2022

50 YEARS 1972–2022

CGMS

JAXA updates since CGMS-49 and report on the medium to long-term future plans

Presented to CGMS-50 Plenary, agenda item 2

Coordination Group for Meteorological Satellites

JAXA CGMS

Current and future JAXA Earth Observation Missions Contributing to Science and Societal Benefits

Current

Greenhouse gases

Water Cycle

Precipitation

Disaster/ Forest

Cloud/ Aerosols/ Vegetation

Greenhouse gases

Future

Cloud/Aerosol Radiation Budget

EarthCARE
CPR:
Cloud Profiling Radar

Greenhouse gases *(MOE Mission)*

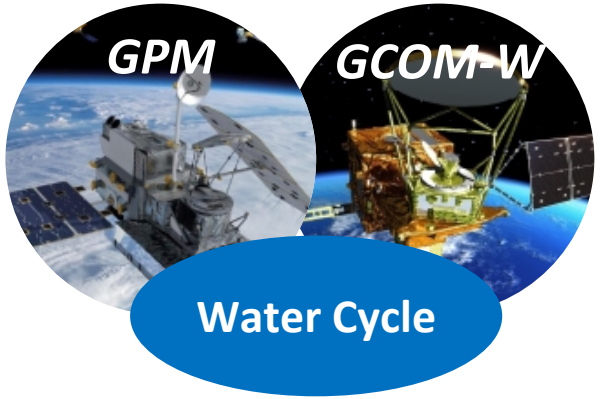
Water Cycle *(JAXA Mission)*

Disaster/ Mapping

Disaster/ Forest

Updates since last CGMS Plenary

Global Satellite Mapping of Precipitation (GSMaP)



- JAXA has participated in the **WMO Space-based weather and climate extremes monitoring (SWCEM)** project with Global Satellite Mapping of Precipitation (GSMaP) for monitoring extremes.
- **The GSMaP data was used in Figure 10.8 in the IPCC AR6** WG1 Full report released in 2021, which showed the climate model evaluation, and the chapter 10 also showed the acknowledgment to JAXA for providing the GSMaP.

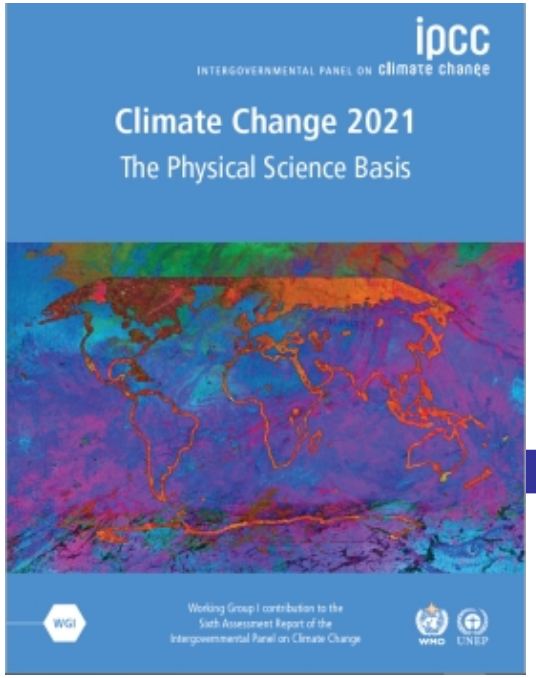
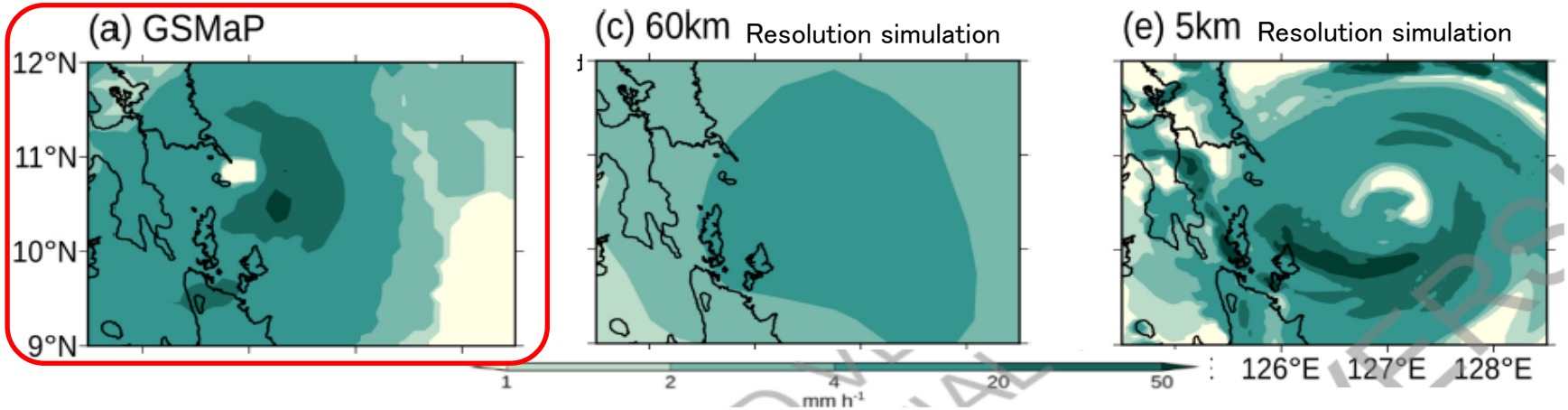


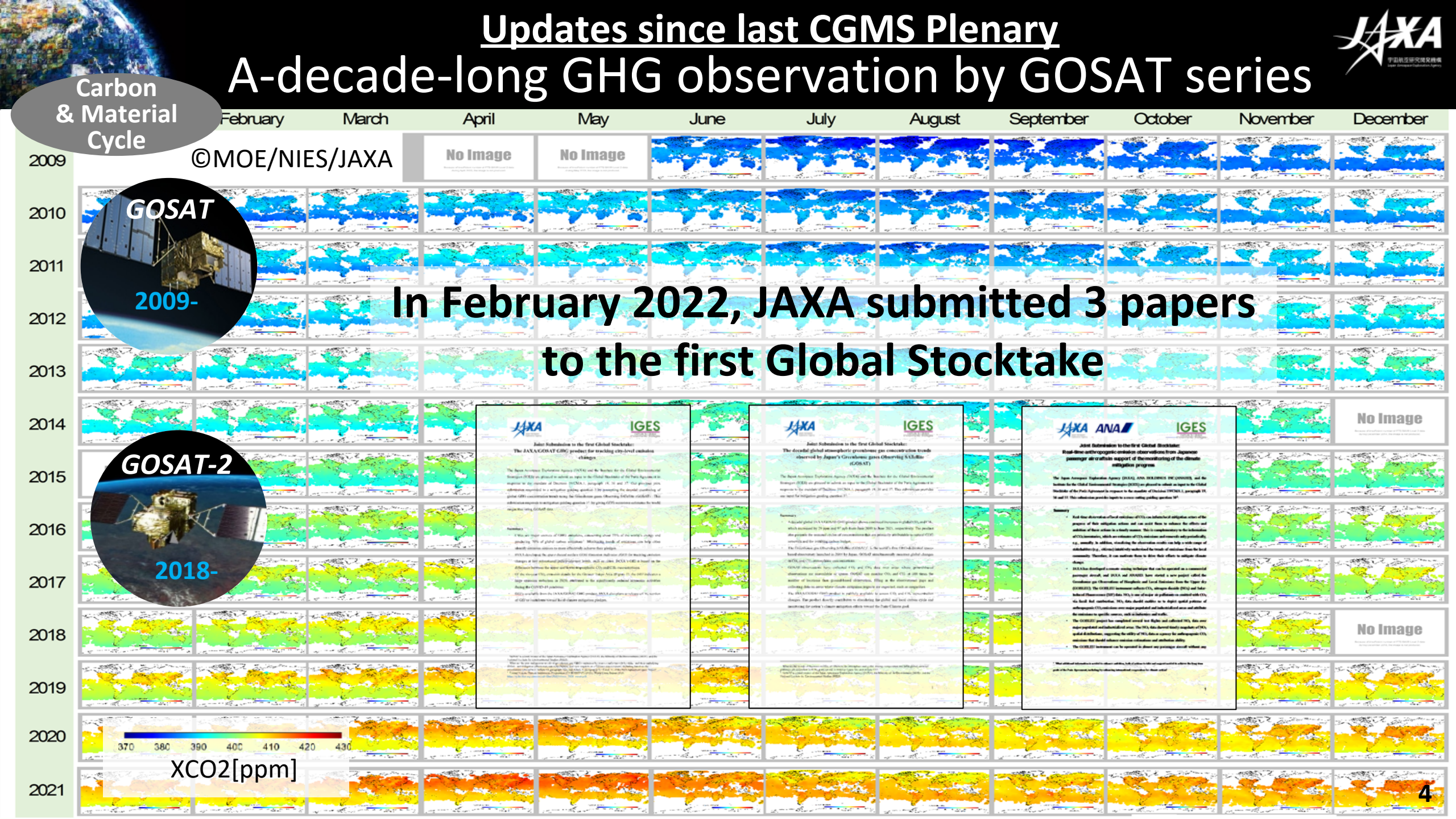
Figure 10.8 in IPCC AR6 WG1 Full report



Comparison of precipitation from GSMaP and numerical simulations (60 km and 5 km resolution) for the case of Typhoon Haiyan.

A-decade-long GHG observation by GOSAT series

Carbon & Material Cycle

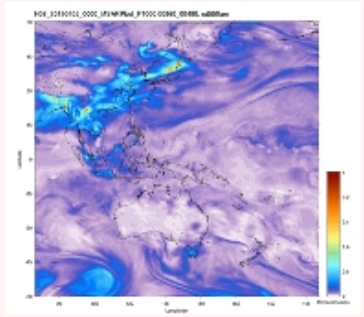


In February 2022, JAXA submitted 3 papers to the first Global Stocktake

Satellite and Model Collaborations toward Earth Environment Predictions

Alert for Public Health

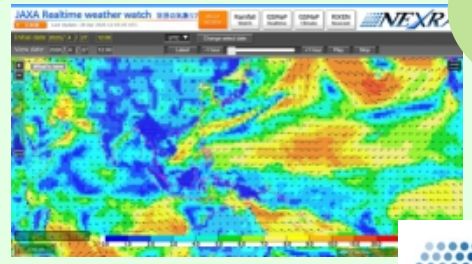
with JMA, MRI, NIES, Kyushu Univ.



Aerosol Model

with U. Tokyo, RIKEN

Severe Weather Heavy Rainfall, Flood



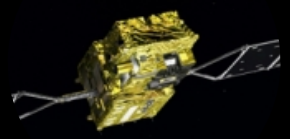
NEXRA

Atmospheric Model

Aerosol

GSMaP

Interaction



Satellite Data

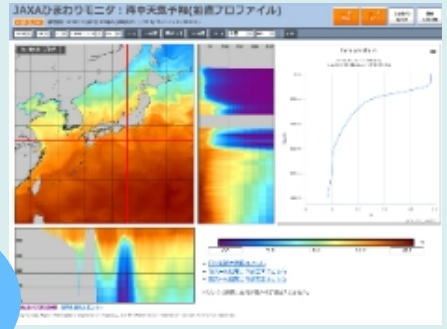
Interaction

SST

GSMaP Down SW

ECVs

Ocean Model



Fisheries, Ocean Transport, Climate

with JAMSTEC, RIKEN

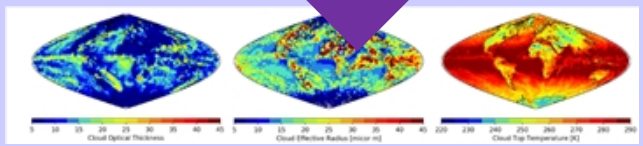
Land/River Model

TODAY'S EARTH
Land surface simulation by JAXA and UTokyo

with U. Tokyo

Drought, Flood, Water-related Hazard

Climate Model & Earth System Model



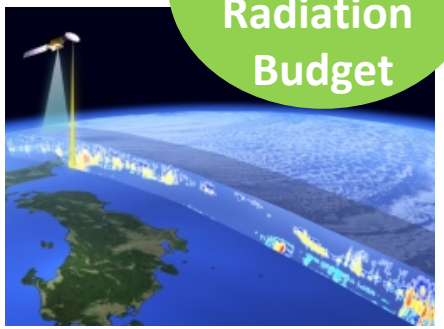
TOUGOU Integrated Research Program for Advancing Climate Models

with U. Tokyo, JAMSTEC, etc.

Future Missions for Climate & Water: EarthCARE (JFY2023) & GOSAT-GW (JFY2023)

To be launched in JFY2023

Cloud/ Aerosol Radiation Budget



- Europe-Japan joint mission
- 3 dimensional global distributions of cloud and aerosol to contribute to precise understanding of climate change
- JAXA and NICT provides world's first satellite-based cloud vertical motion by the Clod Profiling Radar (CPR) with 94 GHz with Doppler Capability at 0.8 km spatial resolution.

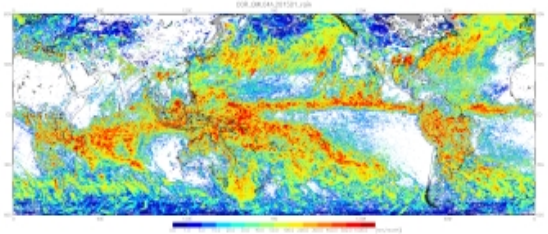
Orbit	Sun-synchronous sub-recurrent orbit Altitude: approx. 400km Inclination angle: 97.05° Local Sun Time at Desc.: 14:00 Revisit time: 25 days
Instruments	**- Cloud Profiling Radar (CPR)** by NICT & JAXA - Atmospheric Lidar (ATLID) by ESA - Multi-Spectral Imager (MSI) by ESA) - Broad-Band Radiometer (BBR) by ESA
Mass	Approx. 2.2 tons at launch
Designed lifetime	3 years

To be launched in JFY2023

Water Cycle

Green-house gases

AMSR3 for both snow & rain



- Carrying two instruments, AMSR3 and TANSO-3.
  - AMSR3 (JAXA) will succeed AMSR series observations with adding new high frequency channels (166 & 183 GHz) for snow fall retrievals and water vapor analysis for numerical weather prediction.
  - TANSO-3 (led by Ministry of Environment in Japan) uses imaging spectrometer technology to measure CO2, CH4 and NO2 globally with medium and locally with high spatial resolution.

Orbit	Sun-synchronous sub-recurrent orbit Altitude: approx. 666km Inclination angle: 98.06° Local Sun Time at Desc.: 1:30 +/- 15 min Revisit time: 3 days
Instruments	**- Advanced Microwave Scanning Radiometer 3 (AMSR3)** **- Total Anthropogenic and Natural emissions mapping SpectrOmeter-3 (TANSO-3)** (for Ministry of Environment in Japan (MOE))
Mass	Approx. 2.6 tons at launch
Designed lifetime	**7 years**

Improvements of AMSR Series

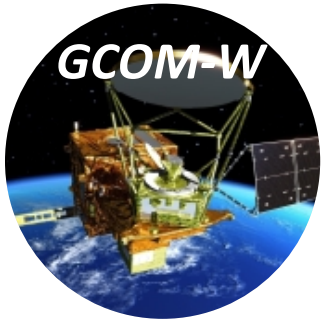
1987

MSR

2002-2011

AMSR

AMSR-E



2012-present

Succeed AMSR-E observation

AMSR2

after 2023

Continue & improve AMSR-E/AMSR2 observation

AMSR3

Sensor	MOS-1/MSR	ADEOS-II/AMSR	Aqua/AMSR-E	GCOM-W/AMSR2	GOSAT-GW/AMSR3
Coverage	Direct receive only	Global			
Swath	317km	1600km	1450km	1617km	> 1530km
Frequencies (GHz)	2 (23,31)	9 (6.9,10.65,18, 23,36,50,52,89)	6 (6.9,10.65,18,23, 36,89)	6 (6.9/**7.3**,10.65,18,23, 36,89)	8 (6.9/7.3,**10.25**/10.65,18,23, 36,89,**166**,**183**)
Polarization	Mixed V and H	V and H	V and H	V and H	V and H (166/183 are V only)
Antenna Size	0.5m	2.0m	1.6m	2.0m	2.0m
Spatial Res.	23km@31GHz	8x14km@36GHz	8x14km@36GHz	7x12km@36GHz	7kmx11km@36GHz

Long-term precipitation observations by Spaceborne Precipitation Radar

1995 2000 2005 2010 2015 2020 2025 2030

TRMM/PR
Ku-band (13.8GHz)
1997 - 2015

Overlap
-> calibrate

GPM/DPR
Ku-band (13.6GHz)
Ka-band (35.5GHz)
2014-

PMM/KuDPR (TBC)
Ku-band (13.6GHz) **With Doppler obs.**

A review of the different operational applications of spaceborne precipitation radars within the International Precipitation Working Group (IPWG) community

May 4, 2021

Contributors by alphabetical order:

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Report coordinated by IPWG co-Chairs:
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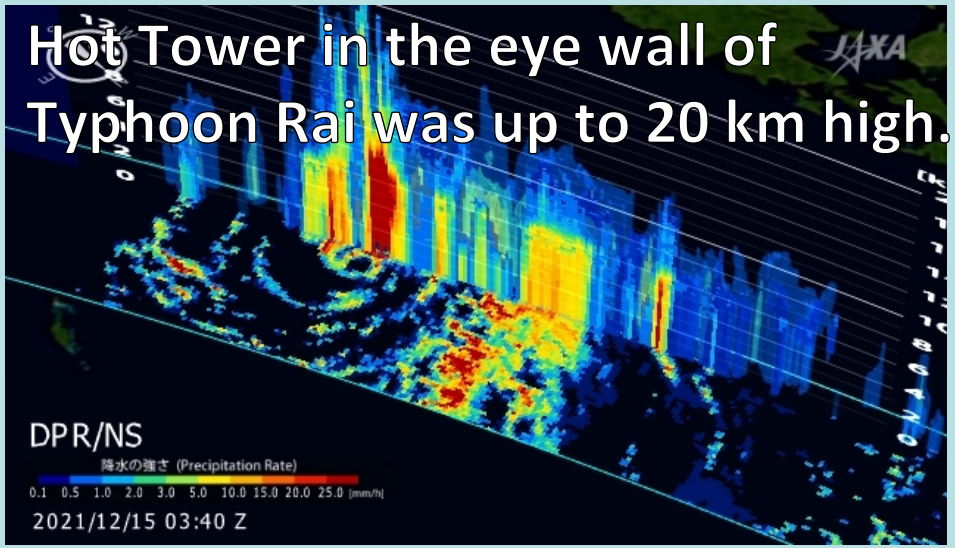
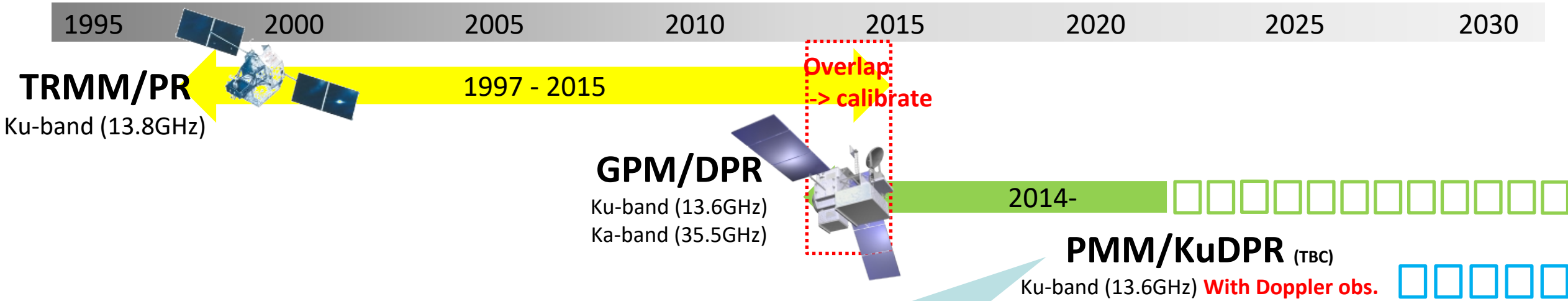
Report reviewing operational applications of precipitation radars by IPWG Published in May 2021

- The Japan Meteorological Agency (JMA) started the DPR assimilation in the meso-NWP system on March 24, 2016.
- Assimilation of GPM/DPR improved the prediction of rainfall location in meso-scale, which is important for disaster prevention.



Long-term precipitation observations by Spaceborne Precipitation Radar



- *JAXA Mission Definition Review (MDR) for the next generation Precipitation Radar satellite was completed in August 2021.*
- *The IPWG report and the letter by CGMS, supported by CGMS members last year, was well received as requirements from international precipitation communities in the MDR.*
  JAXA appreciates the efforts by CGMS and IPWG to support the new mission.
- *In December 2021, Implementation Plan of the "Basic Plan on Space Policy" noted the Precipitation Radar Satellite Phase A activity.*
- *In January 2022, Precipitation Measuring Mission (PMM) Pre-Project Team was established on for the JAXA Spacecraft carrying the Ku-band Doppler Precipitation Radar.*

SUMMARY

Updates since the last CGMS 2021

- In the IPCC AR6 WGI report, JAXA's GSMaP precipitation product is directly used, which is also contributing to the WMO Space-based weather and climate extremes monitoring project.
- To contribute the first Global Stocktake, JAXA continuously provide the data and our advanced research products (partial column concentration), for carbon cycle researchers.
- We also collaborate with various model communities to utilize satellite data in their models to enhance future predictions and contribute to science and society.

Medium to long-term future plans

- As the near-term future missions for climate and water, EarthCARE, jointly developed with ESA, and GOSAT-GW, jointly with MOE and NIES, are both planned to be launched in JFY2023.
- *In January 2022, Precipitation Measuring Mission (PMM) Pre-Project Team was established on for the JAXA Spacecraft carrying the Ku-band Doppler Precipitation Radar, which is following mission to TRMM and GPM.*

Coordination Group for Meteorological Satellites

JAXA CGMS