Current status of Korean Met/Env Sat programs

B.J. Sohn
Seoul National University, Korea

Korean Met/Env Geo-Satellite Programs

GK-1: COMS - first multi-purpose geostationary satellite for Korea in Meteorology, Ocean and Communication (launched in 2010)

GK-2A: Meteorological Satellite (to be launched in the 4th quarter of 2018)

GK-2B: GEMS/GOCI (to be launched in early 2019)

COMS

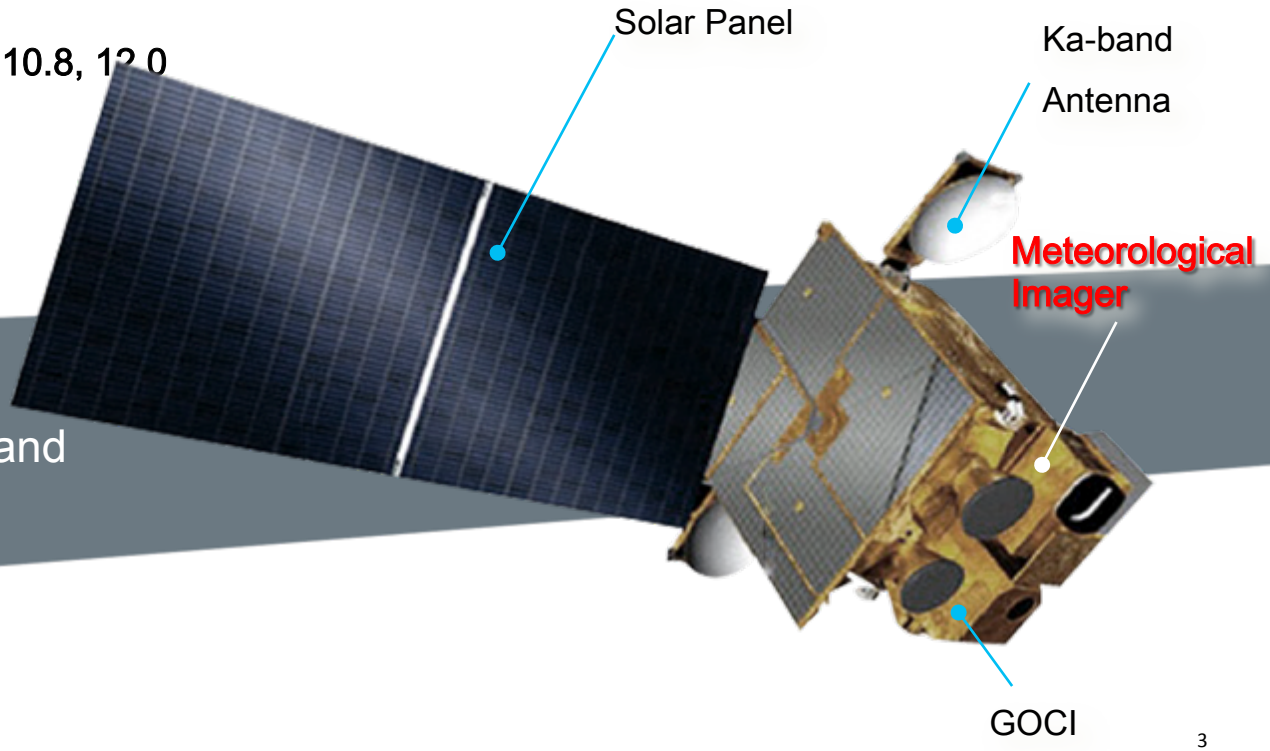
COMS(GK-1) is the first multi-purpose geostationary satellite for Korea in the application of Meteorology, Ocean and Communication

Meteorological Mission : Continuous Observation to support weather forecasting and early detection of severe weather phenomena

Launched: June 27, 2010

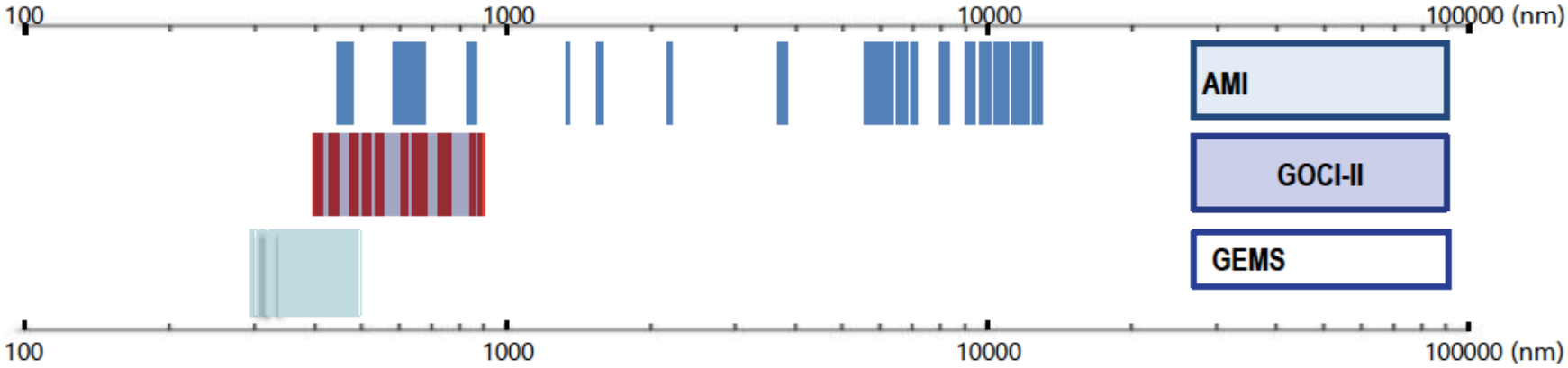
Orbit : 128.2°E

Channels: 0.67, 3.7, 6.7, 10.8, 12.0



Communication, Ocean and Meteorological Satellite

GK-2 Payloads



System Attributes	AMI (GK2A)	GOCI-II (GK2B)	GEMS (GK2B)
Spectral Range	470~1,330nm	370~885nm	300~500nm
Spatial Resolution	0.5~1km (VIS) 1~2km (IR)	< 250m (LA) < 1,000m (FD)	< 56Km^2 at Seoul
Spectral Resolution	400~1,000nm	10~40nm	0.6nm
No. of Channels	16	13	Hyper Spectral
Observation Coverage	FD, RA, ELA, LA	≥ 2,500×2,500km (LA) ≥+/-60deg (FD)	≥ 5,000km×5,000km, (45°N~5°S, 75°E~145°E)
Duty Cycle	FD : 6 times/hr	10 times/day Full Disc 1 time per day	≥ 8 times/day
Imaging Time	FD: 10 min, LA : 120 sec	≤ 30 min	≤ 30 min

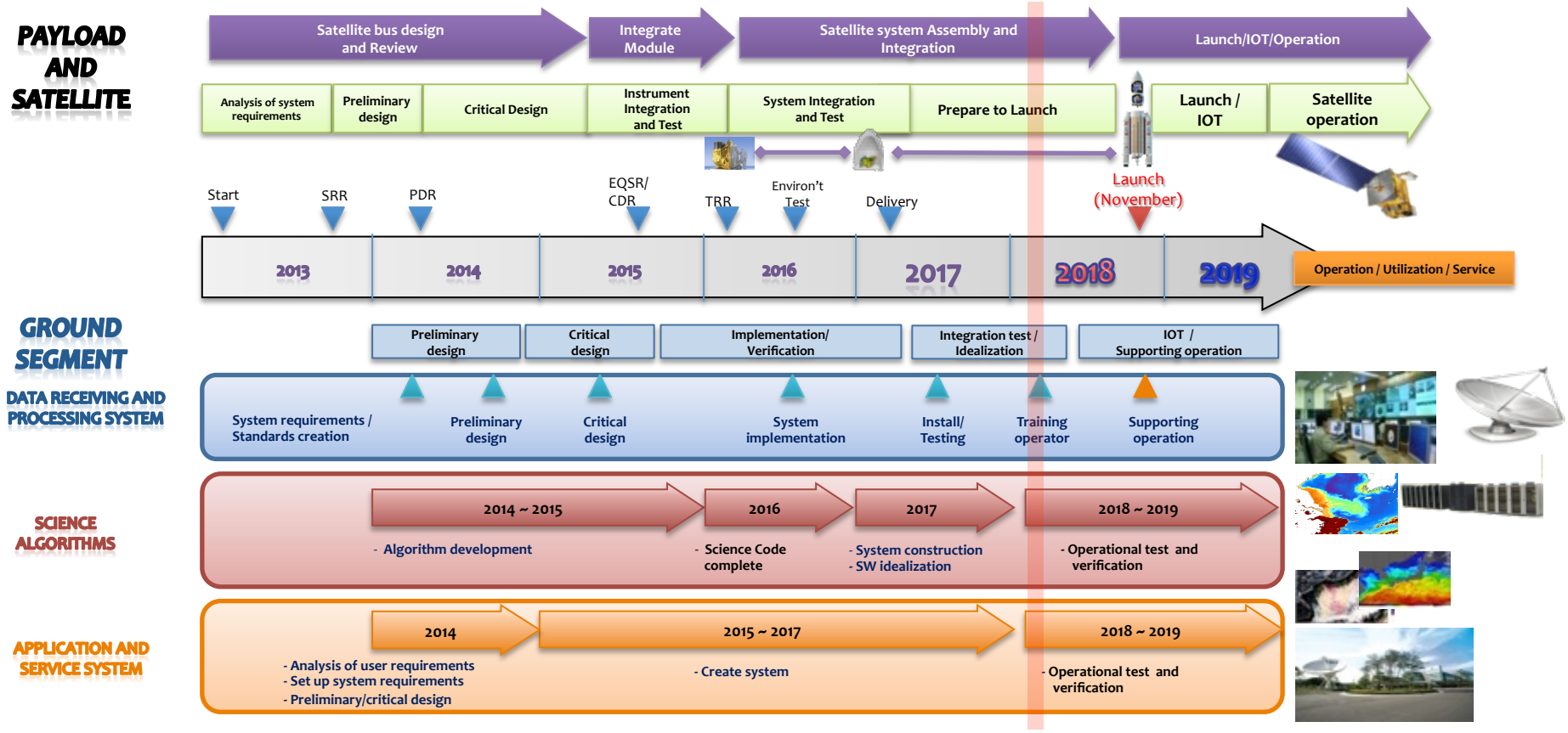
(Courtesy, KARI)

GEO-KOMPSAT-2A AMI (Advanced Meteorological Imager)

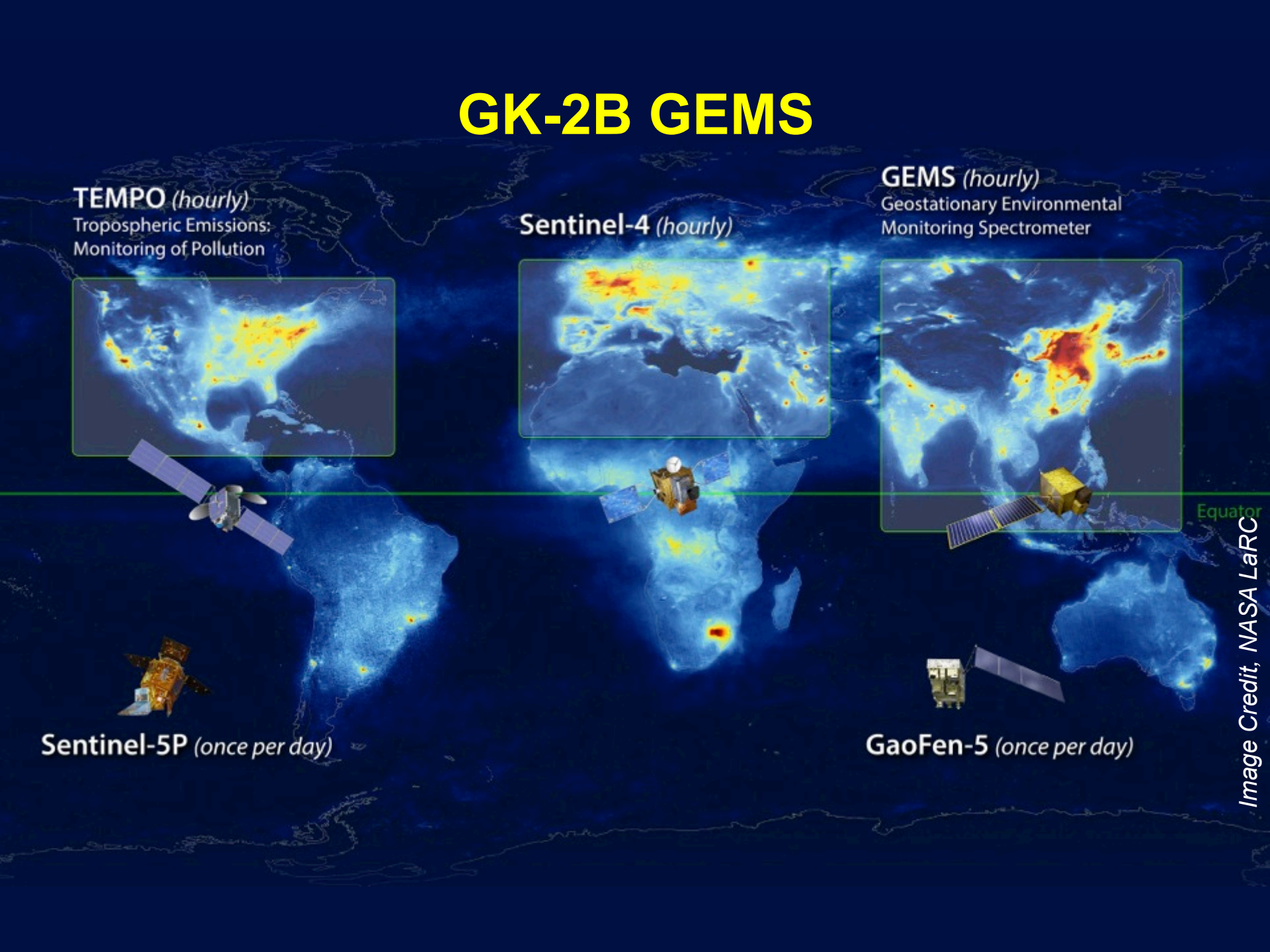
- Multi-channel capacity: 16 channels
- Temporal resolution: within 10 minutes for Full Disk observation
- Flexibility for the regional area selection and scheduling
- Lifetime of meteorological mission: 10 years

Bands		Center Wavelength		Band Width (Max, um)	Resolution (km)	GOES-R (ABI)	Himawari-8 (AHI)
		Min(um)	Max(um)				
VNIR	VIS0.4	0.431	0.479	0.075	1	0.47	0.46
	VIS0.5	0.5025	0.5175	0.0625	1		0.51
	VIS0.6	0.625	0.66	0.125	0.5	0.64	0.64
	VIS0.8	0.8495	0.8705	0.0875	1	0.865	0.86
	NIR1.3	1.373	1.383	0.03	2	1.378	
	NIR1.6	1.601	1.619	0.075	2	1.61	1.6
	NIR2.2				2	3.35	2.3
MWIR	IR3.8	3.74	3.96	0.5	2	3.90	3.9
	IR6.3	6.061	6.425	1.038	2	6.185	6.2
	IR6.9	6.89	7.01	0.5	2	6.95	7.0
	IR7.3	7.258	7.433	0.688	2	7.34	7.3
	IR8.7	8.44	8.76	0.5	2	8.50	8.6
LWIR	IR9.6	9.543	9.717	0.475	2	9.61	9.6
	IR10.5	10.25	10.61	0.875	2	10.35	10.4
	IR11.2	11.08	11.32	1.0	2	11.2	11.2
	IR12.3	12.15	12.45	1.25	2	12.3	12.3
	IR13.3	13.21	13.39	0.75	2	13.3	13.3

Milestone of GK-2A



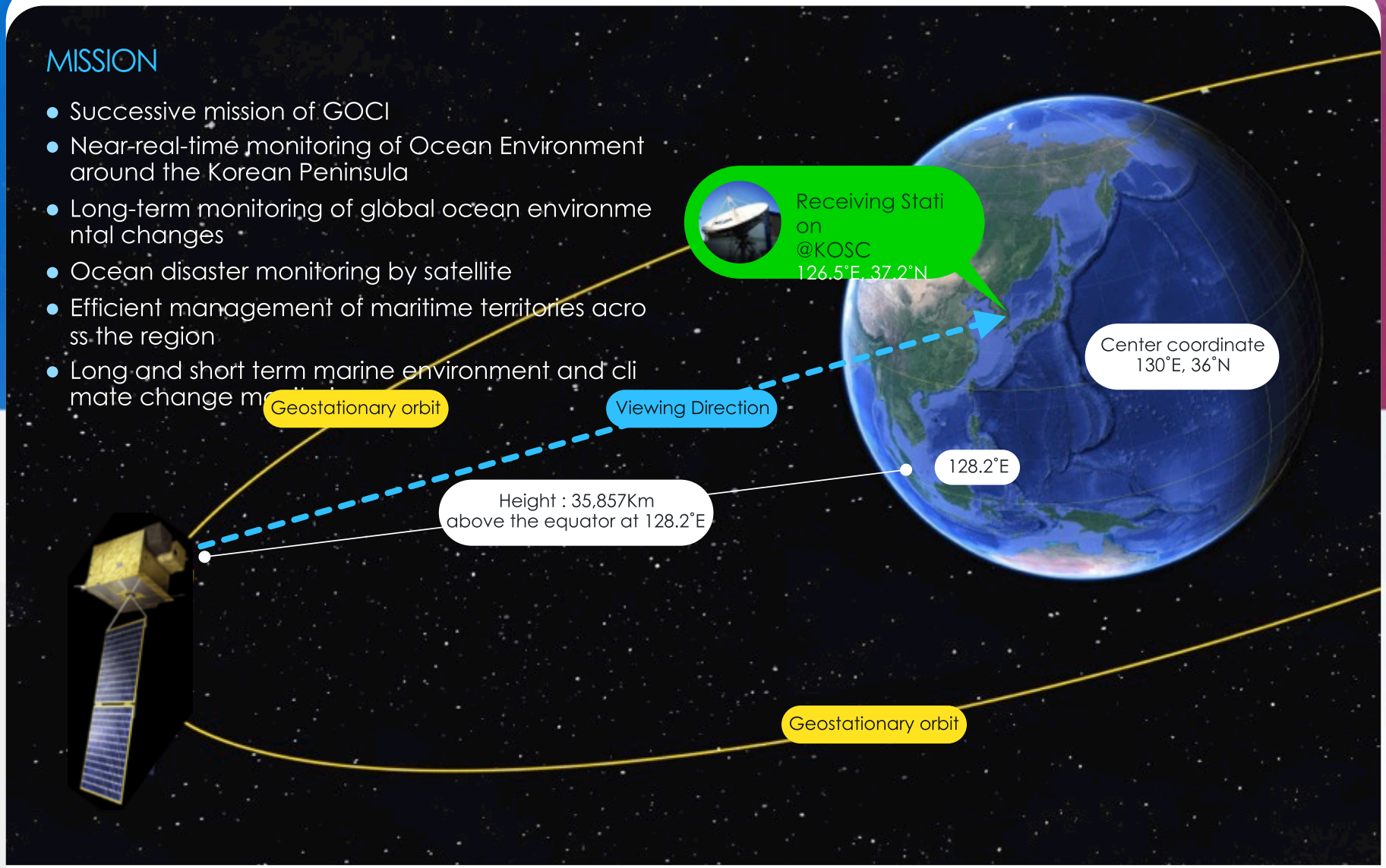
GK-2B GEMS


TEMPO (hourly)
Tropospheric Emissions:
Monitoring of Pollution
Sentinel-4 (hourly)
GEMS (hourly)
Geostationary Environmental
Monitoring Spectrometer
Equator
Sentinel-5P (once per day)
GaoFen-5 (once per day)
Image Credit, NASA LaRC

GOCI-II

MISSION

- Successive mission of GOCI
- Near-real-time monitoring of Ocean Environment around the Korean Peninsula
- Long-term monitoring of global ocean environme ntal changes
- Ocean disaster monitoring by satellite
- Efficient management of maritime territories acro ss the region
- Long and short term marine environment and cli mate change mo



LEO Satellite development

- **Long-term LEO satellite development plan** was approved by National Space D evelopment Committee('14.2) : 12 LEO satellites development('14~'25)
  - KMA LEO satellite launching : 2022

- **2015 : Surveying potential meteorological payloads(ATMS, CrIS, GPM)**
  : studies on economical and social benefits
  : impact studies on NWP (orbit and sensor elimination tests using operational model, UM512)

- **2016 : Feasibility test request** for KMA LEO satellite development budget

- **2017: Studies for user's requirements, ground segment development**

- **Project kick-off in 2018, targeting the launch in 2023.**

Microwave Channel Priority

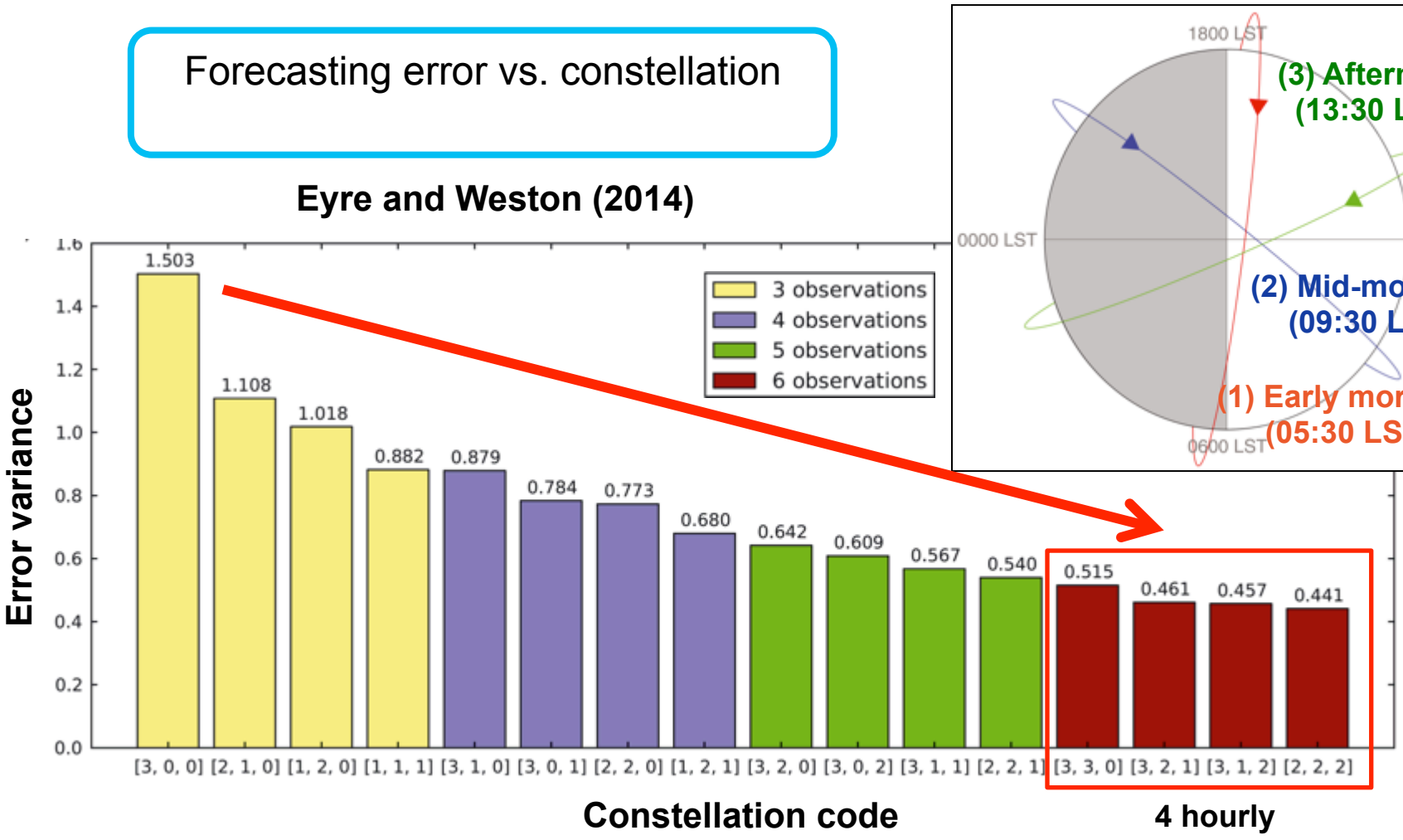
	EON SDR/TDR Performance Estimates								
Channel	Center Frequency (GHz)	Total Bandpass (GHz)	Polarization	Accuracy (K)	NEdT @300 K (K) TDR	NEdT @300 K (K) SDR	EFOV Cross-Track (deg.)	EFOV Along-Track (deg.)	Dynamic Range (K)
1	23.8	0.27	H	1	0.7	0.15	6.3	5.7	0-330
2	31.4	0.18	H	1	0.8	0.19	6.3	5.7	0-330
3	50.3	0.2	H	0.75	0.96	0.22	3.3	2.7	0-330
4	51.76	0.4	H	0.75	0.68	0.15	3.3	2.7	0-330
5	52.85	0.5	H	0.75	0.60	0.13	3.3	2.7	0-330
6	53.5	0.6	H	0.75	0.55	0.12	3.3	2.7	0-330
7	54.15	0.6	H	0.75	0.55	0.12	3.3	2.7	0-330
8	54.75	0.6	H	0.75	0.55	0.12	3.3	2.7	0-330
9	55.5	0.33	H	0.75	0.75	0.17	3.3	2.7	0-330
10	57.290344	0.33	H	0.75	0.75	0.17	3.3	2.7	0-330
11	57.5	0.1	H	0.75	1.35	0.30	3.3	2.7	0-330
12	57.6125±0.048	0.072	H	0.75	1.6	0.36	3.3	2.7	0-330
13	57.6125± 0.022	0.032	H	0.75	2.4	0.54	3.3	2.7	0-330
14	57.6125± 0.010	0.016	H	0.75	3.4	0.76	3.3	2.7	0-330
15	57.6125± 0.0045	0.006	H	0.75	5.5	1.23	3.3	2.7	0-330
16	88.2	2	H	1	0.5	0.12	3.3	2.2	0-330
17	165.5±0.925	3	H	1	0.6	0.13	2.2	1.1	0-330
18	183.31-7	2	H	1	0.5	0.12	2.2	1.1	0-330
19	183.31-4.5	2	H	1	0.8	0.19	2.2	1.1	0-330
20	183.31-3	1	H	1	0.6	0.13	2.2	1.1	0-330
21	183.31-1.8	1	H	1	0.8	0.19	2.2	1.1	0-330
22	183.31-1	0.5	H	1	0.9	0.20	2.2	1.1	0-330
									V1.3, 1/15/14

Notes
H = Horizontal NEdT = Noise Equivalent Differential Temperature
Green – baseline - serves medium range weather forecasting needs and uses GPS RO (COSMIC) to provide stratospheric observations
Blue – enhancement 1 - provides key surface channels used for precipitation monitoring and total water content and used to quality control channels in the baseline
Red - enhancement 2 - mitigate need to rely on GPS-RO and provides better global coverage
Purple – enhancement 3 - improves lower tropospheric water vapor information and better water vapor vertical resolution than baseline

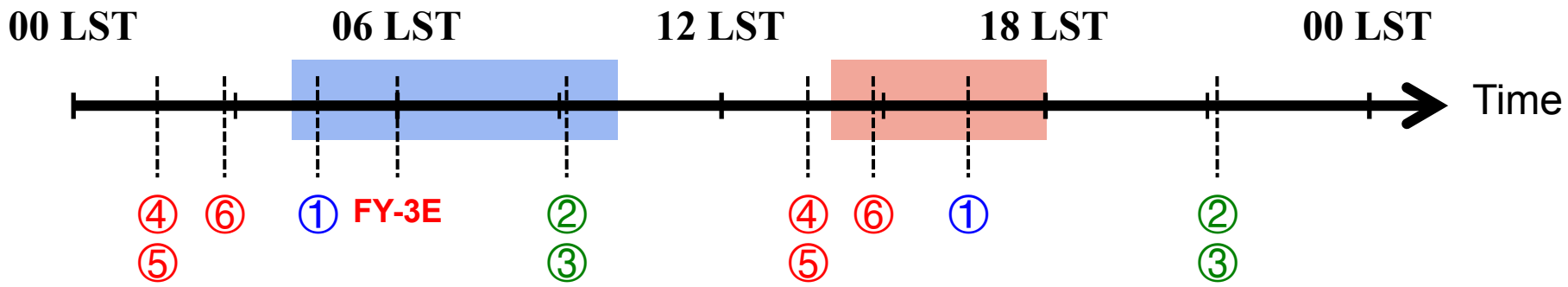
T, q sounding chs (near 60 GHz, 183 GHz), and 19, 22, 37, 89 GHz chs

Orbit Selection

Forecasting error vs. constellation



Eq-crossing times of polar satellites



✓ Early morning (EM) satellites

① NOAA-15 AMSU-A/B (MW)

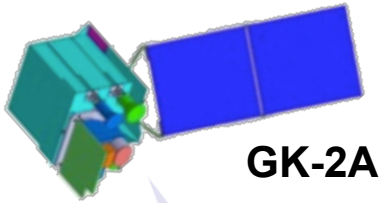
✓ Morning (M) satellites

② Metop-A AMSU-A/MHS (MW)
③ Metop-A IASI (IR)

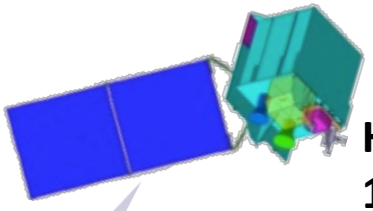
✓ Afternoon (A) satellites

④ Aqua AIRS (IR)
⑤ NOAA-19 AMSU-A/MHS (MW)
⑥ NOAA-18 AMSU-A/MHS (MW)

Korean Polar Sat will likely have dawn/dusk crossing time



GK-2A 128.2°E



Himawari
140.7° E

3-D cloud development and associated thermodynamic/dynamic environmental changes

- Rapid scan for observing the cloud development with 3D view --> cloud's vertical velocity (vertical velocity vs. cirrus development)
- Impact of vertical velocity, winds on the weather forecast (DA)
- UTH --> UT moistening in relation to the cloud development, phase change
- WV and lower clouds - lower level winds; low-level wind vs. cloud dev