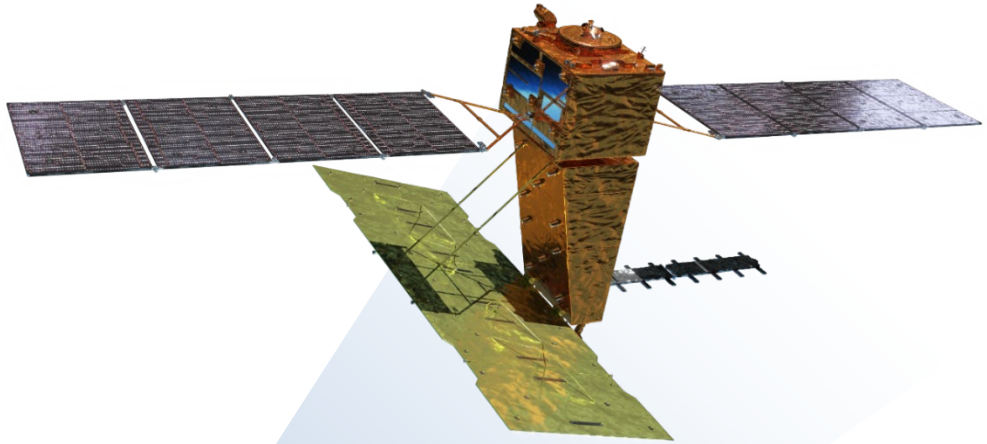
JAXA's SAR Activities and Plans

Yoshihisa Arikawa

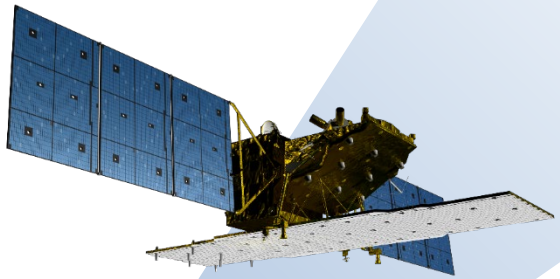
Japan Aerospace Exploration Agency (JAXA)

3rd International SAR Workshop
Saga Prefecture, Japan
6-8 November, 2024

JAXA's ALOS-series L-band SAR



ALOS-4
(2024~ in operation)
PALSAR-3, SPAISE3



ALOS-2
(2014~ in operation)
PALSAR-2, SPAISE2



ALOS
(2006-2011)
PALSAR, AVNIR-2, PRISM

- The ALOS series satellites are continuously developed and operated by JAXA mainly for the purpose of land/ocean monitoring and technological development.
- L-band SAR has been developed and caried in the ALOS series.

Mission objectives of ALOS series:

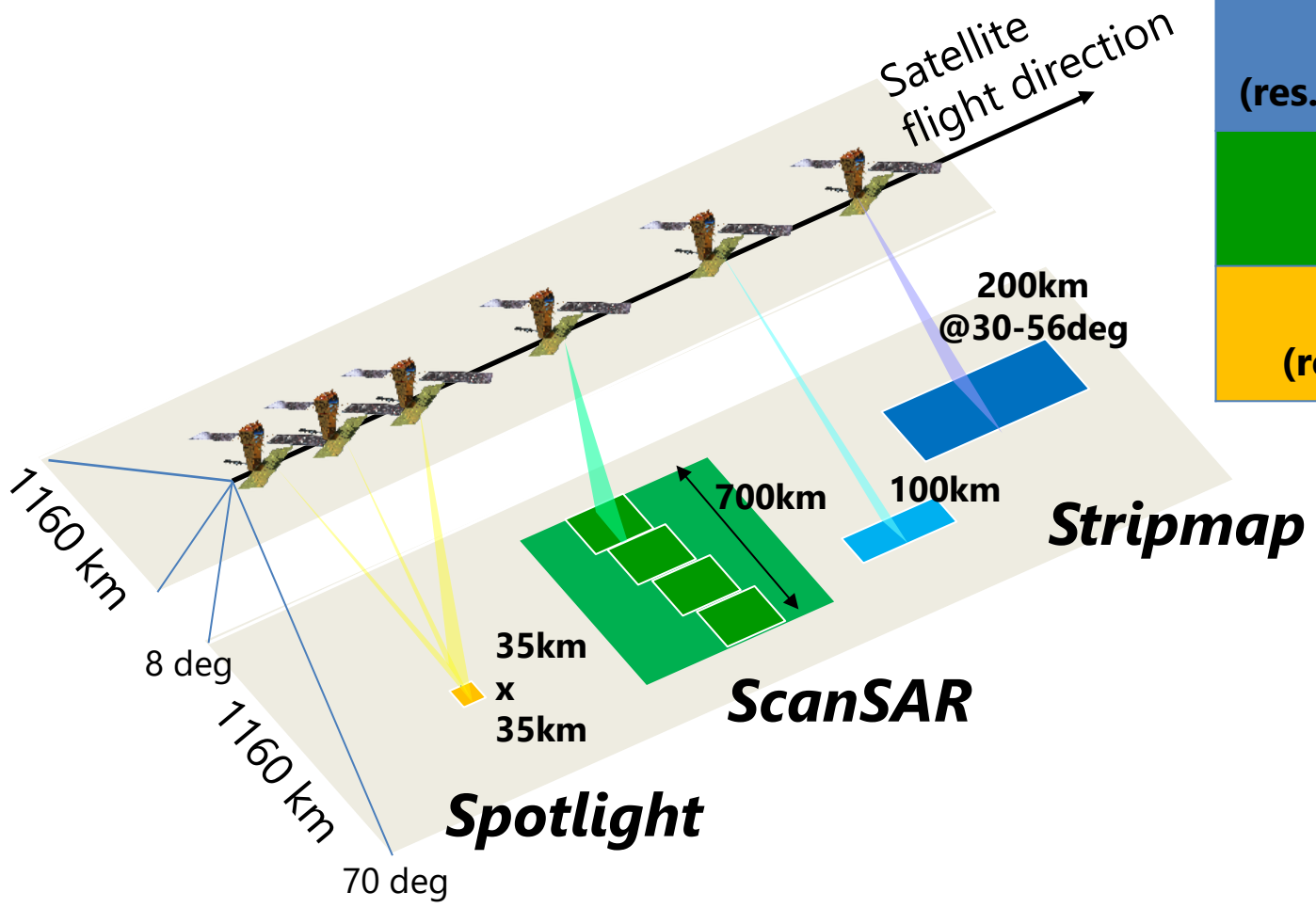
Disaster damage assessment
Flood, Landslides, Building damage, Typhoon, etc.

Land deformation
Volcano, Earthquakes, Landslides, Land subsidence, etc.

Maritime
Vessels, Ocean wind, Sea ice, etc.

Global environment
Deforestation, Glacier, Agriculture, etc.

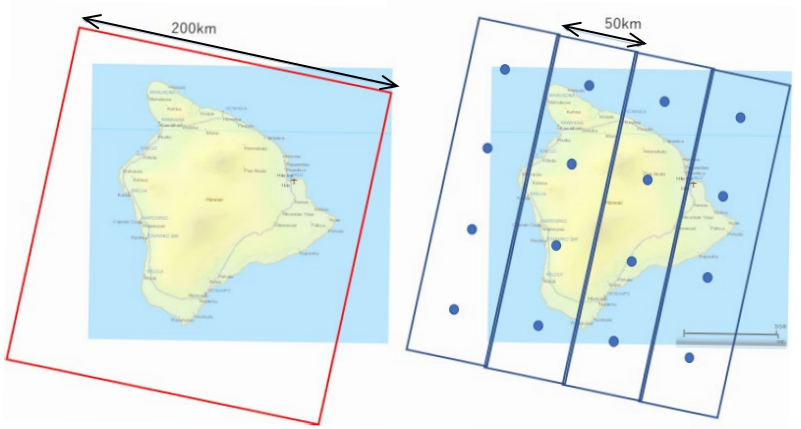
ALOS-2/-4 Observation Mode



Obs. mode	ALOS-4 (PALSAR-3)	ALOS-2 (PALSAR-2)
Stripmap **(res. 3 m/6 m/10 m)**	**100 or 200 km**	30-70 km
ScanSAR **(res. 25 m)**	**700 km**	350 or 490 km
Spotlight **(res. 3 m x 1 m)**	**35 km x 35 km**	25 km x 25 km

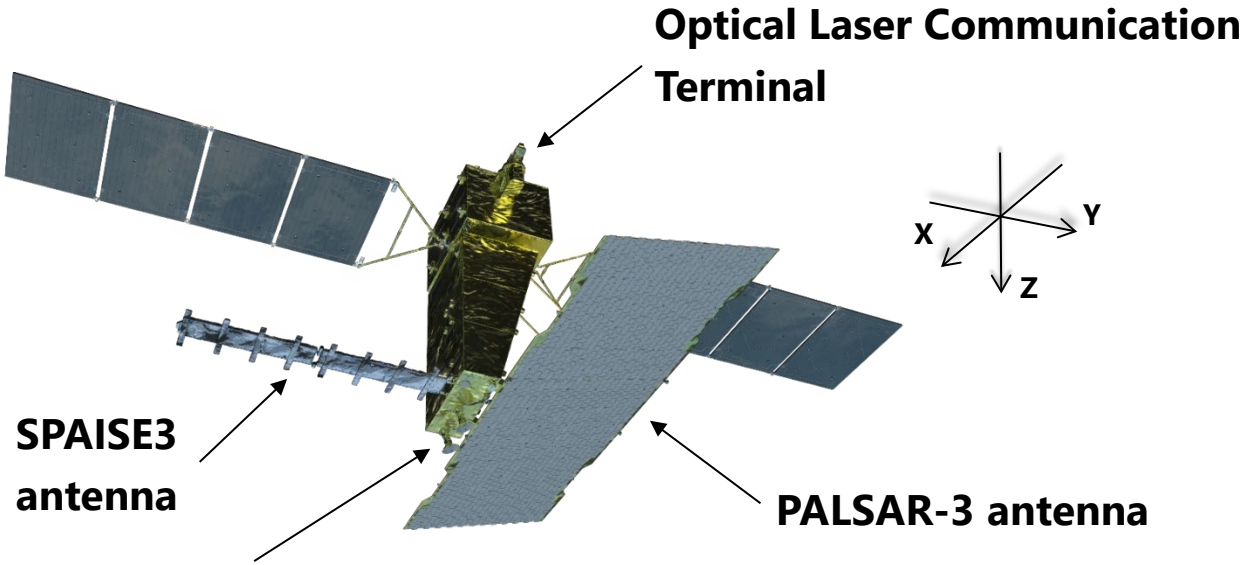
ALOS-4/PALSAR-3
Stripmap mode
200 km swath

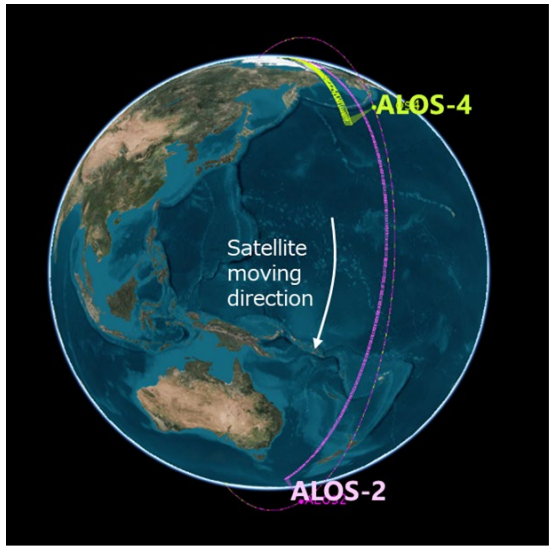
ALOS-2/PALSAR-2
Stripmap mode
50 km swath



Island of Hawaii

Overview of ALOS-4





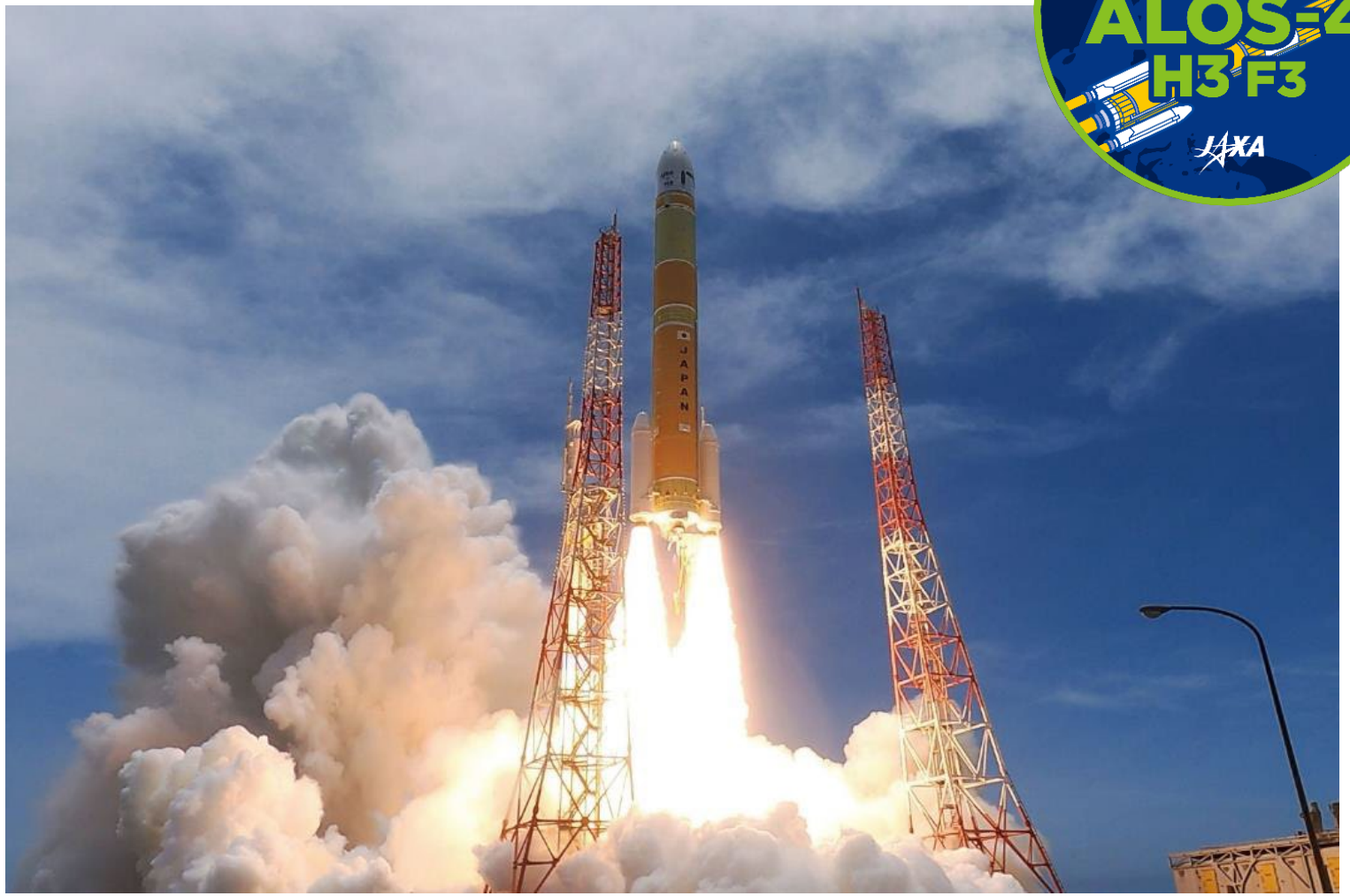
ALOS-4 flies on the same reference orbit as ALOS-2, enabling combined observations and data analysis by both.

Lifetime		7 years
Mission Instruments		PALSAR-3 (L-band SAR) SPAISE3 (AIS receiver)
Size (X, Y, Z)		10.0 m × 20.0 m × 6.4 m
Satellite Mass		Approx. 3,000 kg
Electrical Power	**Solar cells**	Approx. 7,000 W
	Battery	380 Ah
Data recorder		Approx. 1 Tbyte
Downlink		3.6 Gbps (Ka-band) 1.8 Gbps (Optical data relay)
Orbit (Same as ALOS-2)	**Type of orbits**	Sun-synchronous sub-recurrent orbit
	Altitude	628 km
	Local sun time at descending	12:00 ± 15 min
	Revisit time	14 day
	Inclination angle	97.9 deg.

Launch of ALOS-4

ALOS-4 was launched aboard the third H3 Launch Vehicle at 12:06:42 (JST) on July 1, 2024, from the Tanegashima Space Center.





The events following the launch

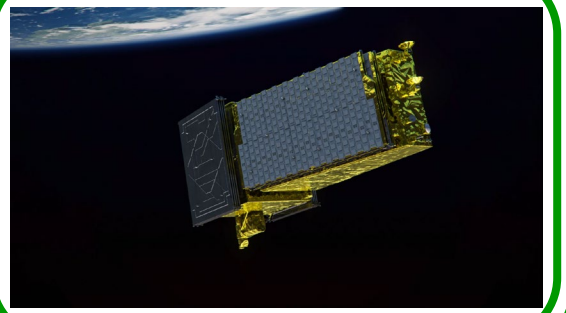
Launch
(1/7/2024 12:6:42 JST)



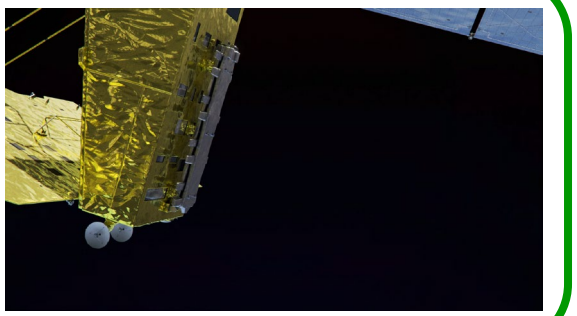
Separation



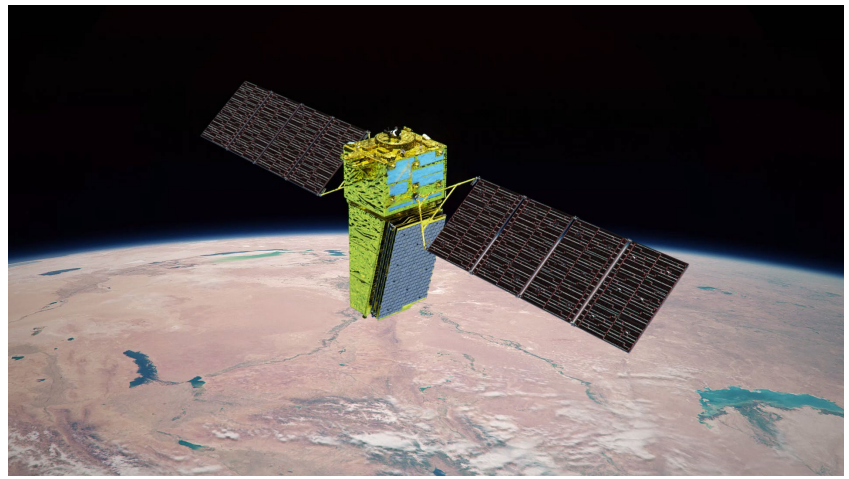
Solar array Deployment



SPAISE3 Deployment



3 days



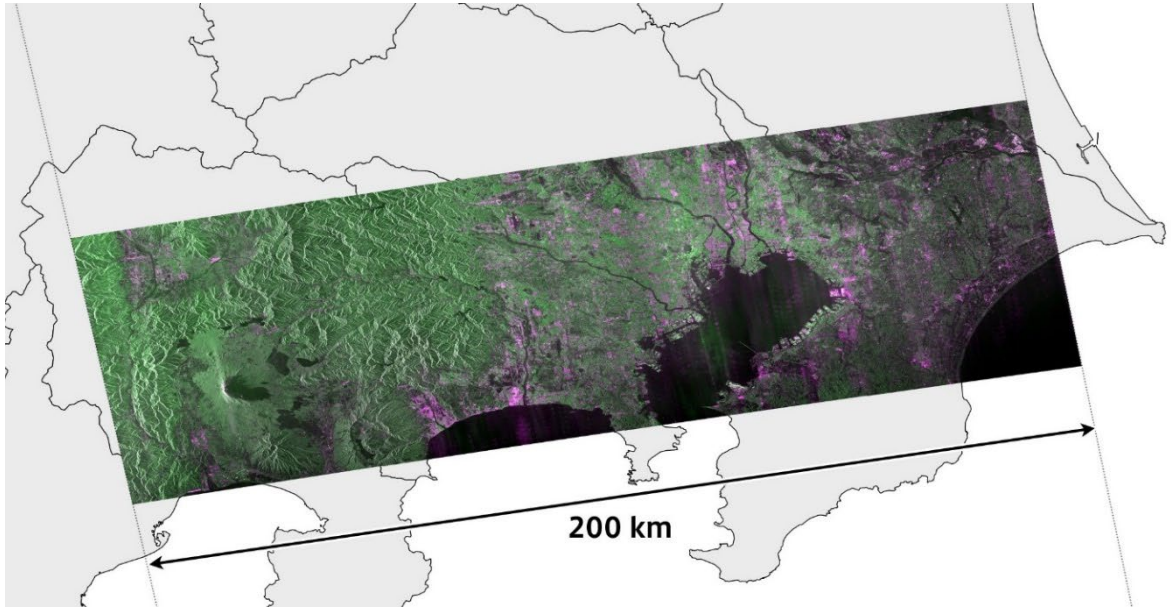
PALSAR-3 Deployment



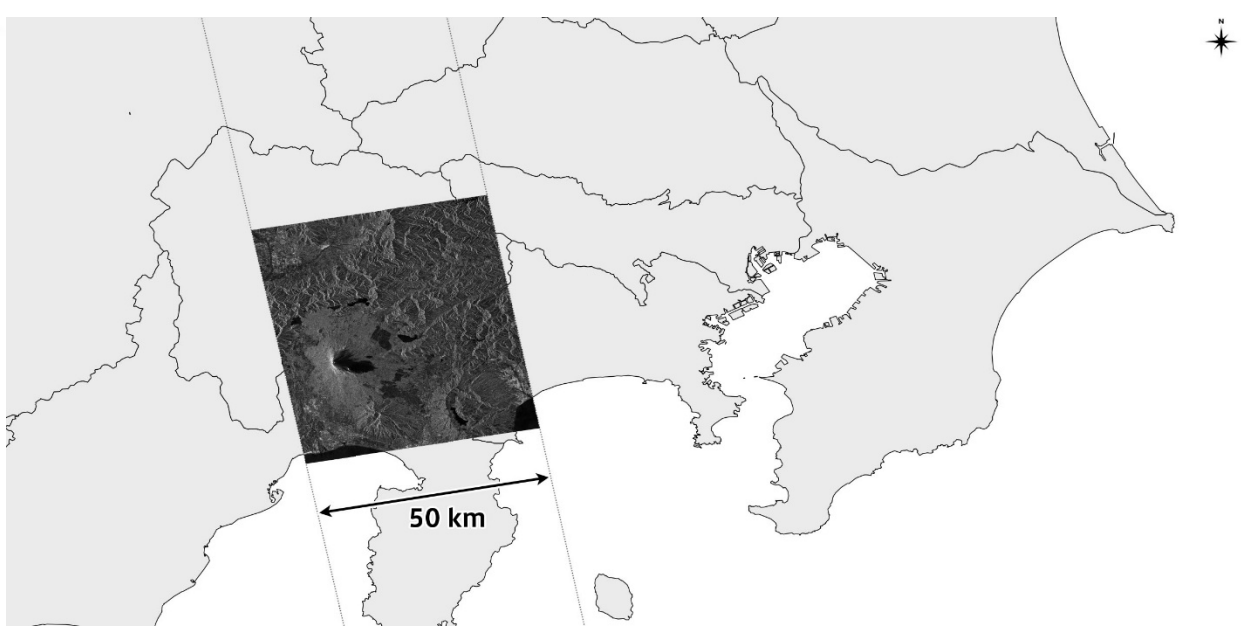
Completion of Critical Operation (3/7/2024)

First light images of PALSAR-3

- The first PALSAR-3 observation was conducted during July 15 to 17, 2024.
  - ✓ Successfully observed over a 200 km swath width with 3 m resolution. PALSAR-3 can observe 4 times wider than the 50 km swath of PALSAR-2.
  - ✓ Use of the new Ka-band data transmission enabling observations of large volumes of dual-polarization data. In PALSAR-2, the high-resolution 3 m mode is operated with one polarization.



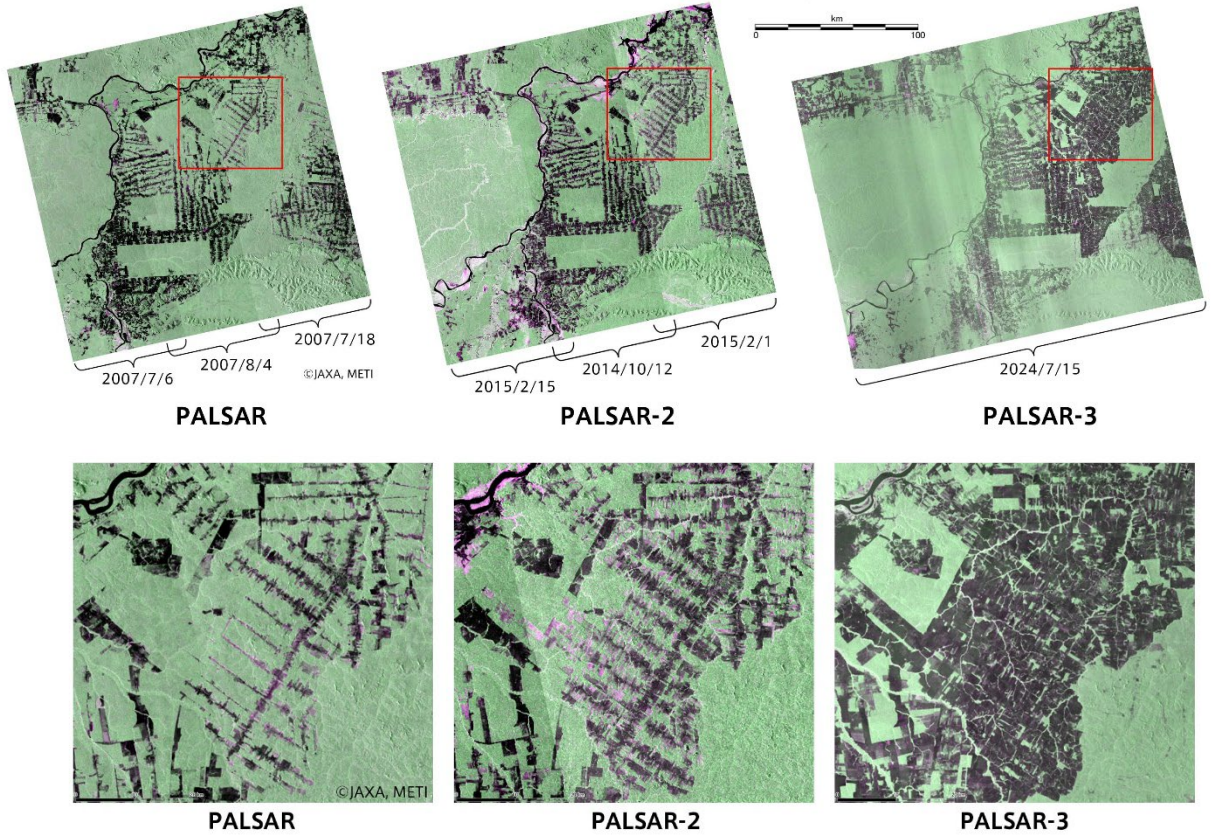
PALSAR-3 image over Tokyo~Mt. Fuji, Japan
(200 km swath, HH and HV polarization)



PALSAR-2 image
(50 km swath, HH-polarization)

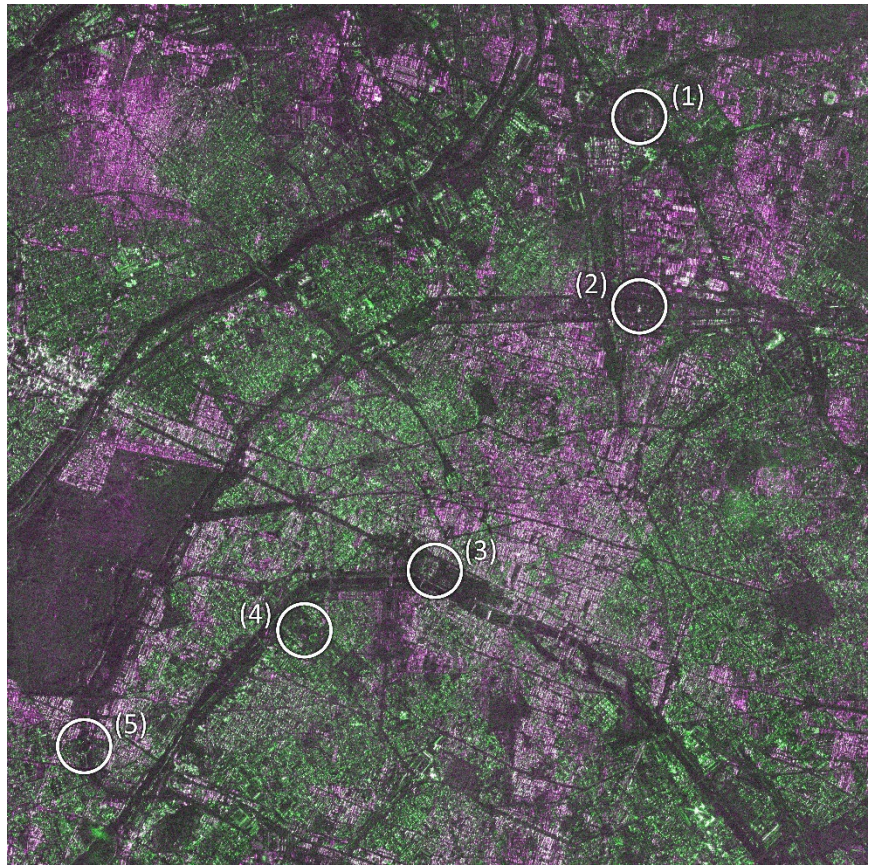
First light images of PALSAR-3

✓ Continuous global observation with 10 m resolution and 200 km swath width



Amazon forest in the State of Rondonia, Brazil

✓ Spotlight mode with 1m × 3 m resolution



Paris, France; Major venues for the Paris 2024 Olympics Games are marked with white circles

(1) Stade de France, the main venue, (2) Porte de la Chapelle Arena, (3) Place de la Concorde, (4) Eiffel Tower Stadium, and (5) Parc des Princes

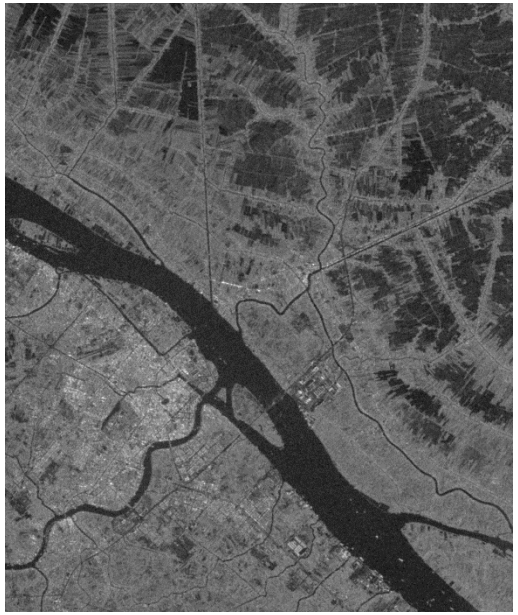
First light images of PALSAR-3

- ✓ Full polarimetric SAR image with 6 m resolution for global observation once per year

Urban and agricultural areas near Can Tho City, Vietnam



HH polarization



HV polarization



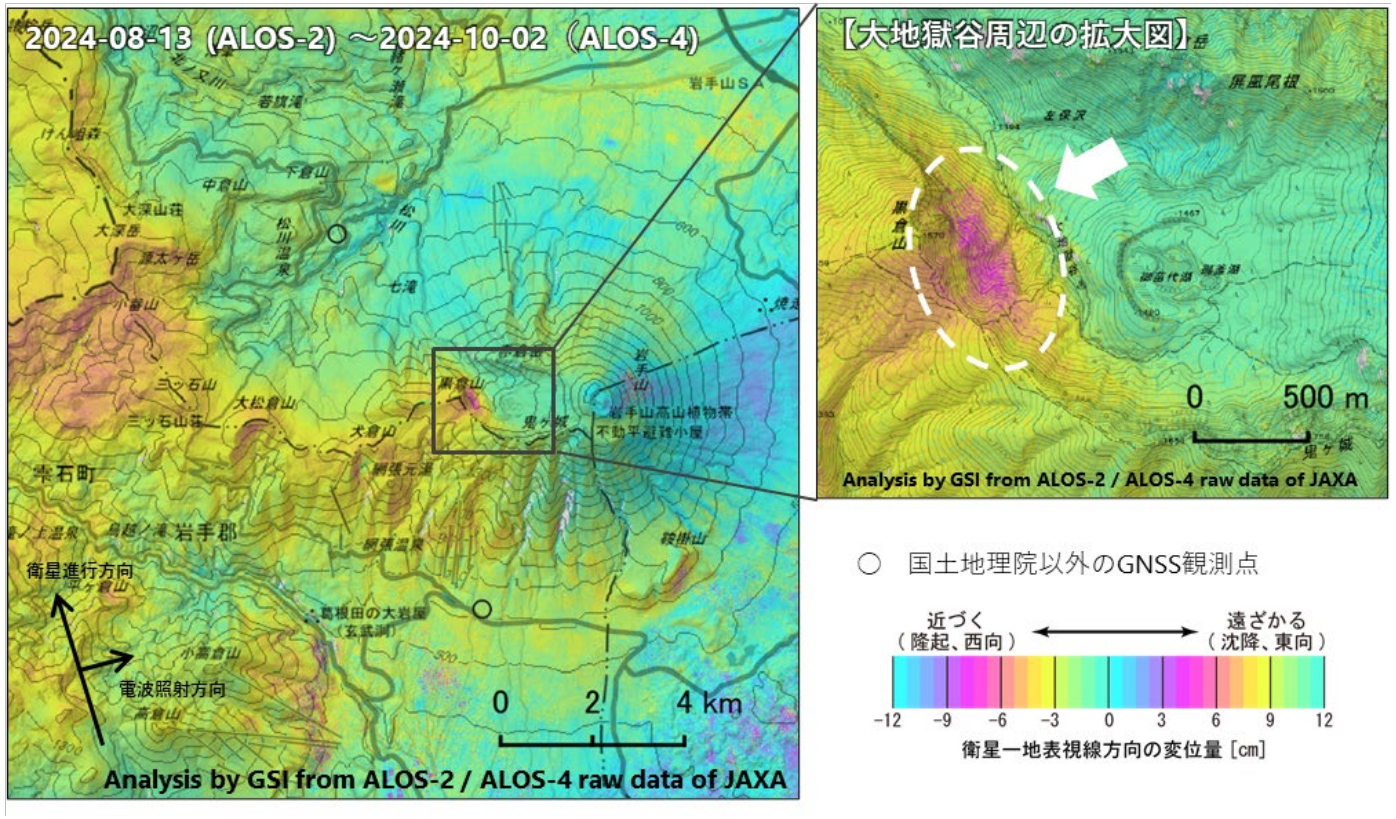
VV polarization



Color composite image
（R：HH、G：HV、B：VV）

Continuous observation with ALOS-2/-4

- During the initial check-out of ALOS-4, interferometric SAR between PALSAR-3 and PALAR-2 was also successfully conducted.
- More frequent and long-term monitoring will be possible by combining with ALOS-2's future observations and its archived data for the past 10 years.



InSAR analysis results of PALSAR-2 and PALSAR-3 at Mt. Iwate, Japan by Geospatial Information Authority of Japan

This information is used by the government to evaluate eruption warnings

(c) Geospatial Information Authority of Japan

PALSAR-3 operation plan

Launch

Jul. 1

Critical operation (LEOP)	Initial check-out operation	Initial cal/val operation	Regular observation
After satellite separation, attitude establishment, solar array paddle deployment, followed by PALSAR-3 and SPAISE3 antenna deployment	Confirmation that the satellite system and mission equipment have the required functions and performance	Calibration and validation on PALSAR-3 products	Start providing PALSAR-3 standard products (*)
Completed Jul. 3	**Completed Oct. 18**	to around Jan. 2025 (about 3 months)	

* JAXA plans to provide PALSAR-3 standard products to general users (all users other than those who have an agreement/arrangement with JAXA) from multiple private companies selected by JAXA.

JAXA is now calling for applications for this data and service providers.

PALSAR-3 Basic Observation Scenario

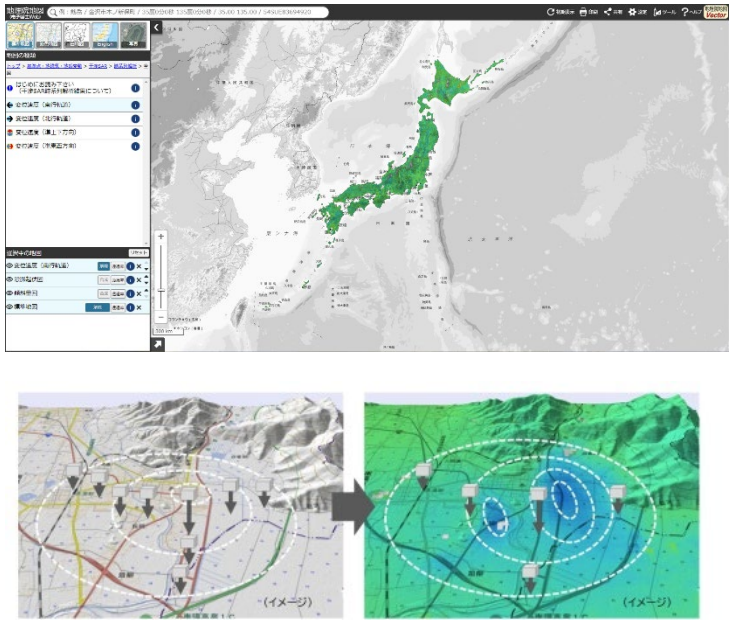
- For regular observations, PALSAR-3 observations will be performed according to the Basic Observation Scenario (BOS). The BOS will be continuously updated based on user feedback during operation.
- Global observations incorporate full polarimetry observations and observations of selected regions for several topics (forest, agriculture, polar/ice, land deformation, etc.).

Area	Theme	Observation			
		Mode	Pol.	Direction	Frequency
Japan	**Disaster basemap**	Stripmap 3 m/200 km swath, ScanSAR	Dual	Right and Left	1 year (left 30-44 deg. only),3 years (the others)
	Timeseries observations	Stripmap 3 m/200 km swath	Dual	Right	Around 20 times/year Reduced frequency is allowed during basemap acquisition.
Global	**Global basemap**	(Asc.) Stripmap 10 m/200 km swath (Des.) Stripmap 6 m/100 km swath	(Asc.) Dual (Des.) Full	Right	1 year
	Disaster basemap	ScanSAR 700 km swath, Stripmap 10 m/200 km swath	Dual	Right	Once every 3 years
	Thematic observations	Depends on theme	Depends on theme	Right	Depends on theme

Promoting social implementation of SAR data use

- Toward the continuous social implementation of SAR data use, we are working on R&D and implementation in cooperation with various data analysis and service provision partners.

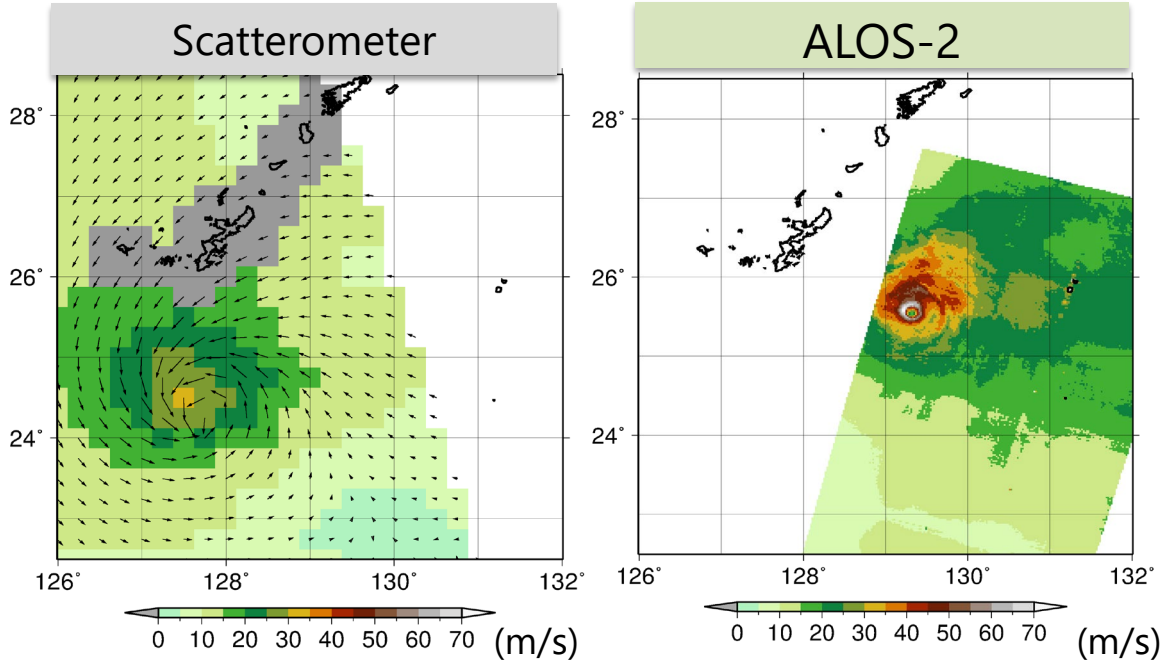
e.g.1) Time-series InSAR data and manuals for national public surveying by Geospatial Information Authority of Japan



Leveling and InSAR combination (concept image)

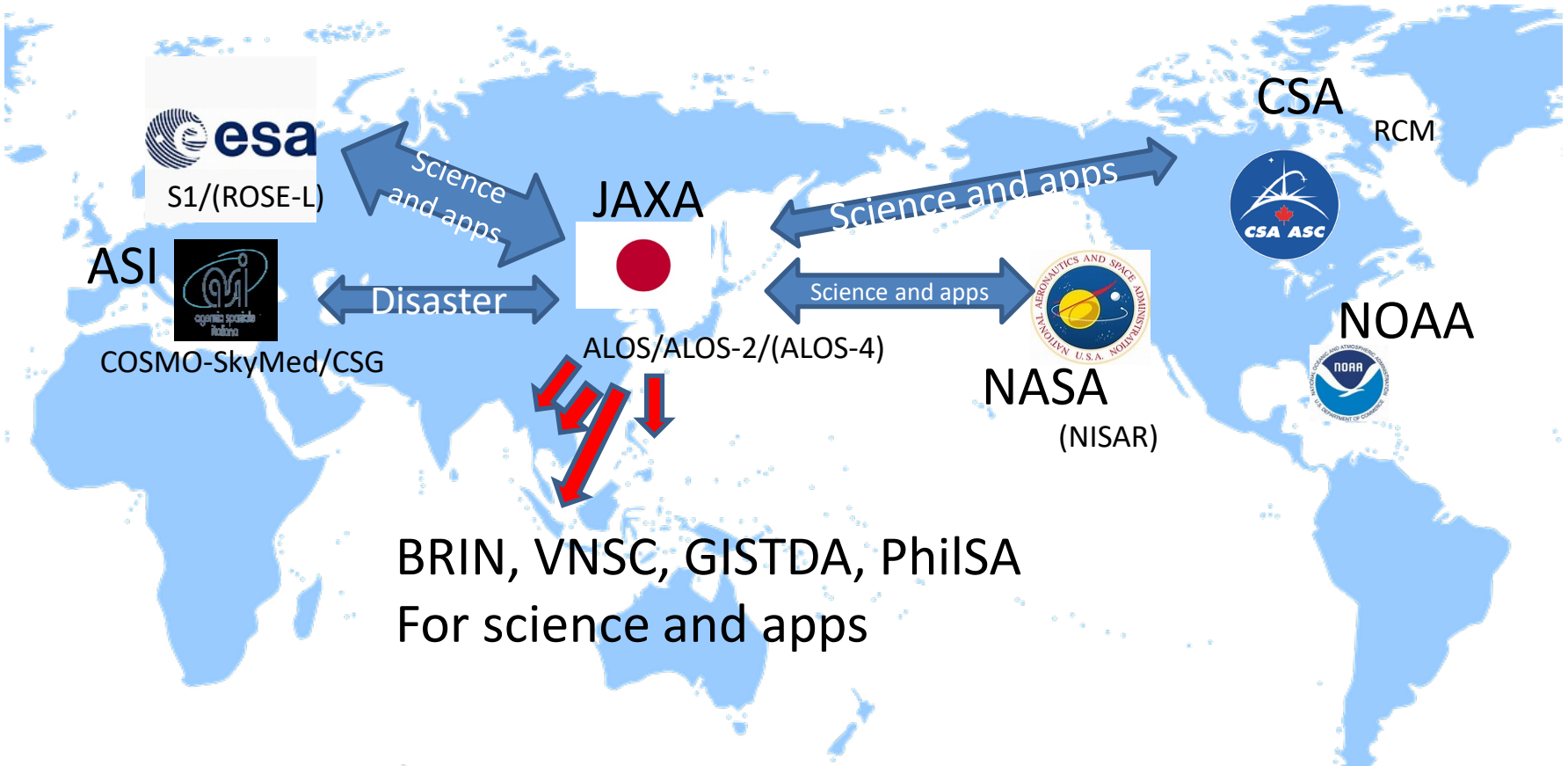
(c) Geospatial Information Authority of Japan

e.g.2) Typhoon wind speed monitoring for improving forecast by Meteorological Research Institute



SAR international cooperation

- SAR-related cooperation is ongoing with space agencies around the world



- Science and apps: Ocean (Sea Ice, ship detection, oil spills), Land use (agriculture, soil moisture, SWE, crustal deformation - volcanos, subsidence, LULCC, forests) with disaster response

Promoting of public-private partnerships

- An industry-government-academia consortium for satellite Earth observation in Japan (“CONSEO”) was established in 2022, with JAXA working as the secretariat.
- In this year, drills on disaster observation and data utilization are planned to identify the issues and future goals of cooperation between public and private SAR/optical satellites.



(c) CONSEO