Recent Remote Sensing Activities in the Republic of Korea

Presented to: UN Commission on Peaceful Uses of Outer Space Scientific and Technical Subcommittee

February 2012 Presented by: Chin Young Hwang

Korea Aerospace Research Institute

Introduction of KARI

Korea Aerospace Research Institute (KARI)

- Established in 1989

- aims to contribute to the development of the national economy and improvement of the quality of life in Korea

  through research, technology leadership, development & distribution on the aerospace science & technology field

- KARI with its 700 engineers/scientists plays a central role in the aeronautics and space development of Korea

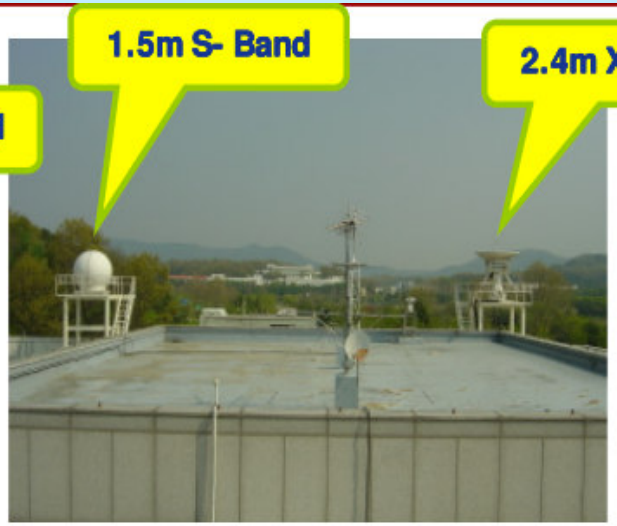
- In 2011, KARI spent about $270million in the aerospace R&D sector and the investment is still increasing

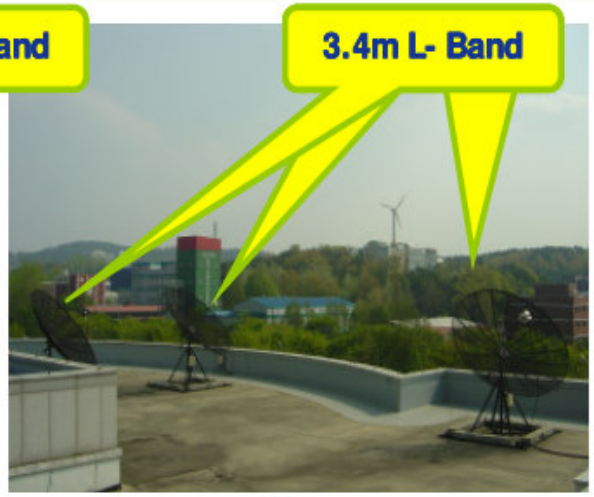
Space Development Plan of Korea

KARI Ground Station

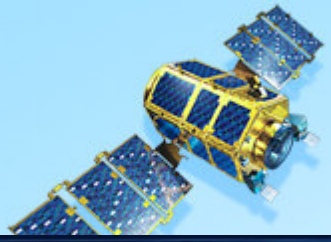
- Located at Daejeon, Korea
- Control KOMPSAT series & COMS
- Receiving, Processing, and Distribution of KOMPSAT data

Antennas at KARI Site





KARI Global Network of Ground Station



SVALBARD

KARI

Sejong

Svalbard Satellite Station (SvalSat)

- KSAT
  (Kongsberg Satellite Services)
- TT&C, Image Receiving
- Location : 78.2N, 15.8E

Remote Sensing Satellite Development

❖ **KOMPSAT Series (Korea Multi-Purpose SATellite)**

KOMPSAT-1

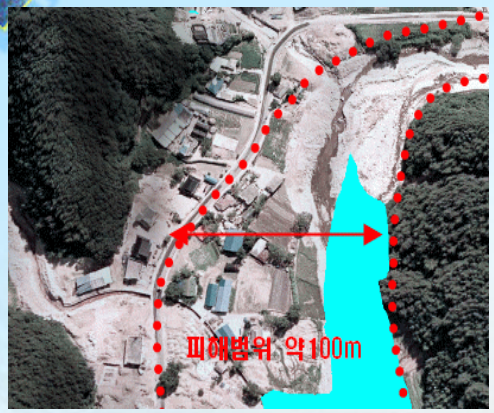
- Electro-Optical Camera
- Resolution (pan. : 6.6m)
- Launch : Dec. 1999
- Mission Terminated in 2009

KOMPSAT-2

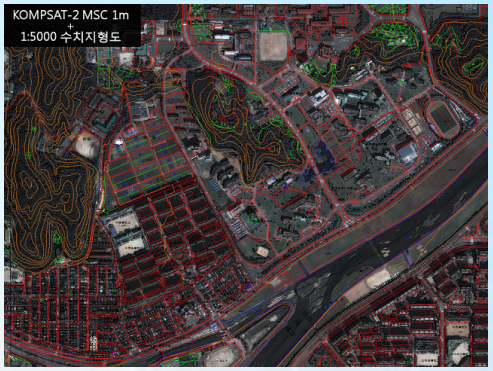
- Multi-Spectral Camera
- Resolution (pan./color : 1/4m)
- Launch : Jul. 2006

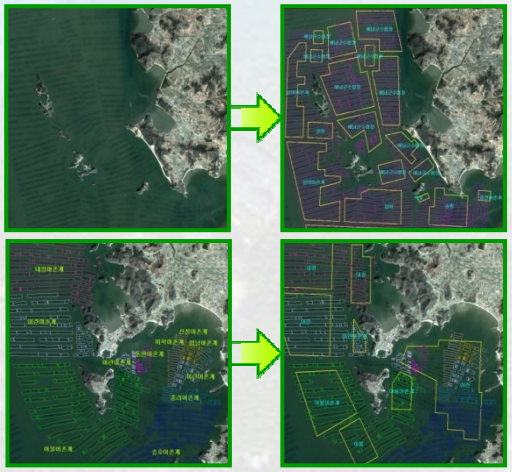
Applications of KOMPSAT-2

Flood Monitoring



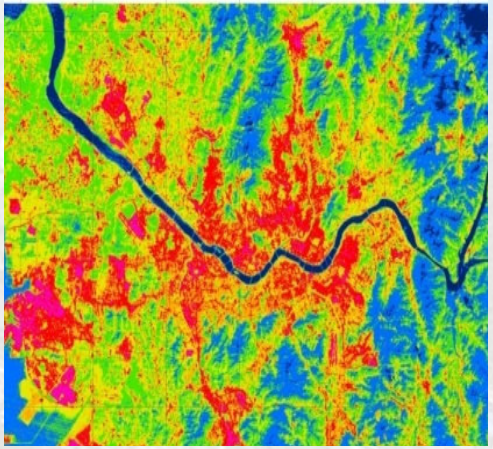
Land Management



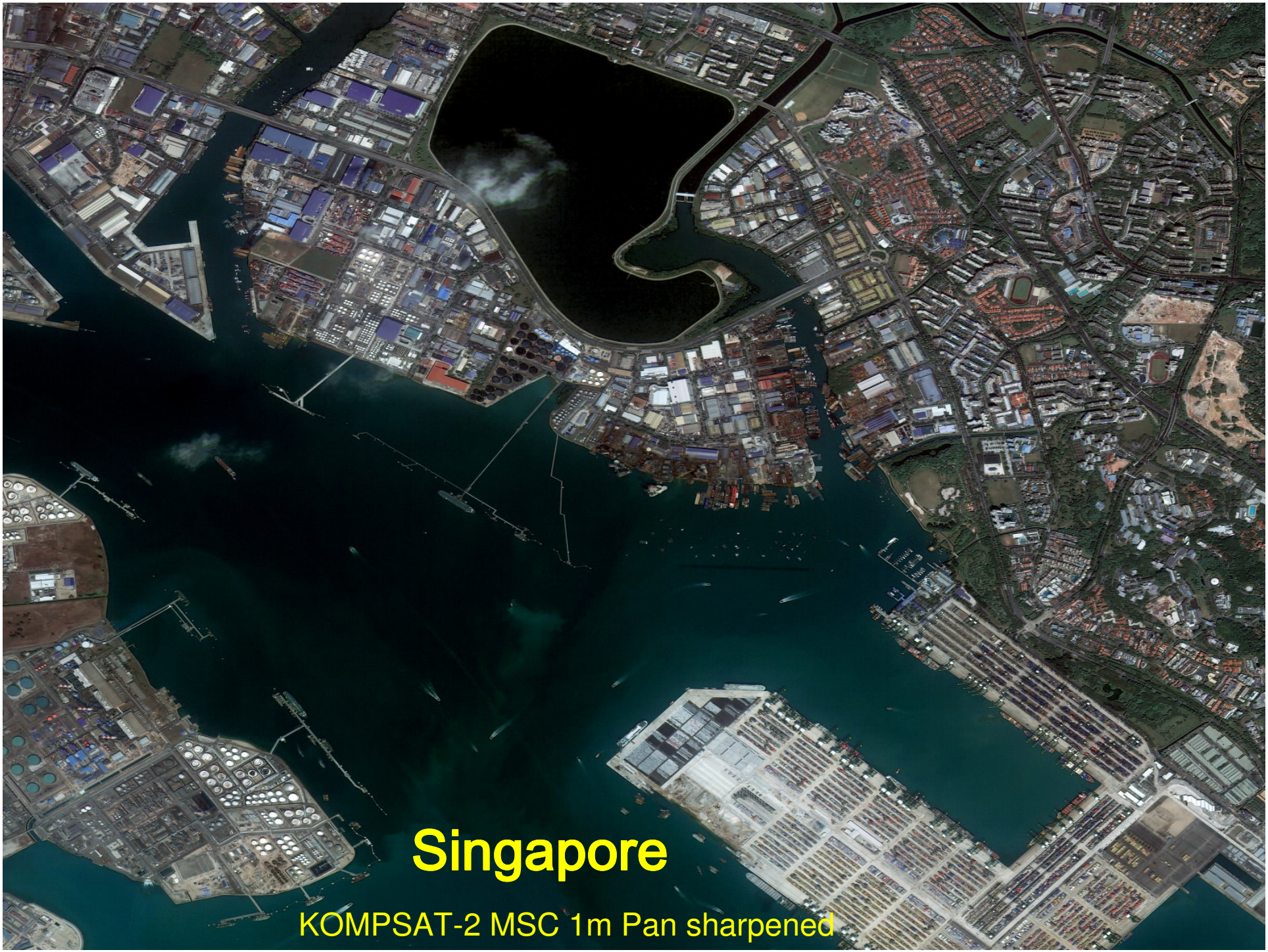


Ocean Resource

Agriculture/Forestry



Environment


Singapore
KOMPSAT-2 MSC 1m Pan sharpened


Astana, Kazakhstan
KOMPSAT-2 MSC 1m Pan sharpened


Gold Coast, Australia
KOMPSAT-2 MSC 1m Pan sharpened

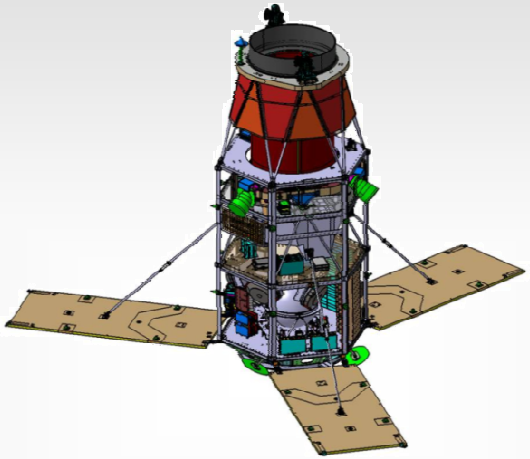
Remote Sensing Satellite Development

❖ **KOMPSAT Series : Under Development**

KOMPSAT-3

- Multi-Spectral Camera
- Resolution
  (pan./color : 0.7/2.8m)
- Launch : 2012

KOMPSAT-3A



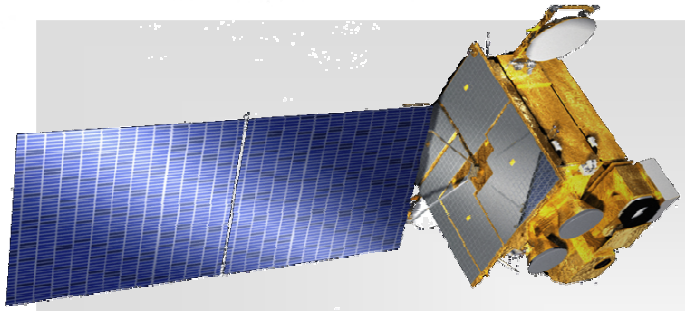
- Multi-Spectral + IR Camera
- Resolution
  (pan./color/IR : 0.55/2.2/5.5m)
- Launch : 2013

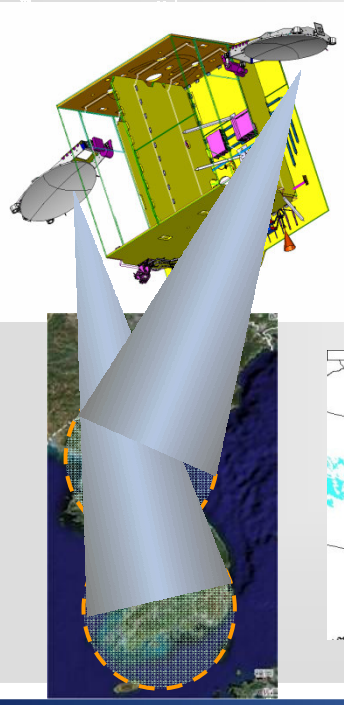
KOMPSAT-5

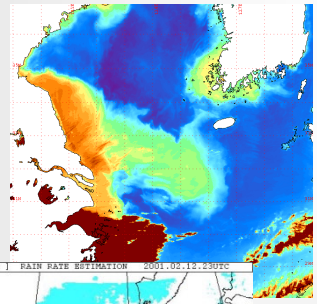
- SAR (Synthetic Aperture Radar)
- Resolution : 1/3/20m
- Launch : 2012

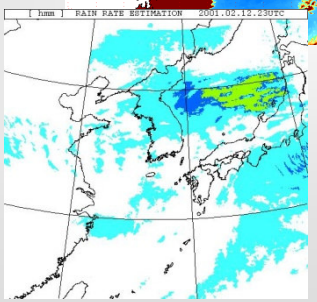
Remote Sensing Satellite Development

❖ COMS Program (Communication, Ocean and Meteorological Satellite)



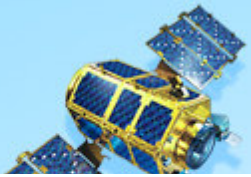






- **Development Outline**
  - Period : Sept. ’03 ~ Dec. ’10
  - Launch : June, 2010
- **Mission**
  - Meteorological & Ocean Monitoring
  - Development of next generation communication payload technology
- **Payload**
  - MI / GOCI / Ka-band Antenna
  - Resolution : 1km(Meteorology), 0.5km(Ocean)
- **Lifetime : 7 years**
- **Altitude : 36,000Km**
- **Weight : 2,500kg, Power : 2.7KW**
- **Launch Vehicle : Ariane-5**

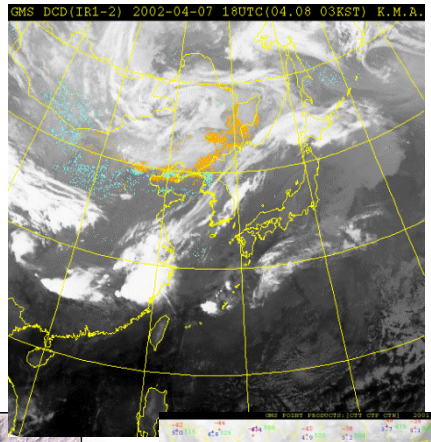
Launch of COMS @ Kourou

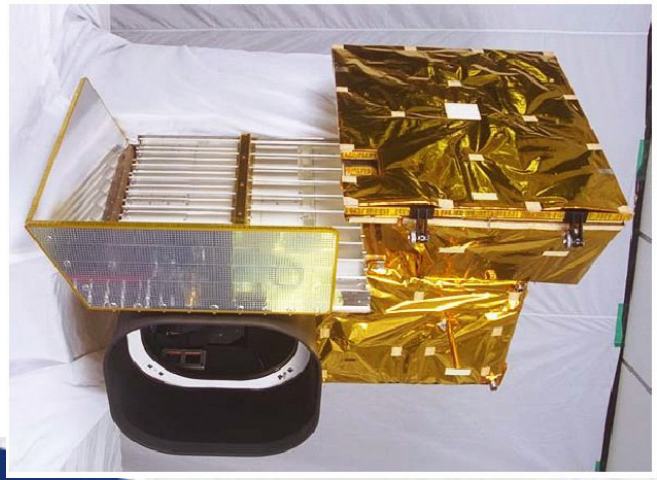


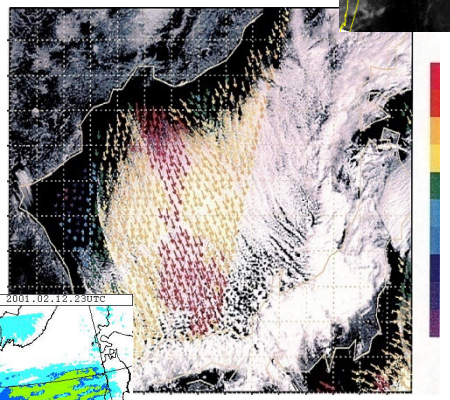
Mission Objectives of COMS(1/2)

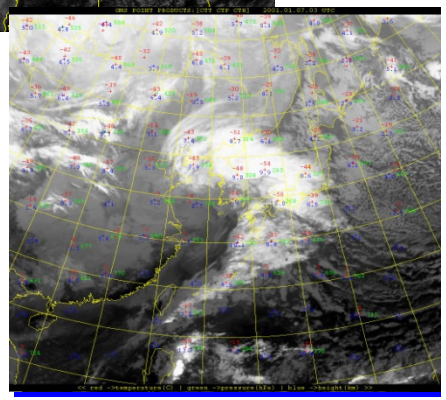
- **Weather Monitoring Mission**

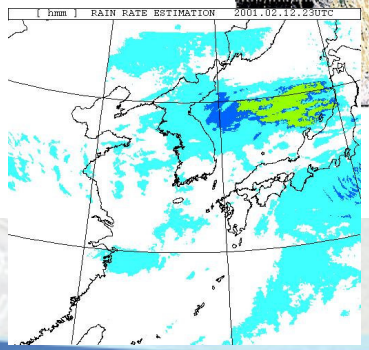
  - **Continuous monitoring of imagery and extracting of meteorological products with high-resolution and multi-spectral imager**
  - **Early detection of special weather such as storm, flood, yellow sand**
  - **Monitoring of long-term change of sea surface temperature and cloud**







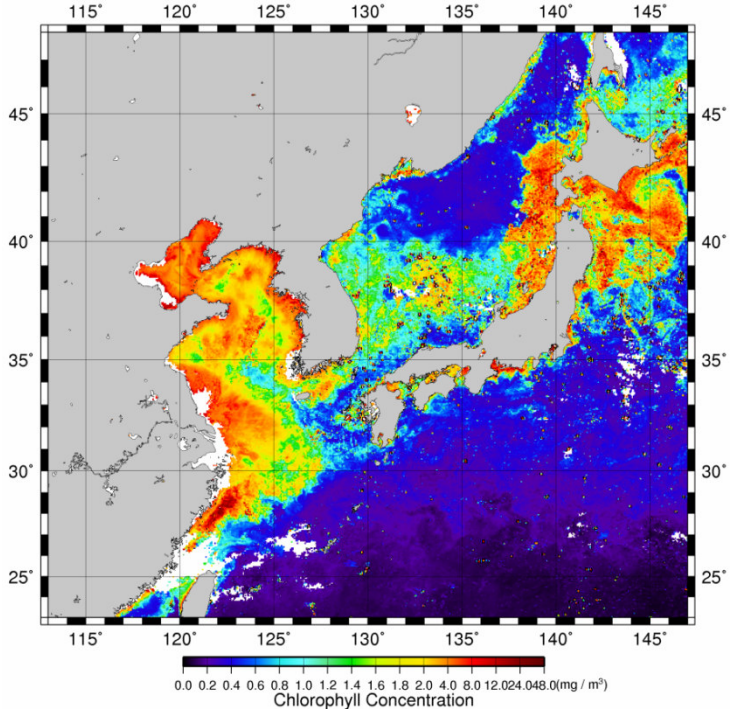


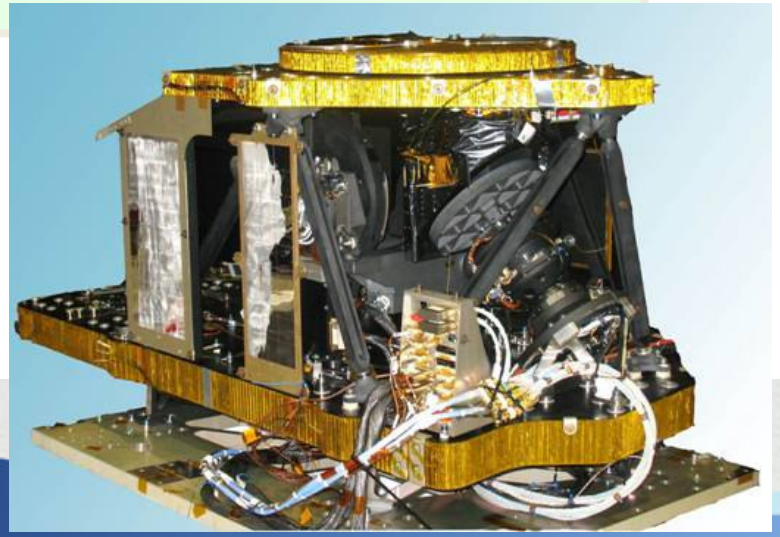


Mission Objectives of COMS(2/2)

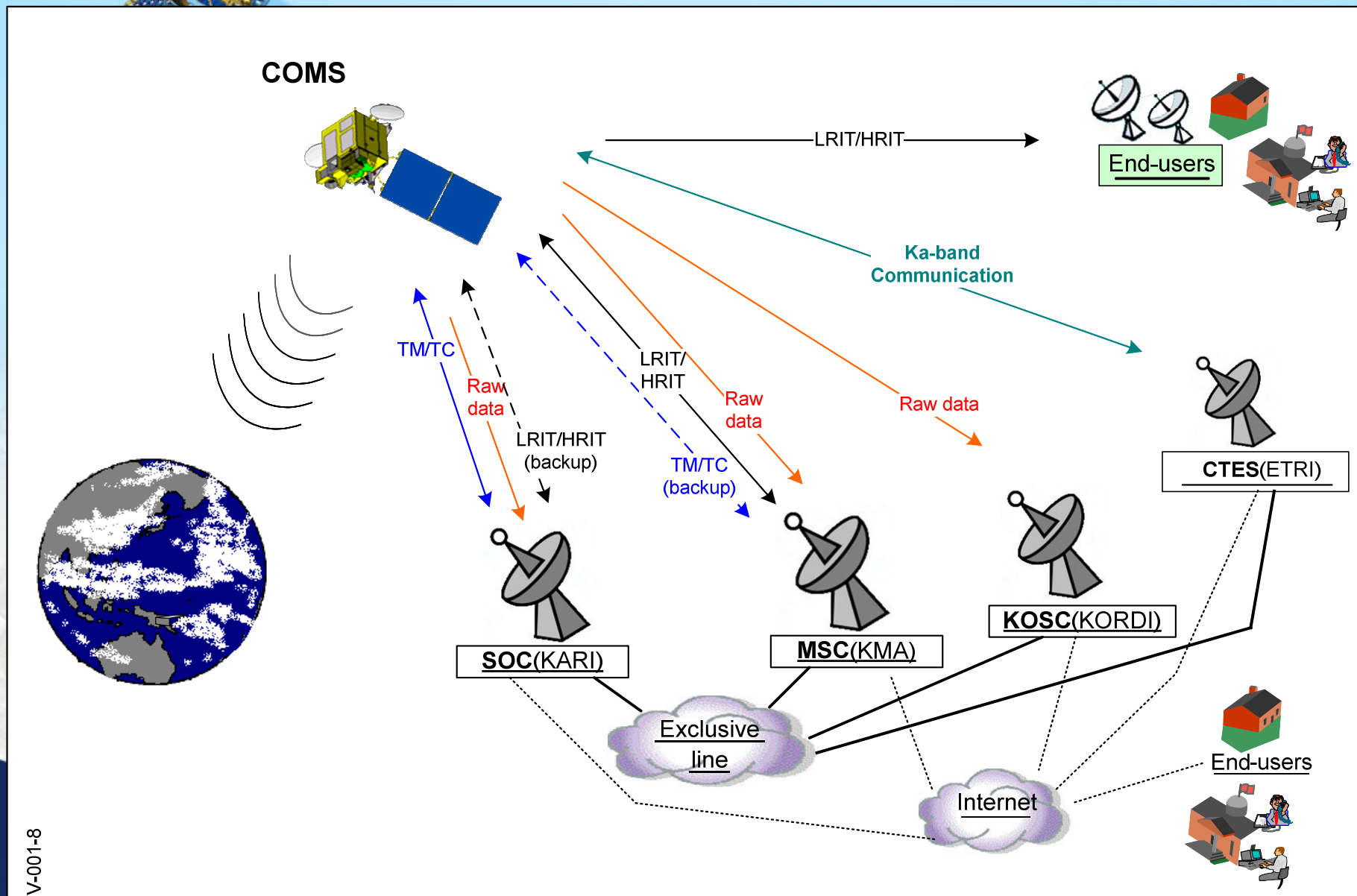
- **Ocean Monitoring Mission – First Geostationary Ocean Color Imager**

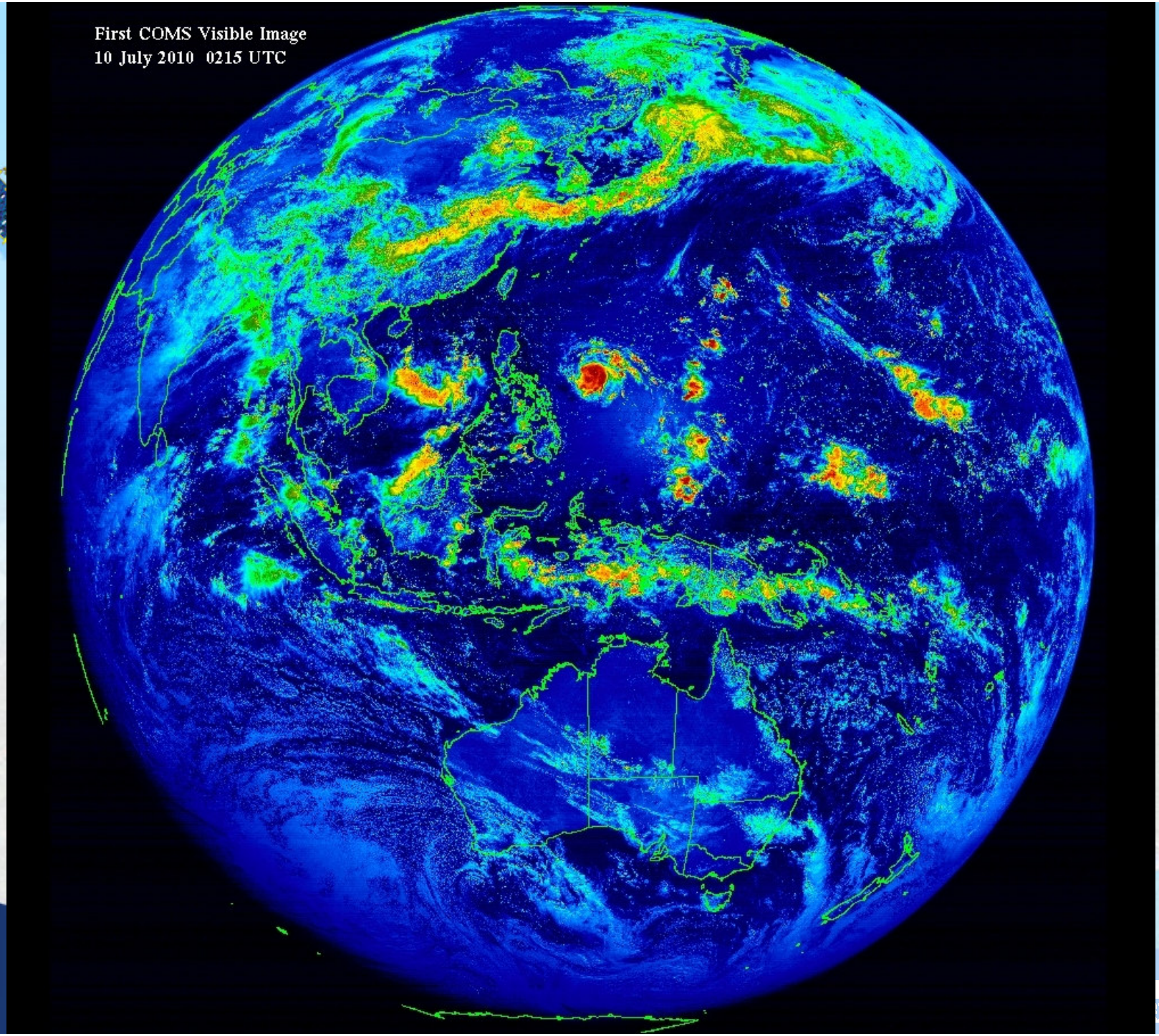
  - Monitoring of marine environments around the Korean peninsula
  - Production of fishery information (Chlorophyll, etc.)
  - Monitoring of long-term/short-term change of marine ecosystem



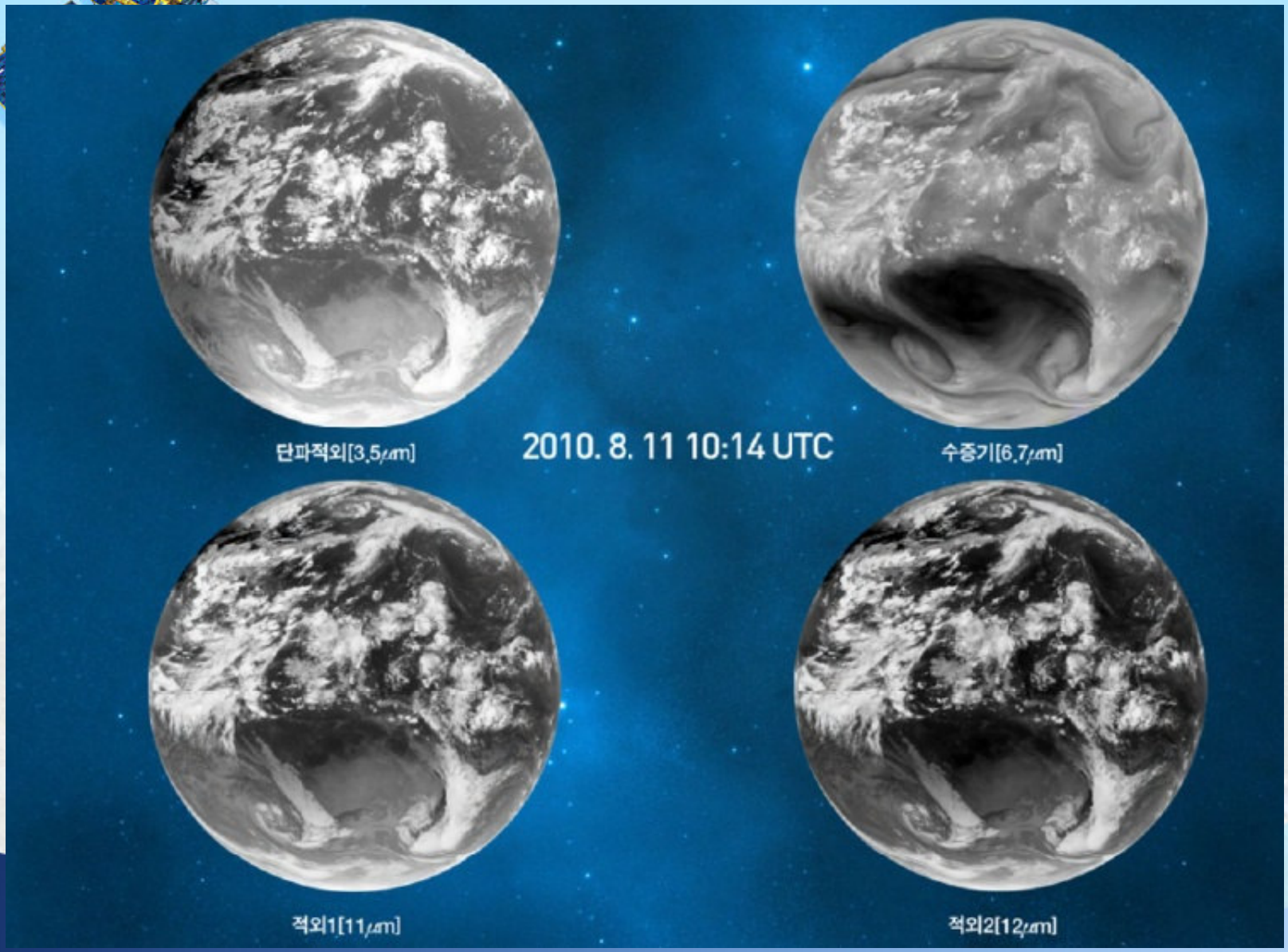


COMS System Architecture



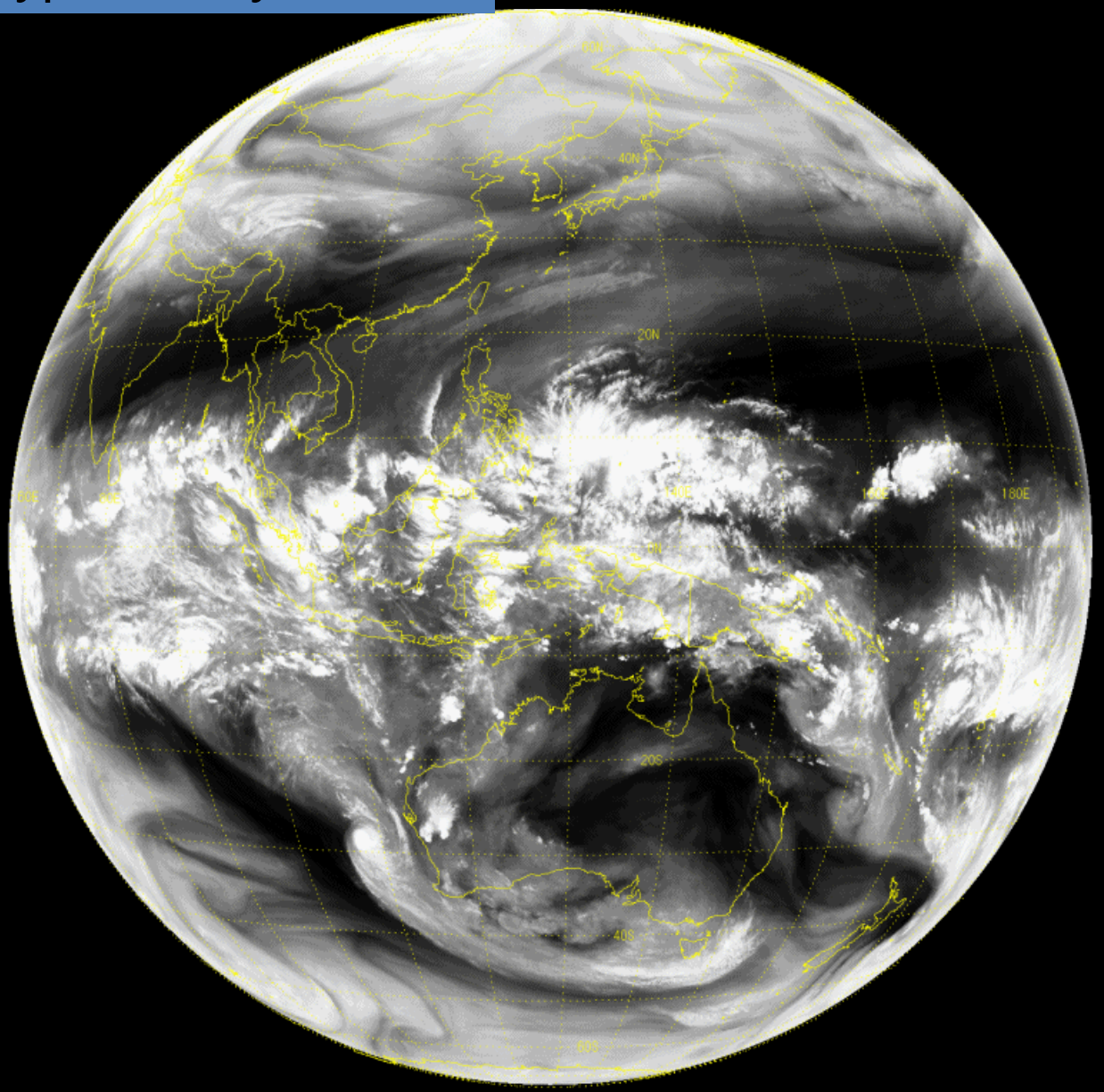

First COMS Visible Image
10 July 2010 0215 UTC

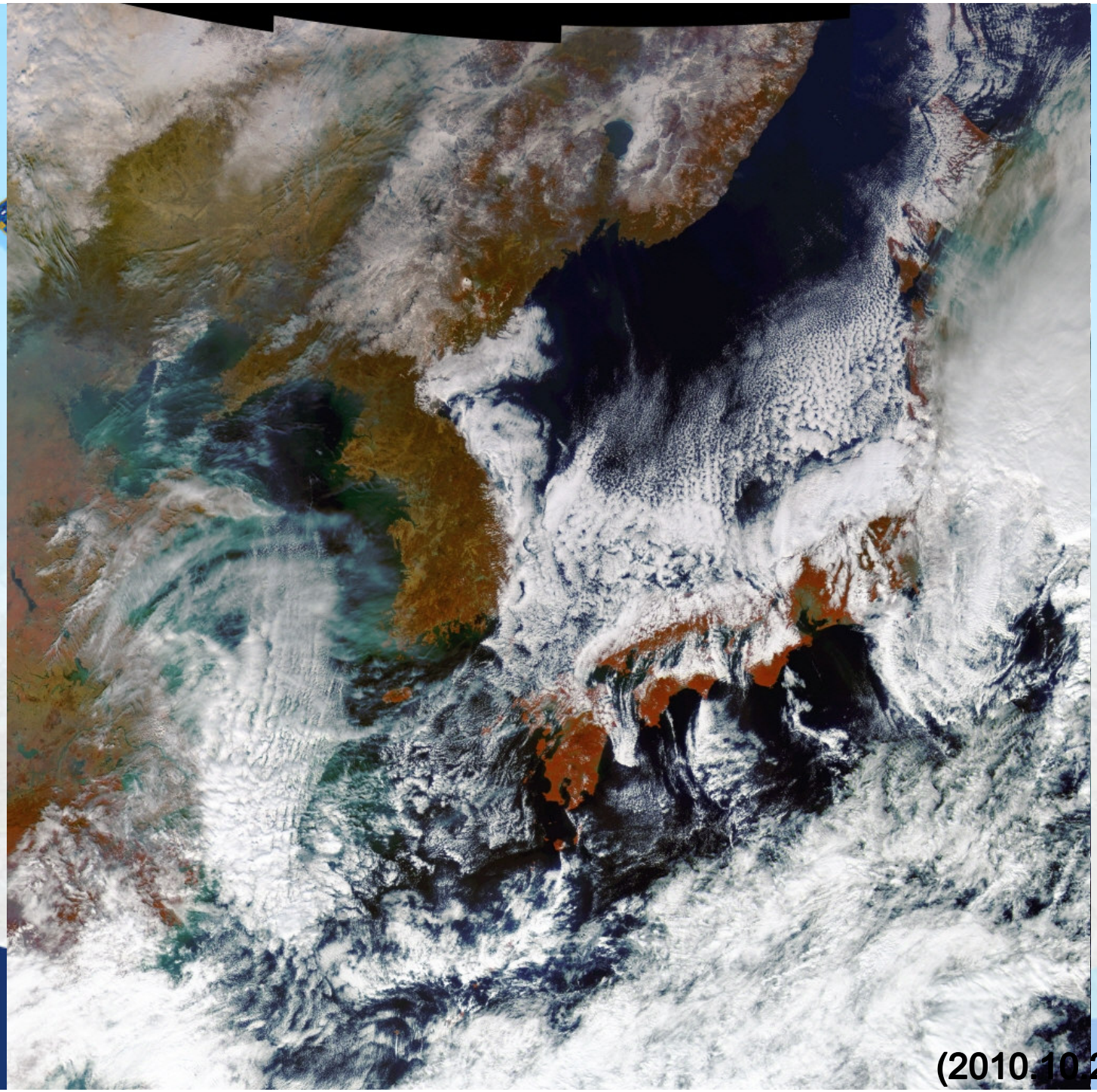
First COMS SWIR, WV, IR image



Monitoring Typhoon by COMS

국가기상위성센터
National Meteorological Satellite Center

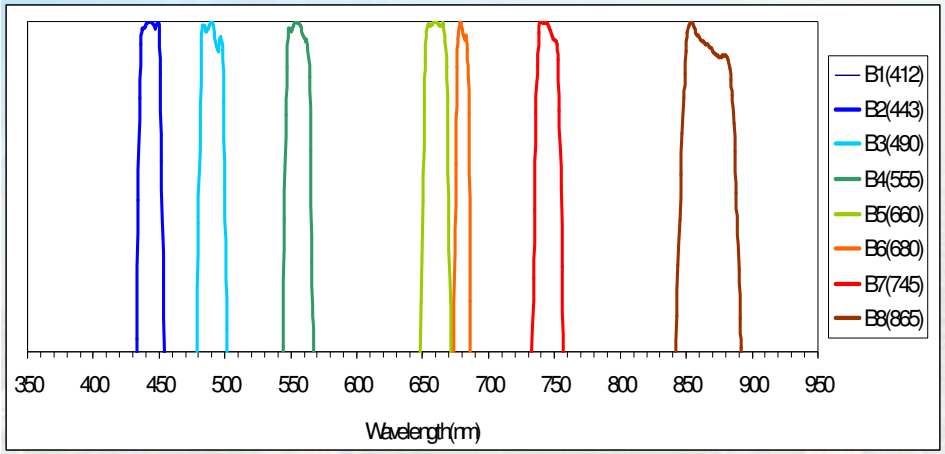




(2010.10.20~2010.11.22)

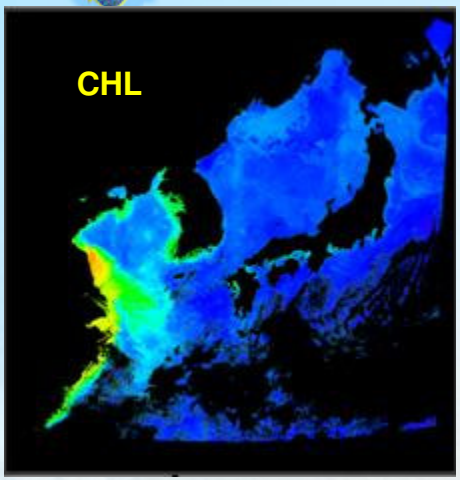
GOCI – Mission Overview

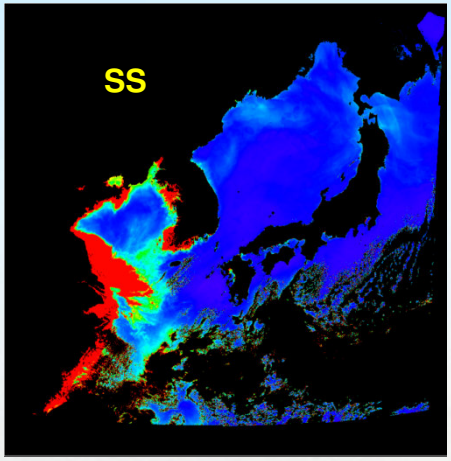
The GOCI is providing full target area images in 8 narrow spectral bands selected for Ocean color monitoring.

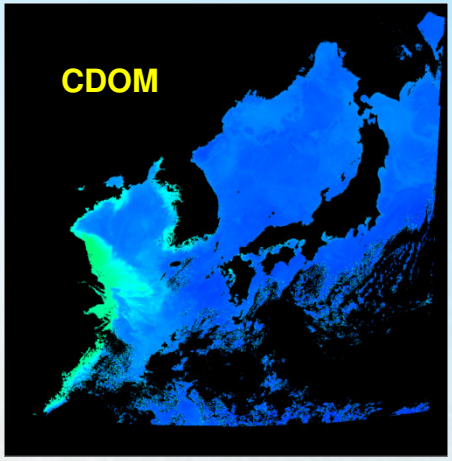


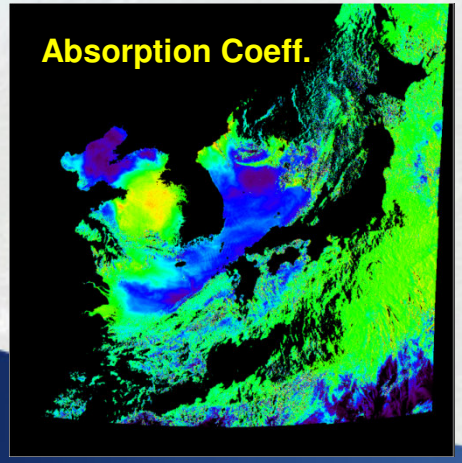
Band	center	Bandwidth	Main Purpose
1	412 nm	20 nm	Yellow substance and turbidity extraction
2	443 nm	20 nm	Chlorophyll absorption maximum
3	490 nm	20 nm	Chlorophyll and other pigments
4	555 nm	20 nm	Turbidity, suspended sediment
5	660 nm	20 nm	Baseline of fluorescence signal, chlorophyll, suspended sediment
6	680 nm	10 nm	Atmospheric correction and fluorescence signal
7	745 nm	20 nm	Atmospheric correction and baseline of fluorescence Signal
8	865 nm	40 nm	Aerosol optical thickness, vegetation, water vapor reference over the ocean

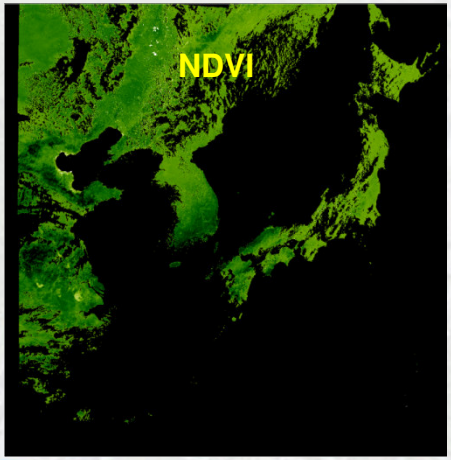
Products of GOCI

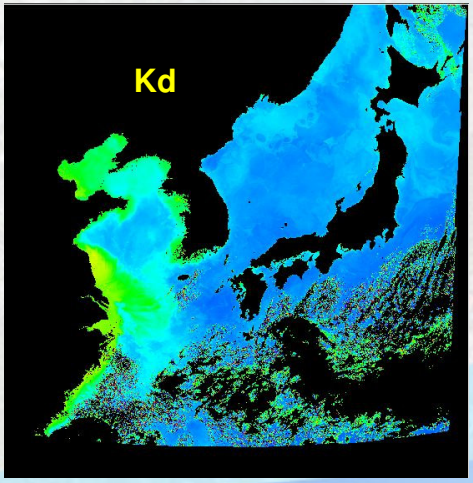




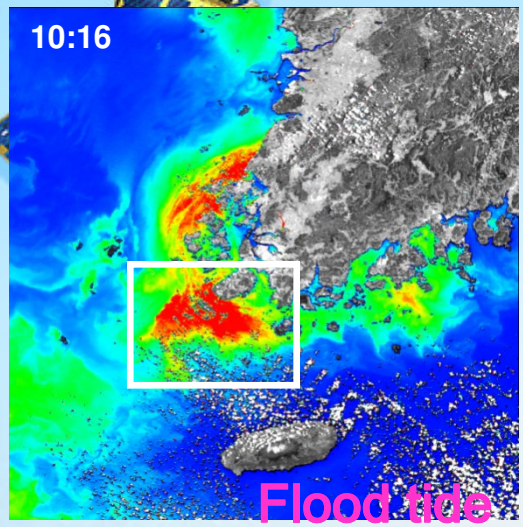


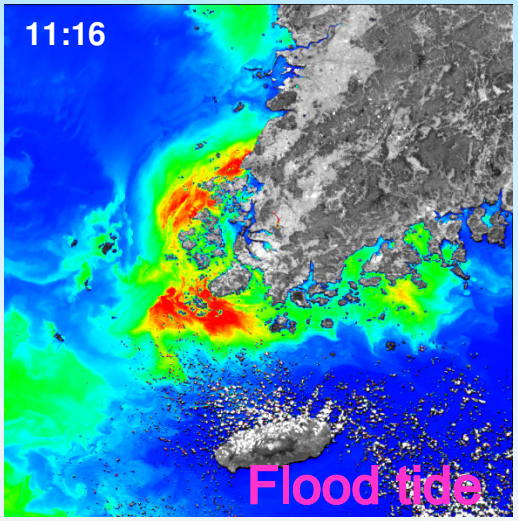


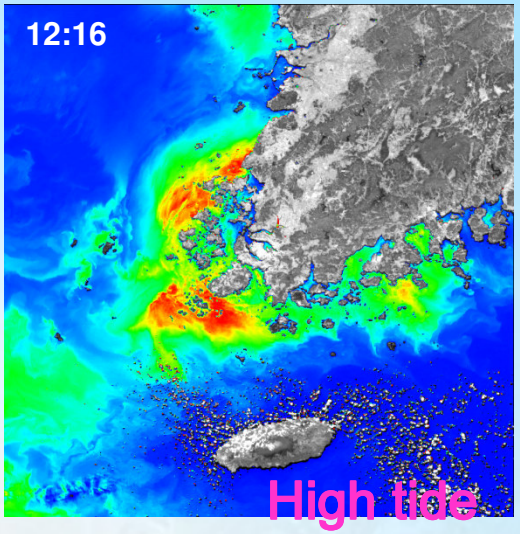


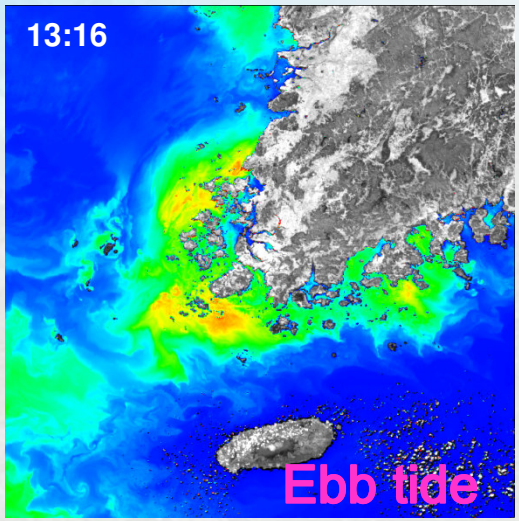


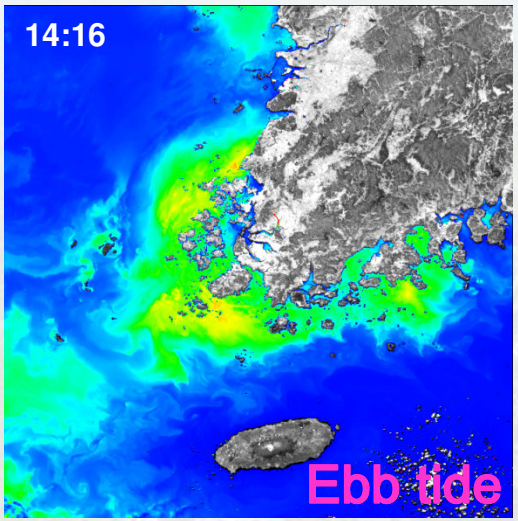
Time series of SS

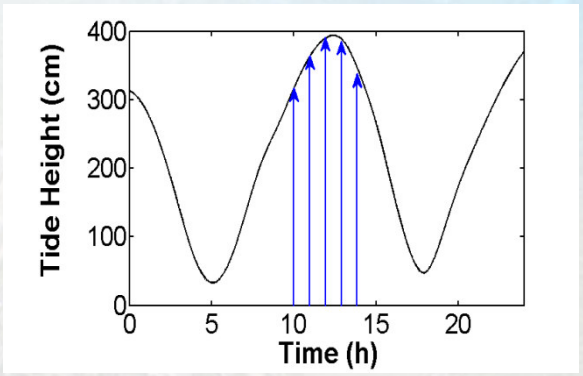




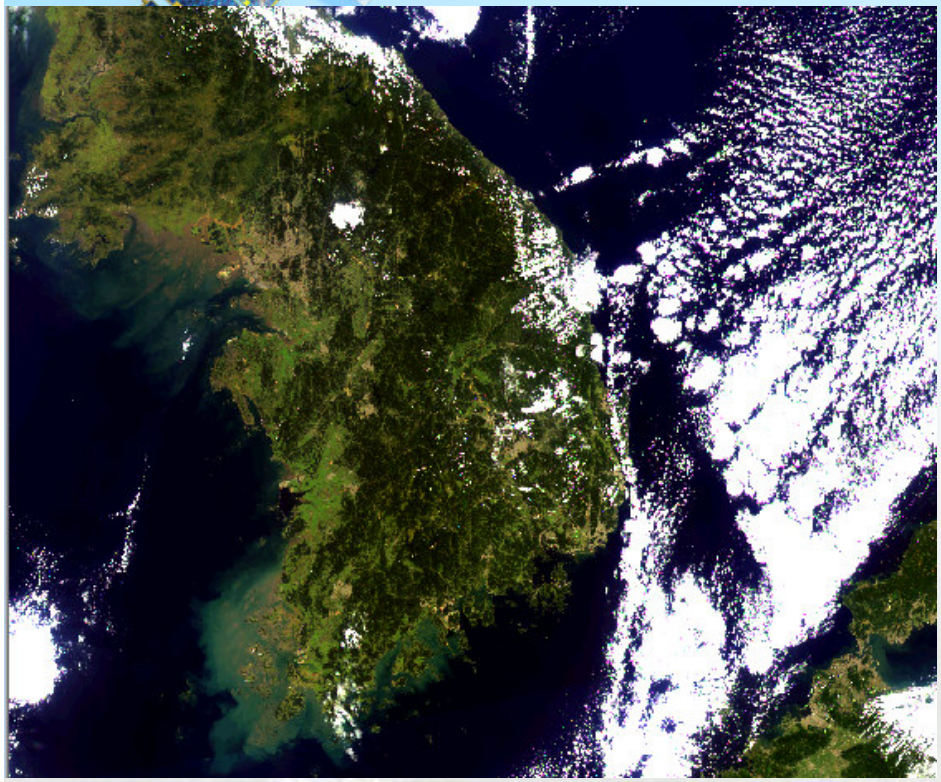








Comparison of GOCI and MERIS

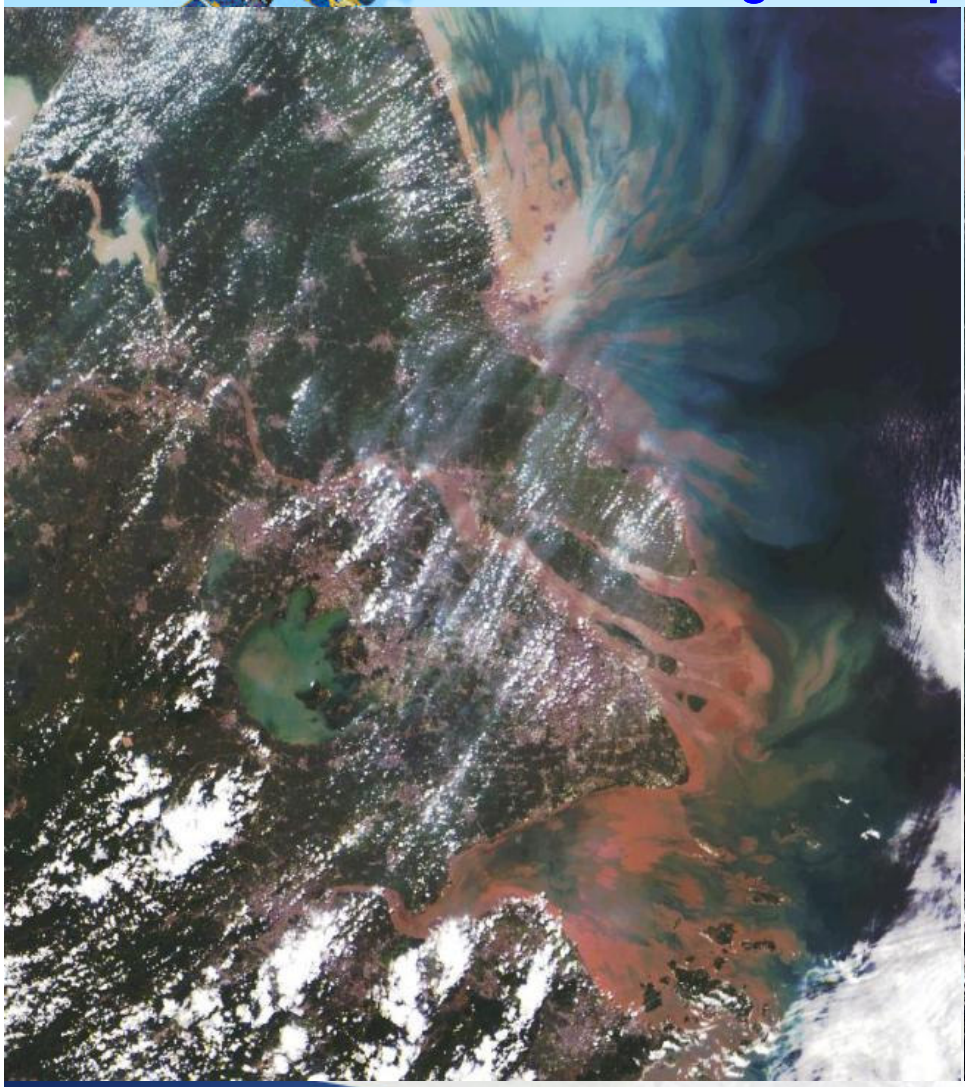


GOCI(2010 09 24 01: 16:43)
(R(680), G(555), B(412))

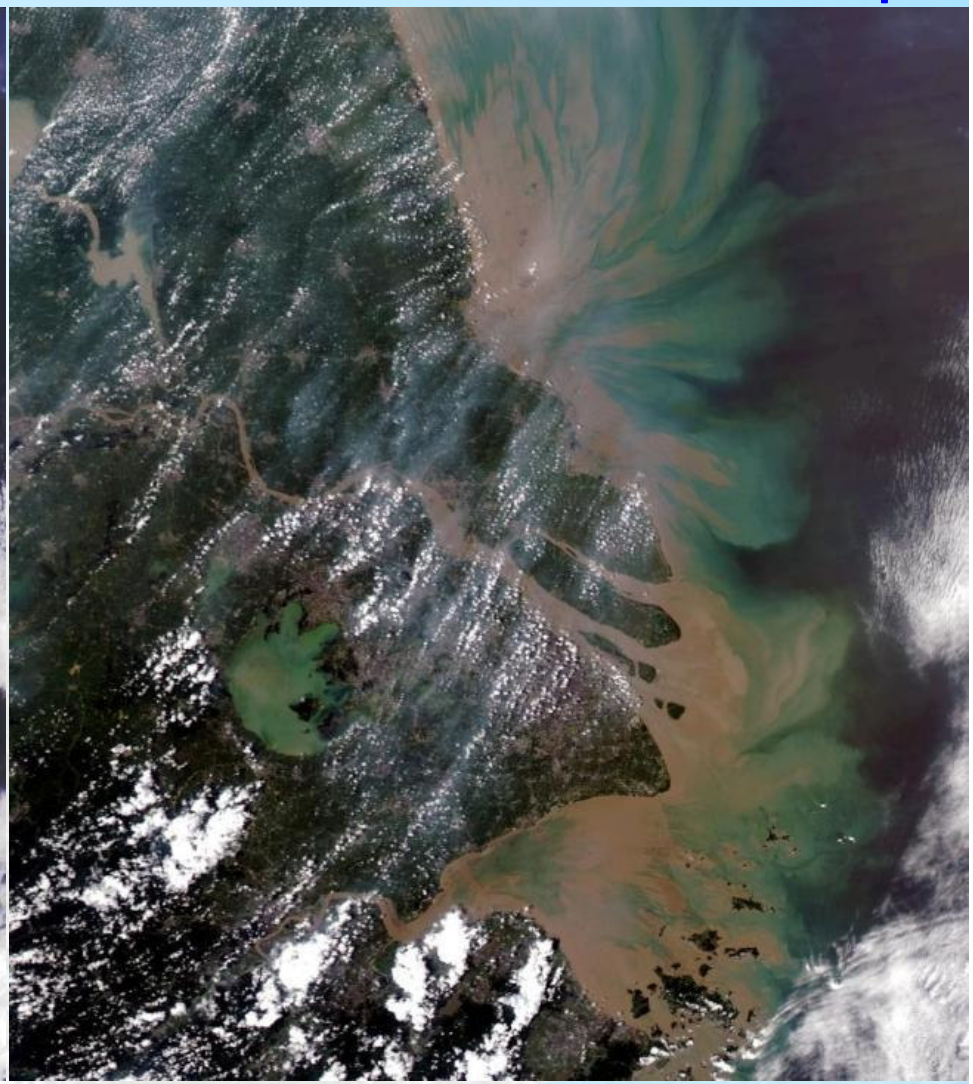
MERIS(2010 09 24 01: 43:51)
(R(681.55), G(560), B(412.5))

GOCI Image Quality

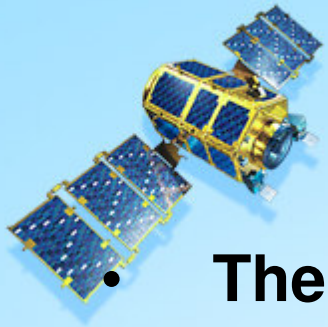
- Image Comparison between GOCI and MODIS Aqua



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

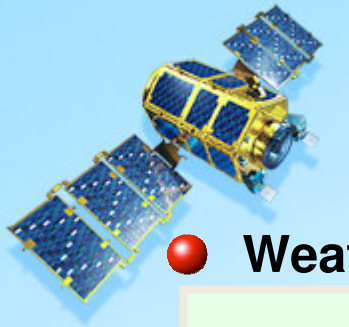


Yangtze River, China (MODIS Aqua, 20100731)
R: 645 G: 555 B:469



GEO-KOMPSAT-A, B Development Plan

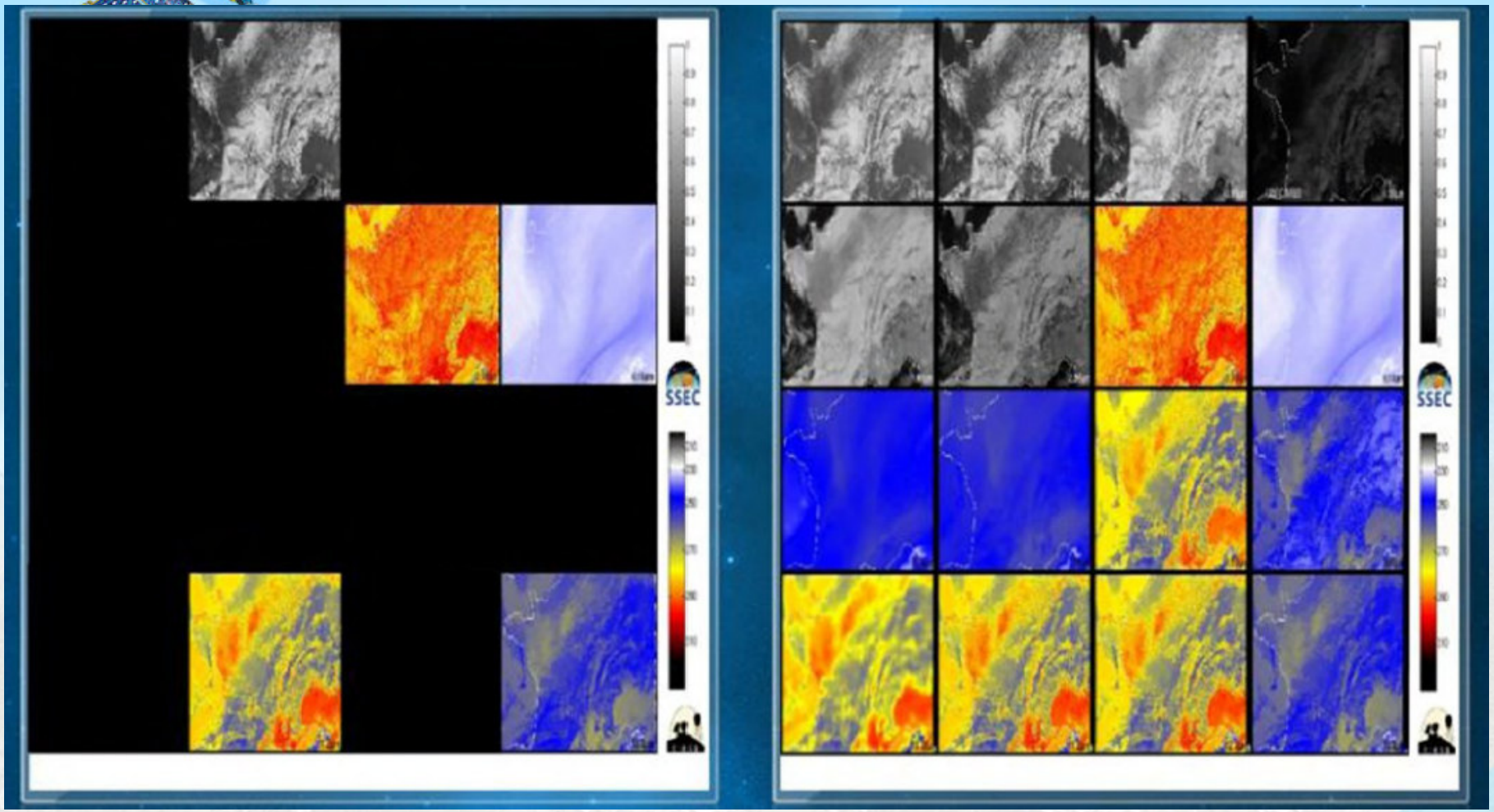
- **The continuity of COMS missions**
  - **COMS program : Launch at 2010, the predicted end of mission at 2017**
  - **For the continuous mission of meteorological and ocean monitoring, the next satellite should be launched no later than 2017**



Anticipation of Mission Objectives

- **Weather Monitoring Mission**
  - Continuous monitoring of meteorological products with higher resolution and early detection than COMS
- **Ocean Monitoring Mission**
  - Continuous Monitoring of marine environment around Korea
  - Production of fishery information and monitoring of ocean ecology and ocean pollution
  - Monitoring of long-term/short-term change of marine ecosystem
- **Environmental Monitoring Mission**
  - Monitoring system for long/short-term environment change of around east Asia
  - Monitoring of yellow sand, air pollutant and aerosol

Evolution of Meteorological Imager



COMS

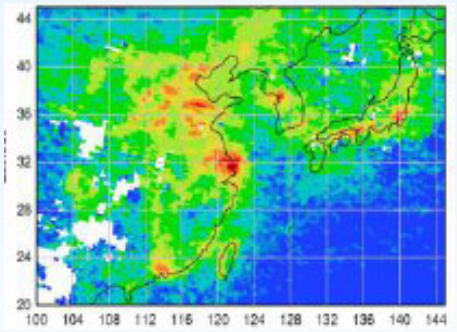
Geo/KOMPSAT-2A

Environmental Monitoring Mission of Geo/KOMPSAT-2B

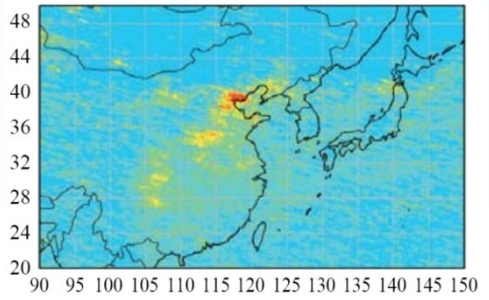
To monitor atmospheric environment and climate change

Monitoring NO_2, SO_2, O_3 , HCHO, Aerosol in East Asia – Emission/Distribution

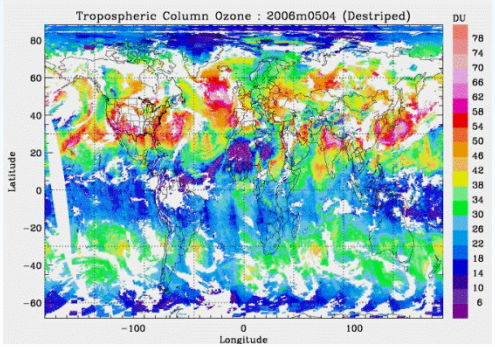
NO_2



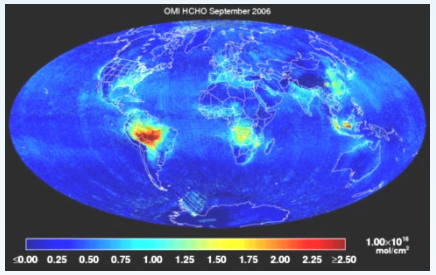
SO_2



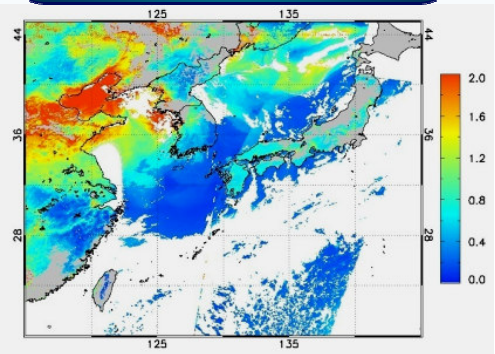
O_3



HCHO



Aerosol



from Bhartia, Richter from OMI and SCIAMACHY

Asia – important region in Global AQ

Both Anthropogenic and Natural Sources throughout the year

Anthropogenic	Geogenic	Biomass burning	Biogenic
			
Pollution	Asian dust	wild fires	sink change
Industry Transportation Mega Cities	Land use change Desertification Population(>60%) – Social benefit	Drought	Deforestation

Monsoon

Typhoon

Tsunami

Tibetan Plateau

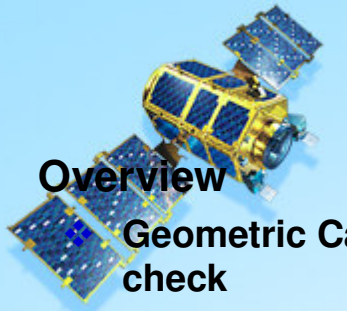
KOMPSAT-5

KOMPSAT-5 GOLDEN Mission

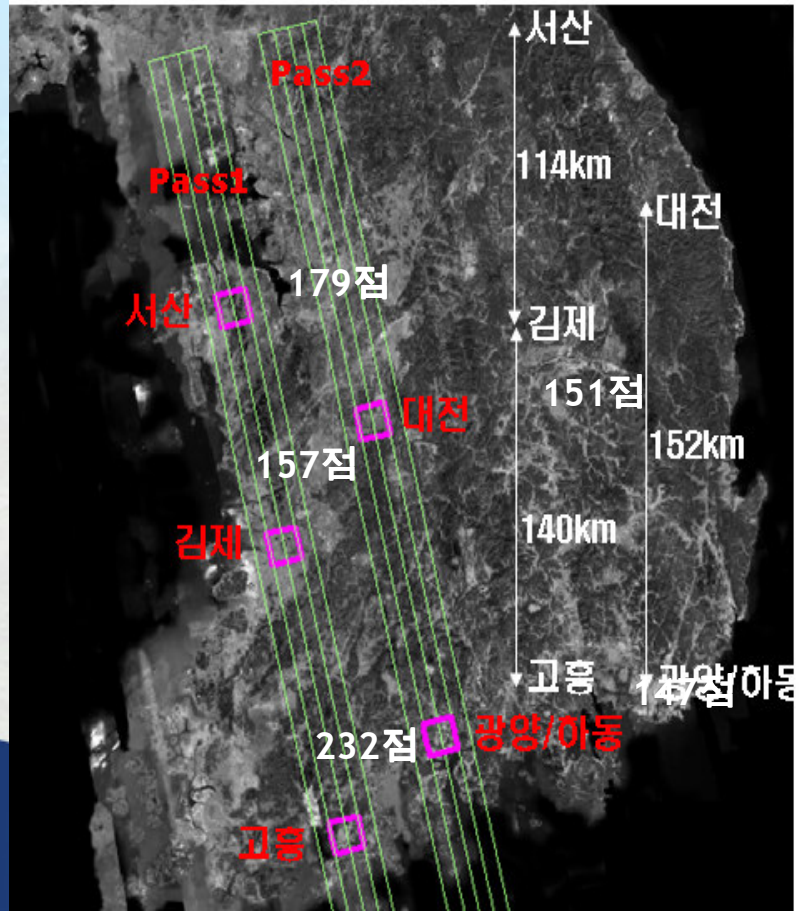
1. **GIS**
2. **Ocean management**
3. **Land management**
4. **Disaster monitoring**
5. **Environment monitoring**
6. **National security**

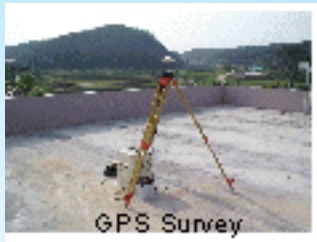
KOMPSAT-5 영상레이더(SAR) 위성의 한반도 관측 임무

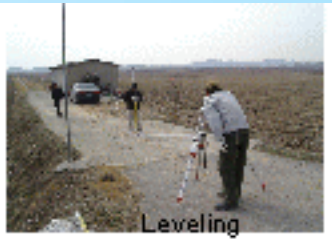
Cal/Val Site in Korea

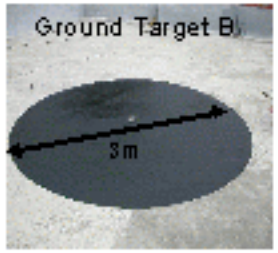


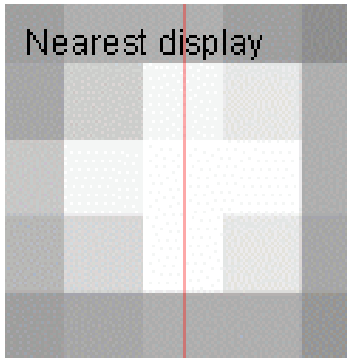
- **Overview**
  - Geometric Cal/Val; Distortion, Misalignment, Accuracy check
  - 5 GCP Sites; Total 866 points
  - Ground Point Accuracy: <5cm
  - Image Point Accuracy: <30cm

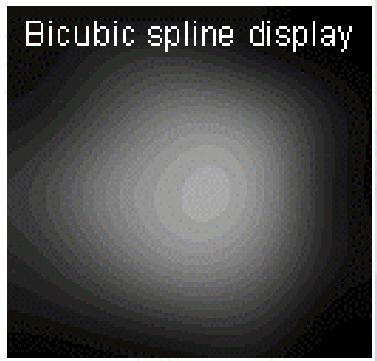




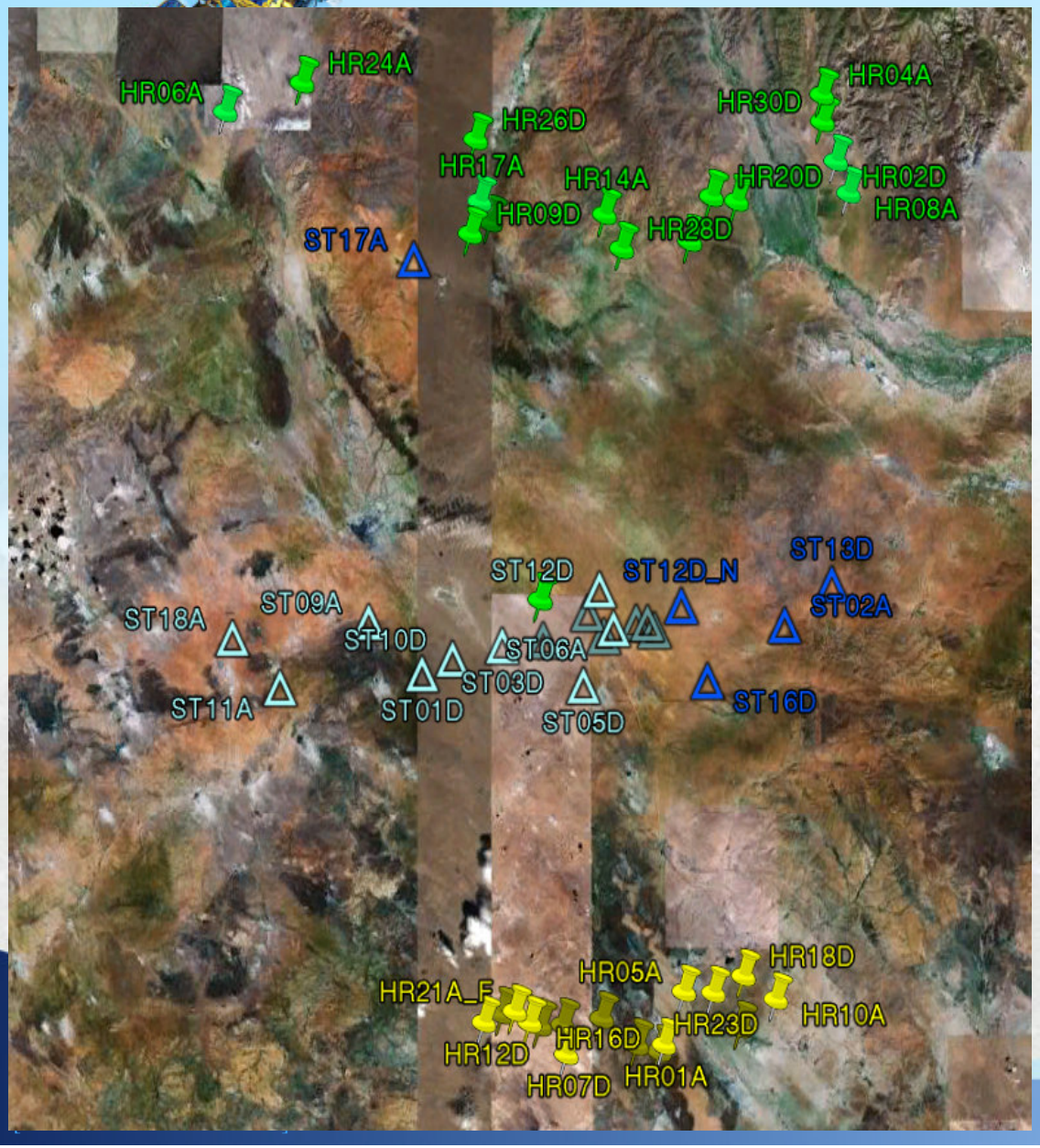








Mongolia Cal/Val Site

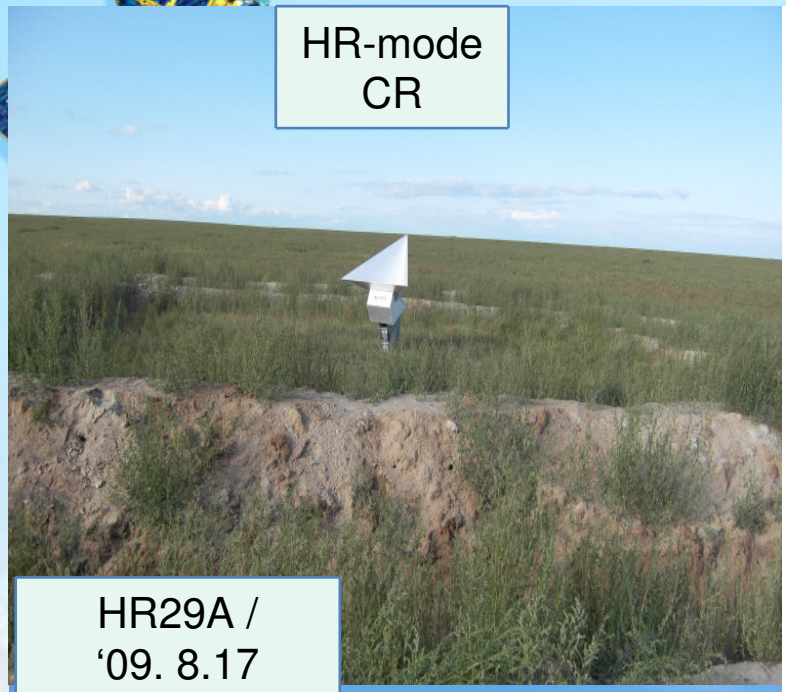


HR-mode CR	2009	
	2010	
ST-mode CR	2009	
	2010	

	HR	ST
2009년	16	5
2010년	16	15
Total	32	20
Spare	3	0

CR Installation

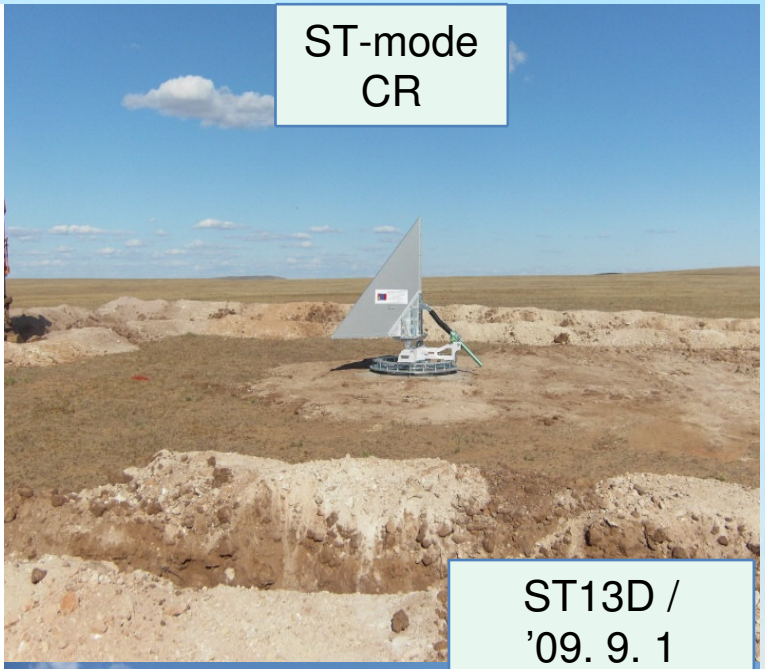
HR-mode CR



HR29A / ‘09. 8.17

HR15D / ’09. 8.25

ST-mode CR



ST13D / ’09. 9. 1

ST06A / ‘09. 9.10

Joining the International Charter

Earthquake of Haiti
- People Gathered in Local Stadium

13 Apr., 2009

13 Jan., 2010

16 Jan., 2010

Oil Spill @ Gulf of Mexico

Gulf of Mexico (Mar. 07, 2010) – After Oil Spill

Flood monitoring @ France

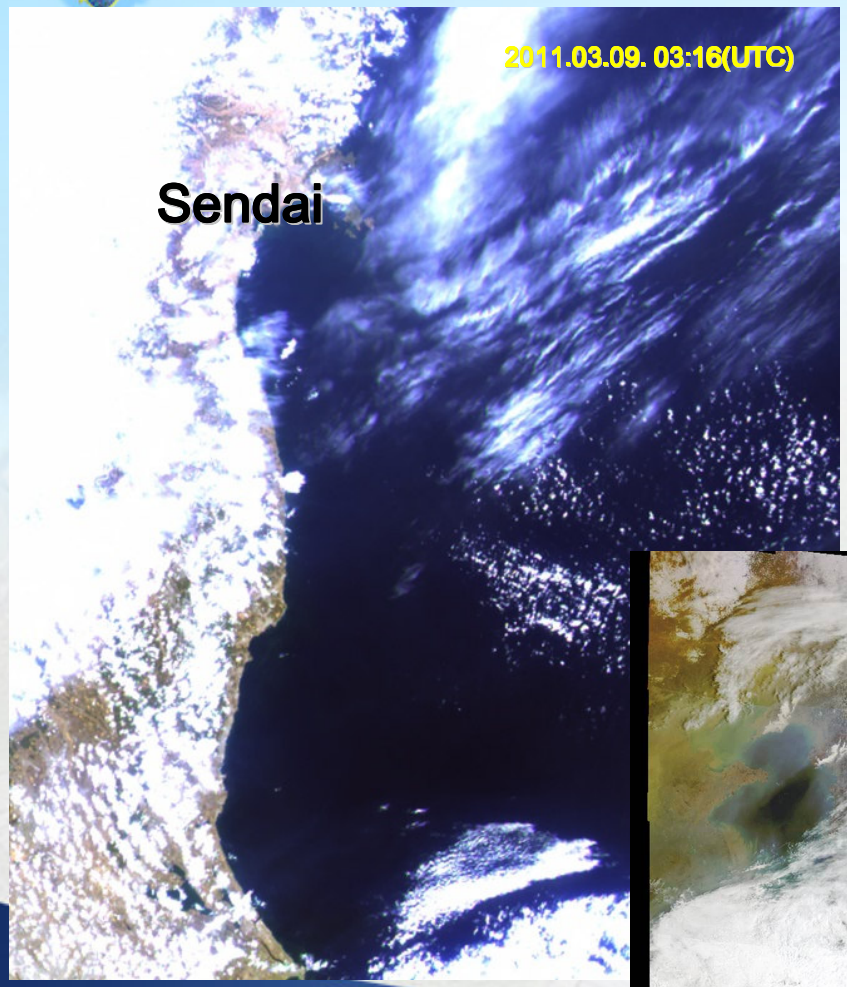
Flood impact map in France (18th Mar. 2009)

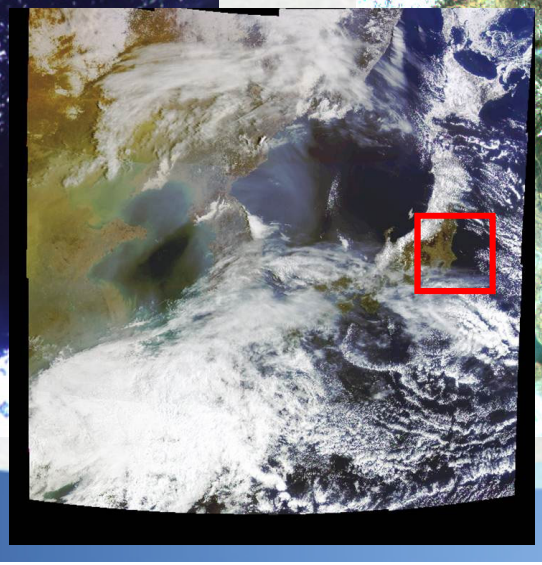
Flood situation map in France (5th Mar. 2010)

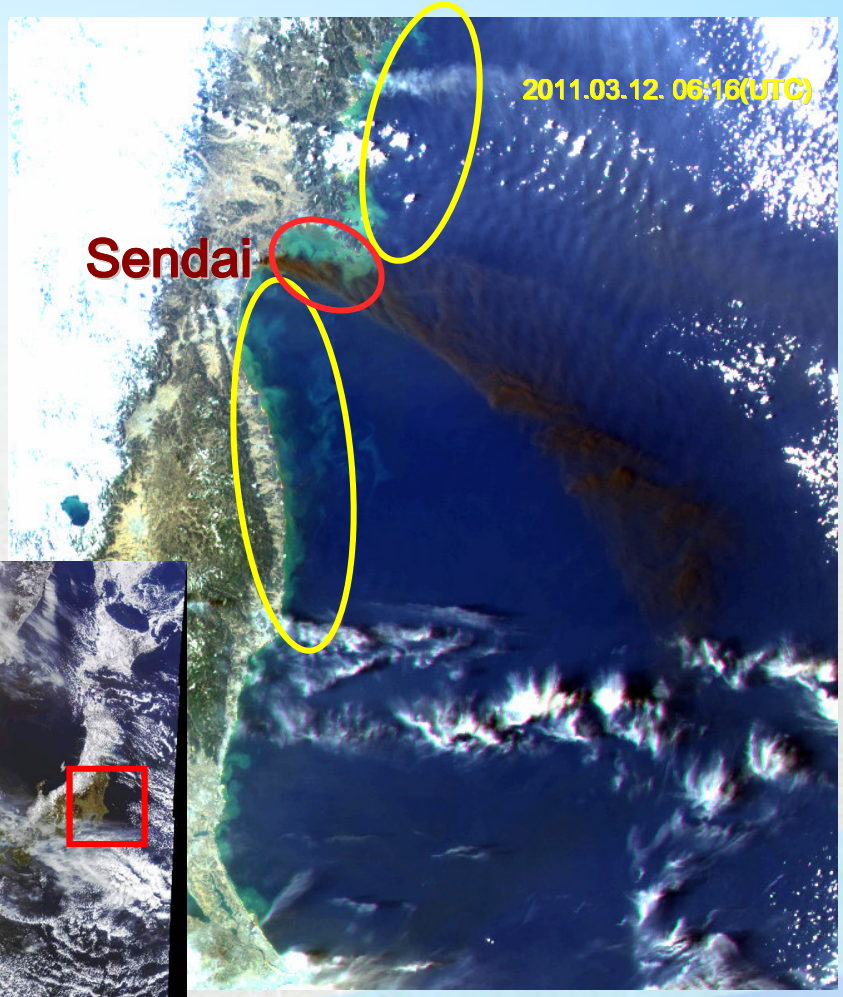
Tsunami observed by GOCI

Changing of Coastal Suspended Sediments

and Fire Monitoring

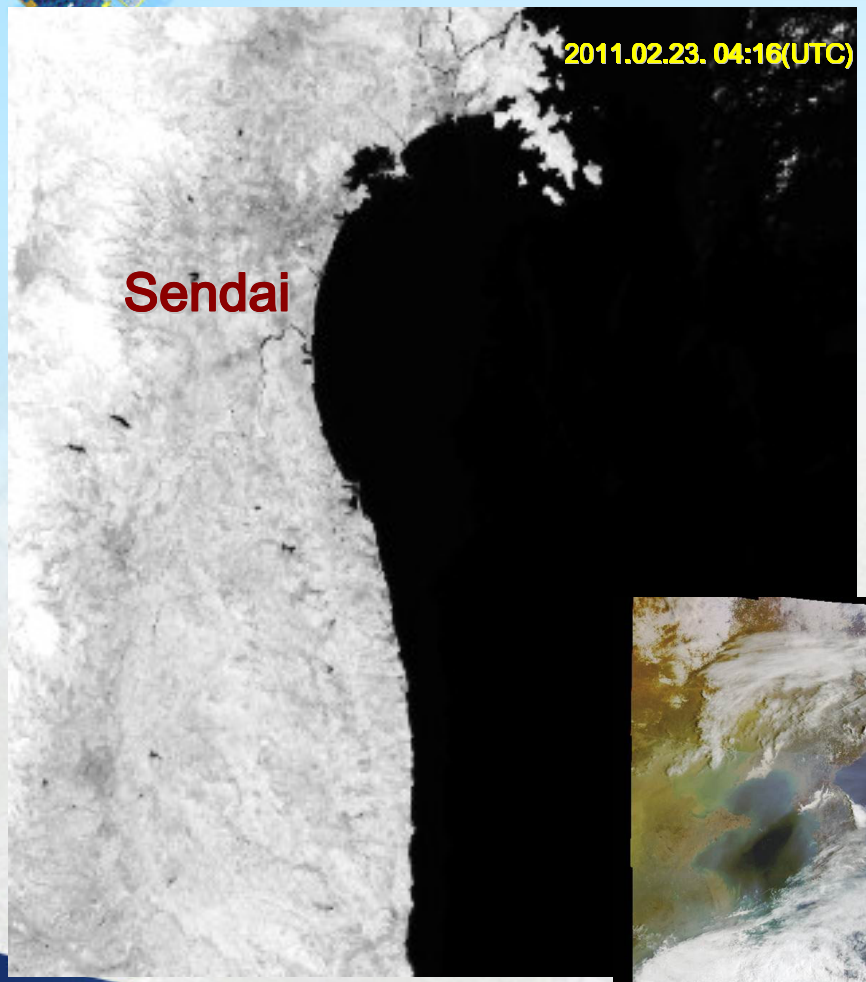


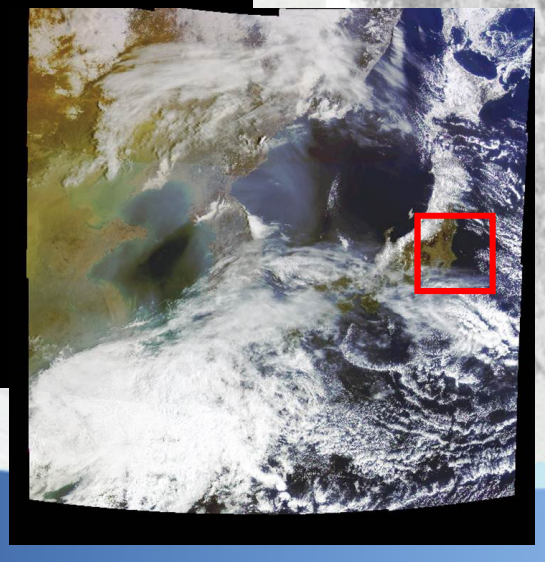


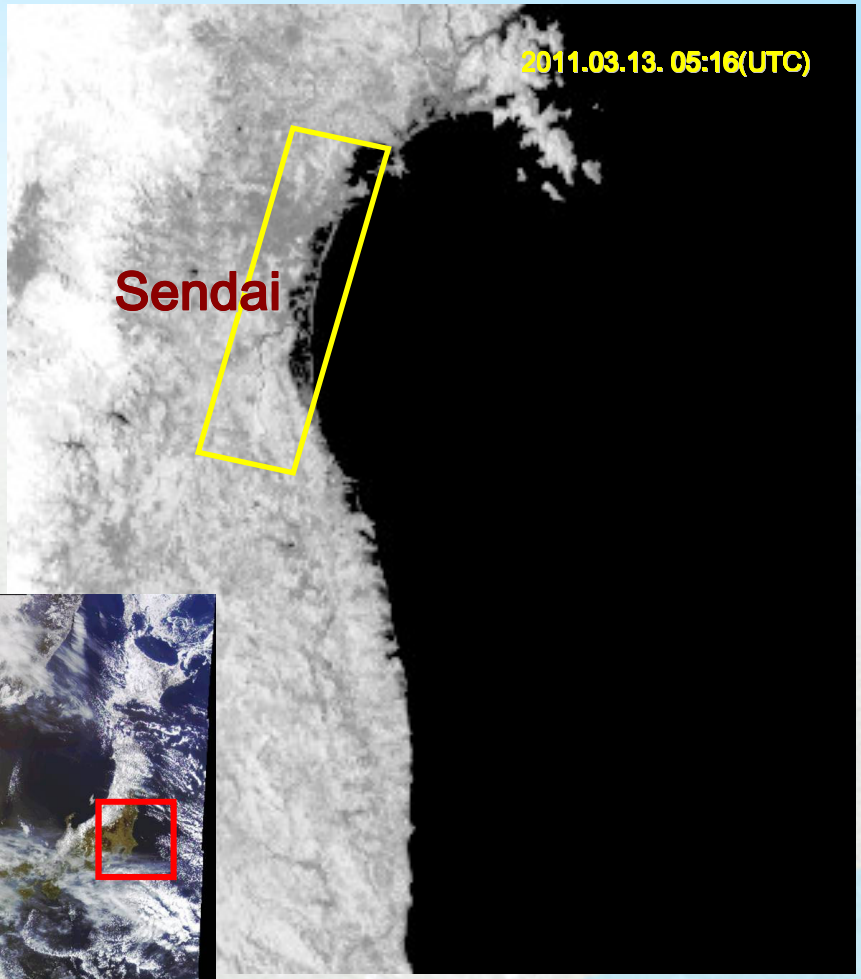


Tsunami observed by GOCI

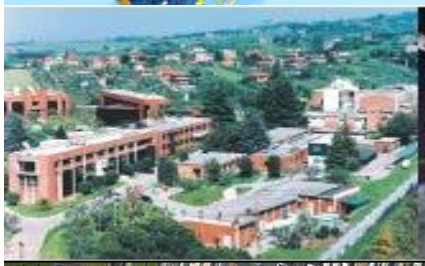
Changing of Coastal Line before and after tsunami

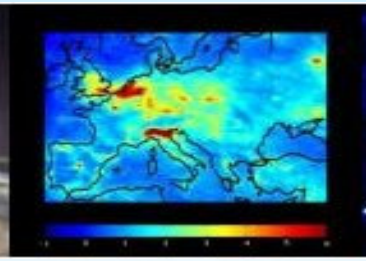
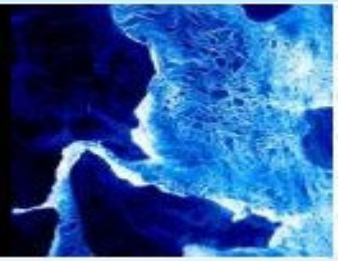






KOMPSAT-2 Project within ESA's Third Party Mission Program



KOMPSAT-2 Ground segment co-operation:

- ESA has since long an operations contract with KSAT for Tromso/ Svalbard facilities, with SISA for Cat-1, and aims to set up a long-term co-operation with KARI
- ESA users are increasingly requesting to extend the Cat-1 Data Portfolio to VHR optical data
- ESA supports the K-2 operations and in return gains the right to extract a quota of archived and new products
- **→ New TPM Co-operation scheme between ESA, European industry and KARI, and first time that TPM has a 1m satellite!**

Thank You!