

Disaster Monitoring and Construction of Spatial Information Using Korea Land Observation Satellite Images

Yi, Sang-oh(Ph.D) - Senior Researcher
National Land Satellite Center, National Geographic Information Institute





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Disaster Monitoring and Construction of Spatial Information Using Korea Land Observation Satellite Images

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01

Background for development of a new satellite series(CAS-500)

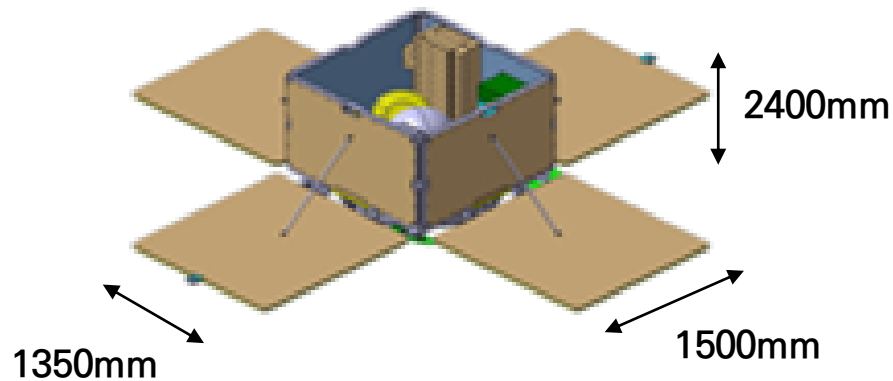
- Satisfying public demands about high-resolution satellite imagery (to improve the accessibility to the satellite imagery and expand the application and industrial field of image processing and analyzing)
 - Needing to develop satellites mostly concerning user requirement and application
- South Korea's government announced the 'industrialization strategy of Space Technology' to maximize socio-economic impacts of space technology (transferring satellite technologies from the public to the private domain)
 - Reducing the cost and time for development of satellite

Therefore, *South Korea's middle size satellite series* called *Compact Advanced Satellite(CAS) 500* has been developed *since 2015*

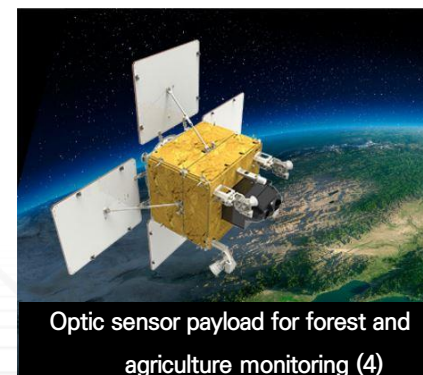
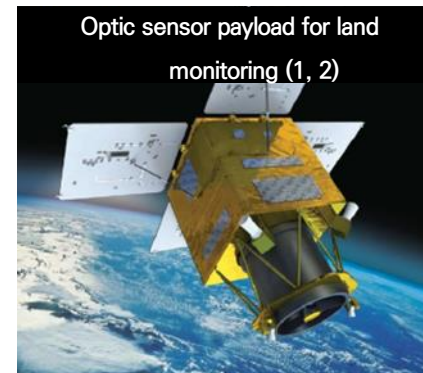


02 Standard Platform, CAS500

- Standard Platform for 500Kg-class Compact Advanced Satellite series had been developed by KARI(Korea Aerospace Research Institute) and industries and would carry various payloads
- Currently, there are plans to develop five satellites of CAS500



〈Standard Platform〉

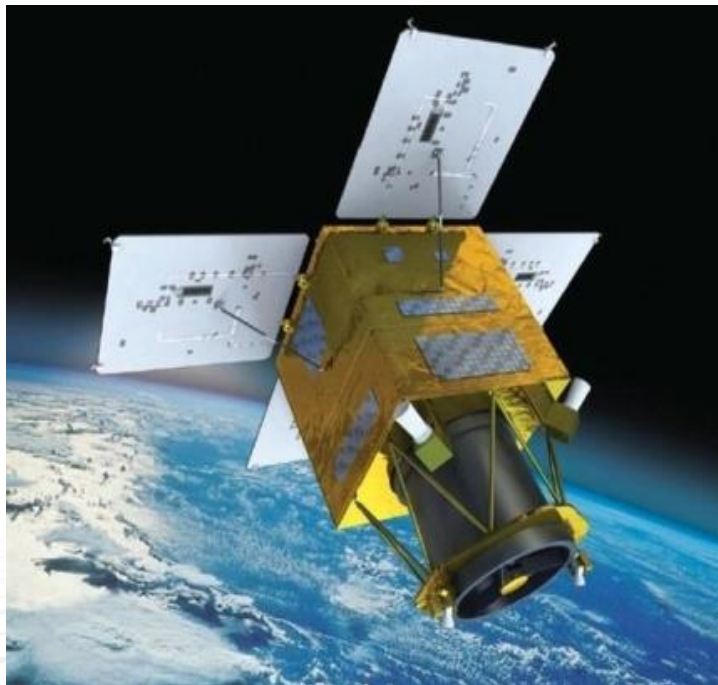


〈CAS500 series〉



01 Specification

- **Mission purpose:** Precise ground observation using electro-optical payload for monitoring land use, natural resource, disaster, and mapping
 - CAS 500 1st and 2nd is Korea Land Observation Satellite Series(1st and 2nd)
 - CAS 500 1st was successfully launched on March 22th, 2021
 - CAS 500 2nd will be launched on December, 2022



(AEISS-C, Advanced Earth Imaging Sensor System)

Korea Land Observation sat 1 / 2	
Mission Orbit	Sun-synchronous Orbit (497.8 km)
Wavelength Bandwidth	MS(4) : 450–900 nm PAN(1) : 450–900 nm (Blue, Green, Red, NIR, PAN)
Resolution(@nadir)	PAN ≤ 0.5m MS ≤ 2.0m
Shooting Width(@nadir)	≥ 12 km
Radiometric Resolution	12 bits/pixel
Lifecycle	≥ 4 years



01 Operational Scenario

- The two identical satellites (1st / 2nd) orbit one behind the other in same orbital plane at having 180 degree phase difference
- Both satellites widely and rapidly observe the Earth’s surface, and conducts multi-path stereo images within very short period such as about 45min

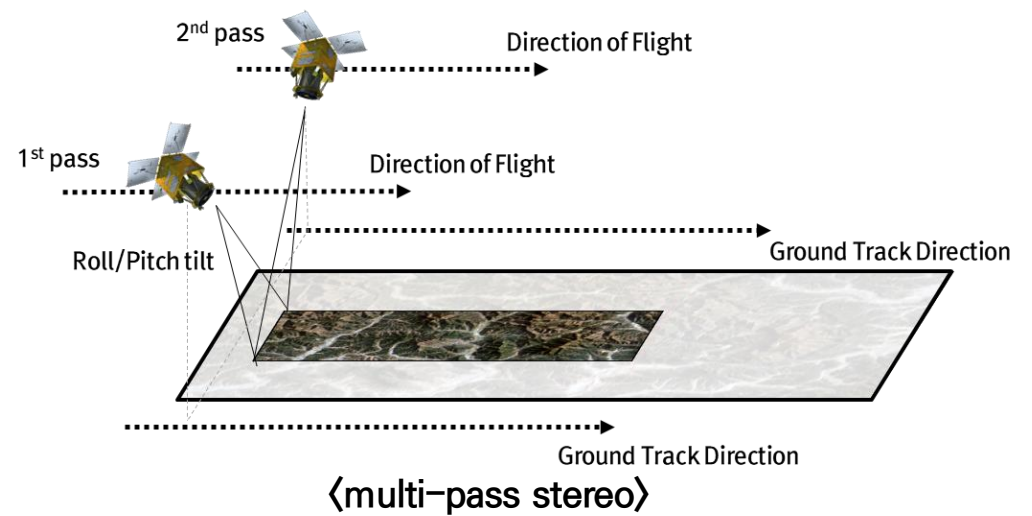
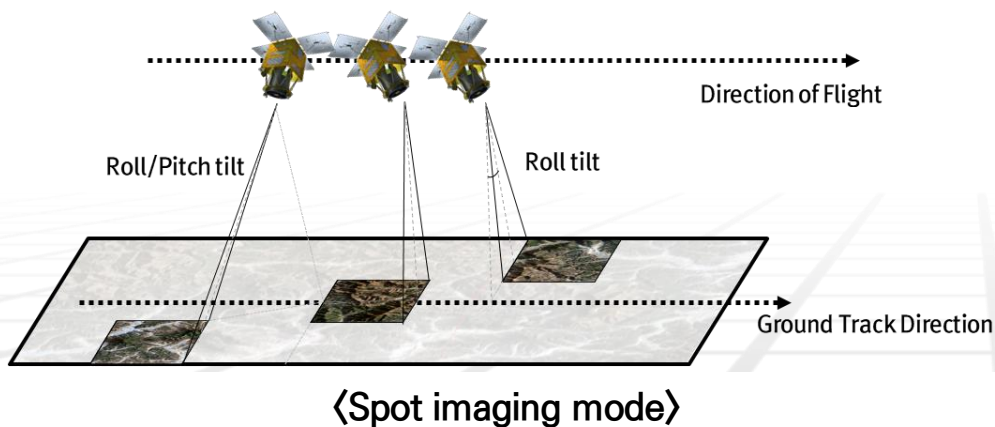
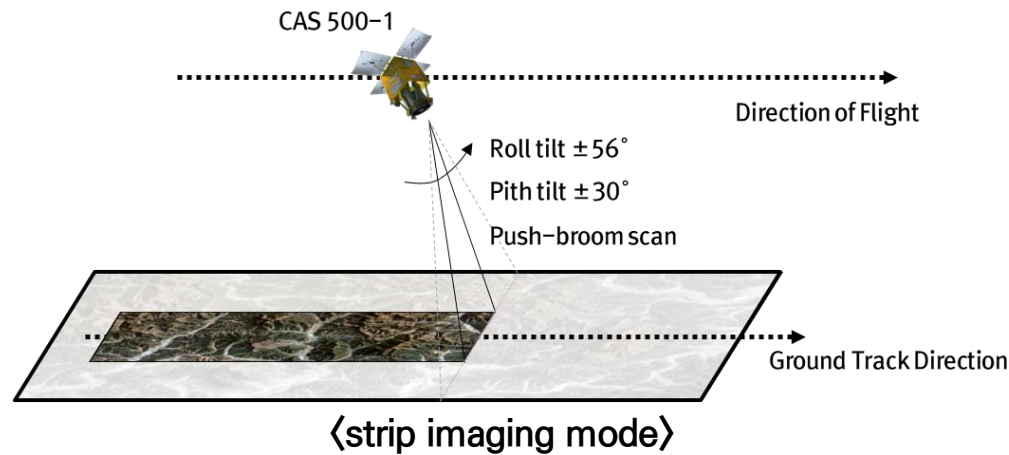


Orbit	Sun synchronous
Altitude	497.8 km
Inclination	97.40°
ECT(KST)	11:00
Periods	95 min
Repeat Cycle	29 days
Revisit time	4.6 days
Roll Tilt	≤ 61°



02 Operational Scenario

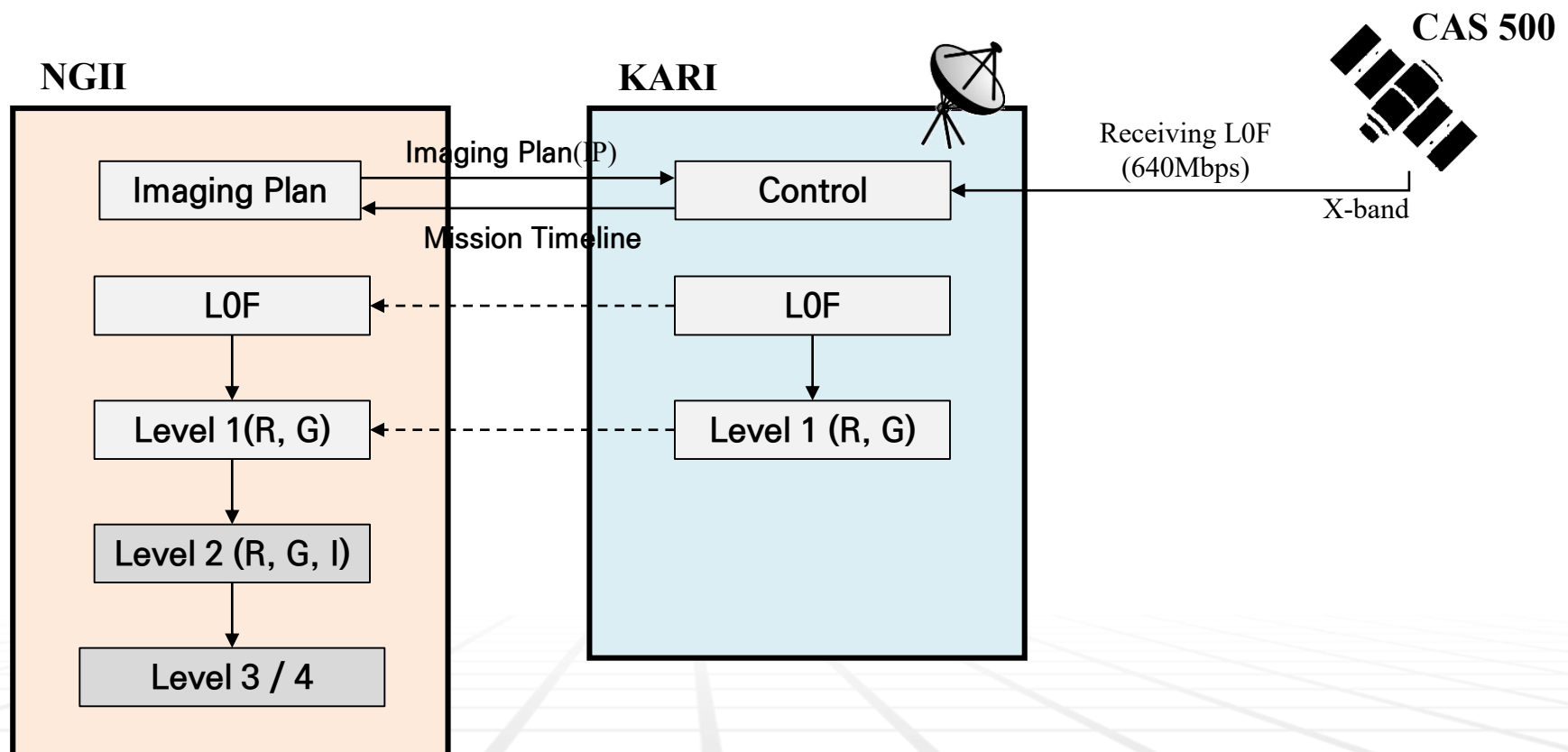
- Observing Mode : Strip, Spot, Multi-pass stereo imaging mode
- Observing time : 5min/orbital plane, 25min/day
- Agility : 50sec. for 30 deg.





03 Satellite Operation(National Land Satellite Center, NGII)

- NGII: Collecting, processing, managing, and distributing the high-resolution satellite images taken by CAS500 1st / 2nd , and the application products
- KARI: Controlling satellite, receiving and processing raw images from satellite





04 NGII Products

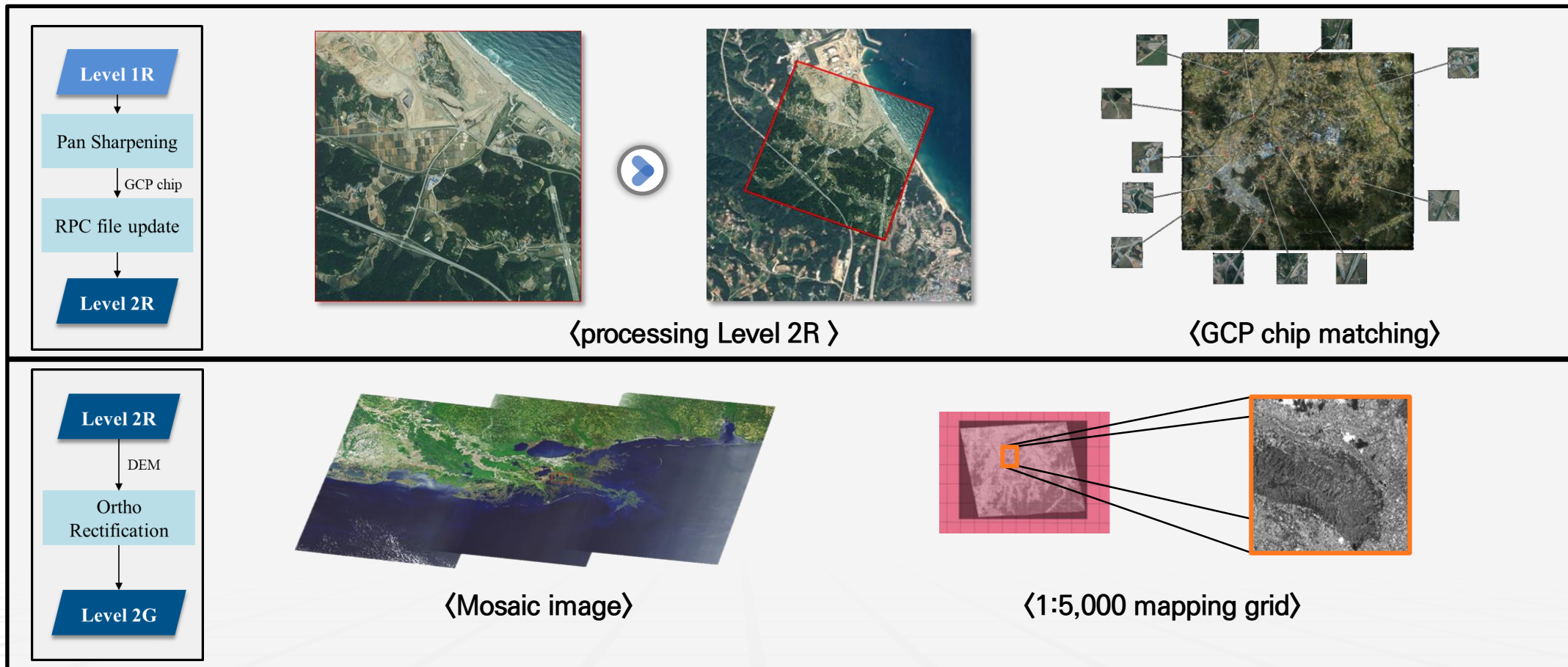
- Product Definition

Products	Level	Description
Standard	Level 1R	Radiometric corrected
	Level 1G	Geometric corrected
Precision	Level 2R	Updated RPC of L1R using GCP Chip
	Level 2G	Orthorectified imagery with precise DEM
	Level 2I	Indexed imagery from Level 2G to 1:5,000 mapping grid
Science(TBD)	Level 3	Reproduced 2D/3D information only with Precise image(Level 2) [Gridded Quality Controlled]
Composite(TBD)	Level 4	Reproduced 2D/3D information with Precise image(Level 2/3) and other spatial information [Model output]



05 Precise image product

- Basically, NGII produces precise image products(Level 2 R, G, I) automatically using Precise Image Processing(PIP) SW, GCP chips and Digital Elevation Model

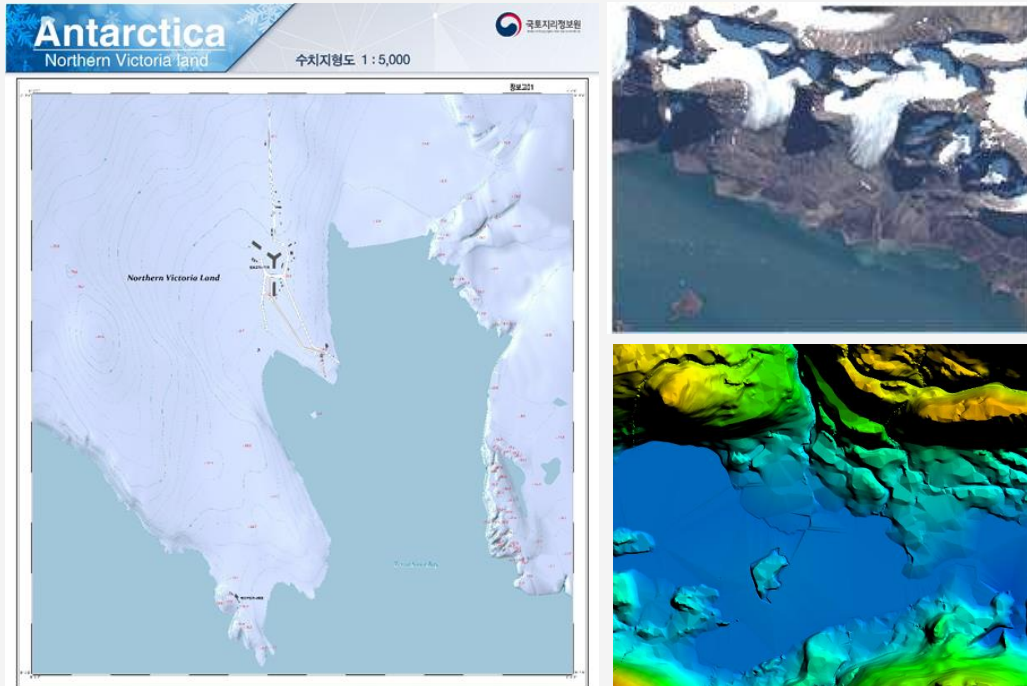




01 2D Mapping

- Conducting and updating the digital maps for the Korean peninsula, especially where the aerial images are unable, and arctic/Antarctic area

Mapping for areas where the aerial images cannot be acquired



< Polar Regions >

Update for National digital map of South Korea

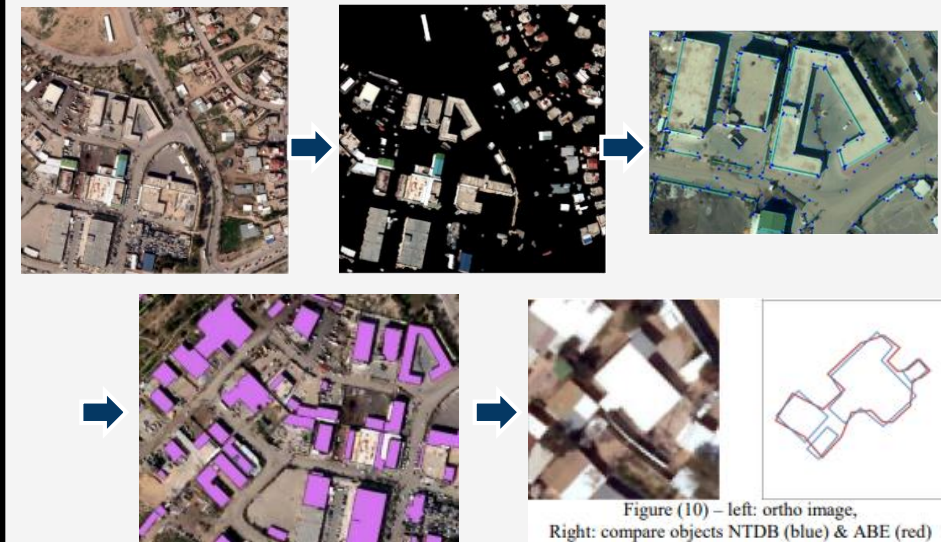


Figure (10) – left: ortho image, Right: compare objects NTDB (blue) & ABE (red)

		Truth data				
Classifier results		Add & Modify	Delete	Identical	Classification overall	Producer Accuracy (Precision)
	Add & Modify	455	0	73	528	86.2%
	Delete	23	283	133	439	64.5%
	Identical	0	142	2673	2815	95.0%
	Truth overall	478	425	2879	3782	
User Accuracy (Recall)	95.2%	66.6%	92.8%			

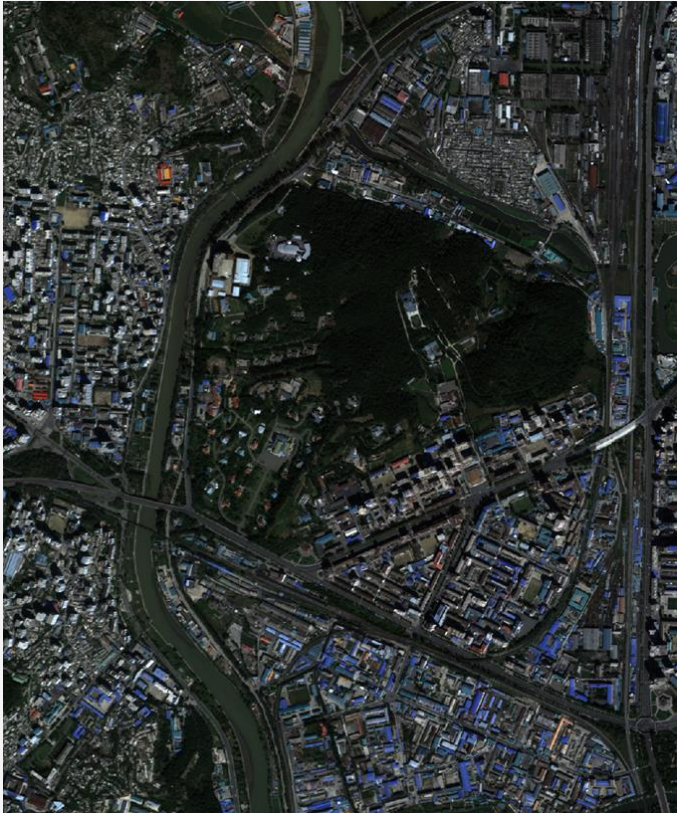
Table (5) – precision and recall accuracy of area B

<Keinan et al., 2016>



02 3D Mapping

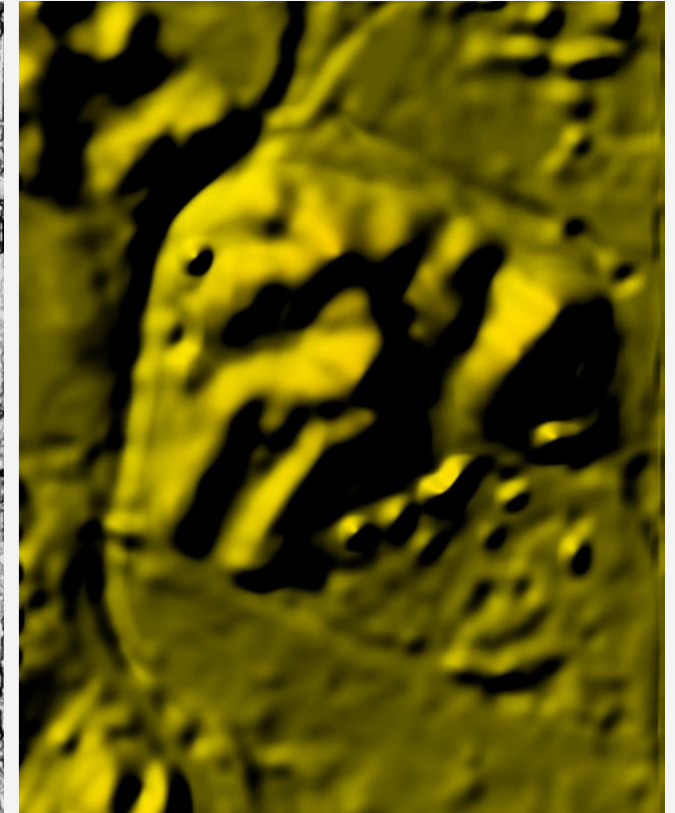
- From stereo pair images, 3D Spatial Information(DSM/DTM) can be generated



〈Satellite image〉



〈DSM〉

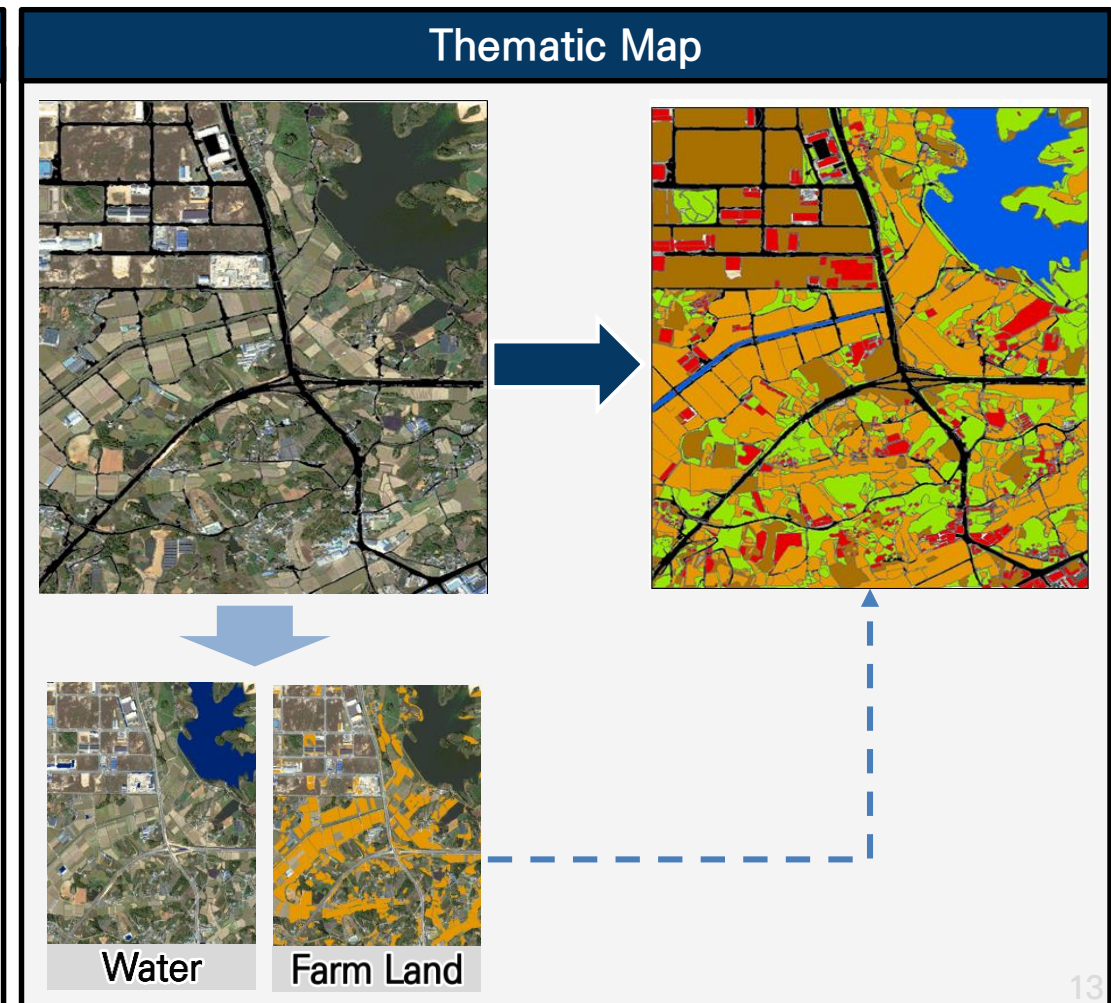
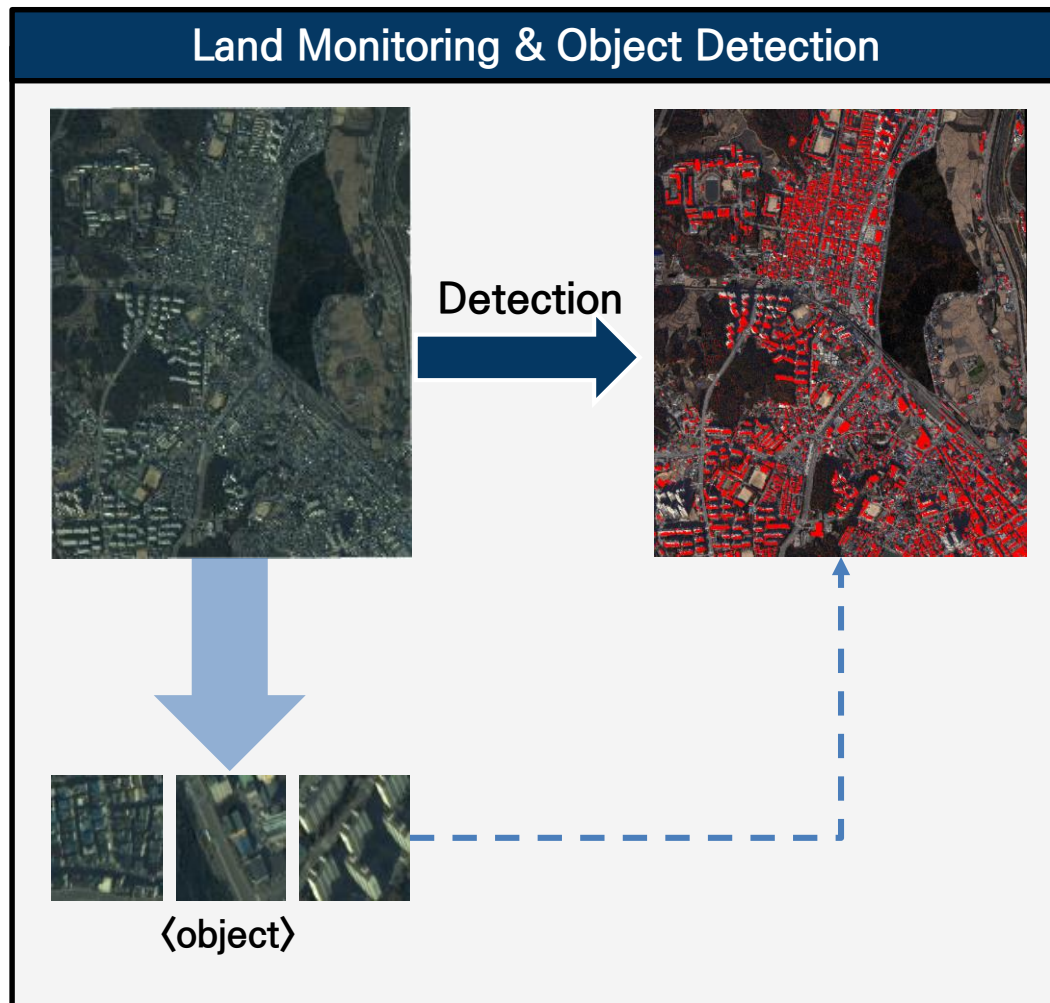


〈DTM〉



03 Monitoring / Thematic Map

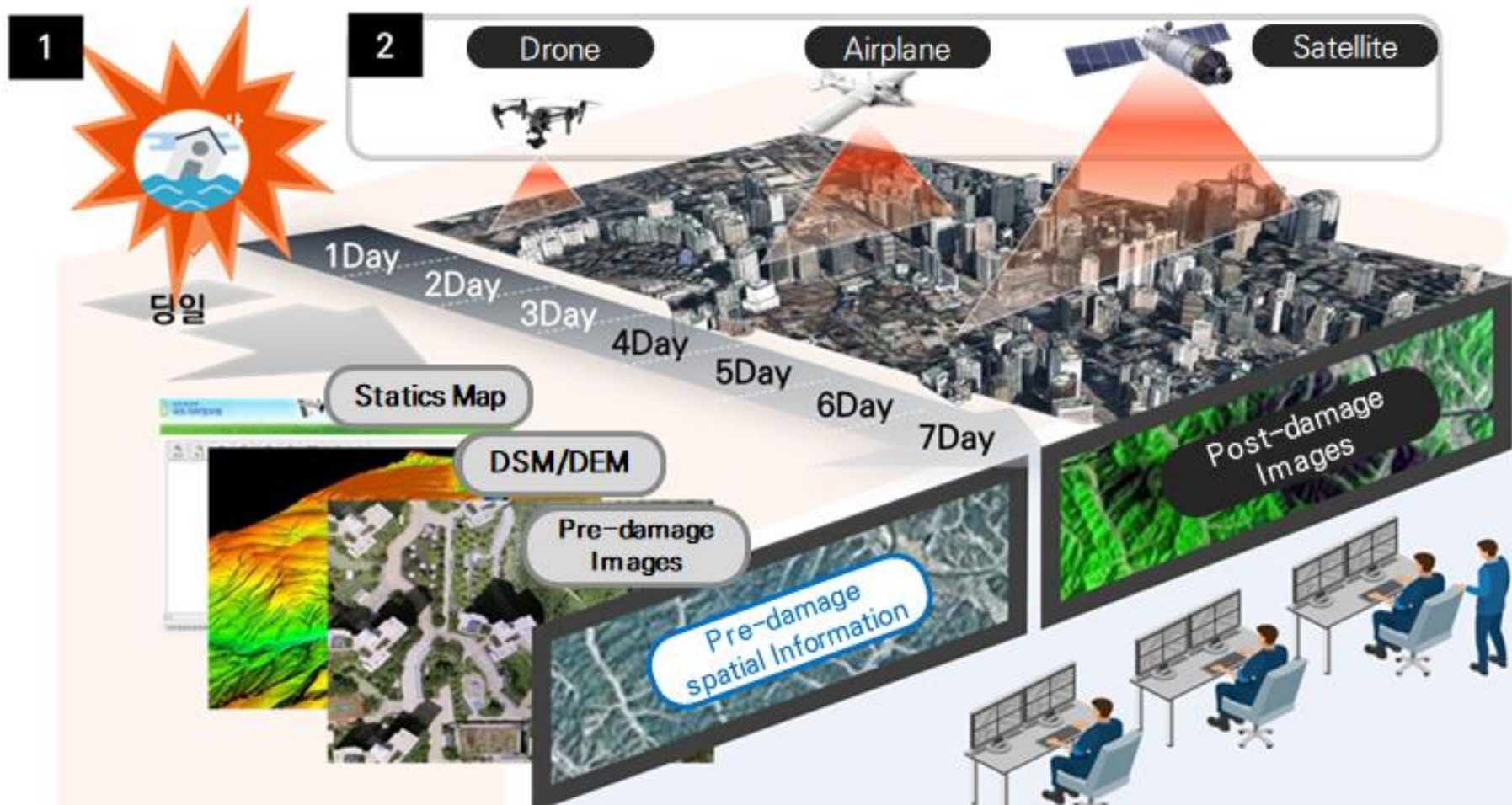
- Monitoring the land use, infrastructure and resources, and producing thematic maps using object-extraction and change detection





04 Responding to disaster

- Monitoring and mitigating disasters such as wildfires, floods, and service them with other geospatial information, called Geospatial-119 service





05 Responding to disaster

● Wild Fire in Korea

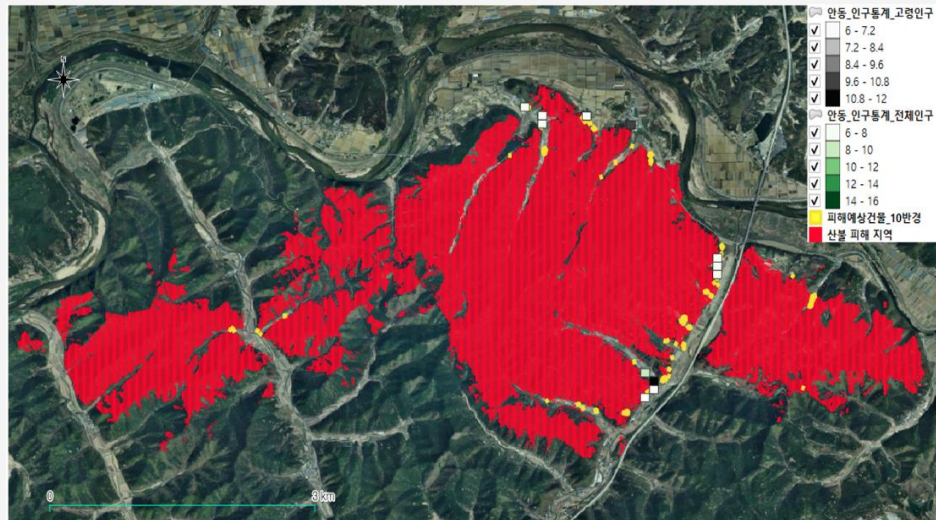
Forest fire on April, 2020 in Andong



< Before disaster >

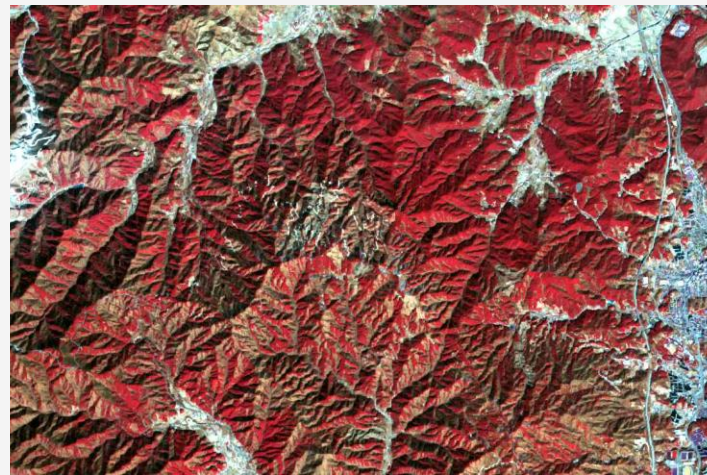


< After disaster >



< Damage analysis results >

Forest fire on March, 2022 in Gangneung & Donghae City



< Before disaster >



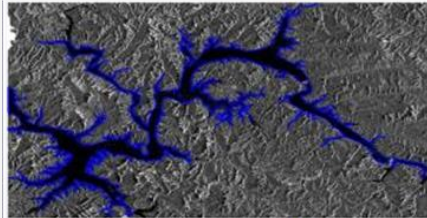
< After disaster >



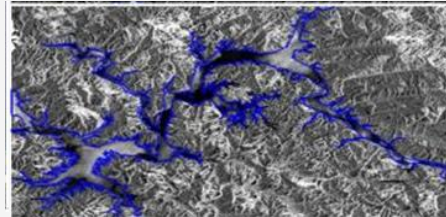
06 Responding to disaster

- Typhoon & Localized Heavy Rain in Korea

Heavy Rain on July, 2020 in Chungjuho Lake



< Before heavy rain >

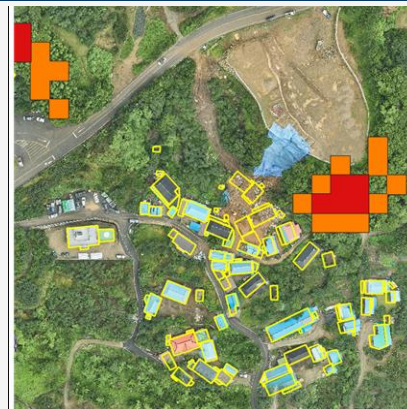


< After heavy rain >

LandSlide on July, 2021 in Gwangyang City



< Before landslide >



< After landslide >

 landslide-prone area

Typhoon on September 4, 2020 in Ulleung Island



< Before disaster >



< After disaster >





- CAS 500 2nd will be launched on end of this year and expected that the capacity to monitor the current situation not only on the Korean Peninsula but also around the world will be increased.
- Through the discovery of various demands in the public and private sectors, continuously produce and provide various products that can be used for mapping and responding to disasters.
 - Contribution in geospatial data ODA and international cooperation system
 - Provides damage information on major disasters occurring in the world
- Considering the design life of the satellite(expected 4years), follow-up satellite of Land Observation Satellite Series development is promoted with the aim of launching 2027

Thanks for listening

NGII National Geographic Information Institute
Homeland love in our mind, geospatial information in daily life

