

Current Status and Future Plan on KMA Space Program

2020. 9. 29.

Dohyeong Kim

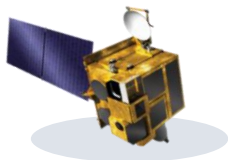
NMSC/KMA



COMS & Geo-KOMSAT-2A/B

COMS

Launched on June 27, 2010



1 **Communication** Ka-band Antenna

2 **Ocean** GOCI

3 **Meteorological** MI

➤ Extended operation: 2 years

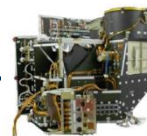
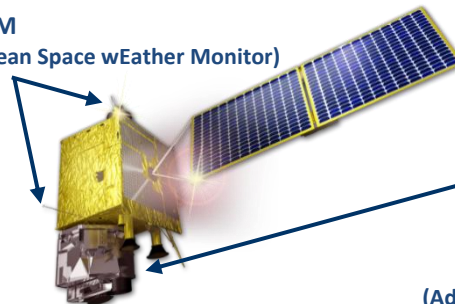
Taking over
the role of
the COMS

GK-2A

Launched on December 4, 2019

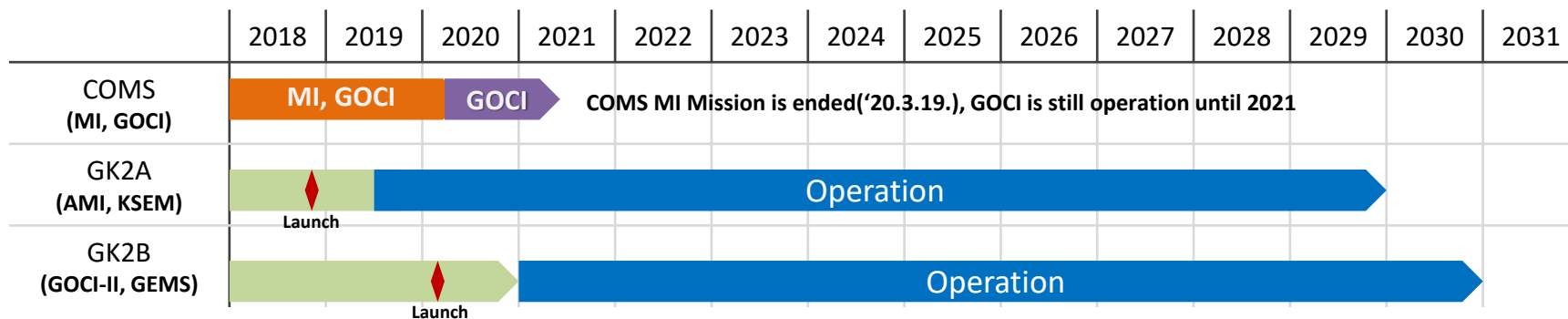
KSEM

(Korean Space wEather Monitor)



AMI

(Advanced Meteorological Imager)



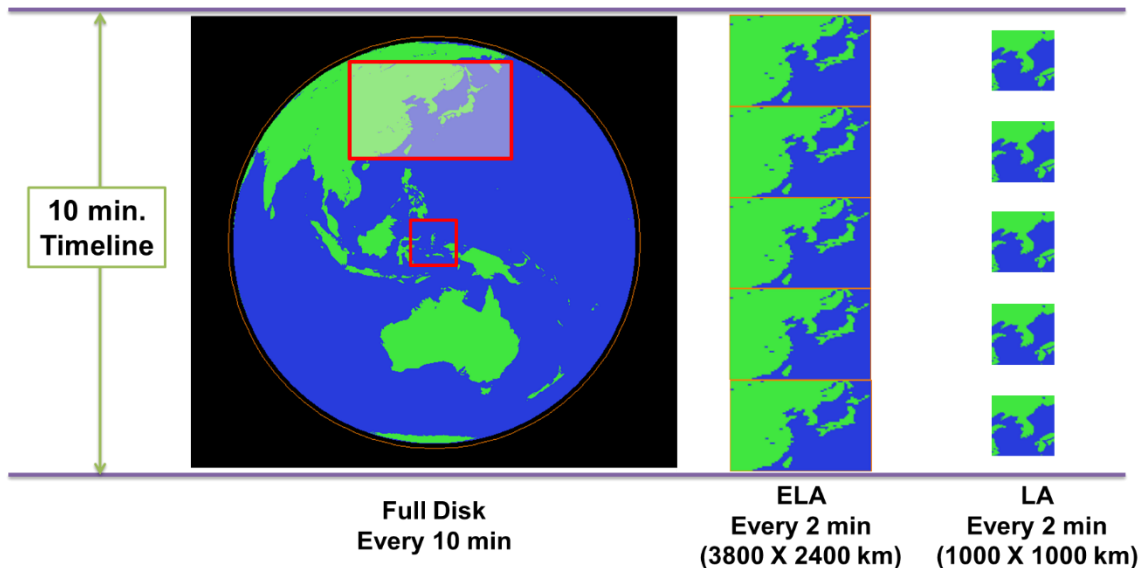
GOCI-II: Geo. Ocean Color Imager-II

GEMS: Geo. Environmental Monitoring Spectrometer

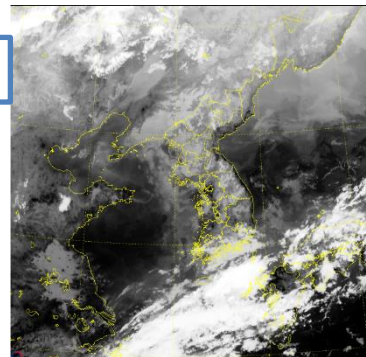
GK2A Timeline and Rapid Scan

KMA operates 10-min timeline with 3 different observation areas

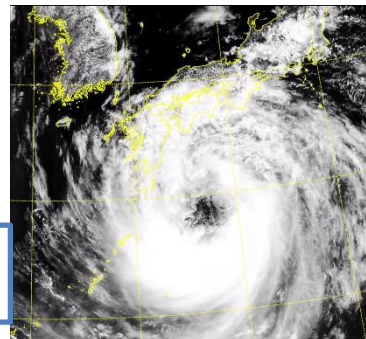
❖ 1 FD(Full Disk) + 5 ELA(Extended Local Area) + 5 LA(Local Area)



LA



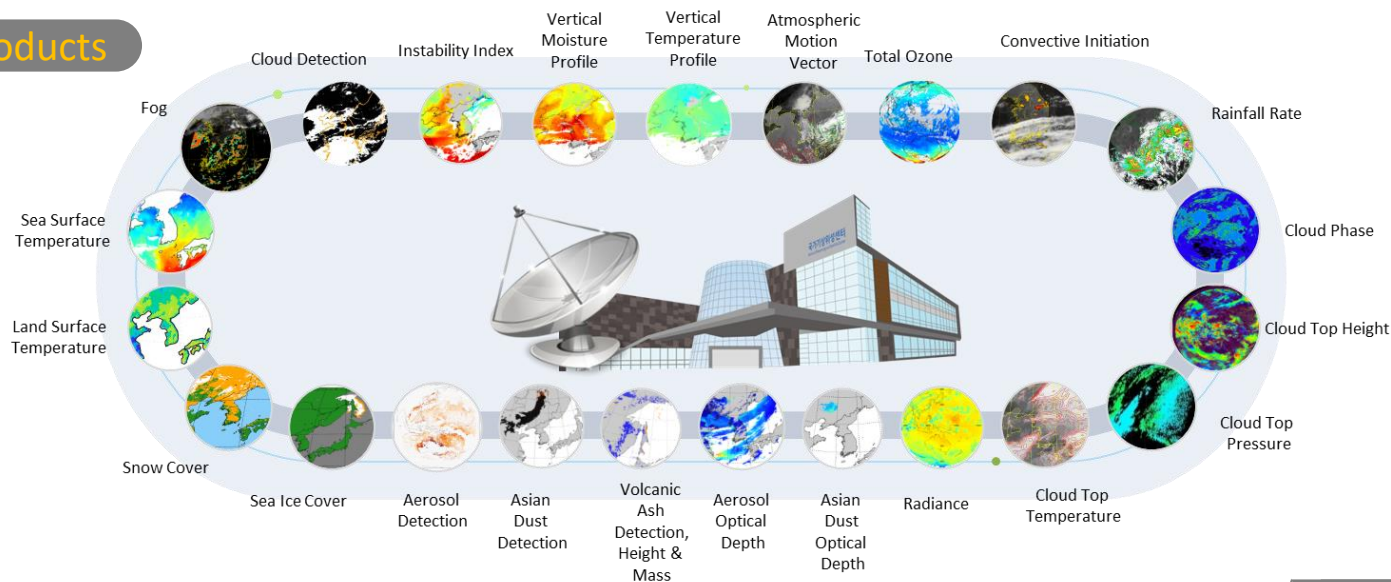
LA
(Target Area)



- Flexibility for the local area selection and scheduling
(Target Area which can observe any area by user request)
- Data format : NetCDF4 for each channels with GSICS information

GK2A/AMI 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

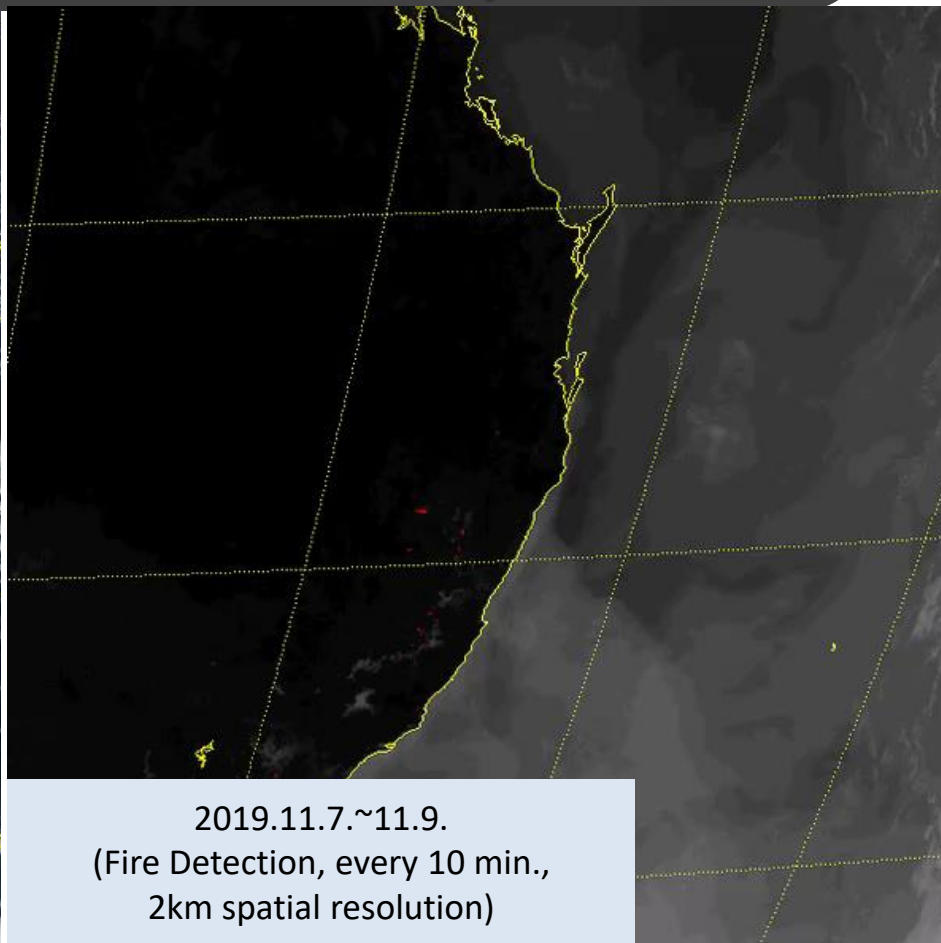
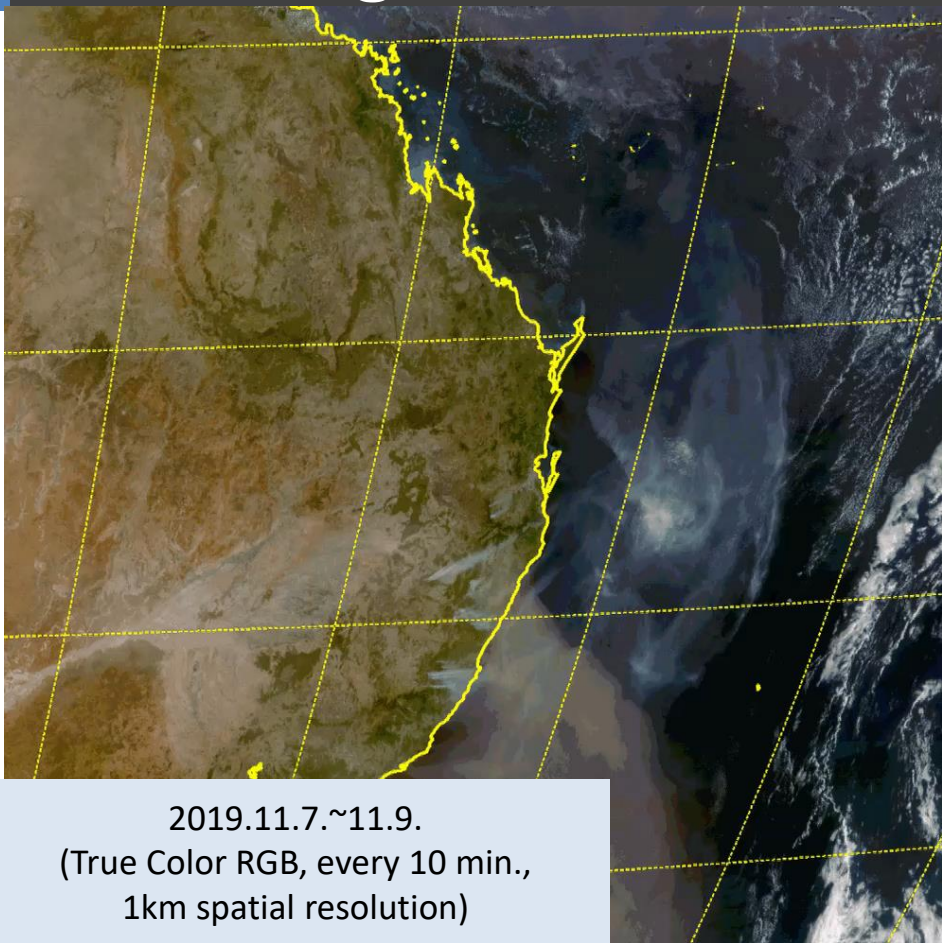
- Cloud Effective Radius
- Cloud Liquid Water Path
- Cloud Ice Water Path
- Cloud Layer/Height
- Probability of Rainfall

- 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

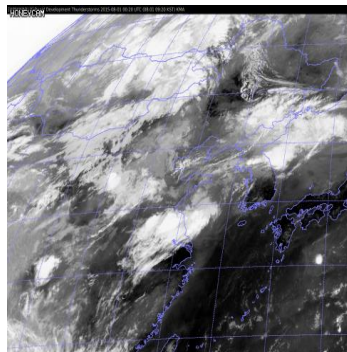
GK2A Target Observation (Australia Wildfire)



GK2A Application to Nowcasting

Increase in application area

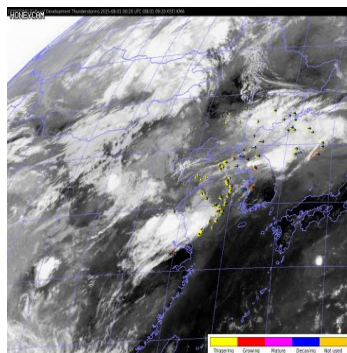
Convective cloud monitoring and analysis (K-RDT)



RDT

(Rapid Development Thunderstorm)

- based on NWC-SAF
- To analysis the lifecycle of thunderstorm (generation, development, maturity, decaying, and movement pattern)

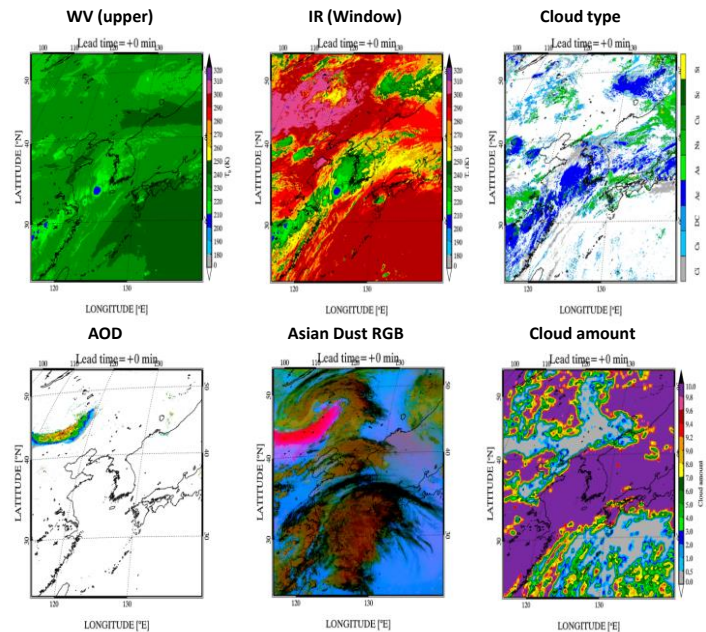


K-RDT

(Koreanized RDT)

- To adjust the parameters considering the characteristics of Korea weather pattern using GK2A
- * Utilization of Neural Network Technique

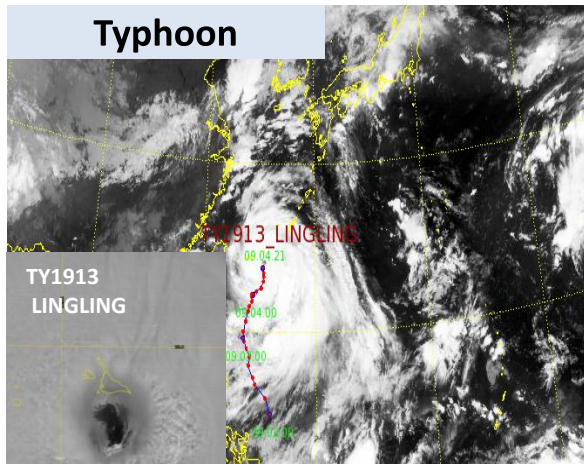
Predicted satellite image (Nowcasting → short-range forecast)



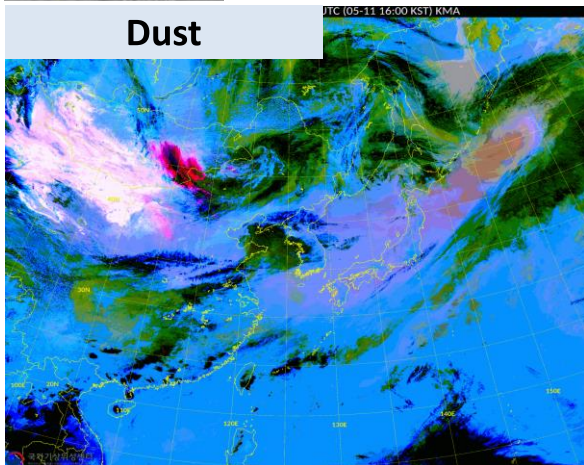
Predicted satellite images compositing satellite images with NWP motion vector

GK2A Application to Forecast

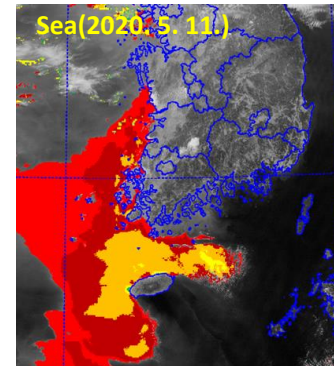
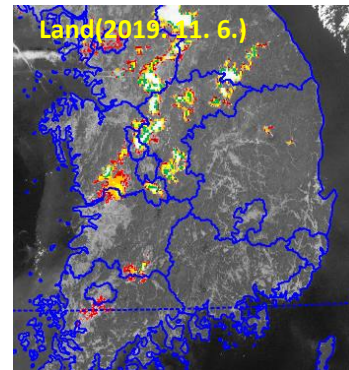
Typhoon



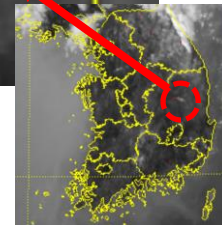
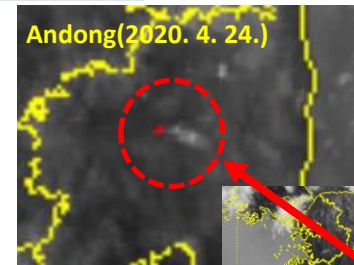
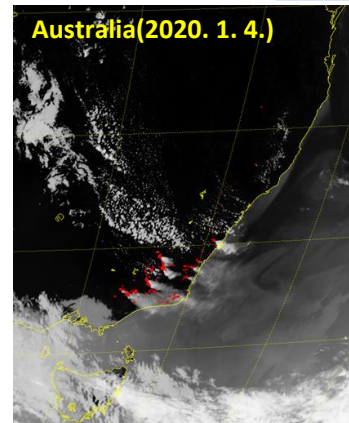
Dust



Fog



Wildfire



Expanding application by fusion of GK2A and GK2B

Inter-comparisons for fusion

❖ GEMS vs. GOCI-II

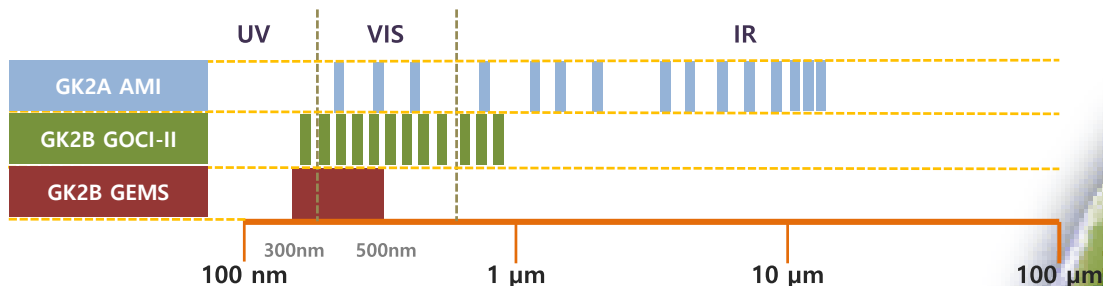
- Solar calibration
- SRF characteristics of GOCI-II
- Absolute radiometric calibration of GEMS

❖ GOCI-II vs. AMI

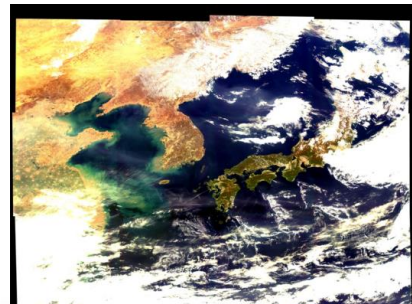
- Solar reference spectrum
- Visible channel inter-comparison

❖ AMI vs. GEMS

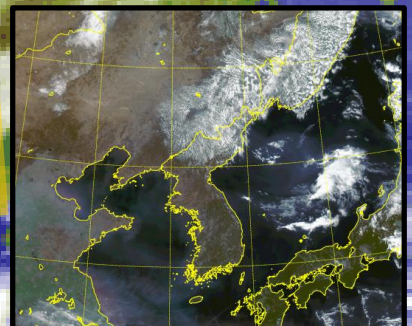
- Absolute solar irradiance
- SRF characteristics of AMI
- Cloud screening/detection for GEMS



* Technical issue: # of channel, bandwidth, spatial/time resolution, observation area



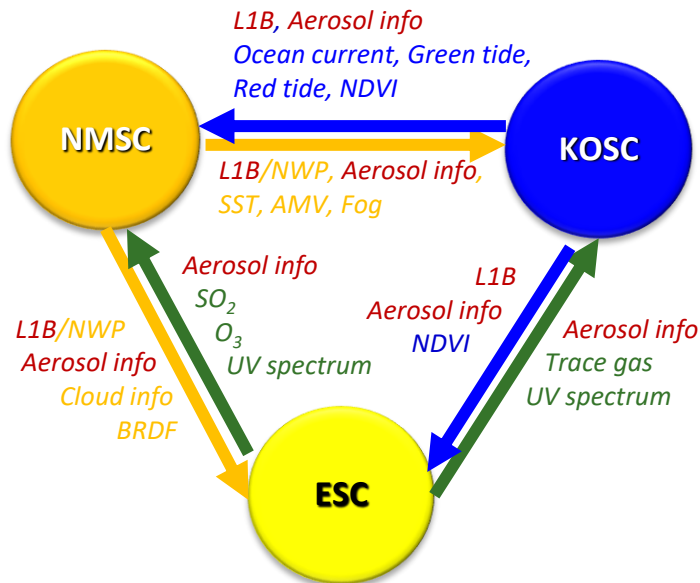
The 1st Image of GOCI-II
2020. 3. 23.



True color RGB of AMI
2020. 3. 23.

Area of fusion between GK2A and GK2B

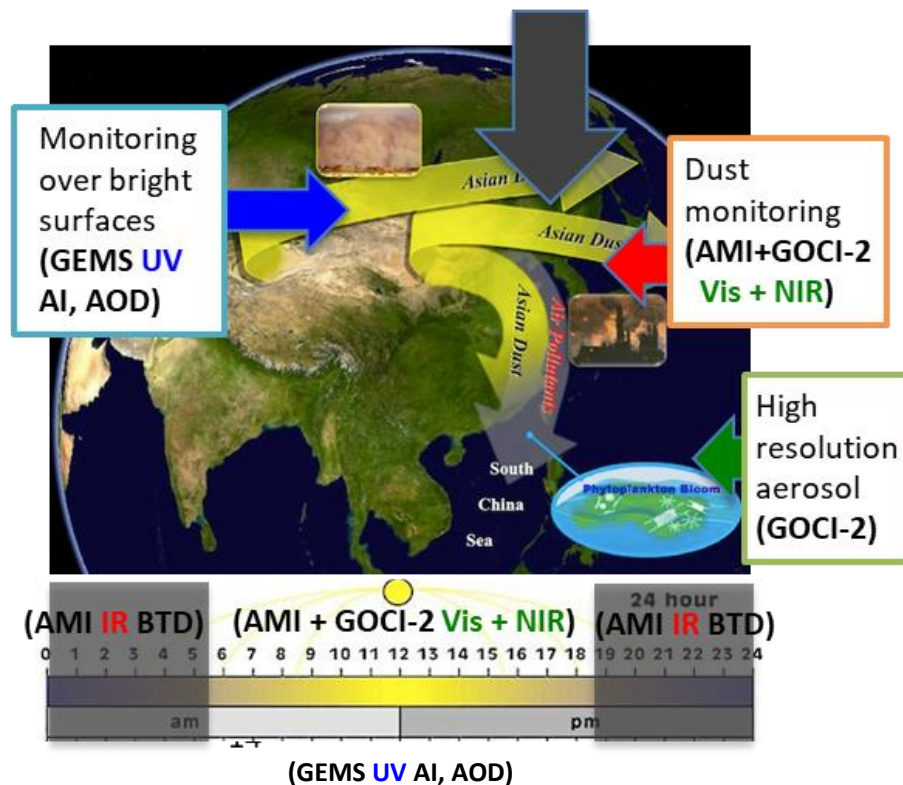
AMI, GOCI-II and GEMS



Monitoring of L1B using the overlapping data
Verification of AMI/GOCI-II SRF using
Hyper-spectral GEMS data

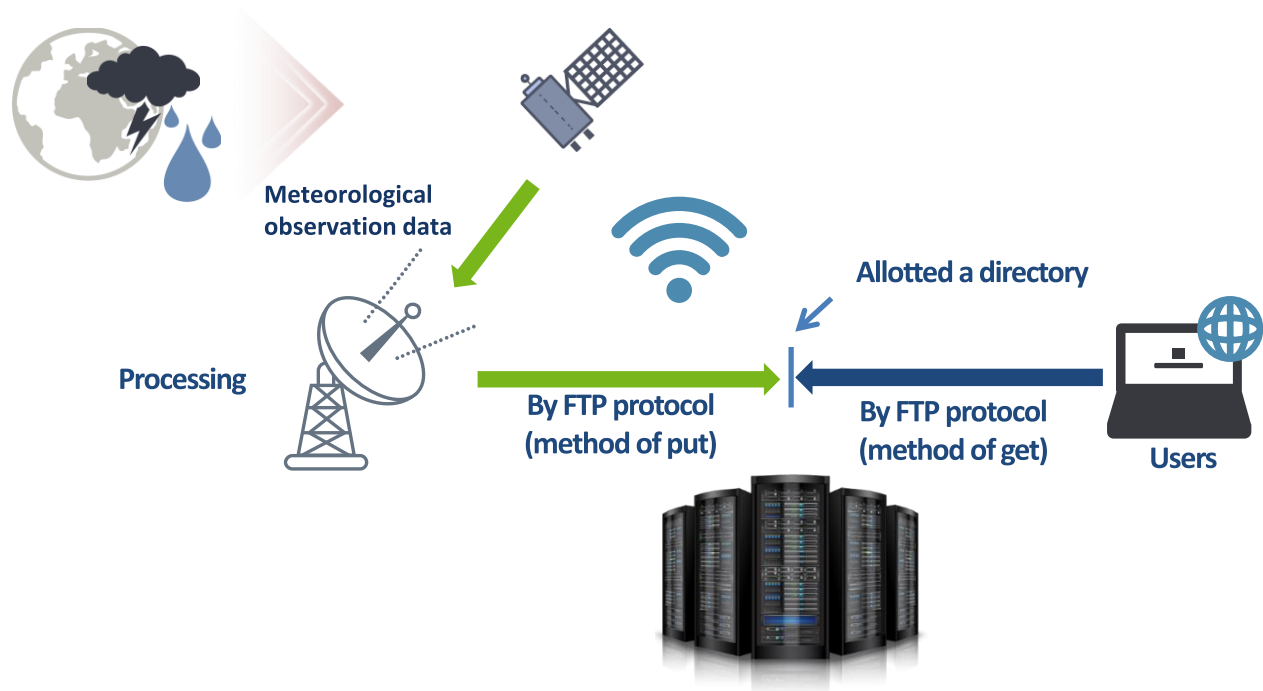
NMSC: National Meteorological Satellite Center, KMA
KOSC: Korea Ocean Satellite Center
ESC: Environmental Satellite Center

Strengthening aerosol monitoring



GK2A Data Access

Real-time FTP Service(RFS)

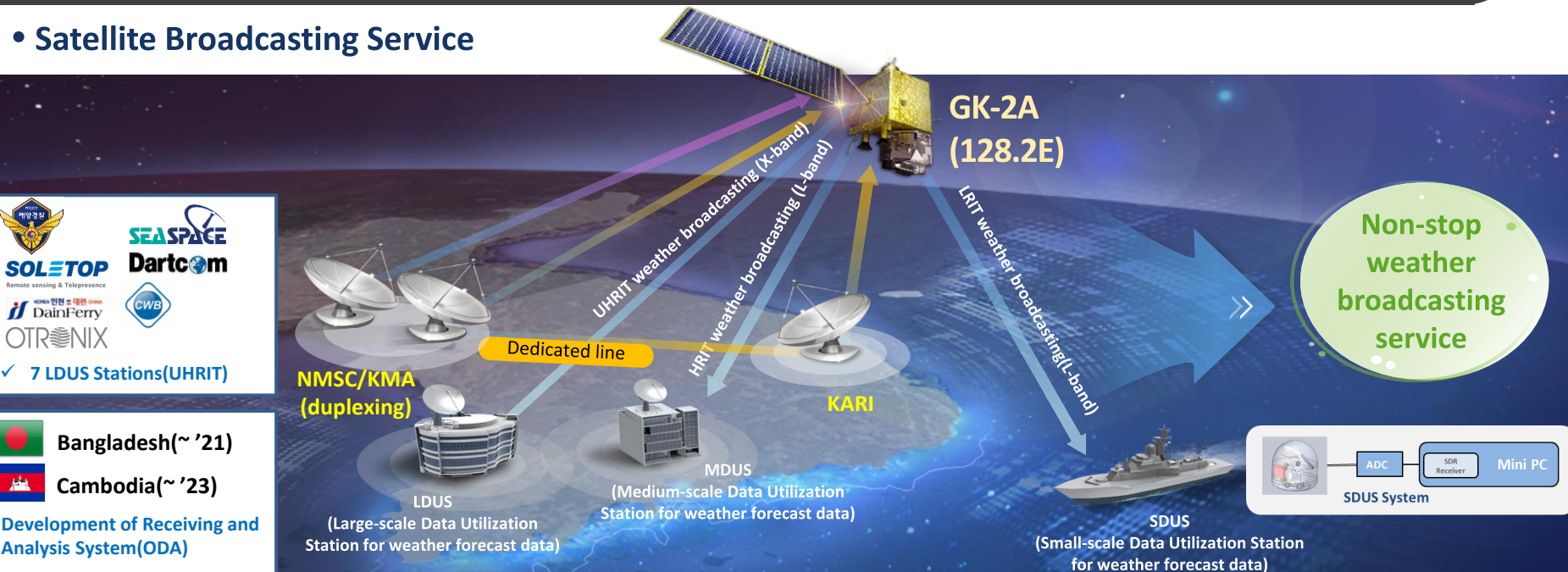


	Vietnam		Australia
	Bangladesh		Japan
	Hong Kong		Malaysia
	Taiwan		Nepal
	Germany		India
	Indonesia		Singapore
	Russia		Netherlands
	USA		

✓ 15 Agencies(2020. 6. 30.)

GK2A Data Access

• Satellite Broadcasting Service



 Bangladesh(~ '21)

 Cambodia(~ '23)

Development of Receiving and Analysis System(ODA)

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 omnidirectional antenna)

GK2A Request-based Rapid Scan Observation

The official request of target area observations by global users over the Asian Pacific region (RA II and RA V) will be available

- Provide significant improvements in the real-time monitoring of Typhoon, thunderstorm and dust events
- Global users submit official request form defining specific request webpage (<http://datasvc.nmsc.kma.go.kr/datasvc>)

GK2A / GK2A AMI Special Observation

Home > Satellites > GK2A > GK2A AMI Special Observation

Search image

(R)10.5um

special area

2020-09-05

13:54 UTC

UTC

Last 3 Hour

2 Min

0.3 sec

< Prev

Play

Next >

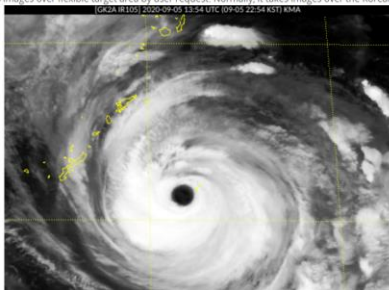
Search

NOW

Auto Refresh: 1 Min

TIME MACHINE

The GK2A AMI special observation mode takes images over flexible target area by user request. Normally, it takes images over the Korean Peninsula.



Rapid Scan Request

Registration Data

No	Registration Data	Name of Requester
16	2020-09-05	박준동
15	2020-09-05	박준동
14	2020-09-04	박준동

Rapid Scan Request

HOME > Reg. receiving station > Rapid Scan Request

Name of Requester:

e-mail:

Country:

Subject:

Purpose of Application:

Observation Mode: ☒ fixed observation ☐ tracking observation

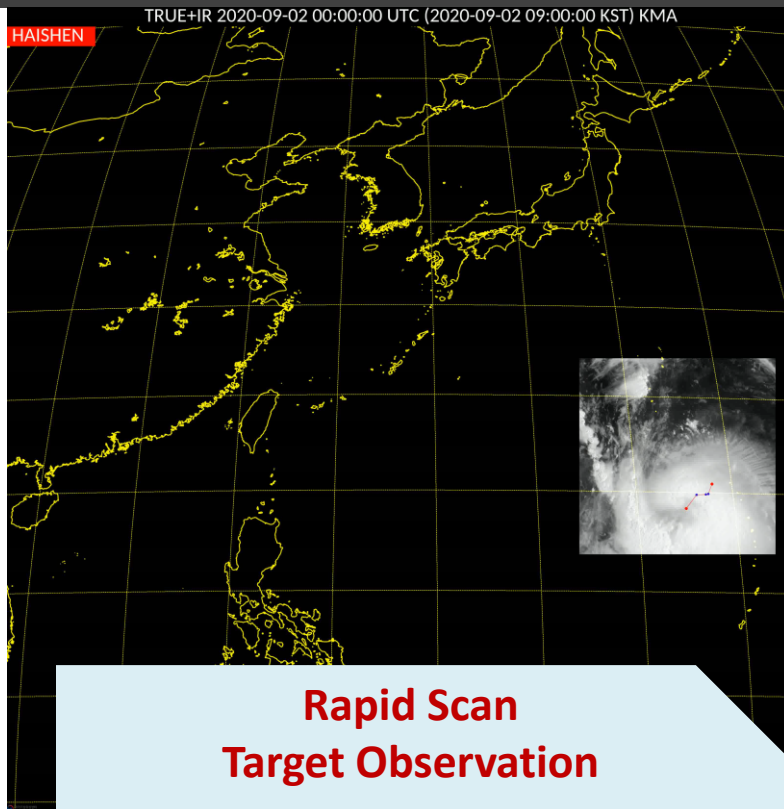
Longitude & Latitude

Latitude: Longitude:

※ Latitude can be only entered between -55 and 65
※ Longitude can be only entered between 70 and 180
※ The latitude and longitude can only be entered to two decimal place.

Observation Duration: -

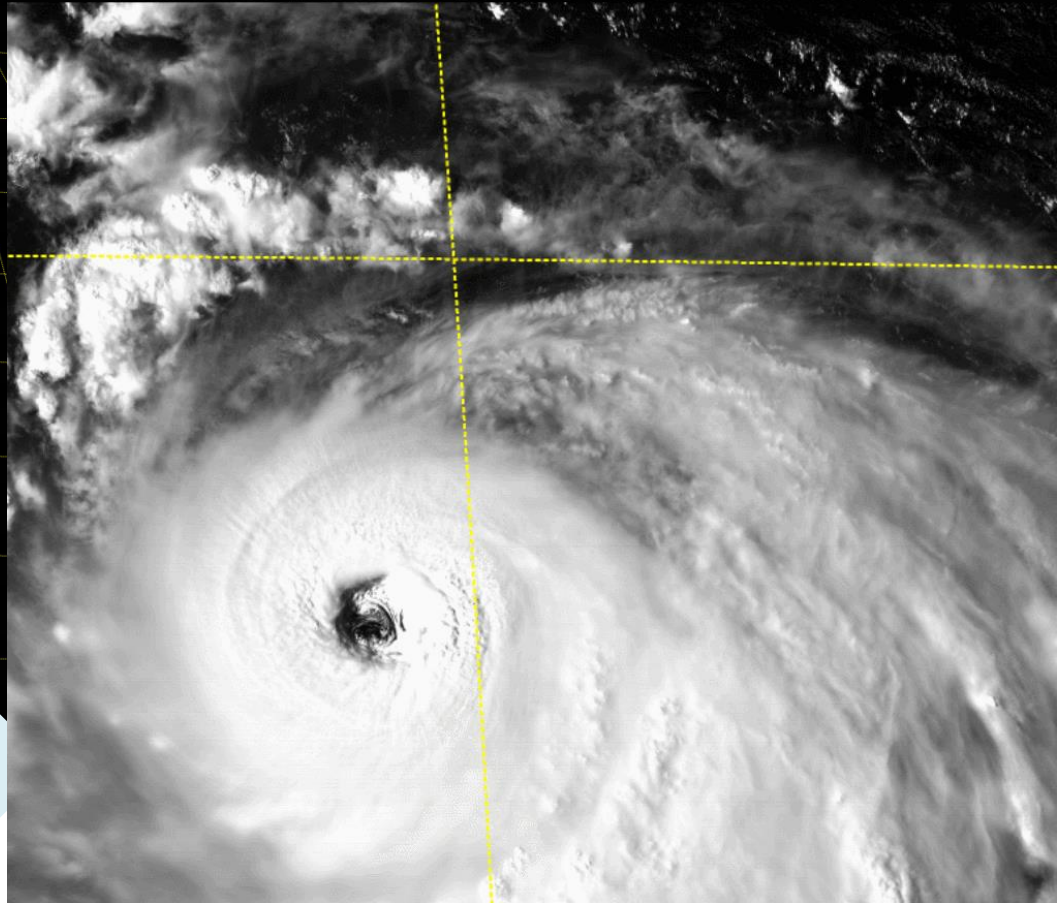
GK2A Rapid Scan(2-minute) Target Observation



Rapid Scan Target Observation

Typhoon HAISHEN
2020. 9. 4. 06 ~ 09 UTC
(VI006, every 2 min., 0.5km)

[GK2A VI006] 2020-09-04 06:10 UTC (09-04 15:10 KST) KMA



KMA follow-on GEO program

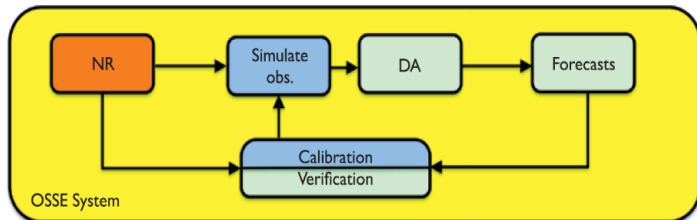
The plan of follow-on Geo-KOMPSAT-2A (Target launch schedule : 2028)

- ✓ Based on Vision for WIGOS in 2040; Geostationary Ring
- ✓ Proposed target instruments
 - ❖ VIS/IR Imager
 - ❖ Hyperspectral IR Sounder
 - ❖ Lightning Mapper
- ✓ **Impacts of Hyperspectral Sounder on KMA NWP model**
 - ❖ Impacts on KMA NWP model (Korea Integrated Model) using OSSE system
 - ❖ Focusing on precipitation (area, intensity) forecast, typhoon track

KMA follow-on GEO program

Impact study of HSSGEO on KMA NWP (KIM) by OSSE system

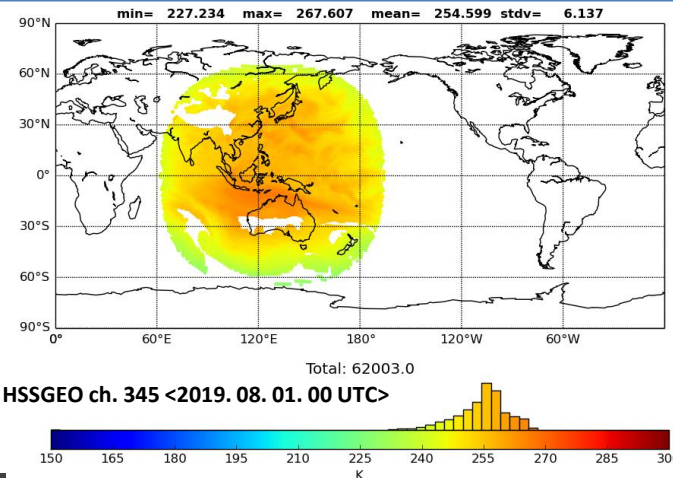
Composition of OSSE system



NR	KIM3.5a , res. : 12.5 km, 91 levs, 3 month free run (2019.6.–2019.8.)
Simulate obs.	$y_o = y_t + (\varepsilon \times \alpha)$ y_o : (OBS) simulate observation y_t : (TRUE) true observation from NR $\varepsilon \times \alpha$: (ERROR) calculated error ε : obs. error of KMA NWP α : error inflation factor (=1)
DA & Forecast	KIM3.4 , res. : 25 km, 91 levs, stochastic physics applied, 3DVAR , 2019.07.22.–2019.08.31. (40 days)

HSSGEO data and DA method

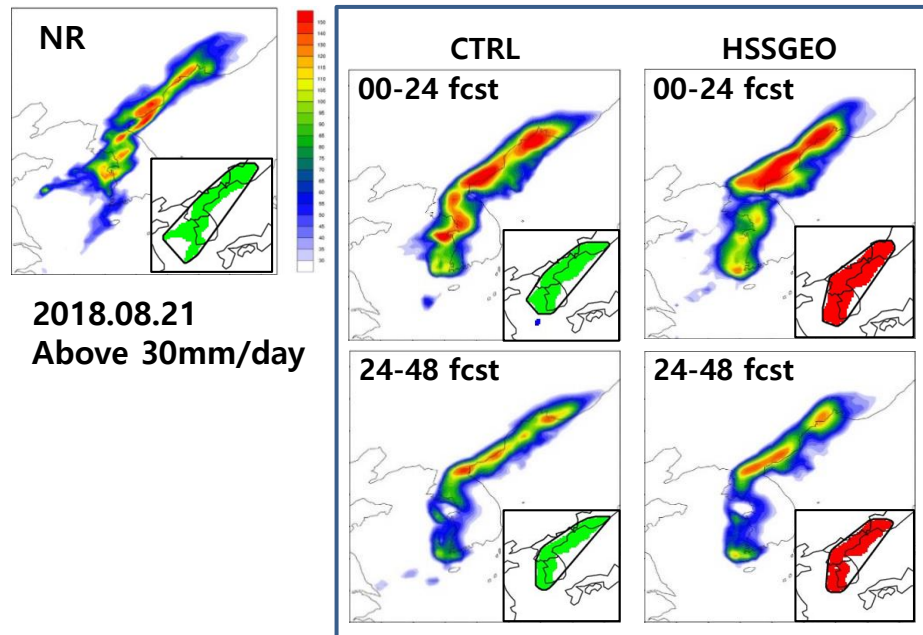
meta data	Equal to meta data of GK-2A
Reference instrument	IASI
Coverage	Full disk (same as AMI of GK-2A) blank : cloud or highland area
Channels	temp. : 81, WV : 10
Thinning	spatial : 300 km, temporal : 1 h
Radiative transfer coefficient	IASI/MetOp-B of RTTOV10.2 is used
Instrument error	same as observation error of IASI



KMA follow-on GEO program

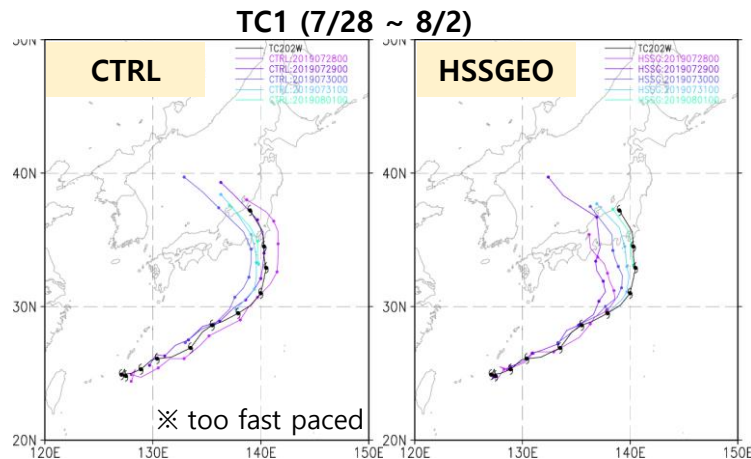
Impact study of HSSGEO on KMA NWP (KIM) by OSSE system

Result of precipitation verification



On short-term forecast, precipitation area and intensity in experiments applying HSSGEO are more similar to NR.

Result of TC track verification



TC track error

	CTRL	HSSGEO
24h	64.88	51.72
48h	159.75	67.88
72h	294.50	179.57

The forecast performance of TC track on short-term forecast is improved by applying HSSGEO.

KMA follow-on GEO program

The plan of follow-on Geo-KOMPSAT-2A (Target launch schedule : 2028)

- Proposed target instruments
 - ❖ VIS/IR Imager, Hyperspectral IR Sounder, Lightning Mapper
- **Two-track strategy** for GK2A follow-on development
 - ❖ Need to update the capacity for Hyperspectral IR Sounder both NWP and Satellite groups
 - ❖ Establish the joint center of satellite data assimilation in KMA
 - ❖ Propose the two-track strategy; first Imager and second is Hyperspectral sounder

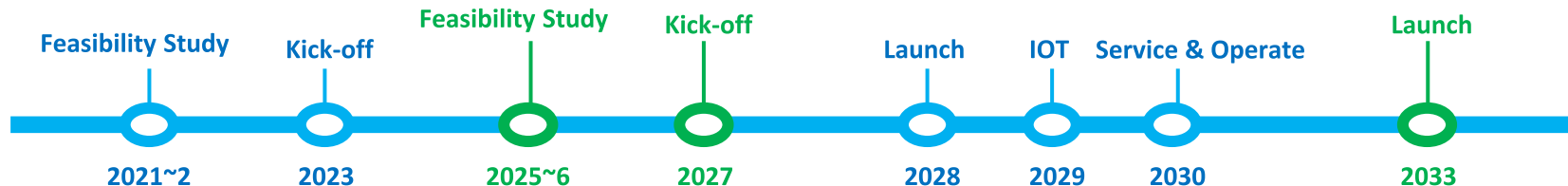
GEO-KOMPSAT-2A Follow-on

1st Step

- Updated AMI + Lightning Mapper

2nd Step

- Hyperspectral IR Sounder



Status of KMA LEO program

Current status of **KMA LEO program** in 2020

- ❏ To investigate the **updated user requirements** and application
- ❏ To investigate the **development roadmap** followed by updated payloads proposed from new user requirements
- ❏ The LEO program is slow in progress due to changes in KMA's internal space program roadmap

Development of **GNSS-RO receiver (2nd payload of CAS500)**

- ❏ To develop GNSS-RO receiver (< 15kg) for NWP application
 - Compact Advanced Satellite, 500kg (total weight including payloads)
 - CAS500 program is also slow in progress due to COVID-19
- ❏ Specification: banding angle error < 10^{-6} radian
- ❏ GNSS-RO Design Concept(2021), and Flight Model(2023)

Thank you

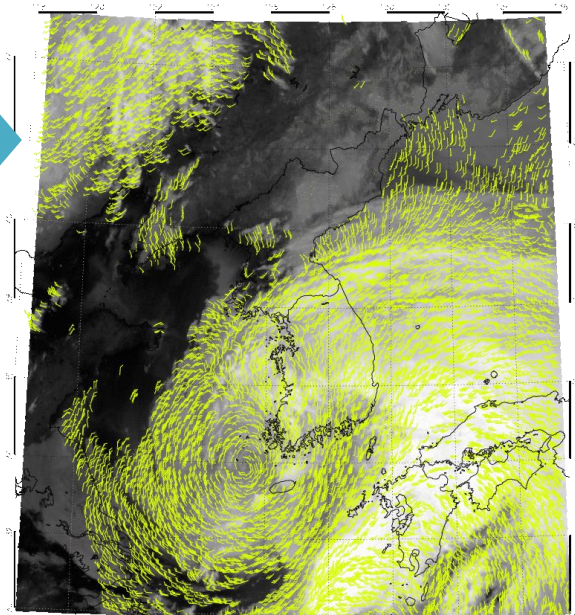


GK2A Rapid Scan AMV

- *Period* : 2019.7.20.07:00 ~ 13:50 KST (TYPHOON – 5 DANAS)
- *Channels* : Visible($0.64\ \mu\text{m}$), IR($10.4\ \mu\text{m}$)
- *Spatial Resol.* : VI($12\text{km}\ 12\text{km}$), IR($16\text{km}\ 16\text{km}$)
- ×
- ×
- *Temporal Resol.* : 10 minutes

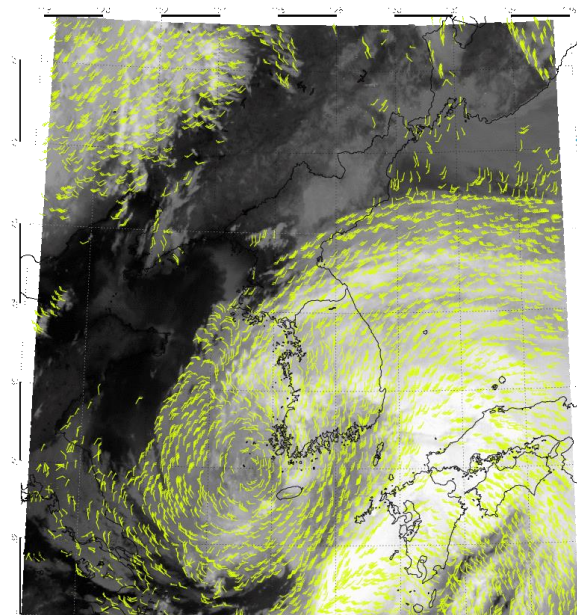


GK2A_AMV_CH3 201907192200(UTC)



VI rapid scan
AMV

GK2A_AMV_CH13 201907192200(UTC)



IR rapid scan
AMV