KIOST Agency Report

Overview of KIOST Updates on GOCI & GOCI-II

Joo-Hyung RYU Ocean Research, Operation and Support Dep. Korea Ocean Satellite Center



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[History of KIOST

☐ Personnel & Budget

Organization

IV Facilities (RVs, Satellitel)



45 Years of History





II Personnel and Budget (2019)





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Office of the Vice President					
	Research Project Developr Division	nent			
	Research Project Development Affairs Section				
	Research Project Services Section	on			
	Technology Transfer & Commercialization Section				
	Marine Environmental & Climate Research Division	Marine Resources Research Division	Coastal & Ocean Engineering Division	Marine Domain Management Research	Ocean Research, Operations & Support
	Ocean Circulation and Climate Research Center	Marine Biotechnology Research Center	Coastal Development and Ocean Energy Research Center	Division Marine Security and Safety Research Center	Department Korea Ocean Satellite Center
	Marine Ecosystem Research Center	Deep sea Mineral Resources Research Center	Uldolmok Tidal Power Station	Marine Disaster Research Center	Instrumental Development and Management Center
	Marine Environmental	Global Ocean Research	Maritime ICT R&D Center	Korean Seas Geosystem	Ocean Data Science Section
	Research Center	Center	Underwater Construction	Research Unit	Ocean Science Library
	Center	Research Unit	Robotics R&D Center		Section
		Tongyoung Marine Living Resources Station			Research Vessel Building Unit
	KIOST School and Academic Programs Division	South Sea Research Institute	East Sea Research Institute	Jeju Research Institute	
		Ecological Risk Research Division	East Sea Environment Research Center	Jeju Marine Research Section	
		Risk Assessment	Coastal Morphodynamics	General Management	
		Ballast Water Research Center	Dokdo Research Center	Jection	
		Library of Marine Samples	General Management Section		
		Vessel Management Section	Ulleungdo Dokdo Ocean		
		Vessel Operation Team	Science Station		
		Marine Observation Team			
KIOST 한국해양과적	각기술원	General Management Section			5

IIIOrganization_HQs, Subsidiaries, Stations





IIIOrganization_Busan Headquarter

- Real

↘ Location





At the Center of Dongsam Innovation Distric, ideally located adjacent to the sea



IIIOrganization_Composition of buildings





More than 68.4% allocated to Research and Experiment



IIIOrganization_Overseas Centers







IV Facilities_KIOST Fleet



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W Facilities_Korea Ocean Satellite Center

Functions

- Operation of Korean ocean color satellite (GOCI) and management of data distribution
- Calibration and validation of GOCI data
- Development of ocean and coastal remote-sensing techniques and satellite sensors

GOCI (Geostationary Ocean Color Imager)

- Significance: World's first geostationary ocean color satellite
- Coverage: 2,500km x 2,500km around Korea
- Frequency: 8 times a day (0~7UTC)
- Ground Sampling Distance (GSD): 500m

GOCI-II

- Anticipated 2020 launch
- Improved GSD (250m)
- Increased spectral bands (13 more)
- Added full disk mode





KIOST: Updates on GOCI and GOCI-II





Status of GOCI Operation Status of GOCI-II & Ground Segment(G2GS)





GOCI Operation Issues: Lifetime, Data Service

GOCI Lifetime

- Official GOCI/COMS operational lifetime is 7 years from the beginning of GOCI normal on-orbit operation and data distribution service (April 1, 2011).
- ✓ GOCI/COMS operational lifetime will be extended until March 2021(TBD).
- ✓ GOCI and GOCI-II can acquire data simultaneously for about one year.

GOCI Data Service

- Near Real-time distribution service to Gov. user
- Web-based data service(<u>http://kosc.kiost.ac.kr</u>)
 - Open access for research/public use
- Public services using Portal
- Mirror site on NASA OBPG
 - Level 1B : same as KOSC(HDF-EOS5 format)
 - Level 2 : processed by NASA Seadas(NASA form)
- User SW : GDPS 2.0







Development of GOCI-II



Satellite Development





The GOCI-II is scheduled to be launched in Mar. 2020.

Comparison of GOCI and GOCI-II requirements

Requirements	GOCI	GOCI-II
Mission Life Time	7 years	10 years
Duty Cycle (Local Area : LA)	8 times / day	10 times / day
Duty Cycle (Full Earth Disk : FD)	-	1 time during day time
Observation Time	≤ 30 minutes for LA	≤ 30 minutes for LA ≤ 240 minutes for FD
Spatial resolution (GSD)	≤ 500 m @ center of Ref. LA (130°E, 36°N)	<mark>≤ 250 m @ Nadir</mark> (Ref. LA : 2.500 km x 2.500 km)
Spectral Range	400 nm – 900 nm (VIS, NIR)	370 nm – 900 nm (VIS, NIR)
Number of spectral bands	8 narrow bands (10 to 40 nm)	<mark>12 narrow bands</mark> (10 to 40 nm) 1 wide band for star imaging
SNR @ nominal ocean radiance	Between 750 and 1200	Between 750 and 1200
MTF @ Nyquist frequency	> 0.3	> 0.25
Calibration	Sun calibration (once / day)	Sun calibration (once / day) Moon calibration (once / month)
Autonomy	@ S/L level	24h (@ instrument level)





Design Drivers from the Main Evolution of GOCI-II

- Smaller Ground Sampling Distance (GSD from 500 m to 250 m)
 ⇒ Specific optimization between detector pixel size, focal length and number of pixels
- High MTF and high SNR
 - \Rightarrow Increase of pupil size, detector pixel optimisation
- Full Disk imaging in Global Observation mode + capacity of Moon imaging
 ⇒ Extension of Field of Regard = extension of 2-axes Pointing Mechanism range
- Improved straylight and ISRD performances
 - \Rightarrow Implementation of an intermediate Field Stop
- More spectral bands (from 8 bands to 12 bands dedicated to Ocean Color imaging)
 New filters and new filter wheel
- Improved INR capabilities thanks to possibility of Star imaging
 - \Rightarrow Dedicated large band filter
- Improved autonomy and flexibility (24h programming, autonomous thermal control, ...)
 - \Rightarrow Major upgrade of Electronic Unit capacities and functionalities





Specification Comparison : GOCI and GOCI-II



The **size of the data increases** because of high spatial resolution, more frequent observation, using the 5 more bands, and more products.



GOCI Status and GOCI-II Plan

G2GS System Design



GTBX-GOCI Toolbox

• Data Analysis Module

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GOCI data visualization on snap is working after installing GTBX plug-in. GOCI L2 and GOCI-II L2 sample data for one slot is shown on it.





GOCI-II Cal/Val Plan & Algorithm Development





3 Committee Meeting, 2018

GOCI-II Imaging Mode : Local & Full Disk Mode

- Reference Local Area (RLA), 10 images a day
- Full Disk (FD) observation, once a day



GOCI-II Reference Local Area coverage by 12 slots



GOCI-II Full Disk Area coverage by 235 slots





Cal/Val Station in Korea



2 Ocean Research Sta. & 1 Buoy + 1Buoy & Ocean Science Sta.

Potential Global Cal/Val Network(concept level)

GOCI-II JOint Ocean reference Network (GI-JOON)

Philippine Candidate Reference Station : Sun Irradiance, UV Index





Suva, Fiji Candidate Reference Station : New Ocean Optical Buoy Indonesia (MTCRC)

: Ocean monitoring, Cal/Val station

GI-JOON (Standard Criteria)

Weno, State of Chuuk Federated States of Micronesia : Wave Glider







Unmanned Helicopter



Technical Specification		
Length	270 cm	
Woight	25 kg	

vveight	25 Kg
Flight time	60 min.
Cruise speed	10 – 20 m/s
Max. take-off weigh	40 kg
Max. payload	15 kg
Fuel capacity	Gasoline, 5 L
Telemetry	40 km



[Specification of sensors]

[microCASI-1920]

- Portable Hyperspectral VNIR Imager
- Spectral Coverage : 0.4–1.0 µm
- Self-Contained Camera & Data Recording
- 288 Spectral Channels



[FLIR Vue Pro]

- Portable Thermal Imager
- Resolution : 640X512
- Spectral coverage : 7.5–13.5 µm
- Lens : 13 mm, 25° X 19°

KOSZ

Unmanned Helicopter was equipped with microCASI and FLIR



Current Status of GOCI-II algorithm development

- GOCI-II algorithms are developed based on the GOCI algorithms
- Atmospheric correction
 - Almost identical to SeaWiFS/MODIS/VIIRS atmospheric correction
 - Partially modified
 - It employs an alternative aerosol estimation scheme from two-NIR bands by using spectral relationship of aerosol multiple-scattering reflectance
 - For turbid water atmopsheric correction, it estimates NIR water reflectance by using 620 and 709 nm in the iterative scheme

✓ Ocean color algorithms

- Primary ocean color products
 - Chl-a (Hu et al., 2012 & Oreilly et al., 2000), CDOM (Siswanto et al., 2011), TSM (Siswanto et al., 2011), Kd490 (Lee et al., 2005), IOP (QAA), Zsd (Lee et al., 2015)
 - Algorithms' coefficients are adjusted for GOCI-II spectral characteristics with in-situ data
- Employed algorithms can be changed during the IOT period





Current Status of GOCI-II algorithm development

- ✓ Preparation of GOCI/GOCI-II data for Climate Data Record
- Inter-comparison between GOCI and other ocean color satellite observations
- Monitoring of multi-year variability of continuous GOCI/GOCI-II products
- ✓ Algorithm/application of GOCI-II combined with AMI and GEMS (GK-2A &B)
- Three sensors on the same geostationary orbit over wide range of solar and earth radiation (GEMS: UV-VIS, GOCI-II: VIS-NIR, AMI: VIS-IR)







Geo-Kompsat 2A/2B

Satellite	GK-2A	GK-2B	
Sensor	AMI	GOCI-II	GEMS
Period	10 years		
Channel	16	13	1000
Wavelength	0.4-13 μm	375-860nm	300-500 nm
Temporal Resolution	10min (FD) 2 min (FLA)	1 h (LA) 1 day (FD)	1 h
Spatial Resolution	2 km	250 m (LA)	7 x 8 km
Observation time	24h	daytime	daytime



*AMI: Advanced Meteorological Imager *GOCI-II: Geostationary Ocean Color Imager-II *GEMS: Geostationary Environmental Monitoring System

KOSC/KIOST in cooperation with NMSC/KMA (AMI operation center) & NIER (GEMS operation center)





Thank you for your attention