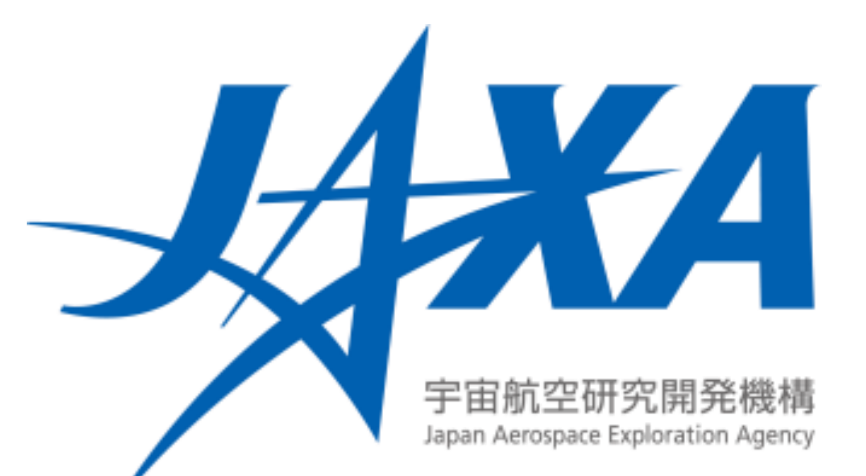




8p.01

# JMA and JAXA



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## JMA

- **Himawari-8**: Launched on 7 Oct. 2014, started operation on 7 Jul. 2015
- **Himawari-9**: Launched on 2 Nov. 2016, under standby status until 2022
- New service and products
  - HimawariRequest: NMHS users in Himawari8/9 coverage area can request target area observation
    - JMA expects the service to support disaster risk reduction activities in the Asia Oceania region
  - ASwind (AMV-based surface wind): Sea surface winds estimated from low-level AMVs for Tropical Cyclone monitoring (Fig.1)
    - 20 km spatial res, every 30 min (full-disk)
  - AOD (Aerosol Optical Depth): retrieval from VIS and NIR bands using GCOM-C algorithm developed by JAXA
    - Scheduled to be used for dust monitoring and data assimilation

- **Himawari follow-on program**
  - The Implementation Plan of the Basic Plan on Space Policy
    - "By FY2023 Japan will start manufacturing the Geo meteorological satellites that will be the successors to Himawari-8 and -9, aiming to put them into operation in around FY2029"
  - JMA started considering the next Geo satellite program, keeping in mind the Vision for WIGOS in 2040. It is examining user requirement, conducting impact assessment of candidate instruments and technological trend surveys in Japan/US/Europe
  - Instrument to be considered
    - Enhanced VIS/IR imager, Hyper spectral IR sounder, Lightning imager,,,
  - OSSE for a hyperspectral IR sounder is conducted in global and regional data assimilation system
    - Geo-HSS is simulated from ERA5 (ECMWF re-analysis 5), assuming MTG/IRS
      - Full disk scan every hour, 30km spatial spacing (at the moment)
    - Apply the nearly operational processing (ch selection, obs error assignment, bias correction, thinning)
    - Assimilate radiances in global OSSE and temperature & relative humidity profiles in regional OSSE
    - Preliminary results of cycle assimilation experiments show improvement in forecasts of Typhoon track and heavy precipitation (Fig.2 & 3)
    - Plan to assess various cases, different obs settings (scanning frequency, area, obs error), improve assimilation processing, and evaluate FY-4/GIIRS

Band	Central Wavelength [μm]	Spatial Resolution
1	0.43 - 0.48	1km
2	0.50 - 0.52	1km
3	0.63 - 0.66	0.5km
4	0.85 - 0.87	1km
5	1.60 - 1.62	2km
6	2.25 - 2.27	2km
7	3.74 - 3.96	2km
8	6.06 - 6.43	2km
9	6.89 - 7.01	2km
10	7.26 - 7.43	2km
11	8.44 - 8.76	2km
12	9.54 - 9.72	2km
13	10.3 - 10.6	2km
14	11.1- 11.3	2km
15	12.2 - 12.5	2km
16	13.2 - 13.4	2km

Fig.2: Preliminary results of global OSSE: forecast scores of representative field and typhoon track forecast (NH/TR/SH/JP/NWP)

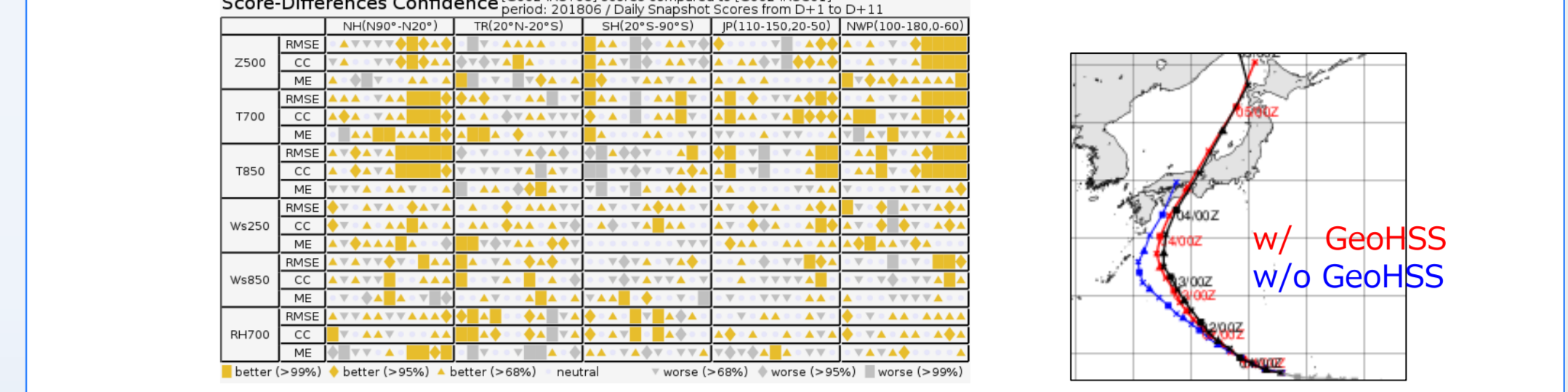


Fig.3: Preliminary results of regional OSSE: 21-hour rainfall forecast (3-hour accumulated rainfall)

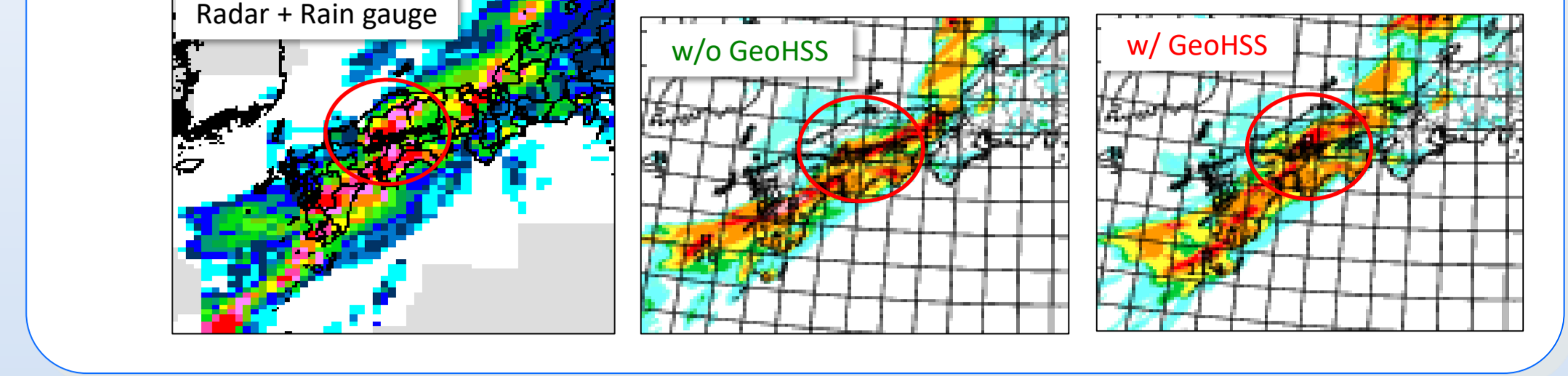
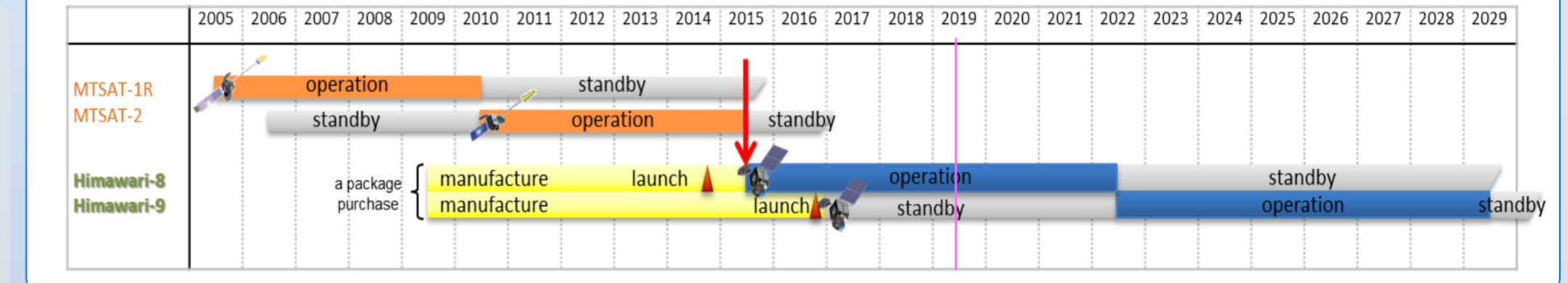
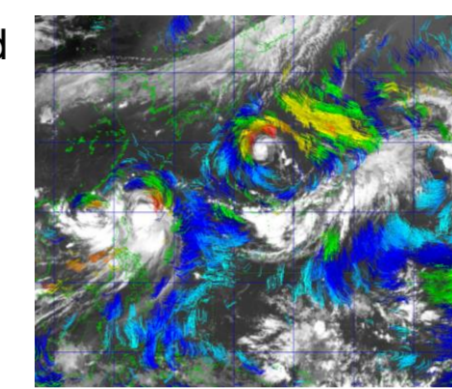


Fig.1: AMV-based surf wind ASWinds from full-disk imagery at 0.64 μm band. The background is 10.4 μm band image. (03UTC 26 July, 2017)



## JAXA

### AMSR2 on GCOM-W May 2012~



- Long-term observation of water and energy cycle
- **GCOM-W** (Global Change Observation Mission – Water)
  - Sun-synchronous orbit at 700 km altitude, 98.186 degrees inclination and 13:30 LT in descending node
- **AMSR2** (Advanced Microwave Scanning Radiometer 2)
  - Conical scanning, dual polarization, multi frequency MW imager
  - Retrieve various water-related ECVs including new products of all-weather sea-surface wind speed, total precipitable water over land
  - Predecessor Aqua/AMSR-E was reprocessed for long-term dataset to be consistent to AMSR2
- All standard products are available on JAXA G-portal: <https://gportal.jaxa.jp/gpr>
- Research products are available on GCOM-W Research Product Distribution Service: [https://suzaku.eorc.jaxa.jp/GCOM\\_W/research/resdist.html](https://suzaku.eorc.jaxa.jp/GCOM_W/research/resdist.html)
- **AMSR2 follow-on mission**
  - Equivalent to AMSR2 except additional high frequency ch (166 & 183GHz) for solid precipitation retrieval and water vapor sounding in NWP
  - Share satellite bus with GOSAT-2 follow-on mission (666km alt, 13:30 LT in ascending node)
    - Finer FOV (5% less), narrower swath width (1535km)
  - Target launch in JFY 2022 (TBD)
    - Currently prepare for project approval review and expect to start phase-B in late 2019

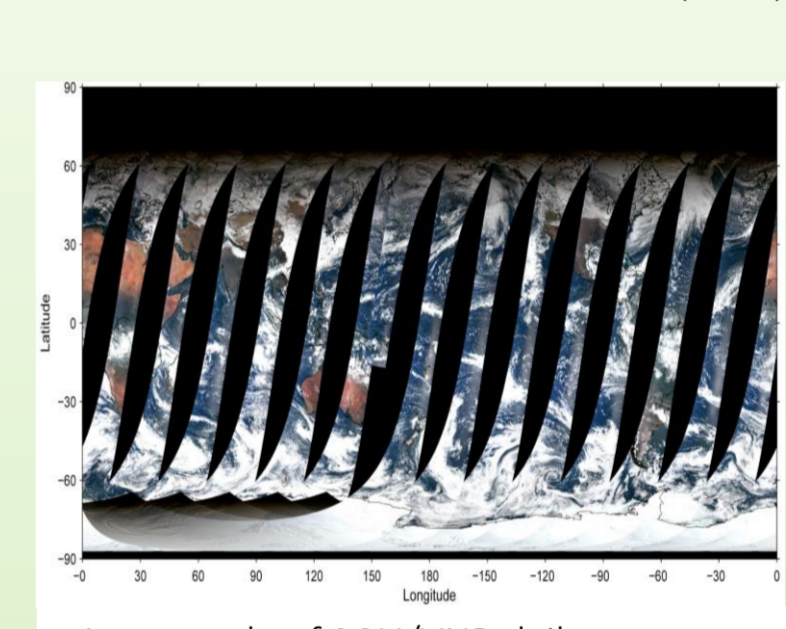
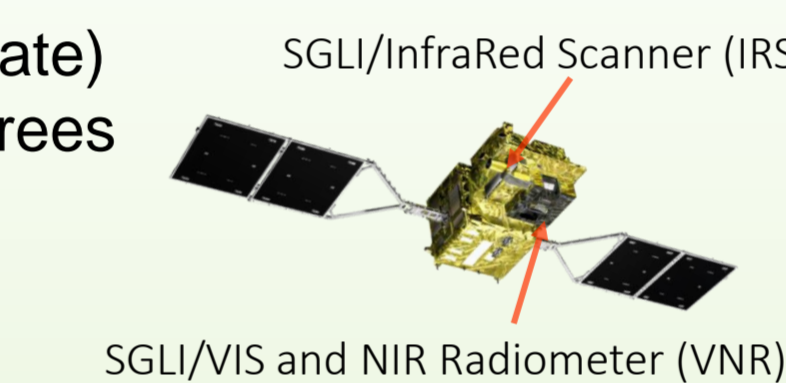
Freq. [GHz]	Temp. res.	Beam width (-3dB) (res. at surface)
6.925/7.3	< 0.34 K	1.8° (35km x 62km)
10.65	< 0.70 K	1.2° (24km x 42km)
18.7	< 0.70 K	0.65° (14km x 22km)
23.8	< 0.60 K	0.75° (15km x 26km)
36.5	< 0.70 K	0.35° (7km x 12km)
89.0 A/B	< 1.20 K	0.15° (3km x 5km)

S	Brightness Temperature
T	Total Precipitable Water (over Ocean)
D	Total Cloud Liquid Water Content
P	Precipitation
S	Sea Surface Temperature
S	Sea Surface Wind Speed
S	Sea Ice Concentration
S	Snow Depth
S	Soil Moisture Content
R	All-weather Sea Surface Wind Speed
E	10-GHz Sea Surface Temperature
S	Land Surface Temperature
S	Thin Ice Detection
S	Total Precipitable Water over Land

### SGLI on GCOM-C Dec. 2017~



- Long-term observation of the aerosol, cloud, and ecosystem
- **GCOM-C**: (Global Change Observation Mission – Climate)
  - Sun-synchronous orbit at 798 km altitude, 98.6 degrees inclination and 10:30 LT of descending node
- **SGLI** (Second-generation Global Imager)
  - SGLI-VNR (Vis and NIR Radiometer) and SGLI-IRS (IR Scanner)
  - Characterized by 250 m resolution (for vegetation, phytoplankton, sea ice), along-track slant view (biomass, land cover), and polarization (aerosol)
  - Polarimetry + near-UV improve aerosol products
  - Algorithm is common for SGLI and Himawari-8
- All standard products (L1,L2,L3) are available on JAXA G-portal: <https://gportal.jaxa.jp/gpr>



An example of SGLI/VNR daily coverage (5 Jan2018)

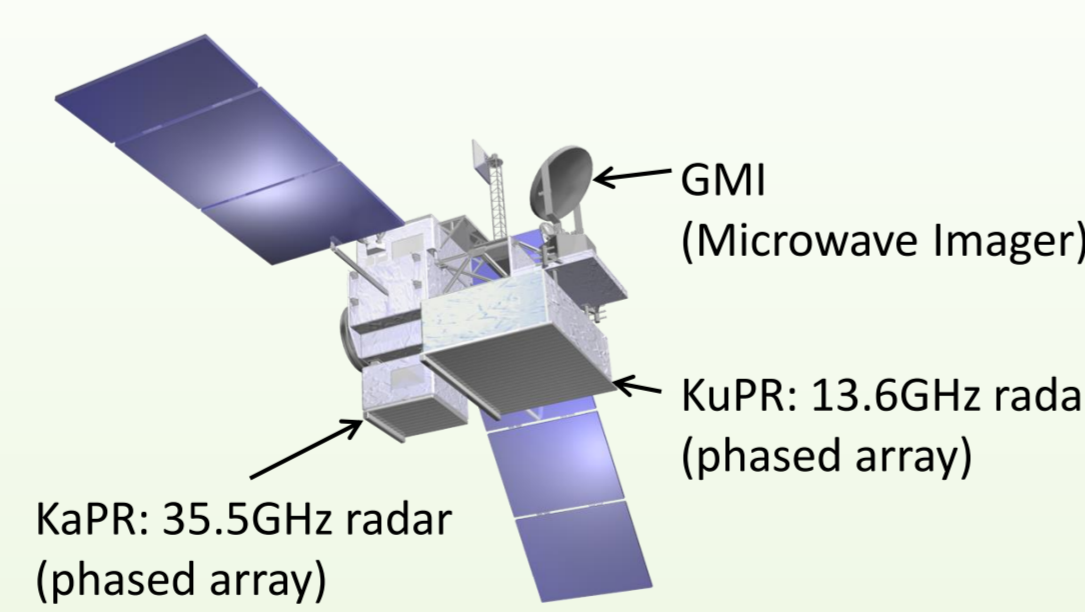
Launch Date	23 Dec. 2017
Weight	2,000kg
Orbit	Sun-synchronous (descending local time: 10:30), Altitude: 798km, Inclination: 98.6deg
Mission Life	5 years (3 satellites; total 13 years)
Scan	Push-broom electric scan (VNR) / Wisk-broom mechanical scan (IRS)
Scan width	1150km cross track (VNR: NP & POL) / 1400km cross track (IRS: SWIR & TIR)
Spatial resolution	250m (land and coast), 500m (TIR), 1km
Polarization	3 polarization angles for POL
Along track tilt	Nadir for VN, SW and TIR, & +/-45 deg for POL

CH	λ, nm	Δλ, nm	W <sub>m</sub> , W/m <sup>2</sup> /sr/μm	Kv, Kelvin	Kc, NEAT	SNR@L <sub>1</sub>	IFOV, m	Tilt, deg
VN1	380	10	60	210	250	250	1000	0
VN2	412	10	75	250	400	250	1000	0
VN3	443	10	64	400	300	250	1000	0
VN4	490	10	53	120	400	250	1000	0
VN5	530	20	41	350	250	250	1000	0
VN6	565	20	33	90	400	250	1000	0
VN7	673.5	20	23	62	400	250	1000	0
VN8	673.5	20	25	210	250	250	1000	0
VN9	763	12	40	350	1200*	250	1000*	0
VN10	868.5	20	8	30	400	250	1000	0
VN11	868.5	20	30	300	200	350	1000	0
POL1	673.5	20	25	250	250	1000	+45	0
POL2	868.5	20	30	300	250	1000	+45	0
SW1	1050	20	57	248	500	1000	0	0
SW2	1380	20	8	103	150	1000	0	0
SW3	1630	200	3	50	57	250	1000	0
SW4	2210	50	1.9	20	211	1000	0	0
TIR1	11080	0.7	300K	340K	0.2K	250 / 500	1000	0
TIR2	12000	0.7	300K	340K	0.2K	250 / 500	1000	0

### DPR on GPM (Global Precipitation Measurement) Feb. 2014~



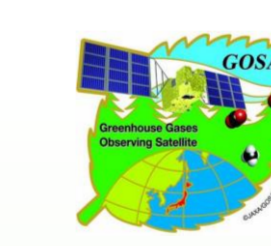
- GPM (Global Precipitation Measurement): an international mission consisting of the GPM core observatory and constellation satellites for high accurate and frequent global precipitation observation
  - Core observatory carries 2 instruments : **DPR** and **GMI** (GPM Microwave Imager)
- **DPR** (Dual-frequency Precipitation Radar)
  - **KuPR** (13.6 GHz) and **KaPR** (35.5 GHz)
  - Change KaPR scan pattern on 21 May 2018
    - Expand swath of 125km (25 bins) to 245 km (49 bins)
    - Dual frequency observations are available in a full swath
  - JMA has operationally assimilated RH profiles estimated from DPR reflectivity in regional data assimilation system since Mar. 2016
  - The DPR 3-dimensional information, which MW radiometers cannot provide, improved heavy rainfall forecast
  - <https://gportal.jaxa.jp/gpr>



Satellite	GPM core		TRMM	
	Radar	KuPR	KaPR	PR
Observation frequency	13.597 & 13.603 GHz	35.547 & 35.553 GHz	13.796 & 13.802 GHz	
Swath width	245 km	125 km	215 km	
Horizontal resolution	5 km	5 km	4.3 km	
Range resolution	125 m	125/250 m	250 m	
Minimum Ze and rain rate	18 dBZ	12 dBZ	18 dBZ	0.3 mm/h
Launch date (JST)	28 Feb. 2014		28 Nov. 1997	
Orbit (inclination)	Non-sun-synchronous (65 deg)		Non-sun synchronous (35 deg)	
Altitude	407 km		350 km	

- **GSMaP** (Global Satellite Mapping of Precipitation)
  - Blended MW and IR precipitation hourly product at 0.1-deg resolution.
  - GSMaP\_RNL: reanalysis version since Mar 2000
  - GSMaP\_MVK: 3 d latency
  - GSMaP\_NRT: 4 h latency
  - GSMaP\_NOW: 0 h latency
    - Extend to the global region using cloud motion estimated from Himawari/GOES/Meteosat in Jun. 2019
  - GSMaP\_RNC: nowcast developed by RIKEN
  - Improve Gauge-adjusted GSMaP\_NRT (v6) in Dec. 2018
    - Contribute to WMO SEMDP (space-based weather and climate extremes monitoring (SWCEM) demonstration project)
  - <https://sharaku.eorc.jaxa.jp/GSMaP>

### GOSAT Jan. 2009~

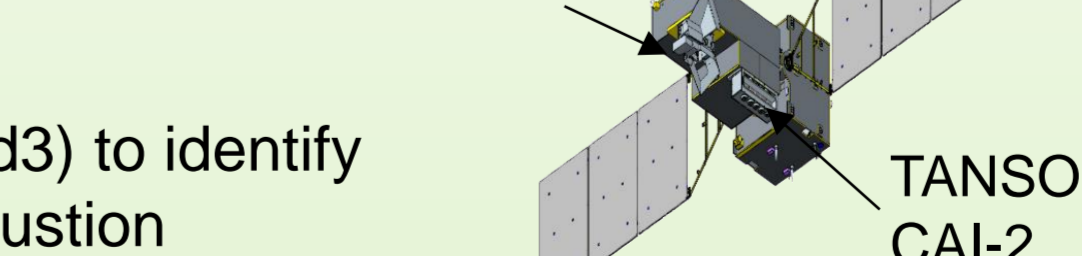


- GOSAT (Green house gases Observing SATellite)
- The world's first spacecraft to measure the concentrations CO<sub>2</sub> and CH<sub>4</sub>
- **TANSO-FTS** (Thermal And Near-infrared Sensor for carbon Observation - FTS)
  - 3 short-wave IR (SWIR) and 1 thermal IR (TIR) bands
  - Column density of CO<sub>2</sub> is mainly retrieved using 1.6 μm absorption
  - Newly retrieve partial-column densities in the upper and lower tropospheric CO<sub>2</sub> using both SWIR and TIR bands
- **TANSO-CAI** (TANSO-Cloud and Aerosol Imager)
  - 4 bands: 0.380, 0.674, 0.870, 1.60 μm
  - Toward 20 year operation: enough fuel, no significant degradation in batteries



### GOSAT-2 Oct. 2018~

- **TANSO-FTS-2**: 5 bands
  - Add CO measurement (band3) to identify CO<sub>2</sub> enhancement by combustion
  - Wider pointing angles
  - Fully customized obs pattern
  - Cloud avoiding pointing
- **TANSO-CAI-2**
  - Increase bands (4→10)
  - Multi-viewing capability to improve aerosol detection



Items	GOSAT/TANSO FTS	GOSAT-2/TANSO-FTS-2
Measurement Gases	CO <sub>2</sub> , CH <sub>4</sub> , O <sub>3</sub> , H <sub>2</sub> O	CO <sub>2</sub> , CH <sub>4</sub> , O <sub>3</sub> , H <sub>2</sub> O, CO
Footprint size (FOV)	10.5 km (15.8mrad)	9.7 km (15.8mrad)
Spectral Ranges (mm): target	band 1: 0.75-0.77 band 2: 1.56-1.72 band 3: 1.92-2.08 band 4: 5.5-14.3	band 1: 0.75-0.77: O <sub>3</sub> , Chlorophyll fluorescence band 2: 1.56-1.69 : CO <sub>2</sub> , CH <sub>4</sub> band 3: 1.92-2.33 : CO <sub>2</sub> , CO band 4: 5.5-8.4 : CH <sub>4</sub> band 5: 8.4-14.3 : CO <sub>2</sub> , O <sub>3</sub>
Observation Mesh	160km (5 points in the CT direction)	160km (5 points in the CT direction)
Scan duration	4, 2, 1.1 seconds / interferogram	4 seconds / interferogram
Sampling resolution	0.2cm <sup>-1</sup>	0.2cm <sup>-1</sup>
Effective Aperture size	Φ64mm	Φ73mm
Avoidance of the cloud	-----	Intelligent pointing