

Status of Activities and Plans for Geo-KOMPSAT-2A Meteorological Products

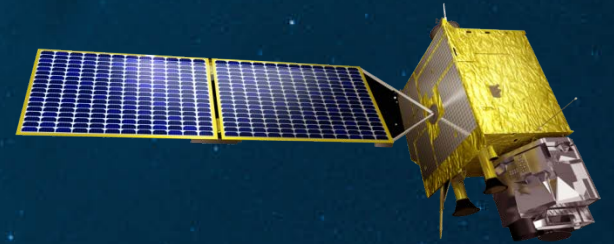
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Outline

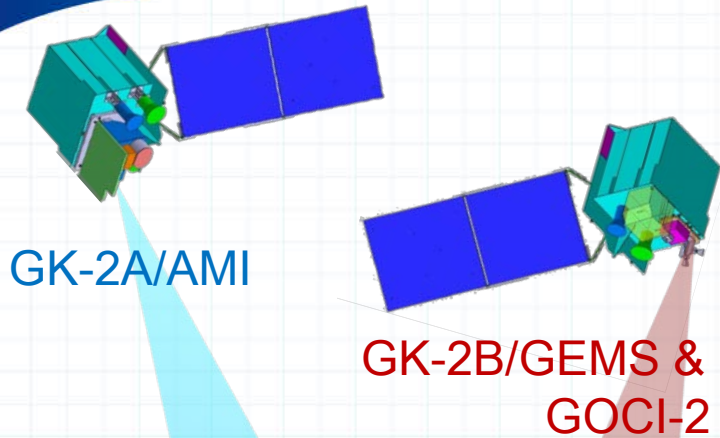
- Overview of Geo-KOMPSAT-2A (GK-2A)
- Status of GK-2A Meteorological Products Development
- Examples of GK-2A Meteorological Products
- Future Plan





Overview of GeoKOPMSAT-2A

Geo-KOMPSAT-2 Program



Launch scheduled

- GK-2A: May 2018
- GK-2B: Mar. 2019

● Specification

	GK-2A	GK-2B	
Payload	AMI	GOCI-2	GEMS
Lifetime		10 years	
Channels	16	13	1000
Wavelength range	0.4 - 13 μm	375 - 860 nm	300-500 nm
Spatial resolution	0.5 / 1 km (Vis) 2 km (IR)	250 m@ eq 1 km (FD)	7 x 8 km ² @ Seoul 3.5x8 km ² (aerosol)
Temporal resolution	10 min (FD)	1 hour	1 hour

AMI: Advanced Meteorological Imager

GOCI-2: Geostationary Ocean Color Imager-2

GEMS: Geostationary Environmental Monitoring Sensor

Geo-KOMPSAT-2A



• Advanced Meteorological Imager (AMI)

		Geo-KOMPSAT-2A AMI					COMS MI	
Channel	Band name	wavelength (μm)	resolution (km)	SNR	NEdT(K) (240/300K)	Radiometric Accuracy	Wavelength (μm)	Resolution (km)
1	VIS0.4	0.47	1	250		5%		
2	VIS0.5	0.51	1	250		5%		
3	VIS0.6	0.64	0.5	120		5%	0.675	1
4	VIS0.8	0.856	1	210		5%		
5	NIR1.3	1.378	2	300		5%		
6	NIR1.6	1.61	2	300		5%		
7	IR3.8	3.9	2		3/0.2	1K	3.75	4
8	IR6.3	6.185	2		0.4/0.1	1K		
9	IR6.9	6.95	2		0.37/0.1	1K	6.75	4
10	IR7.3	7.34	2		0.35/0.12	1K		
11	IR8.7	8.5	2		0.27/0.1	1K		
12	IR9.6	9.61	2		0.35/0.15	1K		
13	IR10.5	10.35	2		0.4/0.2	1K	10.8	4
14	IR11.2	11.2	2		0.19/0.1	1K		
15	IR12.3	12.3	2		0.35/0.2	1.1K	12.0	4
16	IR13.3	13.3	2		0.48/0.3	1.1K		

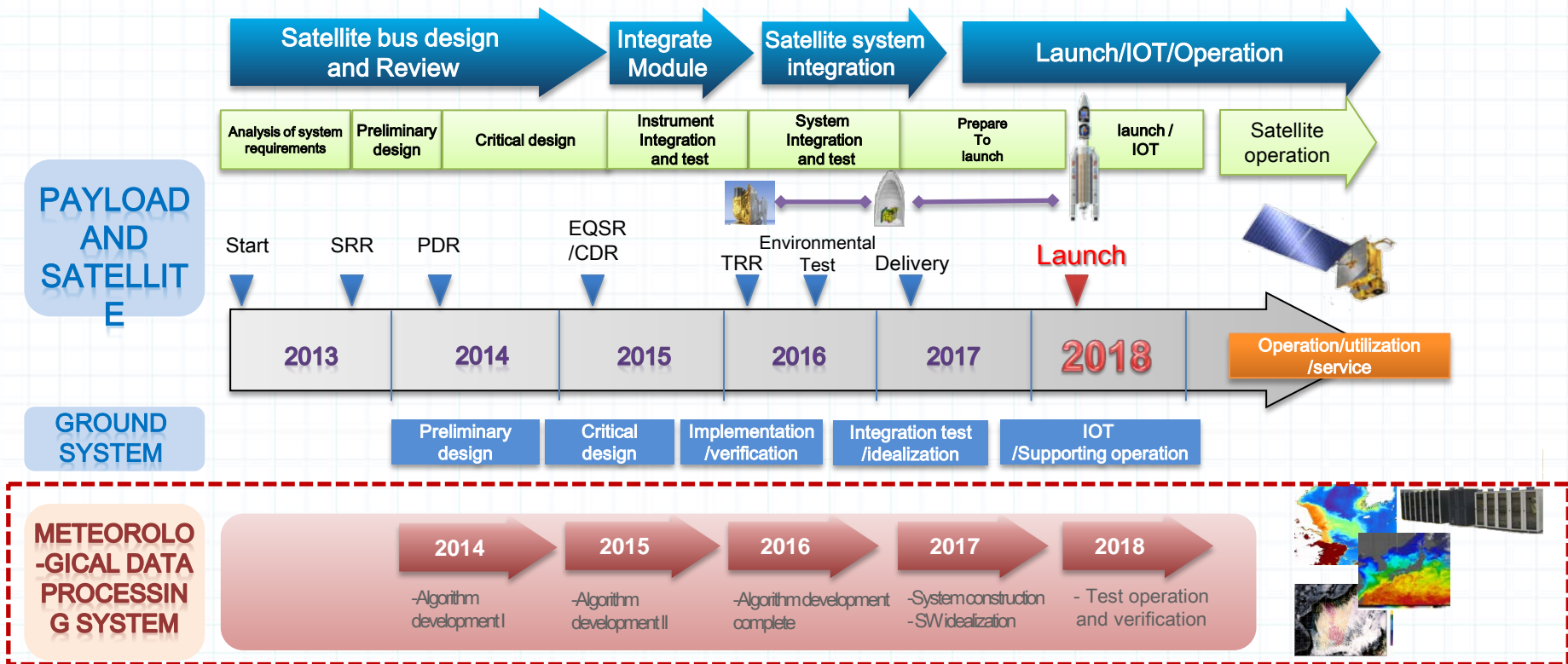


Status of GK-2A Meteorological Products

Status of GK-2A Meteorological Products



- Development of GK-2A meteorological products for applying weather forecast, NWP, climate monitoring was started in July 2014.
 - 23 Primary products
 - 29 Secondary products

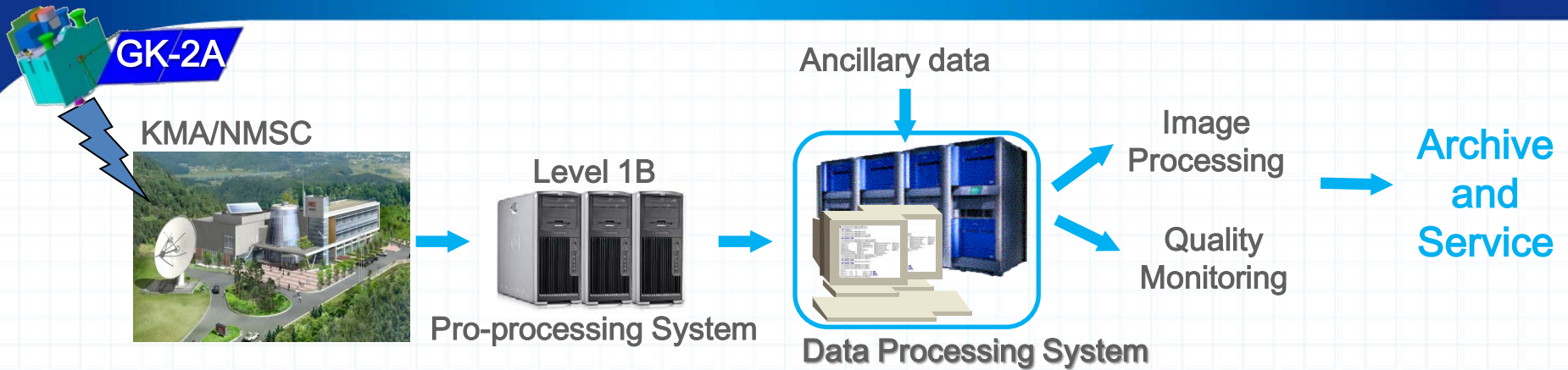


Status of GK-2A Meteorological Products



- Development Schedule
 - 1st phase 2014-2016 : Algorithm Development
 - 2nd phase 2017-2018 : Validation and Integration of Algorithm for Operation
- Algorithm Groups according to their characteristics and applications
 - Scene analysis and Surface information
 - Cloud and Precipitation
 - Radiation and Aerosol
 - Atmosphere and Aviation
 - ※ Twelve faculties in Korean Academia are involving in this project
- Development of application techniques for various users
 - Nowcasting
 - Typhoon and Ocean
 - Numerical Weather Prediction
 - Climate and Environment

Data processing of GK-2A Meteorological Products



Processing Flow

Scene Analysis

Cloud Mask Snow Cover Sea Ice

Cloud

Clear

* All Sky

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

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

GK-2A Meteorological Primary Products



Group	Wavelength	0.4	0.5	0.6	0.8	1.3	1.6	3.8	6.3	6.9	7.3	8.7	9.6	10.5	11.2	12.3	13.3
	Channel ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Scene & Surface Analysis	Cloud detection			✓		✓	✓	✓				✓			✓	✓	
	Snow Cover	✓		✓	✓		✓										
	Sea Ice Cover				✓		✓								✓	✓	
	Fog			✓				✓		✓					✓		
	Sea Surface Temperature														✓	✓	
	Land Surface Temperature														✓	✓	
Cloud & Precipitation	Cloud Top Temperature											✓		✓	✓	✓	
	Cloud Top Pressure											✓		✓	✓	✓	
	Cloud Top Height											✓		✓	✓	✓	
	Cloud Phase											✓		✓	✓	✓	
	Rainfall Rate								✓		✓	✓		✓	✓	✓	
Aerosol & radiation	Aerosol Detection	✓		✓	✓	✓	✓	✓				✓		✓	✓	✓	
	Aerosol Optical Depth	✓		✓	✓	✓	✓	✓				✓		✓	✓	✓	
	Asian Dust Detection	✓		✓	✓	✓	✓	✓				✓		✓	✓	✓	
	Asian Dust Optical Depth	✓		✓	✓	✓	✓	✓				✓		✓	✓	✓	
	Volcanic Ash Det. & Hgt											✓			✓	✓	
	Radiance	✓							✓			✓				✓	
Atmospheric condition & Aviation	Atmospheric Motion Vec.			✓				✓	✓	✓	✓				✓		
	Vertical Temp. Profile								✓	✓	✓		✓	✓	✓	✓	✓
	Vertical Moisture Profile								✓	✓	✓		✓	✓	✓	✓	✓
	Stability Index								✓	✓	✓	✓	✓	✓	✓	✓	✓
	Convective Initiation			✓				✓		✓	✓	✓		✓		✓	✓
	Total Ozone								✓	✓	✓		✓	✓	✓	✓	✓

GK-2A Meteorological Primary Products

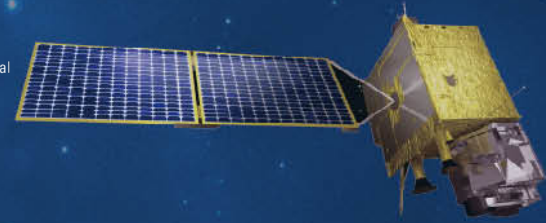


Group	Product	Measurement range	Accuracy	Temporal resolution	Spatial resolution	Coverage
Scene & Surface Analysis	Cloud detection	Clear, Probably clear, Probably cloudy, Cloudy	POD 87%	10~30 min	2 km	FD, ENH
	Snow Cover	0, 1 (binary)	POD 85%	1, 5, 10 days	2 km	FD, ENH
	Sea Ice Cover	0, 1 (binary)	POD 85%	10~30 min	2 km	FD, ENH
	Fog	0, 1 (binary)	POD 70%	10~30 min	2 km	FD, ENH
	Sea Surface Temperature	270~313 K	RMSE 0.4 K	1, 5, 10 days	2 km	FD, ENH
	Land Surface Temperature	213~330 K	RMSE 2.5 K	10~30 min	2 km	FD, ENH
Cloud & Precipitation	Cloud Top Temperature	180~300 K	RMSE 3K	10~30 min	2 km	FD, ENH
	Cloud Top Pressure	100~1000 hPa	RMSE 50 hPa	10~30 min	2 km	FD, ENH
	Cloud Top Height	0~15 km	RMSE 500 m	10~30 min	2 km	FD, ENH
	Cloud Phase	Liquid, Ice, Uncertain	POD 80 %	10~30 min	2 km	FD, ENH
	Rainfall Rate	0~100 mm/hr	RMSE 6 mm/hr @ 10mm/hr	10~30 min	2 km	FD, ENH
Aerosol & radiation	Aerosol Detection	0, 1 (binary)	POD 70~80 %	10~30 min	2 km	FD, ENH
	Aerosol Optical Depth	0~5	Land: $\pm 0.10 \pm 0.3^* \text{AOT}$ Ocean: $\pm 0.05 \pm 0.2^* \text{AOT}$	10~30 min	2 km	FD, ENH
	Asian Dust Detection	0, 1 (binary)	POD 70~80 %	10~30 min	2 km	FD, ENH
	Asian Dust Optical Depth	0~5	Land: $\pm 0.10 \pm 0.3^* \text{AOT}$ Ocean: $\pm 0.05 \pm 0.2^* \text{AOT}$	10~30 min	2 km	FD, ENH
	Volcanic Ash Det. & Hgt	detection: 0, 1 (binary) height: 0 ~ 20 km mass: 0~50 tons/km ²	POD: 70 ~ 80% Height: 3 km mass: 2 tons/km ²	10~30 min	2 km	ENH
	Radiance	Dynamic range of each channel	Depend on cloud detection and products	10~30 min	14 km	FD, ENH
Atmospheric condition & Aviation	Atmospheric Motion Vector	Speed: 0~150 m/s direction: 0~360° altitude: 100~1000 hPa	Mean Vector Diff.: 7.5 m/s	60 min	16 km	FD
	Vertical Temp. Profile	180~320 K	RMSE 1.5 K	10~30 min	2 km	FD, ENH
	Vertical Moisture Profile	0~100%	Lower level: 25%, high level: 50%	10~30 min	2 km	FD, ENH
	Stability Index	Lifted index: -10 to 40 K CAPE: 0~5000 J/kg Shower index: >4 to -10 K Total totals index: -43 to >56 K-index: 0~40	Lifted index: 2 K CAPE: 1000J/kg Shower index: 2 K Total totals index: 1 K index: 2	10~30 min	2 km	FD, ENH
	Convective Initiation	0, 1	POD 70%	10~30 min	2 km	Korea
Total Ozone	100~650 DU	RMSE 15 DU	10~30 min	2 km	FD, ENH	

GK-2A Meteorological Secondary Products



Scene & Surface Analysis (7)	Cloud & Precipitation (14)	Aerosol & Radiation (14)	Atmospheric condition & Aviation (11)
Surface Emissivity	Cloud Type	Aerosol Particle Size	Total Precipitable Water
Surface Albedo	Cloud Amount	Visibility	Tropopause Folding 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		

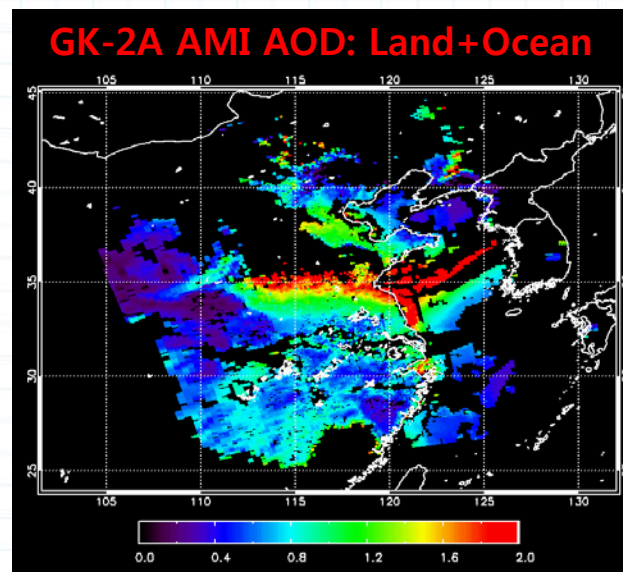
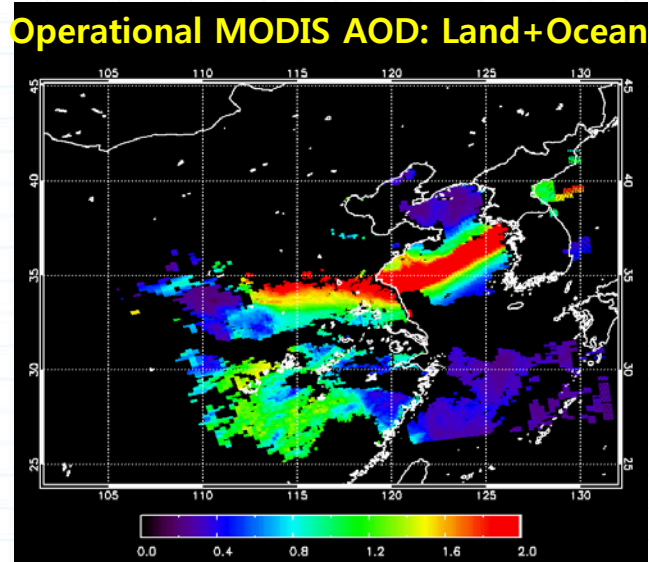
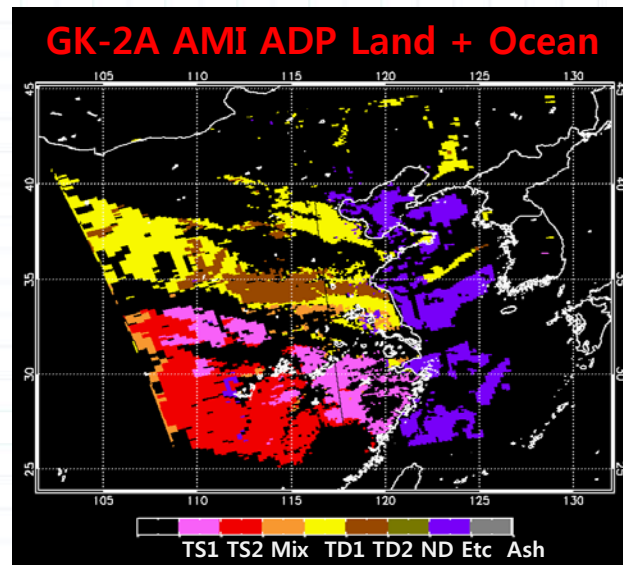
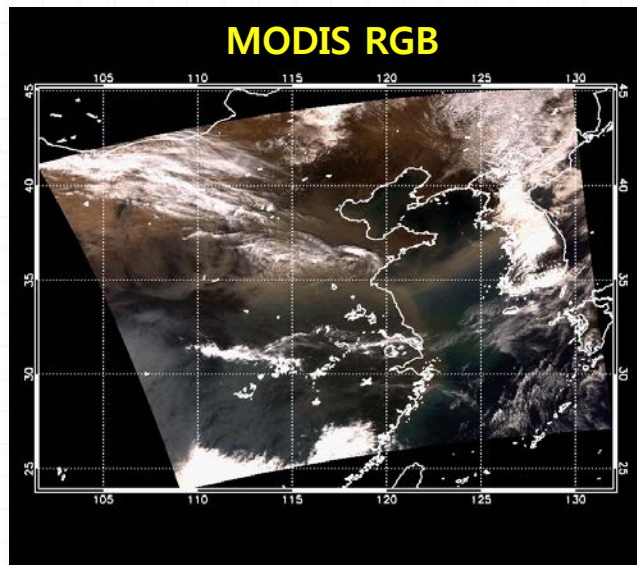


Examples of GK-2A Products

- Highlights

- Develop Individual algorithms for land and ocean, and integrate them
- Develop surface reflectance estimation algorithm using land use, vegetation index, TPW and total ozone in East Asia
- Applying Rayleigh and gas corrections affects to the reflectance of top of atmosphere
Asian dust is one of the Aerosol types of GK-2A
- ※ Aerosol types: smoke, dust, ash, generic
 - ※ GEMS and GOCI-2 of GK-2B will also produce aerosol products, therefore we are going to integrate them to monitor the Asian dust as well as smoke more effectively.

Asian Dust Case (12 March 2010)

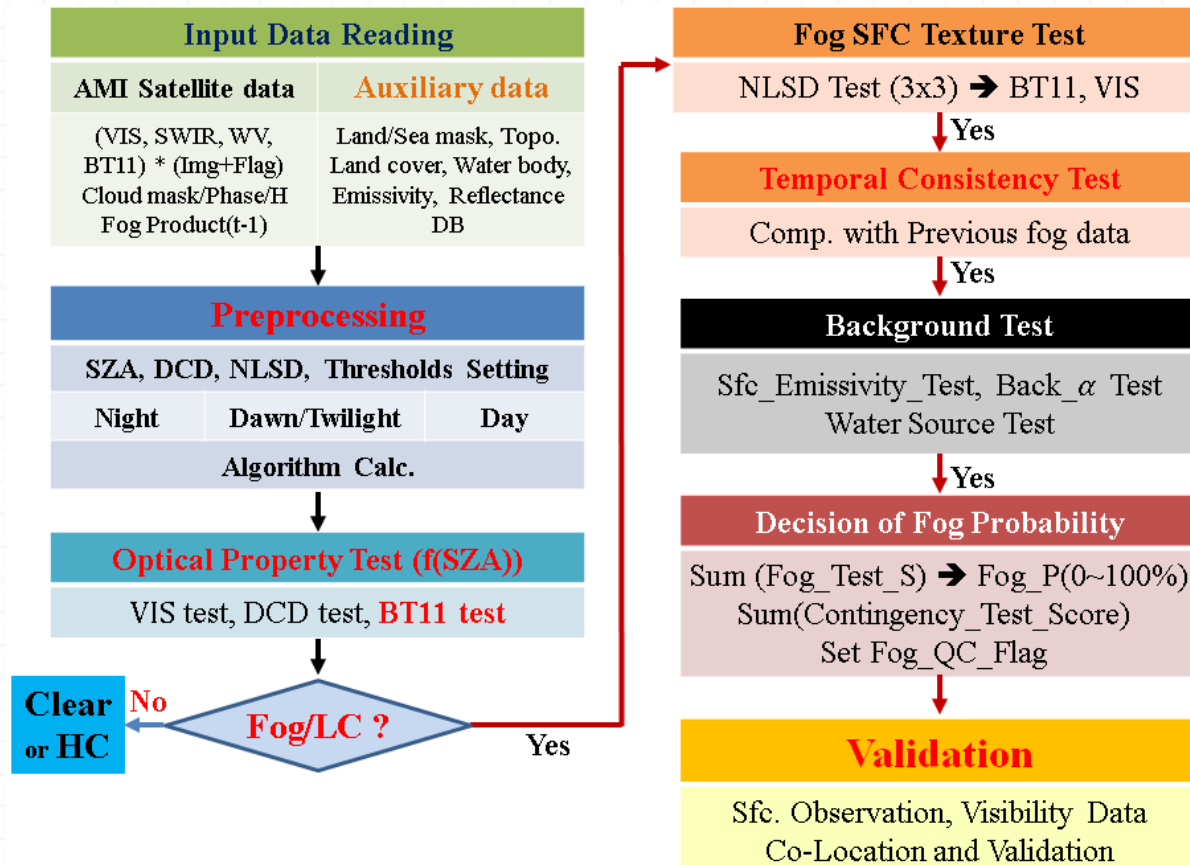


Fog Product

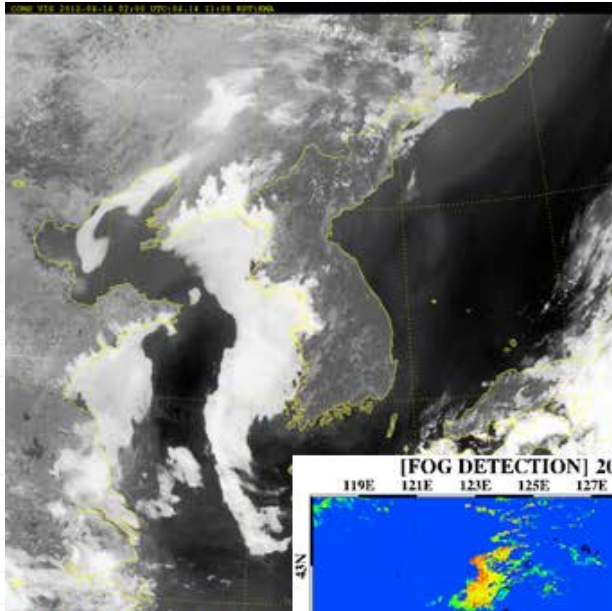


Highlights

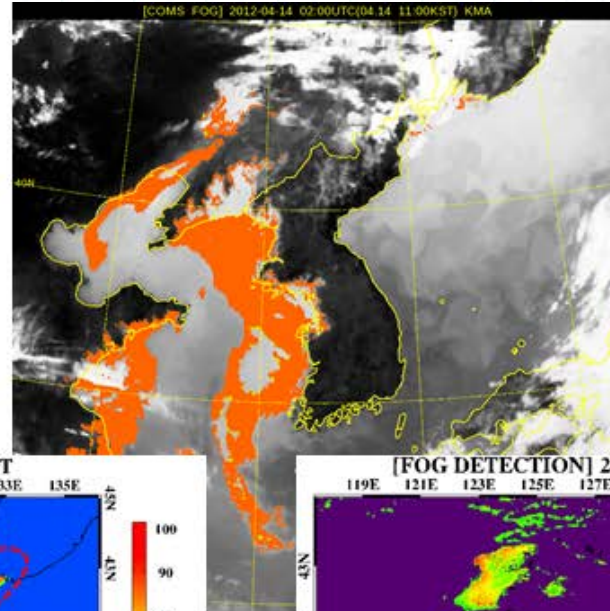
- Introduce normalized local standard deviation of VIS reflectance for fog surface texture test
- Use land surface emissivity DB of each channels (e.g. 3.8 microns) to improve overdetecting problem over the bare soil



Fog Case (14 April 2012 11:00 KST)

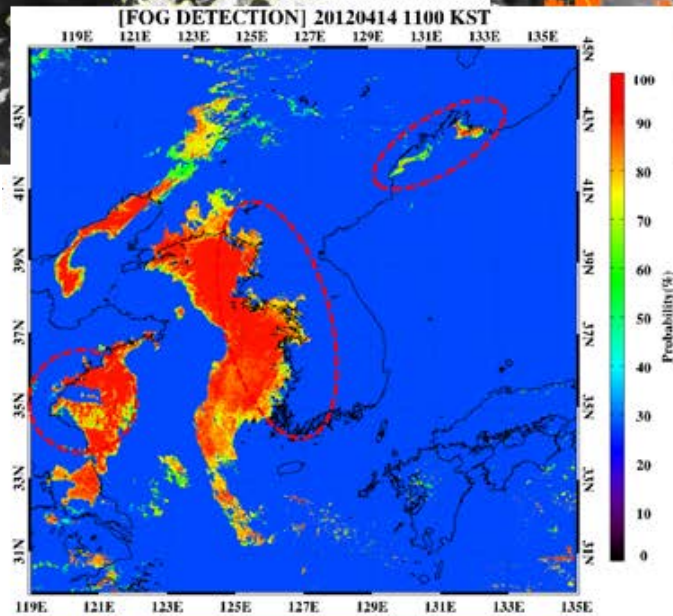


(a) COMS visible image

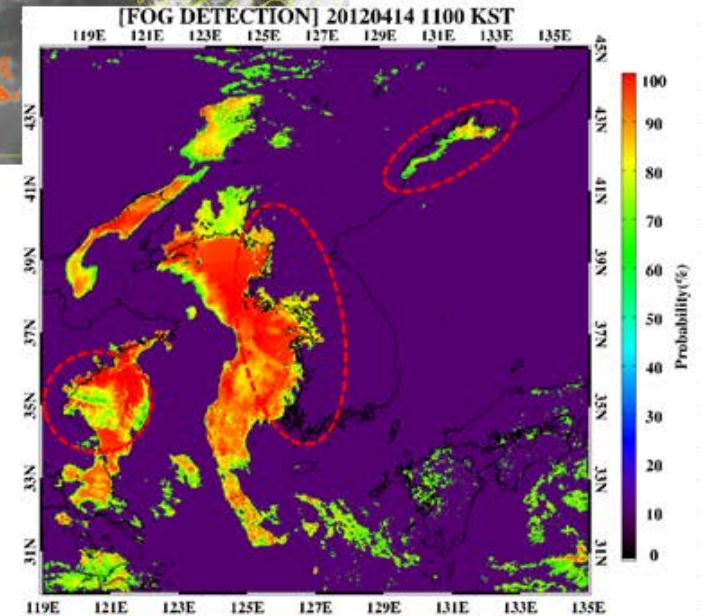


(b) COMS operational Fog

➤ KNU_FDA : Kongju National University Fog Detection Algorithm



(c) KNU_FDA_v1.0



(d) KNU_FDA_v1.1

Papers related to GK-2A/AMI in this conference



- **S05-4** Status of the GeoKompsat-2A AMI rainfall rate algorithm. Shin et al.
- **S06-2** Detection of Convective overshooting tops using MSG SEVIRI, Himawari-8 AHI, and Cloudsat CPR data. Kim et al.
- **S06-4** Application and validation of an artificial neural network approach for the fast estimation of the total precipitable water (TPW) from AHI data. Lee et al.
- **S06-5** Icing detection from geostationary satellite data over Korea and Japan using machine learning approaches. Ha et al.

Papers related to GK-2A/AMI in this conference



- **P03** Status of the GeoKompsat-2A AMI **rainfall potential** algorithm. Hong et al.
- **P14** Current and future Korean geostationary satellite **AMV quality control method**. Park et al.
- **P15** Analysis of **atmospheric motion vector tracking process**. Oh et al.
- **P16** Study of **sulfur dioxide detection** over East-Asia. Lee et al.
- **P28** Study of **tropopause folding turbulence detection (TFTD)** algorithm for the future Korean geostationary satellite. Kim and Kim
- **P30** Machine learning approaches to detect **convective initiation** using geostationary satellite and weather radar. Lee et al.

Future Plan



- In 2016, prototype algorithms of secondary products will be completed and an interface between products and operational applications will be designed.
- In 2017, all algorithms will be optimized using spectral response functions of GK-2A/AMI channels.
- Scientific validation and optimization process for routine operation will be performed before launch and continued to in-orbit test period (~2018).

Thank you for
your attention!

