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Prepared by JAXA
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JAXA updates since CGMS-53 and report on the medium to long-term future plans on Earth observation

JAXA operates various kind of satellite sensors and opens the products to the public. We keep developing and improving the products to address the climate issues.

The major updates since CGMS-53 is the launch of Global Observing SATellite for Greenhouse gases and Water cycle (GOSAT-GW) carrying Advanced Microwave Scanning Radiometer 3 (AMSR3) and Total Anthropogenic and Natural emissions mapping SpectrOmeter-3 (TANSO-3) in June 2025 . JAXA also released the products of the EarthCARE and ALOS-4 which were launched in 2024.

In terms of the WMO project for monitoring extremes, JAXA contributes to the WMO Space-based Weather and Climate Extremes Monitoring (SWCEM) Project by providing more than 25-yr GSMaP rainfall product with climate normal.

JAXA also contributes to the World Data Centre for Greenhouse Gases (WDCGG) and the Global Greenhouse Gas Watch (G3W) by defining the role of satellite products.

Starting in April 2025, JAXA embarked on a new Mid- to Long-term plan for seven years. Within this plan, the Earth observation program is guided by the vision "Envision the Future." Under this vision, JAXA aims to observe our planet wider, faster, deeper, and smarter than before. And we will act together with partner organizations for the safe and resilient world.

Based on these visions, JAXA has identified four thematic priorities as its focus areas. Efforts will accelerate to achieve tangible outcomes within each theme. The thematic priorities are: "Global Water Disaster Risk and Water Resource Management," "Carbon Stocks," "Maritime Observation," and "Infrastructure and Disaster Management."

1 INTRODUCTION

Purpose of the paper is as follows;

1) to update the status of JAXA's Earth Observation satellite program and data product in operation and to be launched shown in Table 1 (Sections 2 and 3), and
2) to introduce the contribution to WMO Space-based Weather and Climate Extremes Monitoring (SWCEM) Project (Section 4).

Table 1. Line-up of the JAXA Earth Observation Satellites and Sensors

Satellites and/or Sensors		Launch (UTC)
In operation		
GOSAT***	Greenhouse gases Observing SATellite	23 Jan. 2009
GCOM-W	Global Change Observation Mission -Water	17 May 2012
GPM/DPR*	Dual-Frequency Precipitation Radar onboard the Global Precipitation Measurement Mission Core Observatory	27 Feb. 2014
ALOS-2	Advanced Land Observing Satellite-2	24 May 2014
GCOM-C	Global Change Observation Mission - Climate	23 Dec. 2017
GOSAT-2***	Greenhouse gases Observing SATellite-2	29 Oct. 2018
ALOS-3	Advanced Land Observing Satellite-3	Launch failed in 7 Mar. 2023
EarthCARE/CPR**	Cloud Profiling Radar onboard the Earth Cloud, Aerosol and Radiation Explorer	28 May 2024
ALOS-4	Advanced Land Observing Satellite-4	1 Jul. 2024
GOSAT-GW***	Global Observing SATellite for Greenhouse gases and Water cycle	28 Jun. 2025
To be launched		
ISS/MOLI	Multi-footprint Observation Lidar and Imager (MOLI) installed in the Exposed Facility of the Japanese Experiment Module (JEM) of the International Space Station (ISS)	JFY2026 (As target)
PMM	Precipitation Measuring Mission (PMM)	After JFY2028

* Joint mission with NASA
** Joint mission with ESA
*** Joint with the Ministry of the Environment (MOE) in Japan and National Institute for Environment Studies (NIES).

2 CURRENT SATELLITE MISSIONS AND PRODUCTS

The GOSAT data since 2009 and GOSAT-2 data since 2019 have been distributed through the GOSAT Data Archive Service (GDAS; https://data2.gosat.nies.go.jp/index_en.html). Simultaneously-observed GOSAT and GOSAT-2 data have been inter-compared and their products are cross-calibrated. Their research products with both total and partial column (lower and upper troposphere) densities of CO2, CH4, and H2O are available at the JAXA GOSAT EORC site (https://www.eorc.jaxa.jp/GOSAT/index.html). JAXA also contributes to the World Data Centre for Greenhouse Gases (WDCGG) and the Global Greenhouse Gas Watch (G3W) by defining the role of satellite products.

GCOM-W is operating normally, and all Advanced Microwave Scanning Radiometer 2 (AMSR2) standard products, including near-real-time products, are freely available via the JAXA G-Portal system (https://gportal.jaxa.jp/gpr/). In addition, several research products, including soil moisture research product that reflects dynamic change of vegetation and was developed for AMSR3, have been distributed through the GCOM-W Research Product Distribution Service (https://suzaku.eorc.jaxa.jp/GCOM_W/research/resdist.html). For better continuity between AMSR2 and AMSR-E on EOS Aqua satellite, JAXA also provides the reprocessed AMSR-E products applying the latest AMSR2 algorithms at the G-Portal system. We also plan to reprocess AMSR-E and AMSR2 data after the data release of AMSR3 to produce long-term and consistent product. An integrated web site of AMSR series with the Data Catalogue (https://www.eorc.jaxa.jp/AMSR/index_en.html) is available. New function of the AMSR Earth Environment Viewer (https://www.eorc.jaxa.jp/AMSR/viewer/index_e.html) to display anomalies from normal value as well as observed value will be available soon for several geophysical parameters, including SST. JAXA plans termination of “near-real-time distribution” of GCOM-W data in the end of August 2026 in corresponding to start of GOSAT-GW/AMSR3 near-real-time data distribution to public. AMSR2 is planned to continue observations and data distribution in delayed mode to assure enough cross-calibration with AMSR3.

GOSAT-GW, joint mission of GOSAT-2 follow-on (TANSO-3) and GCOM-W/AMSR2 follow-on (AMSR3) was launched in June 2025. TANSO-3, a grating imaging spectrometer, is the mission of Ministry of the Environment in Japan (MOE) and National Institute for Environment Studies (NIES). Orbit of the satellite is 666 km altitude (same as GOSAT) with 13:30 Local Time in Ascending node (same as GCOM-W). Sensor specification of the AMSR3 is almost equivalent to AMSR2 with some additional channels. New high frequency channels of 165.5 GHz, 183.31+-3 GHz, and 183.31+-7 GHz V-polarization are available in AMSR3 for snowfall retrievals and water vapor analysis in numerical weather prediction in meteorological agencies. Also, additional 10.25 GHz V- and H-polarization channels with wider band width and improved NEDT will be added to current 10.65 GHz channels to improve robustness of higher resolution SST retrievals especially for fisheries. To prepare future considerable impacts by 5G communication, center-frequency and band width of 36.5 GHz channels are slightly modified from those of AMSR2. TANSO-3 uses imaging spectrometer technology to measure CO2, CH4 and NO2 globally with medium and

locally with high spatial resolution. First images of TANSO-3 and AMSR3 were released in August and September 2025, respectively. Both missions are currently under the Initial Calibration and Validation Operations Phase.

AMSR3 data will be released to public in the end of June/early July 2026. While AMSR3 early access has been available to partner agencies since November 2025, JAXA recently started sharing sample AMSR3 early data with AMSR2 near-real-time users, especially meteorological agencies without MoU, for smooth transition of AMSR2 to AMSR3 in operational applications.

GCOM-C carrying Second-generation Global Imager (SGLI) (launched in Dec. 2017) has achieved the 5-year nominal mission phase, and the operation has been continued as the post-mission phase since Jan. 2023. SGLI has 14 channels of 250-m resolution, three channels of 1-km channels from near-UV (380 nm) to thermal infrared (12 μm) wavelengths, and 1-km polarization channels in red and near infrared wavelengths. The all standard products about cloud, aerosol, snow/ice, surface temperature, vegetation, and ocean colour from SGLI have been open to the public by the latest version Ver.3 via JAXA G-Portal system. Some research products such as Fire detection, Land Cover, Vegetation phenology, Floating Algae Index (FAI) have been available in JAXA JASMES web page (https://www.eorc.jaxa.jp/JASMES/). And recently, new research products, multi-sensor merged aerosol properties, long-term (1978-current) snow cover map (registered in the CDR Inventory), Gross Primary Production (GPP), Net Ecosystem Production (NEP), and Evapotranspiration products (ET) have been open via JASMES.

ALOS-2 was launched on May 24, 2014, and it is currently operating very well even more than its target mission life of seven years since launching the satellite. The mission objectives are as follows;

1) Disaster monitoring of damage areas, both in considerable detail, and when these areas may be large,
2) continuous updating of data archives related to national land and infrastructure information,
3) effective monitoring of cultivated areas, and
4) global forest monitoring in support of carbon cycle science.

To achieve its missions, ALOS-2 carries the Phased Array type L-band Synthetic Aperture Radar-2 (PALSAR-2), which is an active microwave SAR instrument using the 1.2 GHz frequency known as L-band. Compared to the PALSAR instrument onboard its predecessor ALOS satellite, the PALSAR-2 instrument has enhanced features (e.g. finer spatial resolution, spotlight mode, dual-polarisation ScanSAR).
The standard product of ALOS-2 is basically delivered in commercial bases, but the high-level product and the research dataset i.e., annual global mosaics and the forest/non-forest classification maps are distributed from JAXA EORC website free of charge (https://www.eorc.jaxa.jp/ALOS/en/index_e.htm). It is also started the open and free data of PALSAR-2 ScanSAR data from July 2022 (https://www.eorc.jaxa.jp/ALOS/en/dataset/alos_open_and_free_e.htm).

Global Precipitation Measurement Mission (GPM) / Dual-frequency Precipitation Radar (DPR) product is available from JAXA G-Portal system (https://gportal.jaxa.jp/gpr/). For better continuity between GPM and the Tropical rainfall Measurement Mission (TRMM) whose operation had been terminated after its

17 years long service, level 1 calibration factors for both Precipitation Radar (PR) onboard TRMM and GPM/DPR have been communized since 2017.

After the nominal mission operation phase of GPM mission, the scan pattern of the DPR has been changed since 21 May 2018. The new standard product applied to the new scan pattern was released as Version 07 in December 2021. The GPM Core Observatory (GPM-CO) satellite performed two orbit boost maneuvers on Nov. 7 and 8, 2023 that raised its altitude from 407km to 442km. By this orbit boost, the lifespan of the GPM-CO became closer to the original estimates of ending in the early 2030's. On March 5, 2024, JAXA and NASA resumed the GPM/DPR Standard products (L1B are V07B, other products are V07C), which corresponded to the GPM orbit boost.

As the applications of the GPM/DPR, the Japan Meteorological Agency (JMA) has assimilated the DPR data in the meso-NWP system since March 2016. The assimilation technique for the DPR by the JMA was improved on 30th June 2022.

In addition to the above product, some multi-satellite products are open to the public. Under the GPM mission, Global Satellite Mapping of Precipitation (GSMaP) has been developed and provided via JAXA G-Portal and JAXA/EORC website (https://sharaku.eorc.jaxa.jp/GSMaP/index.htm). The GSMaP is basically generated by using GPM constellation satellites, including GCOM-W/AMSR2, and is available since March 2000. It has some types for user purposes including real-time version, gauge-adjusted version, and so on. The GSMaP products are validated by in-situ observation in worldwide under collaboration with the WMO-CGMS International Precipitation Working Group (IPWG).

JAXA improved the algorithm in March 2026 (algorithm version 9). JAXA is conducting the reprocessing of the past GSMaP dataset since January 1998, and the dataset will be available to the public.

The GSMaP near-real-time gauge-adjusted version has been used in the WMO SWCEM project; details are described in Section 4.

JAXA has also developed the geophysical retrieval algorithms for the geostationary satellite "Himawari-8" and "Himawari-9", which are operated by the JMA, in an attempt to seek synergies between Himawari and JAXA's Earth observation satellites, especially with GCOM-C. We have distributed browse images, geophysical data products (SST, cloud, aerosol properties, wildfire, chlorophyll-a concentration, and surface shortwave radiation), and model assimilated data (aerosol properties and SST) from the Himawari and other satellite data through the JAXA Himawari Monitor and P-Tree system (https://www.eorc.jaxa.jp/ptree). We started processing of MTG-I1/FCI by applying consistent algorithms with Himawari and MTG chlorophyll-a concentration and surface shortwave radiation products are available via the system. To connect Himawari and MTG-I1 data, we have extended the data coverage of Himawari in the system from 80E to 70E. Use of more satellite data such as EarthCARE/ATLID and GOES/ABI is investigated for improvement of data coverage and model assimilation.

EarthCARE observes clouds, aerosols, and radiation on a global scale to improve the accuracy of climate change predictions. JAXA and NICT have developed the CPR on the EarthCARE, which is the world's first W-band (94GHz) Doppler radar aboard a satellite. The EarthCARE satellite was launched on 29 May 2024 at 00:20 CEST aboard a Falcon 9 rocket from the Vandenberg Space Force Base in California, US. JAXA/NICT/ESA released CPR first images on 27th June 2024. JAXA released first

image of the synergistic cloud synergy on 4th Oct. 2024. JAXA and ESA EarthCARE products will be distributed by both agencies. EarthCARE Level 1 products were released to the public on 14th January 2025, and Level 2 single-sensor products and 2-sensor synergy products were release on 17th March 2025. Level 2 3-sensor and 4-sensor synergy products were released in December 2025.

ALOS-4 was launched on 1 July 2024 by the H3 Launch Vehicle Flight 3 (H3F3). ALOS-4 is a follow-on mission of ALOS-2, and observes the Earth's surface using its onboard the Phased Array type L-band Synthetic Aperture Radar-3 (PALSAR-3). The data will be utilized for monitoring disaster, forest, sea ice, infrastructure, and other applications with the advantages of Synthetic Aperture Radar (SAR) i.e., all-weather and day-and-nighttime observation capability. With further improved observation performance compared to the predecessor PALSAR-2 aboard ALOS-2, the satellite aims at achieving both high resolution and a wider observation swath. The standard products of PALSAR-3 have been released since 2025.

3 FUTURE SATELLITE MISSIONS AND PRODUCTS

JAXA is developing the Precipitation Measuring Mission (PMM) to build on and further advance its long-standing heritage in precipitation radar satellites, established through TRMM and GPM. The mission objectives for the PMM are as follows;

1) Elucidation of global water cycle parameters and understanding of cloud-precipitation processes,
2) Contribution to enhancement of weather and disaster management,
3) Provision of long-term information on water resources infrastructure contributing to global-scale climate and water issues

On 1st June 2023, the project team of PMM was organized in JAXA. The Preliminary Design Review (PDR) for the PMM satellite system was completed in January 2026, and currently the critical design phase is ongoing. JAXA would appreciate the supports by CGMS and IPWG.

The Multi-sensing Observation LiDAR and Imager (MOLI) will be installed in the Exposed Facility of the Japanese Experiment Module (JEM) "Kibo" of the International Space Station (ISS). It has two sensors: LiDAR and imager. The imager makes us possible to understand forest conditions around the footprint by shooting at the same time as LiDAR observation, although it has a narrow observation swath. MOLI is currently under Phase B study.

4 CONTRIBUTIONS TO WMO SPACE-BASED WEATHER AND CLIMATE EXTREMES MONITORING (SWCEM)

In terms of the WMO project for monitoring extremes, JAXA contributes to the WMO Space-based Weather and Climate Extremes Monitoring (SWCEM) Project by

providing more than 25-yr GSMaP rainfall product with climate normal. GSMaP, developed under the Global Precipitation Measurement (GPM) mission, delivers near-real-time and gauge-adjusted rainfall estimates that underpin SWCEM's flood and drought monitoring.

Based upon experiences in the SWCEM, JAXA started to operate a portal "JAXA Climate Rainfall Watch", which provides information about extreme heavy rainfall and drought over the world using the GSMaP Near-real-time Gauge-adjusted Rainfall Product (GNRT) version 6 and the newer GNRT version 8, both available to SWCEM users through the portal.

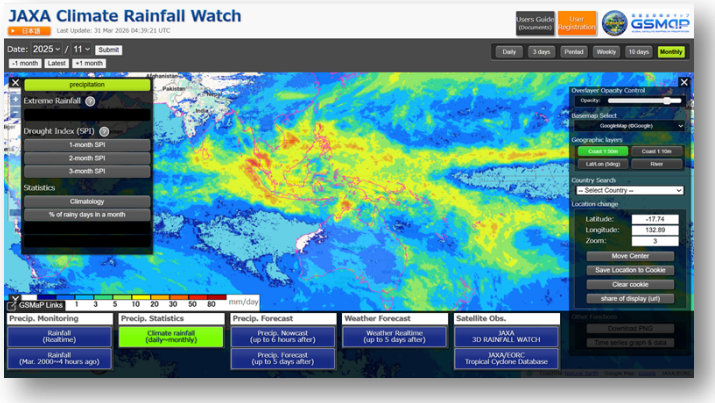

Fig. 1 Graphical User Interface of the "JAXA Climate Rainfall Watch" website (https://sharaku.eorc.jaxa.jp/GSMaP_CLM/)

Each product provides 0.1° (~10 km) gridded precipitation estimates with sub-daily (hourly to 3-hourly) updates and short latency, making them suitable for operational early-warning use. In June 2022, JAXA started to distribute the GSMaP real time data (GSMaP_NOW) to the SWCEM members, corresponding to the recommendation in the 4th Session of WMO Steering Group for the SWCEM in East Asia and Western Pacific (SG-SWCEM-EAWP-4) held during 23-24 March 2022.

The long-term statistical baseline used for anomaly and percentile calculations has been extended from 22 to 25 years (Apr 2000–Mar 2025). The new climatology shows only minor regional differences and improves the robustness of the archive for climate analysis.

Moreover, JAXA hosted the 11th Workshop of the International Precipitation Working Group (IPWG) at Tokyo Institute of Technology from July 15th to 18th, 2024, in collaboration with the IPWG, which is co-sponsored by the CGMS and WMO. An article of the workshop summary was published as Kubota et al. (2024, https://doi.org/10.1175/BAMS-D-25-0011.1).

5 JAXA'S NEW MID- TO LONG-TERM PLAN

Starting in April 2025, JAXA initiated a new seven-year mid- to long-term plan.

Within this framework, the Earth observation program is guided by the vision, “Envision the Future.”

Under this vision, JAXA seeks to observe our planet wider, faster, deeper, and smarter than before, while working in close collaboration with partner organizations to contribute to a safe and resilient global society.

JAXA’s Earth observation program aims to establish a “Sustainable Ecosystem for Earth Observation.” Through innovation, the program endeavors to expand the utilization of Earth observation data and to contribute more effectively to addressing a wide range of challenges, particularly in the Asia-Pacific region. Furthermore, JAXA seeks to generate a positive feedback cycle that promotes increased investment and fosters human resource development in the field of Earth observation.

Based on this vision and goal, JAXA has identified four thematic priorities as its focus areas. Efforts will be accelerated to achieve tangible outcomes within each theme. The thematic priorities are: "Global Water Disaster Risk and Water Resource Management," "Carbon Stocks," "Maritime Observation," and "Infrastructure and Disaster Management."

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Among this program, JAXA plays three fundamental roles.

- First, JAXA will promote the development and utilization of observation satellites that address disasters and global challenges and contribute to diplomatic policy.
- Second, JAXA will promote social implementation in collaboration with private sector-led businesses, including upstream and downstream.
- Third, JAXA will foster innovation that leads to the development and utilization of "new types" of observation satellites.

Over the next seven years, JAXA will advance the Earth observation program with three roles firmly in mind.

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6 CONCLUSIONS

JAXA operates various kind of satellite sensors and opens the products to the public. We keep developing and improving the products to address the climate issues.

The major updates since mid-2025 is the launch of Global Observing SATellite for Greenhouse gases and Water cycle (GOSAT-GW) carrying Advanced Microwave Scanning Radiometer 3 (AMSR3) and Total Anthropogenic and Natural emissions mapping SpectrOmeter-3 (TANSO-3) . JAXA also released the products of the EarthCARE and ALOS-4 which were launched in 2024.

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years. Within this plan, the Earth observation program is guided by the vision "Envision the Future." Under this vision, JAXA aims to observe our planet wider, faster, deeper, and smarter than before. And we will act together with partner organizations for the safe and resilient world. Based on these visions, JAXA has identified four thematic priorities as its focus areas. Efforts will be accelerated to achieve tangible outcomes within each theme. The thematic priorities are: "Global Water Disaster Risk and Water Resource Management," "Carbon Stocks," "Maritime Observation," and "Infrastructure and Disaster Management."