011
  - ✓ The evaluation results are reflected to the development of the operational processing system (design reviews in the next winter)
  - ✓ The new research period has been started from Apr. 2013 (to Mar. 2016)
  - ✓ Coastal algorithm development through characterization of the coastal IOPs
- **Product distribution**
  - ✓ Products will be released to the public one year after the launch
  - ✓ GCOM products will be free of charge for internet acquisition