JAXA's Activities for domestic Disaster Response

November. 2018

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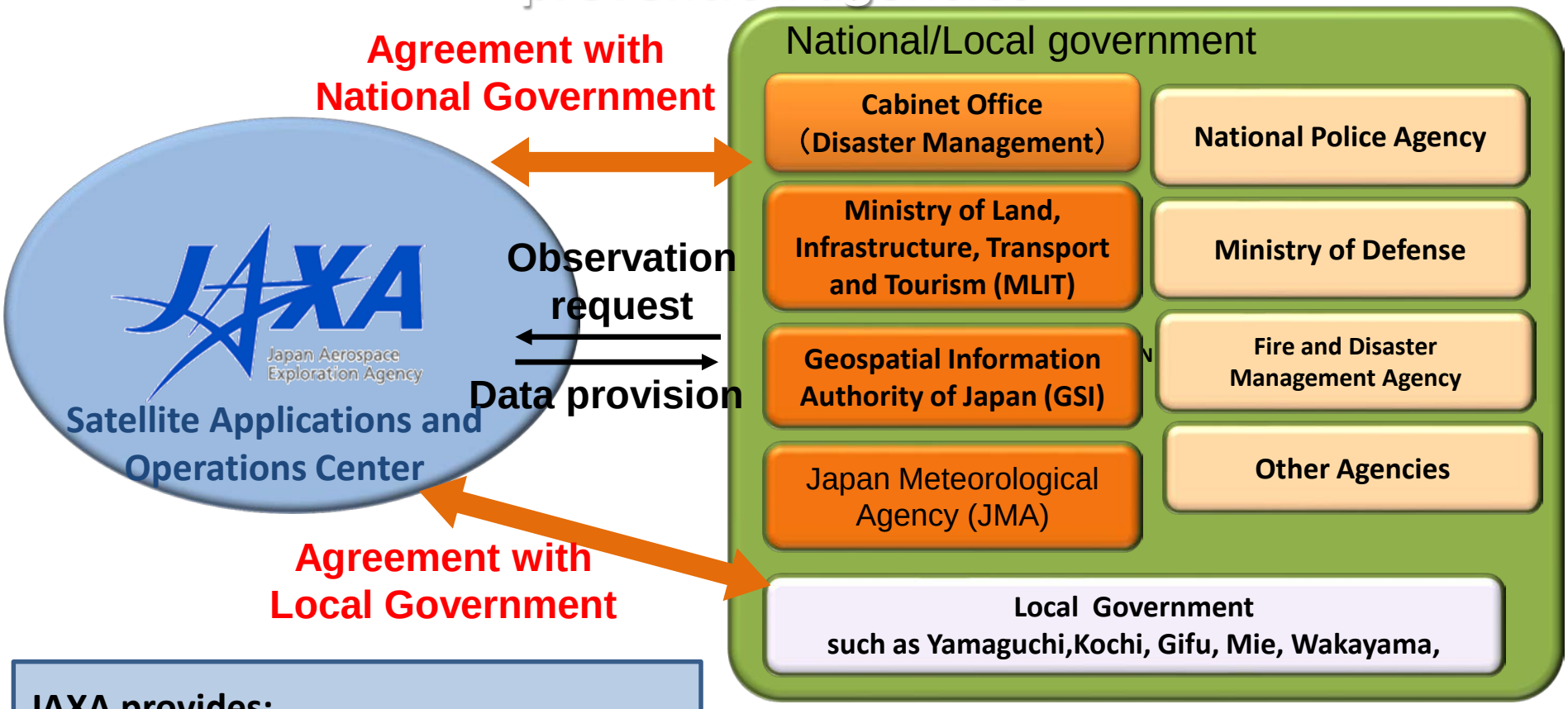
Collaboration with domestic disaster prevention agencies



JAXA provides;

- ●Disaster observation data
- •Emergency observation data
- •Disaster maps
- ●Satellite geographical information (including training)
- ●Know-how on image analysis

Disaster prevention agencies provide;

- ●Emergency observation request
- ●Utilization Results Report
- ●Advice and recommendation
- ●Request for utilization and future systems

Status of ALOS-2 Utilization

ALOS-2 has SAR sensor which has following characteristics.

① imaging at night and under bad weather condition
② imaging repeatedly
③ imaging the wide area
④ detecting crutial deformation of some centimeter

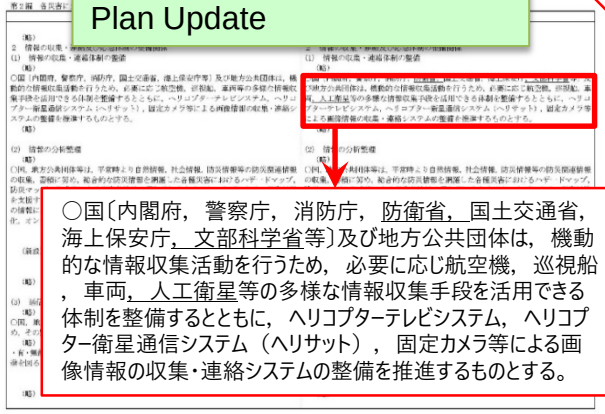
No.	Category	Application	Phase of Disaster Cycle	Main user	Status of Utilization	Examples of Utilization
1	Volcano Disaster	Monitoring of Crustal movement of active volcanos	Disaster Response Precaution	JMA, GSI	Operational	Hakone Sakurajima Nishinoshima
2		Area Detection of ash fall and pyroclastic flow	Disaster Response	MLIT	Demonstration	Kuchinoerabushima
3		Monitoring of lava dome and crater change	Precaution	JMA, GSI	Demonstration	Sakurajima Kirishima
4	Earthquake Disaster	Evaluation of Crustal movement after earthquake	Disaster Response	GSI	Operational	Kumamoto (Apr. 2016) Hokkaido (Sep. 2018)
5		Damage evaluation of bulding collapsion	Disaster Response	Cabinet Office, Local governments	Researh	
6		Detection of Landslides	→(Ref toStorm/Flood Disaster)			
7		Detection of Flood	→(Ref toStorm/Flood Disaster)			
8	Storm/Flood Disaster	Detection of Landslides and Landslide Dams	Disaster Response	MLIT, Local governments	Demonstration	Kumamoto (Apr. 2016) Typhoon 9,10 (2016) Kyuushuu Heavy Rain (2017) Heavy Rain (Jul. 2018) Hokkaido (Sep. 2018)
9		Inspection of Landslide dangerou area after heavy rain or earthquake	Precaution	MLIT, Local governments	Demonstration	After Kumamoto (Apr. 2016) After Kyuushuu Heavy Rain (2017) After Hokkaido (Sep. 2018)
10		Monitoring of Landslide dangerous area	Precaution	MLIT, Local governments	Researh	
11		Detection of Flood	Disaster Response	MLIT, Local governments	Demonstration	Hevy Rain (Sep. 2015) Typhoon 9,10 (2016) Kyuushuu Heavy Rain (2017) Heavy Rain (Jul. 2018)
	Ref.	Phase of Disaster Cycle: Precaution→Disaster response→Recover/Reconstruction				

Update of Government Disaster Management Plan

1. Disaster Management Basic Plan has been updated to include satellite as one of the method for disaster information collection. (approved by the Central Disaster Management Council on Apr. 11, 2017)
2. Local disaster management plan of some prefecture has been updated to include satellite as one of the method for disaster information collection. (Yamaguchi: May, 2017 Tokushima: Oct. 2017 Niigata: Mar. 2018)
3. Disaster management operation plan of Ministry of Land,Infrastructure,Transport and Tourism (MLIT) has been updated to include satellite as one of the method for disaster information collection.(Sep. 2018) The plan indicates that satellite can be used for all type of disaster in addition to anticipated large-scale earthquake such as Nankai Trouph earthquake.

Planning system based on Disaster Countermeasures Basic Act

Basic Disaster Management Plan Update



○国〔内閣府，警察庁，消防庁，防衛省，国土交通省，海上保安庁，文部科学省等〕及び地方公共団体は，機動的な情報収集活動を行うため，必要に応じ航空機，巡視船，車両，人工衛星等の多様な情報収集手段を活用できる体制を整備するとともに，ヘリコプターテレビシステム，ヘリコプター衛星通信システム（ヘリサット），固定カメラ等による画像情報の収集・連絡システムの整備を推進するものとする。

Comparison table of old and new provision

Basic Disaster Management Plan

Central Disaster Management Council

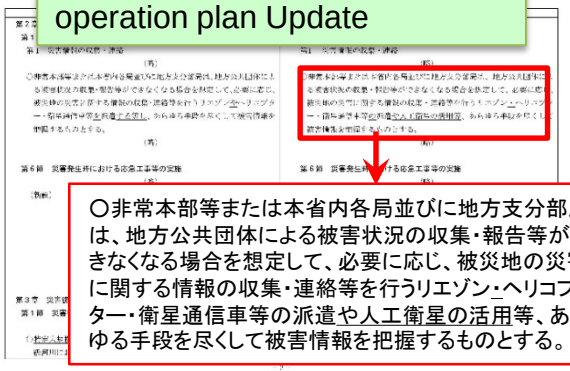
Disaster management operation plan

Designated local government organizations and public institutions

Local disaster management plan

Prefectures and municipalities

MLIT Disaster management operation plan Update



○非常本部等または本省内各局並びに地方支分部局は、地方公共団体による被害状況の収集・報告等ができなくなる場合を想定して、必要に応じ、被災地の災害に関する情報の収集・連絡等を行うリエゾン・ヘリコプター・衛星通信車等の派遣や人工衛星の活用等、あらゆる手段を尽くして被害情報を把握するものとする。

Comparison table of old and new provision

Yamaguchi, Tokushima, Niigata Prefecture Local disaster management plan update

Guideline for satellite usage in disaster response

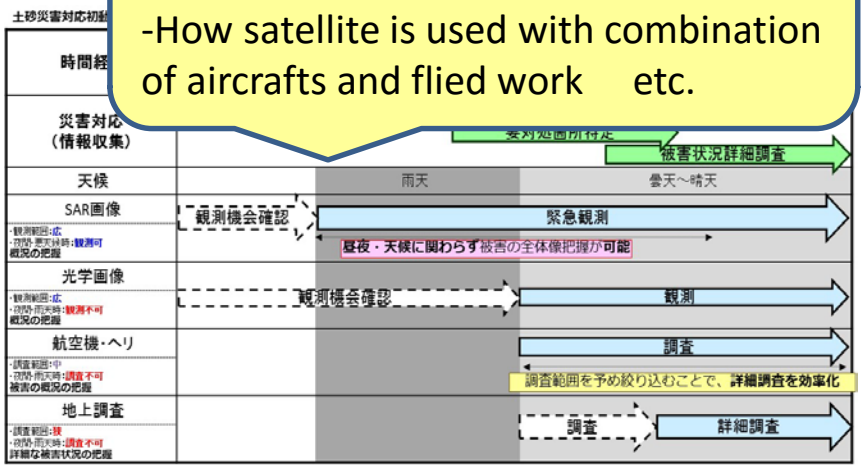
– Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and JAXA has established the guideline for satellite usage in disaster response (published in March, 2018).

MLIT guideline HP: http://www.mlit.go.jp/river/shishin_guideline/index.html (only Japanese)

Guideline for satellite usage in disaster response
Flood version (satellite technical note): http://www.mlit.go.jp/common/001227724.pdf
Flood version (satellite technical note): http://www.mlit.go.jp/common/001227723.pdf
Landslide version: http://www.mlit.go.jp/common/001227722.pdf

–The document is used for education of new staff in regional offices of MLIT. JAXA expects that government staff can use satellite correctly and effectively to accelerate their disaster response.

-government work flow of initial phase of disaster response at flood event
-How satellite is used with combination of aircrafts and flied work etc.



【まとめ】土砂災害対応初動期におけるSAR衛星の活用について

・SAR衛星の強み
➢昼夜問わず観測
➢悪天候時でも観
➢数万㎢もの広範

・SAR衛星画像で分
➢二時期における地
（例）カラー合成画

⇒二時期で白から黒に変化
⇒被覆が、後方散乱強度の大きいものから小さいものに変化
⇒（山林地帯であれば）森林が裸地に変化した可能性あり

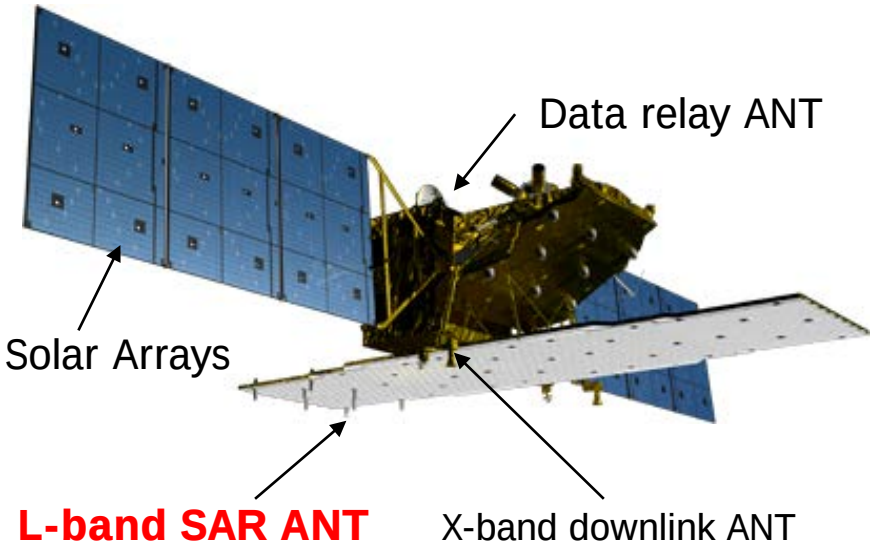
-advantage of satellite usage
-limitation and caution of satellite image/analysis usage etc.

土砂災害への活用時の留意事項

- 災害対応の**初動期**における**甚大な土砂崩壊箇所**や**天然ダム発生箇所**または**土砂崩壊多発エリアの推定**
- 防災ヘリによる**詳細調査ルートの検討**
- 概ね**面積10,000㎡以上**かつ、**幅40m以上**または**長さ100m以上**の土砂崩壊地の抽出を想定（**面積1,000㎡未満規模の土砂崩壊地の抽出は困難**）

Disaster response with ALOS-2

ALOS-2 in-orbit configuration

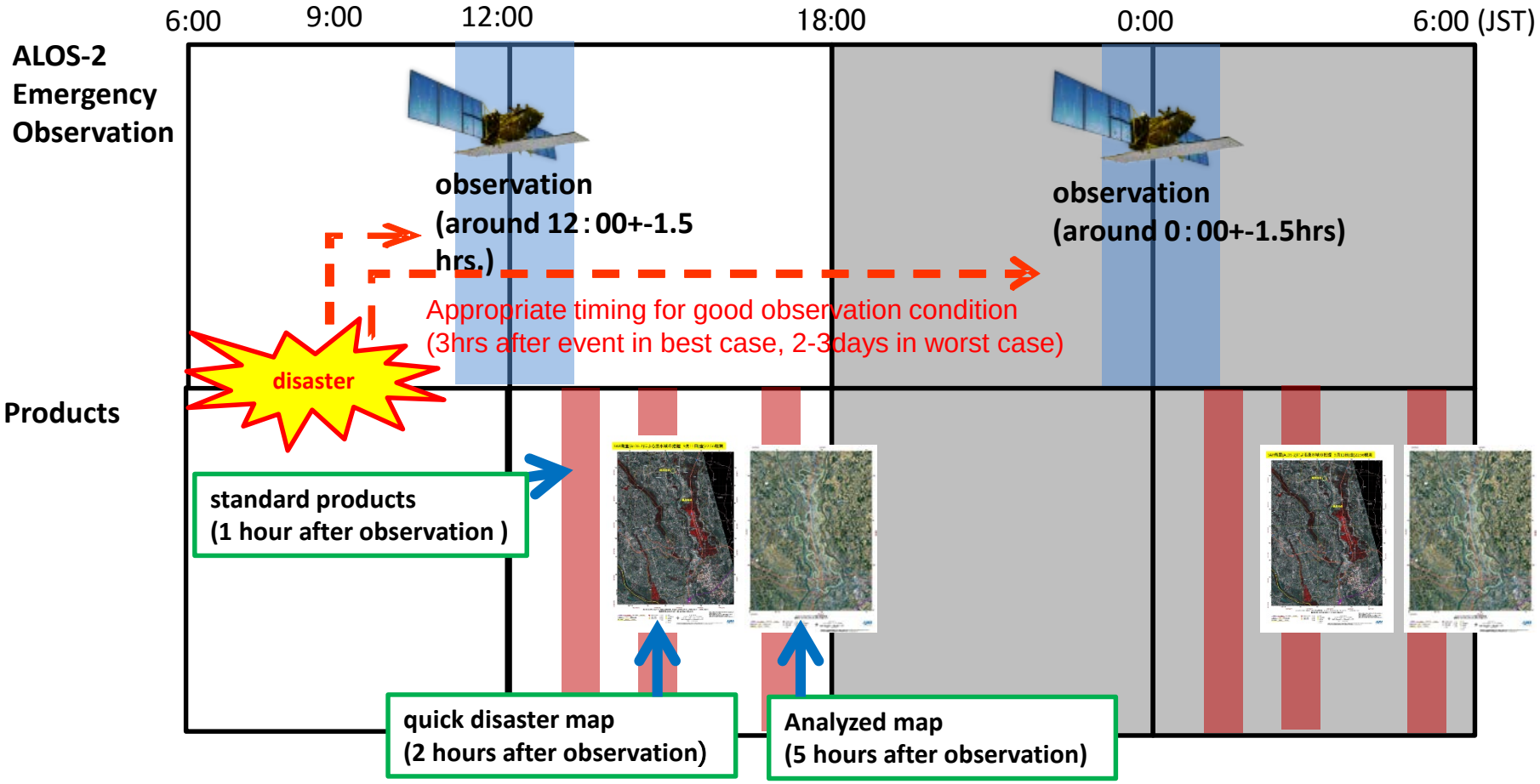


Specifications

L-band SAR (PALSAR-2)	Stripmap: 3 to 10m res., 50 to 70 km swath ScanSAR: 100m res., 350km/490km swath Spotlight: 1×3m res., 25km swath
Orbit	Sun-synchronous orbit, Altitude: 628km Local sun time : 12:00 +/- 15min, Revisit: 14days Orbit control: ≦+/-500m
Life time	5 years (target: 7 years)
Launch	May 24, 2014, H-IIA launch vehicle
Downlink	X-band: 800Mbps(16QAM), Ka-band: 278Mbps (Data Relay)

ALOS-2 Rapid emergency observation (only Japan)

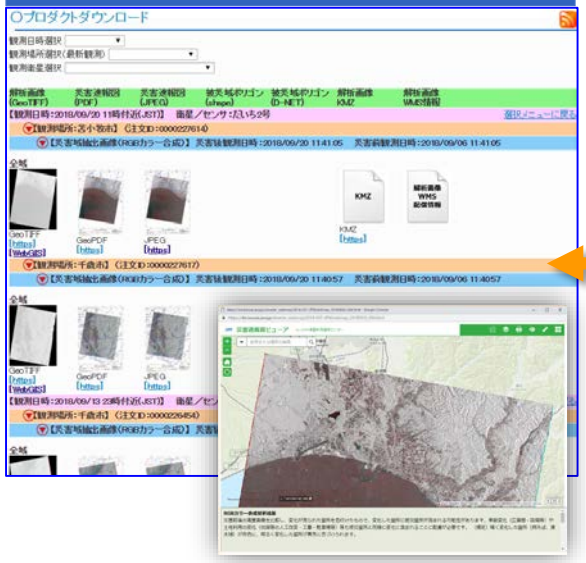
- ALOS-2 Emergency Observation can be performed twice a day (around 12pm and 0am JST)
- observation request until one and half hour before command uplink
- Products will be submitted in a few hours (Quick disaster map in 2 hrs.)



Daichi Bousai WEB portal

"Daichi Bousai WEB portal" is our original site dedicated to providing satellite imagery products to Japanese governments. This site is established on ArcGIS platform so that disaster information systems operated by governments can easily gather the satellite products via online or offline connection.

Provision of satellite products

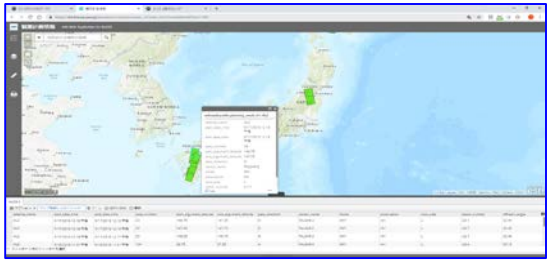


https://jaxa-dis.maps.arcgis.com/

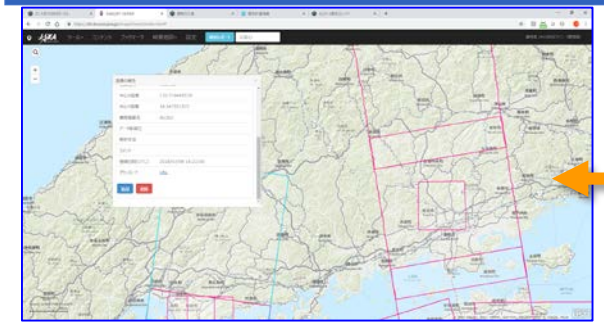
Daichi Bousai WEB portal

ALOS-2 emergency observation possibility

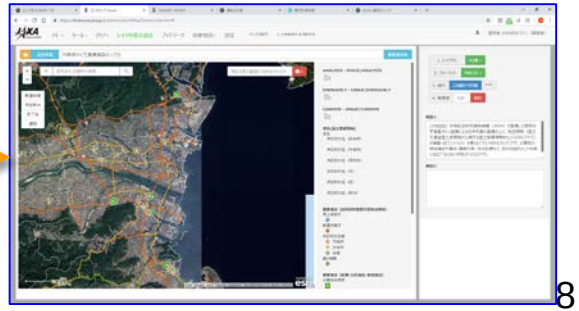
ALOS-2 emergency observation plan



Sharing of standard product with analysis node



Daichi Bousai Map



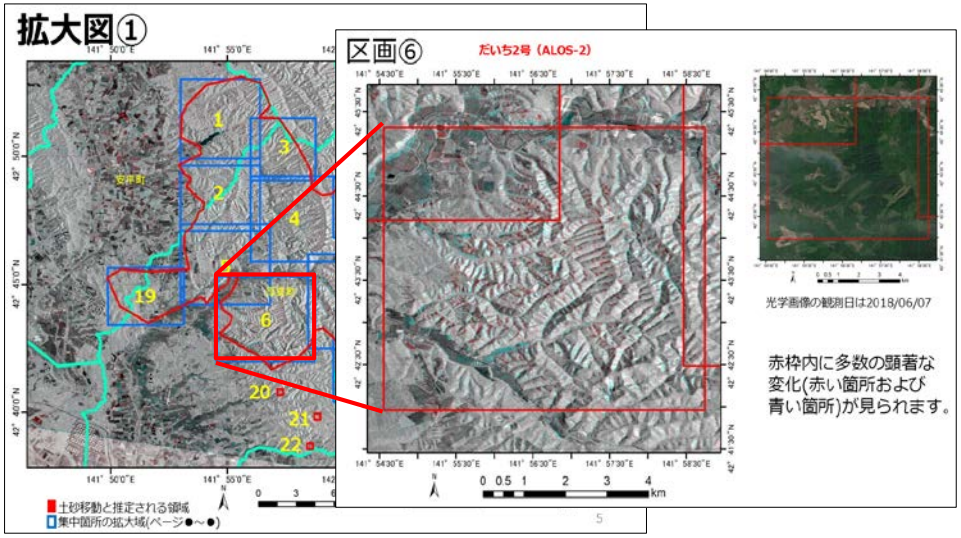
ALOS-2/Sentinel Asia usage for recent disaster response

Earthquake: Hokkaido (September,2018)

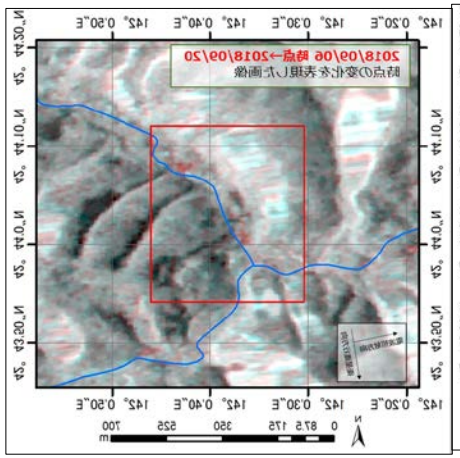
The earthquake (M6.7) occurred in Hokkaido, the north part of Japan, at 3 am of Sep. 6, 2018, which caused lots of landslides. MLIT requested ALOS-2 emergency observation at the noon pass to quickly know the whole picture of landslide area. The analysis of landslides and landslide dams was transferred to the branch office of MLIT and Hokkaido prefecture and used for the following disaster response.

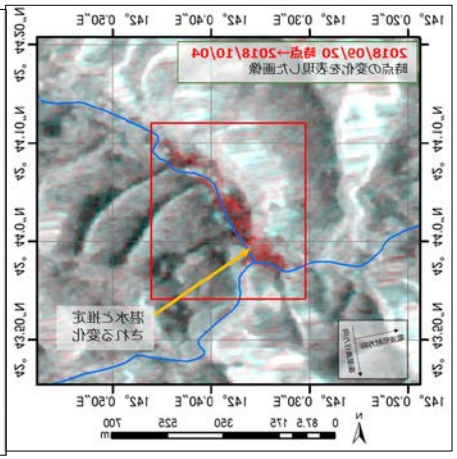
After the earthquake, there was concern that rain and aftershock could enlarge landslides and landslide dams and MLIT has requested ALOS-2 observation every two week until the snow season.

Landslides area analysis with ALOS-2 image



Landslide dams monitoring with ALOS-2 image





No flood was detected with image of Sep. 20 (2 weeks after the earthquake)

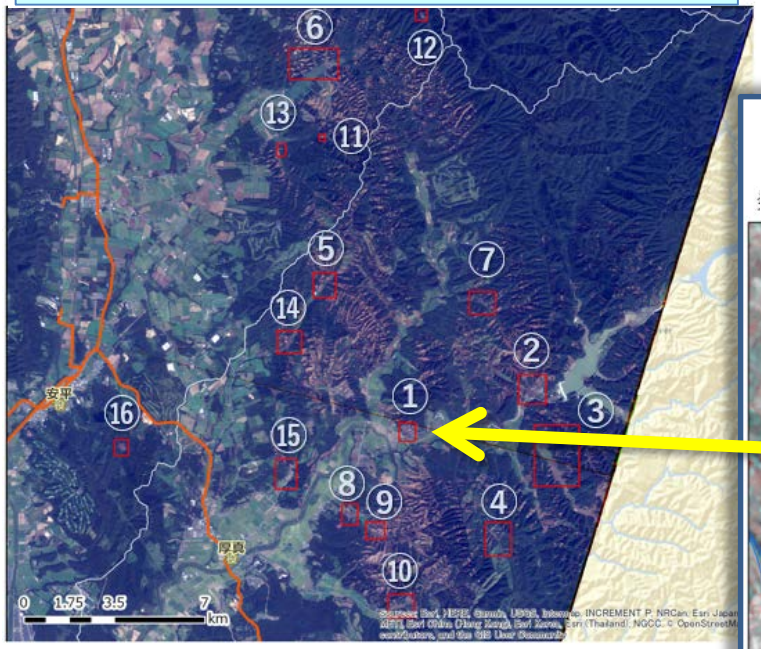
Flood was detected with image of Oct. 4 (3 weeks after the earthquake)

Earthquake: Hokkaido (September,2018)

For Hokkaido Earthquake, Sentinel Asia has been activated just after the event. FORMOSAT-5 successfully took the optical image on September 11 and JAXA provided the whole image to MLIT next day.

For the location of Landslide Dams which were detected by ALOS-2 data analysis, FORMOSAT-5 imagery was used to check if flood was built up. This information was also provided to MLIT.

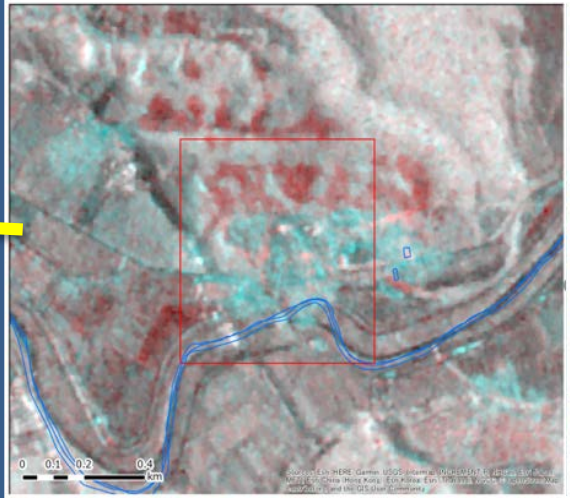
FORMOSAT-5 image acquired on Sep.11



ALOS-2 .vs. FORMOSAT-5 image for Landslide Dams

箇所①：北海道厚真町字富里

ALOS-2 image acquired on Sep.6



FORMOSAT-5 image acquired on Sep.11

RGB Color composite of 2018/8/23&9/6
Red indicates landslide
Light Blue indicates deposited sand

RGB Color composite of 2018/9/11

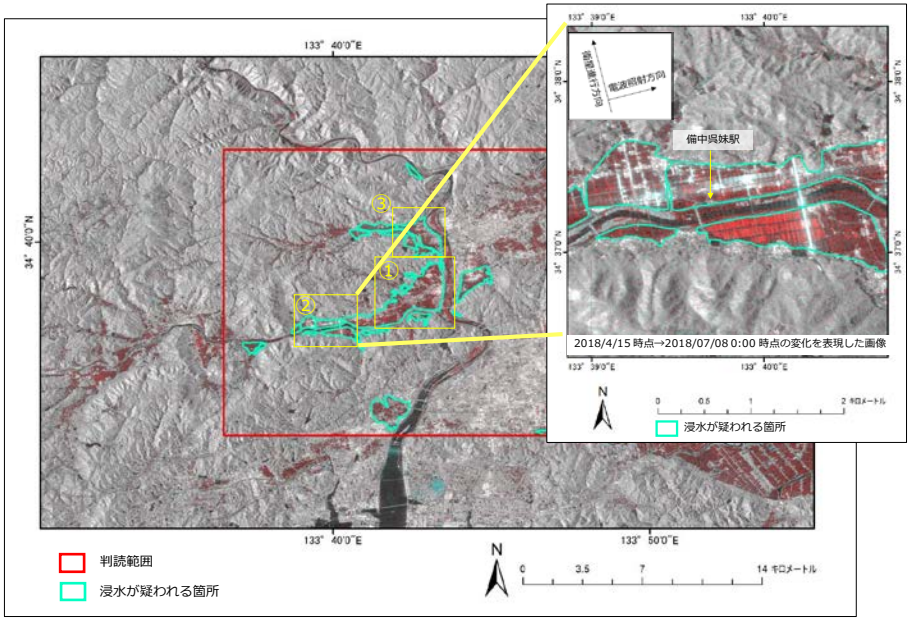
Blue shows river line

No flood was detected by checking FORMOSAT-5 image acquired on Sep.11 for 16 location of Landslide Dams detected by ALOS-2 image acquired on Sep.6.

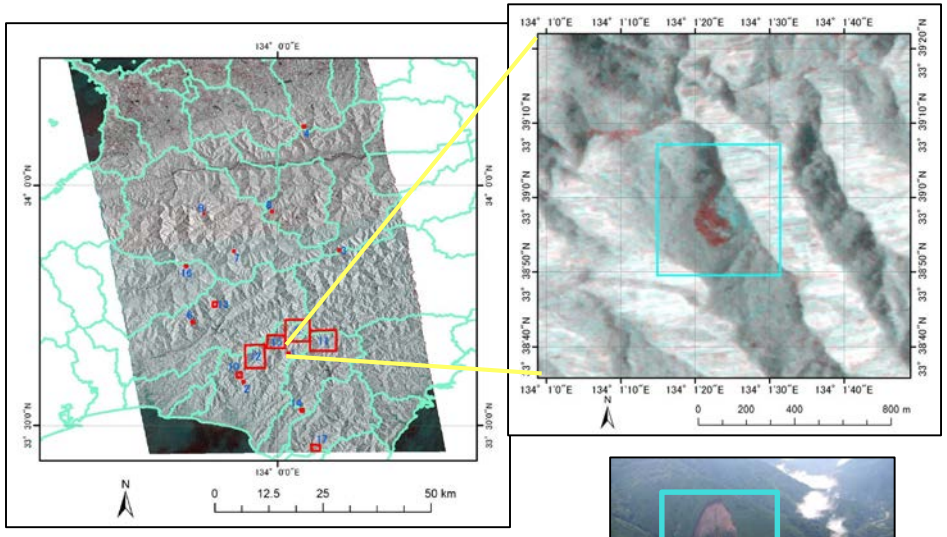
FLOOD and LANDSLIDE: Western Japan (July, 2018)

The heavy rain continuing in Western Japan caused the sever flood and landslides in an extensive area of Western Japan in July. 2018. MLIT and local government requested series of ALOS-2 observation and the analysis of the landslide and flood area.
The analysis results were used for grasping the whole picture of the disaster at the early stage. MLIT used the information for planning of the flight route of helicopter for detail investigation.

Flood area analysis with ALOS-2 image



Landslide area analyzed with ALOS-2 images



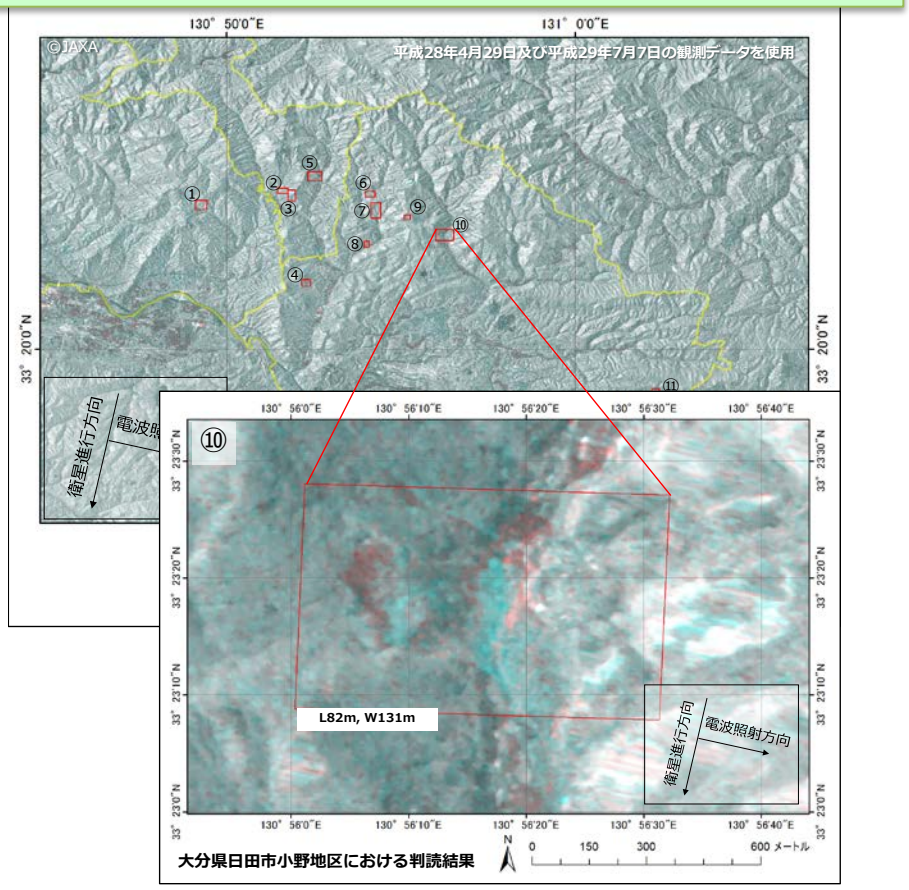
Helicopter investigation detected the landslides at the same location as analyzed with ALOS-2 image.

LANDSLIDE: Kyuushu (July.2017)

The heavy rain (more than 900mm/12hrs) caused the sever flood and landslides in Kyushu in July. 2017. MLIT requested series of ALOS-2 observation and the analysis of the landslide and flood area.
MLIT evaluated that the analysis was worth using for quickly grasping the whole picture of the disaster at the early stage, especially when bad weather prevented investigation by airplanes.

ALOS-2 Observation area

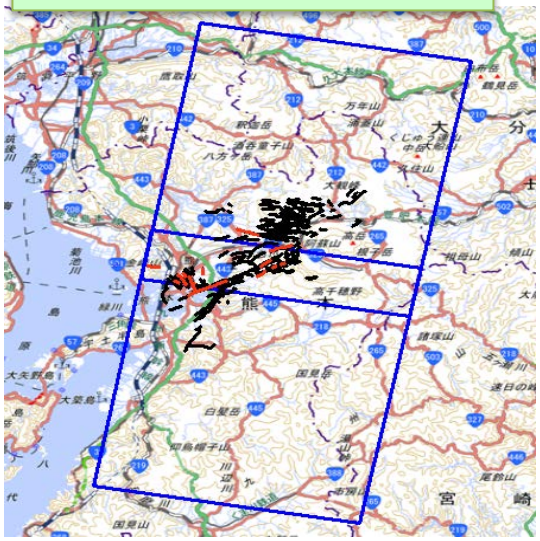
Landslide area analyzed with ALOS-2 images



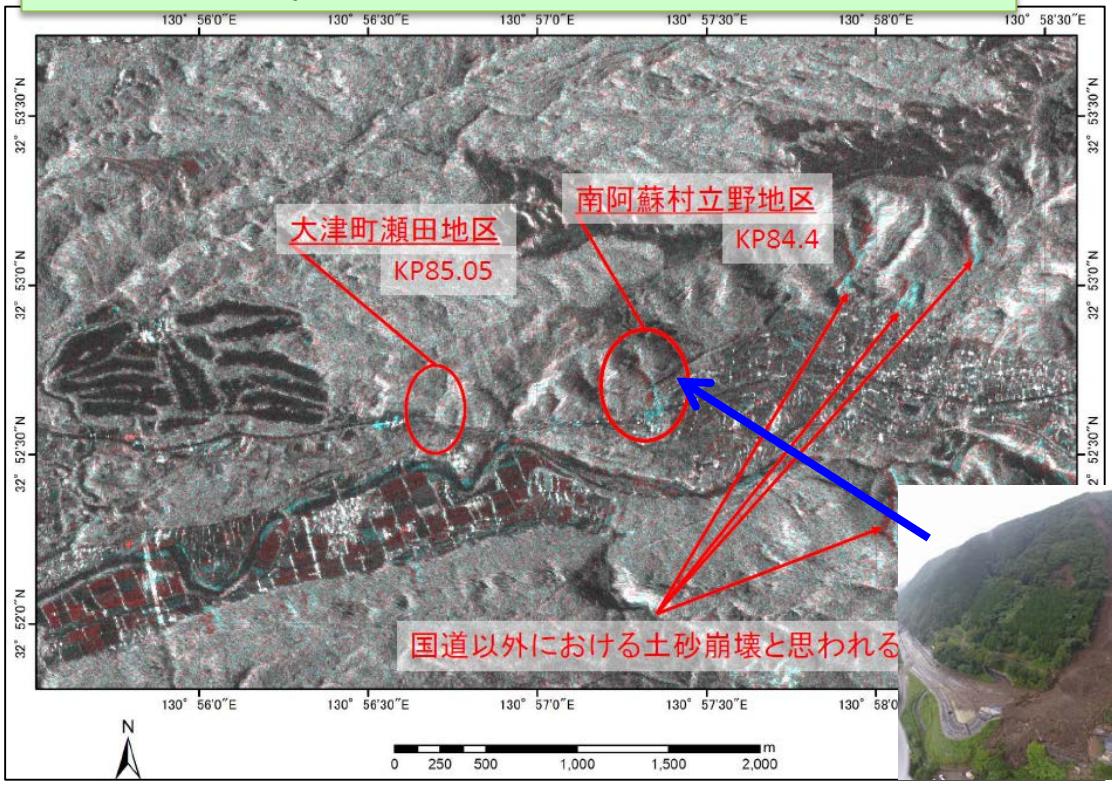
LANDSLIDE: Kumamoto (June, 2016; after earthquake)

Aftar the earthquake in Kumamoto, there was concern that heavy rain could enlarge landslides, Ministry of Land, Infrastructure, Transport and Tourism (MLIT) requested ALOS-2 observation every two weeks during the rainy and typhoon season.
ALOS-2 observation was performed on June, 21st just after the heavy rain, The analysis detected some of new landslides. MLIT used the information to decide activation of detail investigation with helicopters.

ALOS-2 observation area



Analysis to detect landslides （red mark）



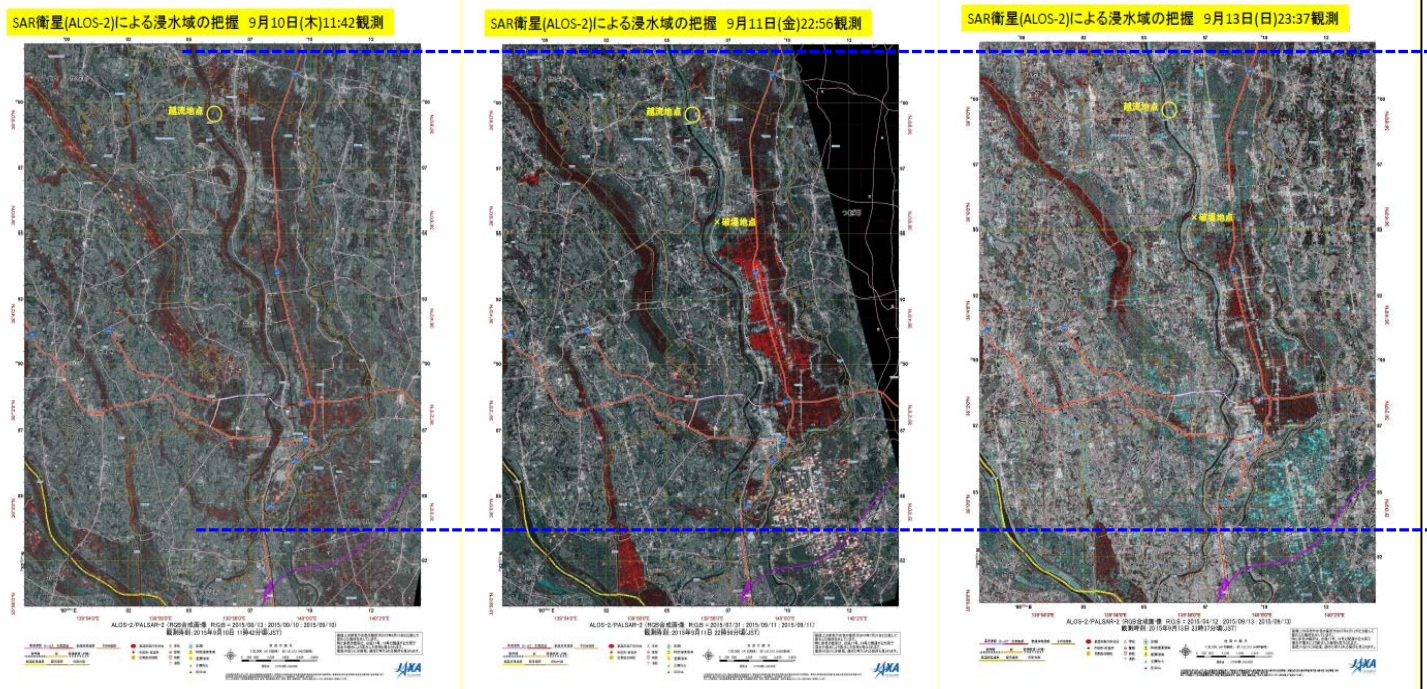
注：九州地方整備局記者発表からの引用
http://www.qsr.mlit.go.jp/n-kisyahappyou/h28/data_file/1466508944.pdf

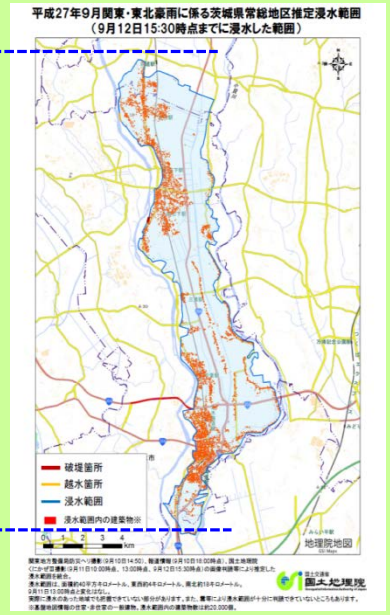
Flood: Kinugawa river

The heavy rain caused by Typhoon 18 of 2015 caused the large-scale flood along Kinugawa river. MLIT requested series of emergency observation. The agency performed the daily monitor of flood and operated the drain pump vehicles according to the flood area estimated by the aerial photos and ALOS-2 data.

Series of flood area analyzed with ALOS-2 images (RGB composite with Pre- and Post-disaster images)

Flood area analyzed with aerial photographs by GSI





The flood area on the middle image of ALOS-2 is almost similar to that derived from the aerial photos, except the city area.