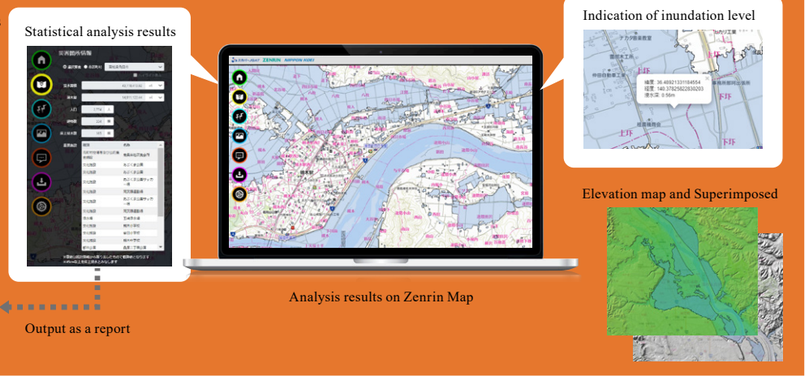
5 BASIC PLAN

Reporting at the time of a disaster

Service image : flooded area

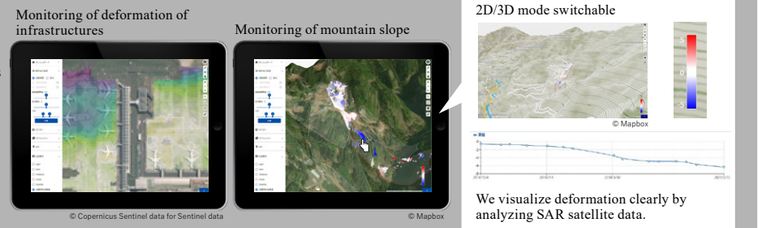
- Inundated area, Landslide area analysis (The charge is only for the cost of satellite images,. Analysis fee is free)
- Detailed analysis about Disaster area (flood damage, flooded amount, scale of collapse, collapsed houses, etc. for each municipalities)
- SNS analysis result (flood damages)



In normal situation

Service image : deformation monitoring, slope monitoring

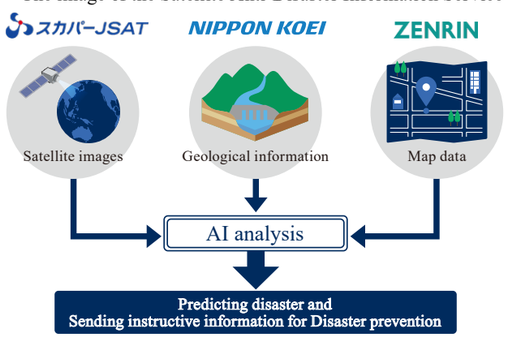
- Regular monitoring of mountain slope (once a quarter) *an assessment for every year
- Monitoring of conditions of principal facilities (once a quarter) *Harbor facilities, Airport, Reclamation, Wide, ground subsidence etc.
- Land deformation (development) Annual Monitoring
- Monitoring of dead trees (every summer)



6 FUTURE PROSPECT / ACHIEVEMENT

We are developing AI system that can predict the risk of disaster by combining basic information such as slope topography, geological characteristics, disaster history, and rainfall records with minute deformation data from satellite images. (Scheduled to start in April 2022)

The image of the Satellite Anti-Disaster Information Service



Project record

Project name	Contractor	Period	Key words
Inundation area research / analysis study work using satellite images	Ministry of Land, Infrastructure, Transport and Tourism, Chubu Regional Development Bureau	2020 2021	Disaster, flooded area, landslide, Utilization of SNS
Advanced satellite remote sensing data utilization model demonstration project to the problem solution	Cabinet Office Space Development Strategy Promotion Secretariat	2020	Normal situation, Infrastructure monitoring, Airport, Small reflector
River erosion control technology development research (river/ water disaster technical field) prevention	Ministry of Land, Infrastructure, Transport and Tourism National Institute for Land and Infrastructure Management	2019 2020 2021	Normal situation, River channel management, embankment management
Demonstration of infrastructure displacement monitoring technology by SAR satellite and Survey on promotion of international cooperative use of frequencies through overseas expansion.	Ministry of Internal Affairs and Communications Comprehensive Communication Infrastructure Bureau	2020	Normal situation, infrastructure monitoring, small reflector

✉ml-siscenter@dx.n-koei.co.jp 🌐www.n-koei.jp/english/

First edition: July 19th, 2021
Update: December 17th, 2021

スカパーJSAT ZENRIN NIPPON KOEI

1 BACKGROUND OF COMMERCIALIZATION

Leading companies from three industries (satellite business, map business, and construction consultants) made a new business partnership to develop “Satellite Anti-Disaster Information Service.”

スカパーJSAT
Developing imaging and analysis technology utilizing optical and SAR satellites

ZENRIN
Providing residential map data, building polygons, statistics, and more for damage assessment

The SKY Perfect JSAT and Nippon Koei started business collaboration of satellite analysis technology and infrastructure facility risk assessment technology in November 2019.

NIPPON KOEI
Developing techniques of risk assessment (displacement alert), risk prediction, and contents to be displayed

Predict and evaluate risks from the satellite data, overlay the information on an accurate map, and perform statistical processing according to the user's requirements.

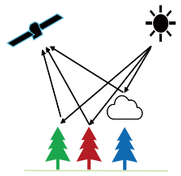
Satellite Anti-Disaster Information Service

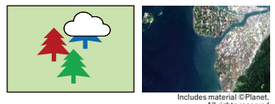
*Basically ZENRIN map is only compatible with the Japan area. The base map and statistical information used in this system need to be replaced for each country or region.

2 OVERVIEW OF SATELLITE REMOTE SENSING

Sensors installed on satellites give us data on the surface of the earth.
There are two types of satellites: optical satellites, which are good for observation of color or shape of an object, and SAR satellites, suitable for observation of its material or minute changes over time.
Advantages of satellite technology are “to observe repeatedly the entire globe at regular intervals with same accuracy.” In addition, past observation data is archived and can be used for analyzing the past.

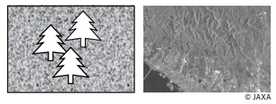
Optical Satellites





- It observes the sunlight reflected from an object.
- The color, size, or shape of the object can be determined.
- The Image is like an aerial photograph.
- Observation under clouds or at night is impossible.

SAR Satellites



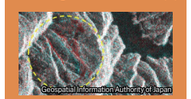
- It observes the reflection of microwaves irradiated by itself.
- The presence of an object, its material, or changes can be determined.
- It can be used regardless of clouds or night-time conditions.
- Since the images are taken under the same conditions, it is suitable for observing changes of an object.

By utilizing the characteristics data of the two types of satellites, it is possible to analyze and evaluate information you want.

Disaster Monitoring
Monitoring of development status (1)

Auto-detect inundation area by analyzing the data from optical and SAR satellites right after a disaster.

Disaster Monitoring
Monitoring of development status (2)



Auto-detect landslide area by analyzing the data fromoptical and SARsatellites right after a disaster.

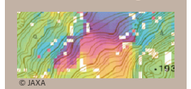
Monitoring of development status (3)

Detect urban development area by analyzing regular record of optical satellite images.

Monitoring of vegetation

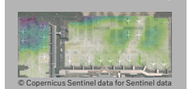
Analyze distribution and conditions of vegetation and detect dead trees by utilizing optical satellites images.

Monitoring of mountain slope



Monitor a wide range of slope deformations and assess the risk of disasters by SAR time-series inter ferometric analysis.

Monitoring of Infrastructure facility



Monitor minute changes in a wide range of infrastructure over time and assess the risk by SAR time-series inter fero metric analysis.

3 SAMPLE CASE AT THE TIME OF A DISASTER

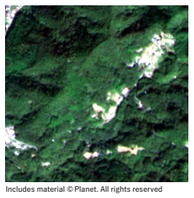
Optical Satellites

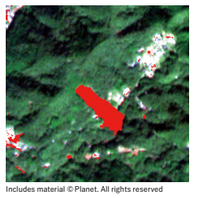
■ Observation of Inundation area

Detect inundation area by analyzing satellite images after disaster and overlaying them on the Zenrin map and providinge disaster information such as the number of flooded houses.

■ Observation of landslide area

Detect landslide area through the analysis of optical satellite images.

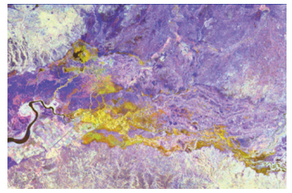


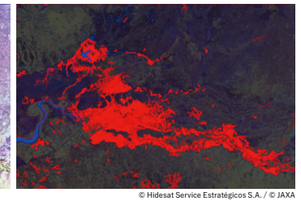


SAR Satellites

■ Observation of Flooded area

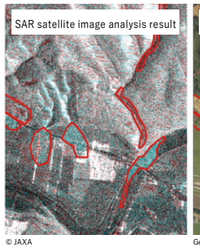
As a characteristic of SAR satellite observation, the water is not detected and only shown as a dark. Using this characteristic, it is possible to find out flooded area even in during rain or at night.





■ Observation of Landslide area

Find out landslide area by overlaying SAR satellite images of before disaster and after disaster.



4 USE CASE IN NORMAL SITUATION

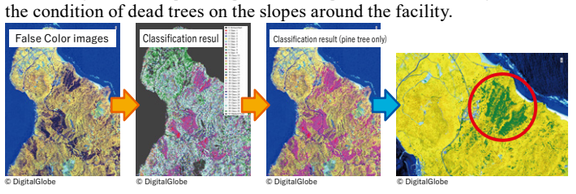
Optical Satellites

Monitoring of development status

Monitor status of deforestation and urban development by analyzing regular record of optical satellite images. The higher resolution that the satellite images have; Even the smaller the changes that can be captured.

Monitoring of vegetation

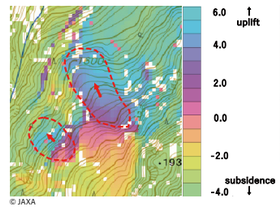
Analyze the spectral information obtained from optical images to detect classification inside of plant colonies and dead tree colonies. Risks can be assessed by monitoring the vegetation overgrowth in the security area and the condition of dead trees on the slopes around the facility.

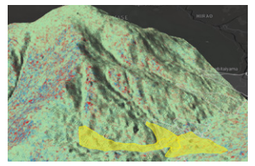


SAR Satellites

Monitoring of mountain slope

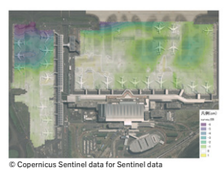
Slope deformations are monitored by regular SAR satellite observations. Our strength is the ability to quantitatively observe a wide area. Engineers evaluate the risk of landslides on slopes where deformation has been confirmed.

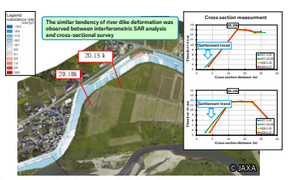




Monitoring of Infrastructure facility

Monitor minute changes in large infrastructure facilities with SAR satellites. Below is a monitoring of an airport (left figure) and a river embankment (right figure). By improving the conventional algorithm, the accuracy and stability of the analysis have been improved.





Comparison of Interferometric SAR Time Series Analysis and Cross-Survey (Left: analysis result, Right: survey result)