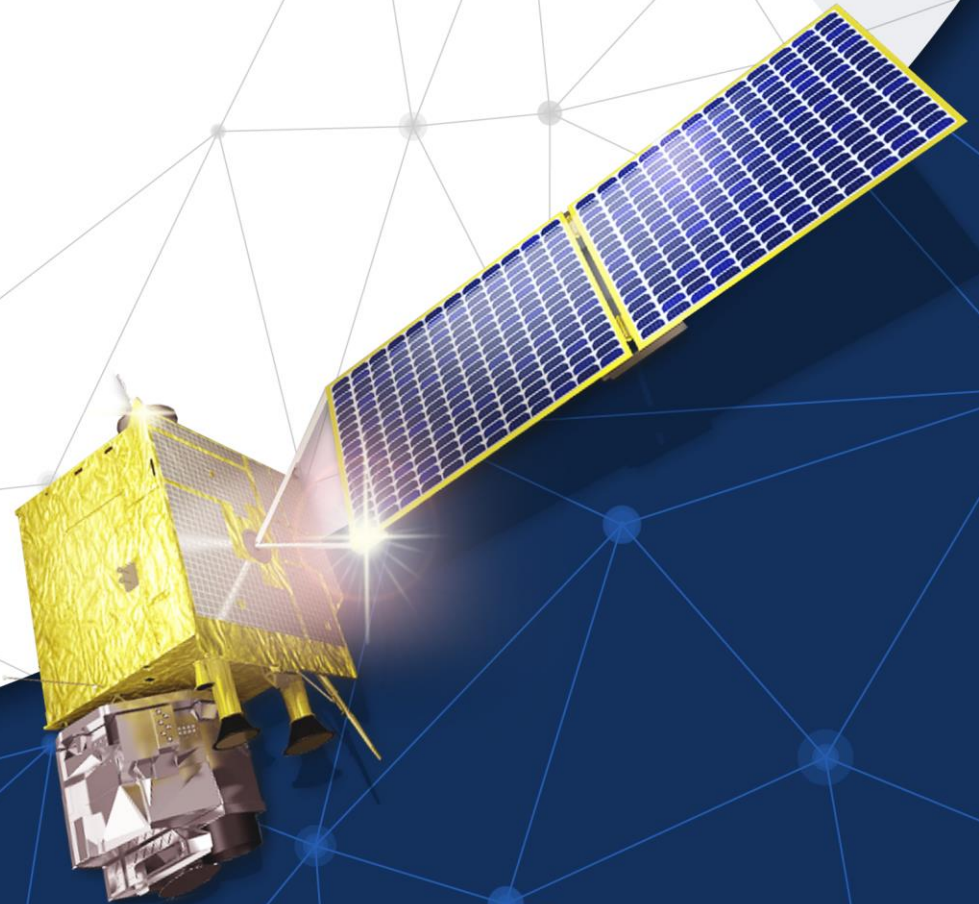


GEO-KOMPSAT-2A AMI Data Service Plan

July 2019

National Meteorological Satellite Center/KMA
Hyunjong Oh (hyunjong.oh@korea.kr)

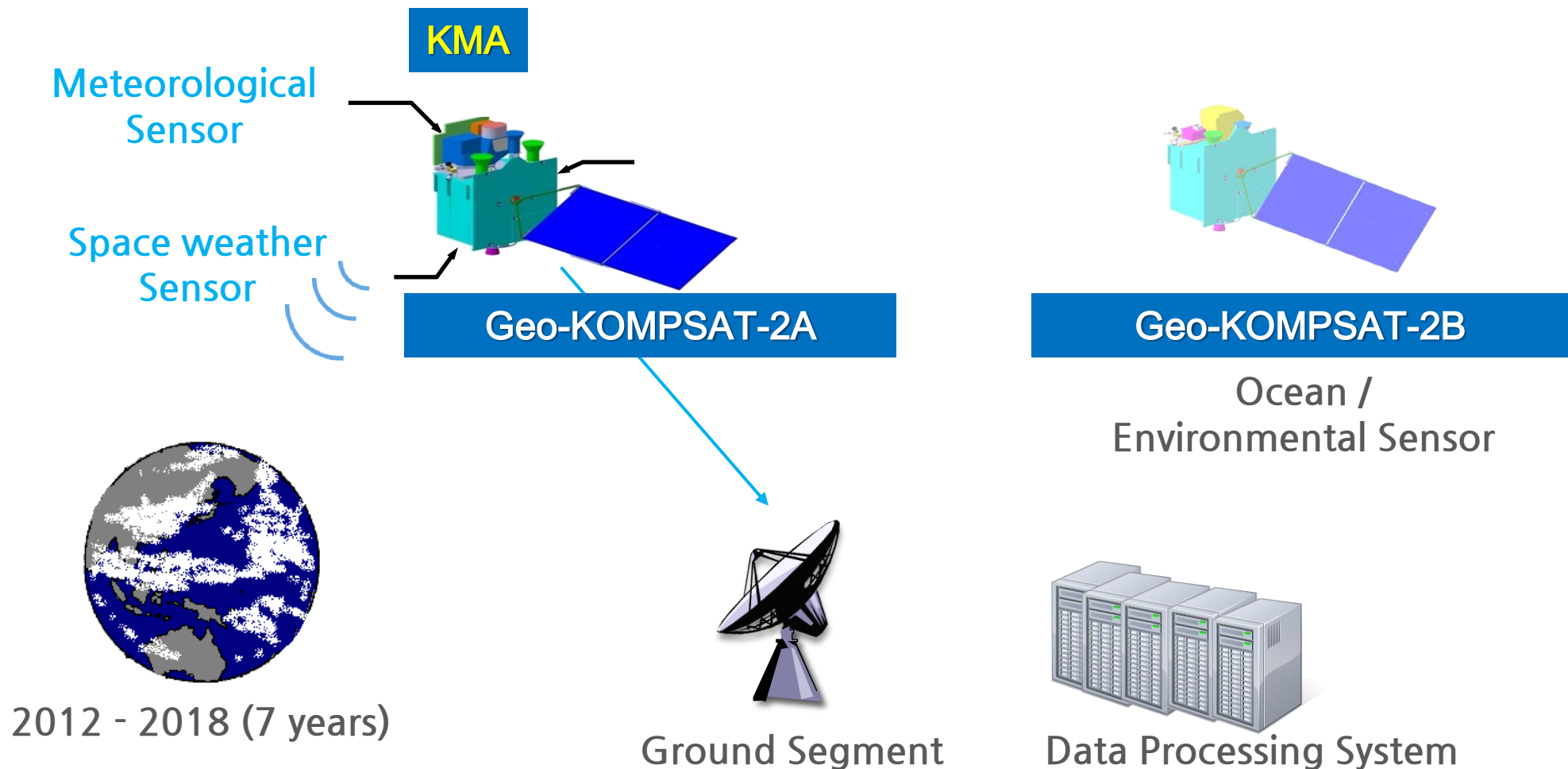


I

GK-2A Satellite

Geo-KOMPSAT-2 Program

- GK-2A for the next generation Meteorological Imager and SWx monitoring
- GK-2B for the Ocean Color and Atmospheric Trace Gas monitoring



01 ▶ Overview of the GK-2A Satellite

The **GK-2A Satellite** is the next generation geostationary meteorological satellite that takes over the meteorological role of COMS and Performs **meteorological and space weather observation task**.

What is the GK-2A Satellite?

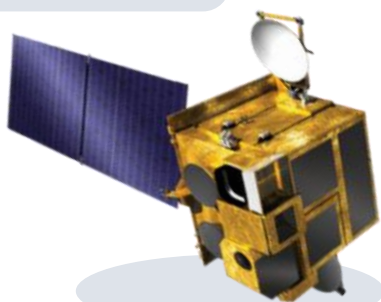
GK-2A is a geostationary satellite* which carries 16 channels and designed to have a lifespan of 10 years.

- Upgraded specification(in comparison to the existing COMS)
 - Channels : 5 to 16 - Lifespan : 7 to 10 years (1.5 times increased) - Spatial resolution : 2 times improved
- Major task : Meteorological and space weather observation after launched in the second half of 2018

* Geostationary meteorological satellites: This is a satellite that continuously observes the same area over an altitude of about 36,000 km above the equatorial surface.

COMS

Launched in June, 2010



- 1 **Communication** Payload
- 2 **Ocean** Payload
- 3 **Meteorological** Payload

Taking over
the role of the
COMS



GK-2A Satellite

Basic Specification of GK-2A Satellite

Payload	Meteorological payload, space weather payload	No. of Channels	16 channels, 3 types of space weather channels
Weight	2,849kg	Lifespan	10 years
		Launch Schedule	Second half of 2018

Geo-KOMPSAT-2A's Payloads

AMI(Advanced Meteorological Imager)

		Center wavelength (μm)		
AMI (Resolution)		ABI	AHI	
1 blue	0.47 (1km)	0.47	0.46	
2 green	0.511 (1km)		0.51	
3 red	0.64 (0.5km)	0.64	0.64	
4	0.856 (1km)	0.865	0.86	
5	1.38 (2km)	1.378		
6	1.61 (2km)	1.61	1.6	
7	3.830 (2km)	3.90	3.9	
8	6.241 (2km)	6.185	6.2	
9	6.952 (2km)	6.95	7.0	
10	7.344 (2km)	7.34	7.3	
11	8.592 (2km)	8.50	8.6	
12	9.625 (2km)	9.61	9.6	
13	10.403 (2km)	10.35	10.4	
14	11.212 (2km)	11.2	11.2	
15	12.364 (2km)	12.3	12.3	
16	13.31 (2km)	13.3	13.3	

KSEM(Korea Space wEather Monitor)

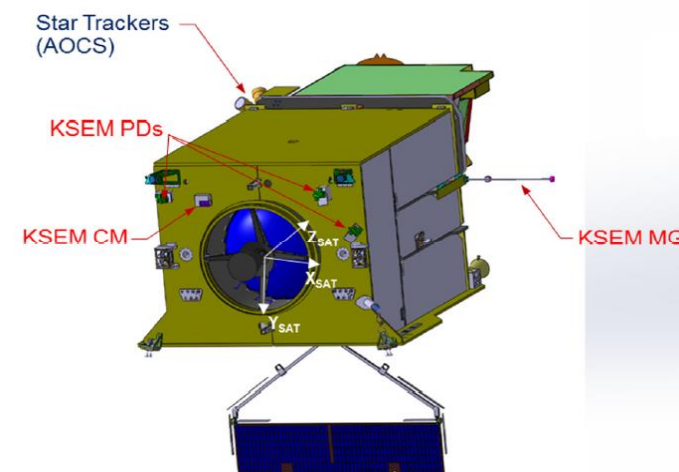
- PD : Particle Detector
- MG : Magnetometer
- CM : Charging Monitor

vs. AHI

- addition 1.38 μm (NIR)
- subtraction 2.3 μm (NIR)

1.38 μm : favorable for cirrus cloud detection, cloud type and amount

2.3 μm : favorable for Land/cloud Properties



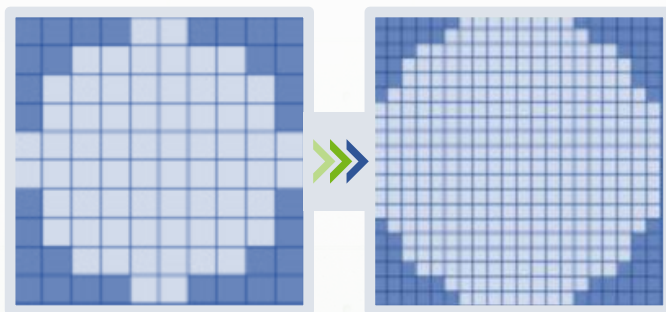
02 Performance Superiority of the GK-2A Satellite System – in comparison to the existing COMS

Increase of the Meteorological Data Generation cycle and Outputs → Support of the disaster response system of countries in the Asia-Pacific region → **Contribute to the Meteorological Industry Activation**

Improvement of spatial resolution (4 times higher)

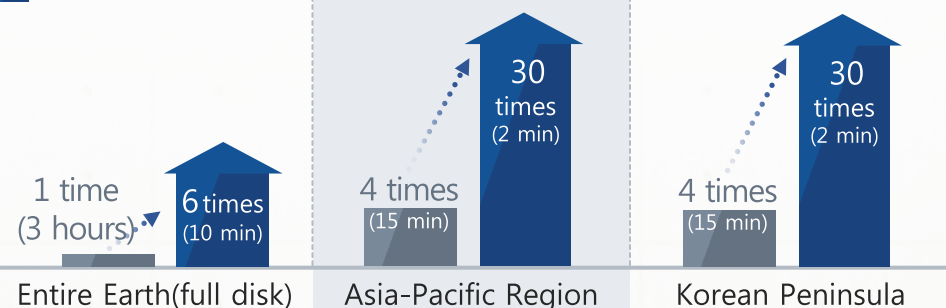
Visible 1km → 0.5km

Infrared 4km → 2km



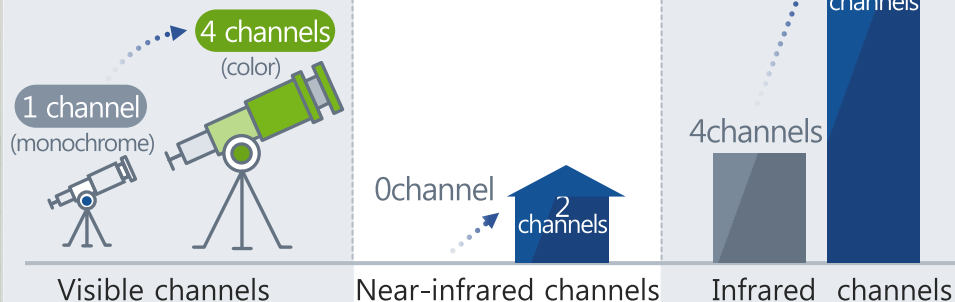
Increase of observation frequency (based on 1 hour)

COMS
GK-2A



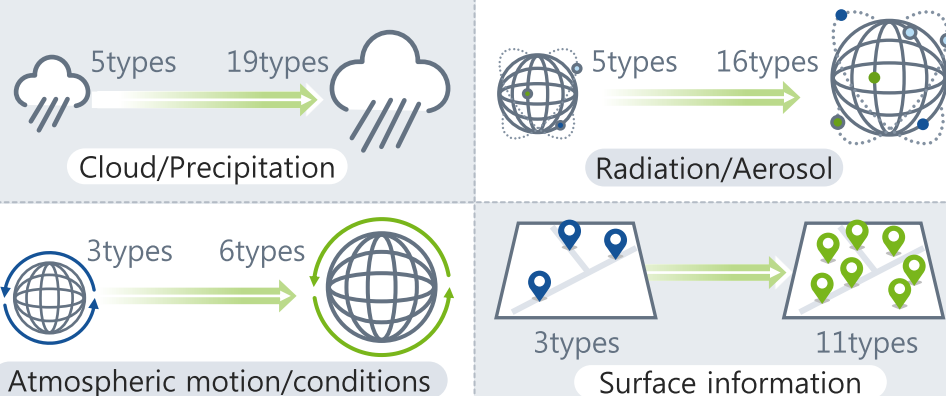
Increase of the number of channels (5 channels → 16 channels)

COMS
GK-2A



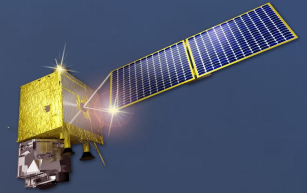
Increase of output

(16 types → 52 types + α , creation of 8 new types of space weather output)



Successful Launch of Geo-KOMPSAT-2A

- The Geo-KOMPSAT-2A was successfully launched on 5th December of 2018 in Guiana, which will succeed the COMS meteorological mission for 10 years.



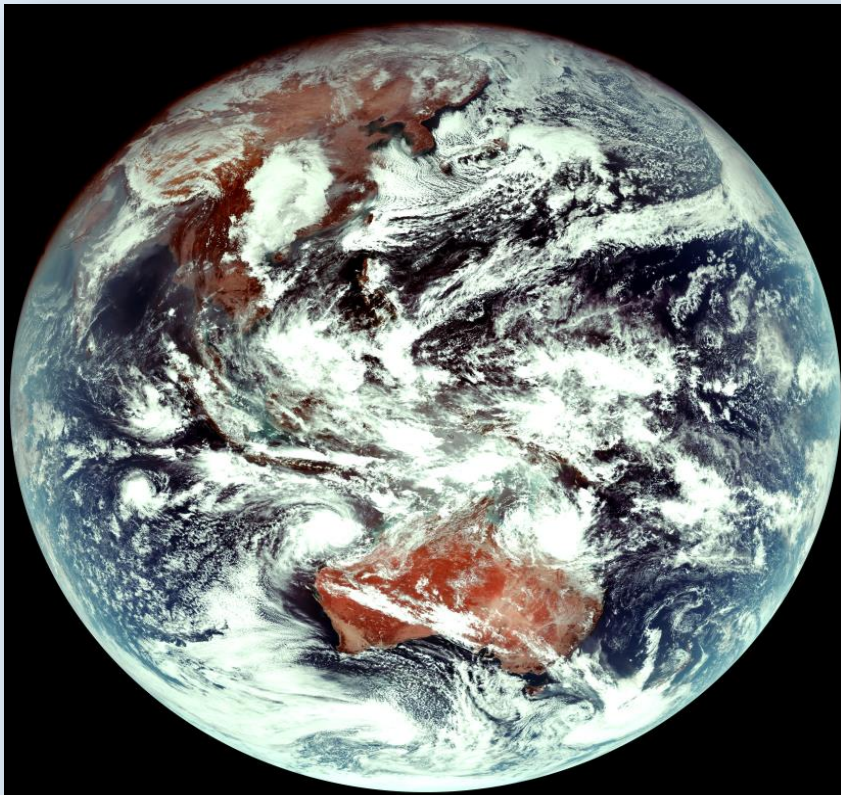
GK-2A Satellite



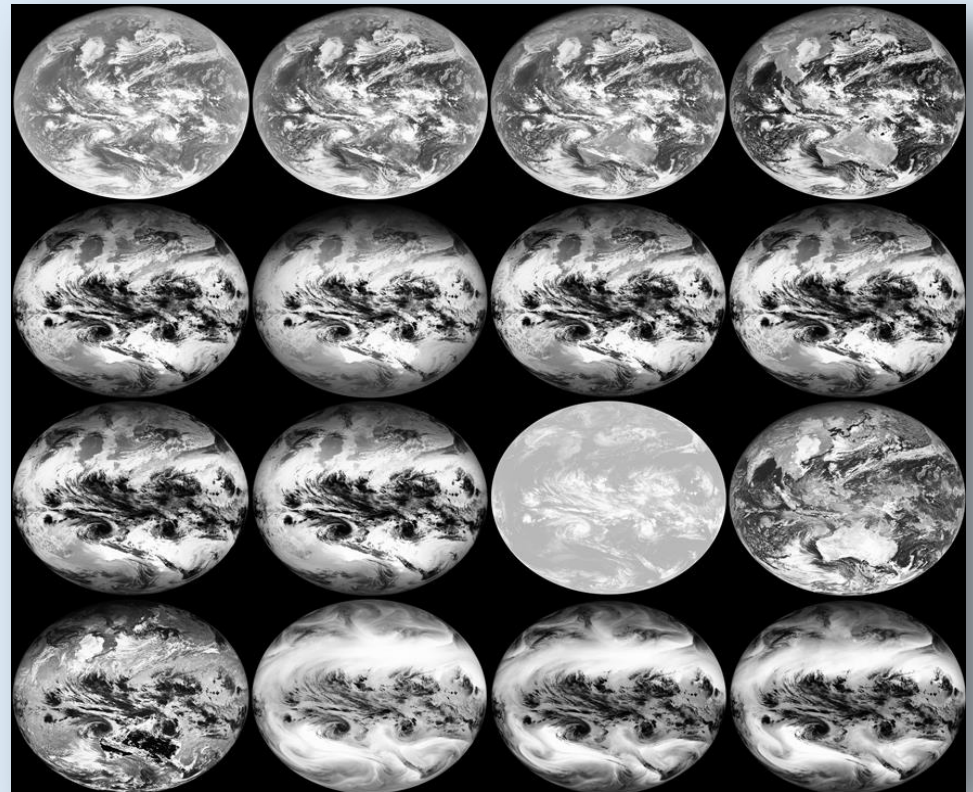
Successful Launch of Geo-KOMPSAT- 2A

- GEO-KOMPSAT-2A was successfully launched on 5th December 2018.
- First images were taken on 26th January 2019.
- Official operation will be started in July of 2019.

First Image of GEO-KOMPSAT-2A



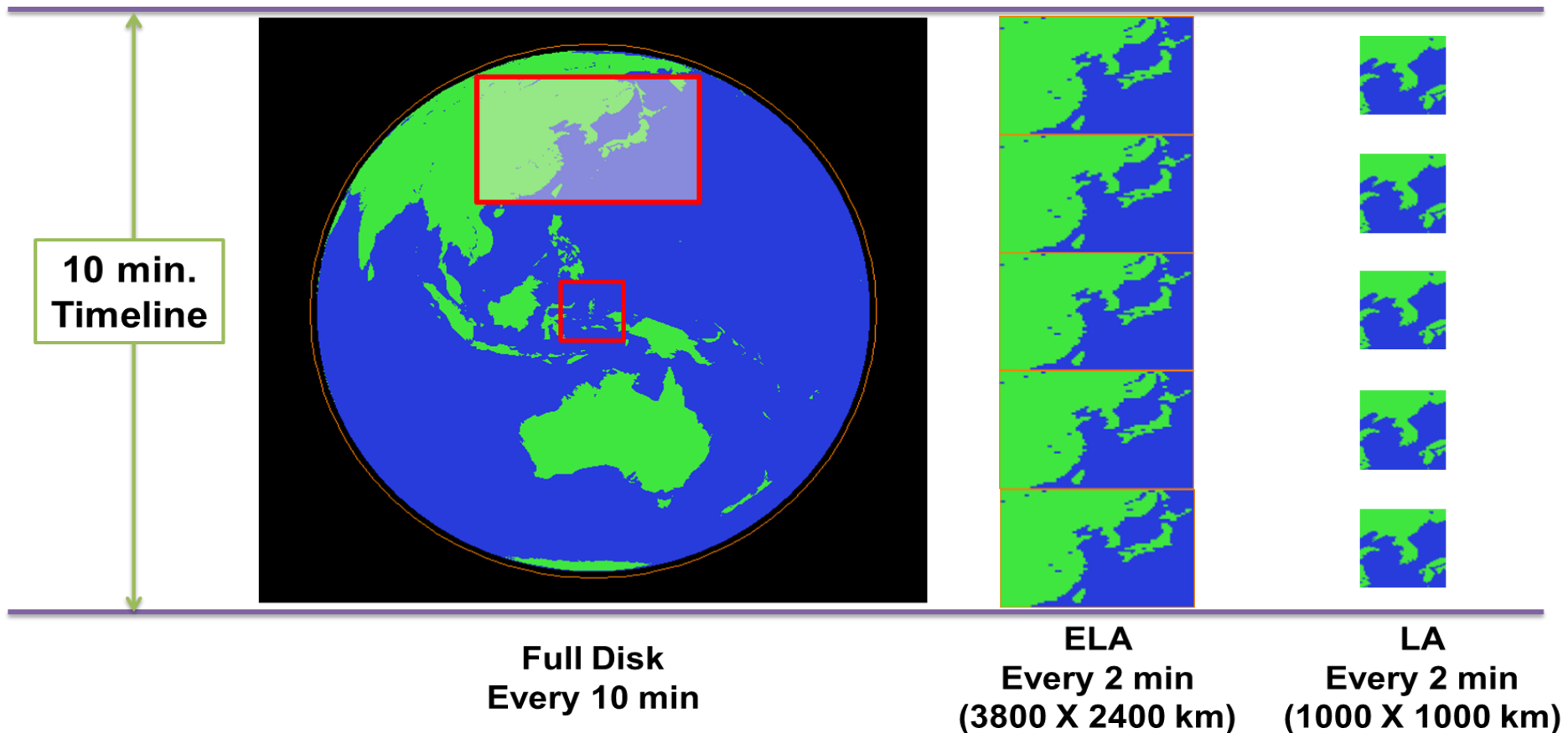
03:10 UTC 26th January 2019



Observation Area and Schedule

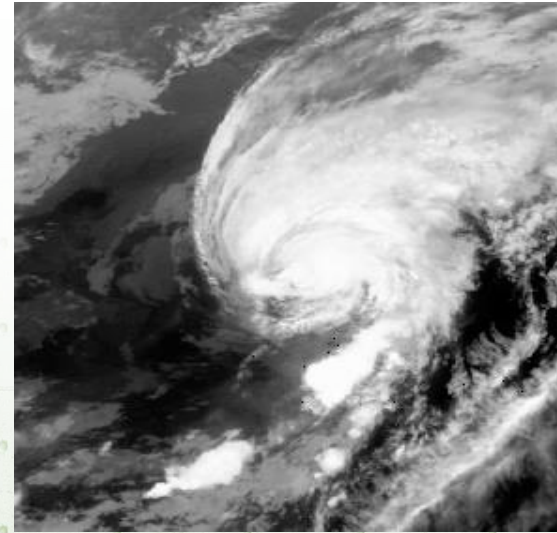
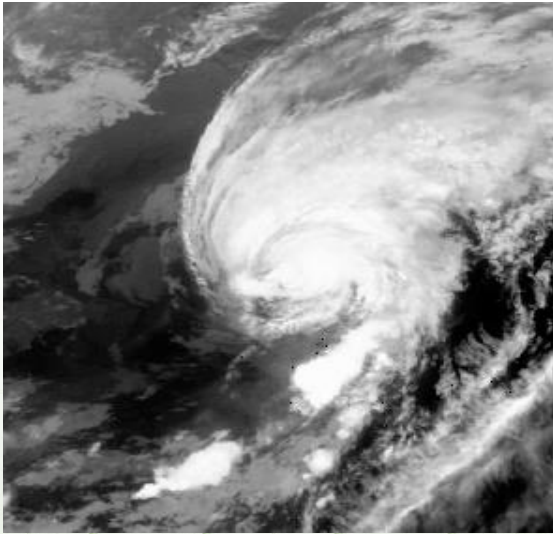
1 FD + 5 ELA + 5 LA : 10 min

- Full Disk (FD)
- Extended Local Area (ELA) : 3800 X 2400 km (EW X NS)
- Local Area (LA) 1000 X 1000 km

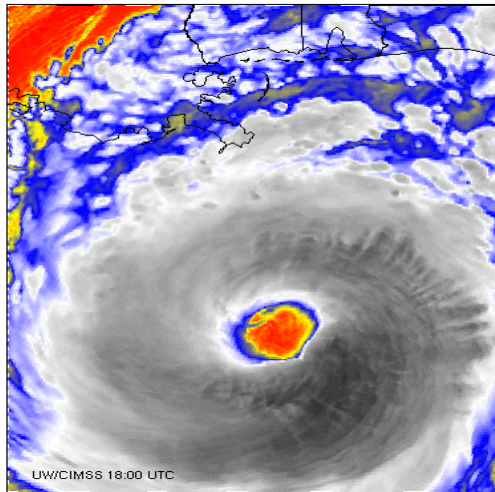


Enhance the weather monitoring with GK-2A

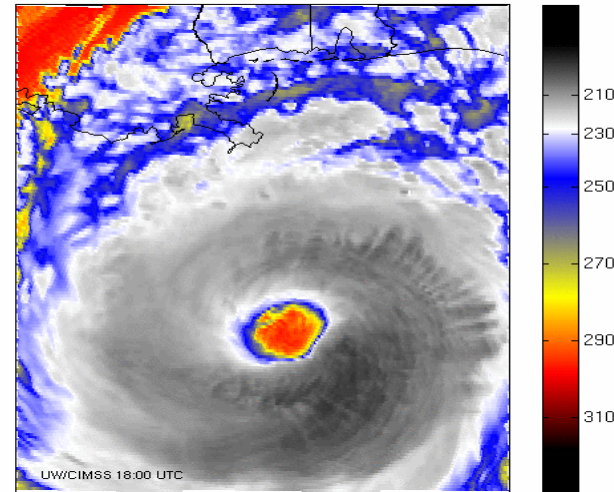
- ◆ Better detection of small-scale events and typhoons



ABI band 14 (11.2 μm) BT (K) 2005-08-28



GOES-12 band 4 (10.7 μm) BT (K) 2005-08-28



Geo-KOMPSAT-2A

10

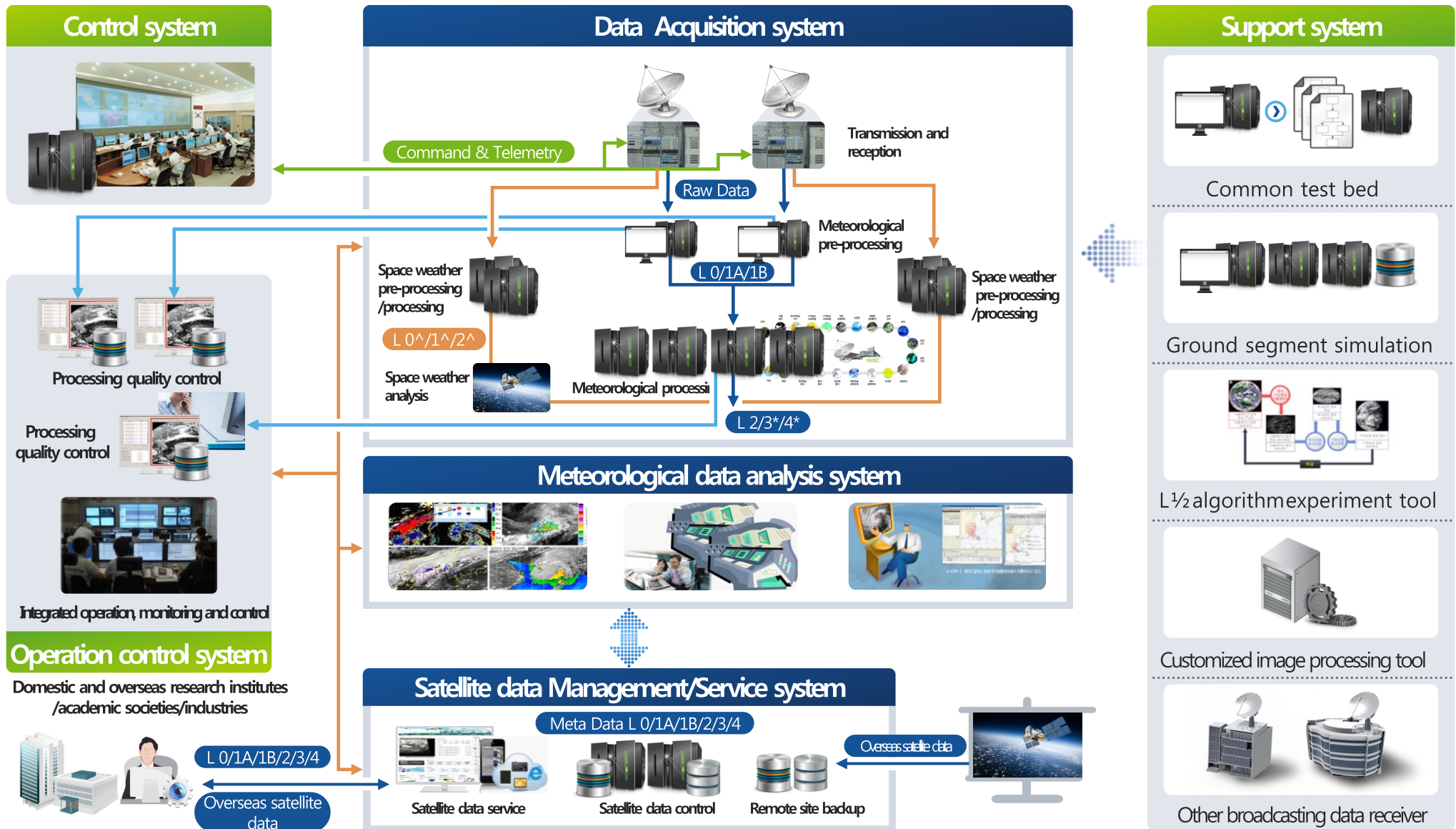
COMS

II

Ground Segment of the GK-2A Satellite

Ground Segment System

04 ▶ Functional Structure of the Ground Segment System



07 ▶ Operation System of the Ground Segment System



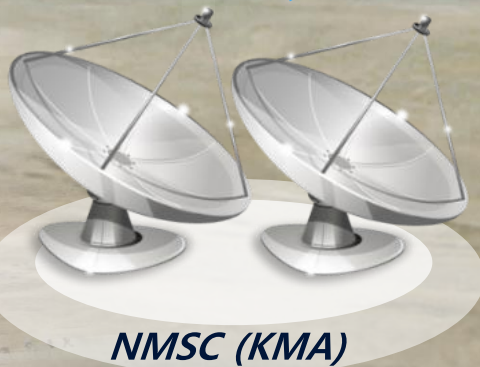
- L-band : Low speed/high speed meteorological broadcasting
- X-band : Super-high speed meteorological broadcasting

◀ **Satellite Broadcasting Service**



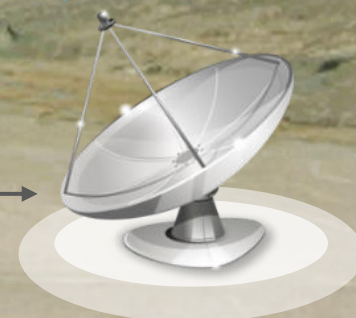
Transmit
(Ground Segment System → Satellite) :
S-band low speed/high speed/super-high speed meteorological
Receive
(Satellite → Ground Segment System) :
X-band - Meteorological observation data

Internet Service



Duplexing Backup

Exclusive Line



Triplexing Backup

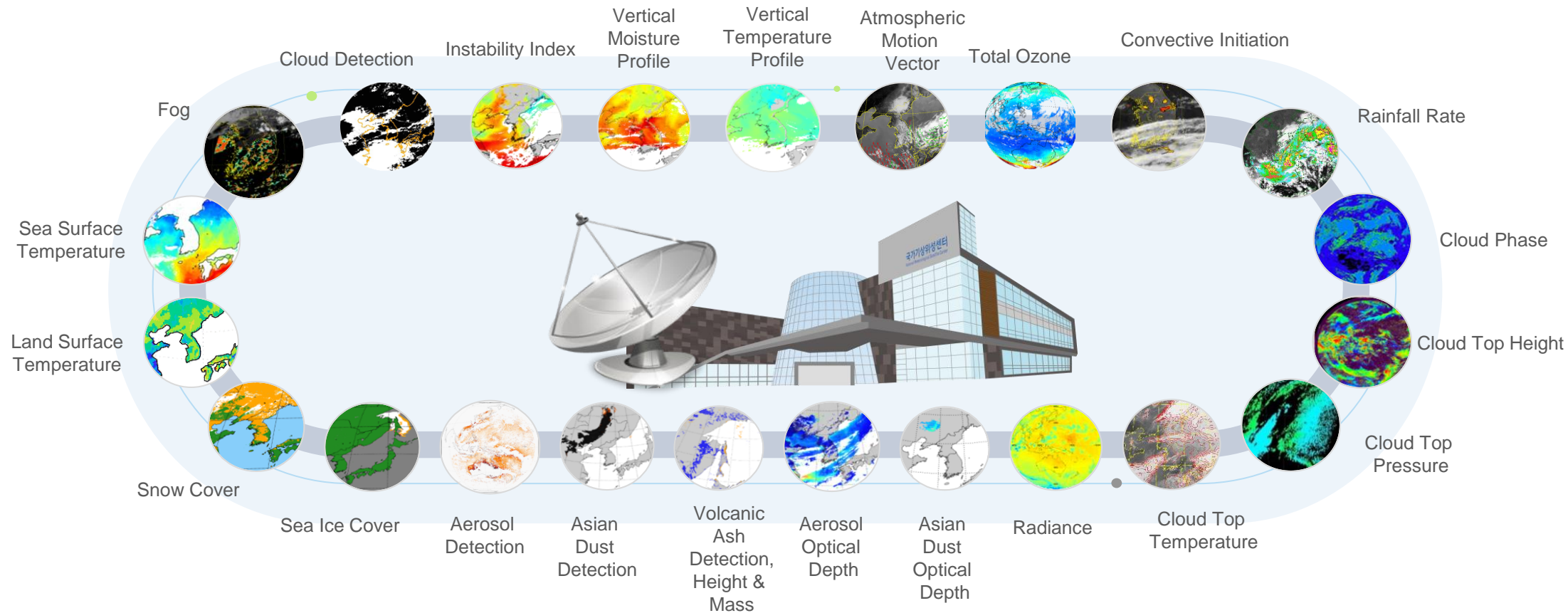
III

Ground Segment of the GK-2A Satellite

Meteorological Algorithm

GK-2A/AMI Geophysical Products

Primary Products



Secondary Products

- Fire Detection
- Vegetation Index
- Vegetation Green Fraction
- Surface Emissivity
- Surface Albedo

- Snow Depth
- Ocean Current
- Cloud Type
- Cloud Amount
- Cloud Optical Depth

- Cloud Effective Radius
- Cloud Liquid Water Path
- Cloud Ice Water Path
- Cloud Layer/Height
- Probability of Rainfall

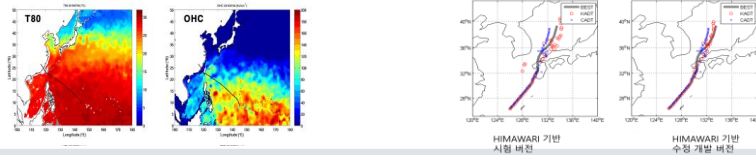
- Rainfall Potential
- Aerosol Particle Size
- Visibility
- Absorbed SW Radiation (SFC)
- Downward SW Radiation (SFC)

- Reflected SW Radiation (TOA)
- Downward LW Radiation (SFC)
- Upward LW Radiation (SFC)
- Upward LW Radiation (TOA)
- Aircraft Icing

- Overshooting Top Detection
- SO2 Detection
- Total Precipitable Water
- Clear Sky Turbulence

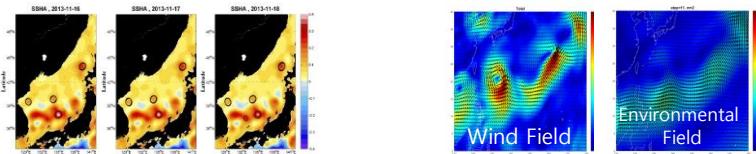
02 ▶ Meteorological Algorithm Application Technology

Typhoon/Ocean



Estimating the intensity change of tropical cyclone

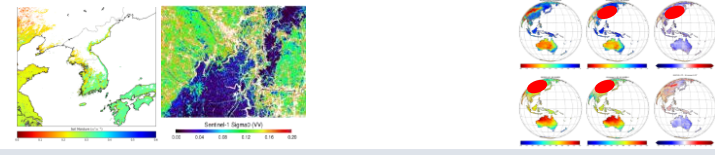
Objective and automatic technique to analyze tropical cyclone (TC) information



Satellite-based ocean environment monitoring and analysis

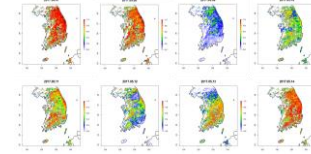
Sea surface wind and 3-D wind field analysis

Hydrology/Environment



Soil moisture & flood

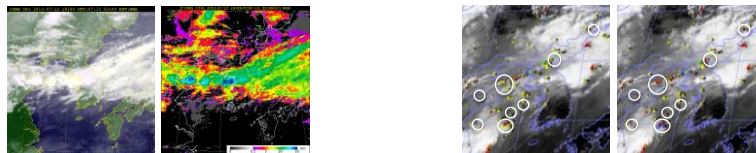
Drought



Forest Fire

Blending, Downscaling, Validation Strategy

Nowcasting



Satellite-based objective cloud analysis

Convective cloud life cycle monitoring and analysis



Multi-satellite sensor precipitation merging and analysis

Improvement of meteorological satellite forecasting production technology

Climate/Environment



Climate change and environmental meteorological monitoring plan

Environmental Meteorological monitoring and analysis technology development plan



Dust (peak height/concentration)

Research on satellite data utilization technology for environmental meteorological prediction model

04 ▶ Space Weather Algorithm

Korea's first space weather observation data processing

Data Processing

- Development of Hybrid* prediction algorithm
- Analysis of space weather by using the KSEM output and ancillary data
- 5 types of space weather outputs

Hybrid: Prediction algorithm that combines empirical formula derived from historical data with artificial neural network



Magnetospheric high energy particle distribution

Geostationary particle distribution

Spacecraft charging index



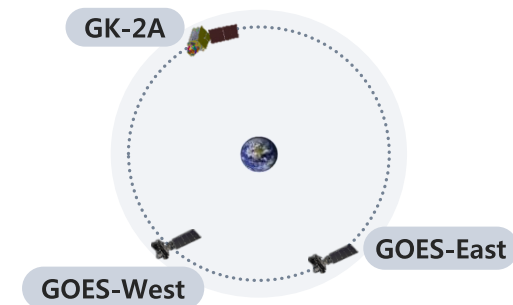
Dst index



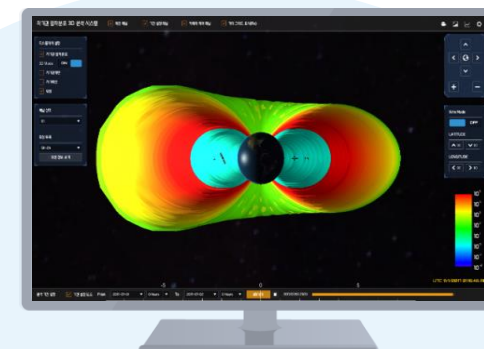
Kp index

Data Application

- Improvement of the algorithm performance using multi-satellite data



- Analysis of 3-dimensional magnetospheric particle distribution via the algorithm output



IV

Ground Segment of the GK-2A Satellite

Satellite Data Service

01 ▶ Overview of Satellite Data Service

WEB-based (Internet & Intranet) satellite data service



- Internet service of satellite meteorological data
- Intranet service of searching and displaying satellite meteorological data images

Weather broadcasting Service



- Large-scale broadcast receiver (LDUS)
- Medium-scale broadcasting receiver (MDUS)
- Small-scale broadcasting receiver (SDUS)

Meteorological satellite data user support service



- Support for editing and analysis of meteorological satellite data on PC (Windows & Linux environment)

Internet Service of Satellite Meteorological Data(real time)

Format	Observation Area	Notes
NetCDF	Full disk	<ul style="list-style-type: none">- Interval : 10 min.- 16 bands(VIS: 0.5-1 km, IR : 2 km)- Approx. 2.25 GB / 10 min.

- GK2A level 1B data will be provided by FTP in real-time.
- Real time service is very similar to the Himawari Cloud.
- Basically one download per one nation.
- Account registration is required.
- High speed Internet access is required. (31 Mbps)

Accessing information to GK-2A RFS

1) Protocol: FTP

2) URL: IP(210.125.45.78) or domain PORT 21

3) Authentication method:

- Log-in with ID and password which are issued by KMA
- Multiple accesses with one account are not allowed

4) Hierarchical Structure of the top page

- Home directory : /SAT

- Data directory : /SAT/GK2A/AMI/L1B/FD/YYYYMM/DD/HH

※ Date and hour directory is categorized based on observation start time in UTC

/YYYYMM : Year(4 digits) Month(01~12)

/DD : day(01~31)

/HH : hour(00~23)

- The latest 7 days data are available on RFS, so the files uploaded 7 days(168 hours) ago are removed on every 00:00 UTC.

```
257 "/SAT/GK2A/AMI/L1B/FD/201905/13/04" is the current directory
ftp> ls
200 PORT command successful
150 Opening ASCII mode data connection for file list
gk2a_ami_le1b_nr016_fd020ge_201905130400.nc
gk2a_ami_le1b_vi006_fd005ge_201905130420.nc
gk2a_ami_le1b_ir096_fd020ge_201905130430.nc
gk2a_ami_le1b_ir096_fd020ge_201905130410.nc
gk2a_ami_le1b_ir087_fd020ge_201905130420.nc
gk2a_ami_le1b_vi006_fd005ge_201905130410.nc
gk2a_ami_le1b_vi005_fd010ge_201905130410.nc
gk2a_ami_le1b_vi008_fd010ge_201905130400.nc
gk2a_ami_le1b_nr013_fd020ge_201905130400.nc
gk2a_ami_le1b_nr016_fd020ge_201905130420.nc
gk2a_ami_le1b_nr013_fd020ge_201905130430.nc
gk2a_ami_le1b_ir096_fd020ge_201905130420.nc
gk2a_ami_le1b_ir105_fd020ge_201905130420.nc
gk2a_ami_le1b_sw038_fd020ge_201905130410.nc
gk2a_ami_le1b_ir087_fd020ge_201905130410.nc
gk2a_ami_le1b_ir133_fd020ge_201905130430.nc
gk2a_ami_le1b_sw038_fd020ge_201905130400.nc
gk2a_ami_le1b_vi005_fd010ge_201905130420.nc
gk2a_ami_le1b_wv063_fd020ge_201905130410.nc
gk2a_ami_le1b_ir123_fd020ge_201905130430.nc
gk2a_ami_le1b_ir105_fd020ge_201905130430.nc
```


Level 1B header structure and effective bit numbers

- GK2A level 1B and level 2 data are generated in netCDF format.
- Level 1B netCDF file contains pixel values, general information, radiometric, geometric correction information, etc.
- Each pixel has 16 bits (include 2 bit quality flag)

L1 Data Header Structure

General Information

Output Information

Pixel File Information

Projection Information

Star Measurement Information

INR Characteristics Information

Image Geometry Quality Information using Star Measurements

Registered Image Information

Quality Area Image Information

< Level 1B data header structure >

Channels Utilized	Bits Remaining
VIS04_A047	11
VIS06_A064	12
VIS05_A086	11
NIR13_A138	12
VIS08_A161	13
NIR16_A225	11
IR38_A390	14
IR63_A618	12
IR69_A695	13
IR73_A734	13
IR87_A850	13
IR96_A961	13
IR105_A1035	13
IR112_A1120	13
IR123_A1230	13
IR133_A1330	13

< Level 1B data effective bit numbers for each channel >

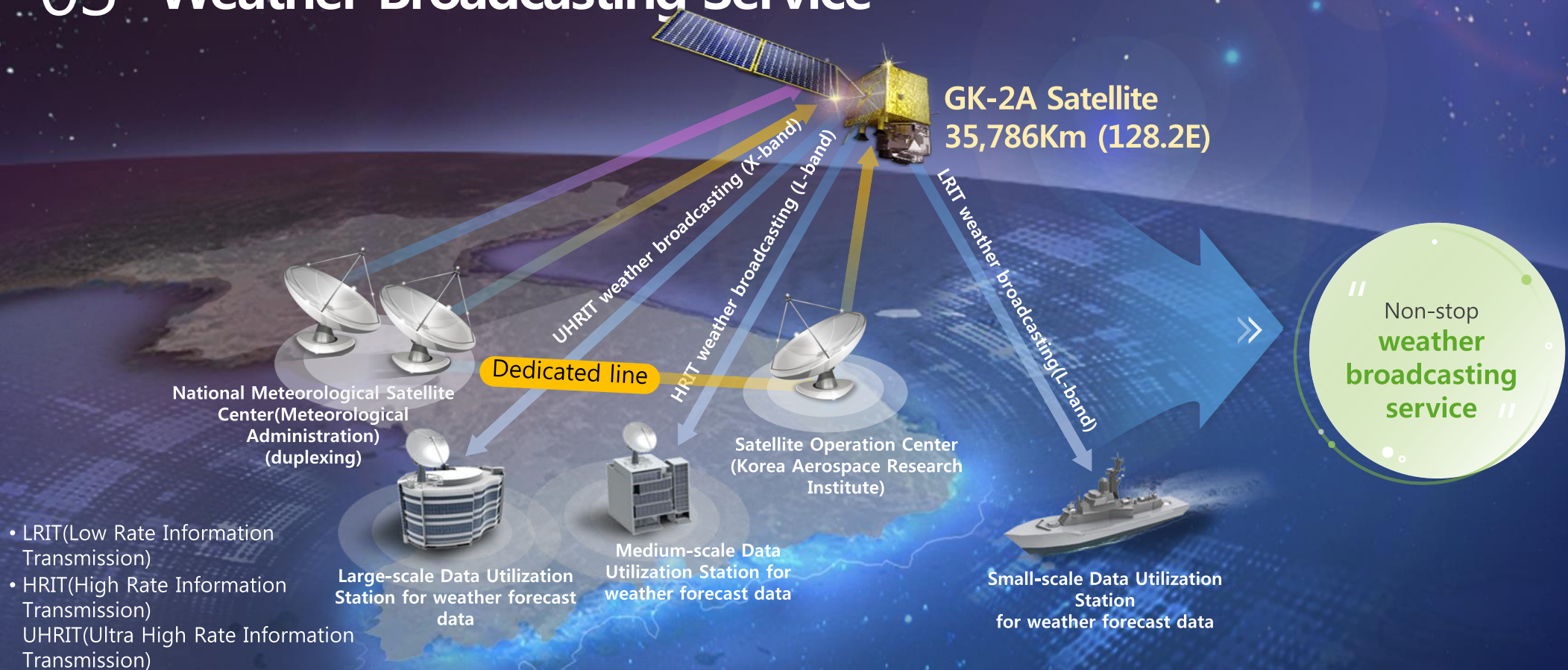
* The sample data and sample codes for reading data are available on NMSC website (<http://nmisc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=gk2aMicro>).

L1B file name description

gk2a_ami_le1b_BAND_scnRESge_yyyymmddhhnn.nc

Description						Example file	Resolution	Size	Channel No.	
BAND	Channel & Wavelength	Vis	vi004	WV	ww063	gk2a_ami_le1b_vi004_fd010ge_201903010900.nc	1km	11000 x 11000	CH1	
			vi005		ww069	gk2a_ami_le1b_vi005_fd010ge_201903010910.nc	1km	11000 x 11000	CH2	
			vi006		ww073	gk2a_ami_le1b_vi006_fd005ge_201903010920.nc	0.5km	22000 x 22000	CH3	
		NIR	vi008	IR	ir087	gk2a_ami_le1b_vi008_fd010ge_201903010930.nc	1km	11000 x 11000	CH4	
			nr013		ir096	gk2a_ami_le1b_nr013_fd020ge_201903010940.nc	2km	5500 x 5500	CH5	
			nr016		ir105	gk2a_ami_le1b_nr016_fd020ge_201903010950.nc	2km	5500 x 5500	CH6	
		SWIR	sw038		ir112	gk2a_ami_le1b_sw038_fd020ge_201903011000.nc	2km	5500 x 5500	CH7	
					ir123	gk2a_ami_le1b_ww063_fd020ge_201903011100.nc	2km	5500 x 5500	CH8	
					ir133	gk2a_ami_le1b_ww069_fd020ge_201903011200.nc	2km	5500 x 5500	CH9	
						gk2a_ami_le1b_ww073_fd020ge_201903011300.nc	2km	5500 x 5500	CH10	
		gk2a_ami_le1b_ir087_fd020ge_201903011400.nc	2km	5500 x 5500	CH11					
		gk2a_ami_le1b_ir096_fd020ge_201903011500.nc	2km	5500 x 5500	CH12					
		gk2a_ami_le1b_ir105_fd020ge_201903011600.nc	2km	5500 x 5500	CH13					
		gk2a_ami_le1b_ir112_fd020ge_201903011700.nc	2km	5500 x 5500	CH14					
		gk2a_ami_le1b_ir123_fd020ge_201903011800.nc	2km	5500 x 5500	CH15					
		gk2a_ami_le1b_ir133_fd020ge_201903011900.nc	2km	5500 x 5500	CH16					
scn	Observation Area - fd : full disk - ela : extended local area - la: local area									
RES	Spatial Resolution - 005: 0.5km - 010: 1km - 020: 2km									
ge	GEOS projection									
yyyy	YEAR									
mm	Month (01 - 12)									
dd	Day (01 - 31)									
hh	Hour (00 - 23)									
nn	Minute (00 – 59)									

03 Weather Broadcasting Service



1. Large-scale Data Utilization Station(LDUS)

- **UHRIT broadcasting**(high resolution Level 1B) **reception**
- Utilization of commercial DVB-S2 receiver
- Weighted/synthetic image display

2. Medium-scale Data Utilization Station(MDUS)

- **HRIT broadcasting reception**
- Application of SDR (SW demodulation/decoding) technology
- Backward compatibility with COMS broadcasting receivers

3. Small-scale Data Utilization Station(SDUS)

- **LRIT broadcasting reception**
- Application of SDR (SW demodulation/decoding) technology
- Building the low-cost system (application of omni-directional antenna)

03 ▶ Weather Broadcasting Service

The meteorological broadcasting service for **large-scale broadcast receivers** **provides** all channel data of the same resolution observed from the **COMS-2A**

1 UHRIT Service

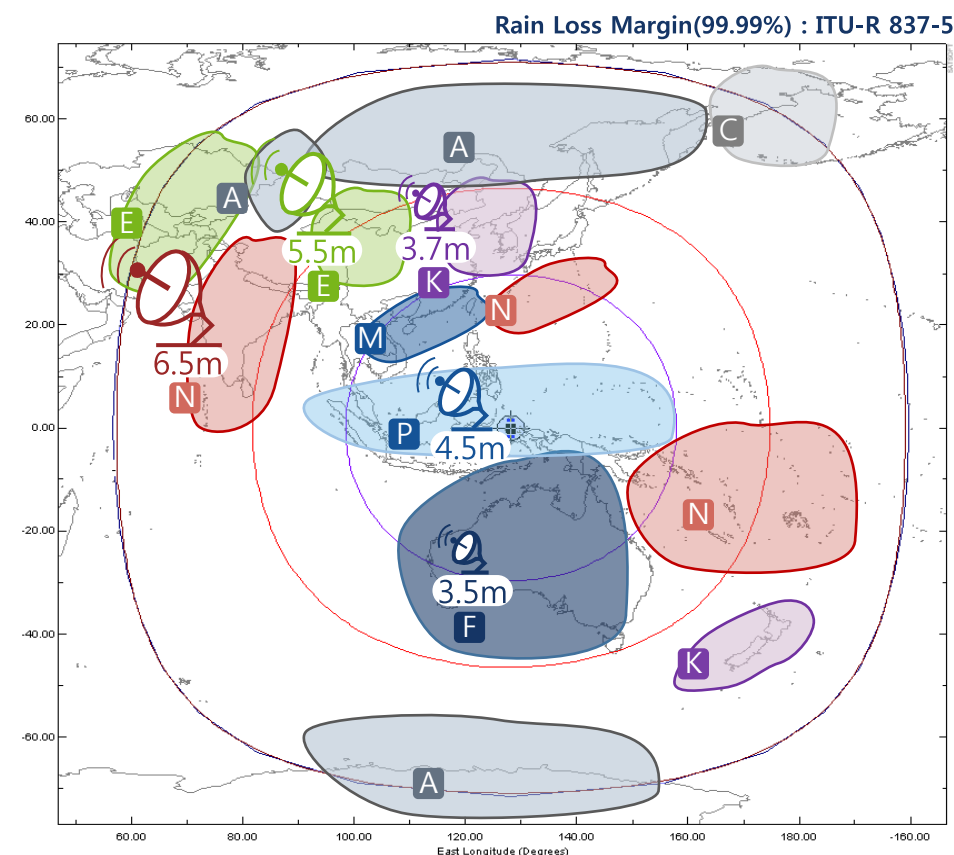
- Frequency Band: X-band
- Transmission Rate: 31Mbps
- Broadcasting Information: 16 High-resolution Channels
Level 1B Data and Image Data of Level2 Products

※ Provide the same resolution data as the observation data
(VIS 0.5km, 1km, IR 2km)

Large-scale Data Utilization Station(LDUS)

- Main Function: Reception of UHRIT Broadcasting, Displaying and Management of Received Data, and Composite/Enhanced Image Generation/Displaying
- Configuration: Antenna/LNB, DVB-S2 Receiver, and Receiving Server
- ❖ **Main Features:** Available for Weather Forecast and Research in Countries without Geostationary Meteorological Satellite

Size of antenna that can receive data transmissions by region



03 ▶ Weather Broadcasting Service

Medium-sized broadcast receivers will remain the same as existing **COMS terrestrial broadcasting services**, while existing COMS-1 receiver will provide **backward compatibility**

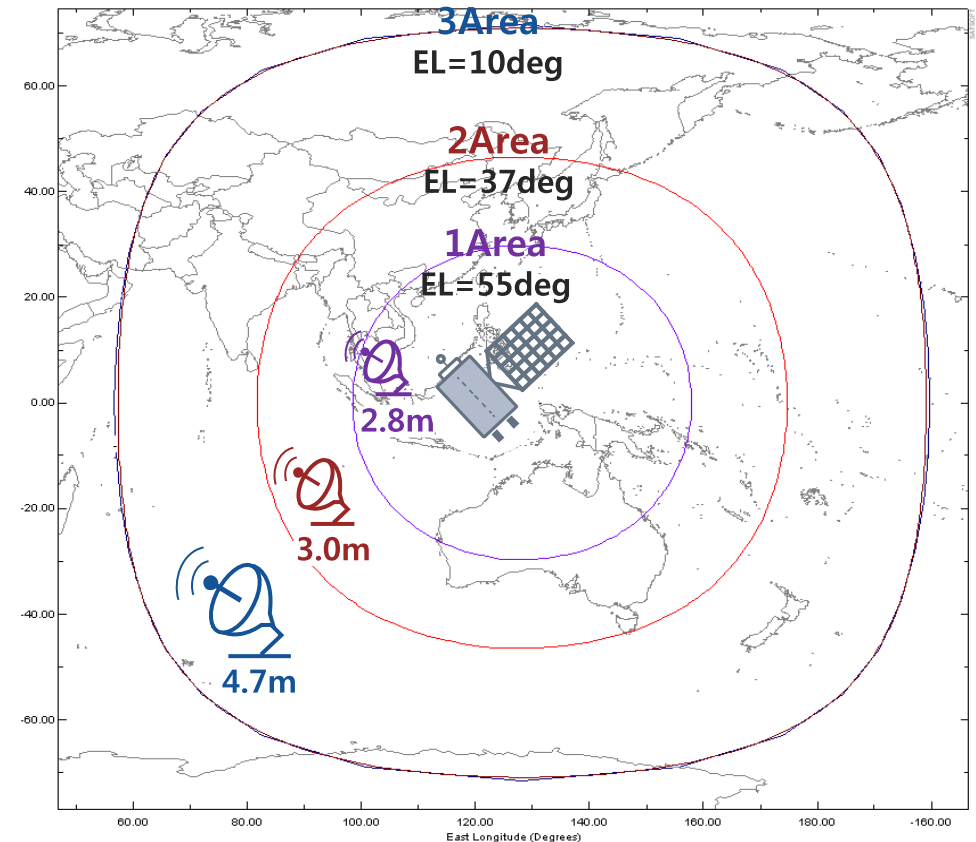
2 HRIT Service

- Frequency Band: L-band
- Transmission Rate: 3Mbps
- Broadcasting Information: 5 Downscaled-channels
Level 1B Data and GOCI II Image Data
- ※ Providing service with the same specification as COMS Satellite HRIT service(frequency, Information transfer rate, and transmission specification, etc.)

Medium-scale Data Utilization Station(MDUS)

- Main Function: Reception of HRIT Broadcasting, Displaying and Management of Received Data
- Configuration: Antenna/LNB, A/D Converter, and Receiving Workstation
- ❖ **Main Features:** Implementing demodulator/decoder with S/W (adopting SDR concept)

Size of antenna by area



03 ▶ Weather Broadcasting Service

Small-sized broadcasting receiver is a low-priced terminal which can be easily installed on a ship, and provides service for a extensive area, **thereby expanding the weather territory**

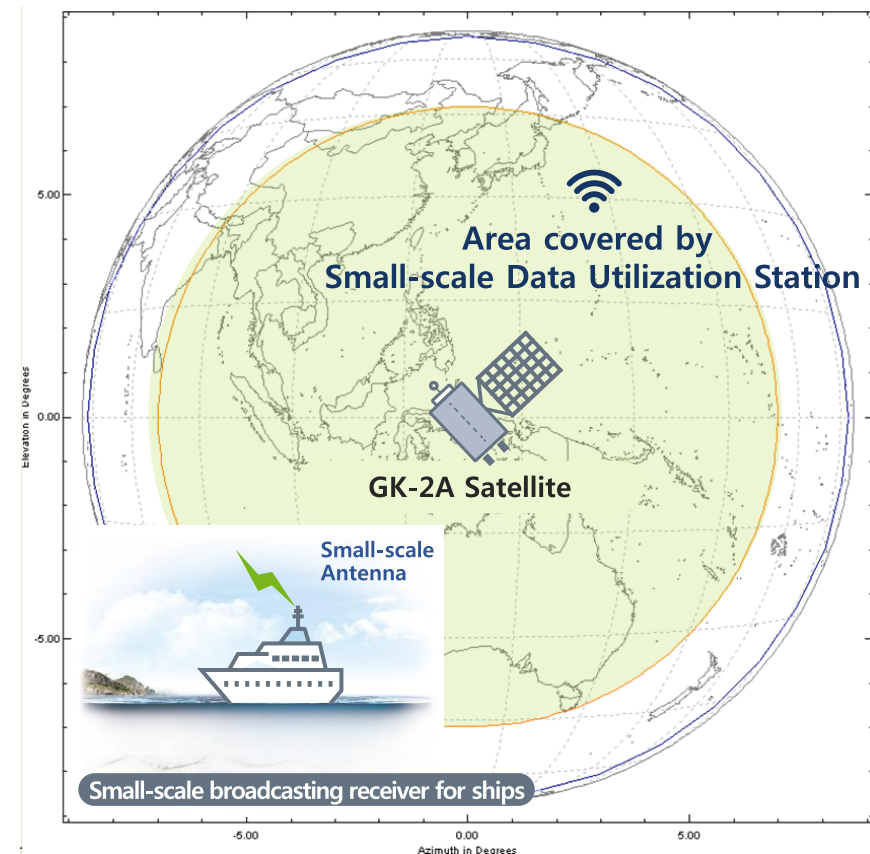
3 LRIT Service

- Frequency Band: L-band
 - Transmission Rate: $\geq 8\text{kbps}$
 - Broadcasting Information: Weather FAX replaceable Image and Text(Satellite Image, Weather Information, and Daily Climate Map, etc.)
- ※ Providing service with the same specification as COMS Satellite LRIT service(frequency, Information transfer rate, and transmission specification, etc.) (Difference at Transmission Rate)

Small-scale Data Utilization Station(SDUS)

- Main Function: Reception of LRIT Broadcasting, Displaying and Management of Received Data
 - Configuration: Small Antenna/LNB, A/D Converter, and Mini-PC
 - Implementing demodulator/decoder with S/W (adopting SDR concept)
 - Providing Service through Personal Smartphone
- ❖ **Main Features:** Low-cost terminal easy to install even in small ship and COMS SDUS H/W Recyclable

The area covered by weather broadcasting service with Small-scale Data Utilization Station

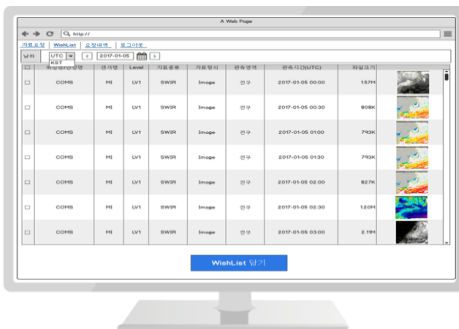


02 ▶ Internet Service of Satellite Meteorological Data

Various satellite **meteorological data services** (such as searching, displaying, or downloading) can be provided **on the website of the National Meteorological Satellite Center**.

Customized satellite data service allowing the users to select a kind of satellite, area, data type, period, and data format

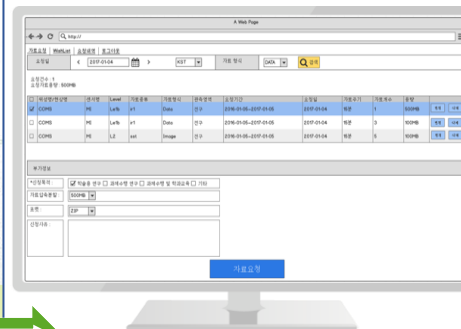
Display of the search list of satellite meteorological data



Satellite, area, data type, and period selected by user

01

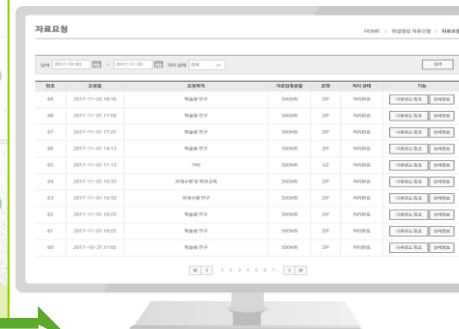
Shopping Cart



Add data to the shopping cart, select data format, and request final order

02

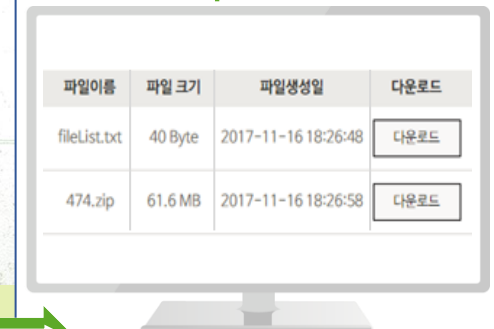
Status is displayed, such as "Being Prepared" or "Download Possible"



Preparation status to be able to download satellite meteorological data

03

HTTP download service is provided



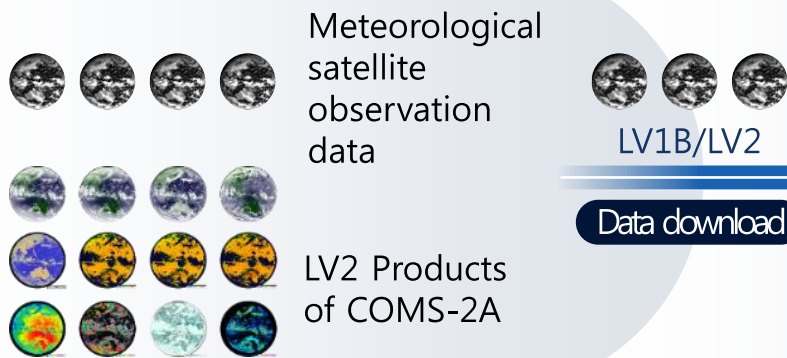
Download of Satellite meteorological data

04

Provide Image Processing Tool for GK-2A

- **Support is provided for utilization of weather satellite data** on personal PC (Windows/Linux environments)
- “Customized image processing tool” will be provided to improve the application of GK-2A satellite data.

External system



LV1B/LV2

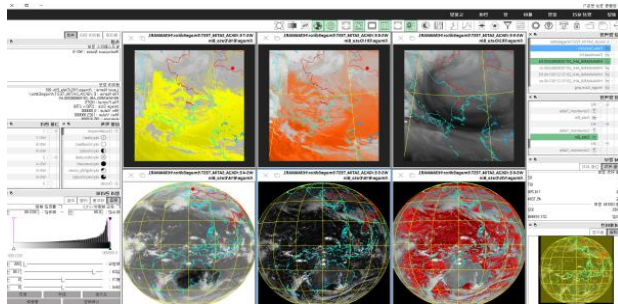
Data download

Personal computers (PCs)

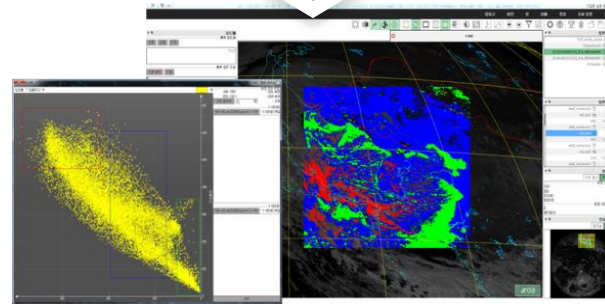
Customized image processing tool

Features of customized image processing tool

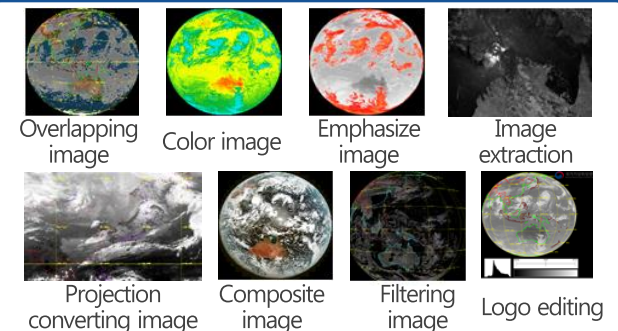
- 1 Intuitive GUI for general users
- 2 Unrestrained weather image editing and analysis
- 3 Automatic process of image edition, according to user scenario
- 4 Supports Map Projection Transitions for Satellite Data
- 5 Meteorological satellite data format conversion
- 6 Compatible with Windows/Linux environments



Meteorological image edition



Map Projection Transitions



Automatic production of edited images

[Plan] GK-2A Level 2 image website over RA-II Area

- **GK-2A level 2 products** such as RI(Rainfall Intensity) will be displayed on Website of **GK-2A Products Service for East Asia Countries** (Y2020)

[Example] International NWP Service for Global Community

International NWP Service
for Global Community

Korea Meteorological Administration

SWFDP-SeA	SWFDP-CA	RA II	AFRICA
Severe Weather forecasting Demonstration Project for Southeast Asia	Severe Weather forecasting Demonstration Project for Central Asia	Pilot Project on Numerical Weather Prediction (NWP) support to National Meteorological and Hydrological Services (NMHSs) in Regional Association II	Partnership between the KMA & East-Africa

World Friend KOREA

INTRODUCTION HOME

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SWFDP-SeA SWFDP-CA **RA II** AFRICA

Select Area 1 Weather chart Map, 6hr Acc-Prec. 2019.02.25.12 +00H 2019.02.25.12 UTC HELP

36hours ago 24hours ago 12hours ago **NOW** 12hours later 24hours later 36hours later

MSL(Pa) and Accum. Precipitation(mm) [-03 - 000] UMN1280 L70(KMA)

VALID : 12UTC 25 FEB 2019(+ 00h) TIME : 12UTC 25 FEB 2019

> Q&A > What's new > Information > Links

Model Description

KMA JMA HMD KOICA

61-16-GIL YEOUIDAEBANG-RO DONGJAK-GU SEOUL 156-720 REPUBLIC OF KOREA
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Thank you