

Current Geo-Satellites : COMS

◆ COMS(Communication, Ocean, and Meteorological Satellite)

- Orbit : 128.2E (Launched on June 26, 2010)

➤ MI : 5 Channel VIS/IR Meteorological Imager

- MI data Service via Satellite : Broadcast to M/SDUSs with H/LRIT

- 16 products(CMW, Fog, AOD, cloud amount, Convective rainfall rate....)

- Service via Landline [Website] KMA/NMSC homepage(for registered users)
[FTP] Access to NMSC FTP(for organization with MOU)

➤ GOCI : Geostationary Ocean Color Imager

- 0.5km X 0.5km(ground sampling distance) with 1hr (8 times/day)

- L1B RGB, Chlorophyll, Colored dissolved organic matter, Suspended solid

- <http://kosc.kordi.re.kr/processingsoftward/gdaps/onlinehelp.kosc>

- <http://map.naver.com> (for Public user)

Low Earth Orbit Satellites : Current

- **KOMPSAT-5(Aug. 22, 2013)** with 550km mean altitude and 97.6 deg inclination

Payload	Characteristics
COSI (primary)	<ul style="list-style-type: none">• SAR (Synthetic Aperture Radar)• X-band Radar with an active phased array antenna
AOPD (secondary)	<ul style="list-style-type: none">• Dual frequency GPS receiver (GNSS-RO data)<ul style="list-style-type: none">– IGOR : Integrated GPS Occultation Receiver

- COSI : Corea SAR instrument, AOPD: Atmosphere Occultation and Precision Orbit Determination
- GNSS-RO data is validated for operational use by KASI cooperating with UCAR and will be distributed regularly via internet in late 2015

- **KOMPSAT-3A(March 26, 2015)**

- ✓ Developed by Korea Aerospace Research Institute(KARI)
 - ✓ Purpose: earth observation(Optical +IR)
 - ✓ Resolution: Panchromatic: 0.55m, RGB: 2.2m, IR: 5.5m
 - ✓ Swath width: 12.0km, Altitude: 528km

Meteorological and Environmental Geo-Satellites : Future

Sector	Satellite in Orbit	Operator	Location	Launch date	Environmental payload and status
West Pacific	GEO-KOMPSAT-2A	KMA	128.2°E	May 2018	Advanced Meteorological Imager (AMI), Space Environmental monitoring payload Direct broadcast via UHRIT/HRIT/LRIT
	GEO-KOMPSAT-2B	MOF(Ministry of Ocean and Fisheries), ME(Ministry of Environment)	128.2°E	March 2019	Advanced Geostationary Ocean Colour Imager(GOCI-II), Geostationary Environmental Monitoring Spectrometer(GEMS)

- **GEO-KOMPSAT-2A, AMI(Advanced Meteorological Imager)**
 - Multi-channel capacity: 16 channels
 - Temporal resolution: within 10 minutes for Full Disk observation
 - Flexibility for the regional area selection and scheduling
 - Lifetime of meteorological mission: 10 years

GEO-KOMPSAT-2A, 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 (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

vs. AHI

- addition 1.38 μm (NIR)

- subtraction 2.3 μm (NIR)

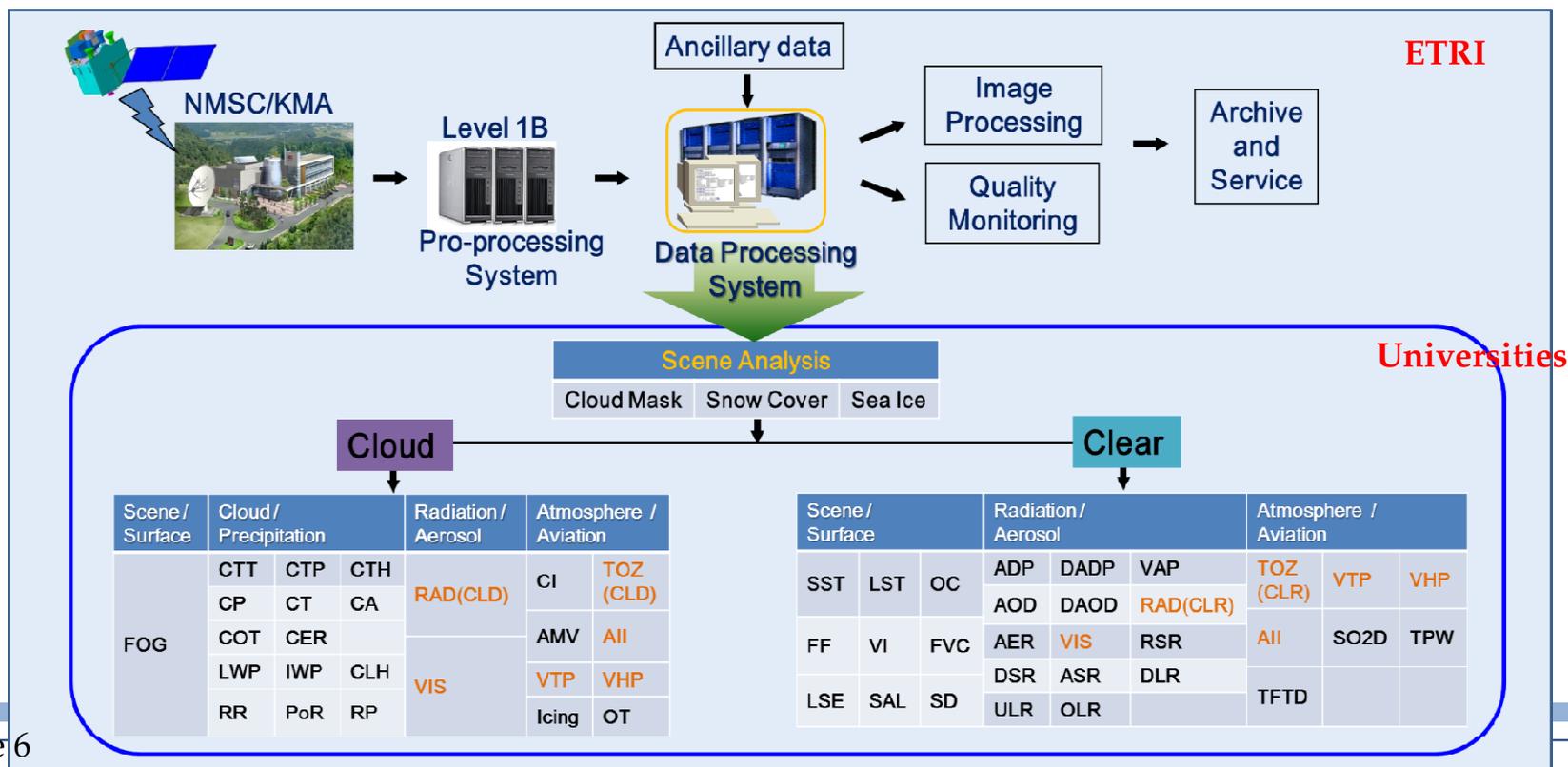
1.38 μm : favorable for cirrus cloud detection, cloud type and amount

2.3 μm : favorable for Land/cloud Properties

- Temporal resolution: within 10 minutes for Full Disk observation
- Flexibility for the regional area selection and scheduling
- Direct broadcast via UHRIT/HRIT/LRIT

GEO-KOMPSAT-2A : 52 Base-line Meteorological Products

- The algorithm prototype of products will be developed by 4 science groups until April, 2017
 - scene and sfc / cloud and precipitation / radiation and aerosol / atmosphere and aviation
 - 16 Korean Prof and 50 developers
 - Optimization of developed programs will be performed until 2018
 - Developed algorithms are strongly recommended to be published SCI and Documents
- MODIS, SEVERI, COMS, and AHI data are used as proxies to evaluate each algorithm



GEO-KOMPSAT-2A: Detailed 52 meteorological products

Scene & Surface Analysis (13)	Cloud & Precipitation (14)	Aerosol & Radiation (14)	Atmospheric condition & Aviation (11)
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 Type	Asian Dust Optical Depth	Stability Index
Sea Surface Temperature	Cloud Phase	Aerosol Particle Size	Total Precipitable Water
Land Surface Temperature	Cloud Amount	Volcanic Ash Detection and Height	Tropopause Folding Turbulence
Surface Emissivity	Cloud Optical Depth	Visibility	Total Ozone
Surface Albedo	Cloud Effective Radius	Radiances	SO ₂ Detection
Fire Detection	Cloud Liquid Water Path	Downward SW Radiation (SFC)	Convective Initiation
Vegetation Index	Cloud Ice Water Path	Reflected SW Radiation (TOA)	Overshooting Top Detection
Vegetation Green Fraction	Cloud Layer/Height	Absorbed SW Radiation (SFC)	Aircraft Icing
Snow Depth	Rainfall Rate	Upward LW Radiation (TOA)	
Current	Rainfall Potential	Downward LW Radiation (SFC)	
	Probability of Rainfall	Upward LW Radiation (SFC)	

Application Projects using Satellite products(2015~2019)

- To be designed to maximize the utilization of the satellite products for forecasters and NWP
- 4 Big areas : recommended using GK-2A and the other satellite data, if necessary NWP and the other observation

Areas	Contents	
Nowcasting	<ul style="list-style-type: none"> •Cloud analysis •Heavy rainfall and snowfall analysis •QPF •Aviation supporting analyses 	
Typhoon & Ocean	Typhoon analysis system based on Satellite SST, red tide, freezing over the ocean 3D Winds analysis	
NWP	Satellite data preprocess for NWP assimilation	
Climate & Env & Sfc & Verification	Soil moisture, Drought and Floods, Fire Fine Dust analysis Verification, grid and image composite technique	

Data Service Plan : Geo-KOMPSAT-2A

[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	
		HRIT	LRIT
Service			
Data Rate	≤ 31 Mbps	3 Mbps	~512 Kbps
Frequencies	Uplink : S-band Downlink : X-band	Uplink : S-band , Downlink : L-band * Same Frequencies band with COMS	
Data Type	TBD	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	TBD	FD, ENH	FD, ENH
Station	LDUS	MDUS	SDUS

[Via Landline]

- Web-based service system will be renovated for GK-2A data
- GK-2A data also will be available in DCPC-NMSC (<http://dcpc.nmsc.kma.go.kr>)

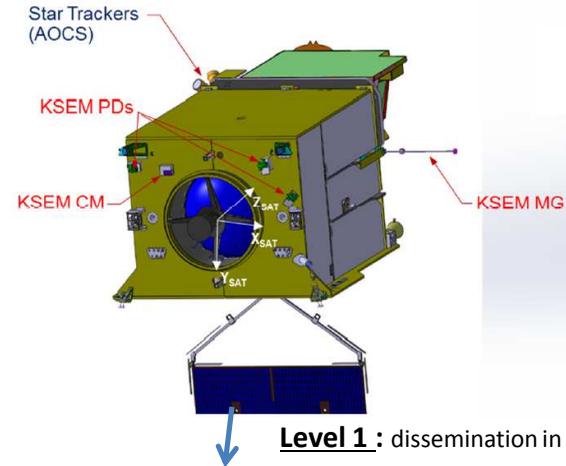
Geo-KOMPSAT-2A : Geostationary Space Environmental(space weather) Monitoring Spectrometer(SEM)

1. KSEM Specification

- 1) PD (Particle Detector)
 - Measurement range : 50keV ~ 2MeV (Electron)
100keV ~ 20MeV (Proton)
 - Angular resolution : 60° at least (pitch angle)
 - Time resolution : 0.33 s
- 2) MAG (Magnetometer)
 - Measurement range : $\pm 3,500$ nT
 - Measurement accuracy : 1nT at least
 - Time resolution : 0.1 s
- 3) CM (Charging Monitor)
 - Measurement range : ± 3 pA/cm²
 - Measurement accuracy : 0.01 pA/ cm²
 - Time resolution : 1 s

※ 5 Level-2 products plan to be utilized for KMA space weather early warning system in 3 service area, **1) satellite operation, 2) aviation support, 3) impact on weather and climate.**

2. KSEM products and utilization



Observation(Level 1) requiring space monitoring		
PD : High energy particle flux	MAG: Magnetic field in 3 axis(x, y, z)	CM : Satellite internal charging

Level 2 : dissemination in 30 min. after Level 1

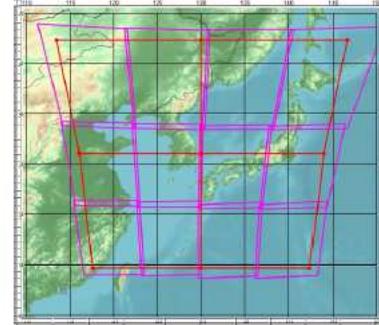
Products (Level 2) requiring space monitoring				
Particle flux around Magnetosphere	Particle flux for the targeted satellite orbit	Satellite Charging Index	Magnetospheric Disturbing index (Dst, Kp)	Prediction on Magnetospheric Disturbing index (Dst, Kp)

Early warning of space severe weather for 1), 2), 3) among KMA 3 service area	Early warning for targeted satellite (ex, WMO GOS satellite...) operation for 1)	Securing GK2A operation from the internal charging	Early warning of space-based and ground-based infra-system for 1), 2) among KMA service area	Early warning of space-based and ground-based infra-system for 1), 2) among KMA service area
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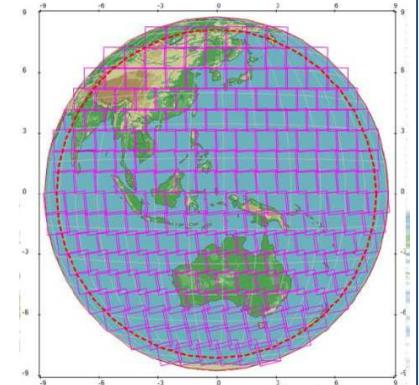
FUTURE GEO-KOMPSAT-2B, **GOCI** : March 2019

- GOCI-II(Geostationary Ocean Colour Imager-II)
 - **The succession and expansion of the mission of GOCI**
 - Supporting **user-definable observation requests** such as clear sky area without clouds and special-event areas, etc
 - 10 times daily regional and 1 time **daily global observation**
 - Higher spatial resolution, **250m×250m** (at Eq), and **12 spectral bands**
 - 1 additional channel for star sensing, lunar calibration (once a month)

Items	GOCI Specs	GOCI-II Specs
Bus	COMS	GEO-KOMPSAT-2B
Increased band number	8 bands (412~865 nm)	12 bands (380 ~ 865nm)
Improved spatial resolution	500m	250m (at 130E, Eq)
More observations	8 times/day	10 times/day
Pointable & Full Disk coverage	Local Area	Local Area + Full Disk



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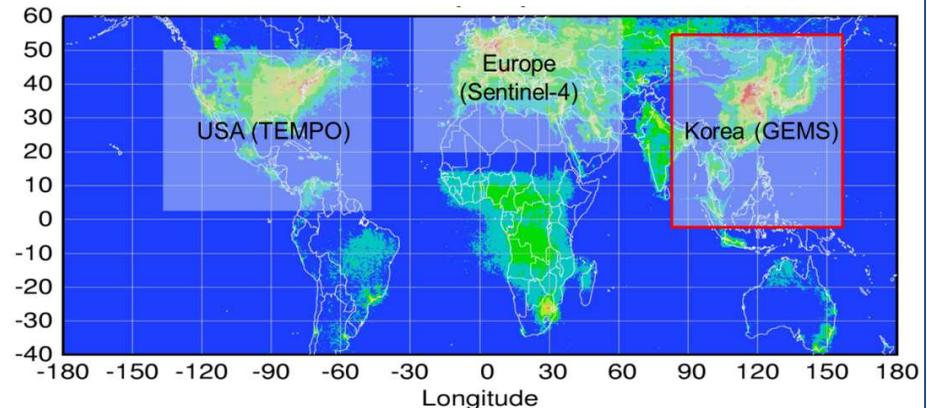


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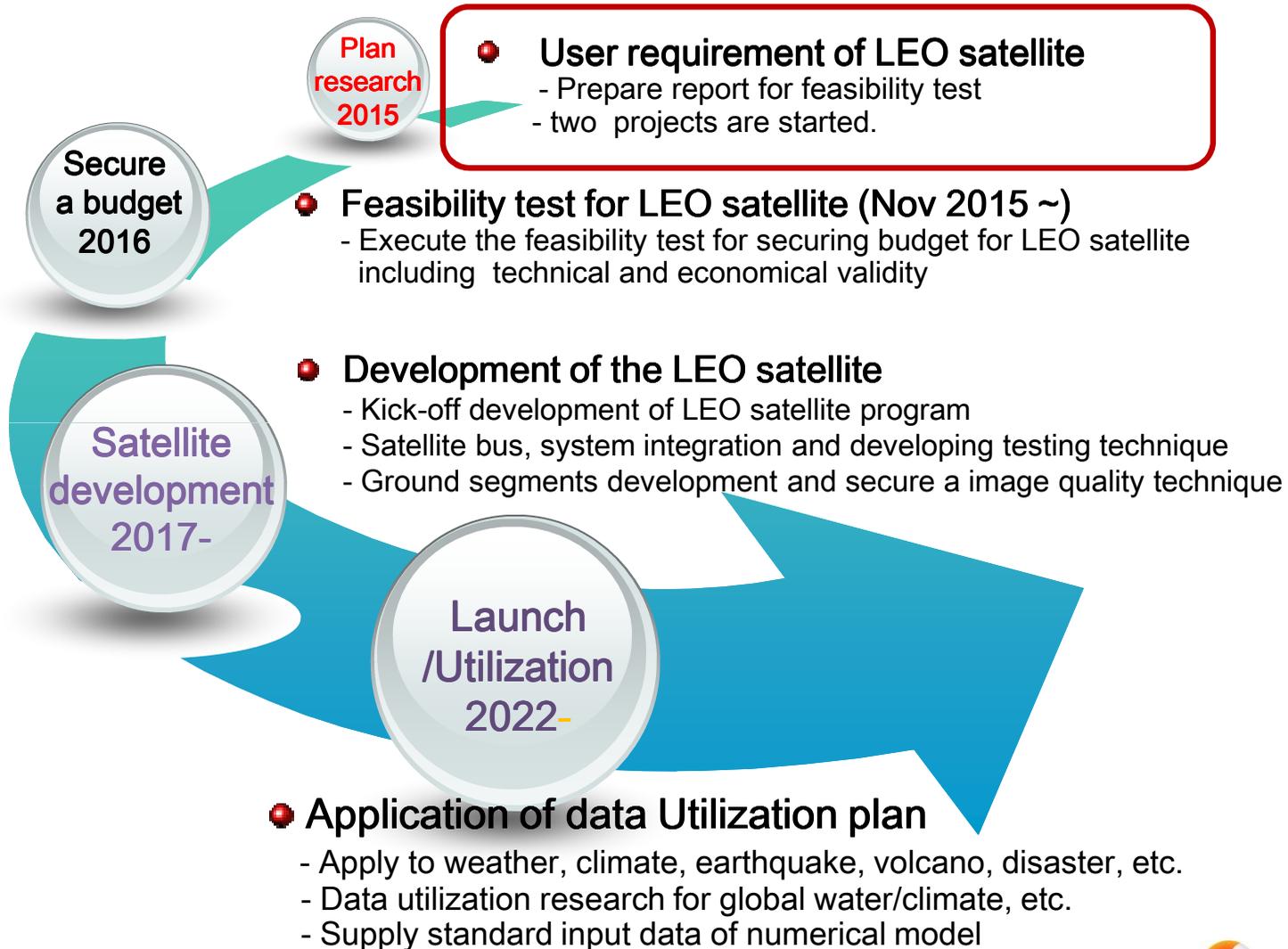
FUTURE GEO-KOMPSAT-2B, **GEMS** : March 2019

- GEMS(Geostationary Environmental Monitoring Spectrometer)
 - Contributing to Atmospheric Composition Constellation under the Committee on Earth Observation Satellites (CEOS)
 - understanding of the globalization of pollution events, source/sink identification, and long-range transport of pollutants and short-lived climate forcers (SLCFs)
 - baseline : Korea (GEMS), Europe (Sentinel-4), and the US (TEMPO)

Bus	GEO-KOMPSAT-2B
Payload	Scanning UV-Visible(300-500 nm) Spectrometer
Measurement	O3, NO2, SO2, HCHO, Aerosols
Duty cycle/Imaging time	8 images during daytime (30 min imaging + 30 min rest) × 8 times/day
Field of regard	> 5,000 km(N/S) × 5,000 km(E/W) N/S: 45°N~5°S, E/W: Selectable between 75°E~145°E



FUTURE LEO SATELLITES for meteorological use



FUTURE LEO SATELLITES for meteorological use

- **Development (plan) : ~ 2022 (or earlier)**
- **Altitude/orbit : 500~900km / Sun-synchronous (TBD), dawn-dusk orbit**
- **Satellite : ~500kg, instrument : ~150kg**
- **Possible Instrument : MW Sounder such as ATMS, AMSU, SSMI**
 - : CRIS with limited channels**
 - : GPM**
 - ~ one or two instrument due to the weight of payloads(~150kg)**
 - ~ instrument type will be decided for feasibility test**
- **International cooperation / joint development for payload and sensors**

Announcements by KMA

- **KMA International Satellite Conference(Seoul, Nov~Dec 2015)**
 - 1st Announcement and call for paper : Early June
 - Proposed Special Scientific Sessions
 - : COMS user workshop
 - : GK-2A algorithms(52 products)
 - : Satellite data assimilation
 - : Satellite data use for climate and environments
 - : expecting payloads and sensors of KMA LEO

- **2016 Asia/Oceania Meteorological Satellite User conference**
 - Nov 2016, Incheon(Song-do) or Busan

Thank you