Current Status of Geo-KOMPSAT-2A & Meteorological Products Development

May 2017

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National Meteorological Satellite Center, KMA

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- Status of GK-2A Meteorological Products Development
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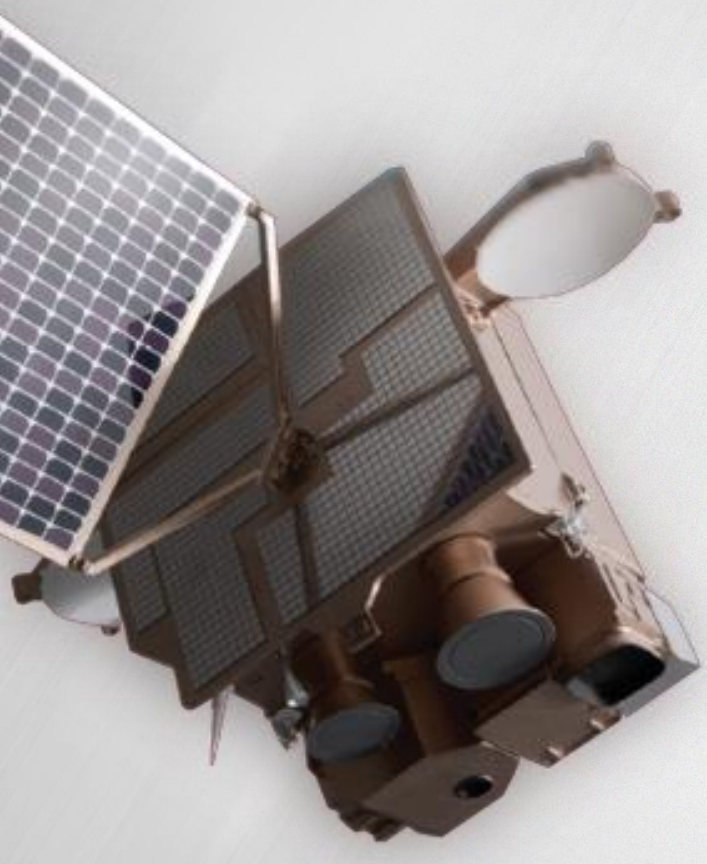


Overview of Geo-KOMPSAT-2A (GK-2A)

Geo-KOMPSAT-2 Program

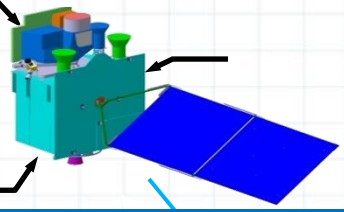
KMA

GK-2A with the next generation Imager and SWx monitoring sensors

➔ continuing and enhancing COMS' mission of sever weather monitoring and supporting other KMA's application

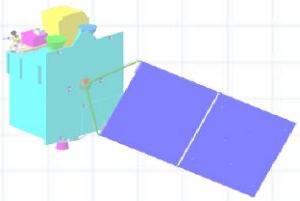
Meteorological Sensor

Space weather Sensor



Geo-KOMPSAT-2A

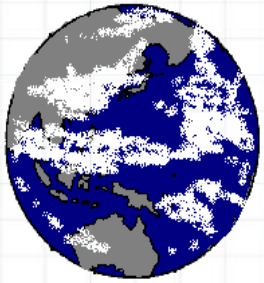
(May 2018)



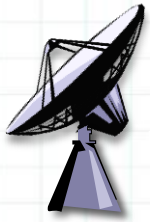
Geo-KOMPSAT-2B

(May 2019)

Ocean / Trace Gas



2012 ~ 2018 (7 years)



Ground Segment

Data Processing System

GK-2A Payloads

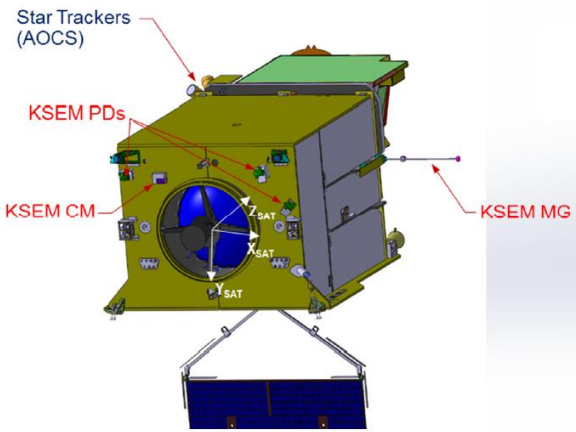
NMSC

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
★		2.25	2.3
	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 (2lkm)	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

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

2.3 μm : favorable for Land/cloud Properties

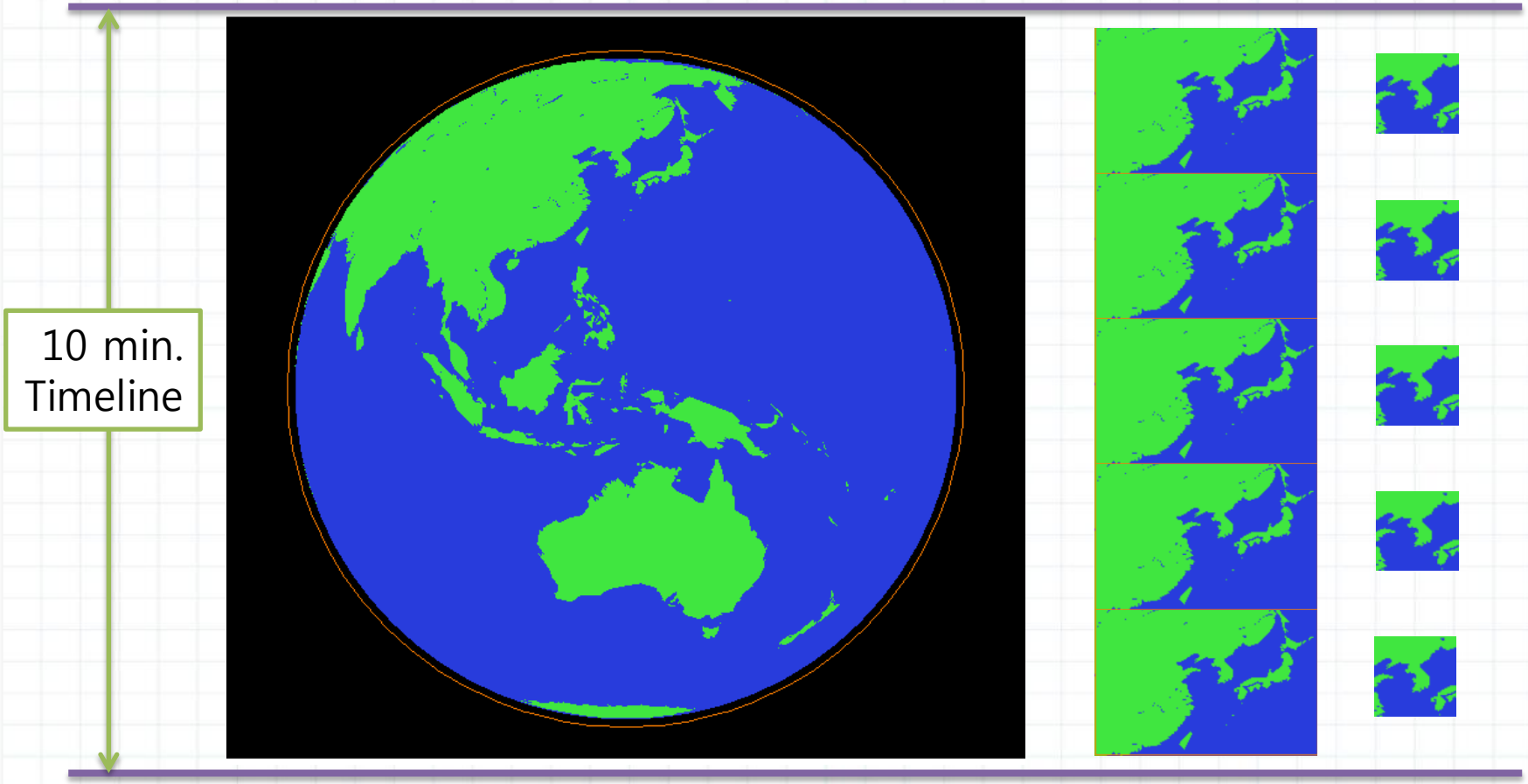


KSEM(Korea Space wEather Monitor)

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

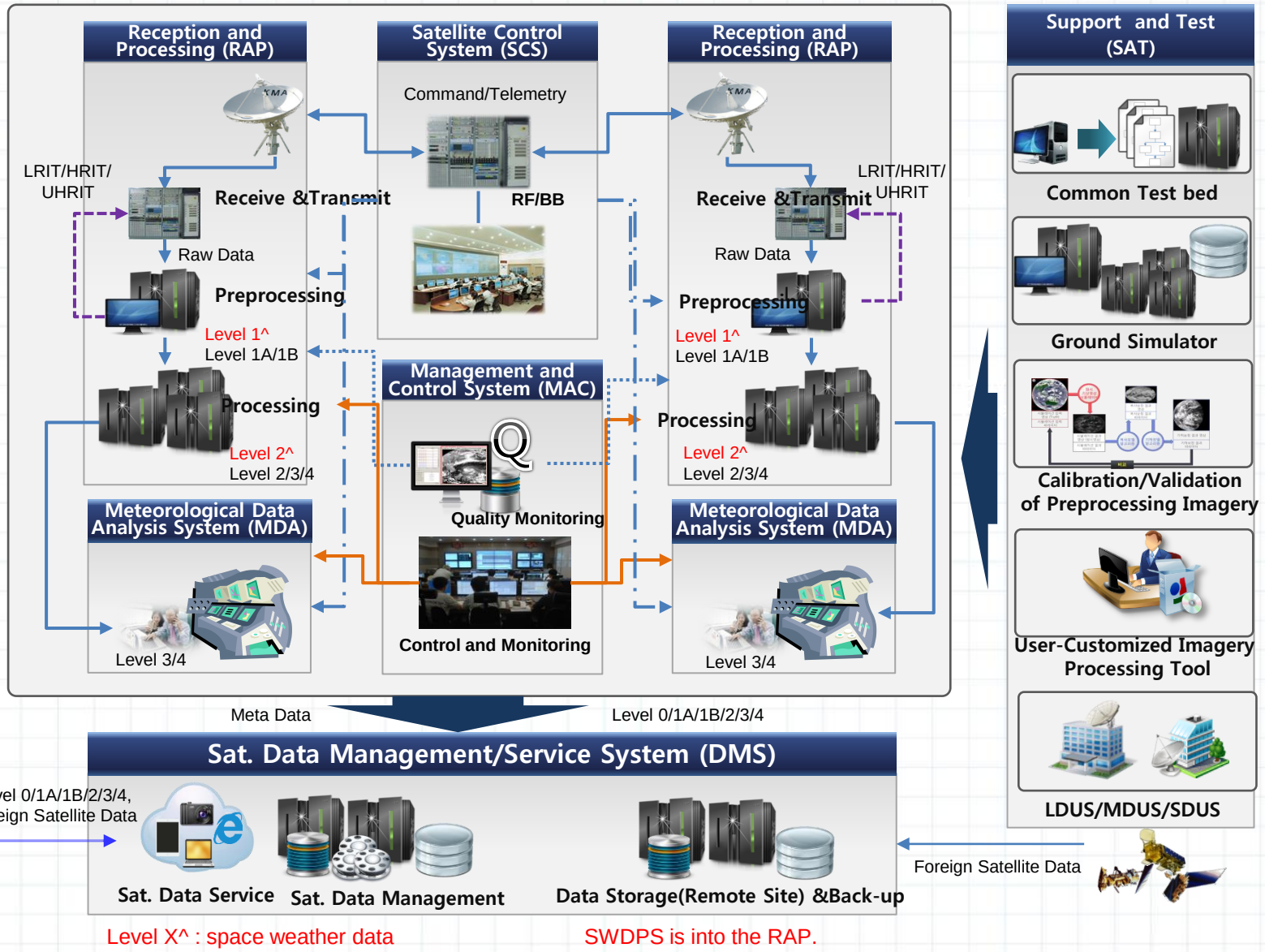
Observation Area and Schedule

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



Configuration of GK-2A Ground System

NMSC



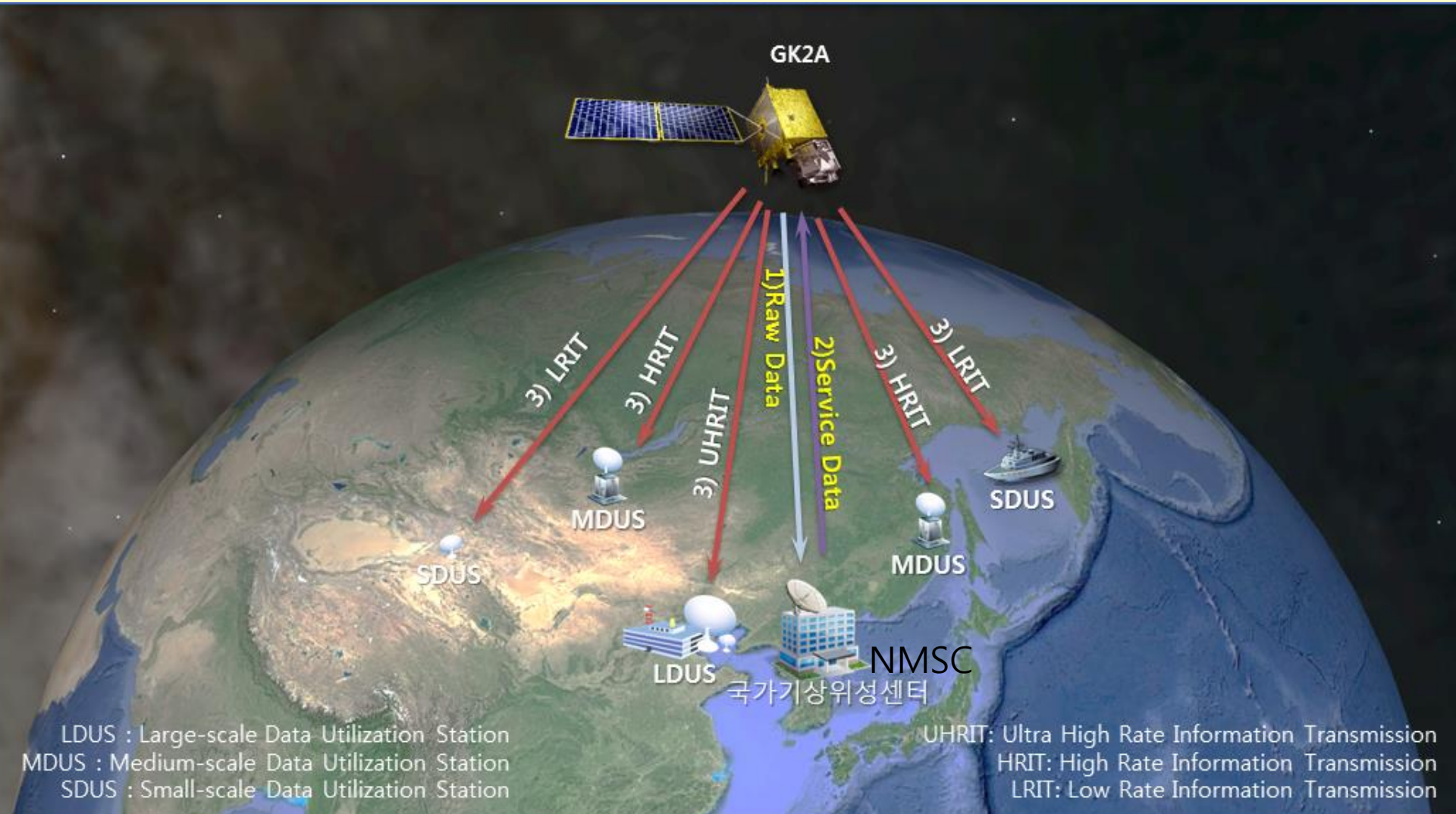
Data Service Plan : GK-2A

NMSC

Broadcasting Strategy

➔ "all data to every nations to want GK-2A data" promptly(within 3 min)

☞ Ultra HRIT(High Rate Information Transmission) with 31 Mbps and DVB-S2



Data Service Plan : GK-2A

NMSC

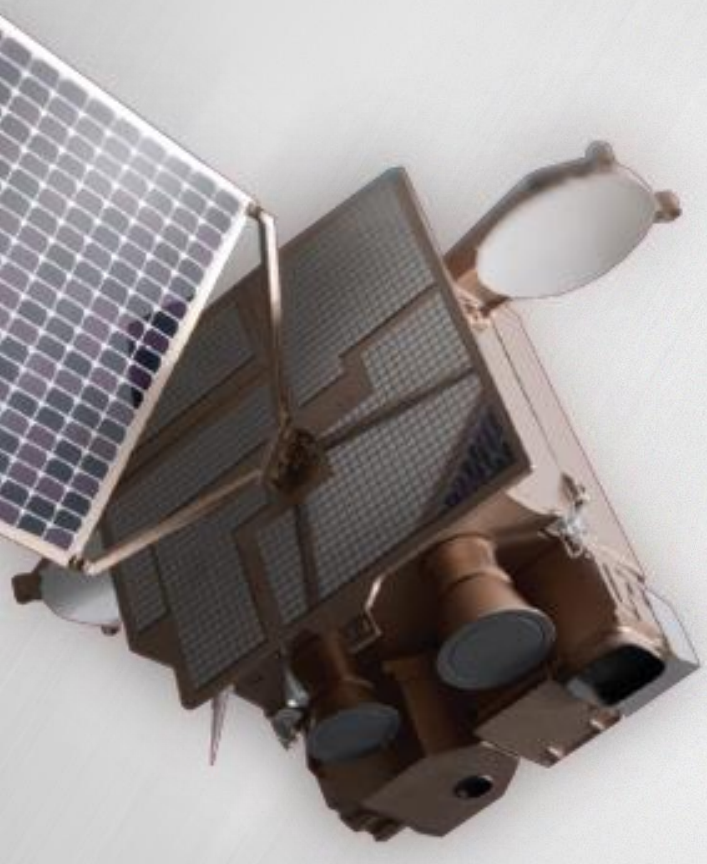
[Via GK-2A broadcast]

- **Broadcast all 16 channels data (UHRIT)** of meteorological observations
- Maintain **L/HRIT broadcast** corresponding to COMS five channels

Categories	UHRIT	COMS-like H/LRIT	
Service		HRIT	LRIT
Data Rate	≤ 31 Mbps	3 Mbps	~256 Kbps
Frequencies	Uplink : S-band Downlink : X-band	Uplink : S-band , Downlink : L-band * Same Frequencies band with COMS	
Data Type	**AMI Image(16 Ch.)** Alphanumeric text Encryption Key Message * Additional info could be added in the future	**AMI Image(5 Ch.)** Alphanumeric text Encryption Key Message GOCI-II products(TBD)	AMI Image (5 Ch.) Alphanumeric text Encryption Key Message Lv2 products GOCI-II image file
Mode	FD	FD	FD
Station	LDUS	MDUS	SDUS

[Via Landline]

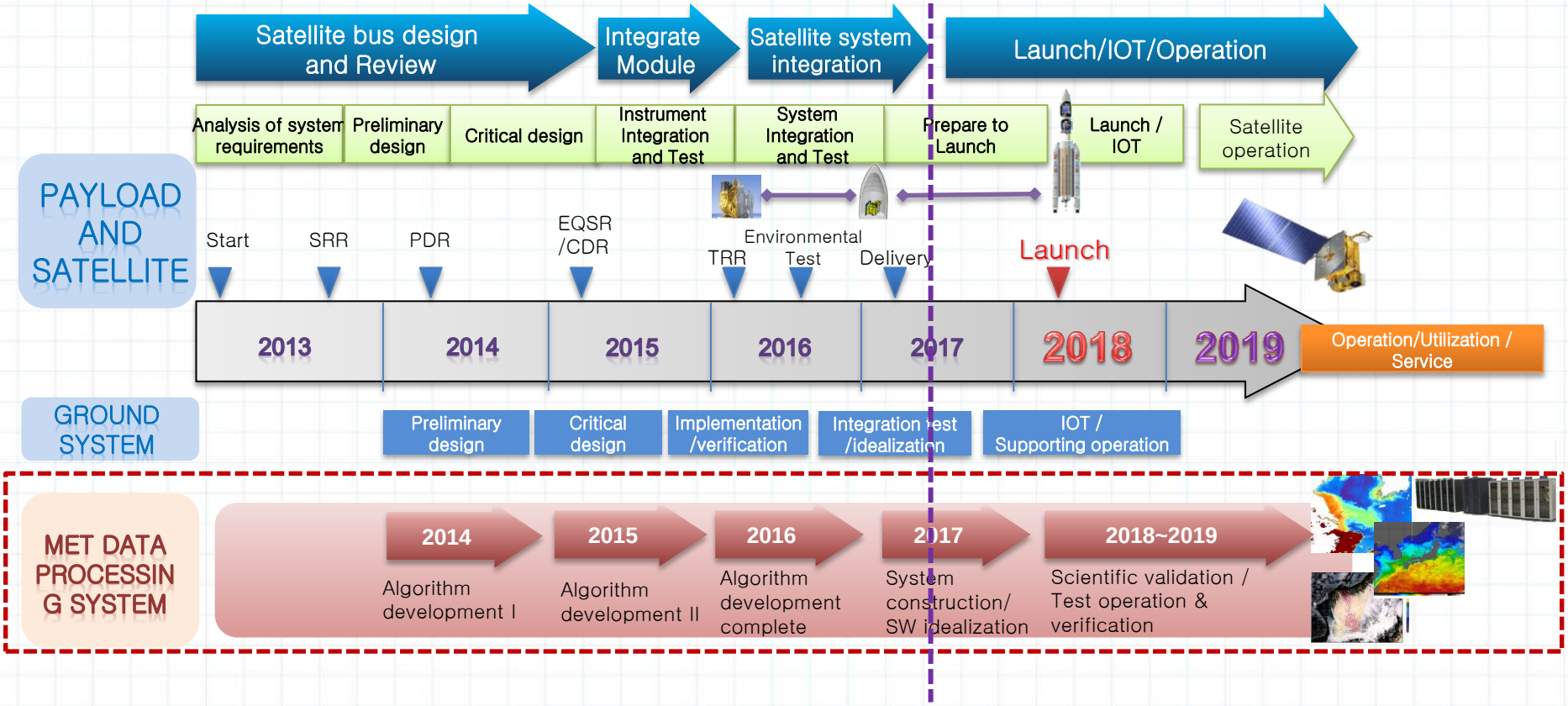
- Cloud service similar to Himawaricloud is under development (completed in 2018)
- Renovated web-based service system is under development (completed in 2018)
- GK-2A data also will be available in DCPC-NMSC (http://dcpc.nmsc.kma.go.kr)



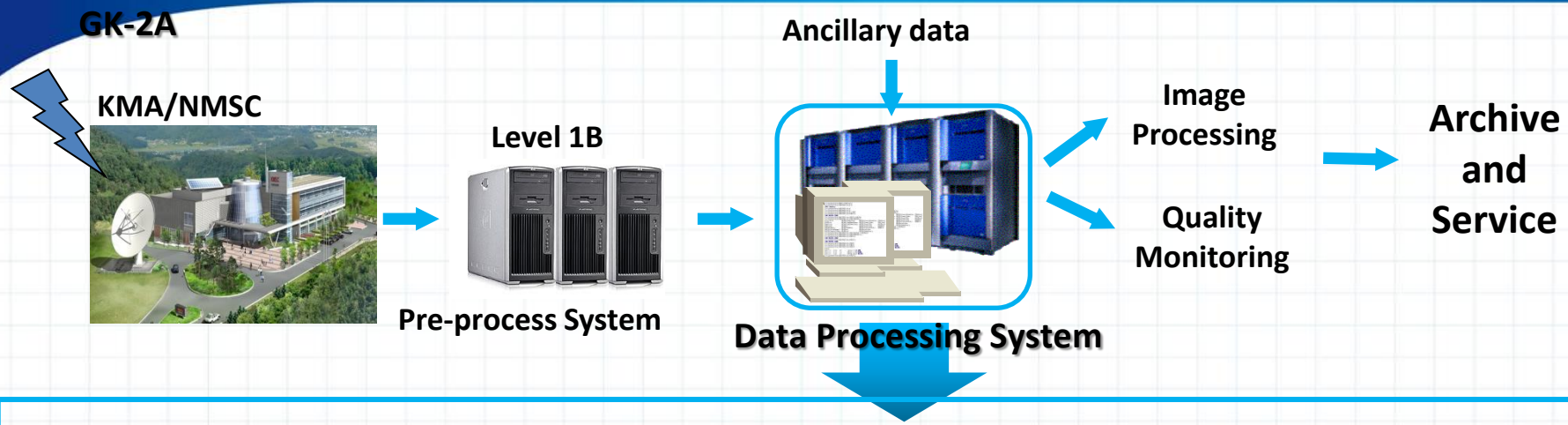
Status of GK-2A Meteorological Products Development

Milestone of GK-2A/AMI Algorithm Development

- Development of GK-2A meteorological products for applying weather forecast, NWP, climate monitoring was started in December 2014.
  - Prototype algorithms of 23 primary products completed
    - improve the algorithms using Himawari-8/AHI data
  - prototype algorithms of 29 secondary products will be finished in this year



Development of Meteorological Product



Processing Flow

Scene Analysis

Cloud Mask | Snow Cover | Sea Ice

Cloud

* All Sky

Scene / Surface	Cloud / Precipitation			Radiation / Aerosol	Atmosphere /Aviation	
FOG	CTT	CTP	CTH	RAD(CLD)	CI	TOZ (CLD)
	CP	CT	CA		AMV	AII
	COT	CER		VIS		
	LWP	IWP	CLH		VTP	VHP
	RR	PoR	RP		Icing	OT

Clear

Scene / Surface			Radiation / Aerosol			Atmosphere /Aviation		
SST	LST	OC	ADP	DADP	VAP	TOZ (CLR)	VTP	VHP
			AOD	DAOD	RAD (CLR)			
FF	VI	VF	AER	VIS	RSR	AII	SO2D	TPW
			DSR	ASR	DLR			
LSE	SAL	SD	ULR	OLR		TFTD		

Data processing system from receiving to broadcasting

➔ ~ 180 times data capacity (resolution 4 time X frequency 4 times X chs 3.2times X outputs 3.5times)

➔ process huge data "More speedily" with the advanced computer Tech

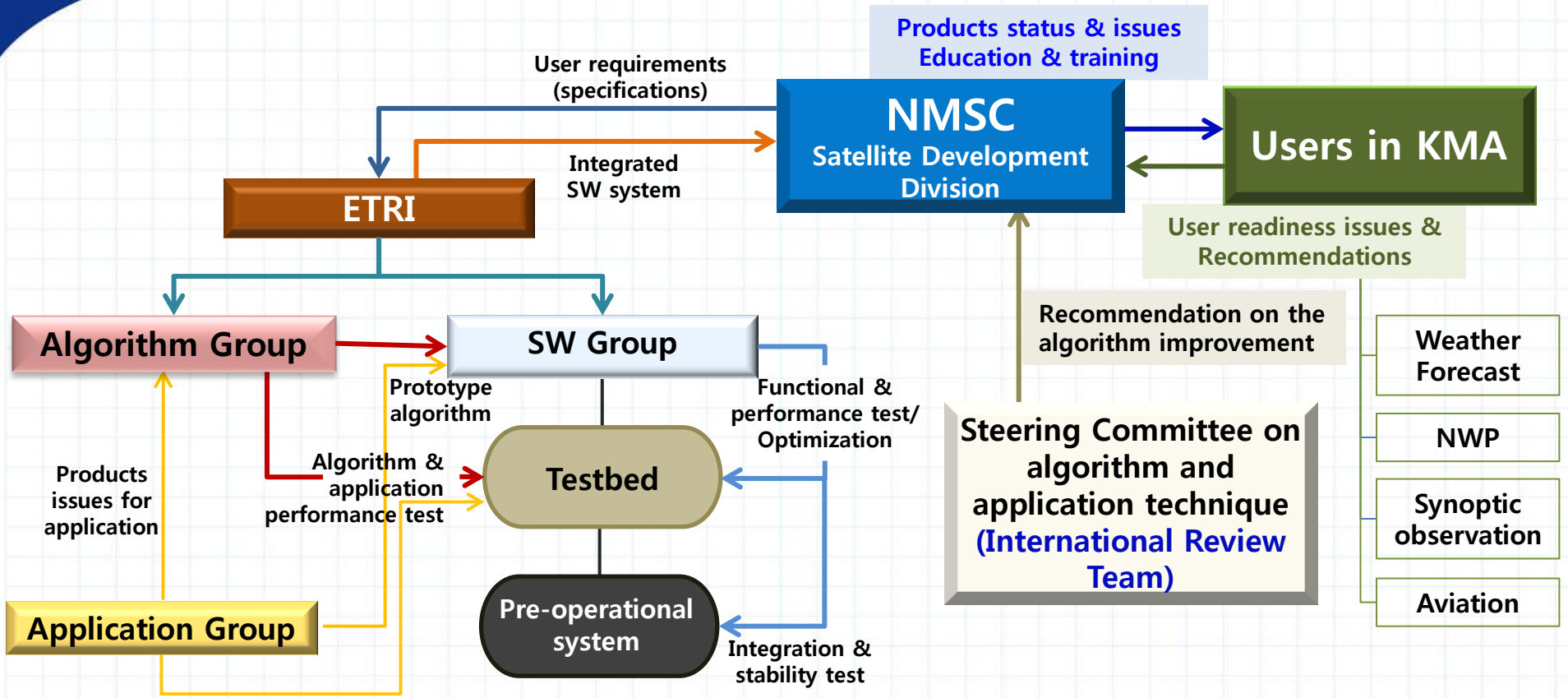
GK-2A/AMI Meteorological Products

KMA

	Scene & Surface Analysis (13)	Cloud & Precipitation (14)	Aerosol & Radiation (14)	Atmospheric condition & Aviation (11)
Primary Products (23)	Cloud detection	Cloud Top Temperature	Aerosol Detection	Atmospheric Motion Vector
	Snow Cover	Cloud Top Pressure	Aerosol Optical Depth	Vertical Temperature Profile
	Sea Ice Cover	Cloud Top Height	Asian Dust Detection	Vertical Moisture Profile
	Fog	Cloud Phase	Asian Dust Optical Depth	Instability Index
	Sea Surface Temperature	Rainfall Rate	Volcanic Ash Detection, Height & Mass	Convective Initiation
	Land Surface Temperature		Radiance	Total Ozone
Secondary Products (29)	Surface Emissivity	Cloud Type	Aerosol Particle Size	Total Precipitable Water
	Surface Albedo	Cloud Amount	Visibility	Clear Sky Turbulence
	Fire Detection	Cloud Optical Depth	Downward SW Radiation (SFC)	SO_2 Detection
	Vegetation Index	Cloud Effective Radius	Reflected SW Radiation (TOA)	Overshooting Top Detection
	Vegetation Green Fraction	Cloud Liquid Water Path	Absorbed SW Radiation (SFC)	Aircraft Icing
	Snow Depth	Cloud Ice Water Path	Upward LW Radiation (TOA)	
	Current	Cloud Layer/Height	Downward LW Radiation (SFC)	
		Rainfall Potential	Upward LW Radiation (SFC)	
		Probability of Rainfall		

GK-2A/AMI Level 2 Products development and user readiness process

KMA

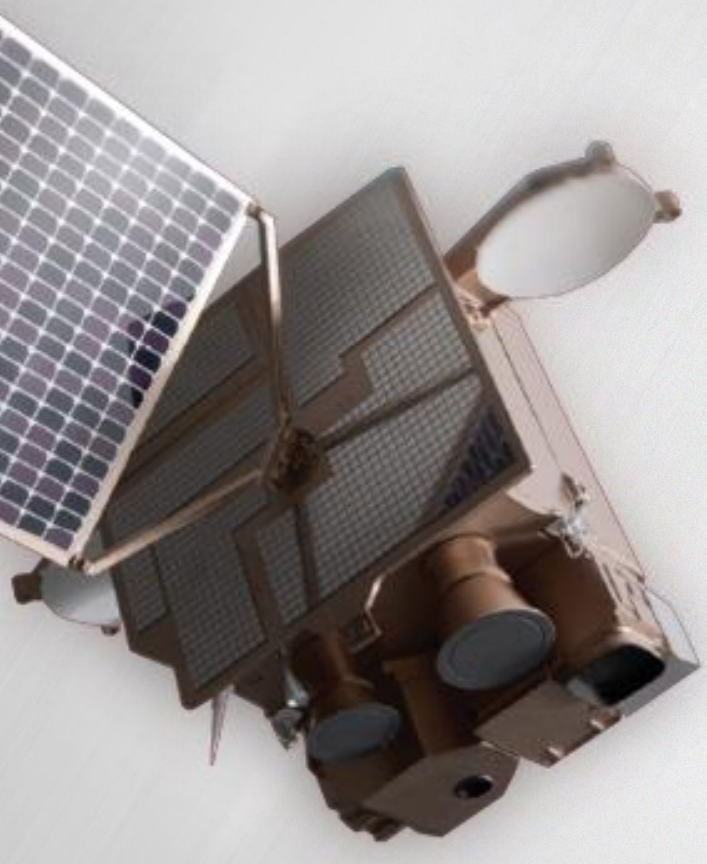


52 Meteorological algorithms('14~'18, about 12 billion won, **8 Universities**)

➔ "more accurate, consistent, reliable" algorithms suitable to East-Asia Region

☞ All developers use "Test-bed system" with large storage to share the codes and data.

ETRI: Electronics and Telecommunications Research Institute



Activities of Algorithm Review and Products Validation

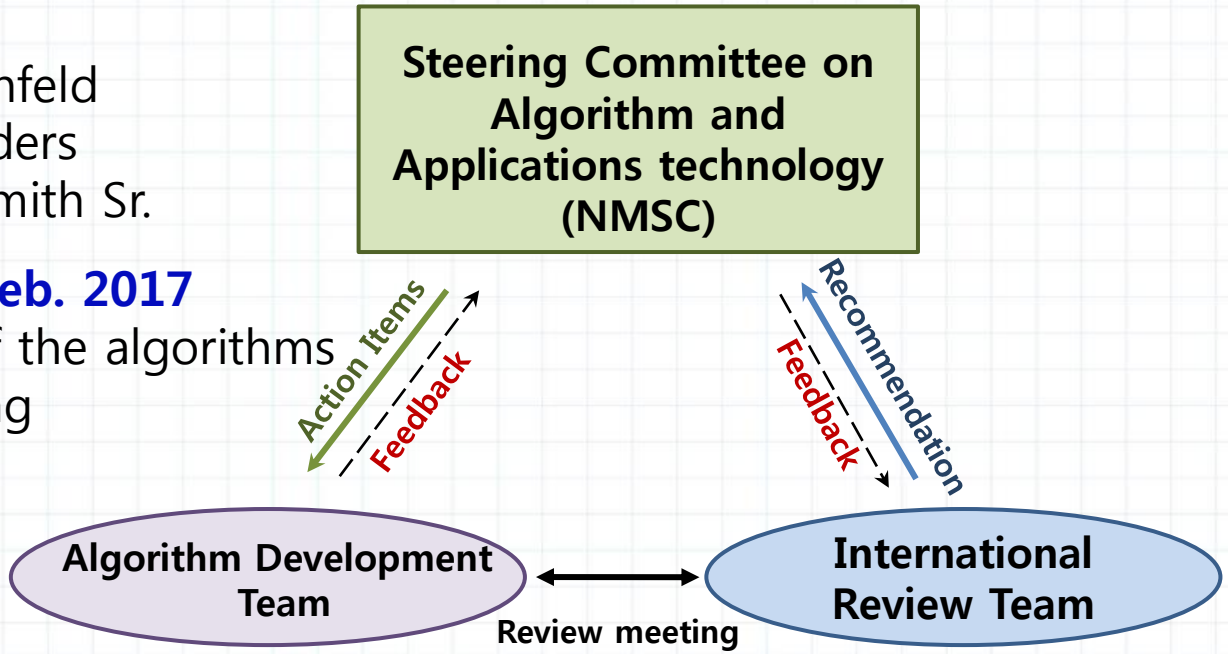
Algorithms Review by International Review Team

❖ **1st review meeting of the meteorological products of GK-2A**

- **Purpose**: in-depth review of the science and concepts for operational geophysical products from GK-2A
- **Period**: 2-6 May 2016
- **Location**: Seoul, Korea
- **Members**: Johannes Schmetz (Chair)
  Vincenzo Levizzani (Co-Chair)
  Christina B. Katsaros
  Paul Menzel
  Daniel Rosenfeld
  Roger Saunders
  William L. Smith Sr.

❖ **2nd meeting: 31 Jan. – 3 Feb. 2017**

- Review the progress of the algorithms after 1st review meeting



Reference /ground truth data for validation

KMA

- Automatic Weather Stations
- Radiosonde stations
- Buoy stations
- Aerosol (Dust) and Ozone monitoring
- Lightning network

LEO Satellites

- Cloud
- Rain rate
- Aerosol/Dust
- etc

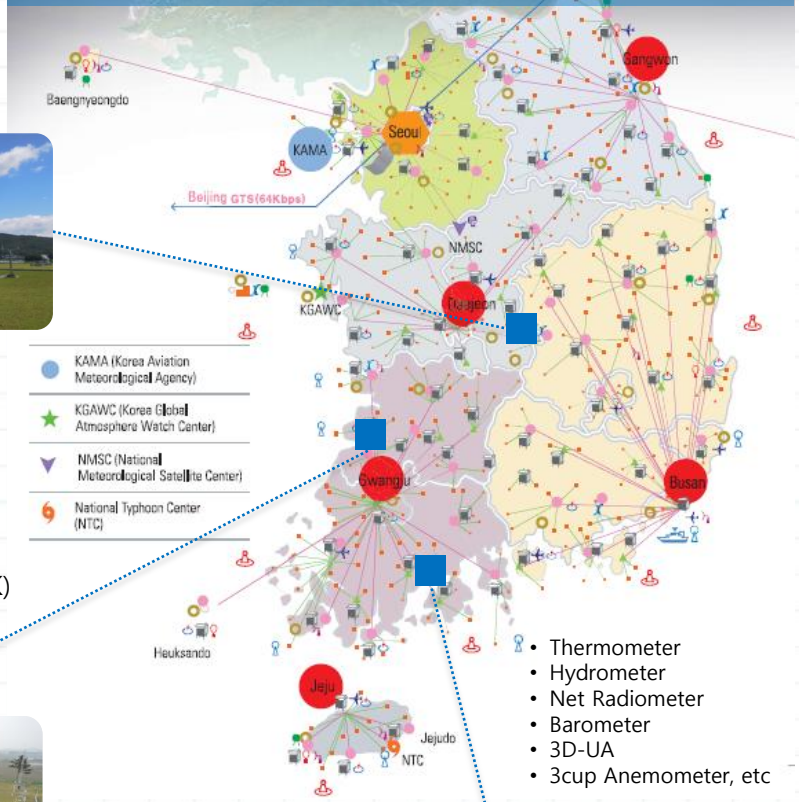
Research Airplane

- Dropsonde
- GVR (radiometer)
- Cloud particles
- Aerosol

Chupungyeong(CPY)

- Cloud radar
- Micro Rain Radar
- Weighing Precipitation Gauge (PLUVIO2)
- Optical Rain Gauge(OSI)
- Parsivel disdrometer
- Visibility meter(PWD20)
- Ceilometer(CL51, CHM 15K)
- Cosmic-ray soil moisture sensor (at rice paddy)

KMA's Observation Network



- Thermometer
- Hydrometer
- Net Radiometer
- Barometer
- 3D-UA
- 3cup Anemometer, etc

Ground GNSS Network

- TPW

Research Vessel

- SST
- T, q profiles

Gochang

- Rain gauges
- Snow Depth

Boseong

Flux Tower

- Radiation
- T, q Profiles
- Visibility

Internal Validation Process of Level 2 Products

- Assess the performance of algorithms for weather events such as fog, dust, and rapid development clouds, and long-term analysis using reference satellite and in-situ data in collaboration with relevant users
- Receive valuable feedback about the product maturity and issues from users in KMA to the algorithm improvement process

Year	2016		2017				2018	
	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q
Products	Cloud Detection	Fog	Cloud top Temp/ Pressure/ Height	Convective Initiation	Rain Rate	Snow Cover/ Sea Ice	Volcanic Ash	
	Vertical T, q profile	Aerosol/ Dust Detection	Cloud Phase/ Type	Aerosol/ Dust Optical Depth	SST	Radiance (clear sky radiance)	Total ozone	
	Instability Index	Cloud Amount			LST	AMV		Launch

Thank You for Listening
KMA
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국가기상위성센터