

# GOCI Status and Cooperation with CoastColour Project

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Contribution from : KOSC colleagues

Nov. 17, 2010

**Korea Ocean Satellite Center  
Korea Ocean Research & Development Institute**

# World' 1<sup>st</sup> GOCI/COMS Launch Campaign

- Launch Date : June 27 2010
- Launch Vehicle : Ariane-V (ESA)
  - Location : Kourou Space Center, [French Guiana](#)



# Previous GOCI special session & presentation

- Sep. 2010 Ocean Optics meeting at Anchorage, USA
- Oct. 2010 SPIE Asia Pacific Remote Sensing at Songdo, Korea
- Oct. 2010 IVOS and OCR-VC meeting at Ispra, Italy
- Oct. 2010 PORSEC at Taiwan, Taiwan
- Oct. 2010 ISRS at Jeju, Korea
- Nov. 2010 IOCCG Level 1 meeting at London, UK
- **Nov. 2010 CoastColour meeting at Frascati, Italy**

# A brief overview of GOCI

- ★ **GOCI** : Geostationary Ocean Color Imager
- ★ **COMS** : Communication Ocean and Meteorological Satellite
- ★ It shall be operated in a **staring-frame capture** mode onboard its COMS.
- ★ The mission concept includes eight visible-to-near-infrared bands, **500 m spatial resolution**, and a **coverage region of 2,500\*2,500 km** centered at Korea.
- ★ The instrument is expected to provide SeaWiFS quality observations for a single study area with imager frequency of **1 hour from 9 am to 4 pm (8 times a day)**.
- ★ GOCI Application : LEO mission + **Operational mission**  
harmful algae bloom (HAB), health of marine ecosystem, movement of suspended sediment and current, and to produce marine fisheries information for fishing communities + **ocean forecasting (with modeling)**

# GEO vs. LEO

	GEO/GOCI	LEO/SeaWiFS	
Altitude	35,857 km	705 km	about 50 times-far
Sensor type	Staring-frame capture	1-axis scanning	
Spatial resolution	500 m	1000 m	4 times better
Spectral range	400-900 nm	400-900 nm	Almost same
Temporal resolution	1 hour	1 day	8 times better
Sun-Satellite position	variable	stable	BRDF
Coverage	local	global	limitation
Bio-optical algorithm	local	global	New local algorithm

GEO is about 50 times farther from the Earth than LEO

GEO spatial resolution is 4 times better than that of LEO

GEO temporal resolution is 8 times better

To be considered and prepared sensor type, geometry & local coverage for overcoming GEO characteristics



03:00(GMT)  
Oct. 26, 2010  
GOCI

26 Oct. 2010  
GOCI L1B Color Composite Image

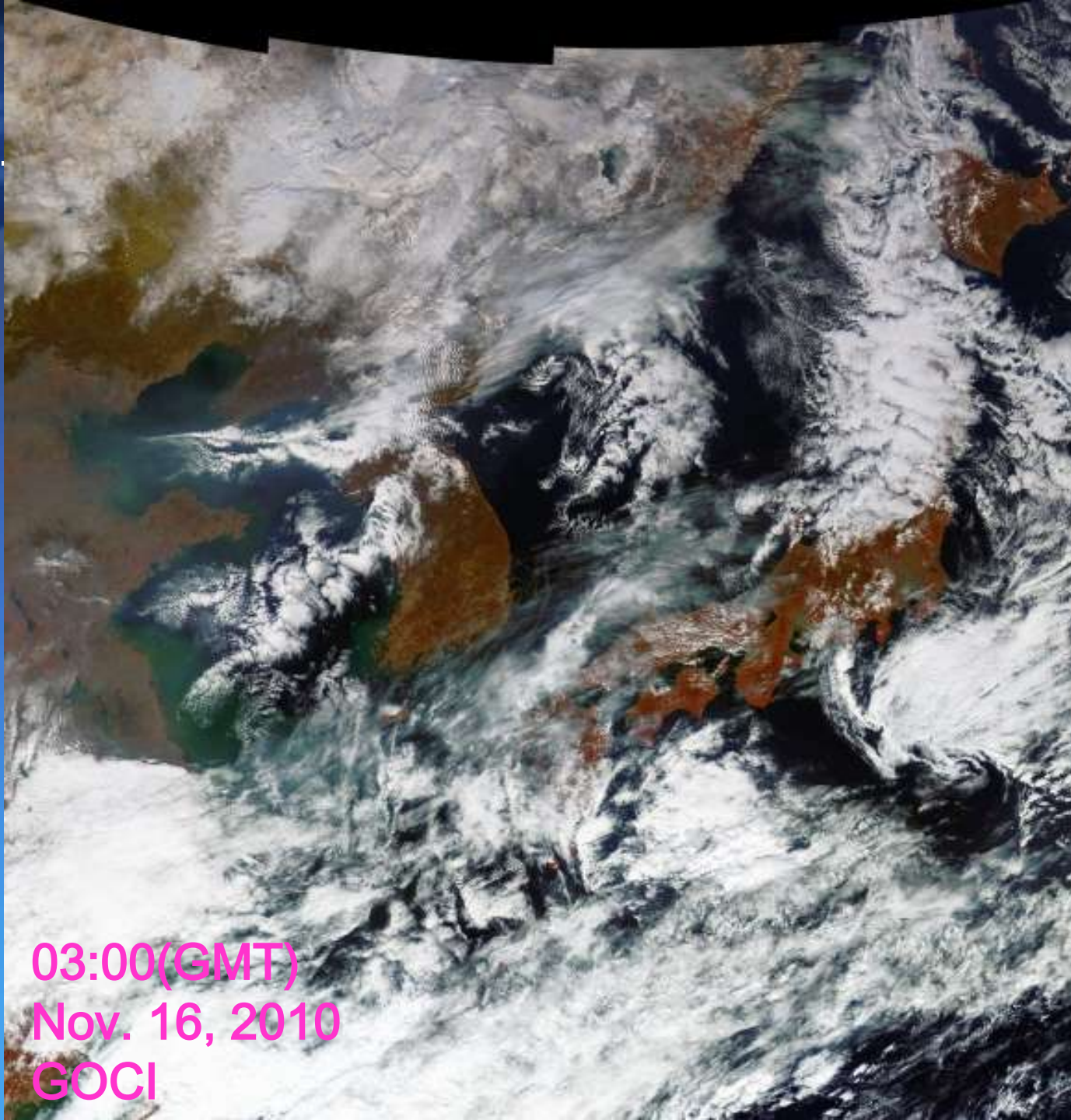
Korea Ocean Satellite Center



해양위성센터

해양과학기술연구원





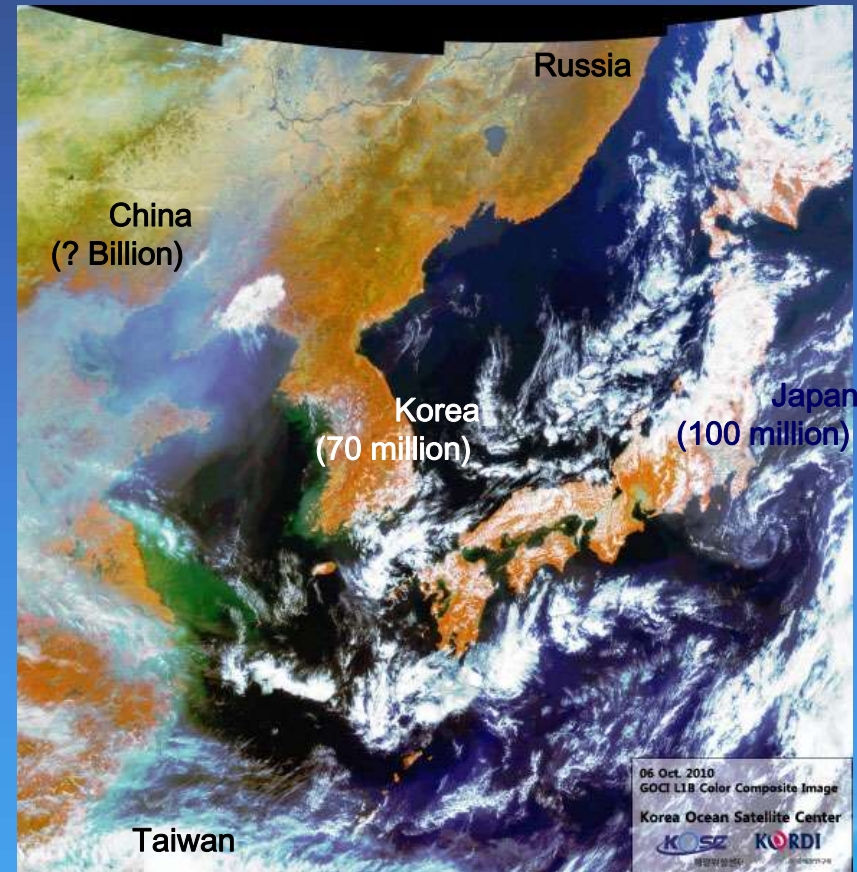
03:00(GMT)  
Nov. 16, 2010  
GOCI

# GOCI coverage

→ GOCI coverage / Earth surface =  $6,250,000 / 520,000,000 \text{ km}^2 = 1.2 \%$   
(Considering the geographical size, coverage area is very small)

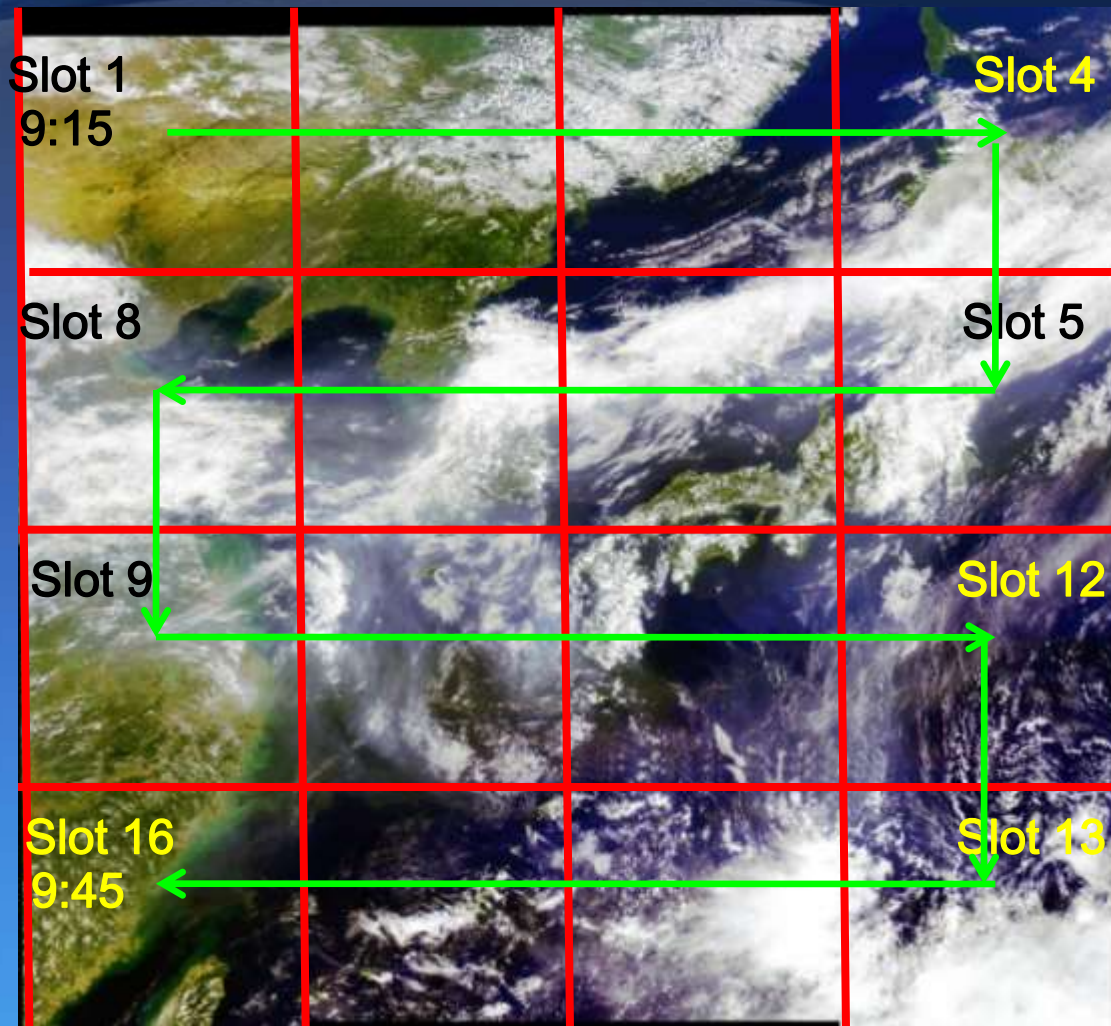
→ East Asia : South and North Korea, China, Japan, Russia, Taiwan

- Population : large (a heavily populated district)
- Economy, Commerce : big (container traffic)
- Defense, Military : important
- Environments : variable, changeable
- Climate change : serious





# Issue 1 : Sensor type



GOCI uses the staring-frame capture method  
It takes 30 min to acquire one set of whole coverage  
Time interval is induced between upper and lower lines  
The zigzag type of capture line brings about non-homogenous time interval

# GOCI slots images



Between Slot Radiometric discrepancy <4%

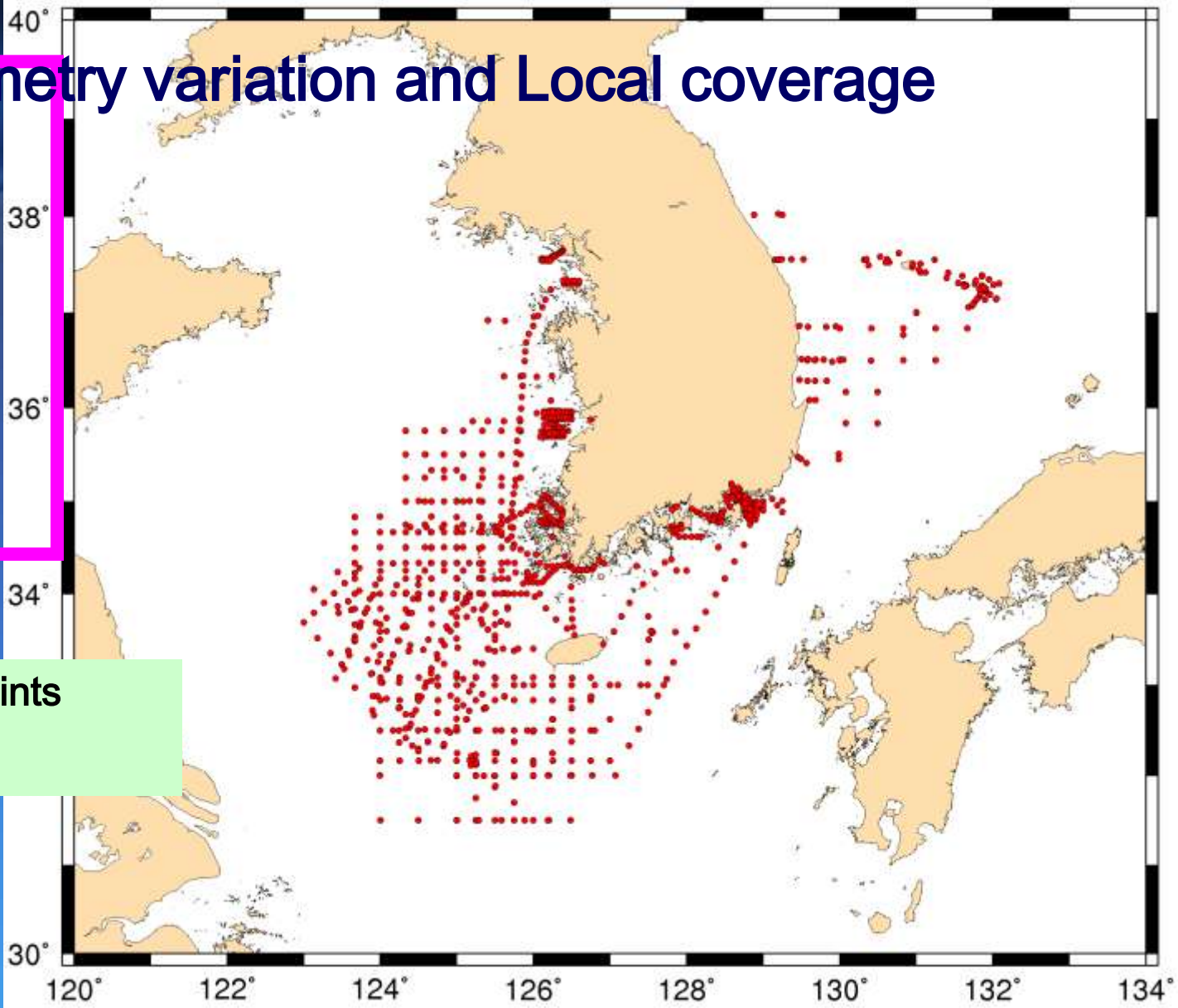


Now we have analyzed reason and are coding correction algorithm





## Issue 2: Geometry variation and Local coverage



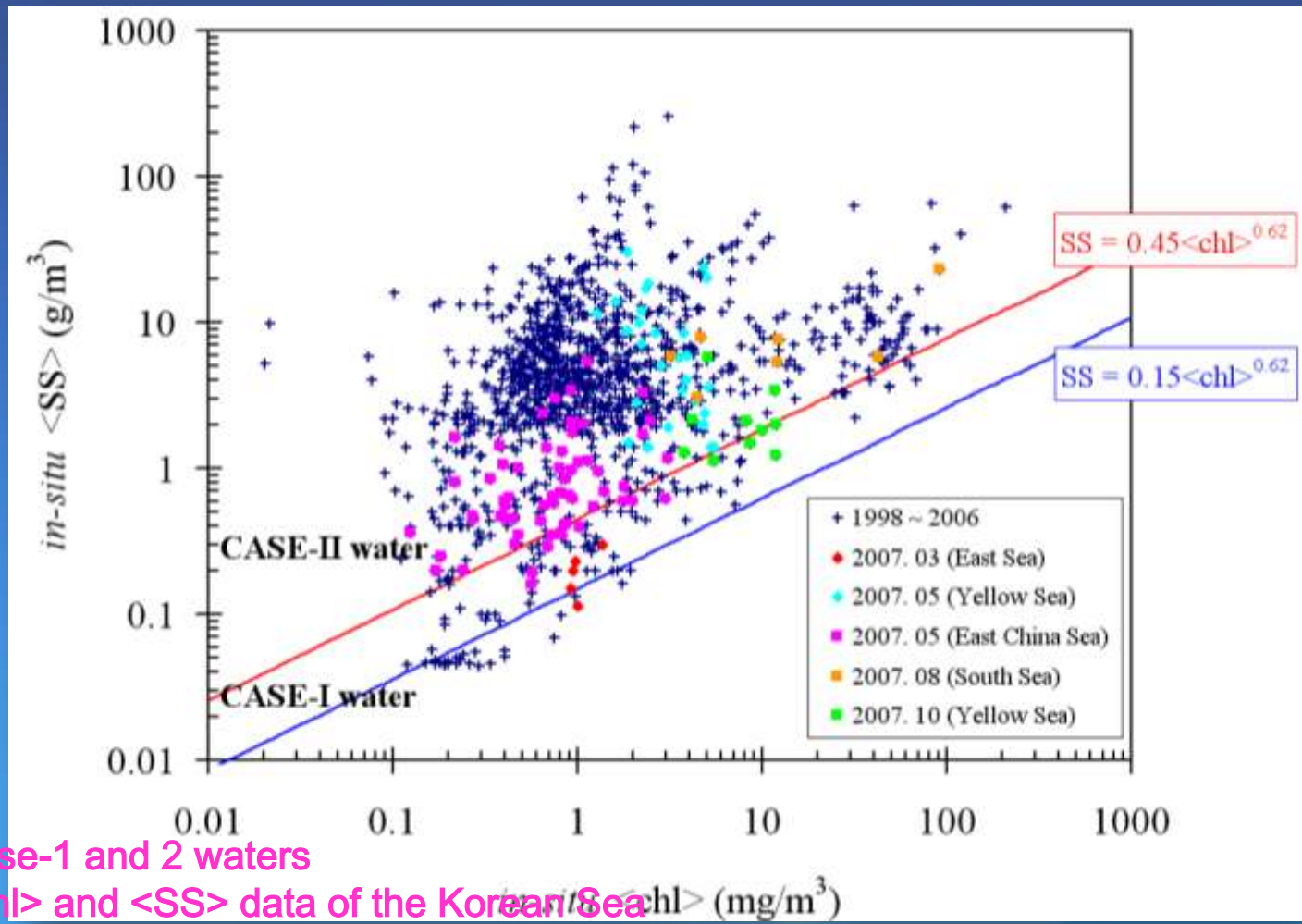
- Total points: 1348 points
- *IOP and AOP*

*In situ* measurements were performed during a lot of cruises in the Korean territorial seas and neighboring waters through the years 1998-2010 onboard the KORDI research vessel and fisher boats.



# GOCI coverage : Case-II water

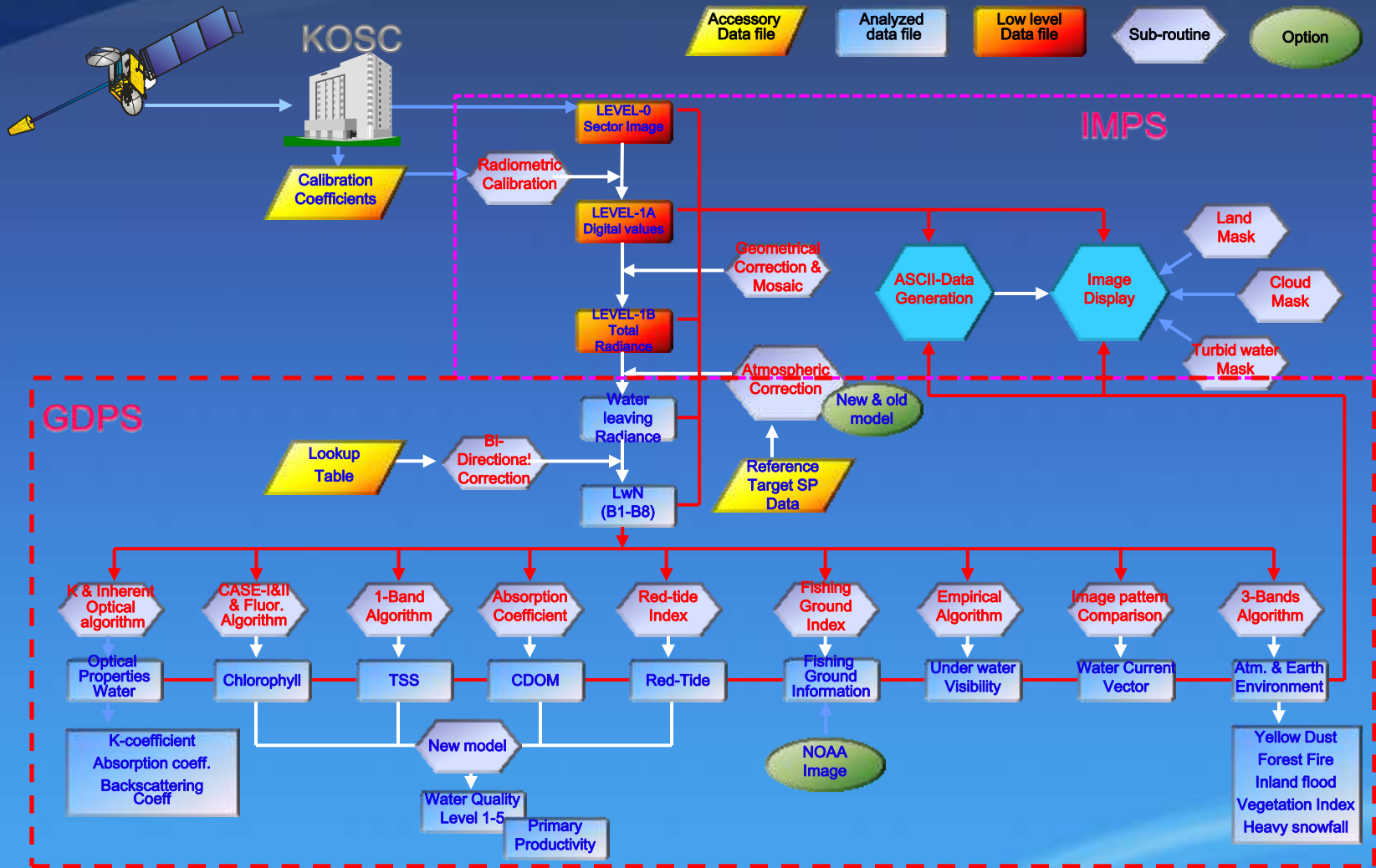
- ▶ In the GOCI swath (==CoastColour site 11),
  - The coastal area of Korea & China and the ECS(seasonal variation) is a typical Case-2 waters
  - East/Japan Sea, central YS & Pacific come under the Case-1 water



Definition of Case-1 and 2 waters

using in situ  $\langle chl \rangle$  and  $\langle SS \rangle$  data of the Korean Sea

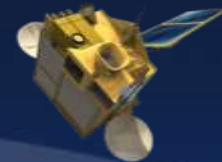
# GDPS : GOCI Data Processing System



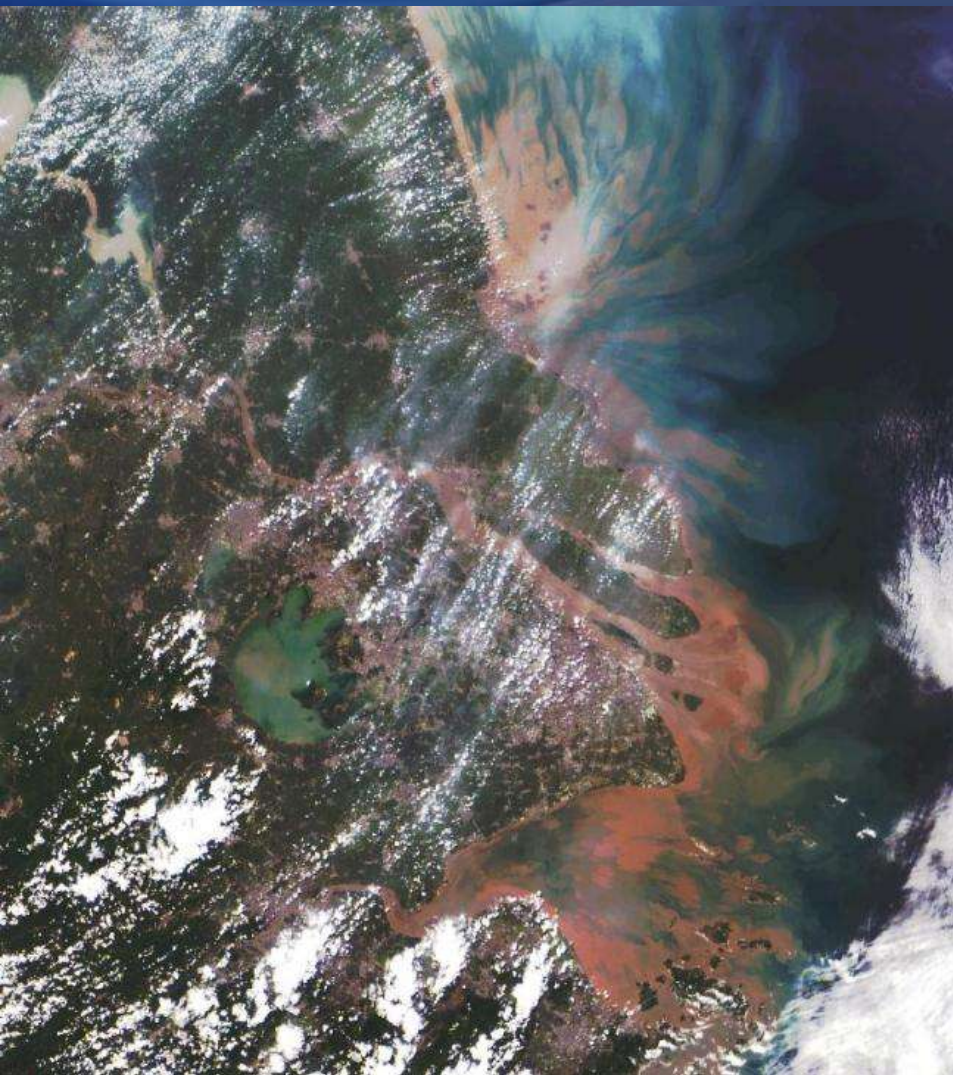




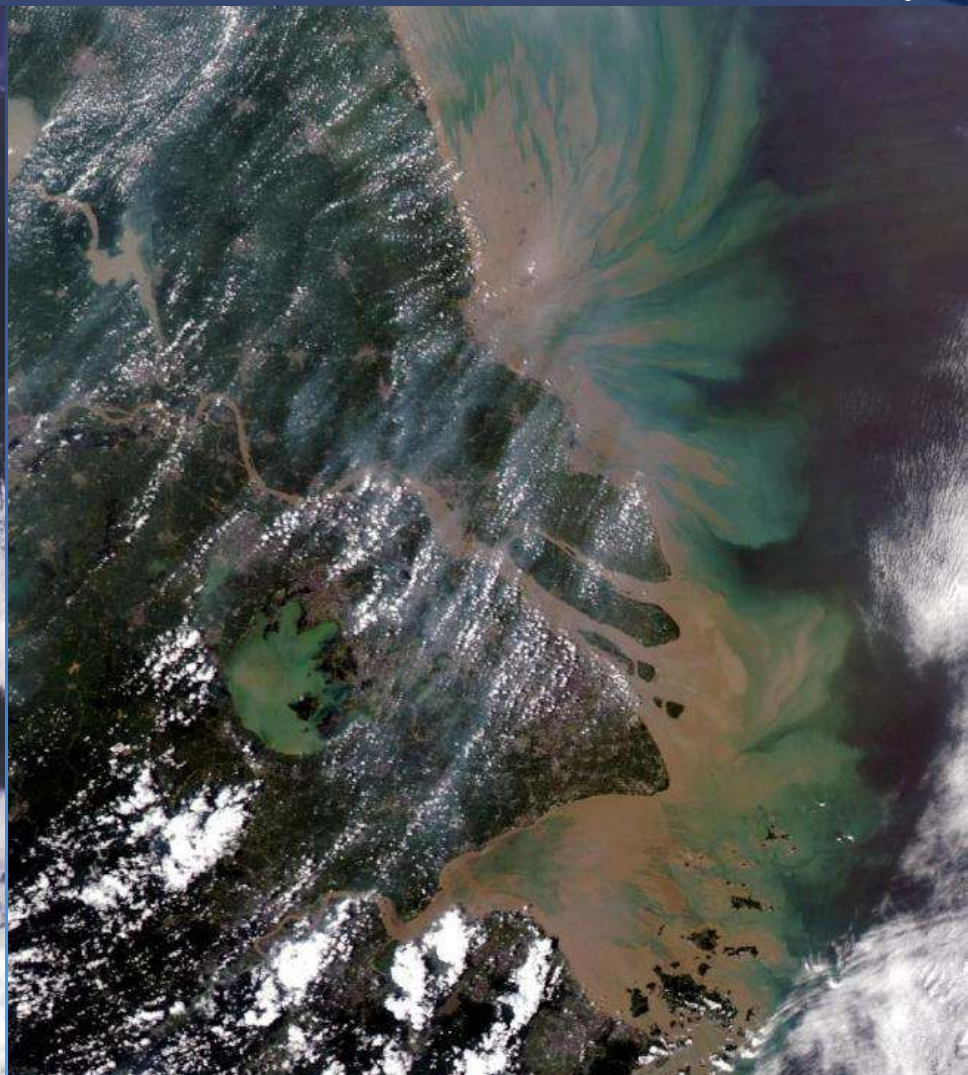
# GOCI Image quality



## ● Image Comparison between GOCI and MODIS Aqua

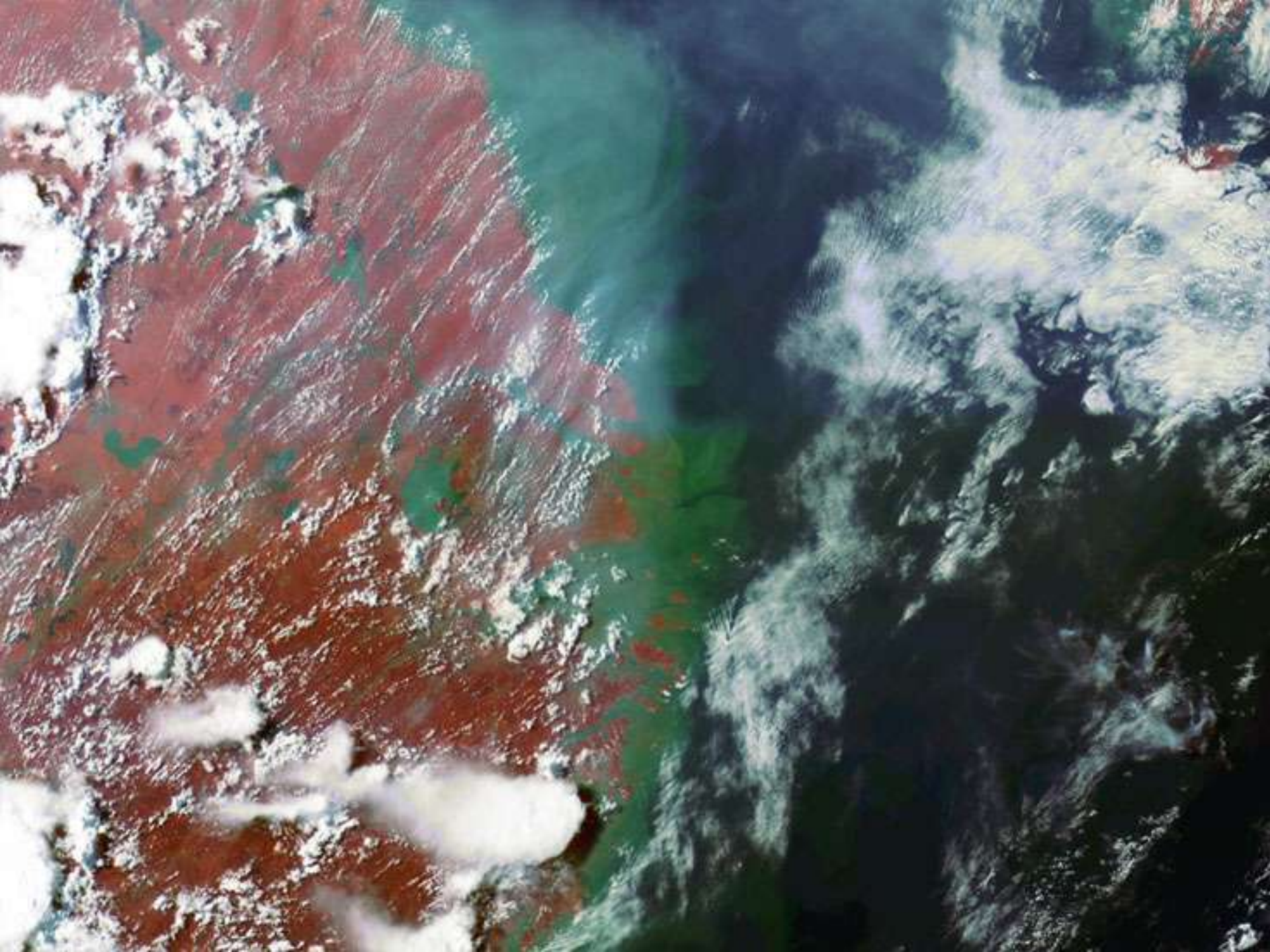


Yangtze River, China (GOCI, 20100731)  
R: 660 G: 555 B:490

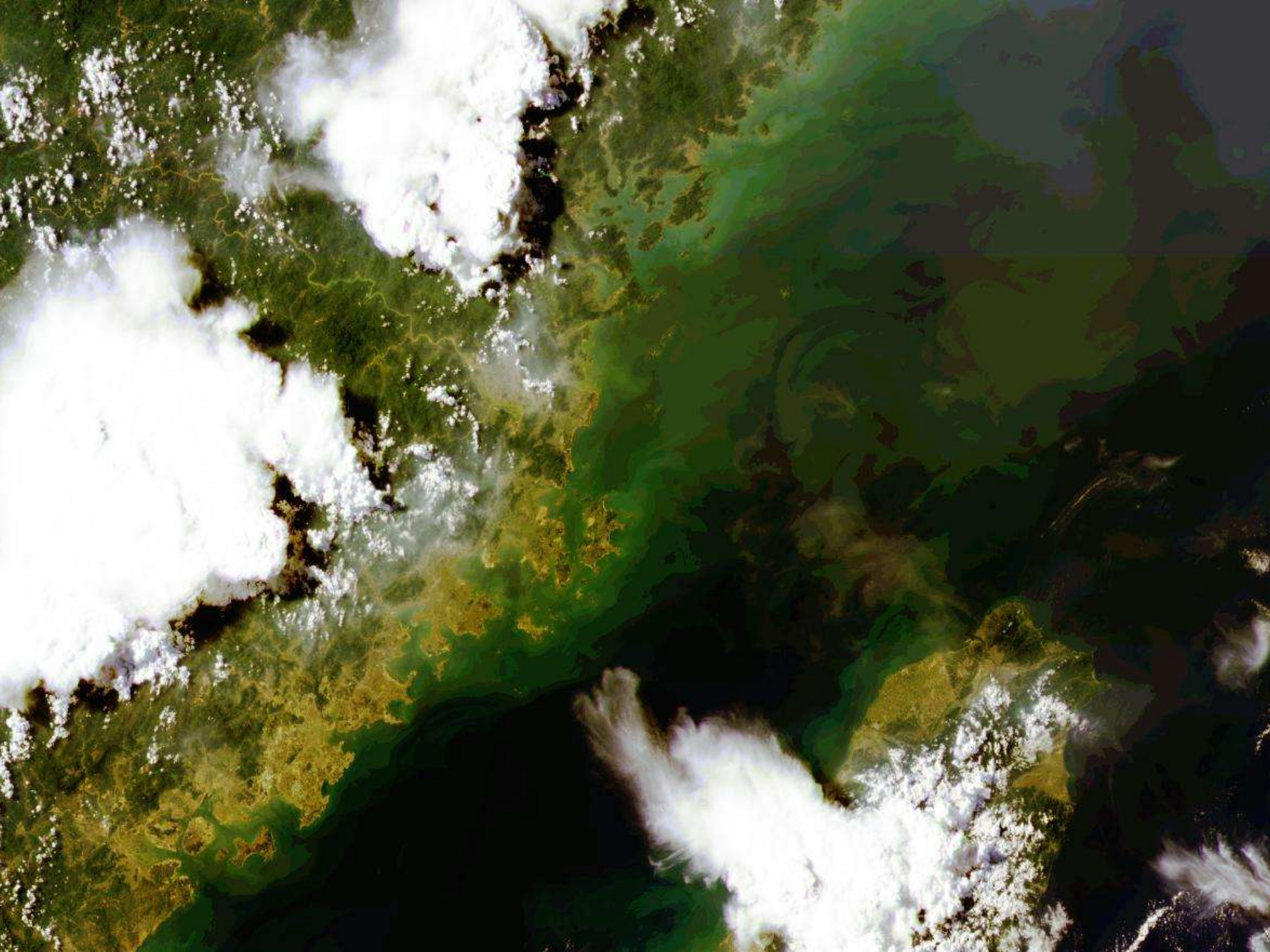


Yangtze River, China (MODIS Aqua, 20100731)  
R: 645 G: 555 B:469







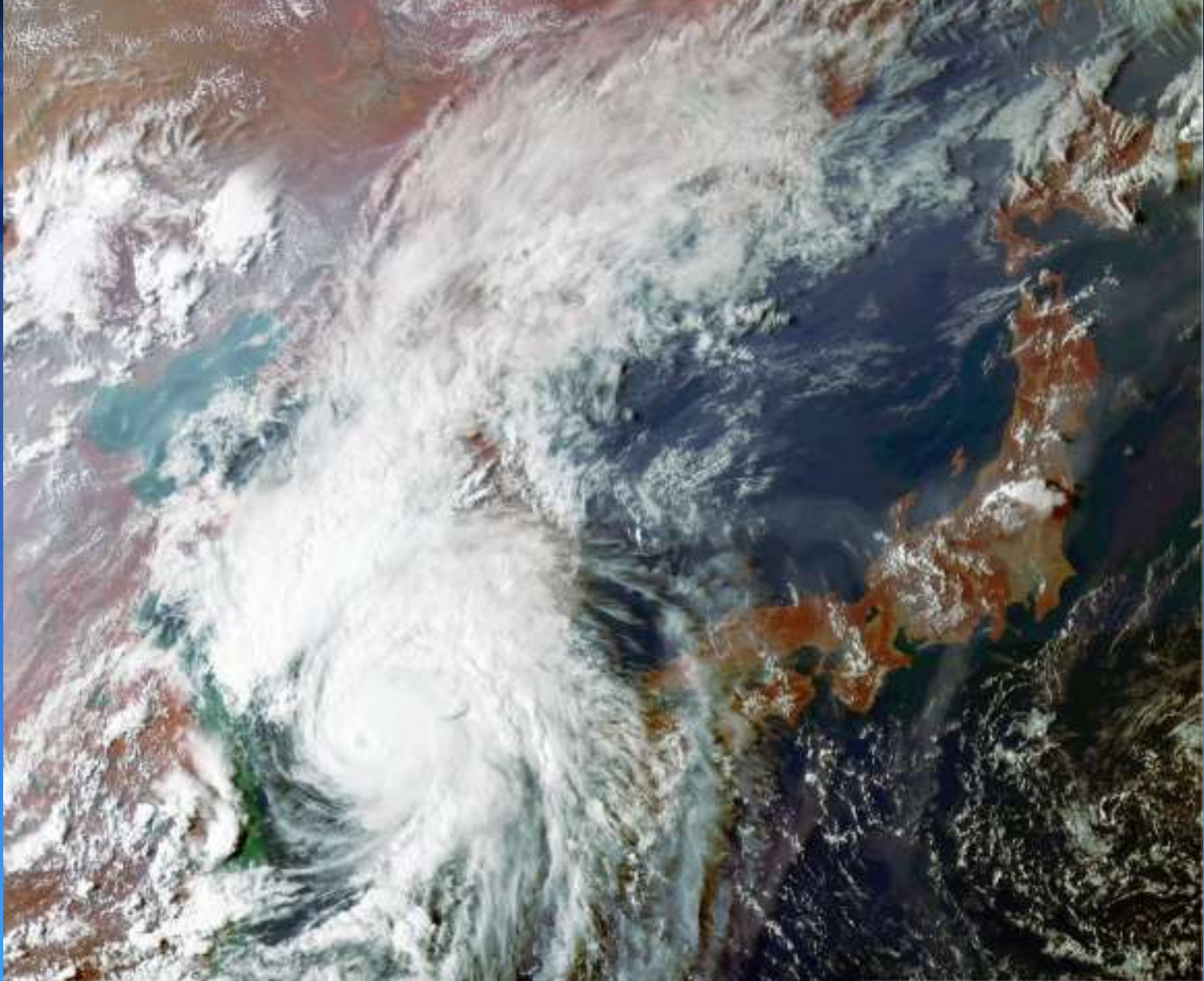






GOCI  
July 13, 2010  
Japan





07:16:41 01 Sep. 2010  
GOCI L1B Color Composite Image

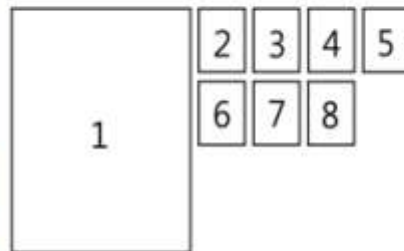
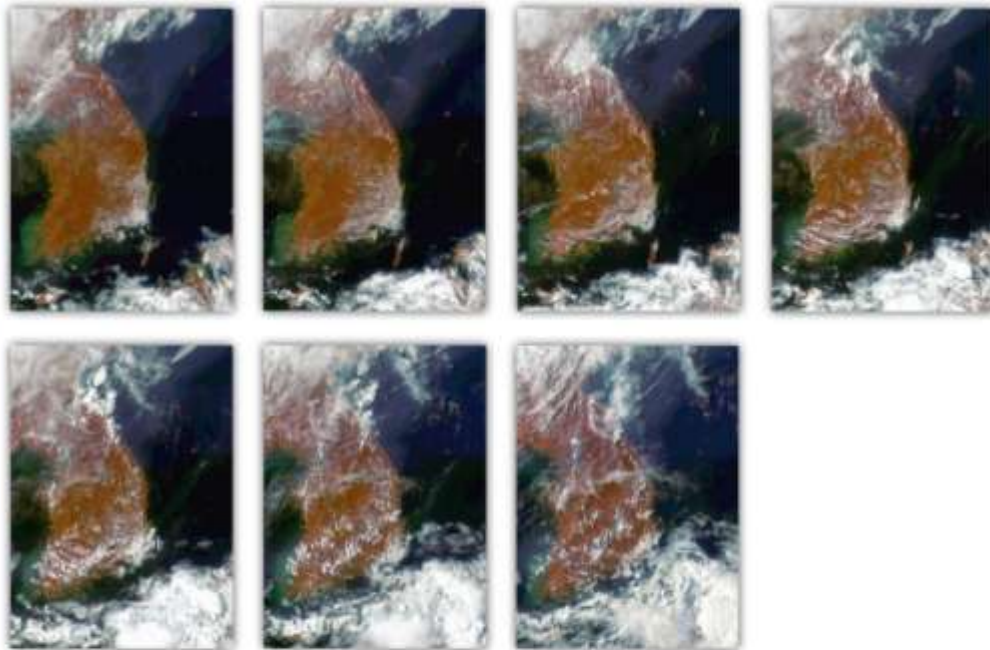
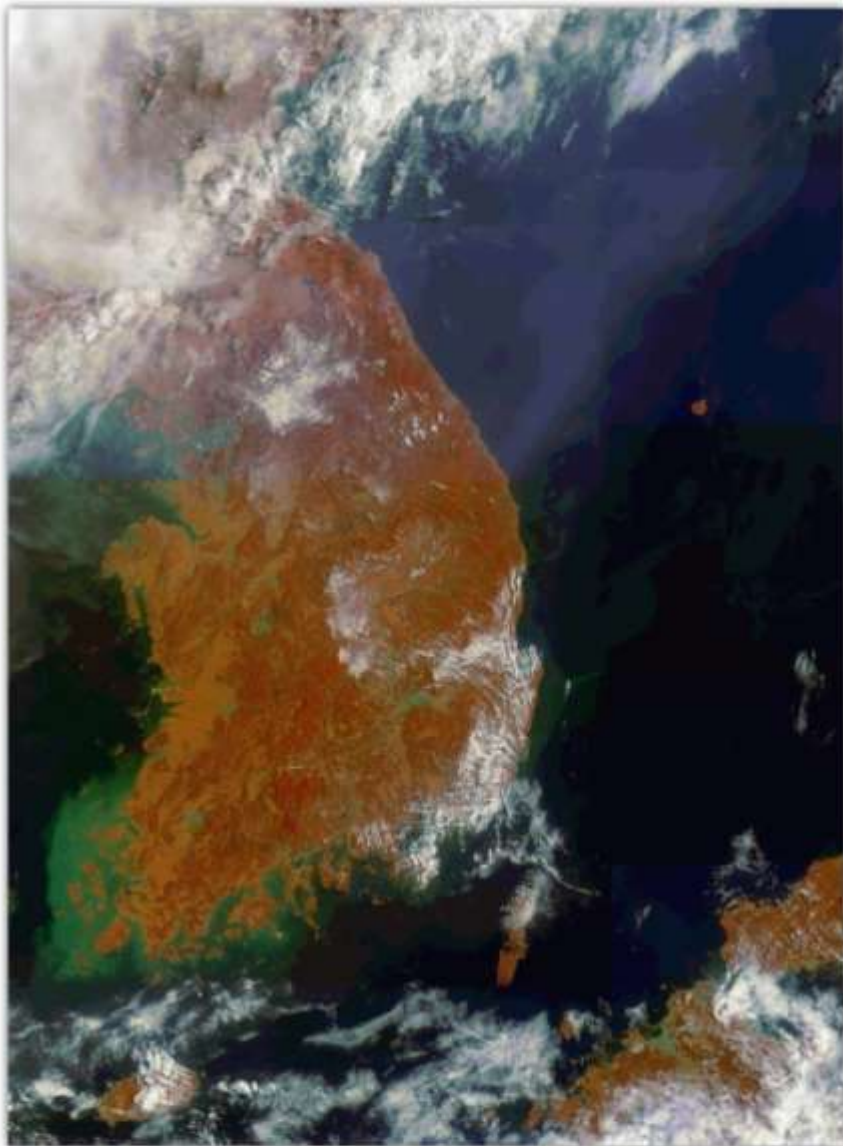
Korea Ocean Satellite Center



한국해양연구원

해양위성센터





- 1 : 2010.08.09 00:16:50(UTC) GOCL/COMS 741 RGB Composite Image
- 2 : 2010.08.09 01:16:50(UTC) GOCL/COMS 741 RGB Composite Image
- 3 : 2010.08.09 02:16:50(UTC) GOCL/COMS 741 RGB Composite Image
- 4 : 2010.08.09 03:16:50(UTC) GOCL/COMS 741 RGB Composite Image
- 5 : 2010.08.09 04:16:50(UTC) GOCL/COMS 741 RGB Composite Image
- 6 : 2010.08.09 05:16:50(UTC) GOCL/COMS 741 RGB Composite Image
- 7 : 2010.08.09 06:16:50(UTC) GOCL/COMS 741 RGB Composite Image
- 8 : 2010.08.09 07:16:50(UTC) GOCL/COMS 741 RGB Composite Image

## 대한민국

GOCL/COMS 741 RGB Composite/Mosaic Images, 2010.08.09 00:16~07:16(UTC)

태풍 멘무가 북상하기 전인 지난 9일 대한민국이 수줍게 모습을 드러내었다.  
한시간 주기마다 변하는 한반도와 주변해역의 모습이 흥미롭다.

To get more clear data

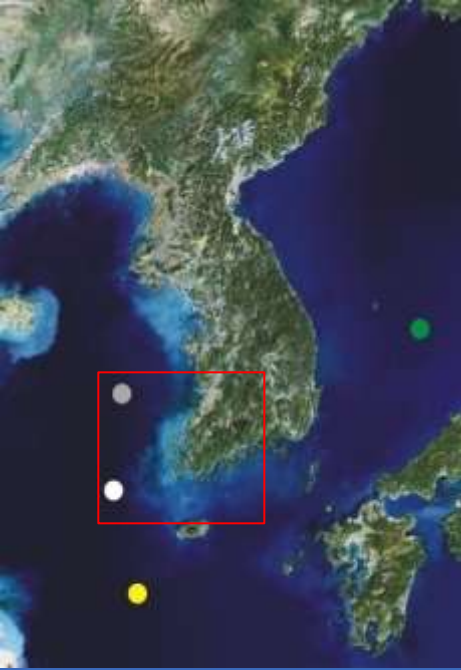


해양위성센터

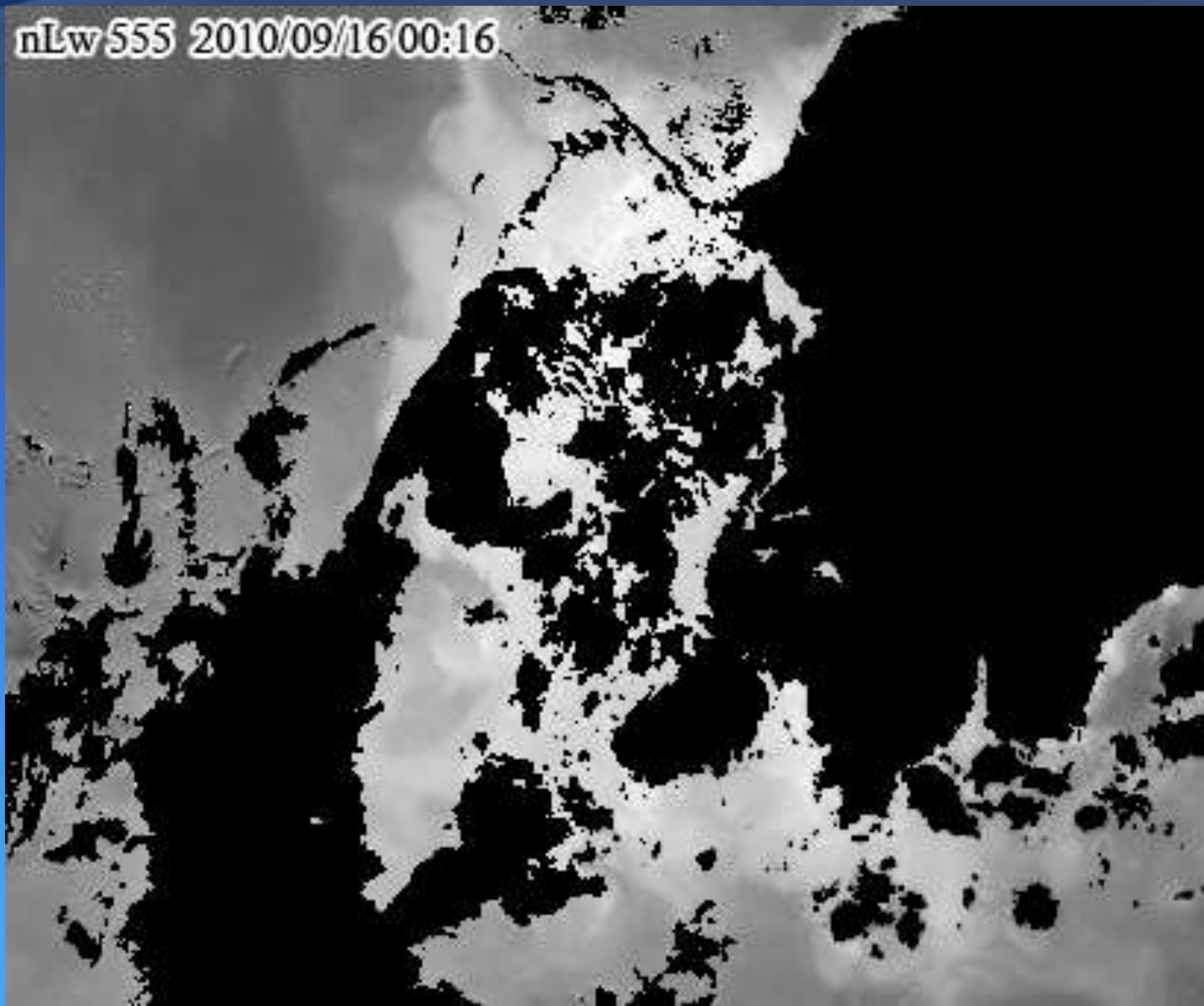


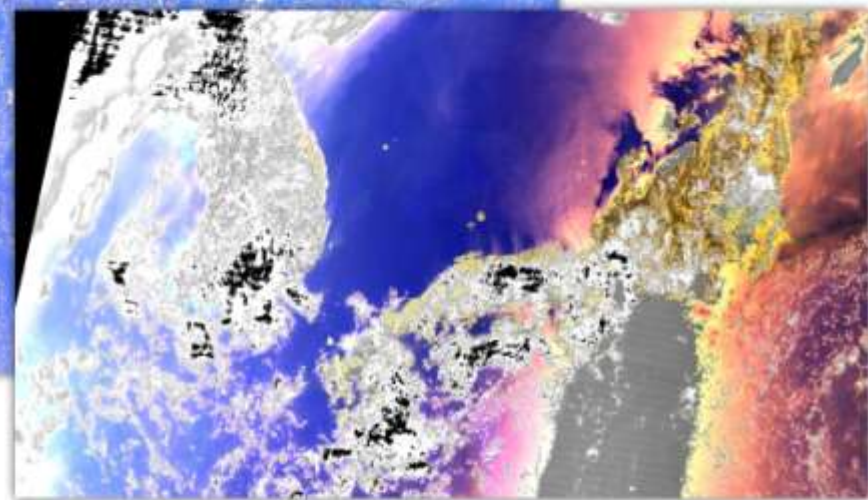
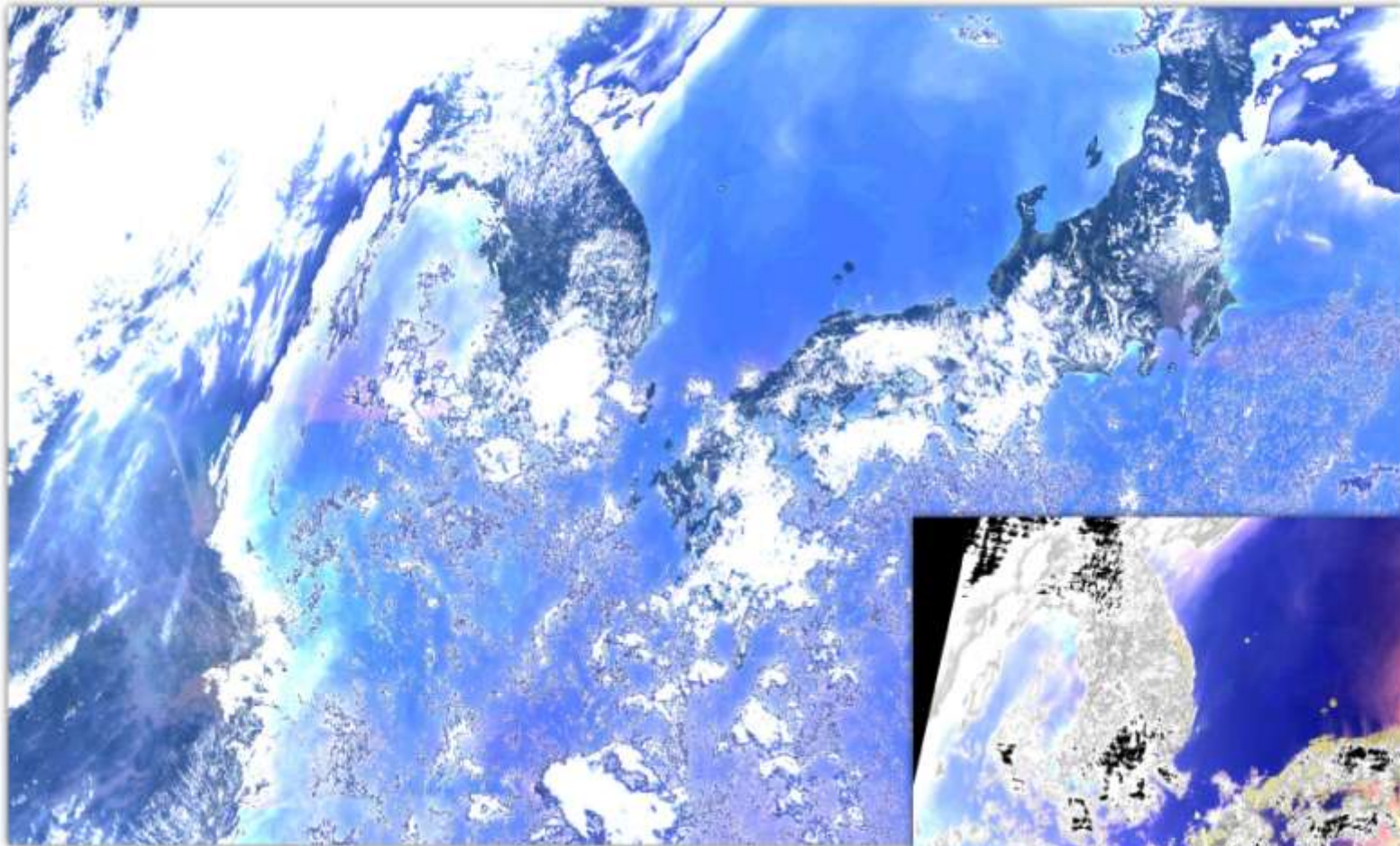
국토해양부





nLw 555 2010/09/16 00:16



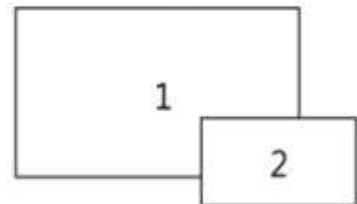


## 한반도와 동해

GOCI/COMS 641 RGB Composite/Cloud, Land Masking Image, 2010.08.05 01:16:59(UTC)

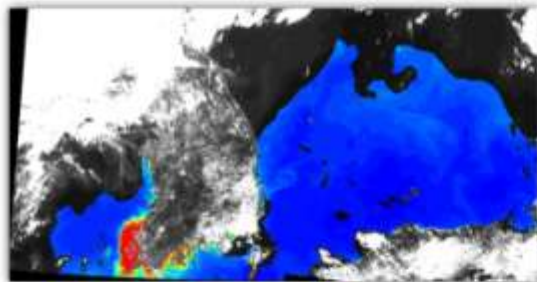
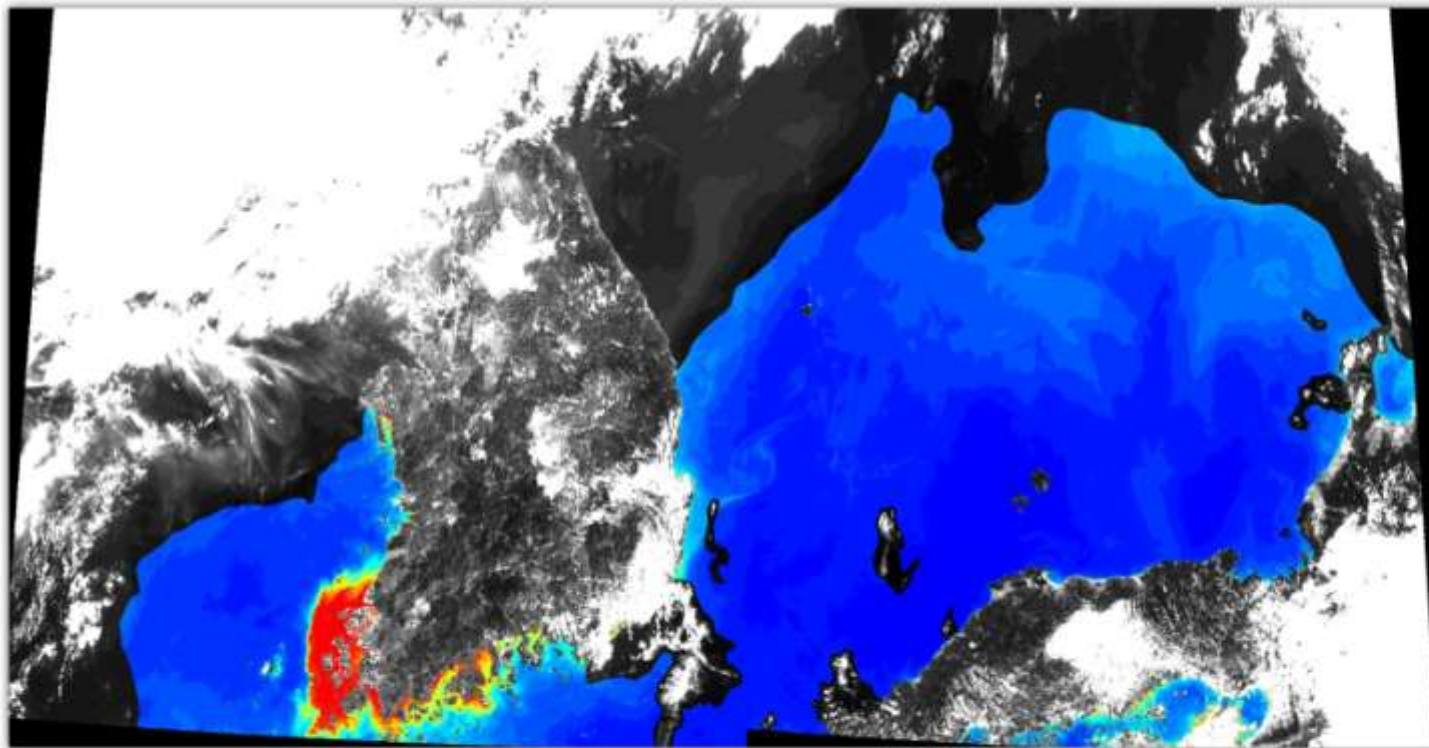
Sunglint의 영향으로 해양부분이 정상적으로 관측되지 않는 MODIS영상에 비해 선명하게 한반도 주변 해역이 관측된다는 것을 확인할 수 있다.

※sunglint(태양 반사) : 바다표면의 태양반사각과 위성이 바다를 보는 각이 동일 할때 생기는 현상으로 바다의 표면이 은색 거울과 같이 보이며 극궤도 위성에서 자주 볼 수 있다. 이로 인해 해석의 관찰하는데 있어 어려움을 야기시킨다.



1 : 2010.08.05 01:16:59(UST) GOCI/COMS 641 RGB Composite/Cloud, Land Masking Image  
2 : 2010.08.05 01:50:00(UST) Terra/MODIS 14,12,8 RGB Composite/Cloud, Land Masking Image



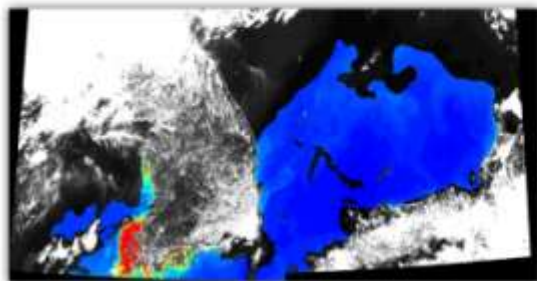


1

2

3

- 1 : 2010.08.09 00:17:00(UST) GOCI/COMS 4 band L1A Processing Image
- 2 : 2010.08.09 01:17:00(UST) GOCI/COMS 4 band L1A Processing Image
- 3 : 2010.08.09 02:17:00(UST) GOCI/COMS 4 band L1A Processing Image



### 한반도 주변해역의 탁수 분포

GOCI/COMS 4 band L1A Processing Image, 2010.08.09 00:17~02:17(UTC)

한반도 주변해역의 탁수 분포영상으로 남서해안 일대에서 높은 농도의 탁수가 분포하고 있다는 것과 포항 주변 해역에서 탁수띠가 동해안으로 흘러들어가는 것을 볼 수 있다.



# Cal/Val activity

## ◆ *in situ* measurements

- ❖ Research vessel, Ferrybox(with KORDI), Glider(with KORDI)
- ❖ Buoy, Ocean research station :
  - To use Korea Operational Oceanography Network(with KORDI)
  - To cooperate neighboring countries (with Japan, China, Taiwan)
  - To join International Group (with IOCCG, OCR-VS, Aeronet-OC)

## ◆ Inter-satellite Cal.

- ❖ Existing OC : MODIS, MERIS
- ❖ HICO (with D. Curtiss)

## ◆ New system

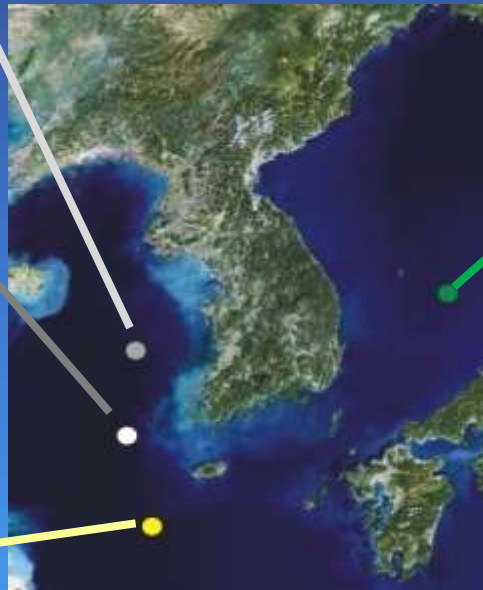
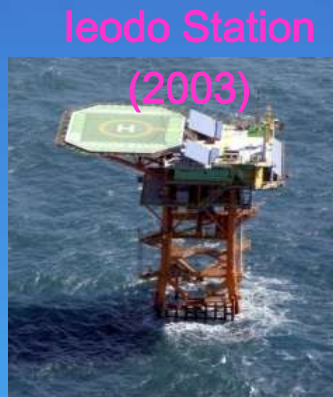
- ❖ Kite, aerostat, airborne (with KARI)
- ❖ Argo-type buoy

## ◆ Uniform land Cal/Val site

- ❖ Desert, Ice, Playa



# Korea Operational Oceanography Network



Two buoys and two ocean stations have already been constructed by KOON project



# Comparison of GOCI and MERIS



**GOCI**(2010 09 24 01: 16:43)  
(R(680), G(555), B(412))

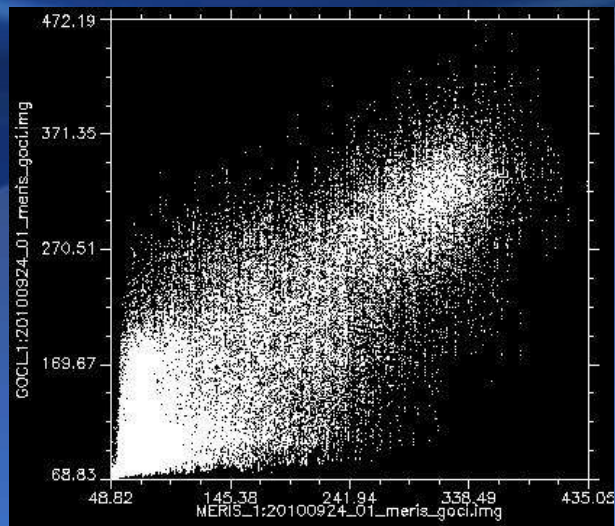


MERIS(2010 09 24 01: 43:51)  
(R(681.55), G(560), B(412.5))

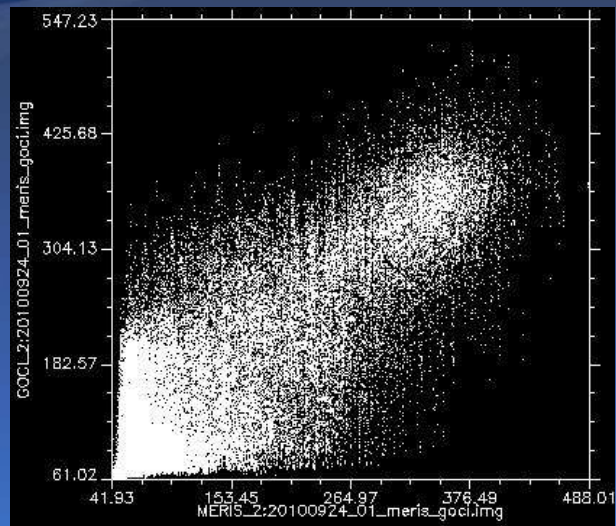
\*GOCI image is geo-corrected by MERIS Geometric information



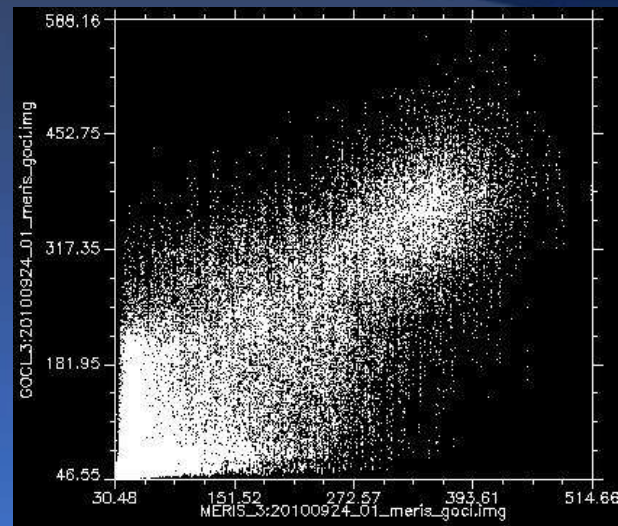
# Comparison of GOCI and MERIS (Scatter Plot)



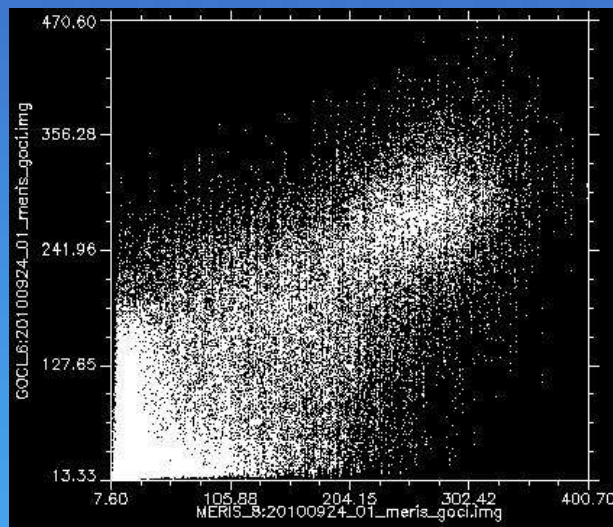
GOCI:412nm, MERIS:412.5nm



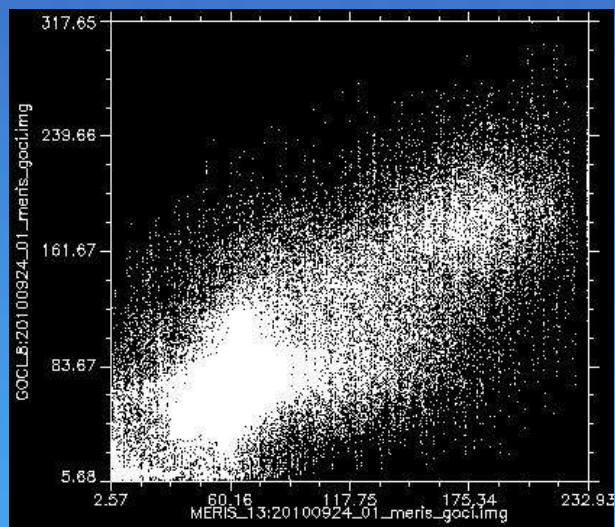
GOCI:,443nm , MERIS:442.5nm



GOCI:490nm, MERIS:490nm



GOCI:680nm, MERIS:681.5nm



GOCI:865nm, MERIS:865nm

# Cross Calibration with LEO Ocean Color Sensors

## Comparison of Spectral Channels

SeaWiFS	MODIS	GOCI	HICO	MERIS	Application
	411nm	412 nm	Hyperspectral	412.5 nm	CDOM
443 nm	442 nm	443 nm	380 -1000 nm	442.5 nm	chlorophyll
	487 nm	490 nm	at 5.2 nm	490 nm	Chl and other pigments
520 nm	530 nm		Can match	510 nm	turbidity
550 nm	547 nm	555 nm	Any GOCI	560 nm	Chl, suspended sediments
			channel	620 nm	Suspended sediments
670 nm	665 nm	660 nm		665 nm	Chl absorption
	677 nm	680 nm		681.25 nm	Chl fluorescence
				705 nm	Blooms, Red edge
750	746 nm	745 nm		753.75 nm	O <sub>2</sub> abs. ref., ocean aerosols
Beyond				760 nm	O <sub>2</sub> abs.
Planned				775 nm	Aerosols, vegetation
Lifetime.	866 nm	865 nm		865 nm	Aerosols over the ocean
Little data				890 nm	Water vapor reference
In 2008				900 nm	Water vapor absorption



# Conclusion and Remarks

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- Fully successful launch campaign of GOCI/COMS
- All functional tests for GOCI was successful.
- GOCI IOT is on-going.
- After GOCI IOT, KOSC will distribute GOCI data and GDPS SW.
- What can GOCI do for CoastColour ? : GOCI data, local algorithm, and Cal/Val activity
- I hope to extend CoastColour(Case-II water) project for GOCI.

# Planned GOCI Data Distribution at KOSC



- Developed GOCI Public Website at KOSC using published and approved for distribution data, publications and presentations.
- KOSC GOCI Web site would be portal for data requests and distribution
  - Data requests require proposal and data agreement signed by the requestor and their institution and approved by MLTM.
- <http://kosc.kordi.re.kr>

Thank you