
Application of Space Technology into DRR in Japan

~日本の防災への宇宙技術の応用~

ACDR2010

17 January 2009 in KOBE

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Disaster Management Support Systems Office
Japan Aerospace Exploration Agency (JAXA)

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- We memorialize many people damaged 15 years ago.
 - And we hope all the people have damaged yet will become fortunate enough.

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Confusion in the Disaster



- Life save within 72 hours, by self/mutual/public help.
- So, it's important to know what's matter, who does, how doing.
- We should collect, send, share information and make communication each other.
- Multilateral cooperation and collaboration with not only public disaster management agencies, but also private company, university/researchers, NGO/NPO, mass media, residents, and so on.



Characteristics of artificial satellite



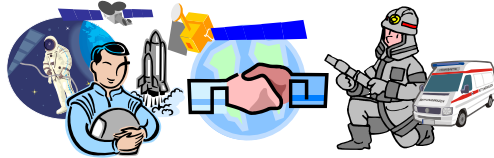
- Wide coverage
 - Like a bird view from higher position.
- Simultaneously
 - Like a higher broadcasting tower to share information in wide area
- Robust against disaster
 - Not on the ground
 - Maintenance free for several years



JAXA promotes satellite application to disaster management



- Space asset will become to global and inevitable infrastructure which has no border.
- JAXA has obtained space technology through original research/development, so as a next phase, should utilize these technology for application contributing to secure and prosperous society; it's not only for JAPAN, but also for ASIA.
- In Japan as well as Asia, natural disaster occurs frequently. For the sake of mitigation and prevention disaster, we must share the information as for disaster beyond border.
- JAXA promotes Sentinel Asia using with various satellites, toward realization of information system which supports mitigation and prevention activities.
- Observation satellites are characterized by wide view revolving around the world, communication satellites are characterized by broad coverage connecting unconnected simultaneously, and they are robust under disaster.
- Nevertheless, space crafts are just only infrastructure dealing with information. Otherwise, mitigation and prevention activities have needed valuable information so called 'intelligence' or 'solution', which are created by multilateral collaboration with various organizations besides space agencies.
- JAXA as a secretariat of Sentinel Asia has expected UNESCAP assists to coordinate the collaboration.



UNESCAP: 国連アジア太平洋経済社会委員会

Trilateral Joint Statement on Disaster Management Cooperation



The heads of government agencies of JAPAN, CHINA, and KOREA held first Trilateral Meeting on Disaster Management in Kobe, Japan on 31st October 2009

4.(3)

Considering [the information sharing](#) on the current efforts by the three countries [to utilize satellite technologies for disaster management](#), and, from the viewpoint of humanitarian concern in the wake of disasters, discussing [the possibility of cooperation for more efficient and effective operations of utilizing satellite images](#).

Role of Earth obs. satellite against disasters

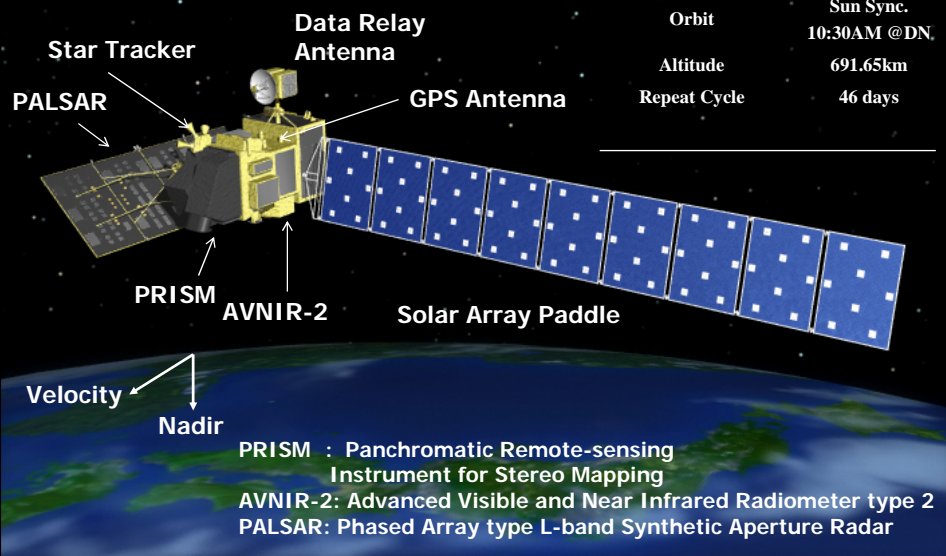
Based on satellite's strong points, "all-weather", "day-and-night", "wide coverage" and "repeat monitoring" images and information are provided to related agencies.

In addition to aviation photos and heli-TV, satellite images help.



Advanced Land Observing Satellite (ALOS)

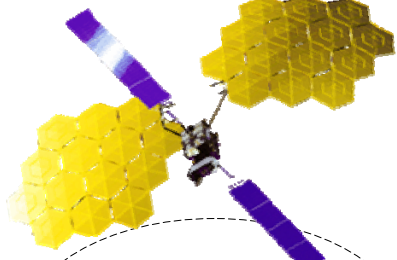
ALOS (Daichi) Satellite System



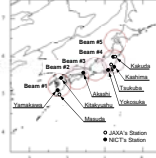
Satellite Communication for information and data transmission





Engineering Test Satellite VIII <ETS-VIII>



Mobile communication via satellite

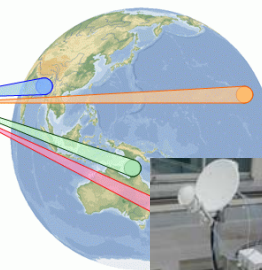



(domestic)





Handheld terminal Portable terminal

Wideband Internetworking engineering test and Demonstration Satellite <WINDS>



High data rate communication via satellite in Asia and Pacific region

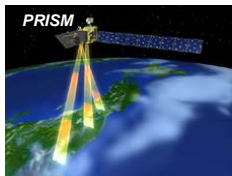


USAT
HDR-VSAT

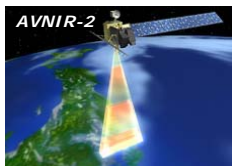


Promotion Activities

Advanced Land Observing Satellite (ALOS)



- Optical (panchromatic)
- Three optical systems in order to obtain terrain data
- Spatial resolution: 2.5m
- Sensor field of view: 35km/70km
- Cross track pointing capability: -1.5° ~ 1.5°
-> Basically, 1 time/46 days observation.



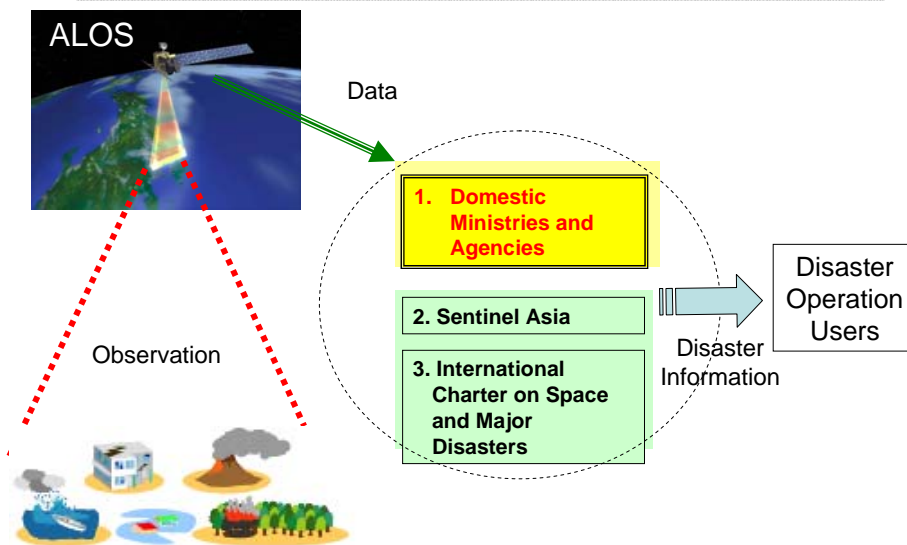
- Optical ~ infrared (4 band)
- Cross track pointing capability
for disaster monitoring : -44° ~ 44°
- Spatial resolution: 10m
- Sensor field of view: 70km



- Synthetic Aperture Radar (L band(1.27GHz))
- Cross track pointing capability: 10° ~ 51°
- Spatial resolution: 10m ,100m (Scan mode)
- Sensor field of view: 70km, 350km (Scan mode), etc...
- All-weather, day-and-night observation

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JAXA's Activity in Disaster Monitoring Program



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List of Emergency Observations by ALOS for Disasters Abroad



(Jan 2009 – Oct 2009)

Country	Frequency	Disaster Type
Indonesia	5	Earthquake (3), Flood (2)
Australia	4	Flood (1), Wildfire(1) , Oil Spill (2)
USA	4	Flood (4)
Vietnam	3	Flood (1), Typhoon(2)
Italy	3	Earthquake (1),Wildfire(2)
Philippines	3	Flood (2),Typhoon(1)
Nepal	2	Flood (2)
Other Countries	25	Flood (8), Earthquake (2),Tsunami (1), Volcano (4), Typhoon/Cyclone(3), Wildfire(5),Other(2)
Total	49	Flood (12), Earthquake (6),Tsunami (1), Oil Spill (1), Volcano (3), Typhoon/Cyclone (5),Wildfire(7), Other(2) ¹³

List of Emergency Observations by ALOS for Disasters in Japan



(Jan 2009 – Oct 2009)

	Date	Place	Disaster Type
1	2009/4/9	Sakurajima Island	Volcanic Eruption
2	2009/7/7	Wakayama Pref.	Flood
3	2009/7/21	Chugoku and Kyushu districts	Flood, Landslide
4	2009/7/28	Wakayama Pref.	Flood
5	2009/8/10	Sizuoka Pref.	Earthquake
6	2009/8/27	Ishigakijima Island	Driftwood
7	2009/8/31	Chiba Pref.	Flood
8	2009/9/18	Mie Pref.	Flood, Landslide
9	2009/10/7	Wakayama Pref.	Flood
10	2009/10/9	Gifu Pref.	Flood

Activities for disaster prevention



	Activities	Theme	Disaster Management Partners
1	Satellite image map	-Preparation of "common geographical information" based on the standard maps and satellite images, in conjunction with the needs of disaster-operation organizations.	Cabinet Office, NPA (Police), FDMA (Fire), MOD (Defense), GSI (Geography), NIED (Disaster)
2	Emergency Observation	-Accept emergency observation request and observe disaster afflicted area by ALOS, and provides satellites imagery.	Cabinet Office, Local Government, Japan Coast Guard, etc
3	Volcanic activity monitoring (WG)	-Investigation of satellite data applicability on volcano surveillance, through ALOS observation of Japanese major volcanoes. -Inclusion of satellite data as one of the standard measures of regular volcano surveillance.	CCPVE (Coordinating Committee for Prediction of Volcanic Eruptions) organized by Japan Meteorological Agency (JMA)
4	Earthquake monitoring (WG)	-Investigation of satellite data applicability on ground distortion monitoring before and /or after earthquake.	H.q. for Earthquake Research promotion, be consist of GSI, AIST (Industrial), NIED, ERI (academia)
5	Flood /Landslide monitoring (WG)	- Investigation of satellite data applicability on landslide and flood.	National Institute for Land and Infrastructure Management, etc.

To investigate the possibility of the utilization for disaster management, These demonstration activities were started in 2006

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Satellite Image Map



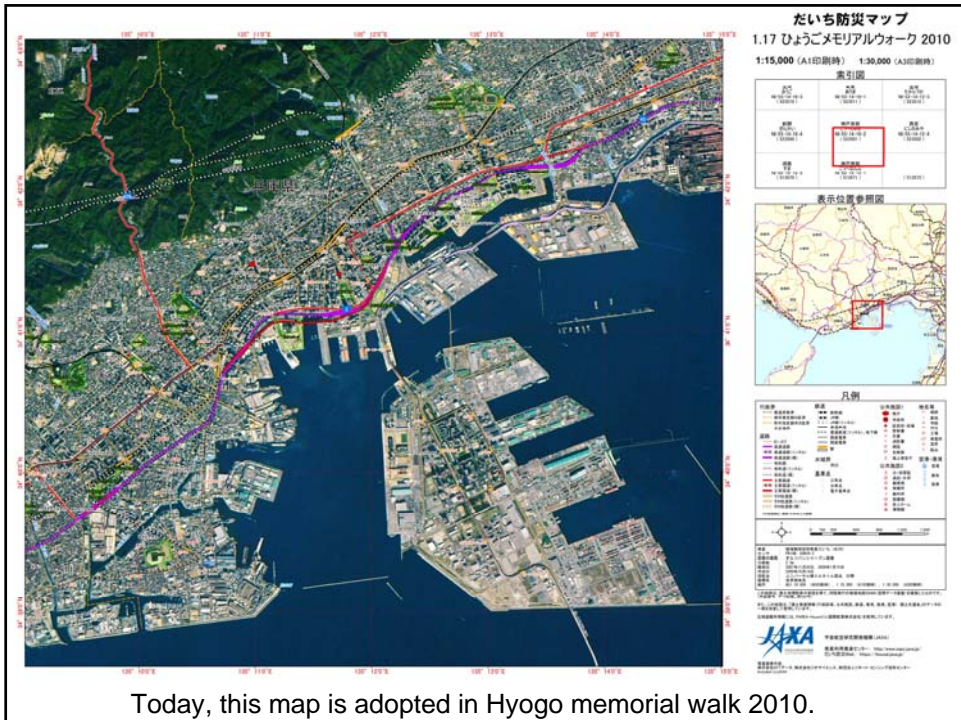
- Developed as a geospatial information tool which everyone, familiar with the area or not, can intuitive understanding for the places.
- Indicate minimum required information such as major landmarks and roads.



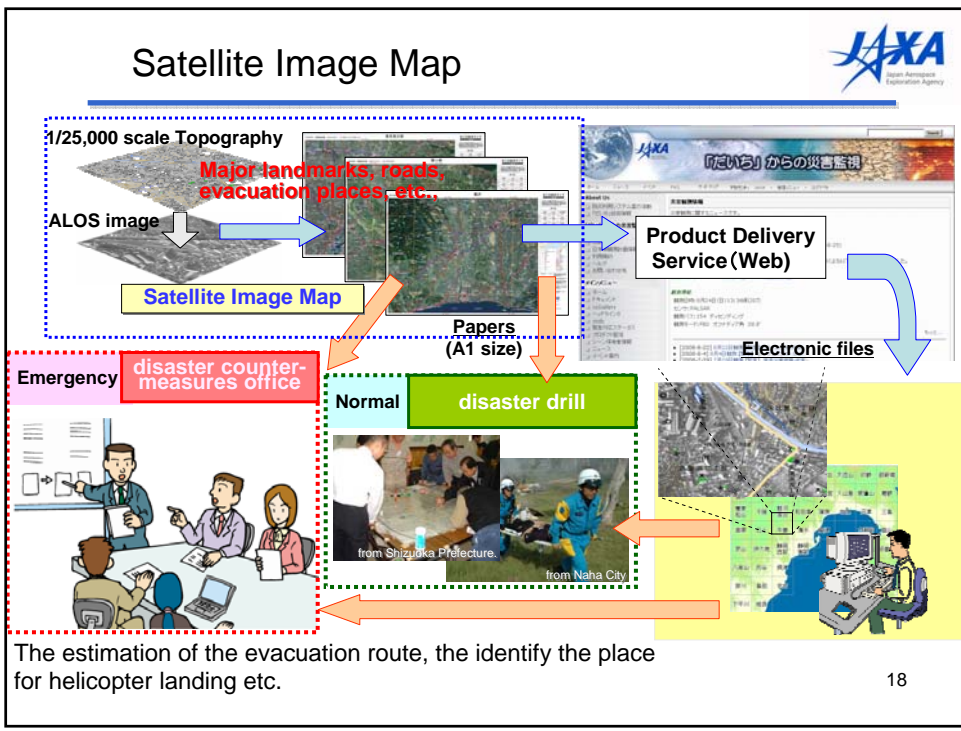
1/50,000 scale map using AVNIR-2.

1/25,000 scale map using pan-sharpened images of PRISM and AVNIR-2.

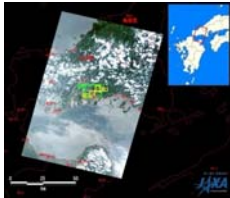
16



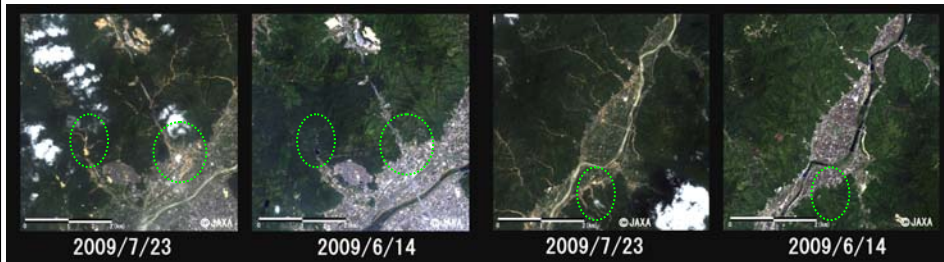
Today, this map is adopted in Hyogo memorial walk 2010.



Torrential rain in Yamaguchi Prefecture (July 21, 2009)



Heavy rainfall on 19-29 July has caused mud slide in Chugoku and northern part of Kyushu districts. 31 people are reported killed, 46 people injured, 48 houses totally destroyed. And Landslides were found to have occurred at 1757 locations.

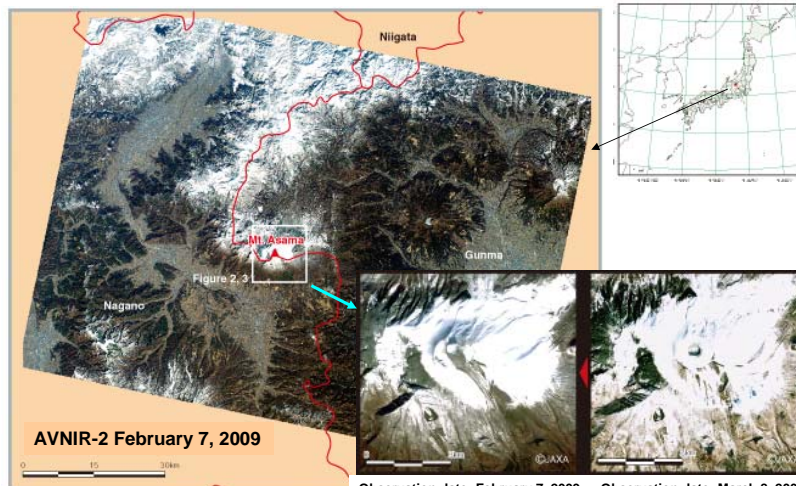


observation around Hofu city by ALOS AVNIR-2.

observation around Hofu city by ALOS AVNIR-2.

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Volcanic eruption of Mt. Asama (Feb. 2, 2009)



AVNIR-2 February 7, 2009

Observation date: February 7, 2009 Observation date: March 8, 2008

Around the summit of Mt. Asama
(Left: after the eruption, Right: before the eruption)

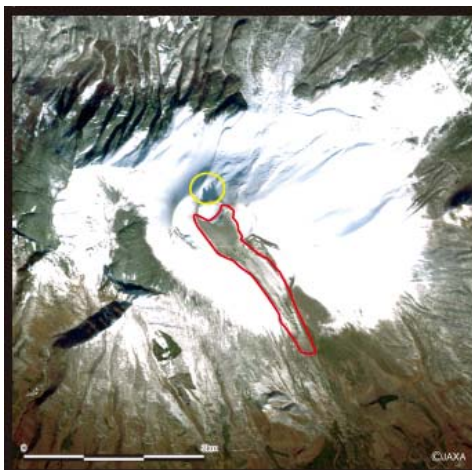
20

Volcanic eruption of Mt. Asama (Feb. 2, 2009)



The part enclosed by the red frame is the place that appeared to be covered with volcanic ash. The area southeast of the crater looks gray with volcanic ash.

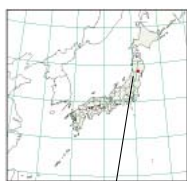
The part within the yellow circle is the shade created by the smoke from the crater.



Observation date: February 7, 2009

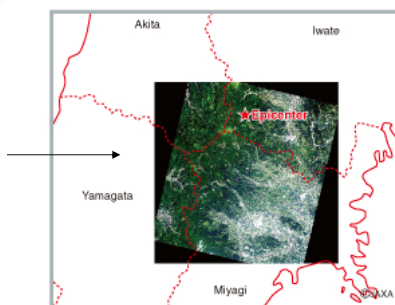
21

Iwate-Miyagi Nairiku Earthquake (June 14, 2008)



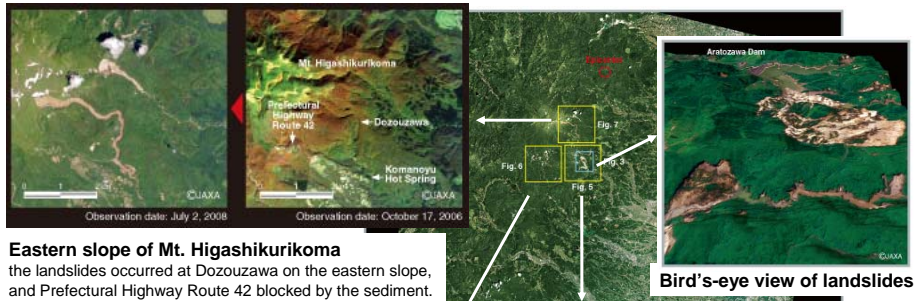
The Iwate-Miyagi Nairiku Earthquake occurred at 8:43 (JST) on June 14, 2008. The magnitude (M) indicating the scale of the earthquake was 7.2.

A total of 30 homes were completely destroyed, and 2,523 more were severely damaged. Landslides were found to have occurred at 48 locations and river channels were blocked in 15 locations.



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Iwate-Miyagi Nairiku Earthquake(June 14,2008)



Eastern slope of Mt. Higashikurikoma
the landslides occurred at Dozouzawa on the eastern slope, and Prefectural Highway Route 42 blocked by the sediment.

Bird's-eye view of landslides

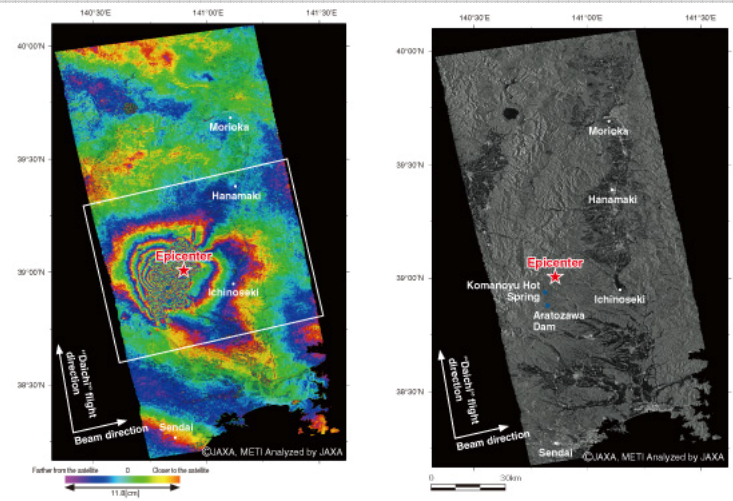


Upstream area of the Ichihassama River
Damaged lakes formed as a result of landslides can be seen in a number of locations (indicated by arrows).

Aratozawa Dam area
In this figure, extensive landslides can be seen at Hiyasawa to the northwest of the dam.

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Iwate-Miyagi Nairiku Earthquake(June 14,2008)



Left image: crustal deformation by means of comparing two differential interferometrically processed images acquired from the same orbit on June 21, 2007 and on June 23, 2008, respectively.
Right image: an intensity image observed by PALSAR on June 23, 2008.

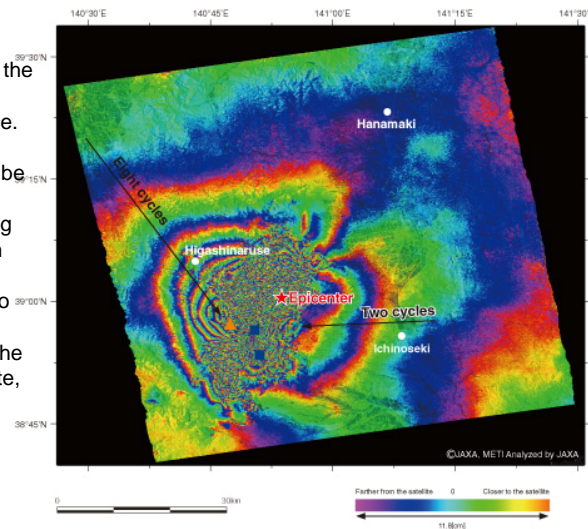
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Iwate-Miyagi Nairiku Earthquake(June 14,2008)



The two-dimensional color change in the image indicates the change in distance between "ALOS" and the ground surface.

Clear interference fringes can be confirmed in the east-west direction of that area, indicating crustal deformation of 23.6 cm (two cycles) occurred in the direction toward the satellite, to the east of the epicenter, and 94.4 cm (eight cycles) in the direction away from the satellite, to the west of the epicenter.



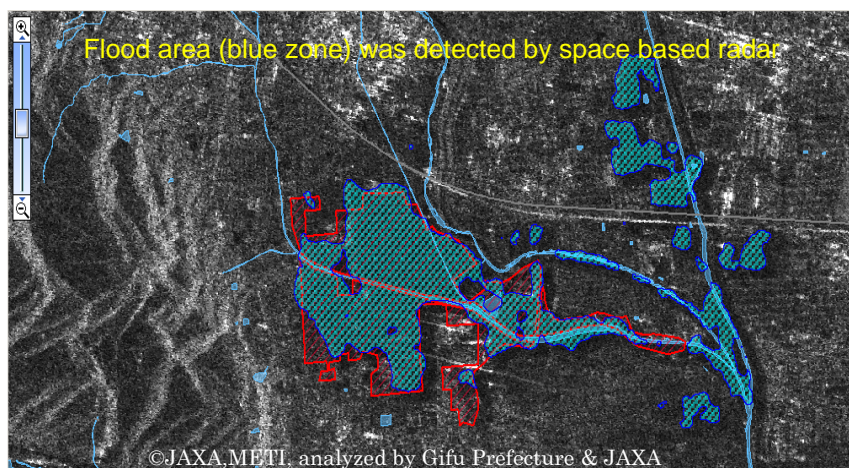
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Torrential rain in Gifu pef.(September 2-3,2008)



いしづか県庁のホームページ
 地域情報センター
県域統合型 GIS 位置検索 データ一覧 地図追加 範囲検索 計測 URL 印刷 ヘルプ

JAXA実証実験(ALOS衛星画像)



岐阜県ホームページ(http://www.gis2.pref.gifu.jp/MyMap2_0/GifuAdvanceMap/GifuAdvanceMap.jsp)より

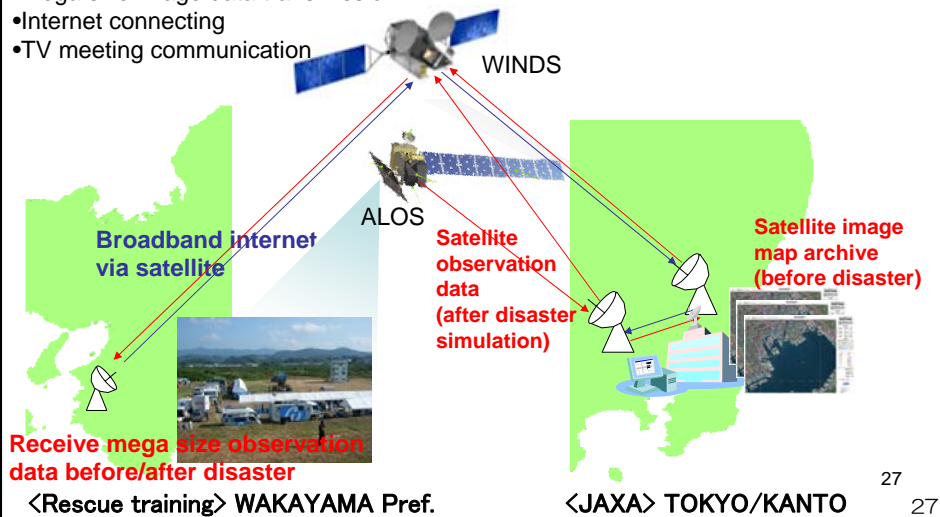
Participation in rescue training



Rescue training at Wakayama prefecture, September 6, 2009

Under the simulation of regular communication traffic confusion

- Mega size image data transmission
- Internet connecting
- TV meeting communication



SENTINEL Asia Sentinel Asia

What is Sentinel Asia

The Sentinel Asia initiative is the international cooperation led by APRSAF (Asia-Pacific Regional Space Agency Forum) to assist disaster management by **Remote Sensing** and **Web-GIS** technologies in the Asia-Pacific region.

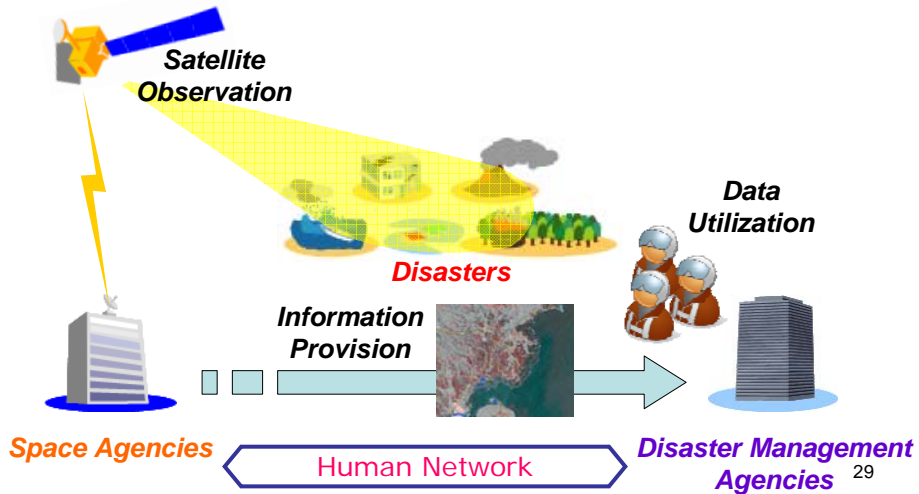
To make effective activity, Sentinel Asia collaborates with **Space Agencies** and **Disaster Management Agencies**.

Sentinel Asia aims to:

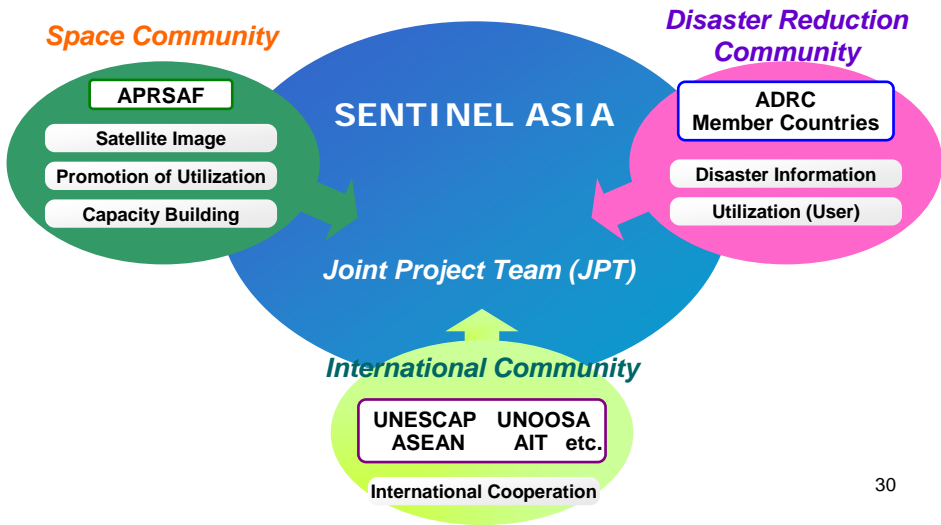
- > Improve safety in society by ICT and space technology
- > Improve speed and accuracy of disaster preparedness and early warning
- > Minimize the number of victims and social/economic losses.

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Concept of Sentinel Asia



Framework of Sentinel Asia



Members of Sentinel Asia

Sentinel Asia organizes Joint Project Team (JPT), and JPT consists of **65 organizations** including **56 agencies from 22 countries** and **9 international organizations**.

Also, Sentinel Asia cooperates with **ADRC** and **their members** (28 Member Countries, 5 Advisor Countries, 1 Observer) closely, and they are also member of Sentinel Asia as well.

JPT
+
m e m b e r s



Main activities of Sentinel Asia

- 
Emergency Observation [Emergency Observation](#)
- 
Wildfire Monitoring [Wildfire Monitoring](#)
- 
Flood Monitoring [Flood Monitoring](#)
- 
MTSAT Imagery [MTSAT Imagery](#)
- 
Capacity Building [Capacity Building](#)

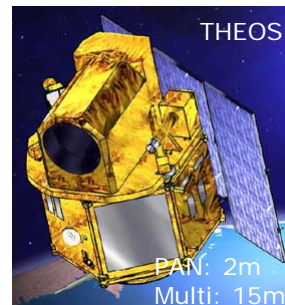
Latest List of Emergency Observation

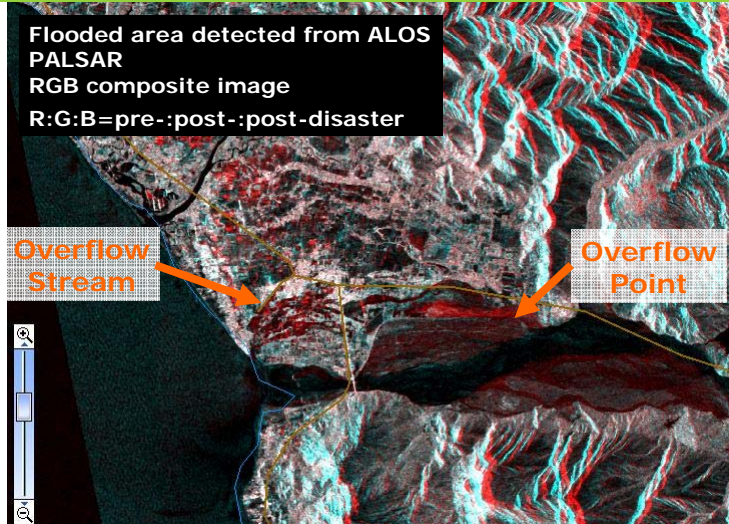
Emergency Obs. Request List

Country: ALL Disaster Type: ALL

Emergency Obs. ID	Occurrence Date (UTC)	Country	Disaster Type	Status	Product	WEB-GIS	Detail	Disaster Inf.
ERNPSD000002	2009/10/06	Nepal	Flood	Active			link	ADRC
ERPHYS000004	2009/10/04	Philippines	Flood	Active			link	ADRC
ERIDLP000014	2009/09/30	Indonesia	Earthquake	Active			link	ADRC
ERVNMN000005	2009/09/26	Vietnam	Flood	Active			link	ADRC
ERPHYS000003	2009/09/26	Philippines	Flood	Active			link	ADRC
ERIDLP000013	2009/09/02	Indonesia	Earthquake	Active			link	ADRC
ERNPSD000001	2009/08/18	Nepal	Flood	Active			link	ADRC
ERPHYS000002	2009/08/08	Philippines	Typhoon	Active			link	ADRC
ERVNMN000004	2009/07/07	Vietnam	Flood	Active			link	ADRC
ERIDLP000011	2009/03/27	Indonesia	Flood	Active			link	ADRC
ERAUGA000004	2009/03/11	Australia	Typhoon	Active			link	ADRC

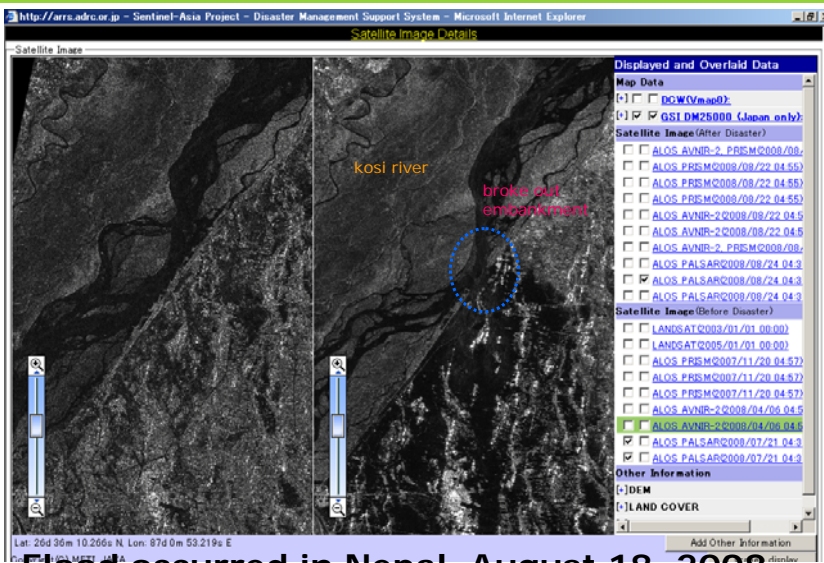
Current Participating EO Satellites





Typhoon hit Philippines, August 8, 2009

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Flood occurred in Nepal, August 18, 2008

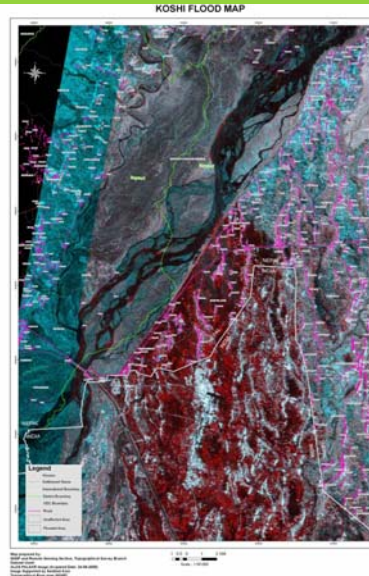
Dear sir/Madame
 The field of work for Ministry of Water Resources (MOWR), Nepal is water, energy (Electricity) and water induced disaster management. Department of Water Induced Disaster Prevention (DWIP) is responsible for the implementation of field activities related to disaster management. MOWR is responsible for formulation of policy, making of programs, monitoring of activities etc in the sector. We had a big disaster caused by breaching of left embankment of Koshi. It caused great loss to Nepal and India. Sentinel Asia helped us very much by provide satellite pictures and data and other relevant materials. You have also provided much needed information in your web site. I, as a focal person from MOWR Nepal, would like to thank your team for helping us to address the mega-disaster.

The coffer dam for diversion of Koshi River to original course has just been completed and rehabilitation and strengthening of the embankment is also in progress and is expected to be completed by March 2009. We would like your continuous monitoring and cooperation in future, too. We would also like to open communication with you. Please inform us about activities

/events/developments that are related to us.

Thanking you again for your kind cooperation.

Shital Babu Regmee
 Joint Secretary
 Ministry of Water Resources
 Singha Durbar, Kathmandu, Nepal

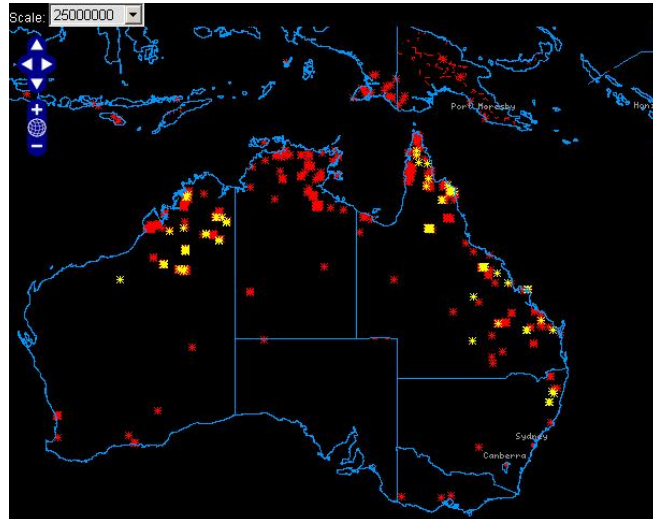


Earthquake occurred in Indonesia, January 4, 2009

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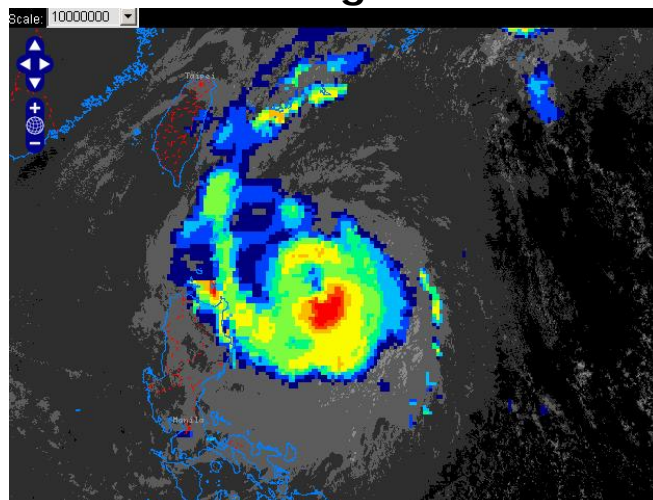
Wildfire Monitoring

Detect **Hotspot information** from satellite data (MODIS), and those Hotspot are disseminated via Sentinel Asia Website every day.



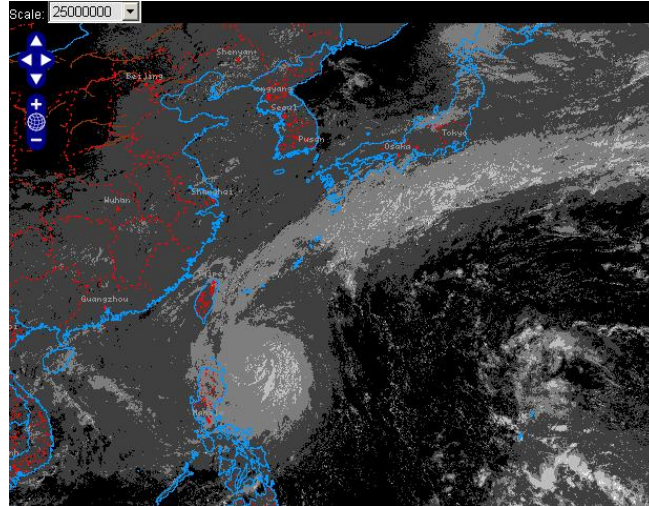
Flood Monitoring

Calculate **Accumulated Precipitation information** from satellite data, and those data are disseminated via Sentinel Asia Website every 1 hour.



MTSAT Imagery

Provide weather satellite, **MTSAT Imagery**, and those imagery are disseminated via Sentinel Asia Website every 30 minutes.



Capacity Building

To enable utilization of earth observation images provided under the Sentinel Asia, we are providing several capacity building opportunities in terms of building capacity for interpretation of earth observation images and how to operate Sentinel Asia System as well.

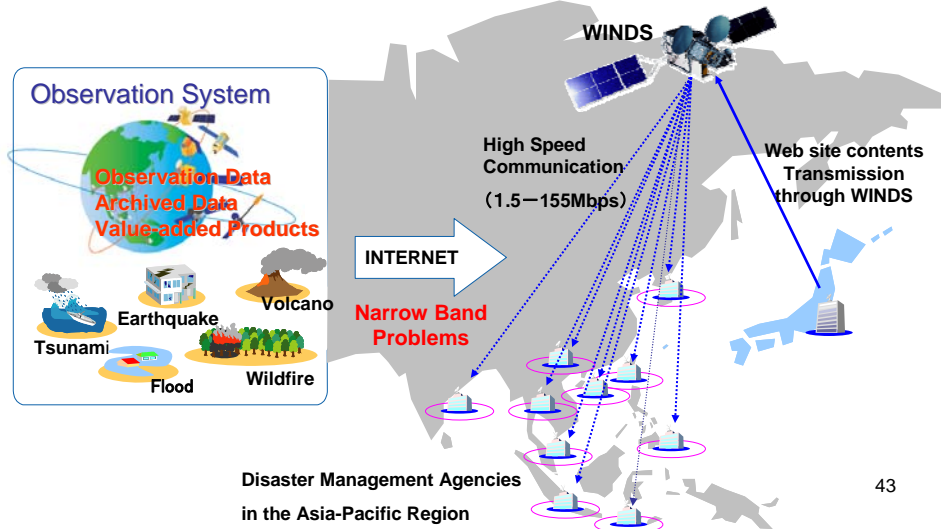
(1) Sentinel Asia System Operation Training (3-5 days)

- > Organize 2 times / Year at South East Asia
- > Sentinel Asia System Operation hands on training
- > R/S data handling hands on training

(2) ALOS Mini Project (2 month)

- > Organize 1 time / Year at Asia Institute of Technology (AIT)
- > R/S data handling/analysis hands on training
- > Consultation for development of thematic map

Utilization of WINDS in Sentinel Asia



Sentinel Asia will aim to be a reliable regional system for DRR, with cooperation and harmonization.

- Operational collaboration with international disaster charter (IDC), and AIT acts as a project manager for collection and exploitation.
- ADRC, key member of Sentinel Asia, acts as RSO of UNSPIDER.
- Now under arrangement, JAXA will make partnership with JICA for more spontaneous utilization of Sentinel Asia.

JICA: JAPAN international cooperation agency 国際協力機構



Contribution to the International Charter Space and Major Disasters



Huge earthquake in Haiti (January 13, 2010)

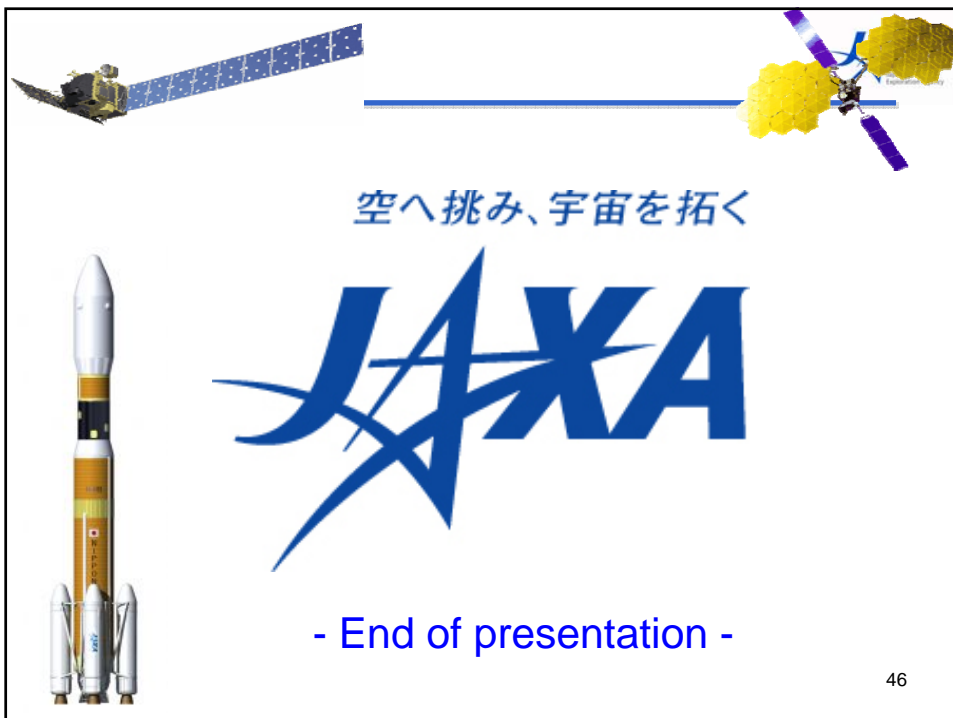


2010/1/14



2007/6/3

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空へ挑み、宇宙を拓く

JAXA

- End of presentation -

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