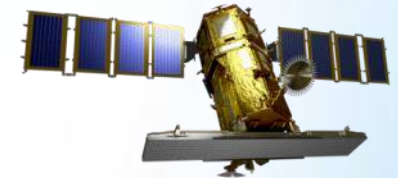
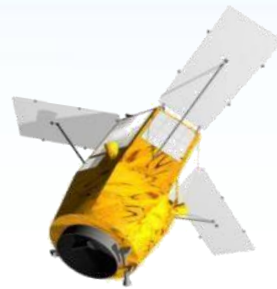
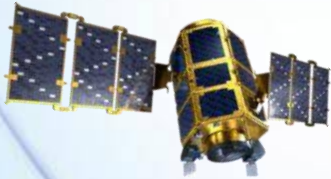


Introduction to SIIS and KOMPSAT



November 2014

Distribution Limitation, SI Imaging Services Proprietary Data The data contained in this document, without the permission of SI Imaging Services, shall not be used or disclosed for any purpose. The data subject to this restriction is contained on all pages.

SIIS in Brief

Fair Access to Satellite Image Data Services

Established on 1st April, 2014

Subsidiary of Satrec Initiative

Exclusive Worldwide Distributor of KOMPSAT-2, 3 and 5

Worldwide distributor of DubaiSat-2

Distributor of Deimos-2 (end of 2014)

Distributor of TeLEOS-1 (2015)



SI in Brief



Leading Small EO Satellite Manufacturer

180 full-time staff (60% with MSc or higher degree)

Over 20 Years Space Experience

Over 20 International & National Space Programs

Listed on KOSDAQ Exchange Market

AS9100 & ISO 9001 certified



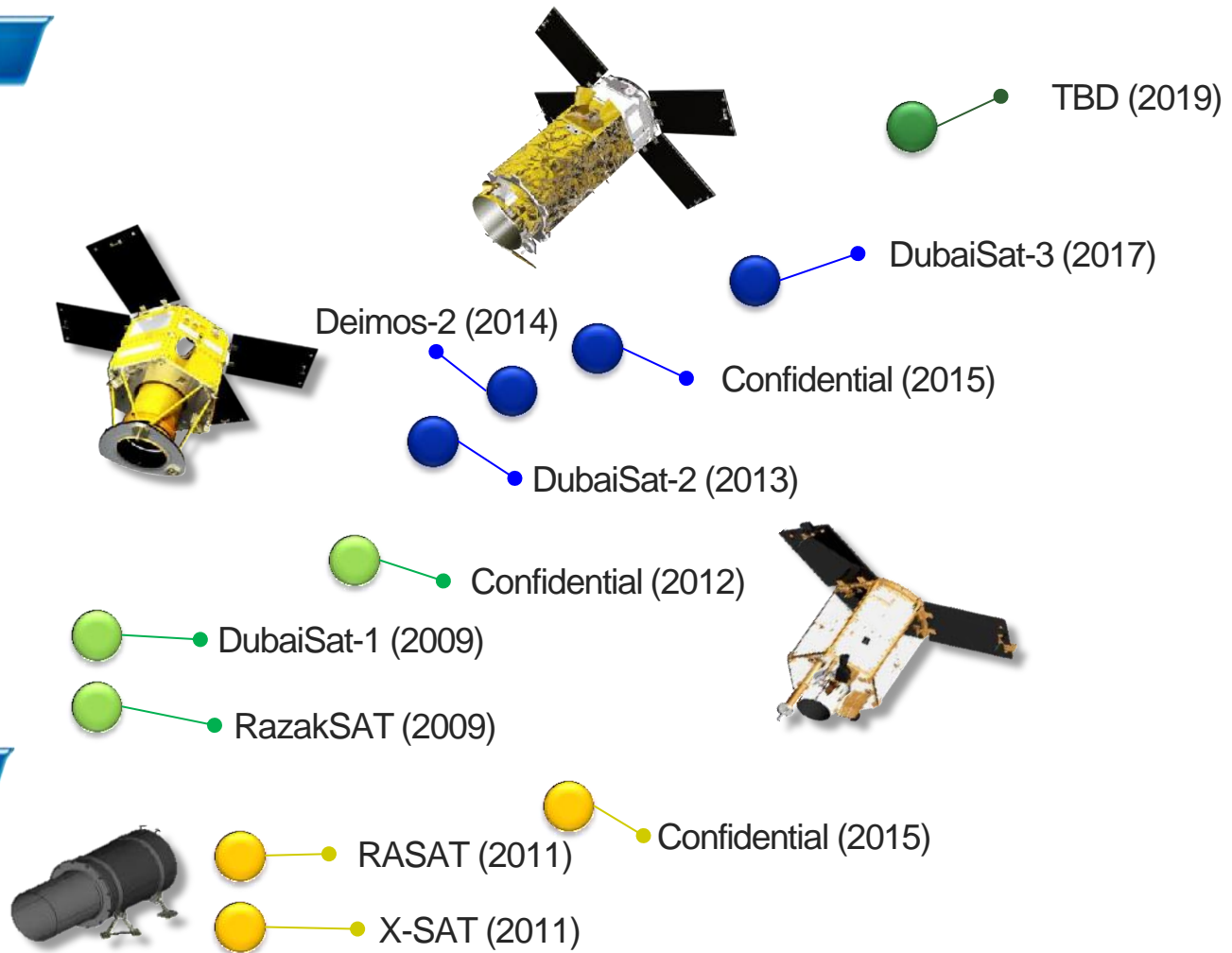
Satellite Systems

SpaceEye-X (0.5m)

SpaceEye-1 (1 m)

SpaceEye-2 (2.5 m)

SpaceEye-10 (10 m)



2005

2010

2015

2020

Business Portfolio

Space

Satellite Platform



Payload



Ground Station



Defense

Mobile Ground Station



UAV Ground Station



Satellite



Radiation Safety

EFRD 3300

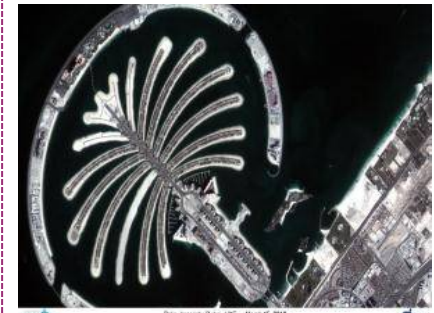


EFRD Metro

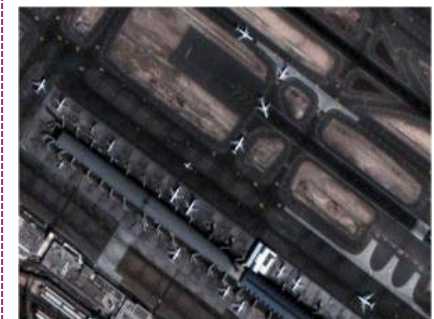


Satellite Imagery

Satellite Image



Value-added Service



Representative of KOMPSAT

SPACE DAILY

your portal to space

AdChoices ▶ ▶ Satellite ▶ Aero Space ▶ Korea ▶ Yield Data

EARTH OBSERVATION

Satrec Initiative Announces Agreement with Korea Aerospace Research Institute

by Staff Writers
Seoul, Korea (SPX) Nov 18, 2012

Satrec Initiative, a leading solution provider for Earth observation missions, announced an agreement with Korea Aerospace Research Institute (KARI) for "Worldwide Marketing and Sales Representative of KOMPSAT-2, 3 and 5 Image data". KARI assigned Satrec Initiative as the 'worldwide exclusive representative' for KOMPSAT imagery sales.



"Satrec Initiative is pleased that KARI has selected us as the representative for KOMPSAT imagery sales. The KOMPSAT imagery will serve worldwide customers as an alternate source of earth observation data," said Sungdong Park, President and CEO of Satrec Initiative. "Also, we expect the growth of Korean remote sensing industry through commercialization of KOMPSAT imagery by domestic company."

GEOSPATIAL WORLD

Geospatial Communication Network

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Satrec Initiative, KARI ink image dissemination deal

Published Date : 15 November 2012

News

Korea: Satrec Initiative, a leading solution provider for earth observation missions, announced an agreement with Korea Aerospace Research Institute (KARI) for "Worldwide Marketing and Sales Representative of KOMPSAT-2, 3 and 5 Image data". KARI assigned Satrec Initiative as the 'worldwide exclusive representative' for KOMPSAT imagery sales.

"Satrec Initiative is pleased that KARI has selected us as the representative for KOMPSAT imagery sales. The KOMPSAT imagery will serve worldwide customers as an alternate source of earth observation data," said Sungdong Park, President and CEO of Satrec Initiative. "Also, we expect the growth of Korean remote sensing industry through commercialisation of KOMPSAT imagery by domestic company."

KARI is the Korean institute dedicated to aerospace research, and is in charge of Korean Space Program.

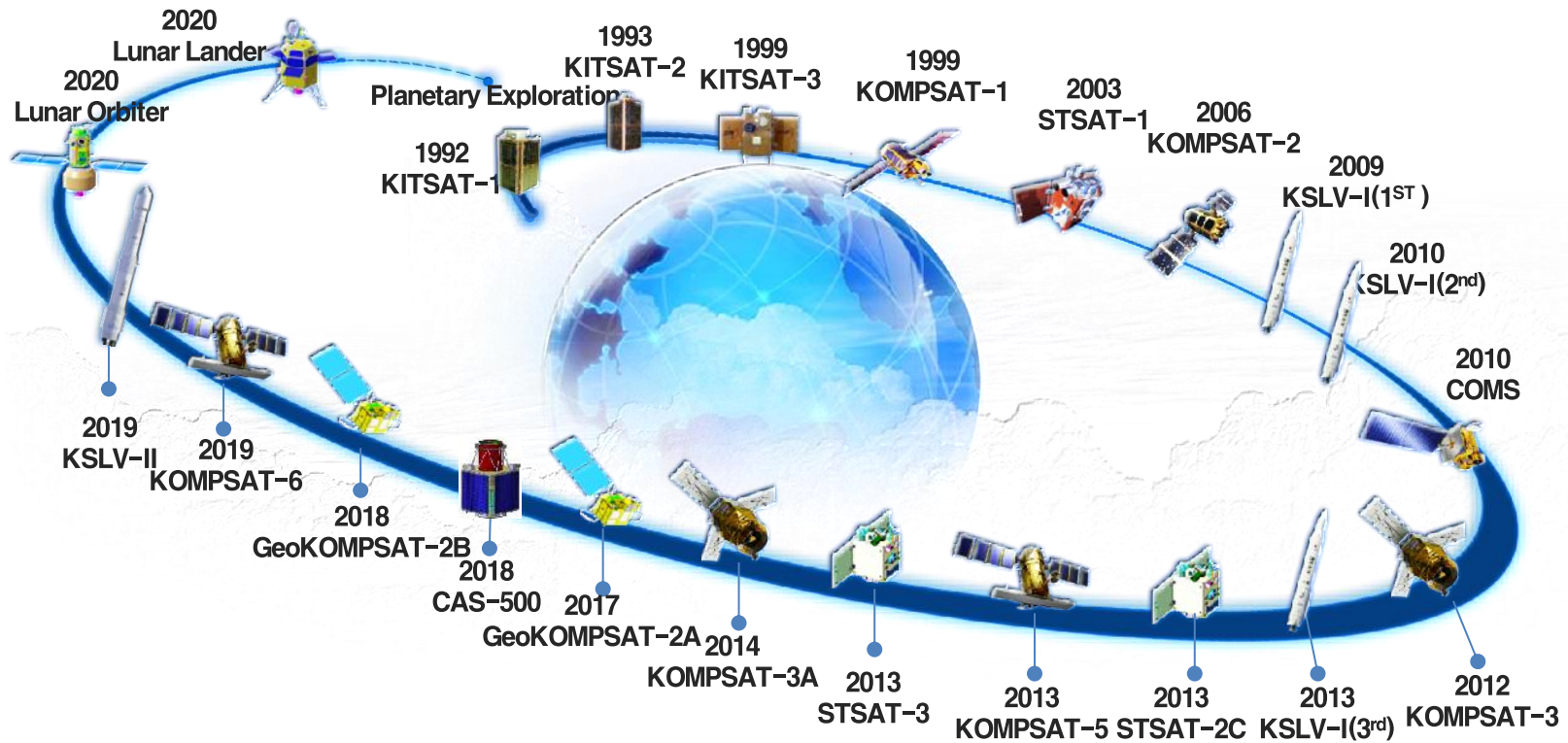
KARI has developed and operated its optical remote sensing satellites such as KOMPSAT-1, KOMPSAT-2 and KOMPSAT-3, and will launch the first Korean SAR satellite, KOMPSAT-5, shortly.



KOMPSAT Constellation

KOMPSAT at Your Service

Space Program of Korea



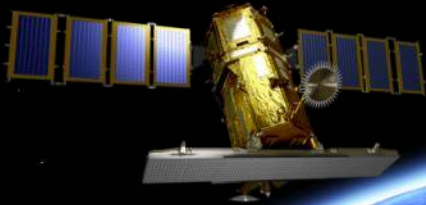
More than **20 years experience** on development and operation

- **10** Satellites Launched
- more than **5** Satellites to be Launched

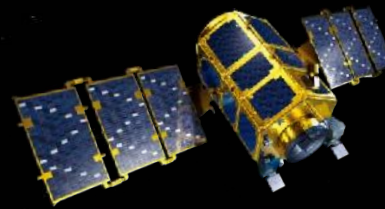
KOMPSAT Constellation

❖ KOMPSAT

- National program
- Developed and operated by KARI (Korea Aerospace Research Institute)
- Dual use : Government & commercial
- Worldwide imagery distribution by SI Imaging Services



KOMPSAT-5
Design lifetime : 5 years
To be launched on Aug. 22, 2013
1.0 m SAR Payload
LTAN : 6:00



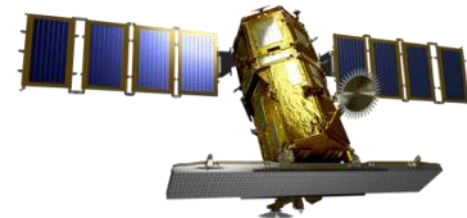
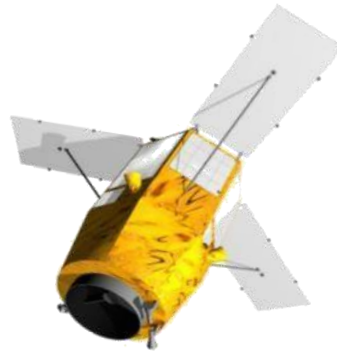
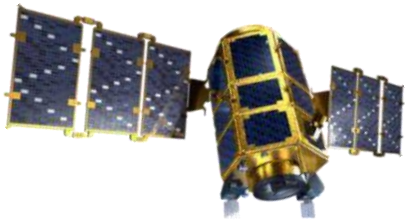
KOMPSAT-2
Design lifetime : 3 years
2006.7.28 -
1.0 m EO Payload
LTAN : 10:50



KOMPSAT-3
Design lifetime : 4 years
2012.5.18 -
0.7 m EO Payload
LTAN : 13:30

KOMPSAT Constellation

- ❖ Integrated solution for optical and radar
- ❖ Unique combination for imaging time (10:50, 13:30, 06:00/18:00)
- ❖ Korean government's long term commitment → data continuity



KOMPSAT-2

- Launch in July 2006
- Optical
- LT: 10:50
- 1 PAN + 4 MS
(R/G/B/NIR)
- PAN: 1 m (15 km)
- MS: 4 m (15 km)

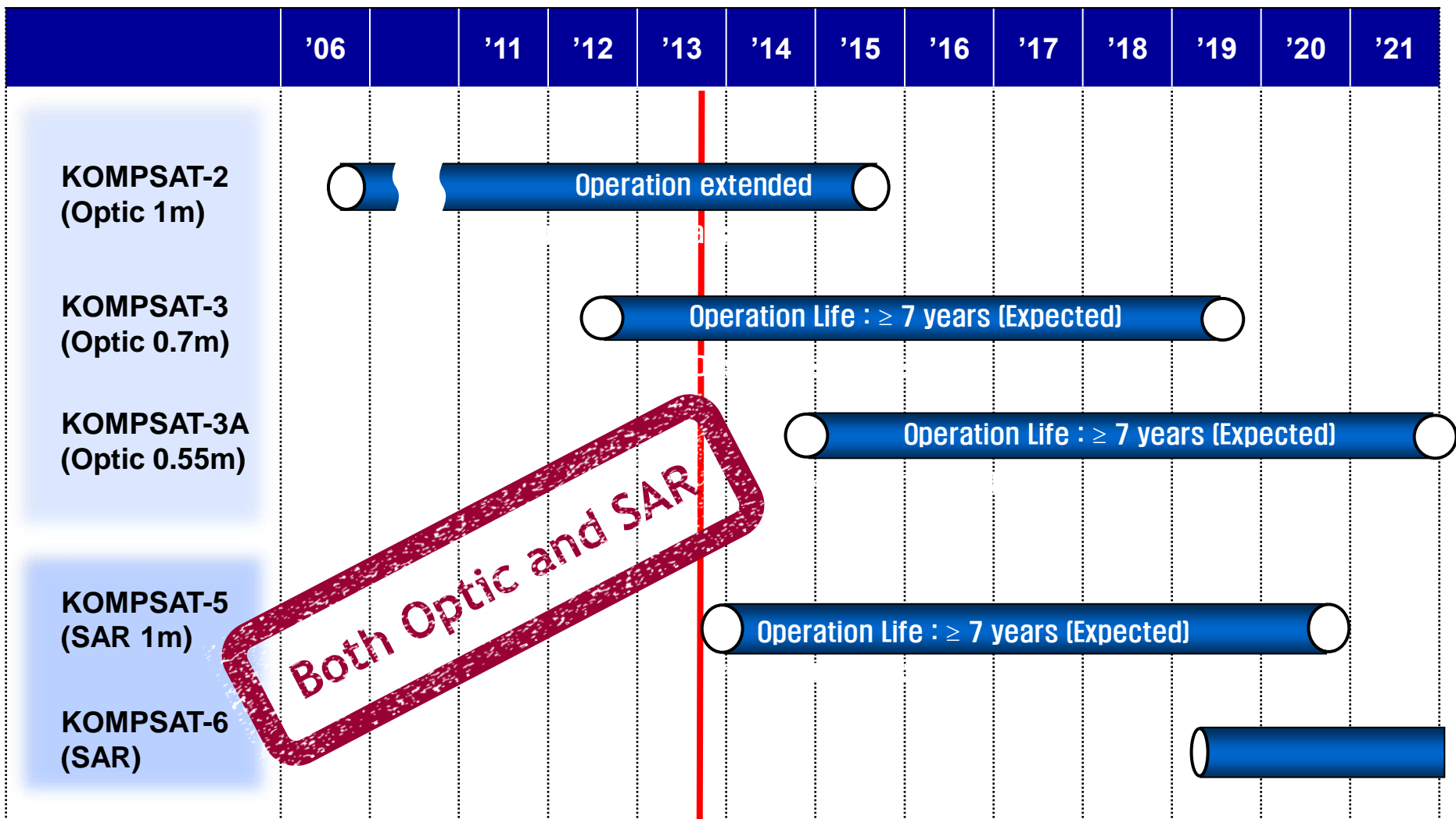
KOMPSAT-3

- Launch in May 2012
- Optical
- LT: 13:30
- 1 PAN + 4 MS
(R/G/B/NIR)
- PAN: 0.7 m (16 km)
- MS: 2.8 m (16 km)

KOMPSAT-5

- Launch in early-2013
(planned)
- Radar
- LT: 06:00/18:00
- Spotlight: 1 m (5 km)
- Strip: 3 m (30 km)
- ScanSAR: 20 m (100 km)

KOMPSAT Data Continuity



Korean Government has clear policy to have high resolution imagery by own satellites

Evolution of KOMPSAT Images

❖ Jamsil Olympic Stadium, Seoul

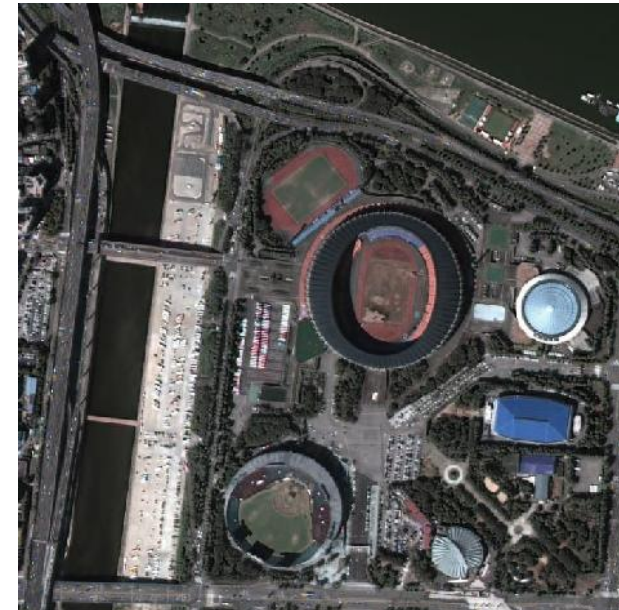
- - Main Stadium of 1988 Seoul Olympic



(KOMPSAT-1)
Resolution (pan. : 6.6m)



(KOMPSAT-2)
Resolution (pan./color : 1m/4m)



(KOMPSAT-3)
Resolution (pan./color : 0.7m/2.8m)

KOMPSAT Global Network

• Svalbard Satellite Station (SvalSat)

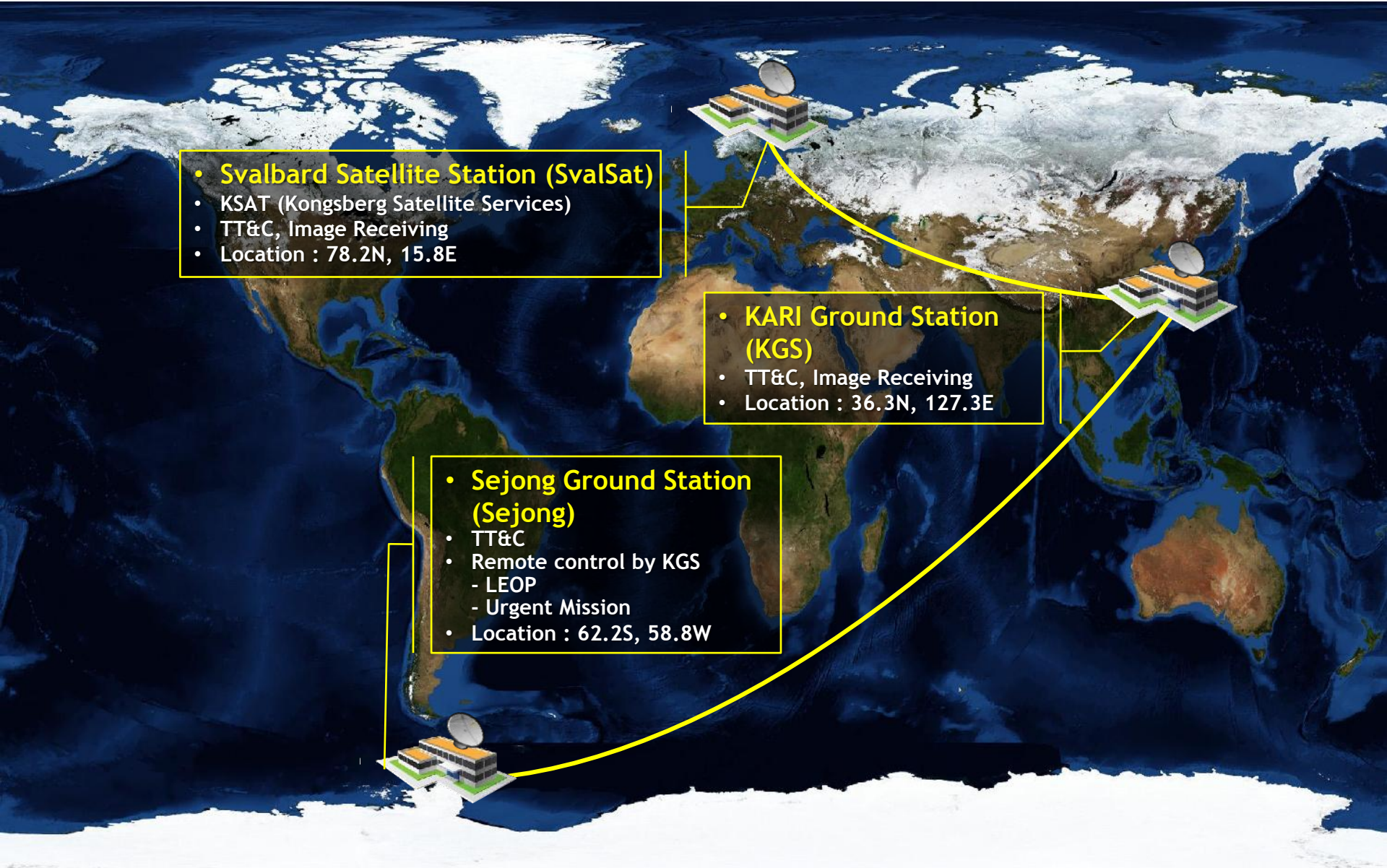
- KSAT (Kongsberg Satellite Services)
- TT&C, Image Receiving
- Location : 78.2N, 15.8E

• KARI Ground Station (KGS)

- TT&C, Image Receiving
- Location : 36.3N, 127.3E

• Sejong Ground Station (Sejong)

- TT&C
- Remote control by KGS
 - LEOP
 - Urgent Mission
- Location : 62.2S, 58.8W





KOMPSAT-2

Alternative 1m Solution

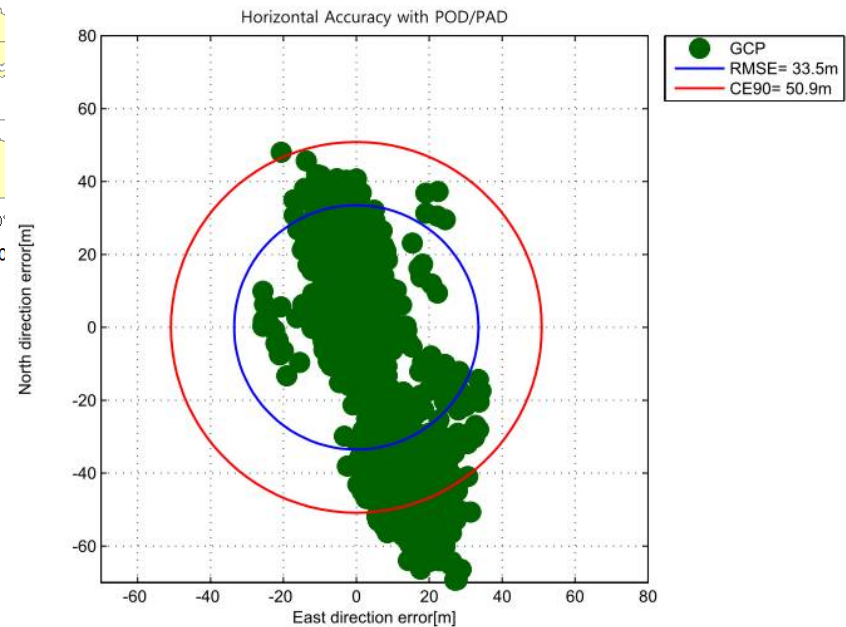
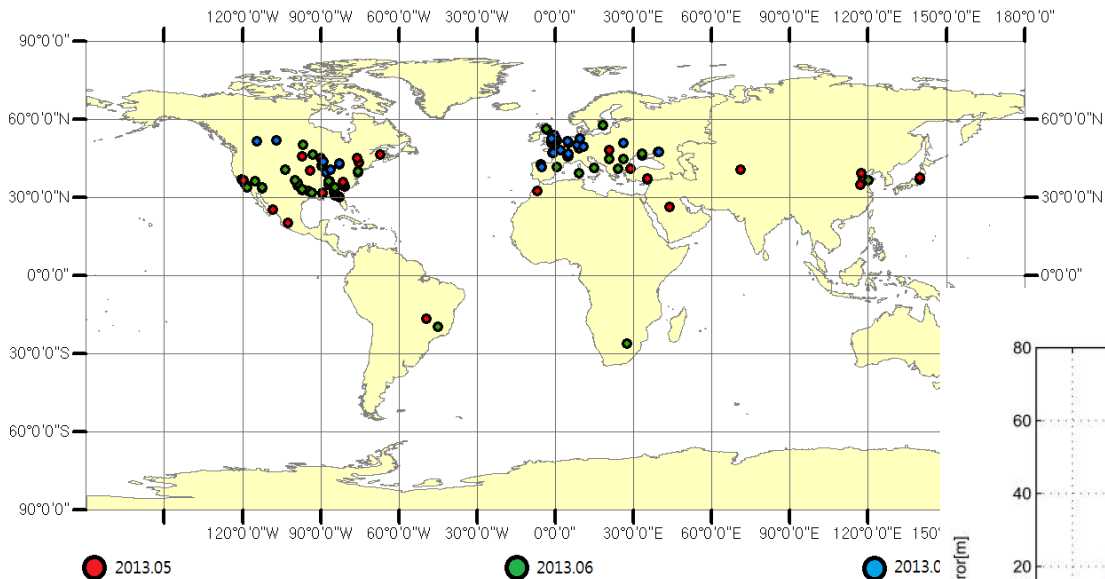
Sydney, Australia

Specifications

Launch	28 July, 2006
Ground Sampling Distance	PAN : 1.0 m @altitude 685 km(nadir) MS : 4.0 m @altitude 685 km(nadir)
Swath Width	15 km (nadir)
Spectral Bands	PAN : 500 ~ 900 nm MS1 (Blue) : 450 ~ 520 nm MS2 (Green) : 520 ~ 600 nm MS3 (Red) : 630 ~ 690 nm MS4 (NIR) : 760 ~ 900 nm
Location Accuracy	< 50.9 m CE90 (expected)
Tilt Angle	Roll(-30~30 deg.)
Data Quantization	10 bit / pixel
Orbit	Sun Synchronous Orbit <ul style="list-style-type: none">• Altitude : 685 km• Inclination : 98.127 deg.• MLTAN : 10:50
Duty	20% per orbit

Location Accuracy

❖ < 50.9 m (CE90) is expected without GCP

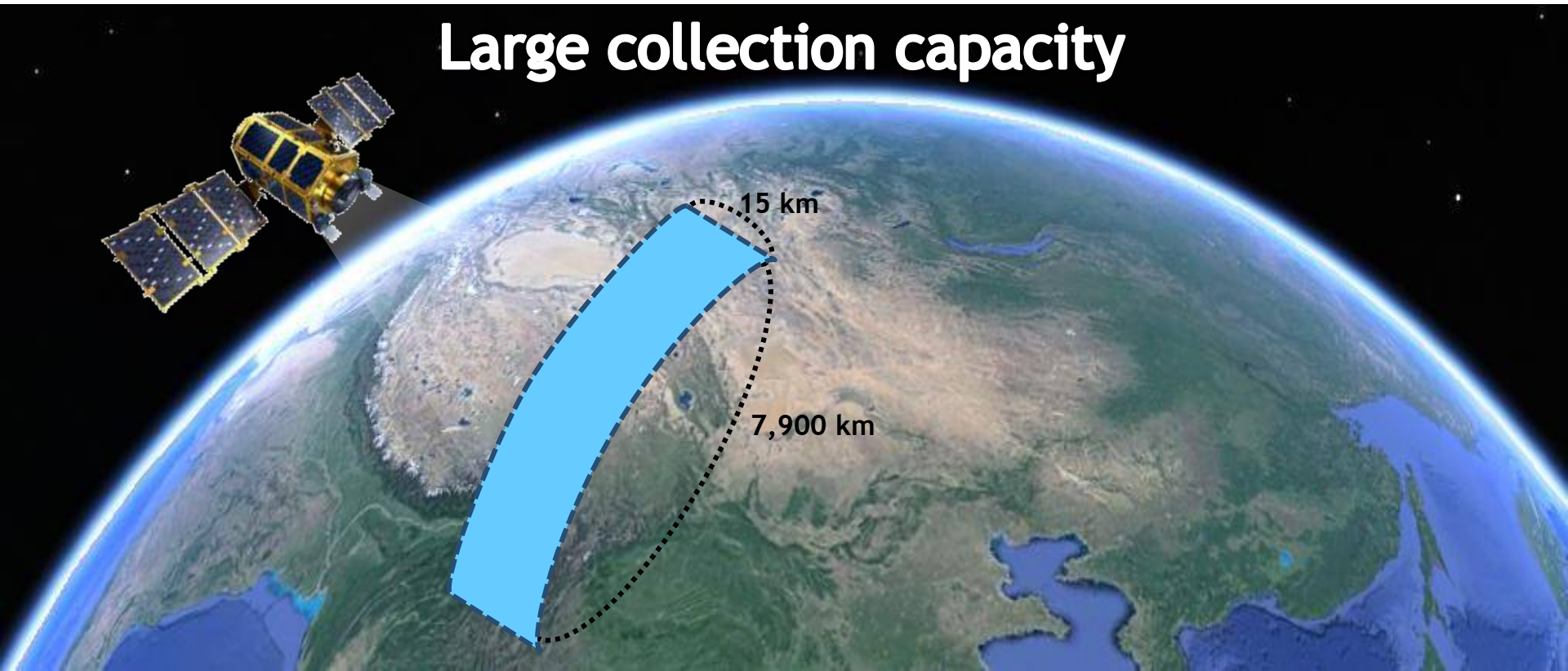


Good for Large Area Mapping

❖ Higher duty cycle

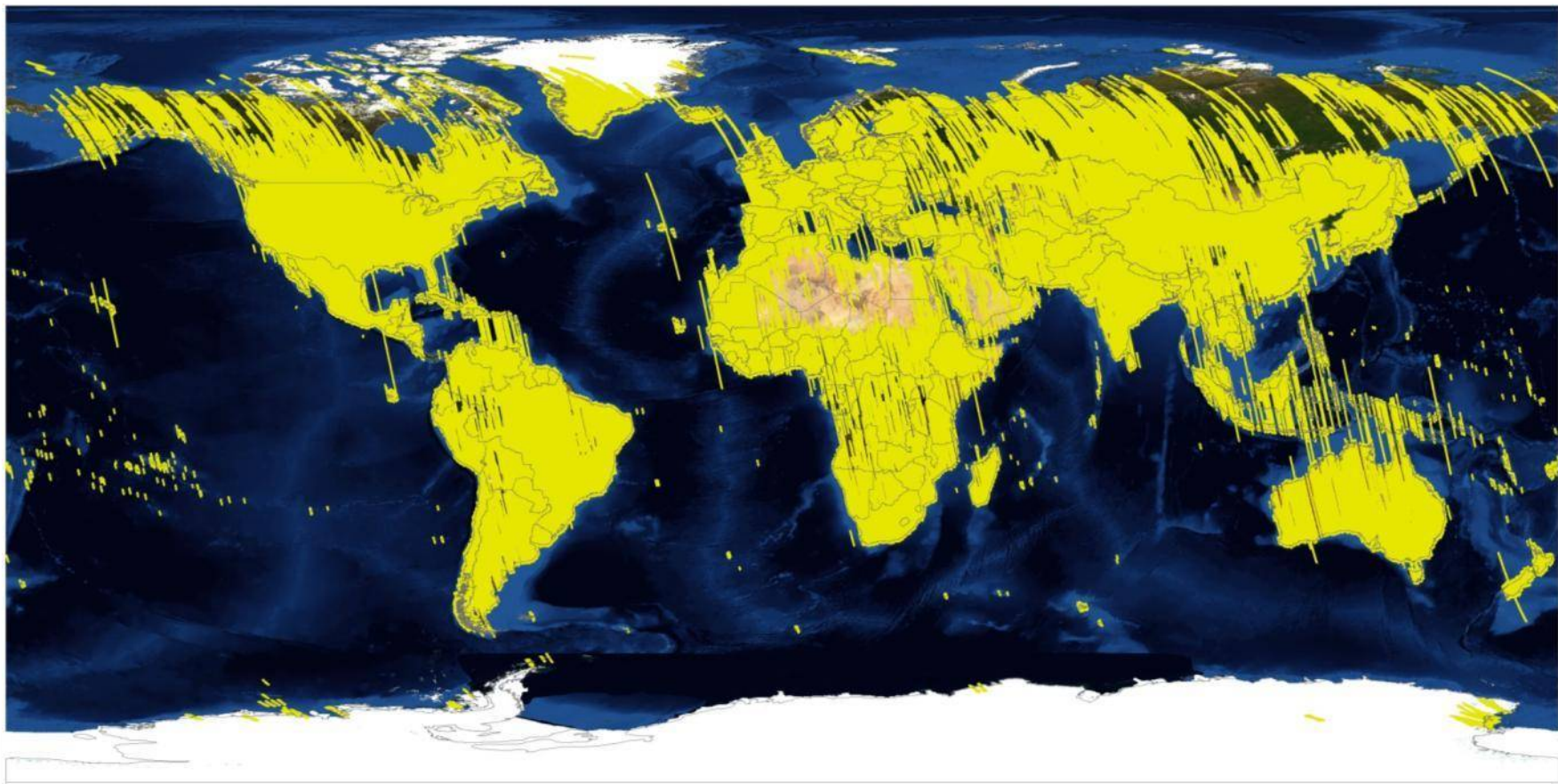
- 20% per orbit (about 18 minutes per orbit)
- Max 15 km x 7900 km per orbit (about 118,500 km²)

Large collection capacity



Huge Archive

- ❖ **More than 600 Million km² all over the world**
 - More than 2.7M scenes

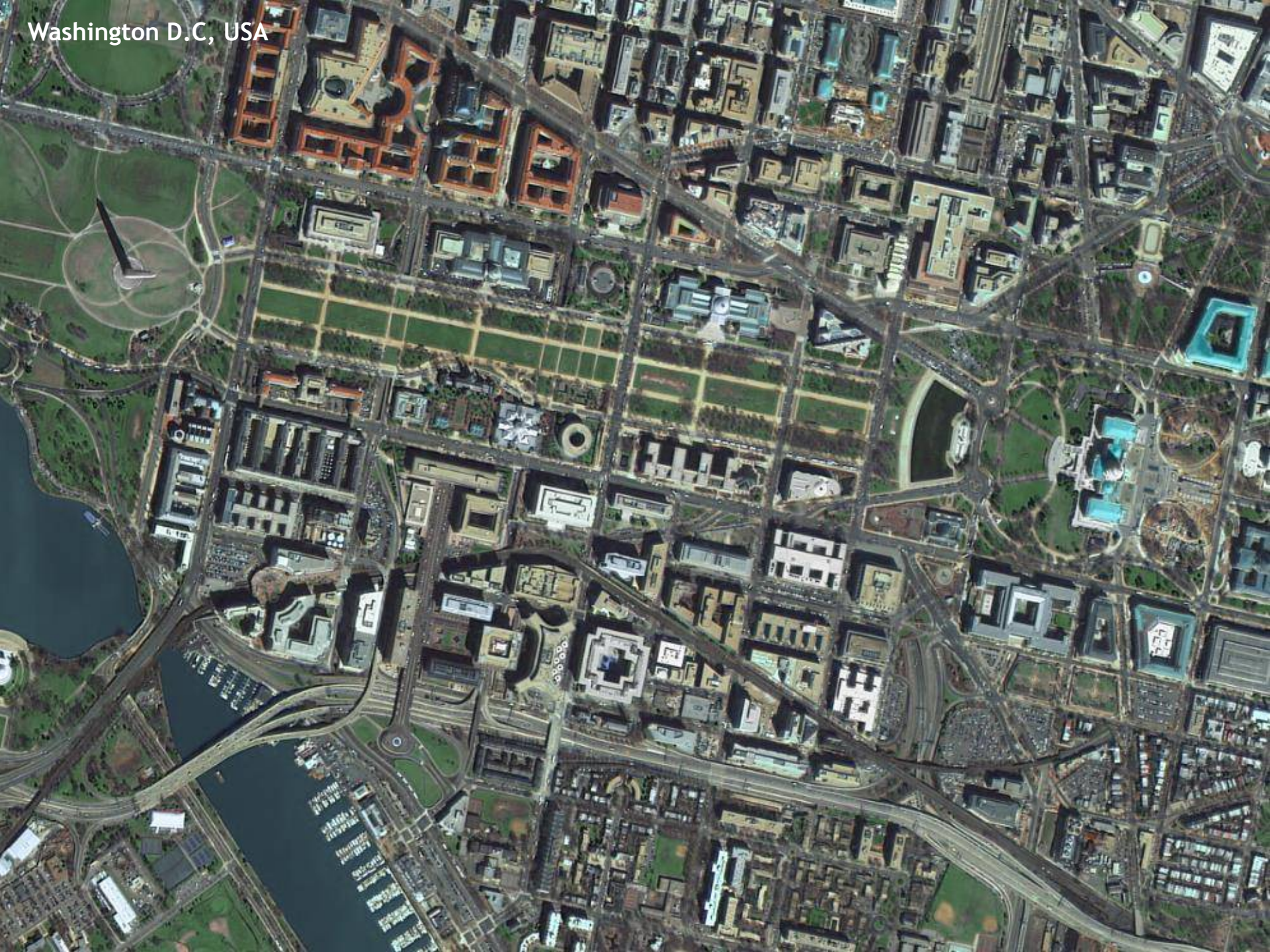


As of Aug. 2013

San Diego, USA



Washington D.C, USA





KOMPSAT-3

Sub-Meter in the Afternoon

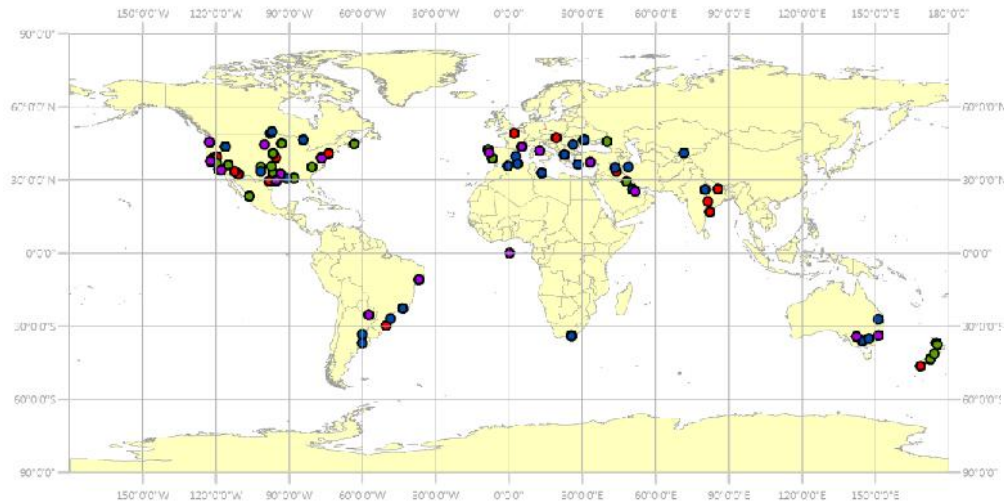
San Francisco, USA

Specifications

Launch	17 May, 2012
Ground Sampling Distance	PAN : 0.7 m @altitude 685 km(nadir) MS : 2.8 m @altitude 685 km(nadir)
Swath Width	16 km (nadir)
Spectral Bands	PAN : 450 ~ 900 nm MS1 (Blue) : 450 ~ 520 nm MS2 (Green) : 520 ~ 600 nm MS3 (Red) : 630 ~ 690 nm MS4 (NIR) : 760 ~ 900 nm
Location Accuracy	< 48.5 m CE90
Tilt Angle	Roll(-45~45 deg.) / Pitch(-30~30 deg.)
Data Quantization	14 bit / pixel
Orbit	Sun Synchronous Orbit <ul style="list-style-type: none">• Altitude : 685.13 ± 1 km• Inclination : 98.14 ± 0.05 deg.• MLTAN : 13:30 +10/-15 min
Duty	10% per orbit

Location Accuracy

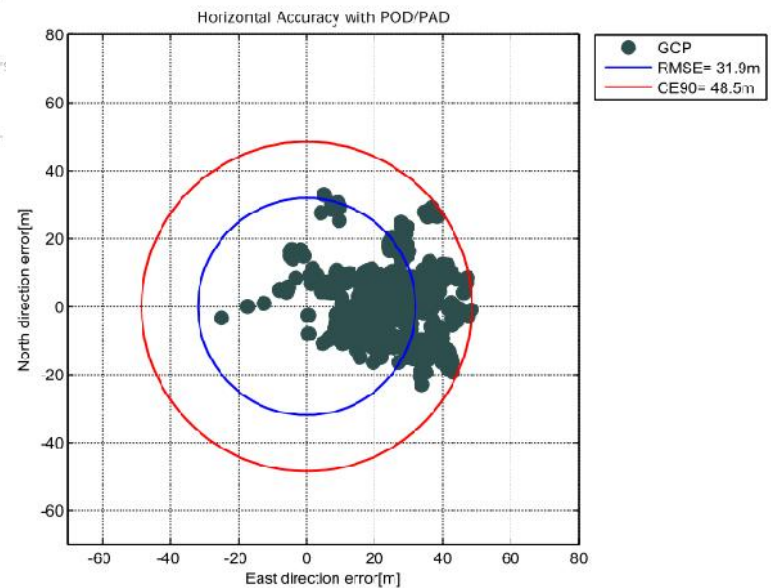
❖ < 48.5 m (CE90) is expected without GCP



● 2013.04

● 2013.05

● 2013.06

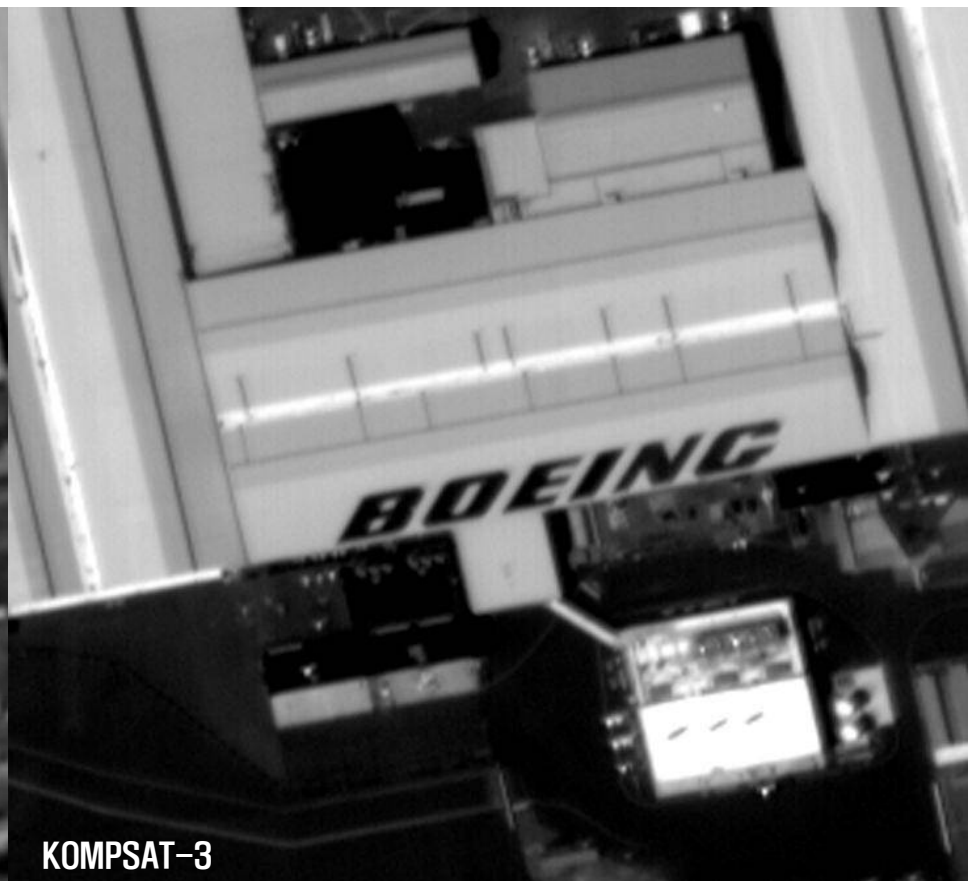


Very High Resolution

❖ 70 cm Ground Resolution



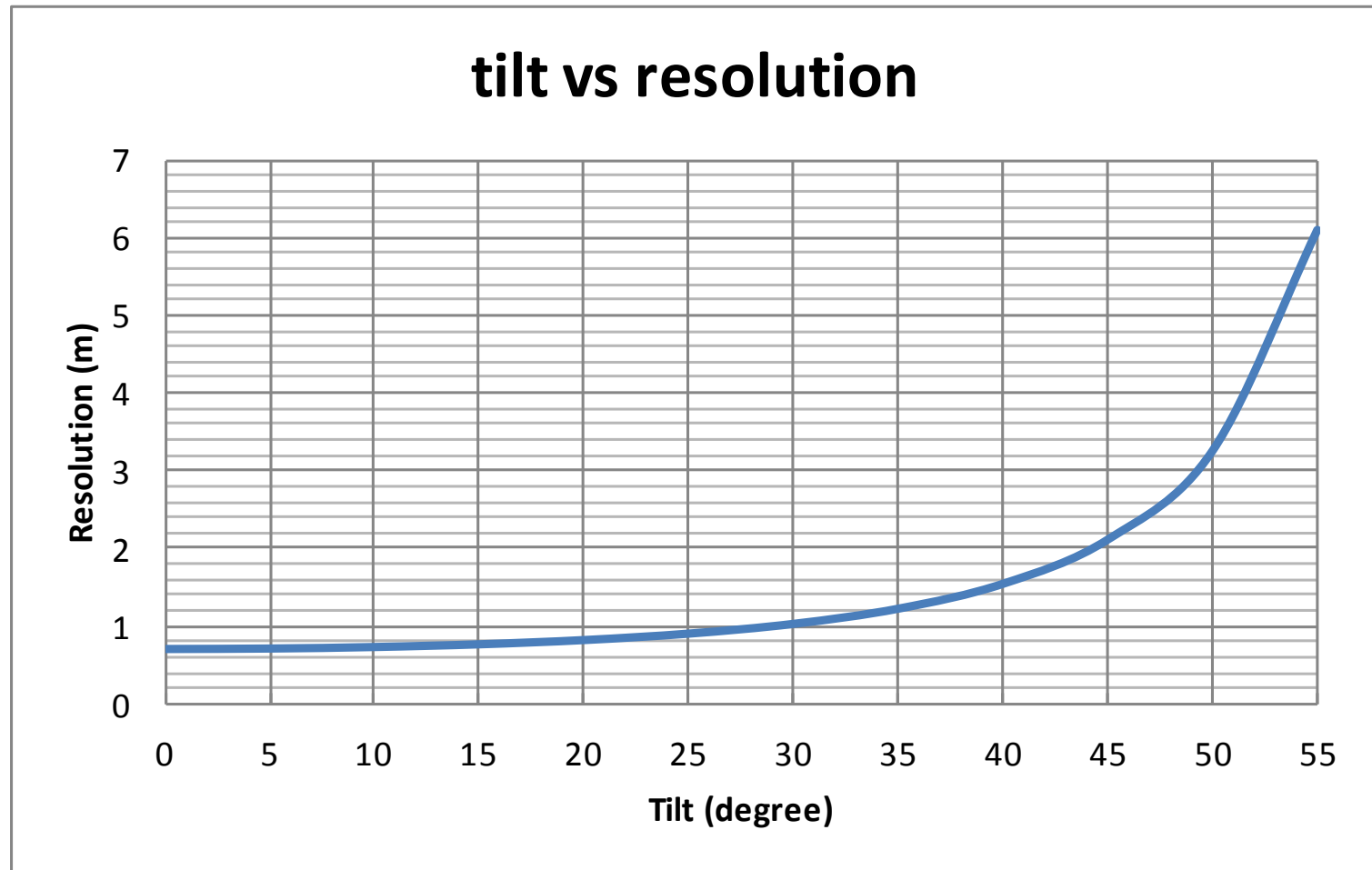
KOMPSAT-2



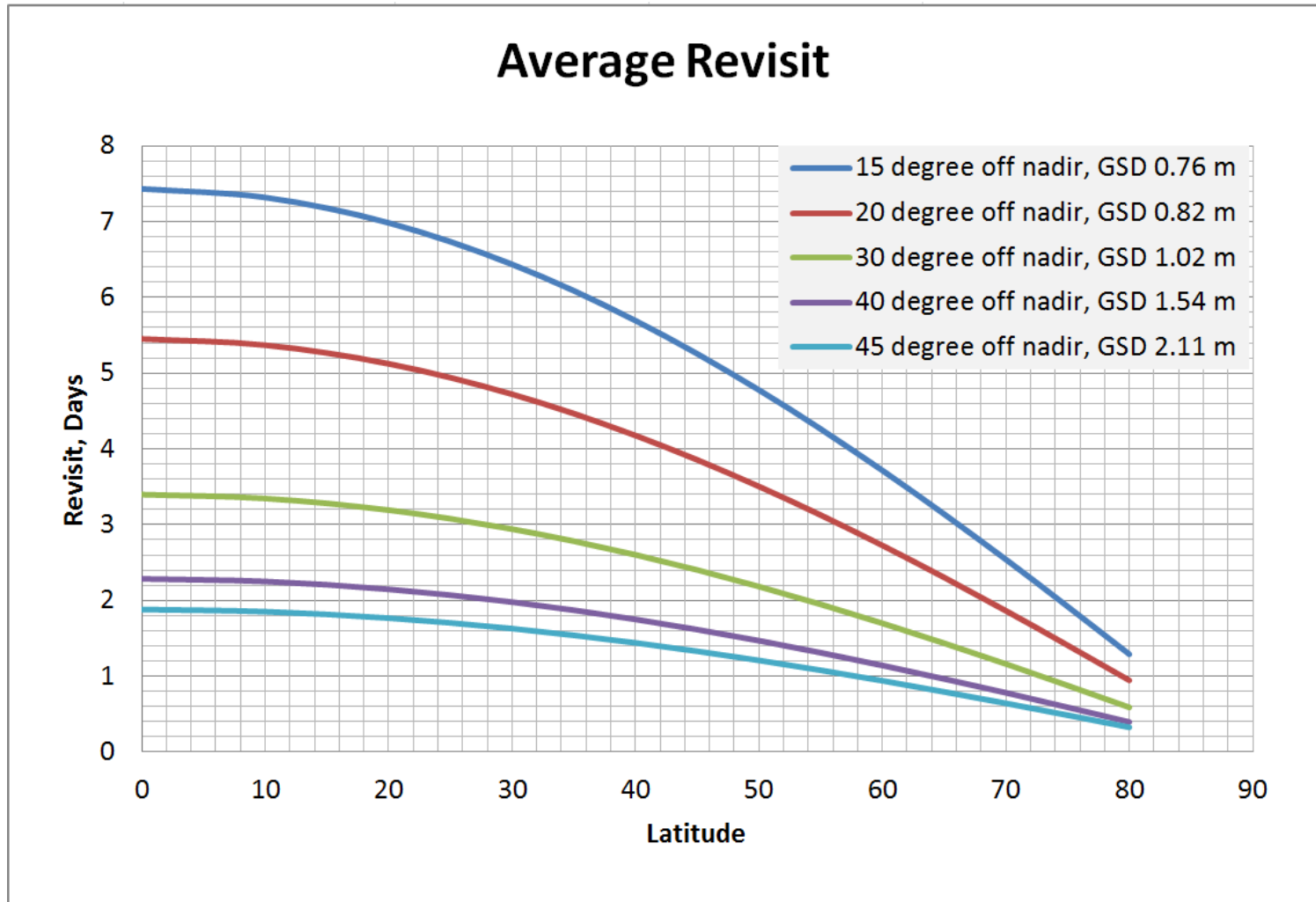
KOMPSAT-3

Very High Resolution

❖ 70 cm Ground Resolution

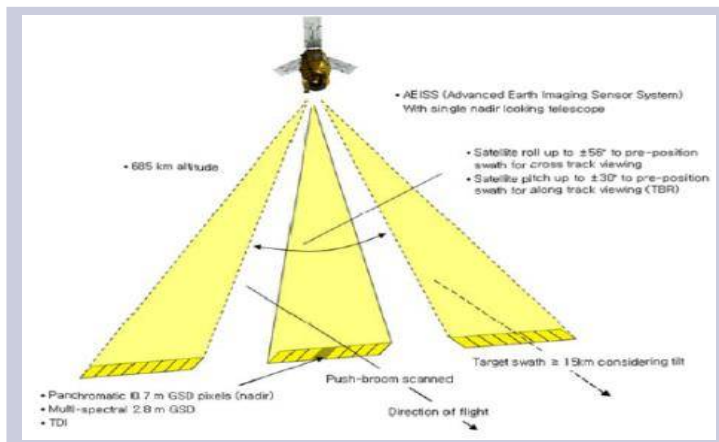


Revisit Characteristics

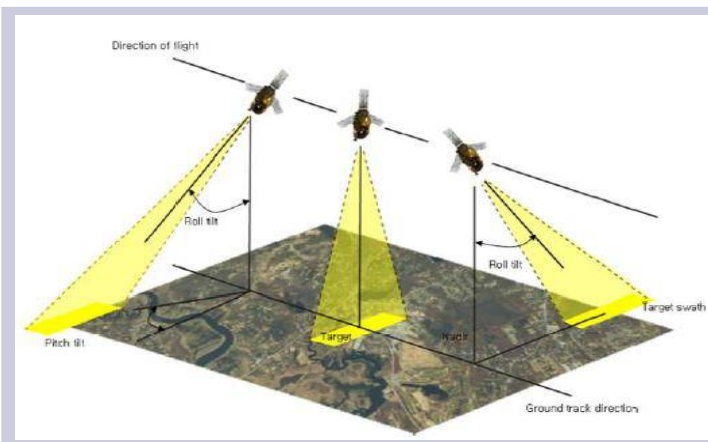


Imaging Modes

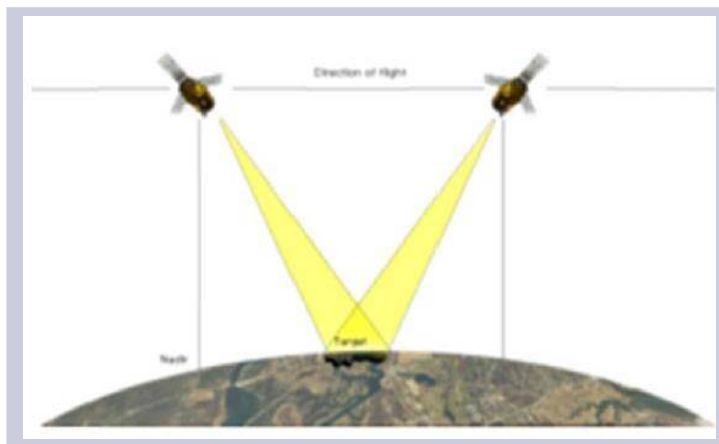
Singe Pass Imaging



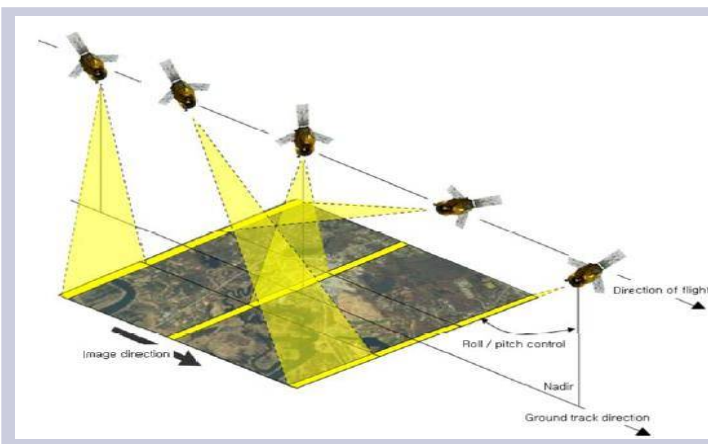
Multi Point Imaging



Single Pass Stereo Imaging

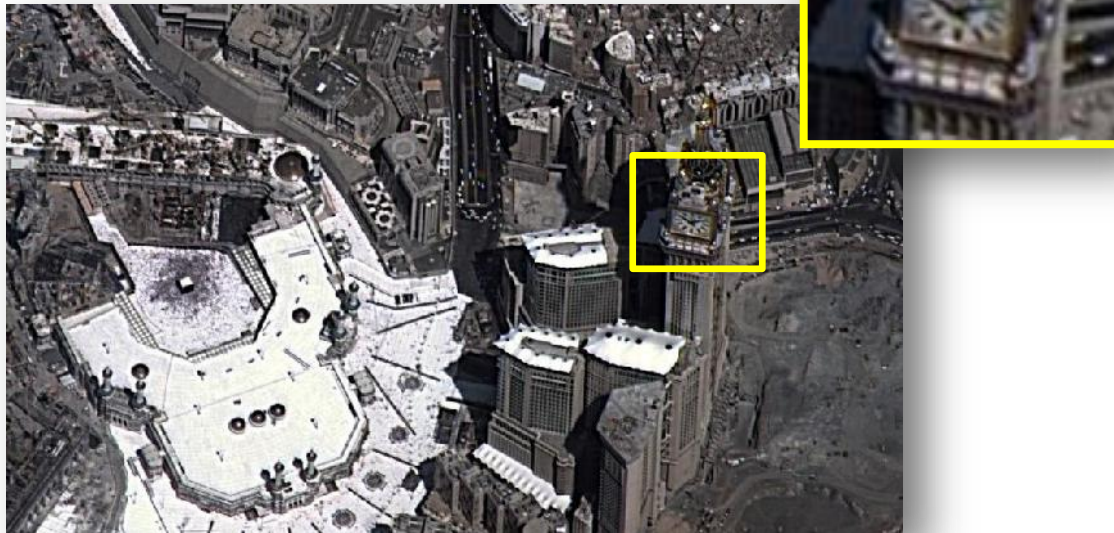


Wide Area Along Imaging



Unique Local Time

- ❖ Unique VHR sensor with multispectral in the afternoon
- ❖ Increase visibility of specific target (cloud cover changes)
- ❖ Change detection even within a day possible



More Information per Pixel

- ❖ Highest bits per pixel among the commercial imagery
 - 14 bits per pixel
 - Better performance for spectral analysis



KOMPSAT-2 : 10 bits

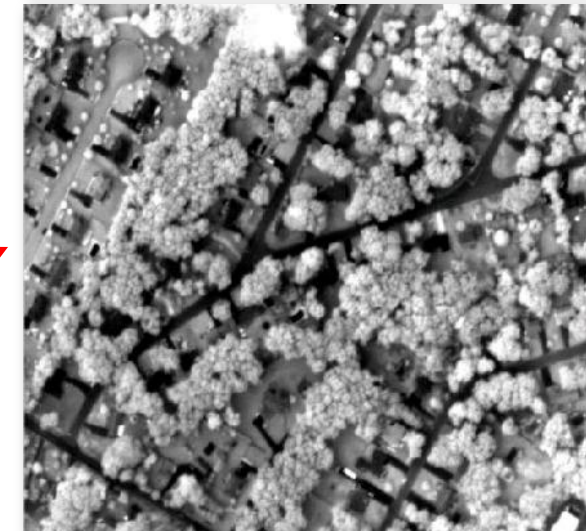
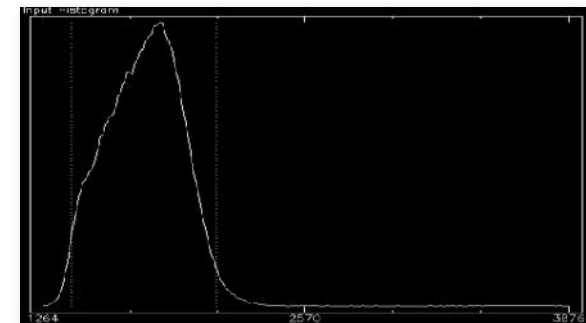
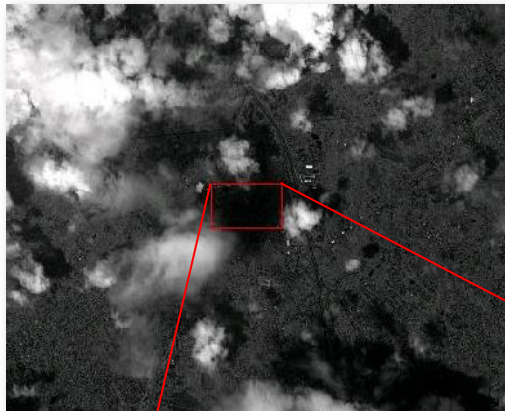


KOMPSAT-3 : 14 bits



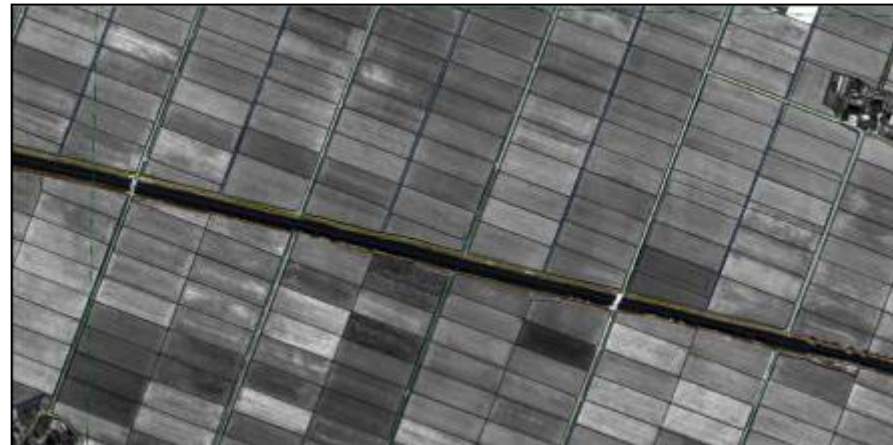
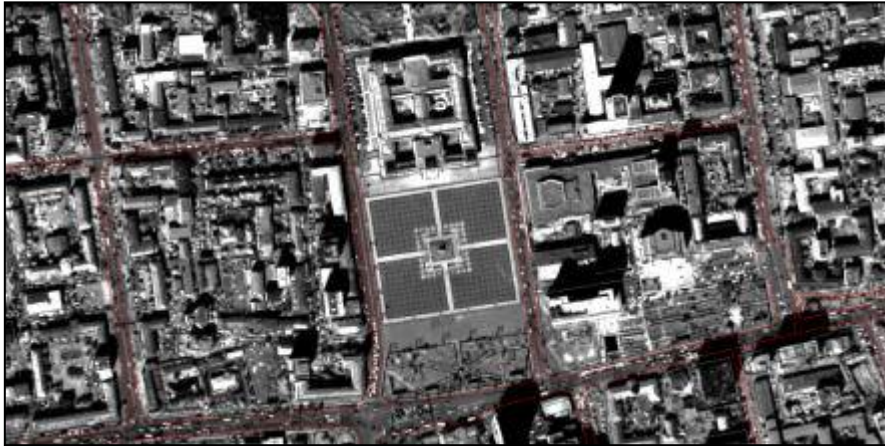
More Information per Pixel

- ❖ Highest bits per pixel among the commercial imagery
 - Better color balancing
 - Data extraction from shadow areas



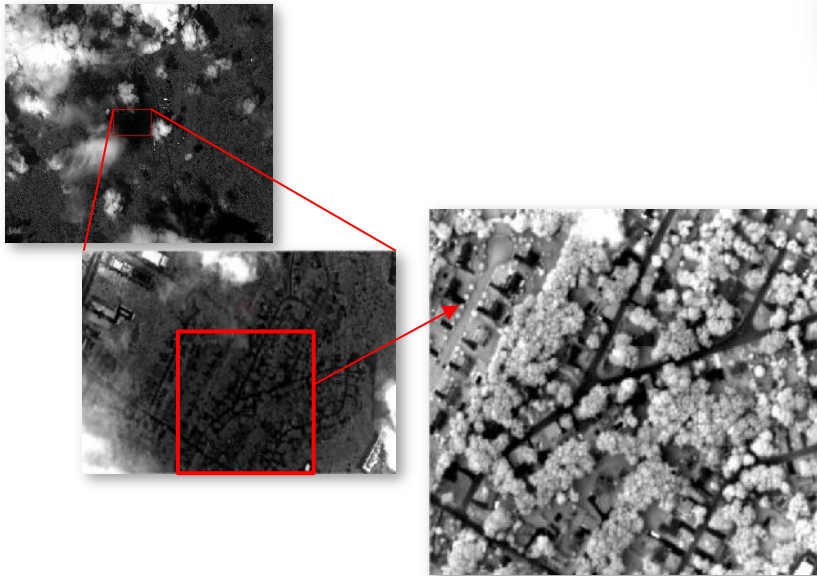
Orthorectification

❖ Comparing with 1:5,000 maps



Better Interpretation & Color

- ❖ Data extraction from shadow areas
- ❖ Better color balancing

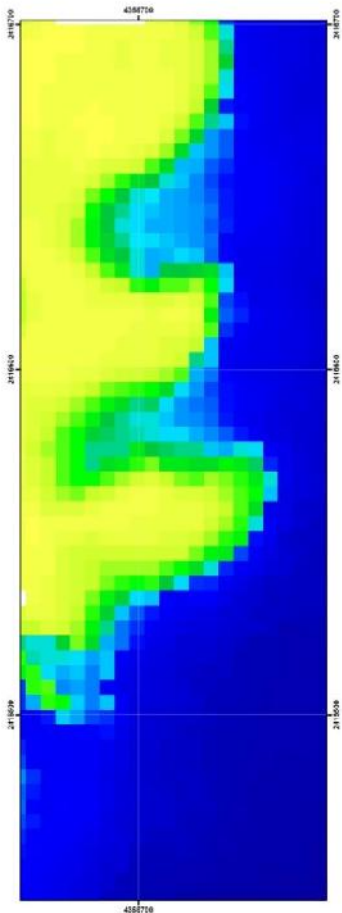


Courtesy of  PCI
GEOMATICS

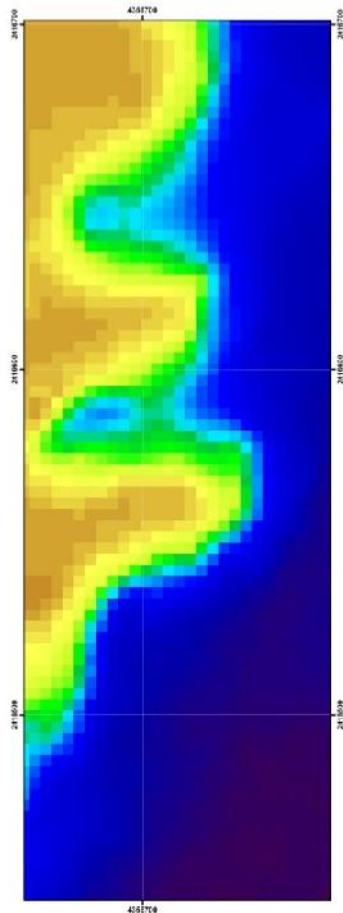
More information from Bathymetry

❖ Space Based Bathymetry

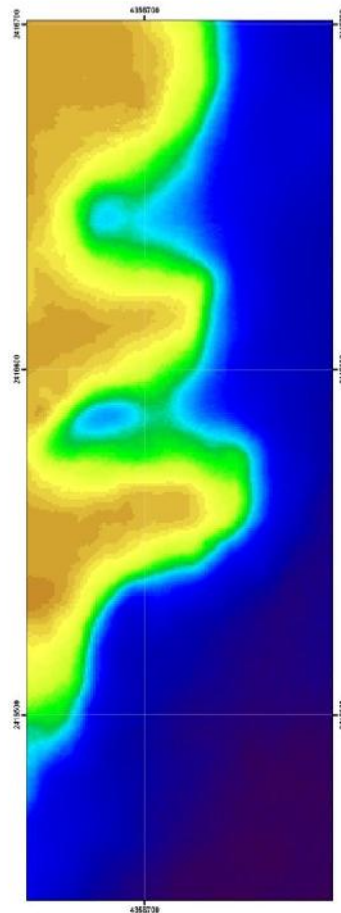
WorldView-2, 4m spatial resolution



KOMPSAT-3, 2.8 m spatial resolution



KOMPSAT-3, 0.7m spatial resolution



Satellite Derived Bathymetry of Saudi Arabia/ Red Sea

Data Source

Satellite sensor data: WorldView-2, KOMPSAT-3
Spectral bands: 8
Spatial resolution: 4m, 2.8m, 0.7m
Data Acq time of recording: 2016/03/16 08:56 (UTC), 20:30:30 10:55 (UTC)

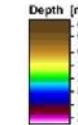
Processing method

Satellite data were processed with the Most Advanced Inversion System (MAIS) by EOMAP. MAIS is designed for the physically based assessment of water depth. Bathymetry is based on scene sea level.

Legend

□ AOI boundary

Bathymetry [m]



Overview



Spatial Reference

UTM Zone: UTM Zone 37N
Datum: WGS 84
EPSG code: 32670

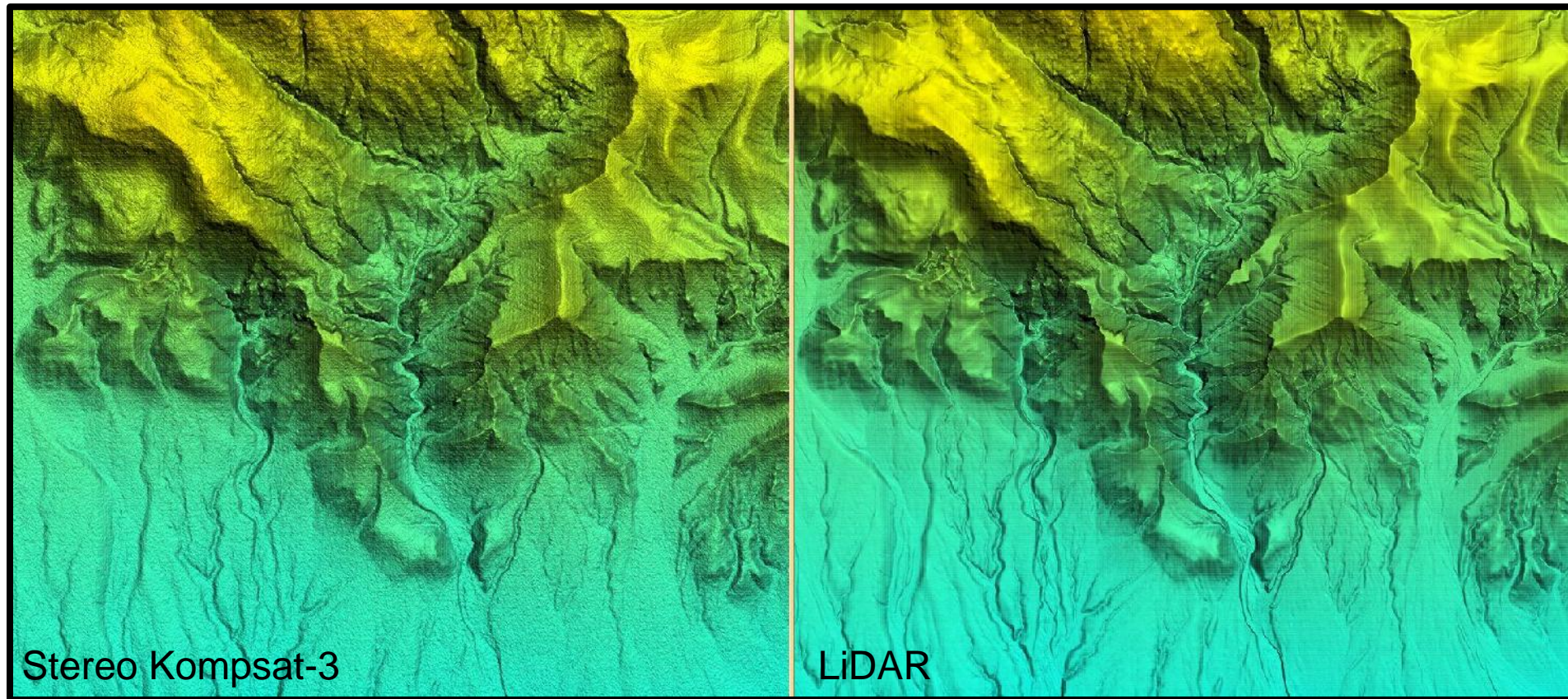


Courtesy of



Better Correlation with Stereo

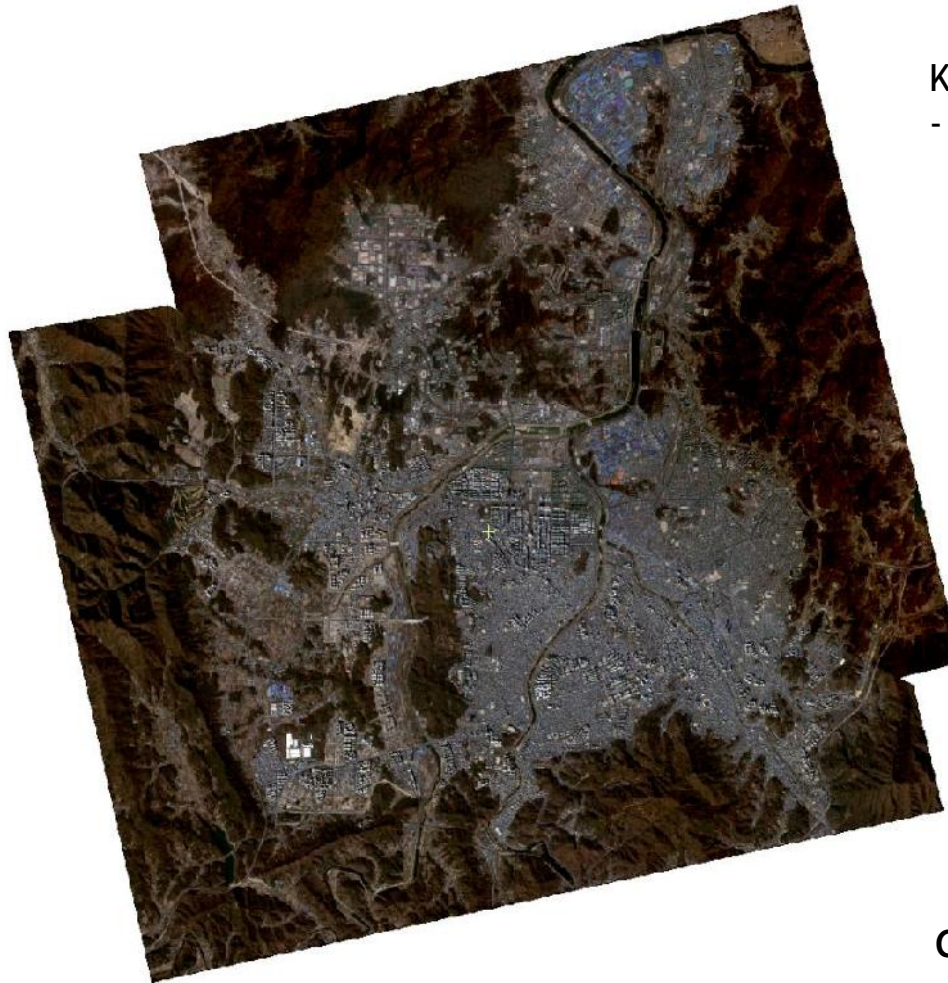
❖ KOMPSAT-3 DEM Generation



Courtesy of  PhotoSat

Mosaic: KOMPSAT-2/3

❖ Combination of KOMPSAT-2 and KOMPSAT-3

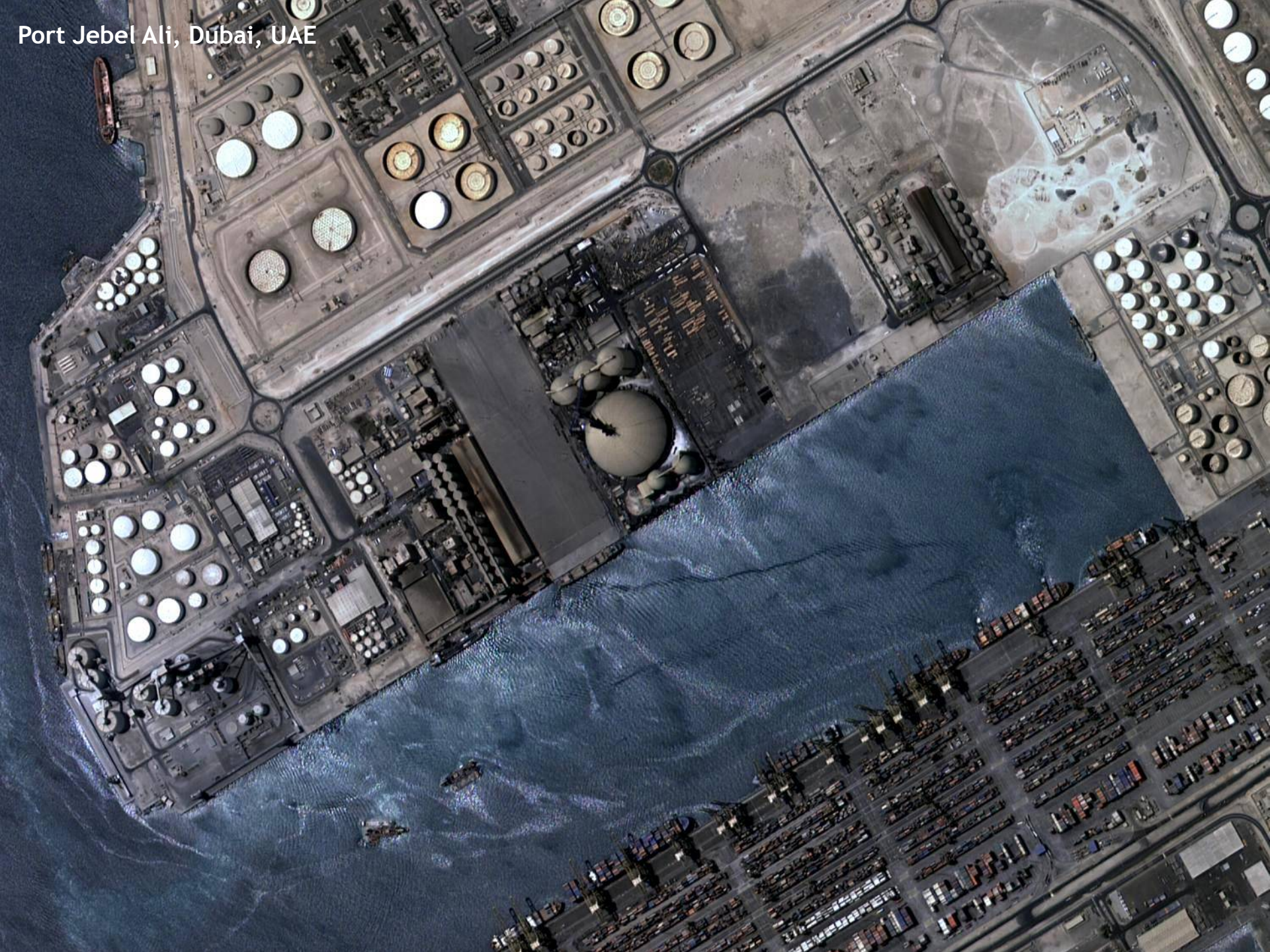


KOMPSAT-2 (1.0m)
- Oversampled to 0.7m

KOMPSAT-3 (0.7 m)

Courtesy of  PCI
GEOMATICS

Port Jebel Ali, Dubai, UAE



Beijing, China





KOMPSAT-5

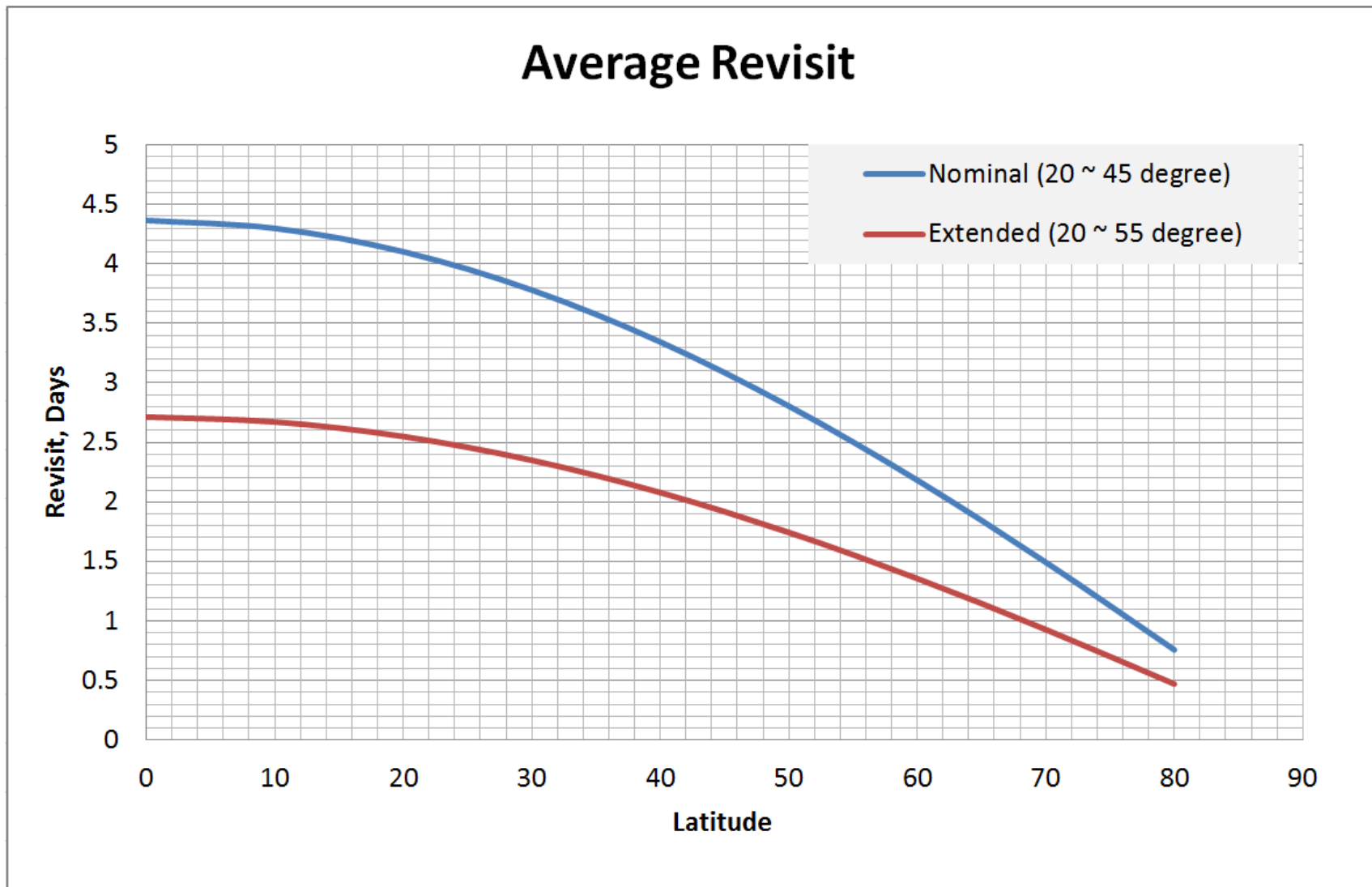
Brand New VHR X-Band SAR

Sochi, Russia

Specification

Launch	22 August, 2013
Payload	Synthetic Aperture Radar (SAR)
Frequency	9.66 GHz (X-band)
NESZ	≤ 17 dB
Radiometric Accuracy	≤ 1 dB
Incidence Angles	20 ~ 45 deg. (nominal, 304 km coverage) 45 ~ 55 deg. (extended, additional 186 km coverage)
Orbit	Sun Synchronous, Dawn-dusk orbit <ul style="list-style-type: none">• Altitude : 550 km• Inclination : 97.6 deg.• Local Time : 6 A.M. and 6 P.M.
Duty	2 minutes per orbit
Image Mode	<ul style="list-style-type: none">• Spotlight (HR)• Strip (ST)• ScanSAR (WS)
Local Time	6:00 AM and 6:00 PM
Revisit Time	24 hours on average

Revisit Characteristics



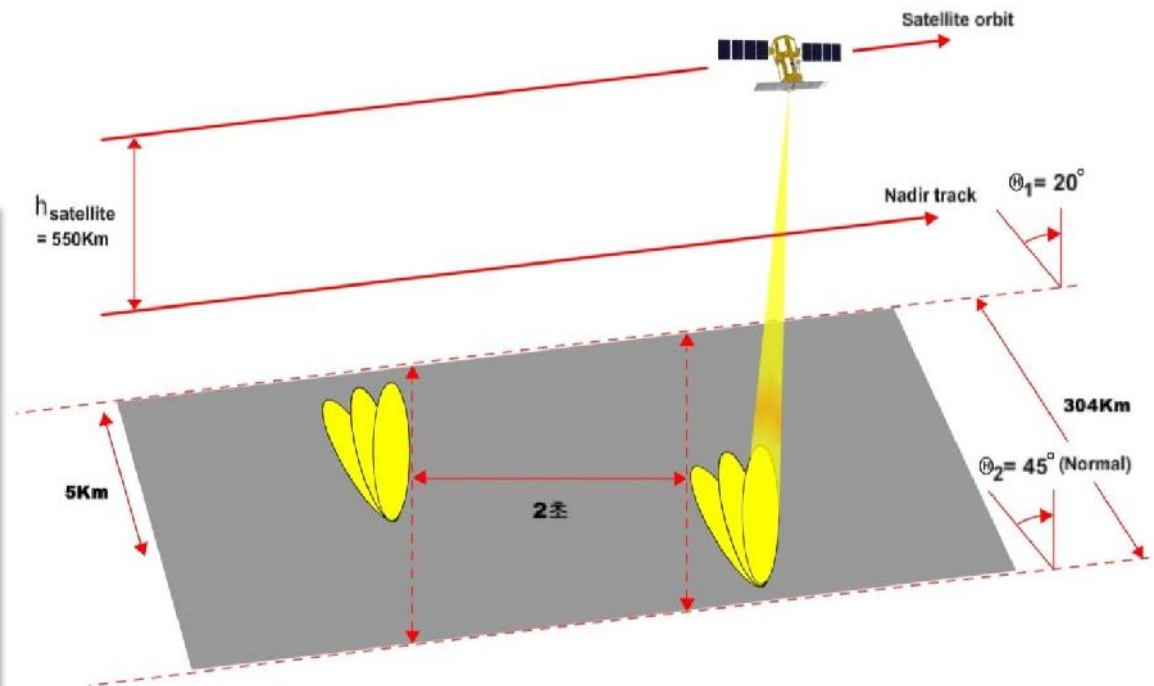
Synthetic Aperture Radar

- ❖ **Similar design with Cosmo-SkyMed**
- ❖ **Frequency: 9.66 GHz (X-band)**
- ❖ **NESZ: ≤ 17 dB**
- ❖ **Radiometric accuracy: ≤ 1 dB**
- ❖ **Imaging modes**
 - **Spotlight**
 - **Strip**
 - **ScanSAR**

Imaging Mode (1/3)

❖ Spotlight (HR)

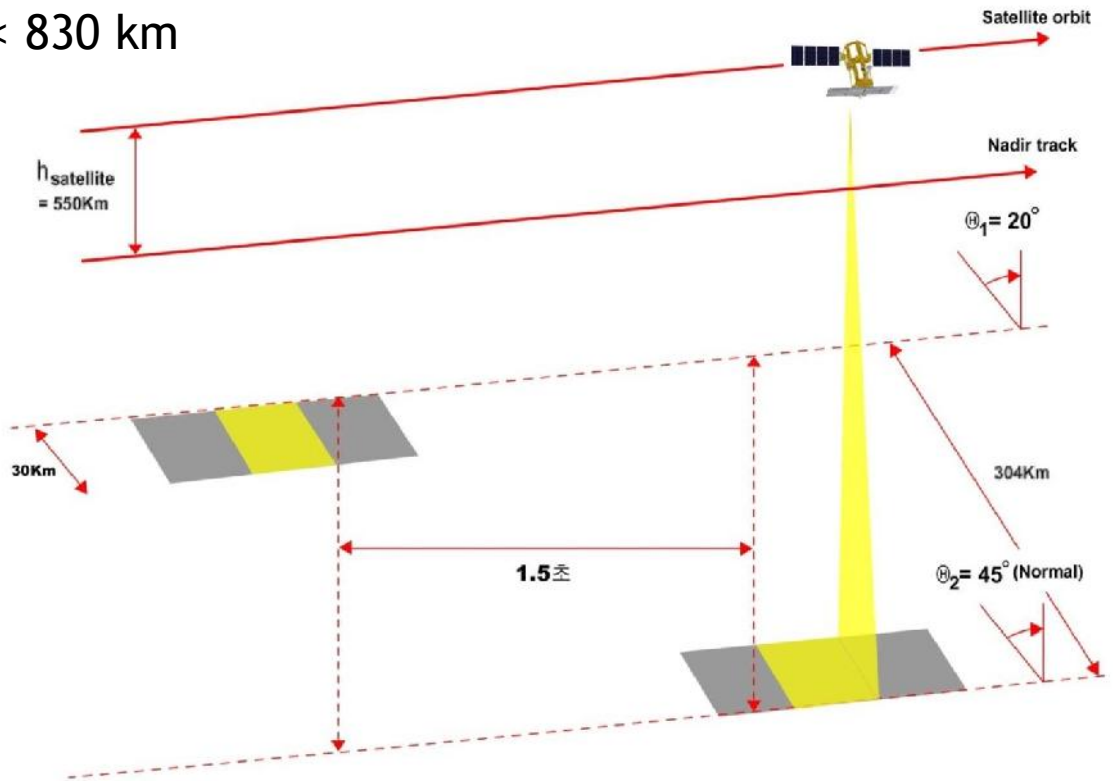
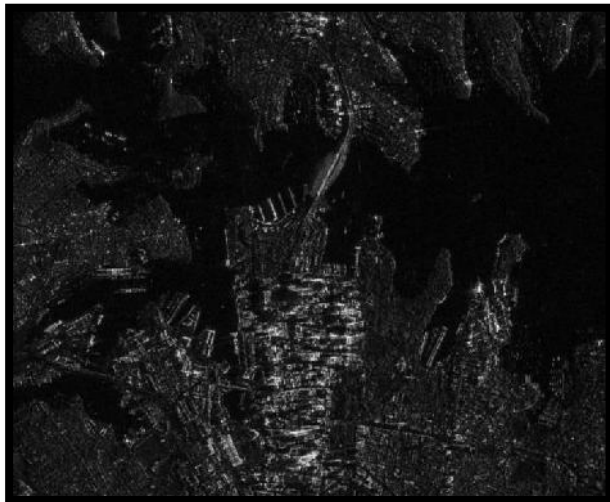
- GSD : 1 m
- Swath : 5 km
- Scene size : 5 km x 5 km



Imaging Mode (2/3)

❖ Strip (ST)

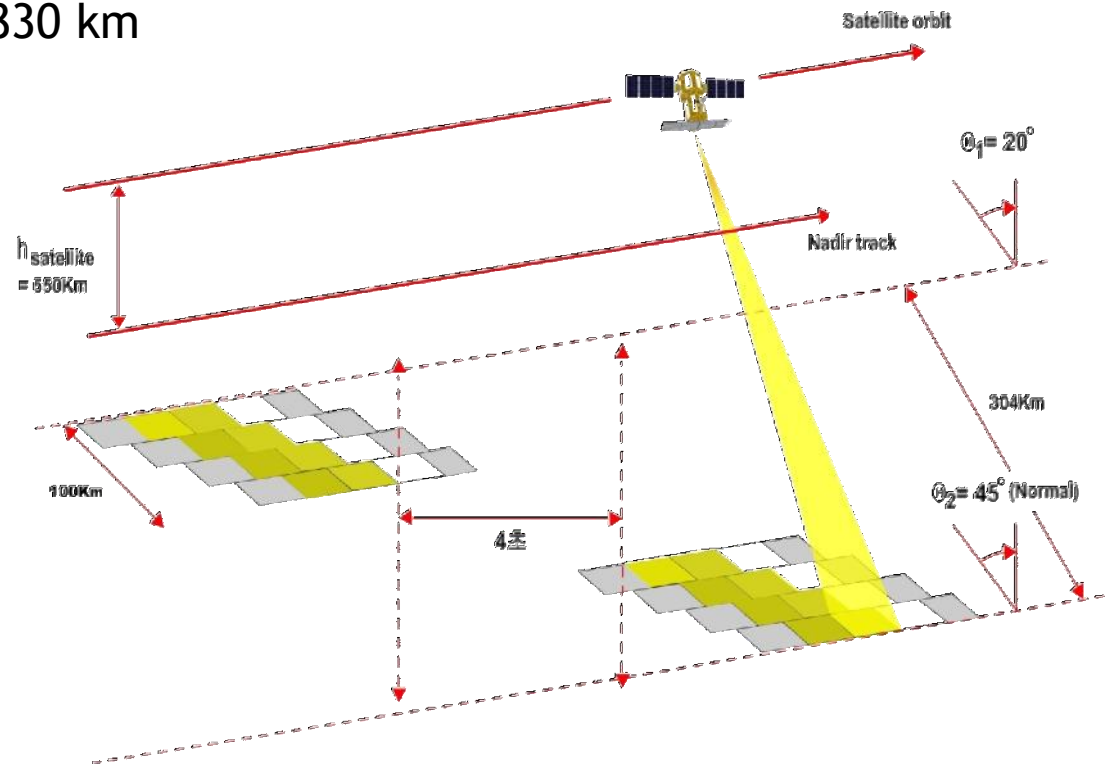
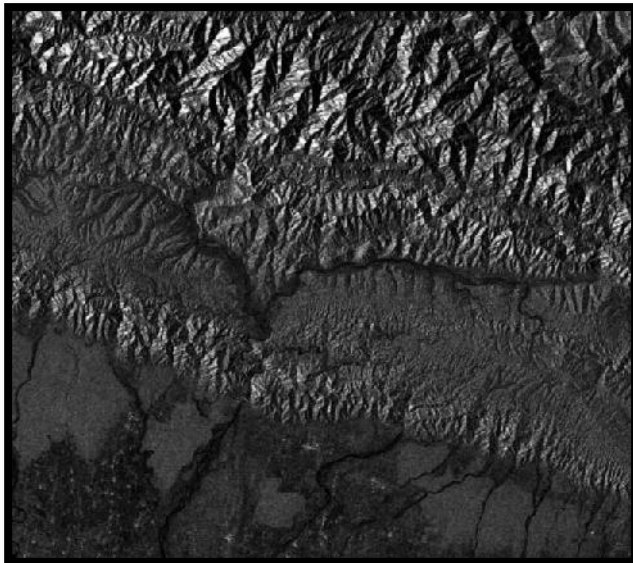
- GSD : 3 m
- Swath : 30 km
- Acquisition length : < 830 km



Imaging Modes (3/3)

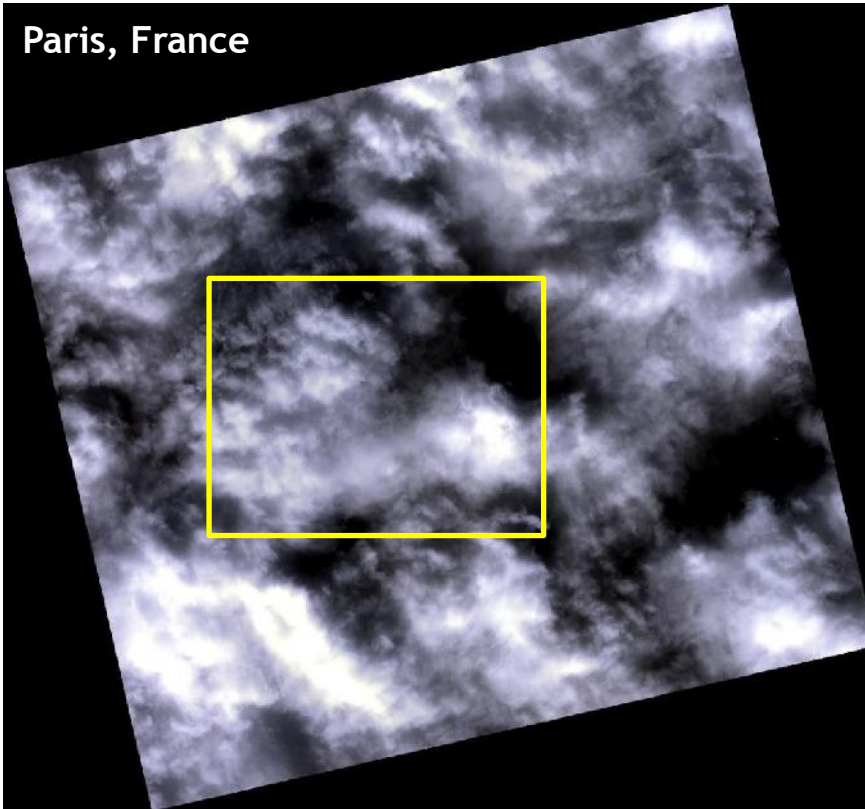
❖ ScanSAR (WS)

- GSD : 20 m
- Swath : 100 km
- Acquisition length : < 830 km



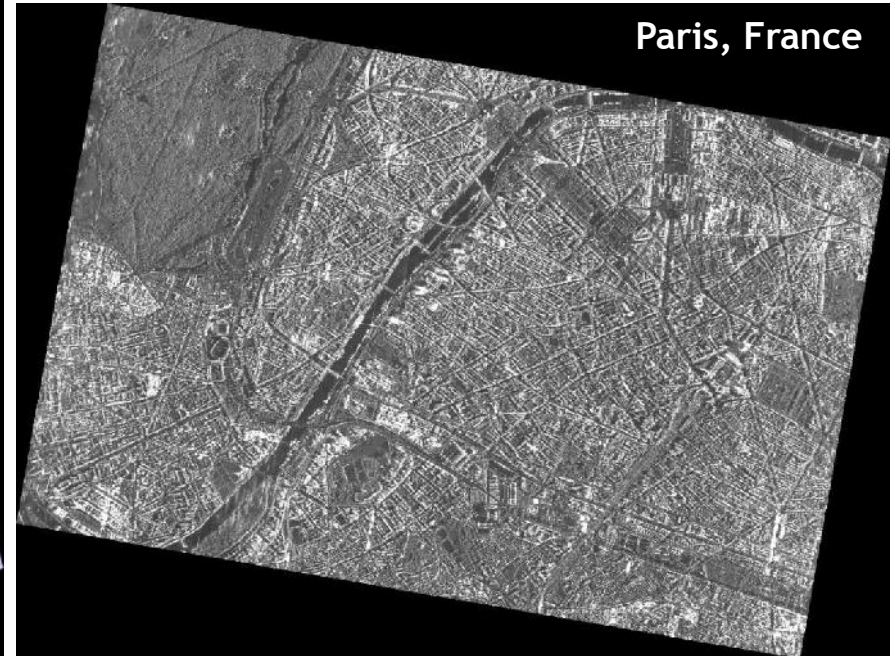
All weather capability

Paris, France



K3 : 2013. 10. 16

Paris, France



K5 : 2013. 10. 16

San Diego, USA



Minneapolis, USA





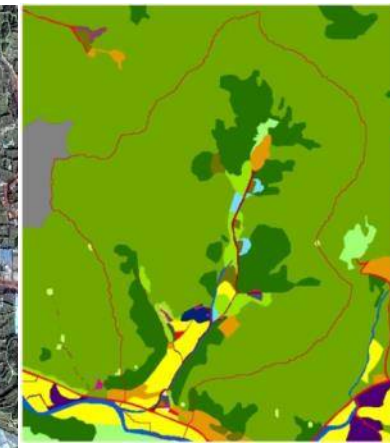
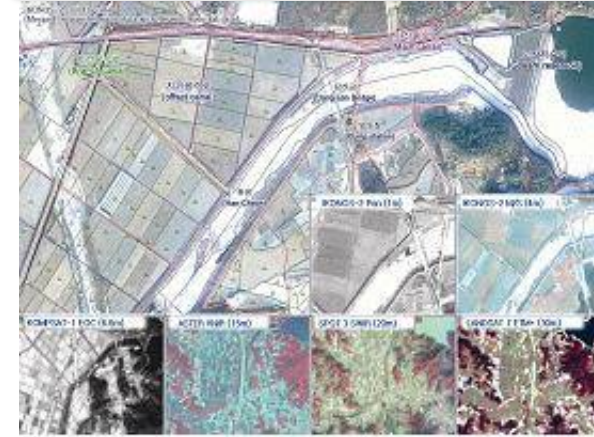
KOMPSAT Applications

Applications

National Defense



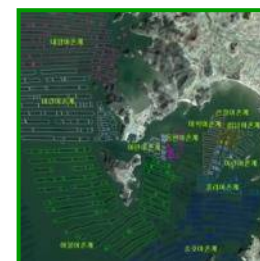
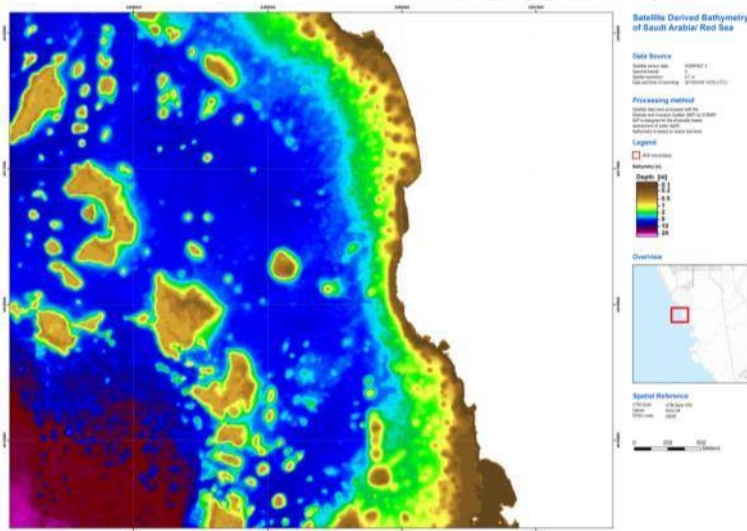
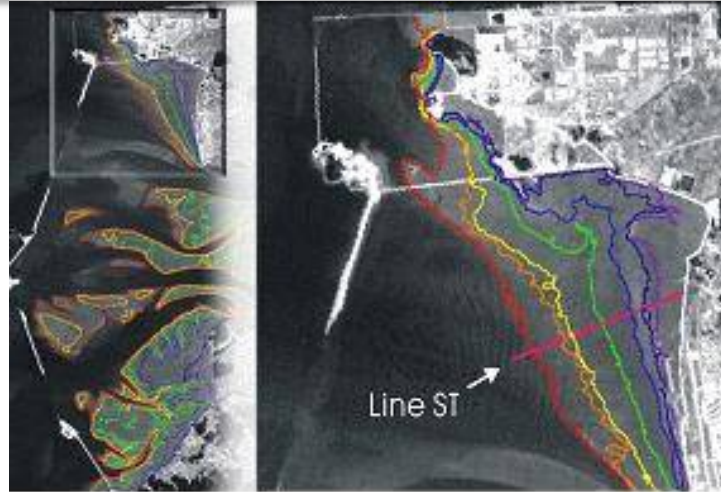
Agriculture & Forestry



Boundary	
1110	Consolidated paddy
1210	Specialized crop
1211	Food pepper
1212	Soybean
1213	Corn
1214	Bean
1220	Pumpkin
1221	Potato
1222	Sweet potato
2110	Grassland
2210	Coniferous forest
2220	Broad leaved forest
2300	Graveyard
3140	Residential area
3150	Bare field
3210	Road
3211	Farm road
3310	Industrial facility
3320	Industrial area
3330	Mining area
3441	Temple
3500	Aquary
3540	Factory
4210	Stream

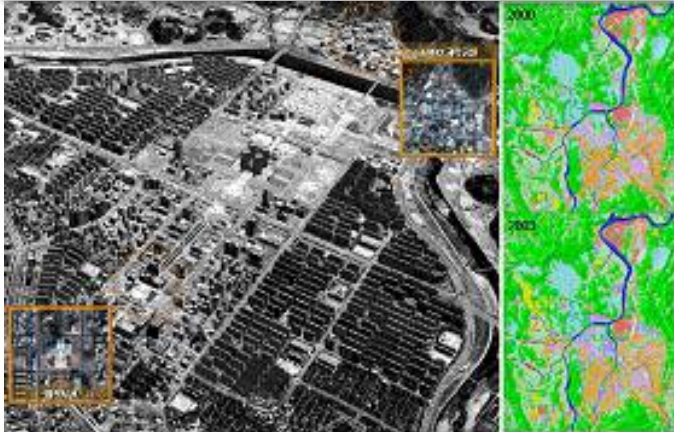
Applications

Ocean & Water Resource



Applications

Land & Urban Planning



Geo Information System

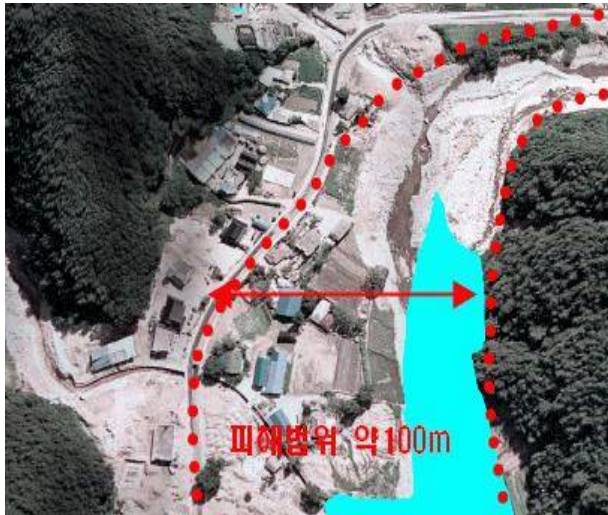
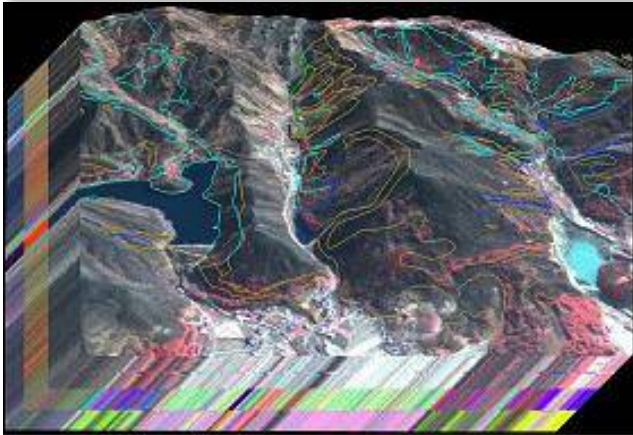


Mapping



Applications

Natural Disaster Monitoring



Geological & Resource



Defense and Security Application

❖ Monitoring Military Activities

- to support critical decision making and the warfighter.
- area mapping, target identification, and reconnaissance.

❖ Military Mapping

- to support logistics of specific missions, to plan logistics for deploying resources, assess battle damage, and evaluate infrastructure.

❖ Critical Infrastructure Surveillance

- to monitor critical infrastructure to support counter-terrorism intelligence

❖ Monitoring of Borders

- to monitor frontiers (land and sea) and to monitor illegal activity such as illegal immigration and trafficking.
- Cross-boarder surveillance, transportation monitoring.

❖ Coastal security

- Monitoring of unrecognized vessels.

Crash Site of Malaysia Airline MH17

Hrabove in Donetsk Oblast, Ukraine

48.138192N 38.639193E

Primary crash site and debris field



Crash Site of Malaysia Airline MH17

Hrabove in Donetsk Oblast, Ukraine

48.138192N 38.639193E

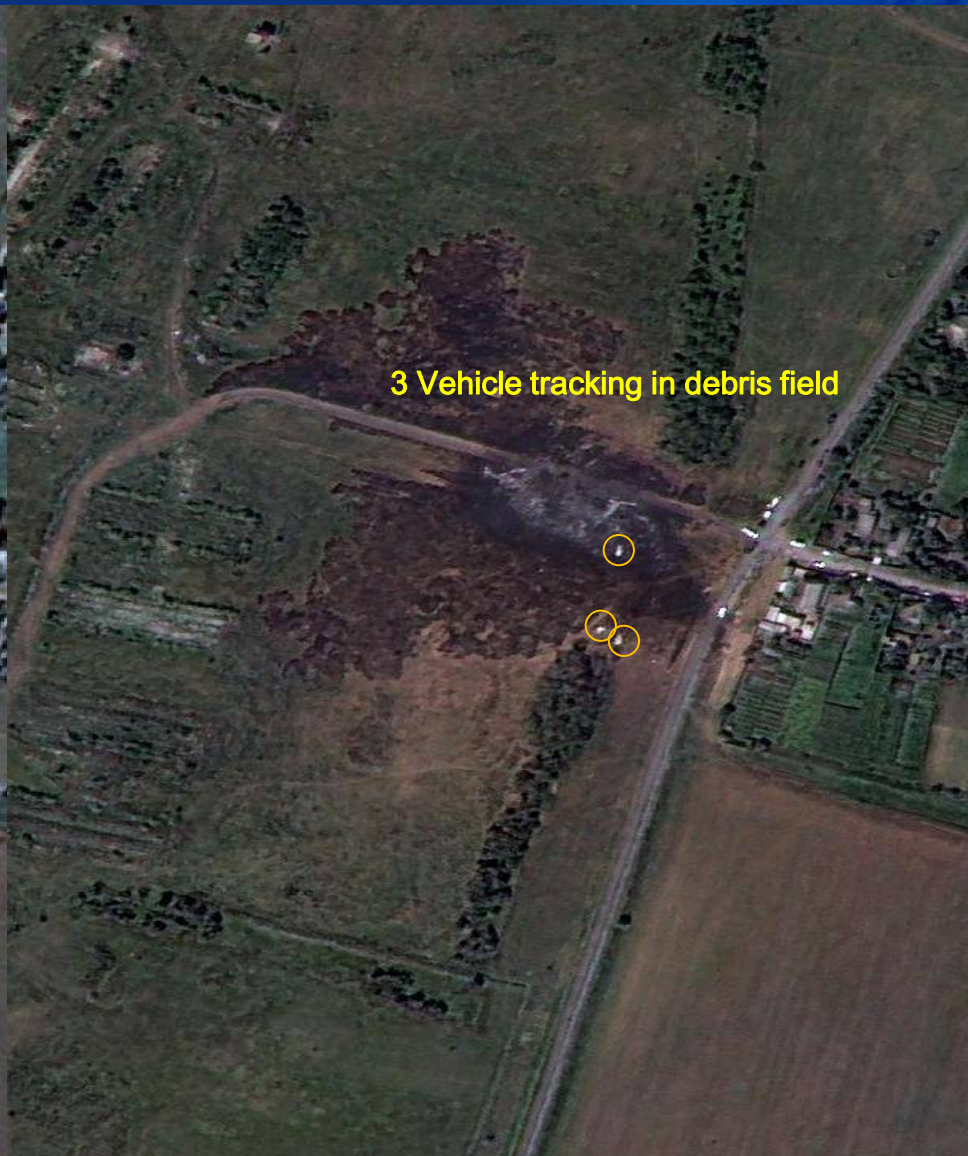
Secondary crash site and debris field



MH17 tail piece



① Multi sensor rapid response



KOMPSAT-2 Natural Color Imagery
UTC0 07:49:43 July 21, 2014

KOMPSAT-3 Natural Color Imagery
UTC0 09:51:52 July 21, 2014

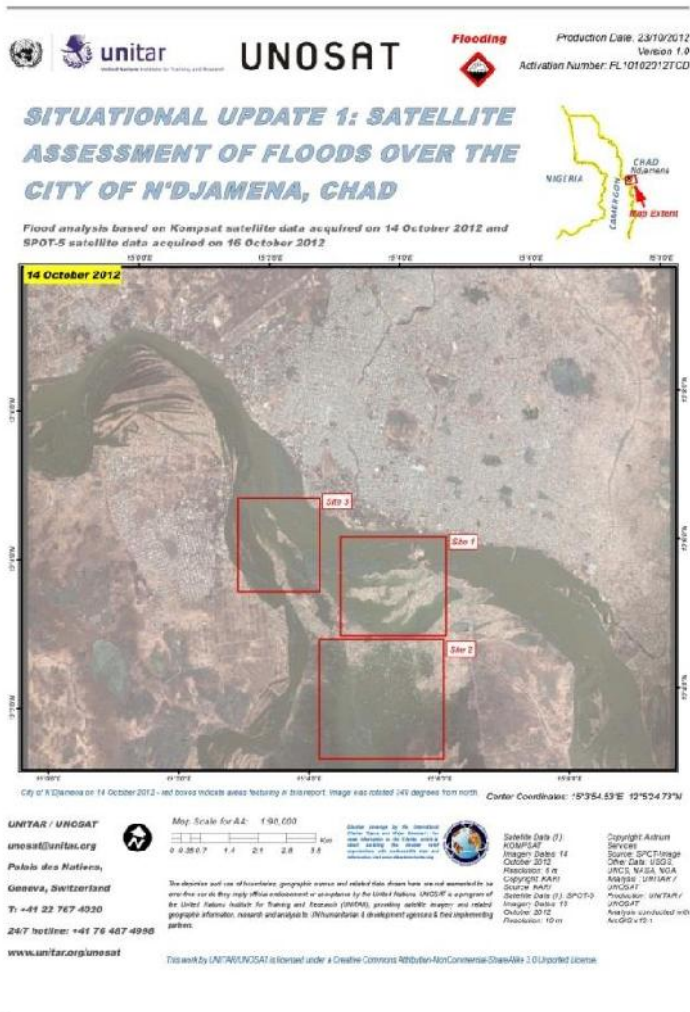
② Multi sensor rapid response



KOMPSAT-2 Natural Color Imagery
UTC0 07:49:43 July 21, 2014

KOMPSAT-3 Natural Color Imagery
UTC0 09:51:52 July 21, 2014

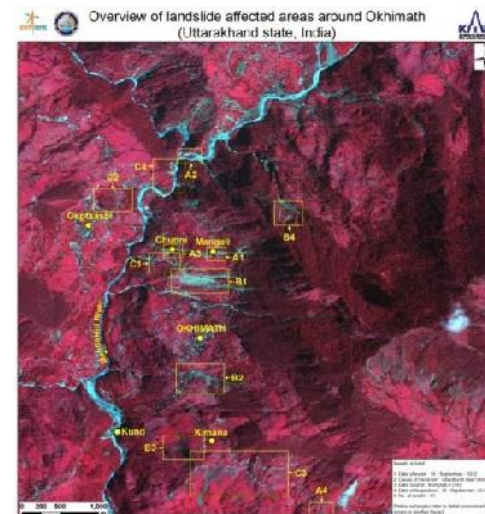
Disaster Management



KOMPSAT-2



Flood extent map by KOMPSAT-2 (Niger in Africa)



Landslide damaged map by KOMPSAT-2 (India)

Assessment of Battle Field

Damascus, Syria

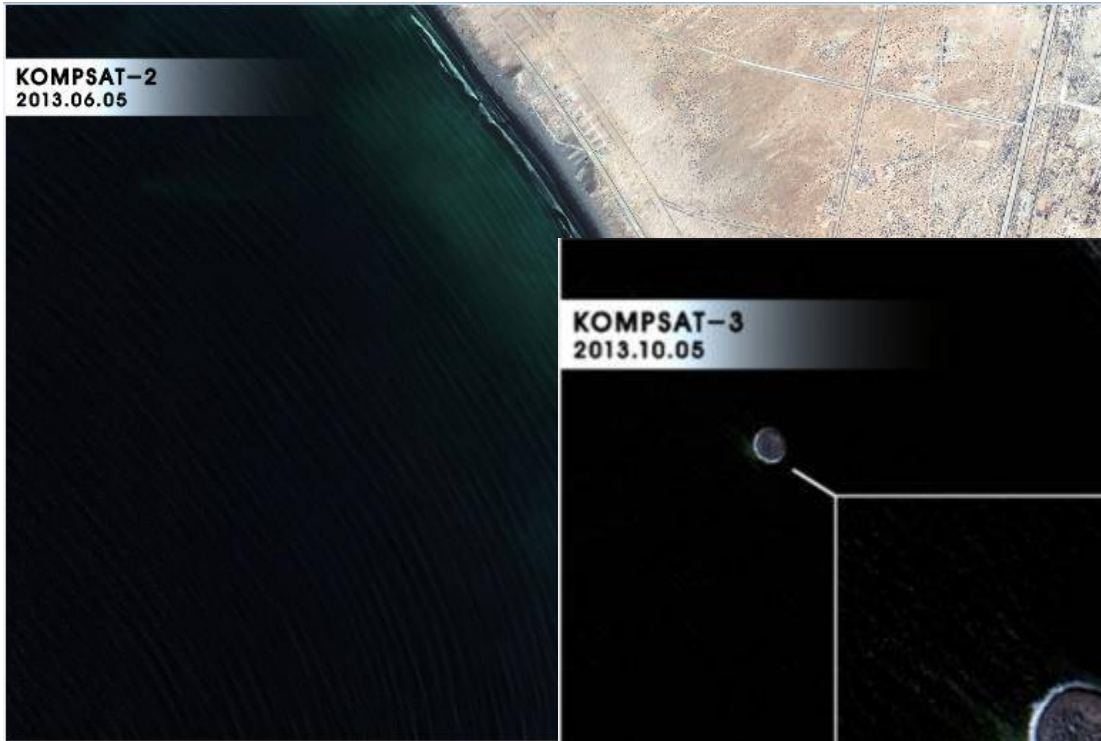
Aug. 17, 2013



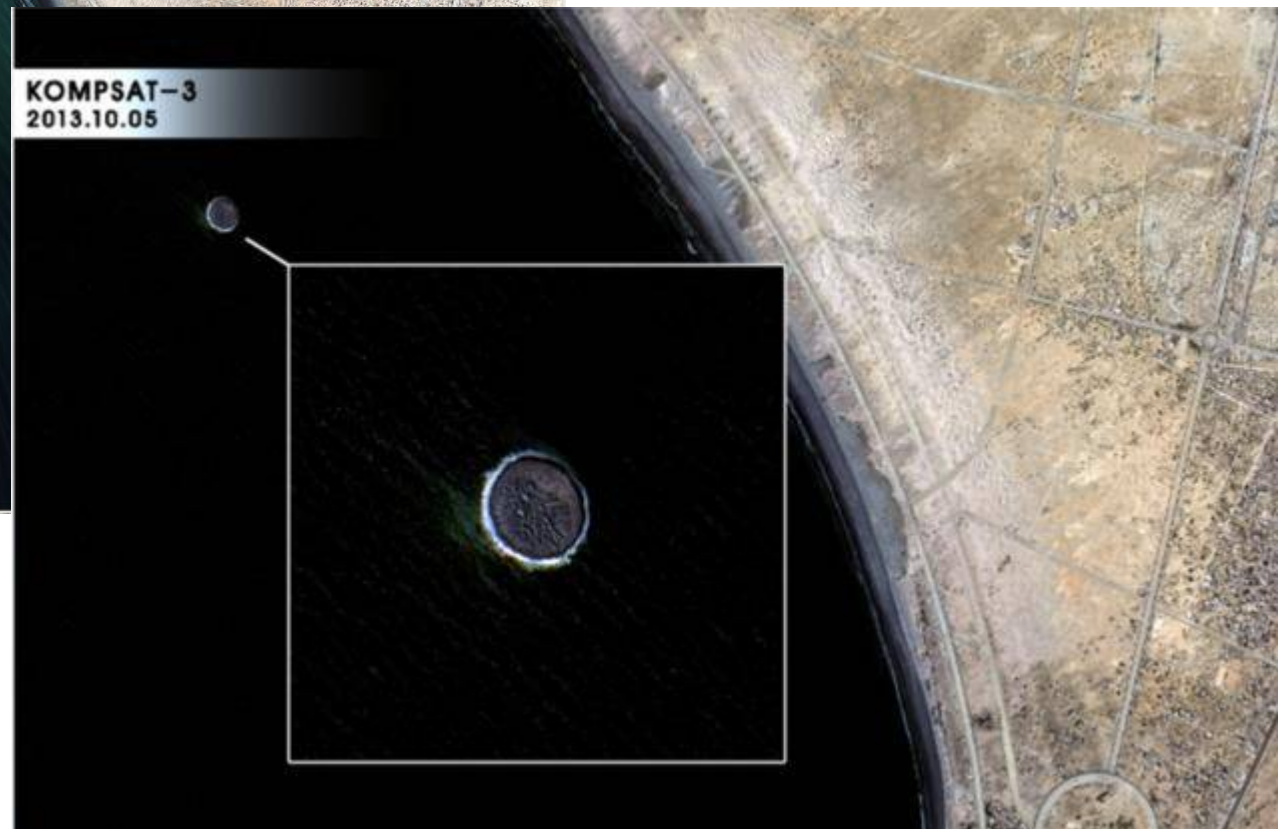
May 5, 2013



Disaster Monitoring



New Island in Pakistan
After earthquake 24, Sep.

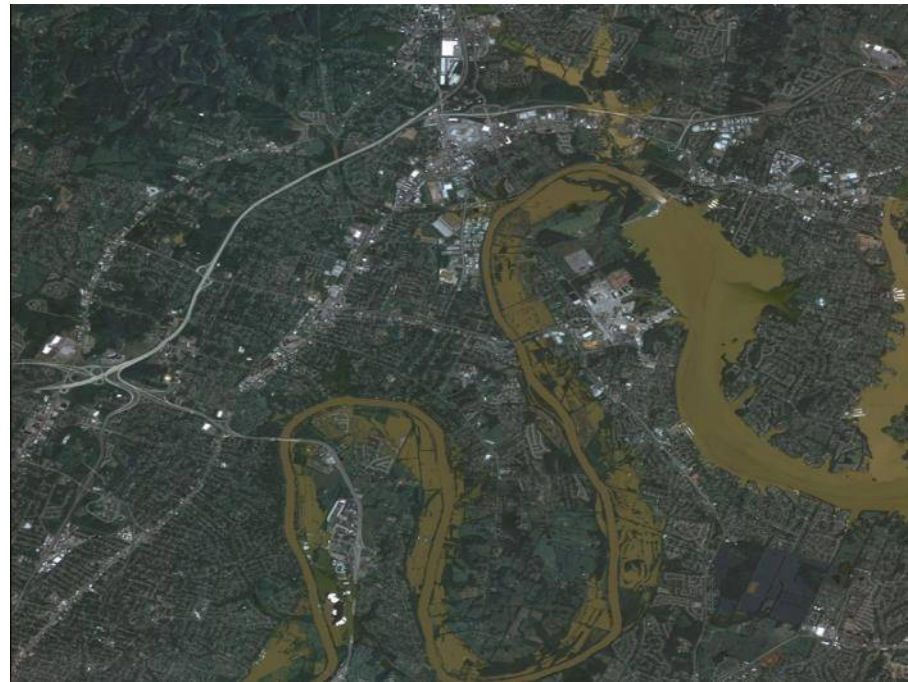


Disaster Management

❖ Flood in Nashville (May, 2010)



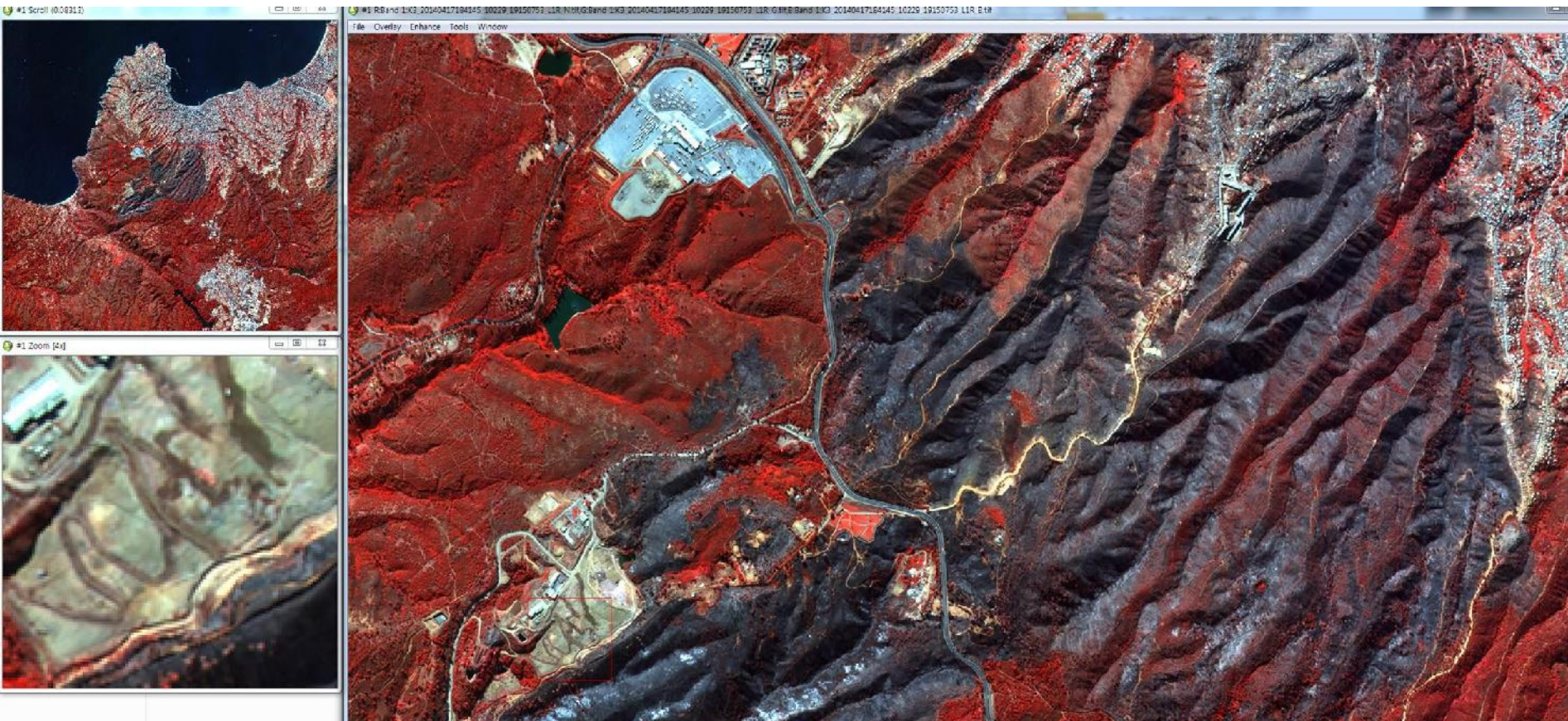
07. 09. 19



10. 05. 04

Disaster Management

❖ Fire in Chile (14th of April, 2014)



KOMPSAT-3, 17-04-2014

Disaster Management

❖ Fukushima Nuclear Power Plant (recovery)



2011. 3. 14 (After 3 days)

2013. 2. 21

Agriculture Monitoring

❖ KOMPSAT-2, Rice Field [1]

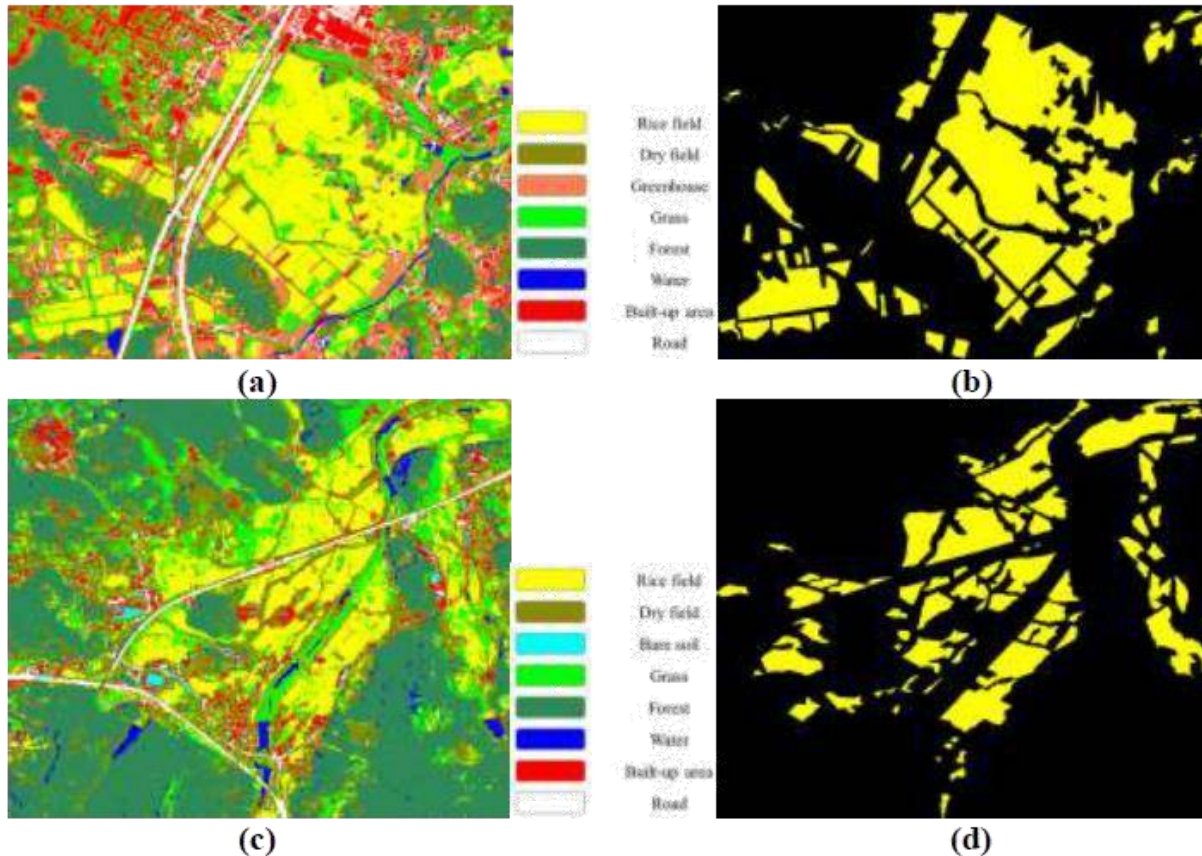
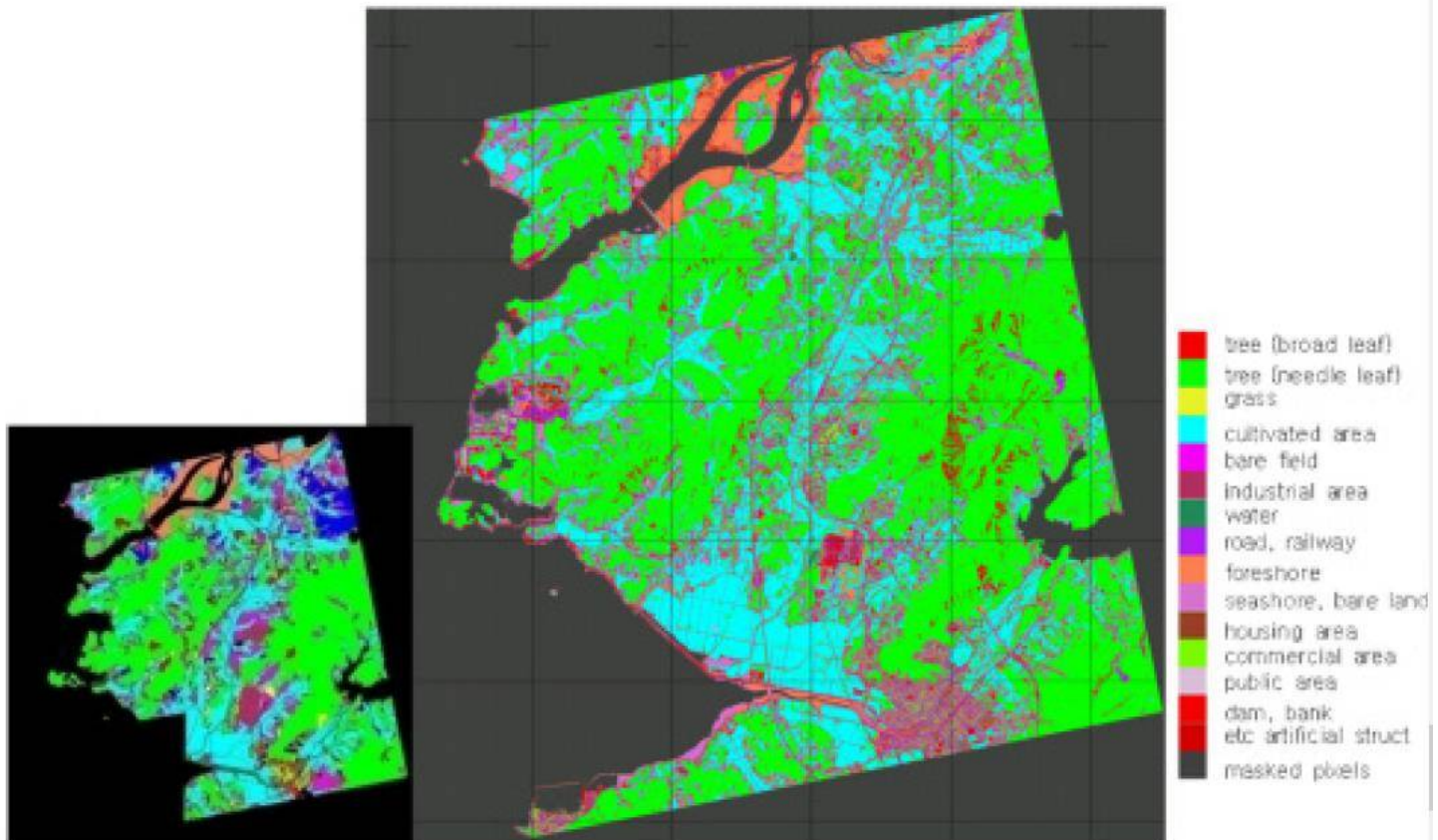


Fig. 4: Classification results and reference data of rice fields. (a) Daejeon (b) Reference in Daejeon (c) Gongju (d) Reference in Gongju

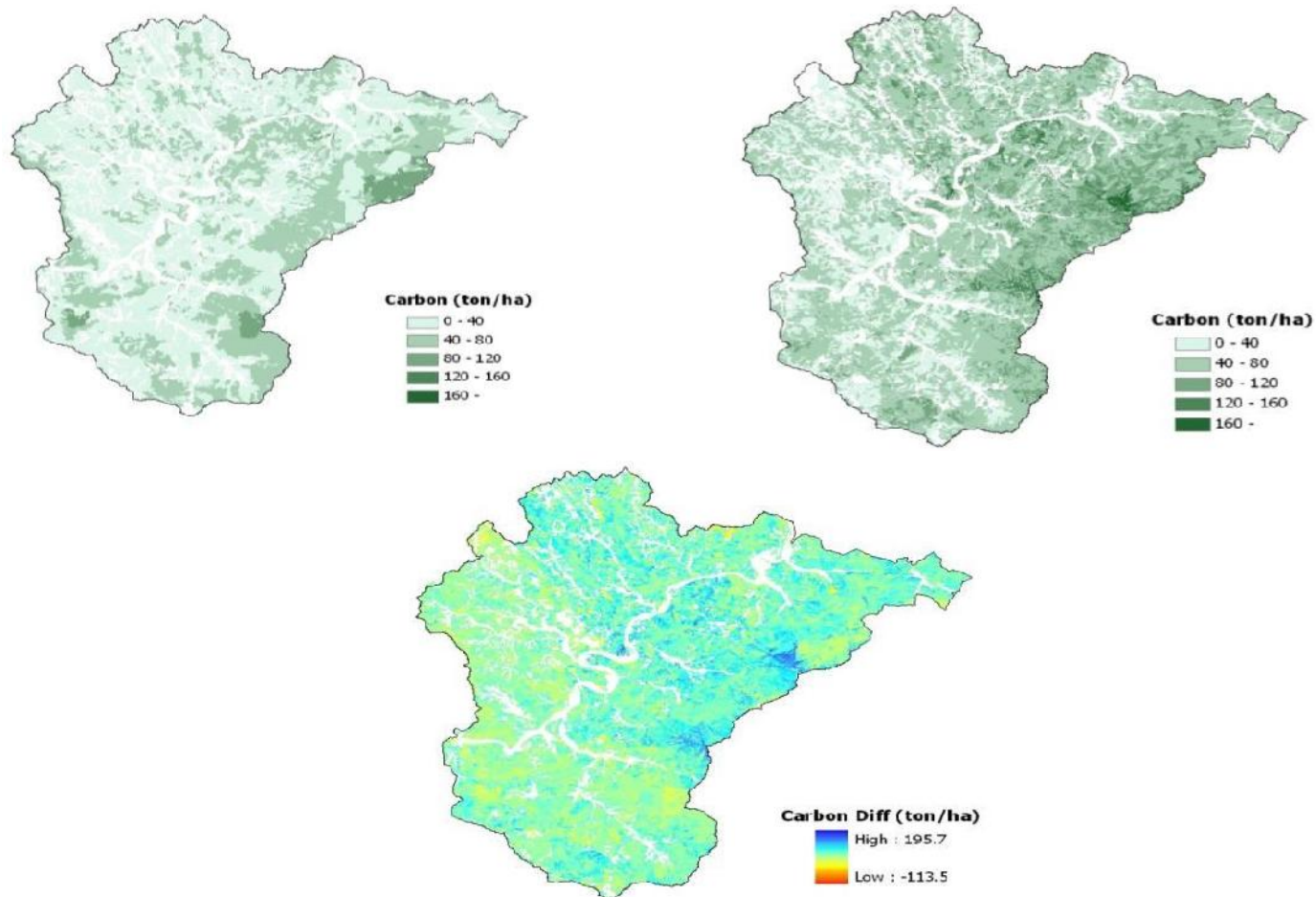
Forest Management

❖ Application Of KOMPSAT-2 Imagery for Carbon Emission Inventory Map



Forest Management

❖ Carbon Storage Estimation



Land Cover Map

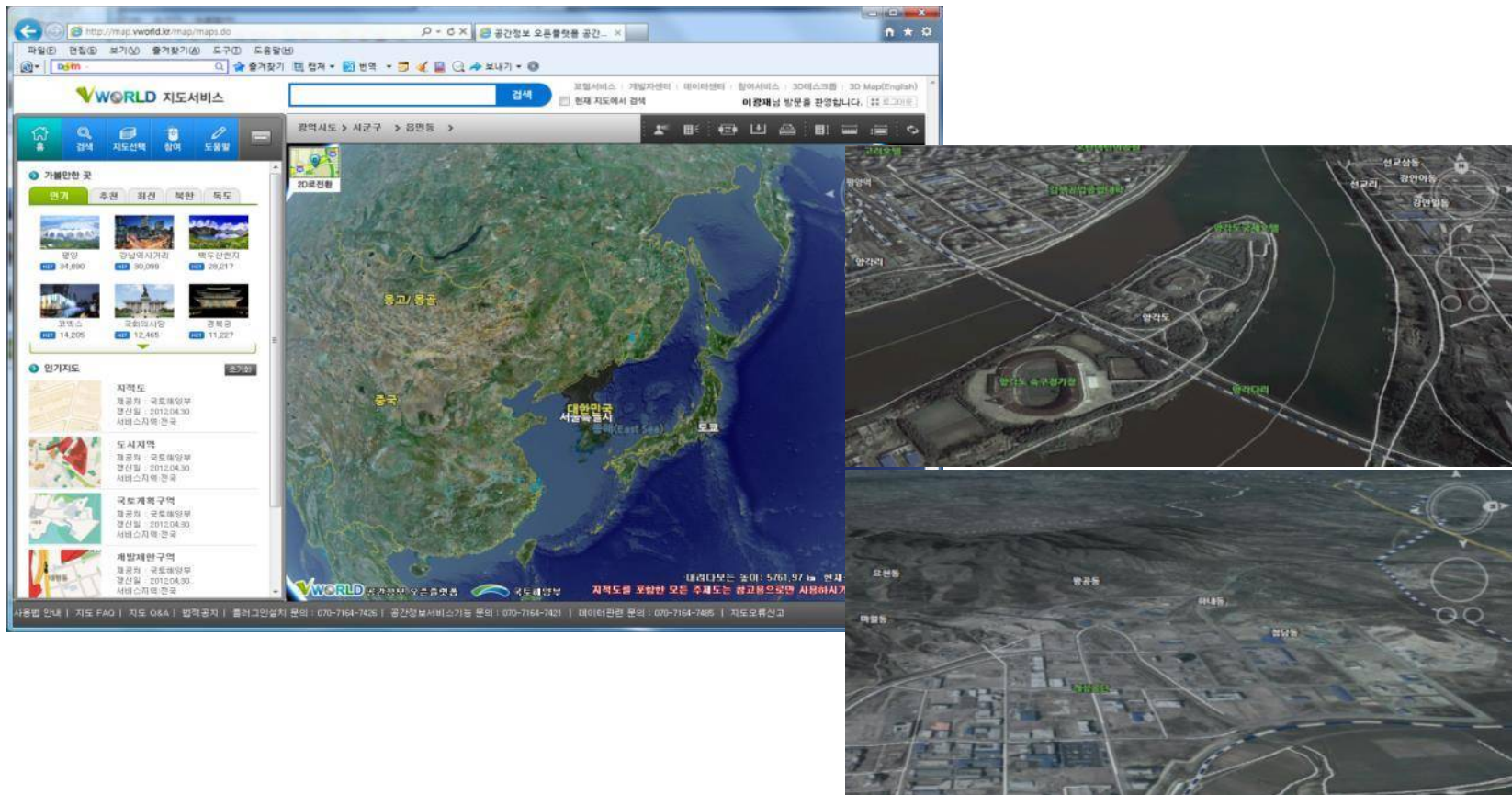
❖ Land Cover Map(KOMPSAT-2)



Mapping

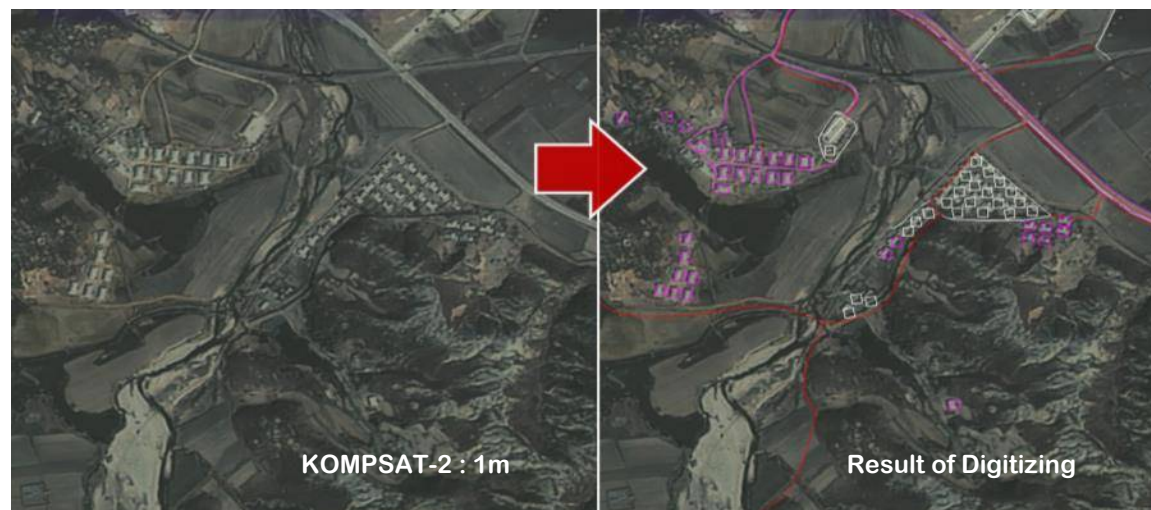
❖ Open Map API “V-world”

- Realization of 3D spatial information using KOMPSAT-2 imagery



Urban Change Mapping

❖ Updating digital map by using KOMPSAT-2 data





Thank You