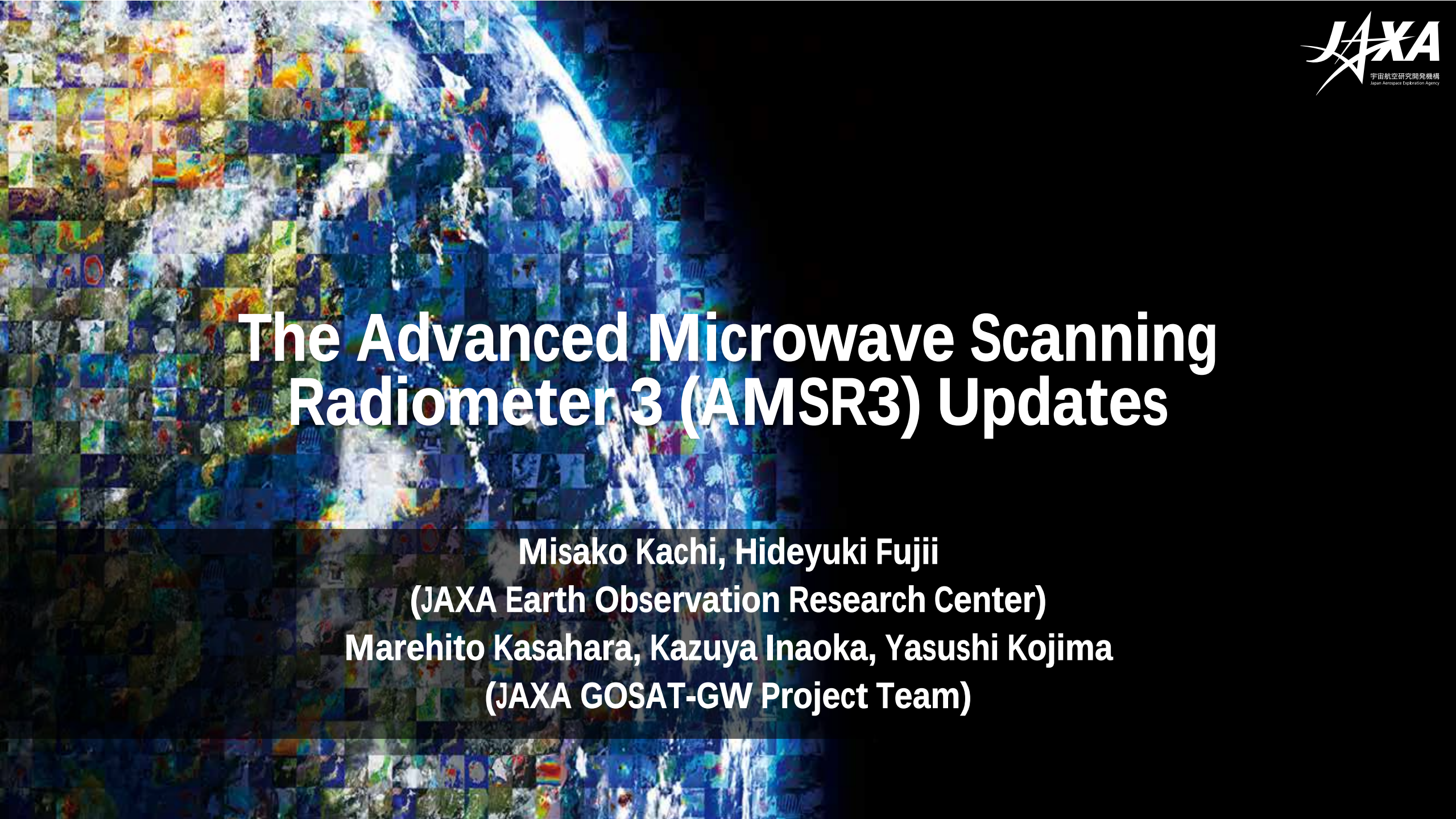

The Advanced Microwave Scanning Radiometer 3 (AMSR3) Updates

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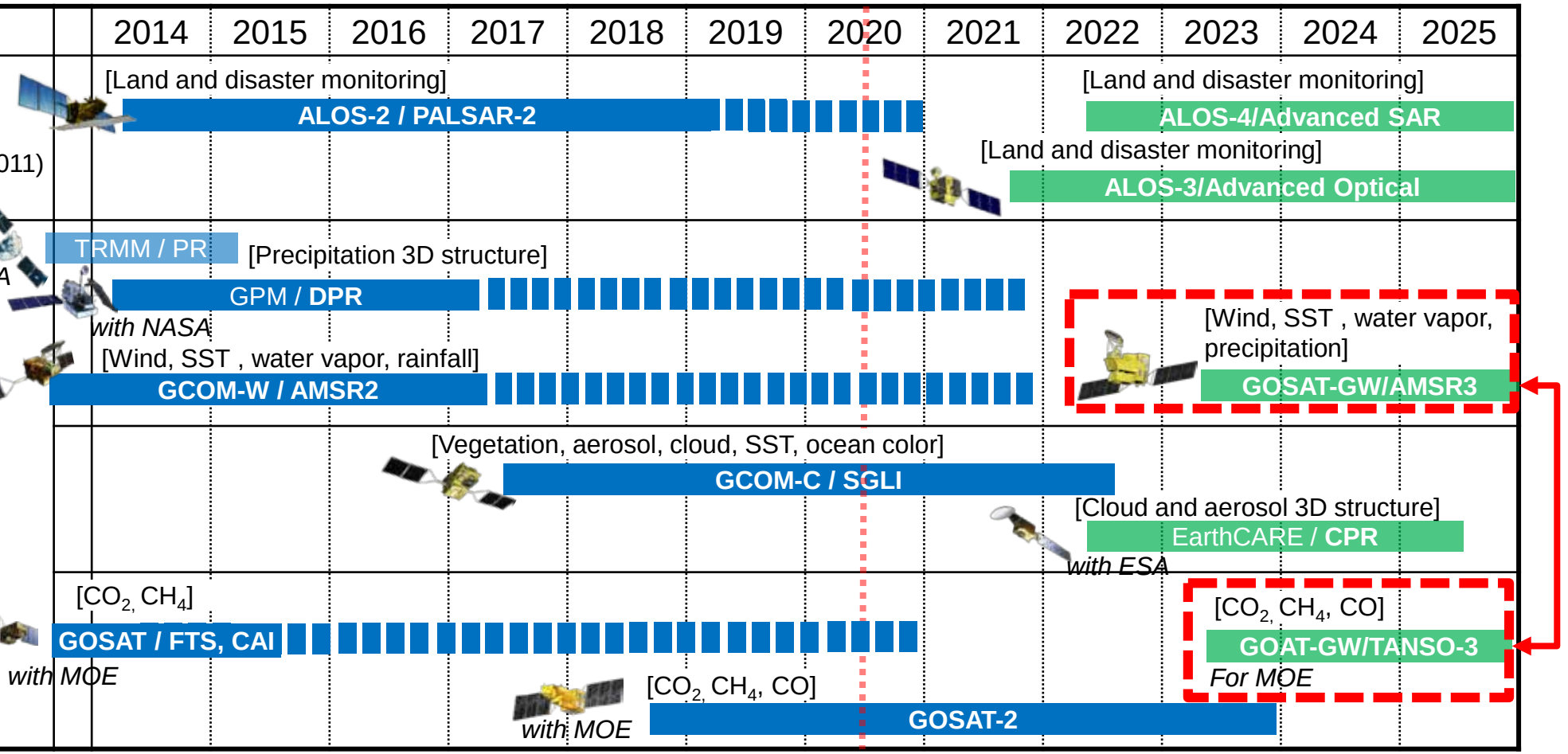
JAXA's Earth Observation Satellite/Instrument



Mission status: Completed On orbit Development

History of Passive Microwave Observations

- With experience of development and operation of MSR, JAXA developed 1st generation of AMSR (AMSR and AMSR-E) with large antenna size and C-band channels. AMSR-E continuous its science observation about 9.5-year, and its high capabilities enable to expand utilizations in operational and research areas.
- 2nd generation of AMSR (AMSR2) was launched in 2012 and succeeds AMSR-E observations to establish its data utilization in various areas.
- 3rd generation of AMSR (AMSR3) is being developed and to be launched in JFY2023.

1987

MSR

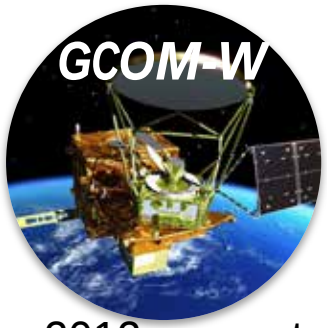
- 2-channel in 23GHz & 32GHz
- Antenna size: 0.5m
- Spatial resolution: 23-32km
- Swath width: 317km

2002-2011

AMSR

AMSR-E

- 6-frequency, 14-channel
- Antenna size: 1.6m
- Spatial resolution: 6-74km
- Swath width: 1450km



2012-present

Succeed AMSR-E observation

AMSR2

- Improved onboard calibration
- Additional 7GHz channels to mitigate impact of RFIs

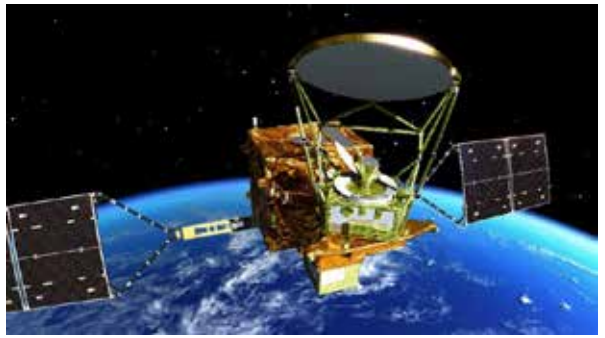
after 2023

Continue & improve AMSR-E/AMSR2 observation

AMSR3

- New high-frequency channels for snowfall and NWP
- Additional 10GHz channels with better NEDT for robust SST

AMSR2 on GOM-W



Instrument	**Advanced Microwave Scanning Radiometer 2 (AMSR2)**
Altitude	**705 km**
Orbital inclination	**98.2 deg**
Local sun time at Ascending node	**13 :30**
Launch vehicle	**H-IIA**
Launch	**May 18, 2012**
Designed lifetime	**5 years**

- ü Successor of Aqua/AMSR-E, providing continuous data for climate studies and operational applications
- ü Carrying AMSR2, a multi-polarization and multi-frequency microwave imager
- ü Improving on-board calibration target has resulted reduction of annual TB variation due to calibration and improvement of TB stability
- ü Achieved designed mission life (5-year) on May 18, 2017, and continues observation
- ü Recent Highlights
  - ü Version-up of SST and Sea Surface Wind Speed & release of new research products in Oct. 2020
  - ü Release of AMSR Environment Viewer on web in Jun. 2020
  - ü Capturing TPW & SST variation during heavy rainfalls around Japan in Jul. 2020
  - ü Capturing SST decrease during passing of three typhoons in Aug.-Sep. 2020
  - ü Capturing second minimum sea ice extent in Sep. 2020

AMSR3 on GOSAT-GW: Global Observation SATellite for Greenhouse gases and Water cycle

- GOSAT-GW will carry two instruments, AMSR3 and TANSO-3.
  - AMSR3, led by JAXA, will succeed AMSR series observations adding new high-frequency channels for solid precipitation retrievals and water vapor analysis in NWP.
  - TANSO-3, led by Japanese Ministry of Environment (MOE) and National Institute of Environment Studies (NIES) , will improve observation capability of greenhouse gases from GOSAT-2/TANSO-2.
  - Target launch is JFY2023 (Apr. 2023 - Mar. 2024)
- Mission targets of AMSR3
  - To produce long-term continuous data record
  - To enhance operational utilization of near-real time data
    - weather forecast including hurricane analysis
    - fishery in coastal area
    - navigational assistance on arctic shipping route
    - new geophysical parameter products

GOSAT-GW Satellite Specifications

Orbit	**Type**	Sun-synchronous, Sub-recurrent orbit
	Altitude	666km, recurrent cycle 3days (same as GOSAT)
	MLTAN	13:30±15min (same as GCOM-W)
Mass		2.6 ton (Including propellant)
Power		> 5.3 kW
Design life		> 7 years
Launch vehicle		H-IIA rocket
Mission data downlink rate		Direct transmission with X-band: 400 Mbps Direct transmission with S-band: 1 Mbps (Only for AMSR3)
Instrument		TANSO-3 (for GHG) AMSR3 (for Water Cycle)

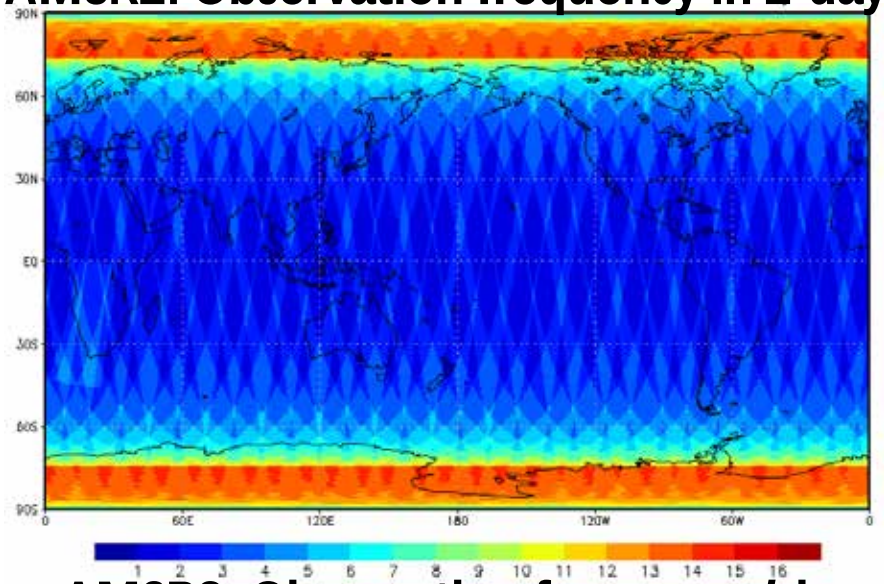
Comparison of Orbit Specifications

- Orbit specification of GOSAT-GW is decided to satisfy requirements from both AMSR3 and TANSO-3 missions.
- Ascending orbit will be during daytime (same as GCOM-W), orbit altitude is same as GOSAT, and local sun time is same as GCOM-W. Orbiting number of one recurrent day is 44 and smaller compared to that of GCOM-W (233), so there are some differences in observation frequency.

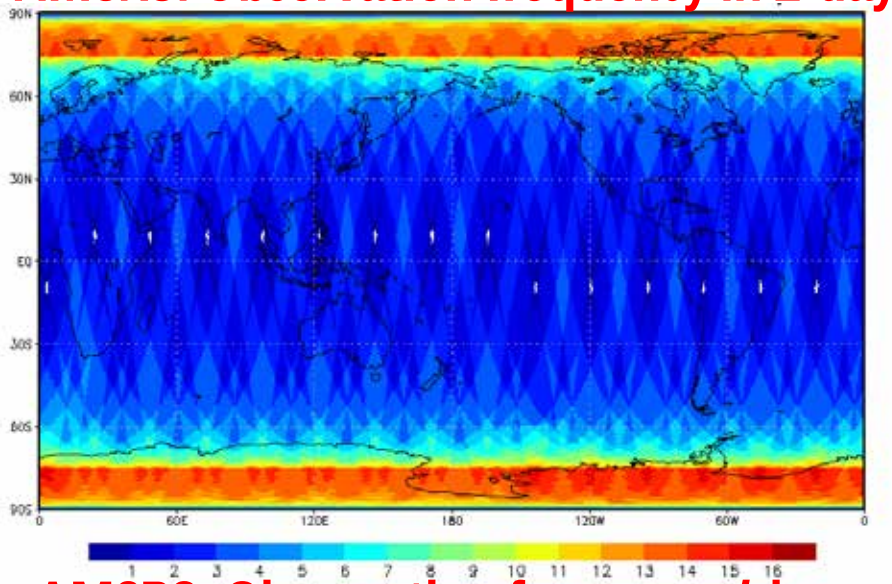
Orbit conditions	GCOM-W/AMSR2	GOSAT-GW/AMSR3
Altitude	699.6 km	665.96 km
Inclination angle	98.2 degrees	98.06 degrees
Local sun time in Ascending node	13:30	13:30
Swath width	1600 km	1530 km
Recurrent day	16 days (233 orbits)	3 days (44 orbits)

AMSR3 Observation Frequency

AMSR2: Observation frequency in 2-day

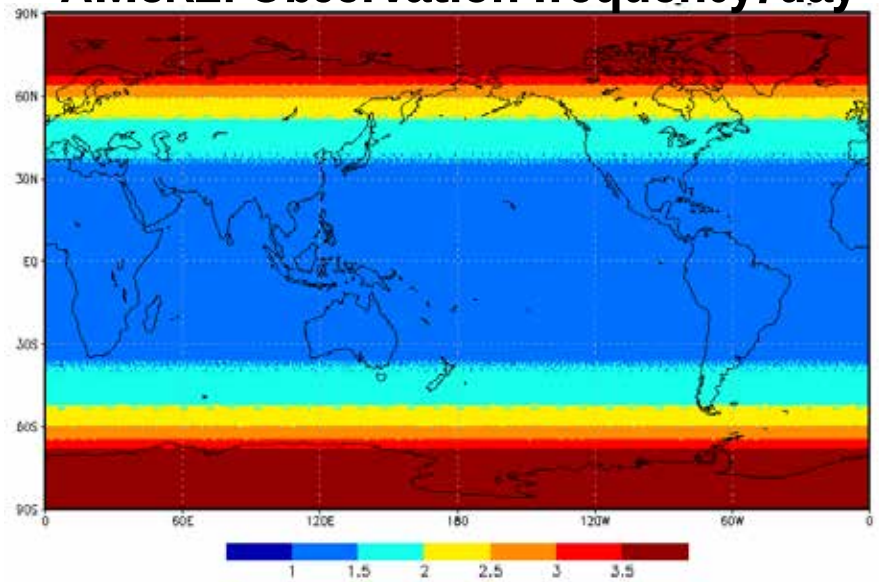


AMSR3: Observation frequency in 2-day

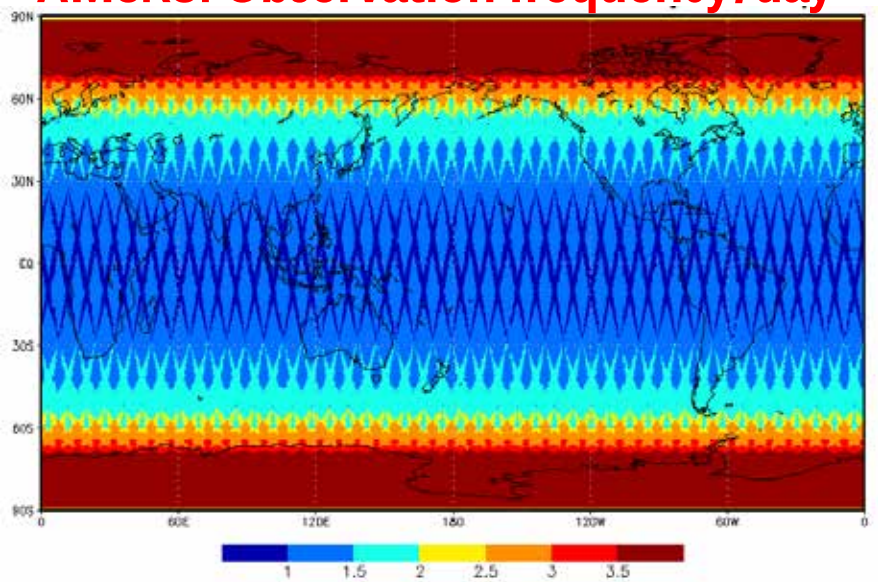


Unlike AMSR2, **AMSR3 cannot cover global area within 2-day** and small missing areas (white) are remained.

AMSR2: Observation frequency/day



AMSR3: Observation frequency/day



Observation frequency of AMSR3 is **NOT homogeneous** for every longitude and there are fixed areas less than 1 observation/day (blue).

Current Status of AMSR3

- Dec. 2019: Started GOSAT-GW Project
- Jun. 2020 - Preliminary Design Review (PDR) of GOSAT-GW Satellite System
  To be completed by the end of JFY2020 (Mar. 2021)
  - ØAug. 26, 2020: Completed AMSR3 PDR
  - ØDec. 23, 2020: Completed TANSO-3 PDR
- Changed the specification of Ka-band passband to reduce the future risk of RF interference from 5-G mobile communication system
- Being coordinated major characteristics and performances of G-band
- Being conducted manufacture and test of engineering models of AMSR3 component (ex. G-band antenna sub-system, Receivers)

Future Plan

- Critical Design Review (CDR) of AMSR3 in first half of JFY2021
- Completion of AMSR3 Development in second half of JFY2022
- Launch of GOSAT-GW Satellite in JFY2023
  - Ø AMSR3 Product will be released to the public about one year after the launch.

Specification of AMSR3 Instrument

AMSR3 Sensor Characteristics

Sensor type	Conical scanning total power microwave radiometer
Antenna	Off-set parabolic antenna (ϕ2.0m aperture)
Swath width	> 1530m
Quantization	12 bit
Incidence angle	55 deg. except 89GB, 166G,183G
X-polarization	< -20dB
Beam efficiency	> 90%
Range	2.7-340K
Sampling interval	5-10km
Data rate	87.4 kbps (average)
Life time	7 years

* Red indicates differences from AMSR2

AMSR3 Channel Sets

Center frequency [GHz]	Polarization	Band width [MHz]	NEDT (1σ)	Beam width (spatial resolution)
6.925 7.3	H/V	350	< 0.34 K	1.8 ° (34km x 58km)
10.25	H/V	500	< 0.34 K	1.2 ° (22km x 39km)
10.65	H/V	100	< 0.70 K	1.2 ° (22km x 39km)
18.7	H/V	200	< 0.70 K	0.65 ° (12km x 21km)
23.8	H/V	400	< 0.60 K	0.75 ° (14km x 24km)
36.5	H/V	840	< 0.70 K (TBD)	0.35 ° (7km x 11km)
89.0 A/B	H/V	3000	< 1.20 K	0.15 ° (3km x 5km)
165.5	V	4000	< 1.50 K	0.3 ° (4km×9km)
183.31±7	V	2000×2	< 1.50 K	0.27 ° (4km×8km)
183.31±3	V	2000×2	< 1.50 K	0.27 ° (4km×8km)

Changes from AMSR2 including additional channels in red

Definition of AMSR3 Processing Levels

Processing Level	Definition
Level 0	AMSR3 data with quality check flags appended.
Level 1A	A scene data product that stores the antenna temperature count value converted by the radiometric and geometric correction processing from Level 0 data, the antenna temperature conversion coefficients, etc.
Level 1B	A scene data product that stores the brightness temperature converted from the Level 1A antenna temperature using the conversion coefficients.
Level 1R	A scene data product that stores the brightness temperature that is spatially resampled from Level 1B to match the center position and size of the Field of View (FOV) of each frequency band at each pixel.
Level 1C	A scene data product that stores the brightness temperature that is spatially resampled from Level 1B to match the center position of the FOV of each frequency band at each pixel.
Level 1H	A scene data product that stores the brightness temperature that is spatially resampled from Level 1B to match the center position of the footprint of each frequency band and to enhance spatial resolution of the low frequency bands at each pixel.
Level 2	A scene data product that stores a physical data retrieved from the brightness temperature at each pixel.
Level 3	A grid data product that stores the brightness temperature or physical data converted using grid processing and temporally statistical processing.

List of AMSR3 Products

Standard Product
Brightness Temperature (6-183GHz) (L1B)
Resampled Brightness Temperature (6-183GHz) (L1R)
Total Precipitable Water (over ocean & land)
Integrated Cloud Liquid Water Content (over ocean)
Precipitation (liquid & solid)
Sea Surface Temperature (6GHz & 4-frequency)
Sea Surface Wind Speed
All Weather Sea Surface Wind Speed
Sea Ice Concentration
High-resolution Sea Ice Concentration
Soil Moisture Content
Snow Depth (snow depth & SWE)

Red indicates differences from AMSR2

Research Product
FOV-center Matched Brightness Temperature (L1C)
High-resolution Brightness Temperature (L1H)
High-resolution Sea Surface Temperature (20km res.)
Sea Ice Motion Vector
Land Surface Temperature
Vegetation Water Content
Thin Ice Detection
Soil Moisture Content & Vegetation Water Content by Land Data Assimilation (L4)
Climate Data Record (CDR) for each parameter

(as of Oct. 2020)