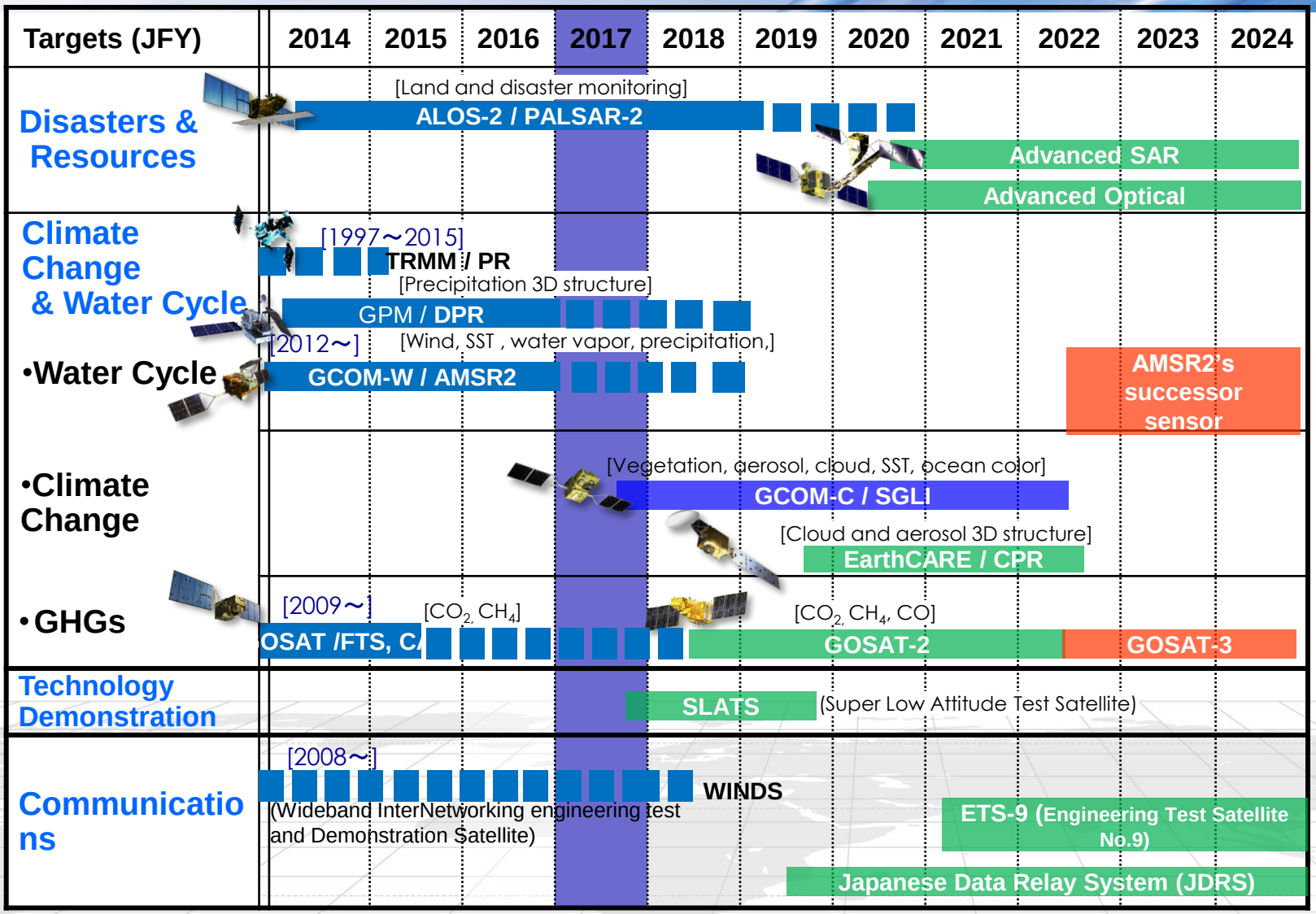
JAXA Status

Riko OKI (JAXA/EORC)

30th GEWEX SSG
January 29, 2018
Washington DC

Schedule of JAXA Satellites



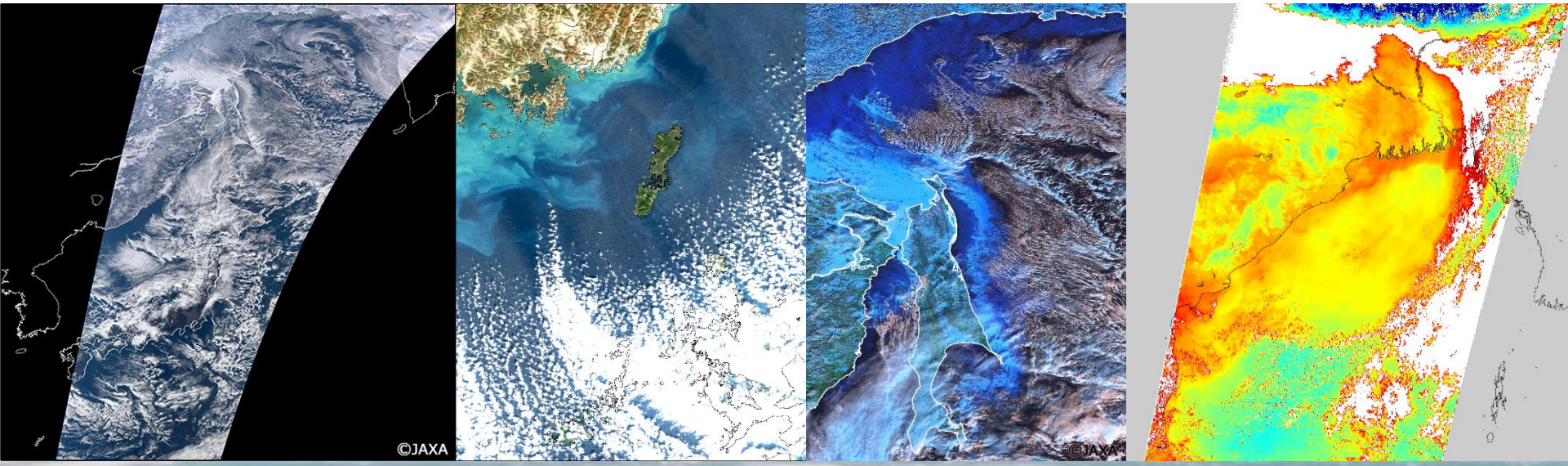
Mission status: On orbit (Extended Life Period) Development Study

GCOM-C Summary and Future Plan

- JAXA completed the development of GCOM-C and launched on December 23, 2017. We are conducting check out of the satellite in the normal condition.
- On orbit checkout phase will be finished at the end of March.
- After then, we will start the operation phase and conduct the initial CAL/VAL activity until December.
- We will release the SGLI products to the public at the end of this year via G-Portal.

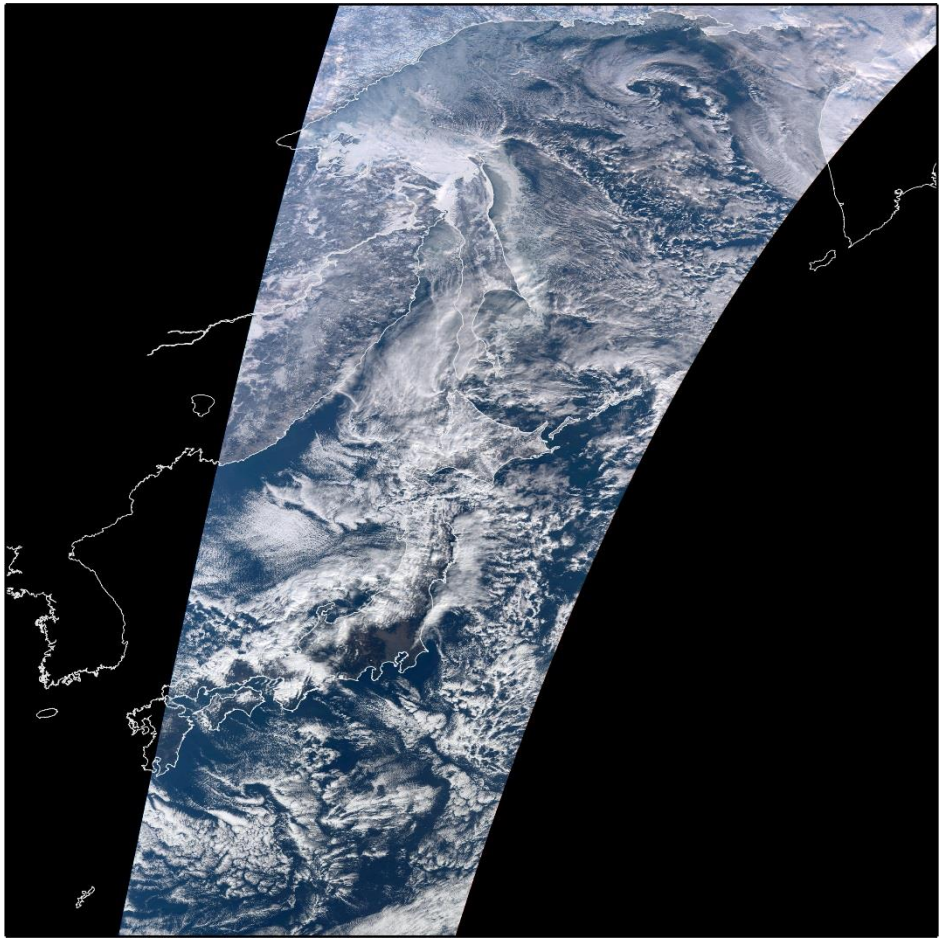
First light from GCOM-C SGLI

- We confirmed that VNR and IRS(SWI) channels functioned properly. JAXA opened the first light image to public on January 12, 2018 from the following web site. http://suzaku.eorc.jaxa.jp/GCOM_C/index.html
- On January 22nd, we got the first light image of SGLI of Thermal InfraRed (TIR) channel. As a result, we confirmed that the all of SGLI channels were available for observation.



気候変動観測衛星「しきさい」
Global Change Observation Mission-Climate “SHIKISAI”

SGLIによるオホーツク海の海氷分布と日本列島（１）
Color composite image around the Okhotsk Sea Ice



図は，気候変動観測衛星「しきさい」搭載のSGLIが2018年1月6日午前10時20分頃（日本時間）にオホーツク海から日本列島上空で取得した250m分解能の観測データを用いて，人間の肉眼での見た目に近い色で合成したトゥルーカラー合成画像※です。積雪，海氷や雲は白色に，海は紺色に，陸域は茶色に見えています。

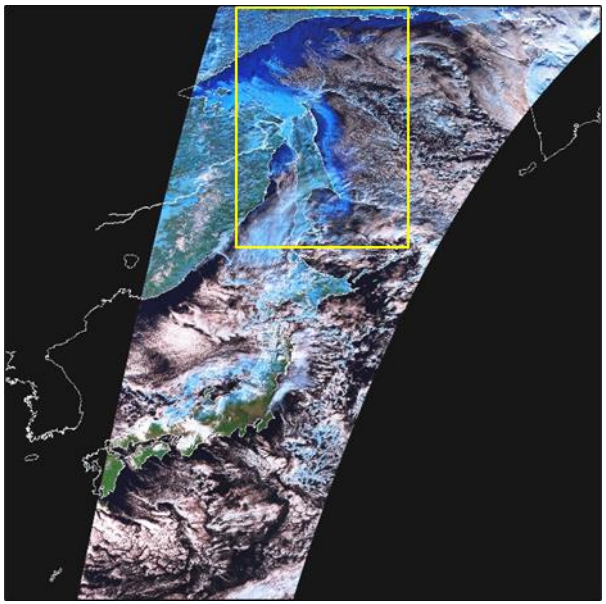
This image is a true color composite※ image of 250 m spatial resolution captured over the Okhotsuk Sea and Japan Islands with SGLI onboard the SHIKISAI around 10:20 on January 6th 2018 (JST). Snow, sea ice, and clouds are shown in white. Land and ocean areas are seen in dark brown and blue colors.

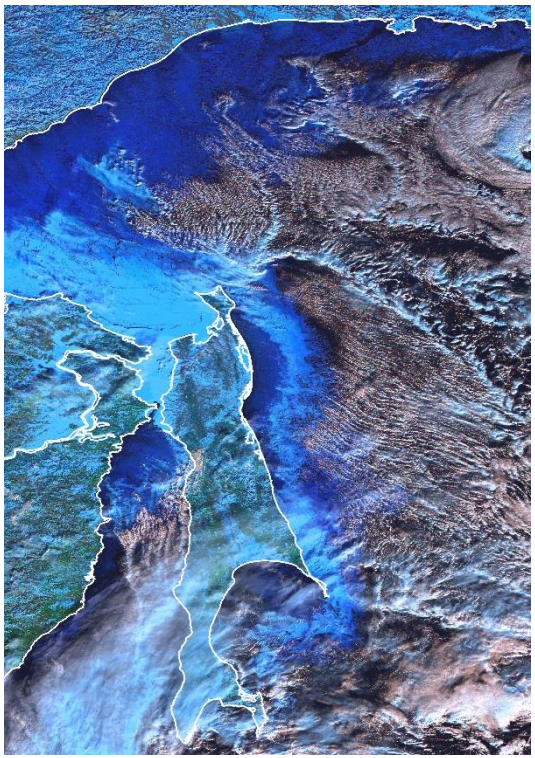
※赤，緑，青にSGLIのVN8, VN5, VN3の各チャンネル反射率を割り当てたRGB合成画像
Reflectances of SGLI VN8, VN5, VN3 channels are assigned to red, green, and blue colors

これらの図は、「しきさい」（GCOM-C）と地上局の通信確認のための試験電波により、平成30年1月1日から6日（日本時間）にかけて取得された観測画像です。
These images are obtained by using the test radio wave transmitted from GCOM-C/SGLI on January 1st to 6th, 2018 (JST).

気候変動観測衛星「しきさい」
Global Change Observation Mission-Climate “SHIKISAI”

SGLIによるオホーツク海の海氷分布と日本列島（２）
Color composite image around the Okhotsk Sea Ice





図は，気候変動観測衛星「しきさい」搭載のSGLIが2018年1月6日午前10時20分頃（日本時間）にオホーツク海から日本列島上空で取得した250m分解能の観測データによる疑似カラー合成画像※（左：全体図，右：黄枠内の拡大図）。積雪や海氷は濃い水色に表現されており，水雲（白色）や氷雲（積雪よりやや明るめの水色）と識別しやすくなっている。大陸からの冷たい季節風の吹き出しによって形成された海氷が，樺太の東岸に沿って海流に乗って南下している様子が捉えられている。

This image is a false color composite※ image of 250 m spatial resolution captured over the Okhotsk Sea and Japan islands with SGLI onboard the SHIKISAI around 10:20 on January 6th 2018 (JST). Snow and sea ice are shown in deep blue while water and ice clouds are seen in white and light blue, respectively. Sea ice are formed along the eastern coast of the Eurasia Continents and spreads along the east side of Sakhalin flowing down to the south.

※赤，緑，青にSGLIのSW3, VN11, VN8の各チャンネル反射率を割り当てたRGB合成画像
Reflectances of SGLI SW3, VN11, VN8 channels are assigned to red, green, and blue colors

これらの図は、「しきさい」（GCOM-C）と地上局の通信確認のための試験電波により、平成30年1月1日から6日（日本時間）にかけて取得された観測画像です。
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気候変動観測衛星「しきさい」
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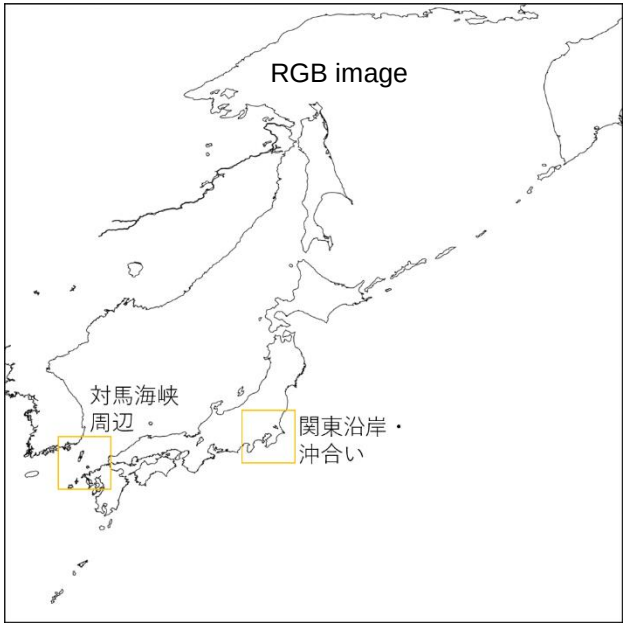
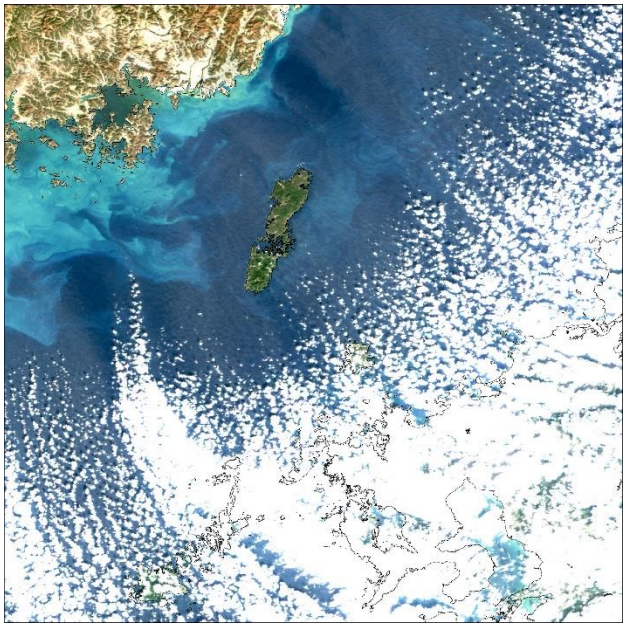
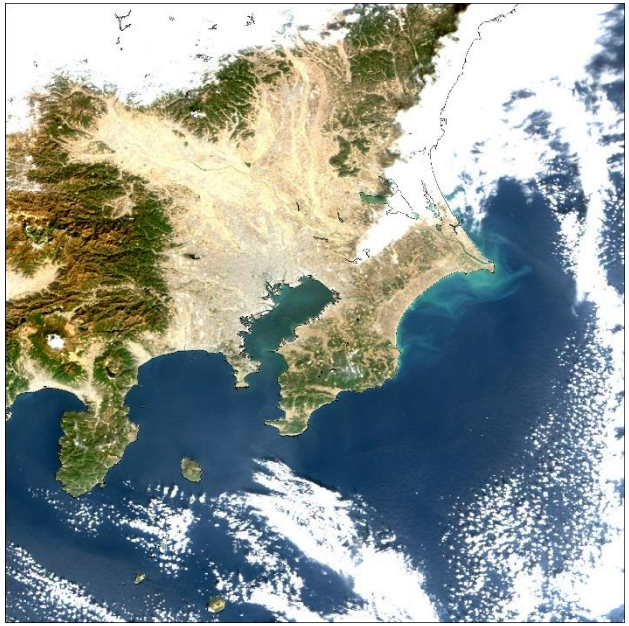
SGLIによる日本近海の海色
Images of ocean color around Japan







図は、気候変動観測衛星「しきさい」搭載のSGLIが250m分解能で観測した2018年1月1日午前11時10分頃（日本時間）の対馬海峡周辺域（中央）と2018年1月6日午前10時28分頃（日本時間）の関東沿岸・沖合い（右）のカラー合成画像です（左に画像の切り出し位置を示した地図を示す）。SGLIは暗い海面を高感度に観測可能な海洋観測用チャンネルを備えており、水中の懸濁物質やプランクトンの濃度差によって生じる僅かな色の違いを捉えることができます。図3に示すように、沿岸海域の海色の様子を詳細に観測することで、漁場予測や赤潮発生状況の把握に役立てられると期待されています。

These images are color composite* images of around Tsushima island (middle) and around Kanto area (right) observed with SGLI onboard the SHIKISAI around 11:10 on January 1st 2018 (JST). Locations of the images are shown in the left image. SGLI can observe the spatial distribution of ocean colors with the spectral channels of high sensitivity designed for ocean color observation in order to retrieve the concentrations of suspended matter and phytoplankton in water. These observations are useful for fishery prediction and the monitoring of red tide occurrence.

*赤，緑，青にSGLIのVN7, VN6, VN4の各チャンネル反射率を割り当てたRGB合成画像
*Reflectances of SGLI VN7, VN6, VN4 channels are assigned to red, green, and blue colors

これらの図は、「しきさい」（GCOM-C）と地上局の通信確認のための試験電波により、平成30年1月1日から6日（日本時間）にかけて取得された観測画像です。
These images are obtained by using the test radio wave transmitted from GCOM-C/SGLI on January 1st to 6th, 2018 (JST).

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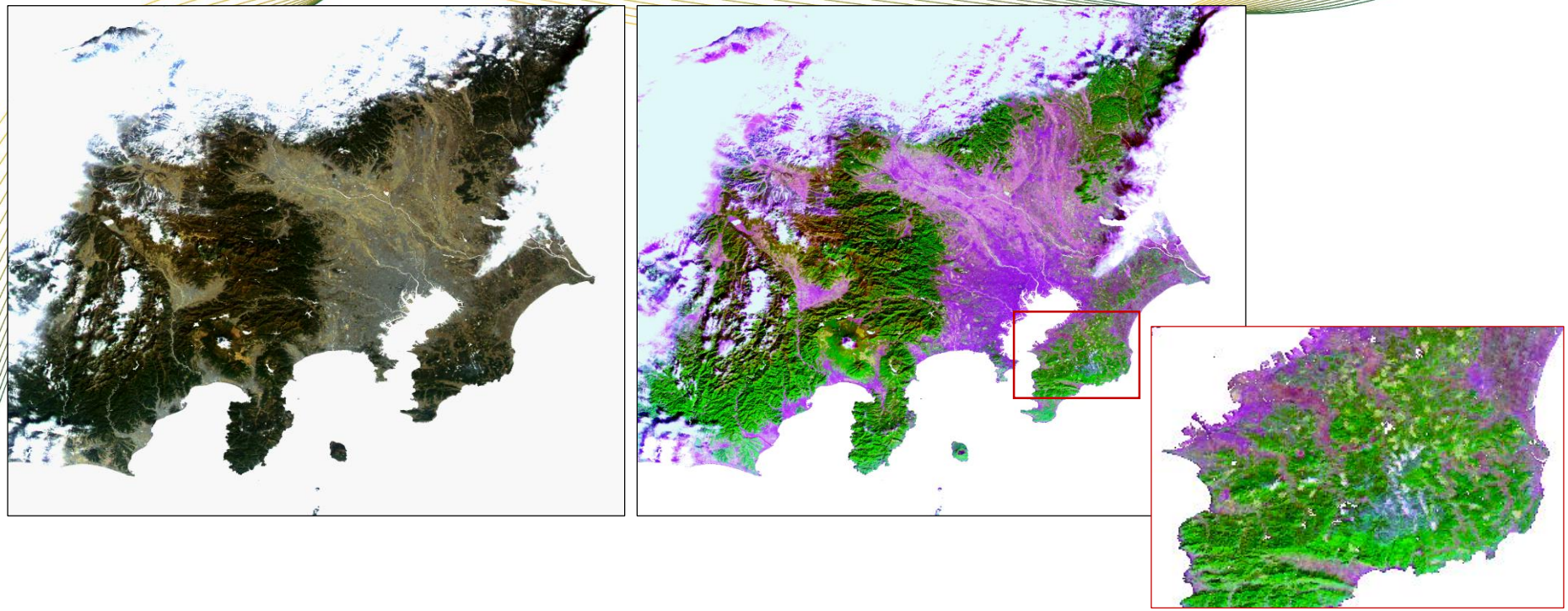
SGLIによる関東・中部地方の植生
Color composite image of vegetation in Japan



図は、気候変動観測衛星「しきさい」搭載のSGLIが2018年1月6日午前10時30分頃（日本時間）に関東上空で取得した250m分解能の観測画像で、左に人間の肉眼での見た目に近い色で合成したトゥルーカラー画像*、右に近赤外域の波長を使用して合成したナチュラルカラー画像を示す。静岡県や関東山地東側に広がる常緑針葉樹はトゥルーカラーでは暗く写り落葉性樹木との区別がはっきりしないが、植生に感度が高い近赤外域を用いるナチュラルカラーでは鮮やかな緑色で表されている。一方、房総半島等に点在するゴルフ場は、芝生が色褪せる時期のため、緑色ではなく薄黄色の斑点状に見えています（右下の拡大図参照）。**

The image shown in the left is a true color composite* image and the image in the right is a false color composite image of 250 m spatial resolution captured over Kanto area in Japan with SGLI onboard the SHIKISAI around 10:30 on January 6th 2018 (JST). Evergreen forests are seen in dark green in the true color image and are not discriminable, while in the false color image evergreen forests are clearly visible in bright green colors. On the other hand, small yellow patches are seen in the enlarged false color image shown in the lower right. These are golf courses covered with faded grasses in winter.**

*赤，緑，青にSGLIのVN8, VN5, VN3の各チャンネル反射率を割り当てたRGB合成画像
*Reflectances of SGLI VN8, VN5, VN3 channels are assigned to red, green, and blue colors

**赤，緑，青にSGLIのVN8, VN11, VN3の各チャンネル反射率を割り当てたRGB合成画像
**Reflectances of SGLI VN8, VN11, VN3 channels are assigned to red, green, and blue colors

これらの図は、「しきさい」（GCOM-C）と地上局の通信確認のための試験電波により、平成30年1月1日から6日（日本時間）にかけて取得された観測画像です。
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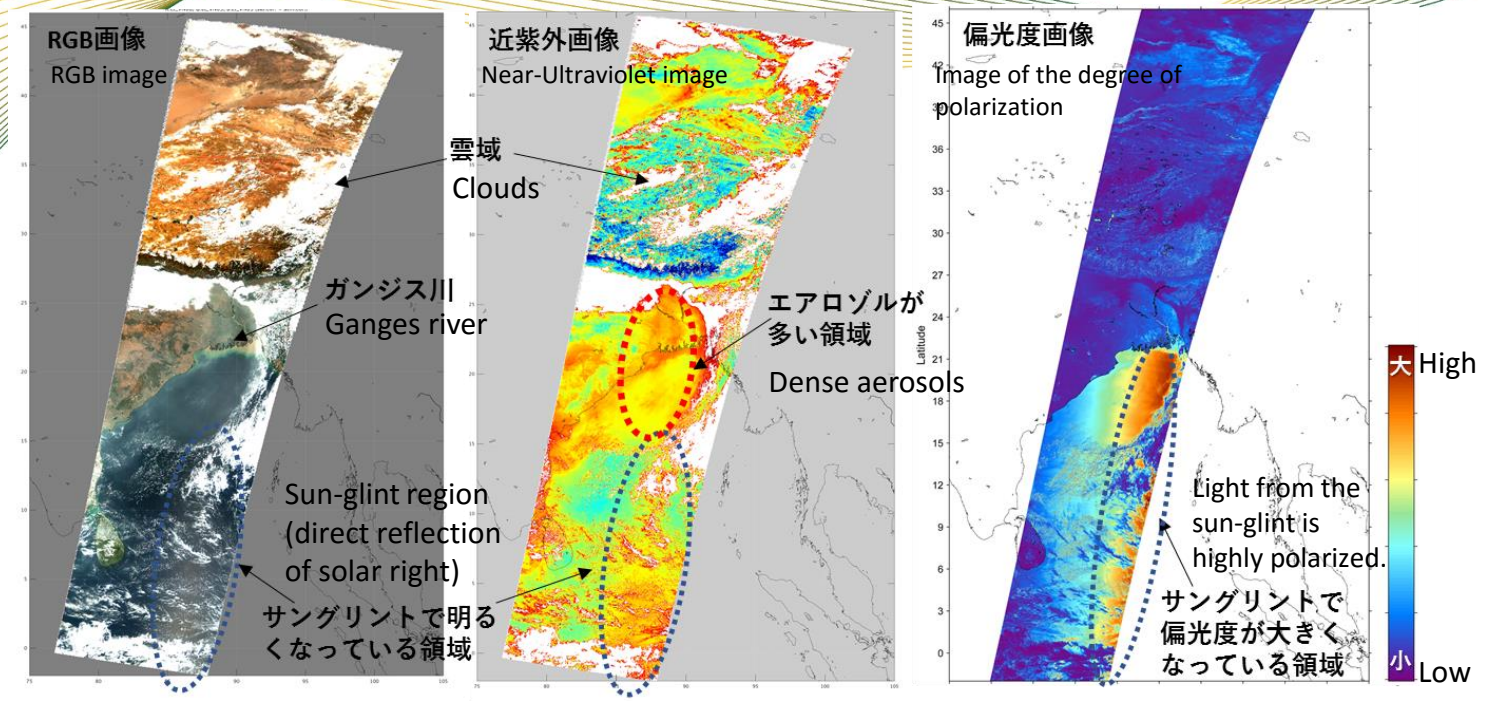
Global Change Observation Mission-Climate “SHIKISAI”

SGLIによるガンジス川付近のエアロゾル
Images of aerosol over Ganges river



図は、気候変動観測衛星「しきさい」搭載のSGLIが2018年1月3日午前11時40分頃（日本時間）にインド上空で取得した250m分解能の観測データによる合成画像で，左からトゥルーカラー合成画像*，VN01の近紫外域画像，PL2の偏光度画像をそれぞれ示している。SGLIは地表面からの反射の影響が少ない近紫外域の光を観測可能であり，また，赤や近赤外域の光の偏光を計測するチャンネルを持っています。近紫外域チャンネルそして偏光チャンネルを用いることで、陸上のエアロゾルの情報を従来よりも高精度に抽出することができます。近紫外域チャンネル画像では、ガンジス川下流の河口付近（画像中央）から海上にかけて非常に濃いエアロゾルが分布している様子が確認できます。また偏光度画像では、太陽光が海面で反射した光（サングリント）が偏光している様子を確認できます。今後、偏光観測機能の健全性、性能を確認した上で、エアロゾル観測に適した斜め45度方向に鏡筒を傾け、偏光チャンネルによるエアロゾル観測を行っていく計画です。

The images are (left) left is a true color composite* image, (middle) near-ultraviolet (NUV) image, and (right) degree of polarization (POL) image captured over Ganges river, India with SGLI onboard the SHIKISAI around 11:40 on January 3th 2018 (JST). Dense aerosols are seen around the mouth of Ganges river to coastal ocean in the NUV image. In the DPOL image the solar light reflected at ocean surface are seen to be highly polarized. SGLI can observe aerosols over land and ocean using the functions of NUV and polarization observations.

*赤，緑，青にSGLIのVN8, VN5, VN3の各チャンネル反射率を割り当てたRGB合成画像
*Reflectances of SGLI VN8, VN5, VN3 channels are assigned to red, green, and blue colors

これらの図は、「しきさい」（GCOM-C）と地上局の通信確認のための試験電波により、平成30年1月1日から6日（日本時間）にかけて取得された観測画像です。
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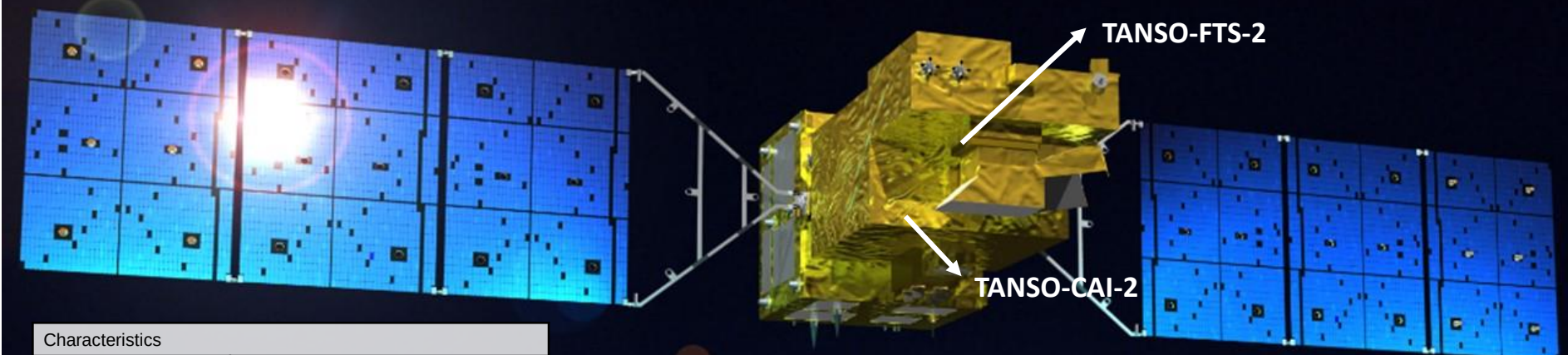
GOSAT-2 to be launched in 2018



Characteristics	
Life	5 years
Orbit	Sun-Synchronous (628km)
Mass	About 2 t
Launch	FY 2018
Observation	CO_2, CH_4 and CO

1. Simultaneous CO (carbon monoxide) measurement
2. All target mode capability
3. Cloud-avoiding pointing with onboard camera

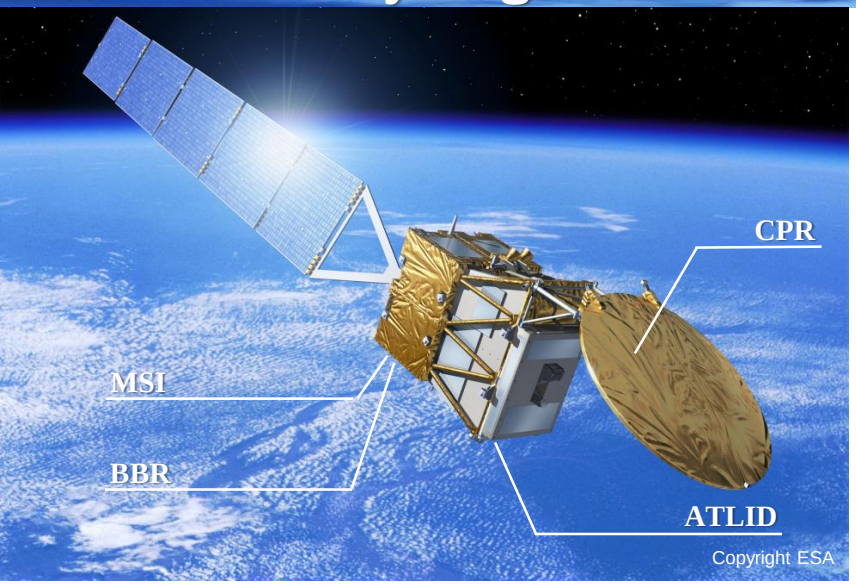
TANSO-FTS-2

	Band 1	Band 2	Band 3	Band 4	Band 5
Target Gases	O_2	CO_2, H_20	CO_2, CH_4, CO, H_20		
Spectral Coverage (μm)	0.75-0.77	1.56-1.69	1.92-2.33	5.5-8.4	8.4-14.3
Spectral Coverage (cm-1)	12,950 - 13,250	5,900 - 6,400	4,200 - 5,200	1,188 - 1,800	700 - 1,188
Spectral Resolution	0.2 cm^{-1}				
Exposure	4 sec				
IFOV	9.7 km				
Pointing	±40 deg. (Along track), ±35 deg. (Cross track)				
Polarimetry	Yes (P and S channels)			No	

TANSO-CAI-2 (radiometer)

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Spectral Band (nm)	333 - 353	433 - 453	664 - 684	859 - 879	1585 - 1675	370 - 390	540 - 560	664 - 684	859 - 879	1585 - 1675
Tilt	+20 deg. (Forward viewing)					-20 deg. (Backward viewing)				
Spatial Resolution	460 m				920m	460 m				920m
Swath	920 km									

EarthCARE
Synergetic Obaservation by Four Instruments

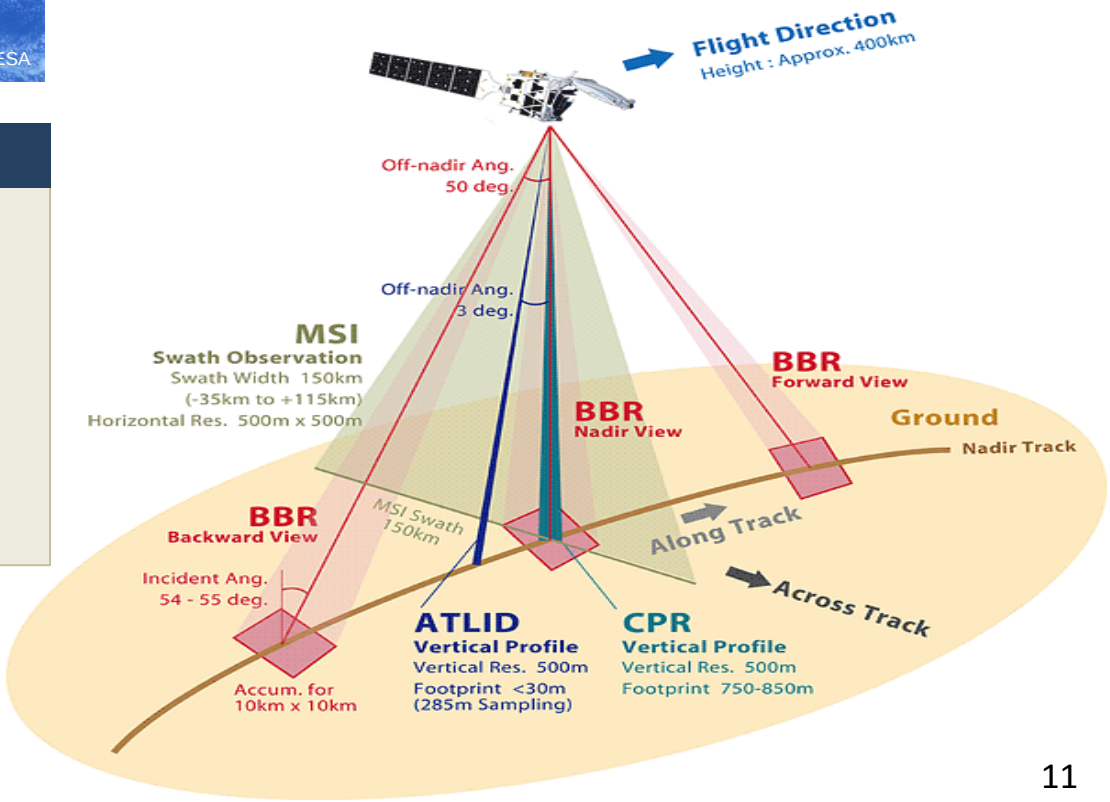


Synergetic Observation by Four Instruments on Global Scale

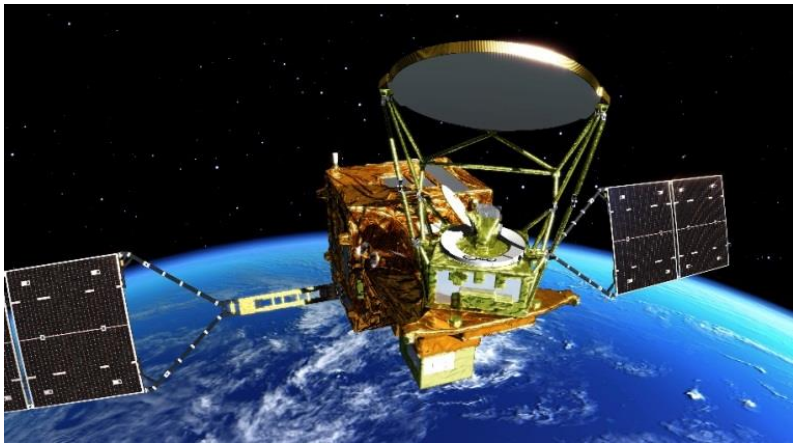
- Three-dimensional structure of aerosol and cloud including vertical motion
- Radiation flux at top of atmosphere
- Aerosol – cloud – radiation interactions

Observation Instruments on EarthCARE

CPR	Cloud Profiling Radar	NICT JAXA
ATLID	Atmospheric Lidar	esa
MSI	Multi-Spectral Imager	esa
BBR	Broadband Radiometer	esa



Overview of GCOM-W and AMSR2



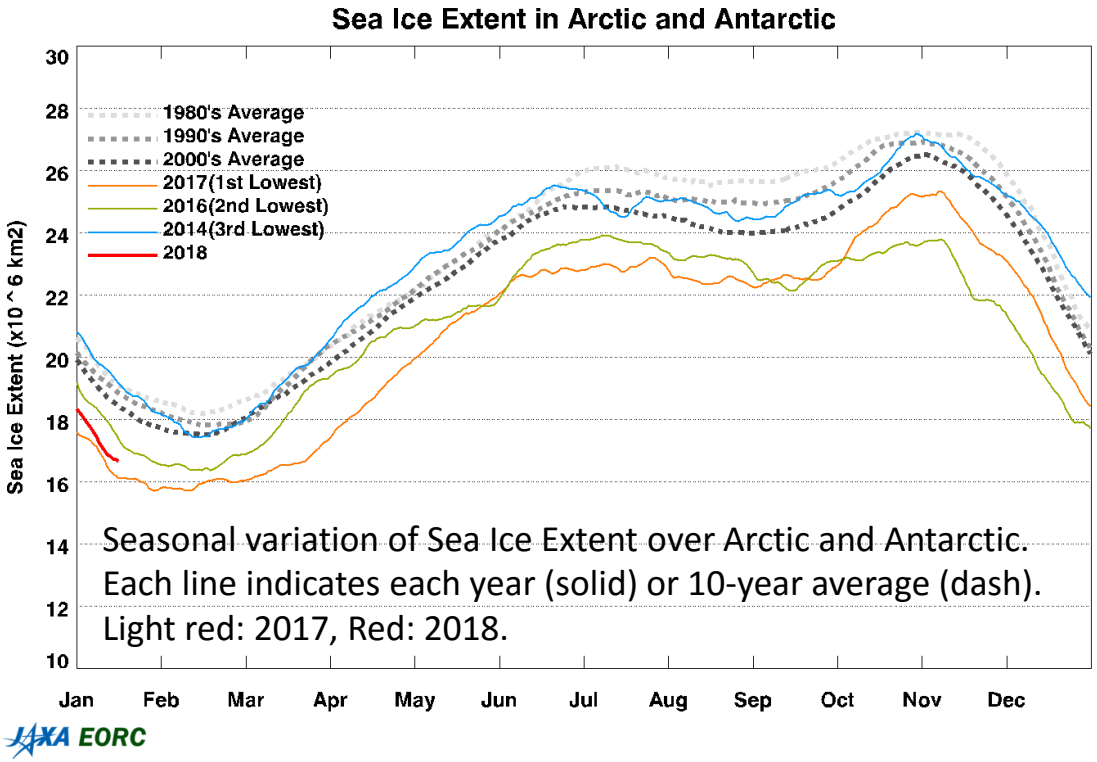
Instrument	**Advanced Microwave Scanning Radiometer 2 (AMSR2)**
Altitude	**705 km**
Orbital inclination	**98.2 deg**
Local sun time at Ascending node	**13 :30**
Launch vehicle	**H-IIA**
Launch	**May 18, 2012**
Designed lifetime	**5 years**

- ✓Successor of Aqua/AMSR-E (launched in May 2002), providing continuous data for climate studies and operational applications
- ✓Joining A-train constellation and also GPM constellation
- ✓Carrying AMSR2, a multi-polarization and multi-frequency microwave imager
- ✓Observing various water-related ECVs at high spatial resolution
- ✓Improving on-board calibration target has resulted reduction of annual TB variation due to calibration and improvement of TB stability
- ✓Achieved designed mission life (5-year) on May 18, 2017, and continues observation

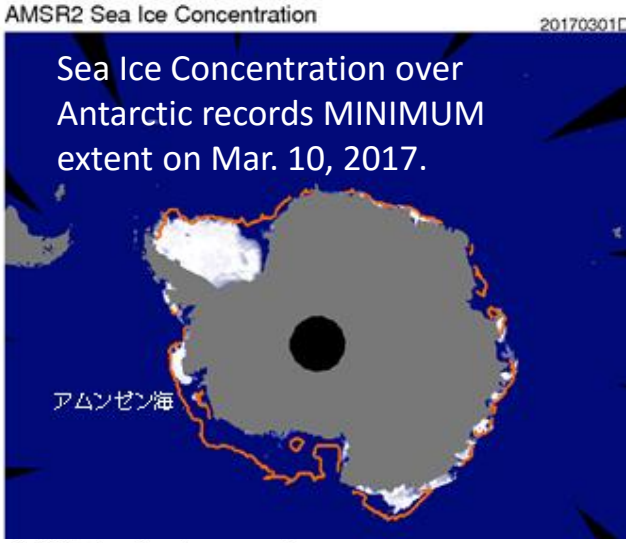
GCOM-W Operation

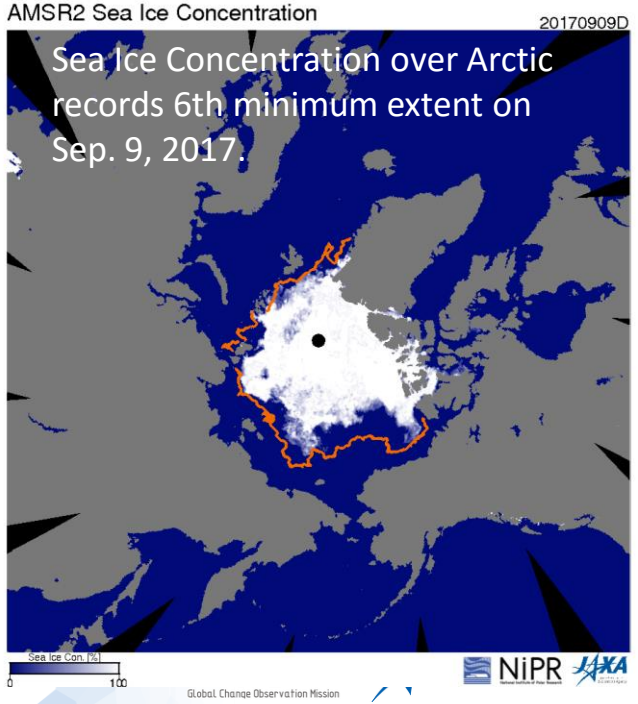
- GCOM-W satellite and AMSR2 instruments are in healthy conditions.
- Enough fuels to keep current orbit for more than 15 years
- No major problem in data acquisition and processing.
- Mission data : **99.6 %** acquired from July 3, 2012 to Dec. 31, 2017
- Data Loss (except annual inclination adjust maneuvers, half orbit, twice per year):
  - Jul. 17, 18, 23, 2012: Calibration activity (half orbit each day)
  - May 10 - 14, 2013 : SEU-induced observation halt
  - Dec. 4, 2015: SEU-induced data recorder halt (20 hours)
  - Apr. 15, 2016: SEU-induced observation halt (20 hours)
  - Aug. 3, 2016: Retrograde maneuver (half orbit)
  - Sep. 27, 2017: SEU-induced data recorder halt (20 hours)
  - Nov. 25, 2017: SEU-induced observation halt (14 hours)

Sea Ice Extent in 2017



Seasonal variation of Sea Ice Extent over Arctic and Antarctic. Each line indicates each year (solid) or 10-year average (dash). Light red: 2017, Red: 2018.





- Global: Records minimum in Feb. 2017
- Arctic: Records 6th minimum in Sep. 2017
- Antarctic: Records minimum in Mar. 2017

JASMES (JAXA): http://kuroshio.eorc.jaxa.jp/JASMES/climate/
ADS (NIPR): https://ads.nipr.ac.jp/vishop/#/monitor

Status of AMSR2 follow-on Mission

- The Roadmap for the Basic Plan on Space Policy was revised in Dec. 2017: "The government should conduct development research on AMSR2's successor sensor on condition that hosted payload with GOSAT-3 in JFY2018."
- The government approved to submit a draft budget for JFY 2018 to built and test prototypes of the sensor's components.

- Currently in Mission Definition Phase (Candidates of Pre-Project)
  - Collaborating with GOSAT-2 project team on the feasibility study on the hosted payload capability along with mission concept study.
  - Scientific synergies between AMSR2 f/o and GOSAT-3 are discussed among science communities.
  - Mission requirements for operational utilizations and science are currently discussed under the GCOM user committee.
- Next Step in JAXA
  - Mission Definition Review (MDR) is planned in 2018

JAXA GPM mission status

- After the launch on February 2014, 3-year and 2-month operation was completed at the end of April 2017.
- JAXA completed the End of Prime mission review of the GPM/DPR on June 19th 2017 to confirm achievements of the mission requirement.
- The GPM/DPR management review was held on 26th October 2017 for approval to move extended mission phase.
- On 1st December 2017, JAXA/GPM project team moved to the SAOC (Space Application Operation Center).

DPR Sensor Status

- JAXA is continuing DPR data monitoring to confirm that DPR function and performance are kept on orbit.
  - Operation Mode
  - Temperature
  - Bus Voltage and Current
  - System Noise
  - Sea Surface Radar Cross Section (σ0)
  - Internal Calibration
    - ～1 time / week
  - External Calibration
    - 2 periods / year (～5 times / period)
  - TX/RX Amplifier Status
    - 2 times / year

DPR data monitoring results show that there is no degradation of DPR function and performance from Launch till now.

GPM Algorithm Development Status (Summary)

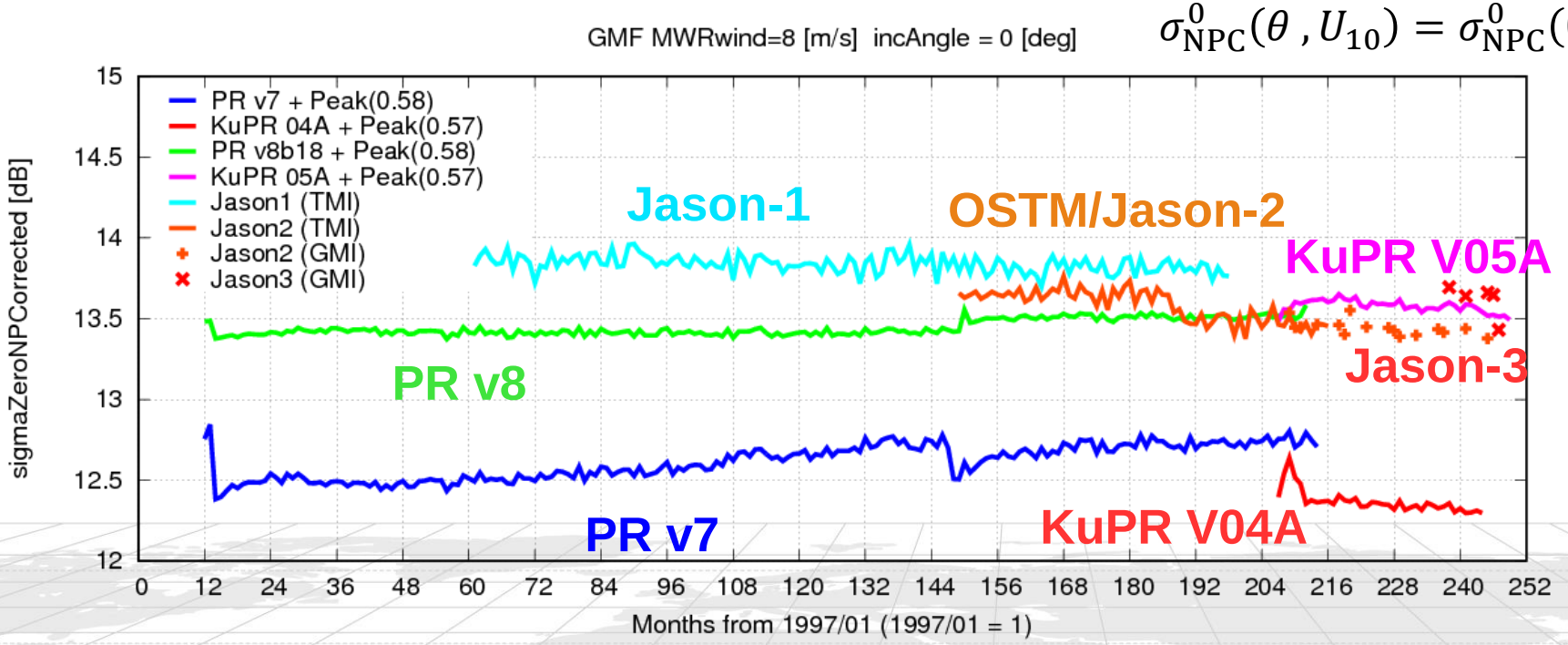
- DPR Level 1 algorithm (JAXA)
  - V05 product was released in May 2017.
- DPR Level 2 and 3 algorithm (Joint Japan-U.S.)
  - V05 product was released in May 2017. V06 product will be release on Spring 2018.
- DPR/GMI combined Level 2 algorithm (Joint Japan-U.S.)
  - V05 product was released in May 2017. V06 product will be release in Spring 2018.
- DPR Latent heating algorithm (Japan-U.S.)
  - DPR Spectral Latent Heating (SLH) V05 product was released in July 2017. V06 product will be release on Summer 2018.
- Global Rainfall Map algorithm [GSMaP] (Japan)
  - V04 Product was released in January 2017.
- TRMM/PR Level 1 algorithm (JAXA)
  - V8 product was released in October 2017.
- TRMM/PR Level 2 and 3 algorithm (Joint Japan-U.S.)
  - V8 product will be released in late spring 2018.

Performances of DPR L1 V05 & PR L1 V8

- Comparisons of the NRCS (σ^0) with various sensors.

→ Better continuity of the TRMM/PR V8 and the GPM/KuPR V05

$$\sigma^0_{\mathrm{NPC}}(\theta, U_{10}) = \sigma^0_{\mathrm{NPC}}(0, 8)$$



TRMM PR : 13.8 GHz
GPMCore KuPR : 13.6 GHz
Jason Poseidon : 13.6 GHz

(*1) σ^0 of PR v8b18 is almost the same with the latest PR V8.

Sampling biases of PR and KuPR caused by the their range sampling (~125m) are corrected in the figure.

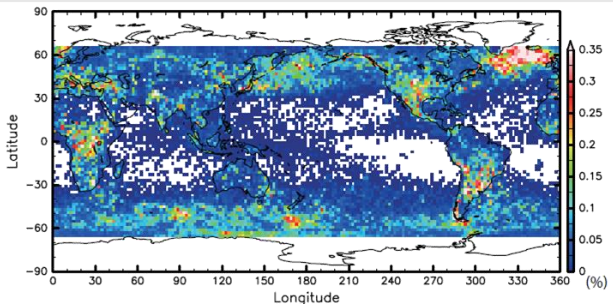
flagHeavyIcePrecip and flagSurfaceSnowfall in the DPR V5 output

Distribution of intense solid precipitation（hail and graupel etc.,） retrieved by DPR

Iguchi et al. 2017 (in press)

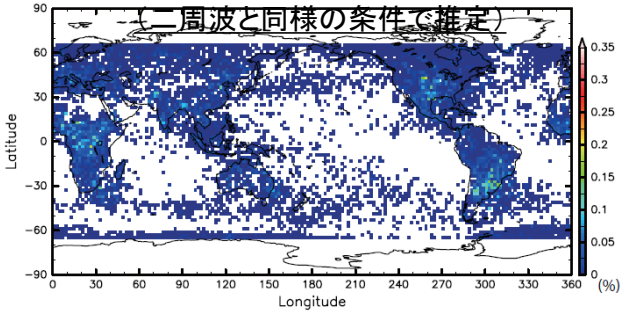
＊すべて、割合は全観測（無降水含む）に対する割合

Percentage of intense solid precipitation retrieved from dual frequency information



Percentage of intense solid precipitation, but from single（KuPR) frequency

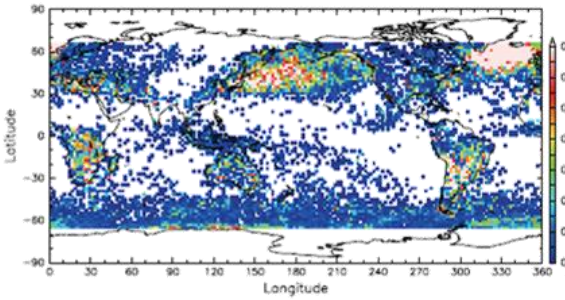
（二周波と同様の条件で推定）



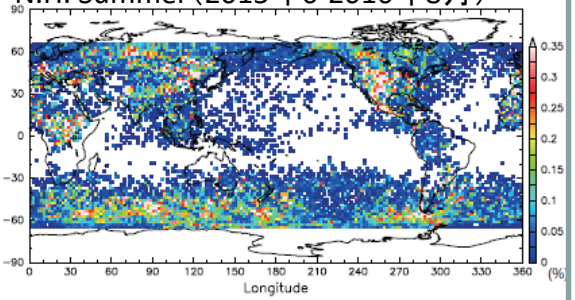
could get new information by using dual frequcies

Percentage of intense solid precipitation in column

N.H. winter（2015年12-2016年2月）

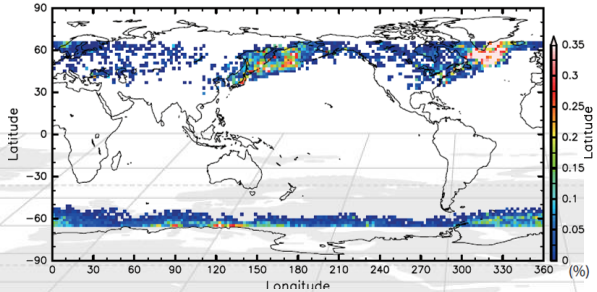


N.H. Summer（2015年6-2016年8月）

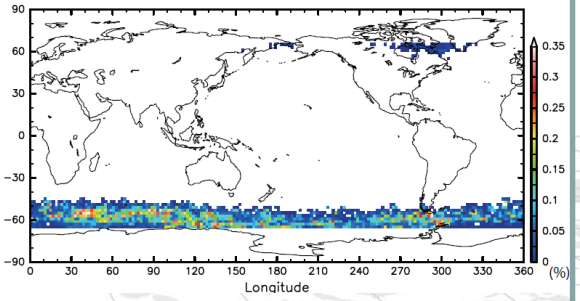


Percentatge of intense solid precipitation that reaches the ground surface

N.H. winter（2015年12-2016年2月）



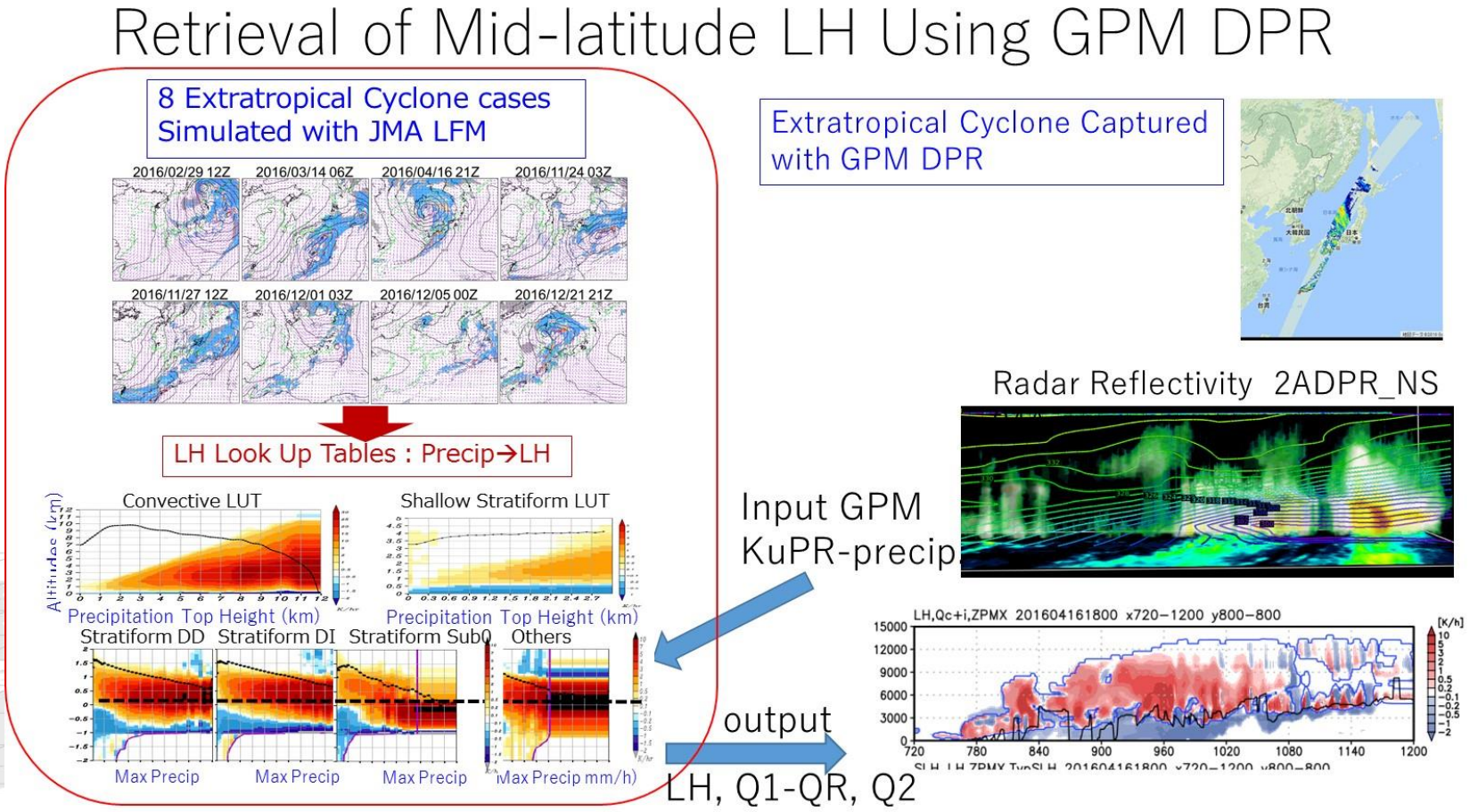
N.H. summer（2015年6-2016年8月）



Solid precipitation that reaches the surface can be seen over ocean than land in the winter of Northern Hemisphere. Especially over north western Pacific and north western Atlantic

DPR SLH V05 product

- GPM latent heating V05 product released in Jul. (SLH) and Aug. (CSH) 2017 included LH retrievals over mid-latitudes.



(provided by Prof. Takayabu, Univ. Tokyo)

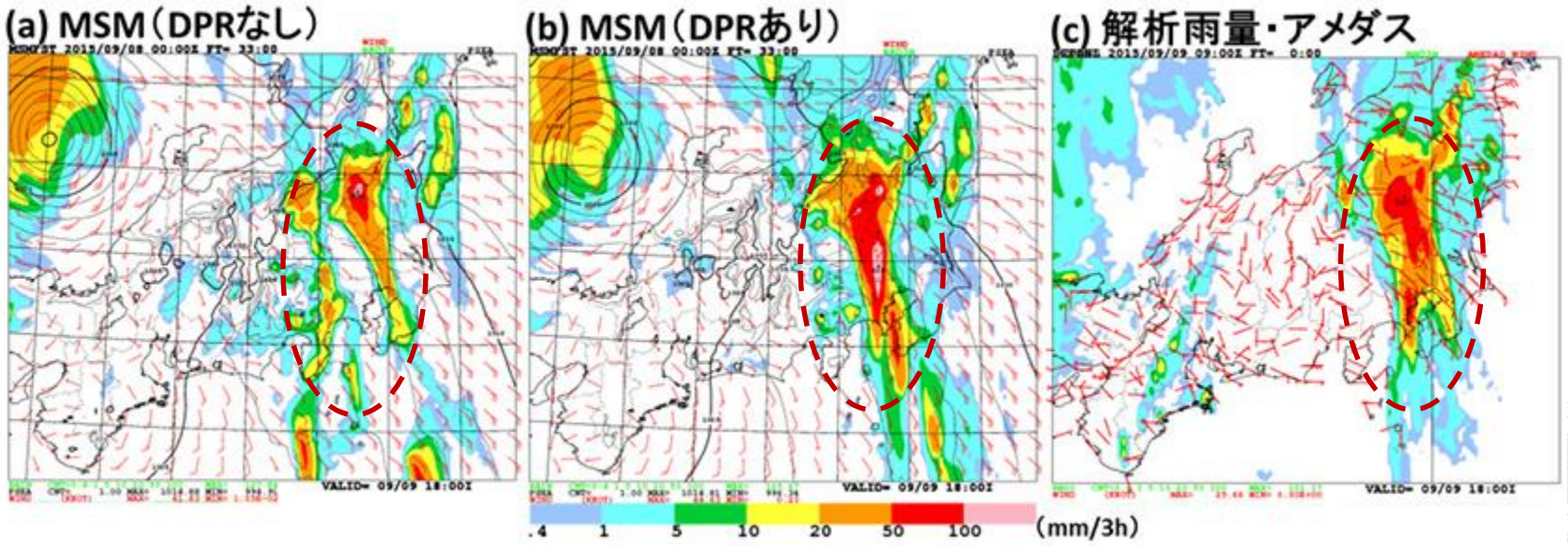
GPM/DPR Data Assimilation in the JMA NWP system

The Japan Meteorological Agency (JMA) started the DPR assimilation in the meso-NWP system on March 24 2016.
Word‘s first “operational” assimilation of spaceborne radar data in the NWP system of meteorological agencies!

a) 33-hour prediction without the DPR

b) 33-hour prediction with the DPR

c) Observation



Provided by JMA

- **Example of Kanto-Tohoku Heavy Rainfall in 2015**
- **Improvements in water vapor analysis accuracy over the ocean**
- **Improvements in rainfall forecast accuracy**

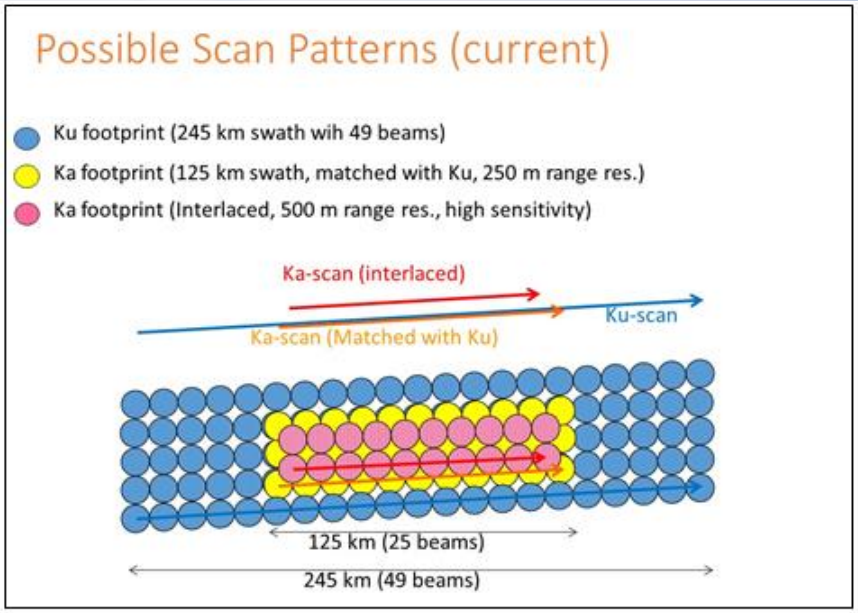
Scan pattern experiments in Sep. 2017

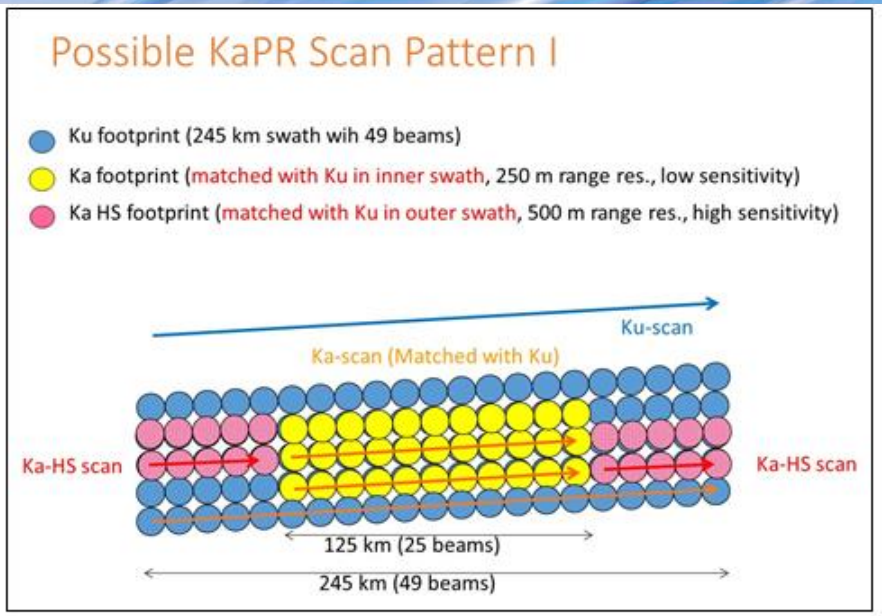
- Two scan pattern experiments and transmitters OFF operation were scheduled.

Experiments	Date
Wide swath experiment	Sep 26 13UTC - Sep 27 13UTC
KaPR's scan pattern experiment	Sep 27 13UTC - Sep 28 13UTC
Transmitters OFF operations	Sep 28 13UTC - Sep 29 13UTC

- All experiments were completed.
- These data will help feasibility studies of possible KaPR scan pattern change in extended mission period and the future spaceborne radar development.

KaPR's scan pattern experiment (KaPR only)





(1) Major changes:

- KaPR-HS's scan pattern was changed.
  → Dual-frequency technique will be applied in a full swath.

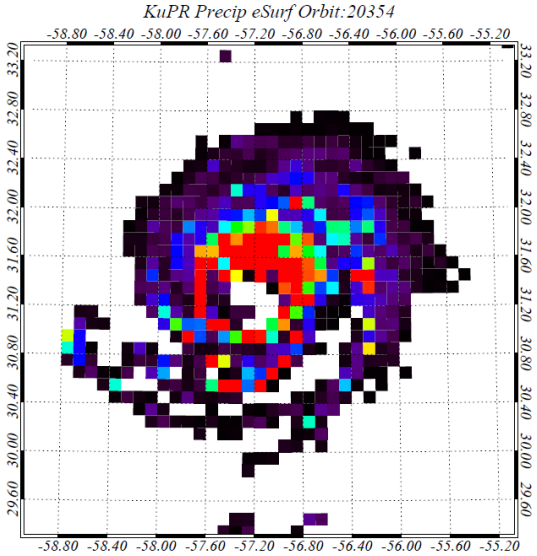
(2) Minor changes:

- Scan timing of KaPR-MS scan was slightly changed to realize improvement of beam matching between KuPR and KaPR (by a request from the DPR-L2 team).

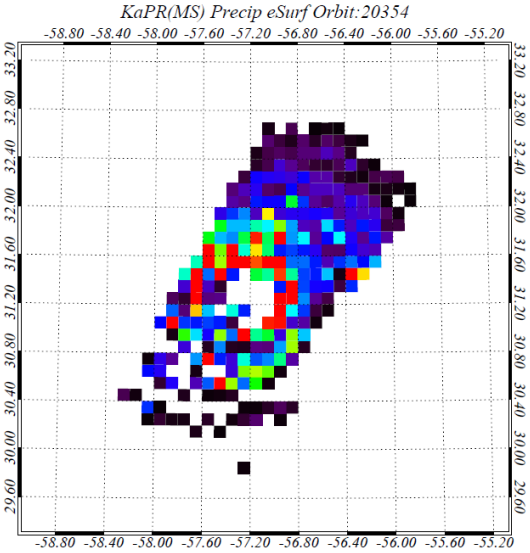
Preliminary KaPR's scan pattern experiment

Sep 27th 2017 Hurricane LEE Precipitation (eSurf)

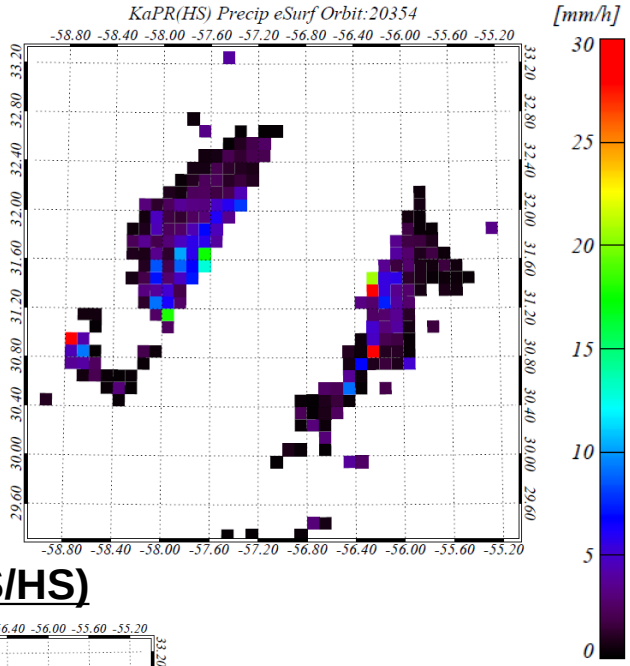
KuPR



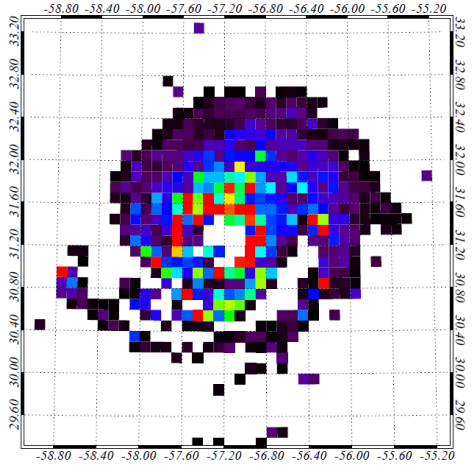
KaPR(MS)



KaPR(HS)



KaPR(MS/HS)

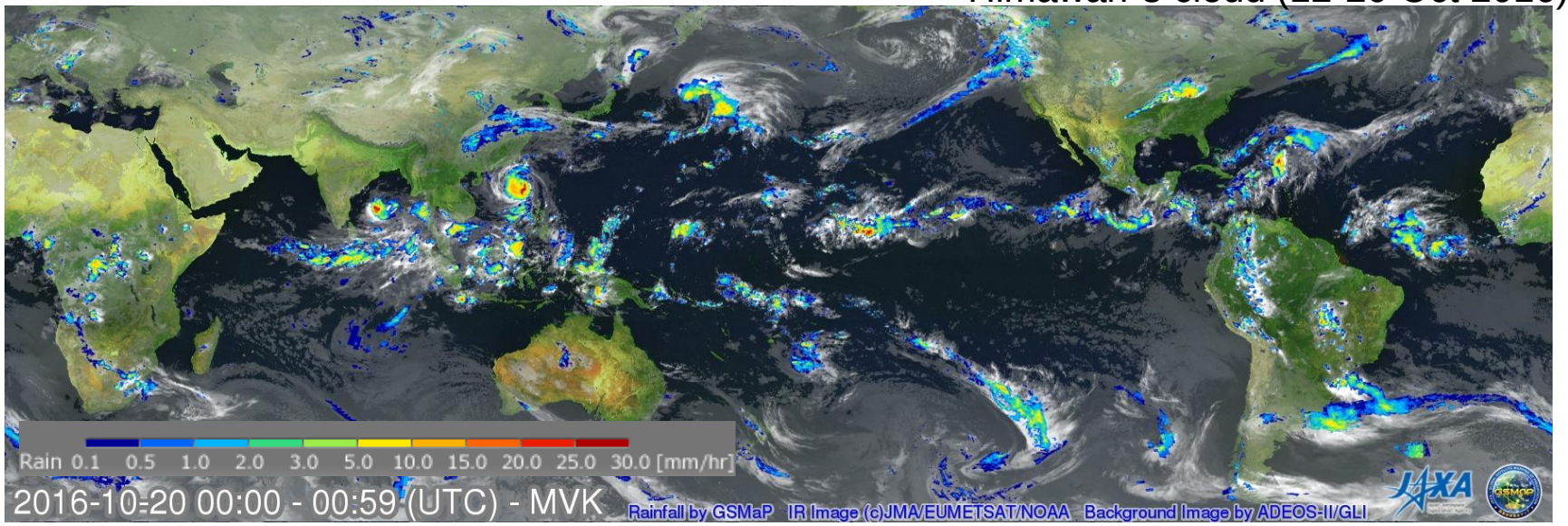


Dual-frequency technique will be applied in a full swath.

Global Satellite Mapping of Precipitation (GSMaP)

http://sharaku.eorc.jaxa.jp/GSMaP/

GSMaP_NRT hourly rain with Himawari-8 cloud (12-20 Oct 2016)



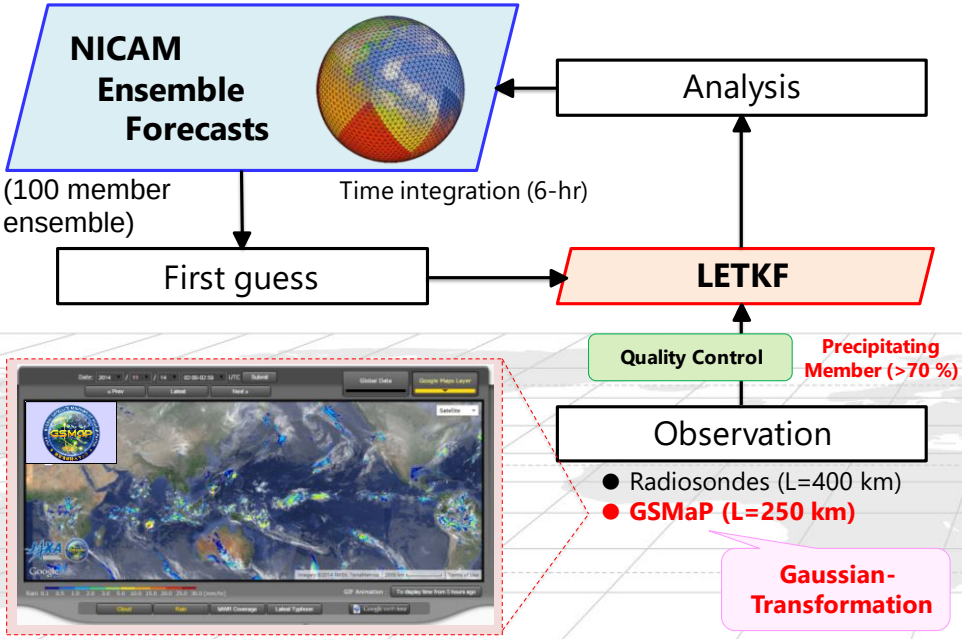
- GSMaP is a blended Microwave-IR product and has been developed in Japan toward the GPM mission.
  - U.S. counterpart is “IMERG”
  - GSMaP (v6) data was reprocessed as reanalysis version (GSMaP_RNL) since Mar. 2000 period , and was open to the public in Apr. 2016, and new version, GSMaP (v7) was released in 17 Jan. 2017.
  - GSMaP realtime product (GSMaP_NOW) in the domain of GEO-Himawari, GSMaP Riken Nowcast (GSMaP_RNC) data developed by RIKEN/AICS (Otsuka et al. 2016) are now available from JAXA/EORC ftp site.

GSMaP assimilation in JAXA supercomputer system

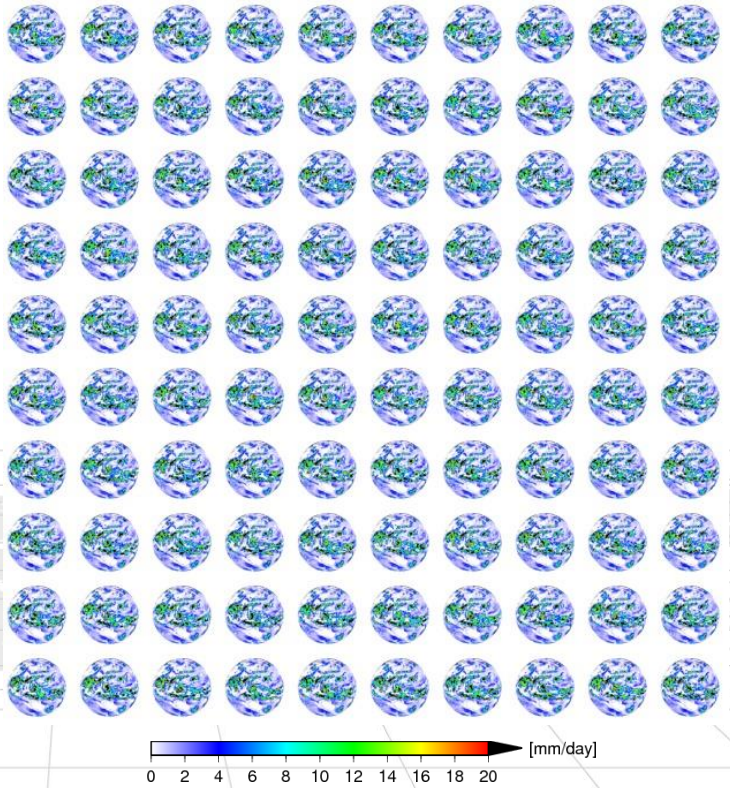
- The NICAM-LETKF data assimilation system using the GSMaP is installed at JAXA supercomputer system generation 2 (JSS2) and experimentally operational in near-real time with Univ. Tokyo (Prof. Satoh) and RIKEN (Dr. Miyoshi). The data is now available from the EORC ftp site.

JSS2 SORA J-SPACE Data Assimilation Team AORI

Assimilating GSMaP with NICAM-LETKF

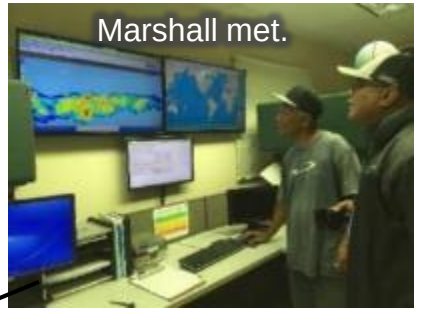


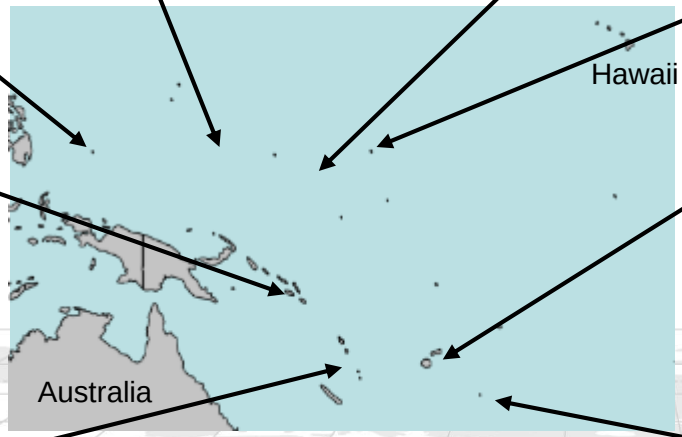
NICAM 100 member precipitation
2017/07/01 00-24UTC (1 day)

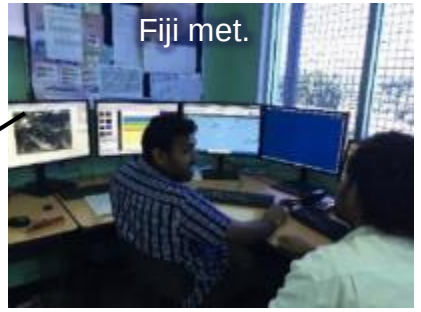


Utilization in Pacific

We provides GSMaP NOW (**realtime**) website, customized for each island.
Pacific meteorological agencies use GSMaP for **realtime rainfall monitoring** around their island **even over the ocean**.







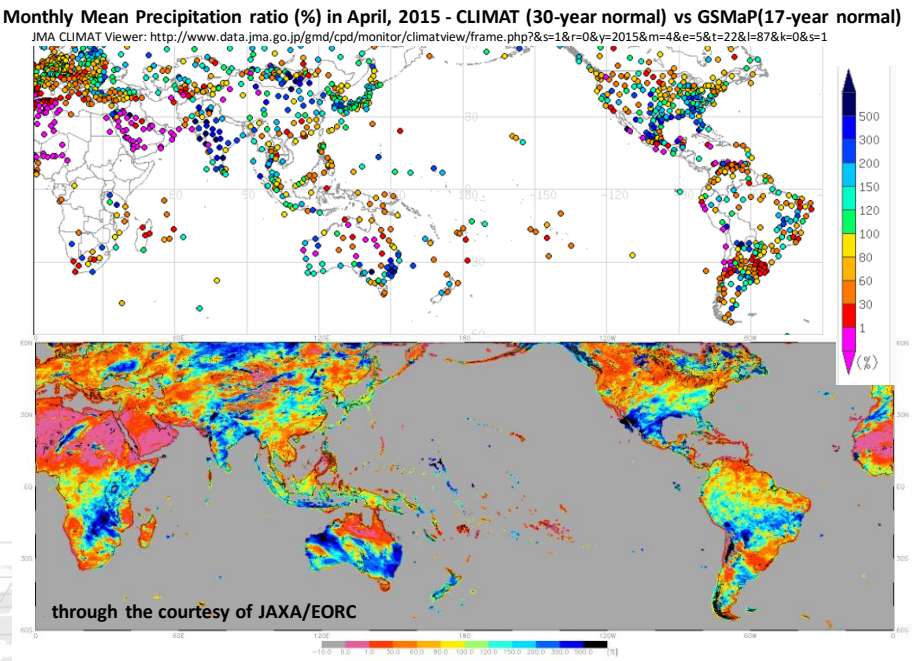
- No need to set up any computer specially
- Free to use
- Everyone can view the Website via internet access

WMO SEMDP

- WMO Space-based Weather and Climate Extremes Monitoring (SWCEM) Demonstration Project (SEMDP)
  planned by Mr. Kurino (WMO)

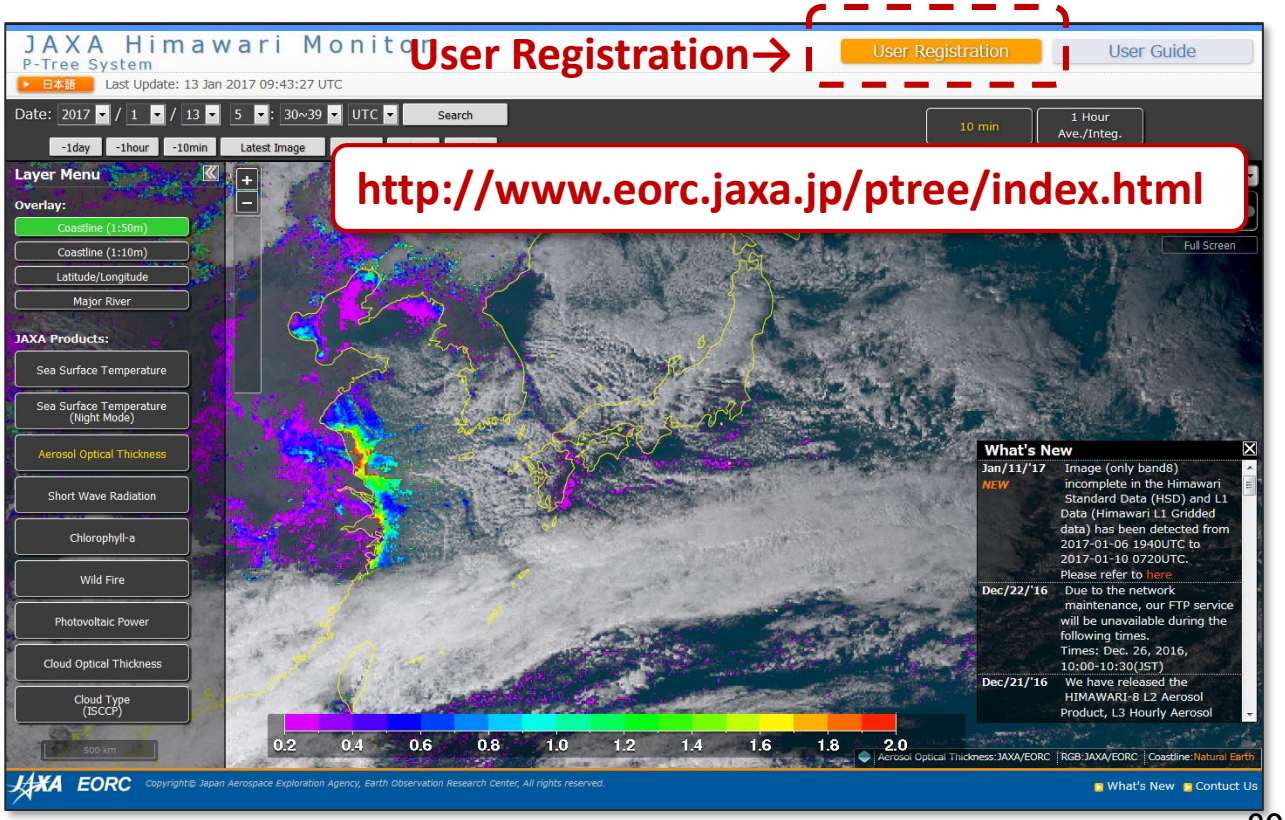
(i) monitoring **persistent heavy precipitation** and **droughts**;
(ii) making best use of existing and newly developed satellite derived products and time series of measurements;
(iii) making best use of products that combine satellite information with in-situ and/or model reanalysis data;
(iv) recommendations as to which products should be transitioned from research to operations, including an assessment of those products.

GSMaP climate analysis



JAXA Himawari Monitor

- JAXA has been developing Himawari-8 products using the retrieval algorithms which will be consistent with the upcoming Japanese earth observation missions (GCOM-C, GOSAT-2 and EarthCARE), in order to seek synergies between the satellites
- JAXA Himawari Monitor website site was opened in August 2015 to distribute Himawari original (Level 1) and geophysical (Level 2) products
- Over 500 registrations from domestic and international users until today

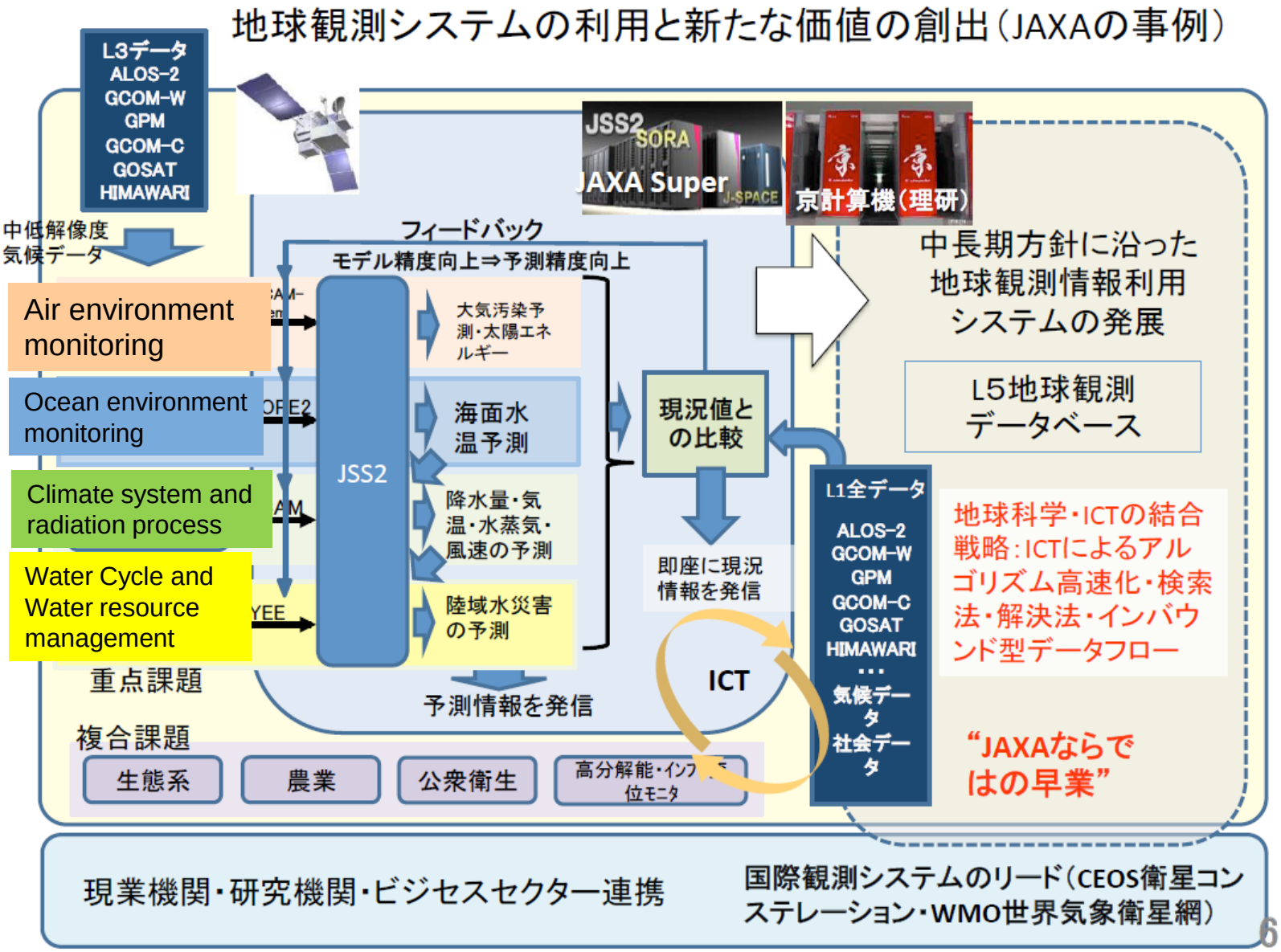


Aerosol Optical Thickness (1530UTC 13 Jan 2017)

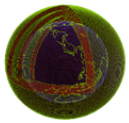
Themes and Satellites to be used for Earth Observation Priority Research

Research Field \ Satellite		ALOS-2	GPM TRMM	Earth CARE	GCOM	GOSAT	Himawari	Collaborating Organizations
Application to Disaster Prevention		●						
ocean Ocean Environment Monitoring	①Ship Monitoring	●			●			
	②Environmental Monitoring		●		●		●	National Institute of Polar Research, Meteorological Research Institute, Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
water Water Cycle and Water Resource Management			●		●		●	The University of Tokyo, Public Works Research Institute
atomosphere Atmospheric Environmental Particle Monitoring				●	●	●	●	Meteorological Research Institute, National Institute for Environmental Studies, Kyushu University, Japan Meteorological Agency
infra structure Infrastructure Displacement Monitoring		●						Infrastructure Development Institute, etc.
climate Climate System and Radioation Process			●	●	●	●	●	The University of Tokyo, Meteorological Research Institute, Tokyo University of Marine Science and Technology, RIKEN etc.
eco system Ecosystem		●	●		●	●	●	University of Tsukuba, National Institute for Environmental Studies, Hokkaido University, Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
agri culture Agriculture		●	●		●		●	National Institute for Agro-Environmental Science, The University of Tokyo
public health Public Health		●	●		●		●	National Center for Global Health and Medicine, Nagasaki University, the University of Tokyo

Active use of satellite data with models



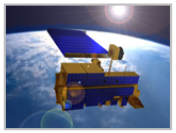
Water Cycle and Water Resource Management



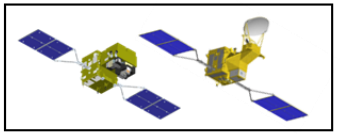
JMA 55-year Reanalysis (JRA55)

TRMM

Aqua



Terra



GCOM & future satellites

Weather Forecast (4DDA Cycle)

Input

Satellite observation data

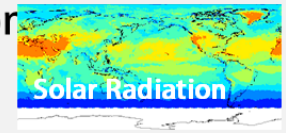
Surface weather data

Temperature; Humidity; Rainfall; Winds; Downward radiation; etc.

Input

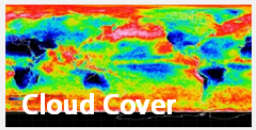
Satellite land information

Rainfall; Downward radiation; Cloud cover; etc.



Solar Radiation

Rainfall Map



Cloud Cover

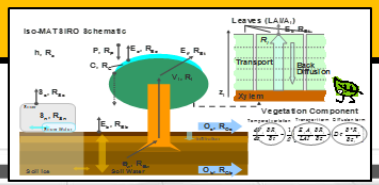
Forcing

Input

Global 50km

Japan 1km

Land Surface Model (MATSIRO5)



Surface hydrological data

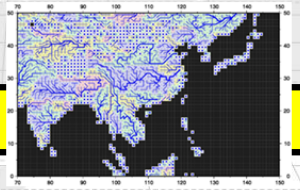
Surface temperature; Soil moisture; Runoff; evaporation; etc.

Validation

Global 25km

Japan 1km

Global Hydrodynamic Model (CaMa-Flood)



River Discharge, Flood Area Rate..

Risk Indices

JAXA/ Univ. Tokyo

Water CYCLE research task at EORC

R&D phase | Operation phase

steps

～3rd year	～7th year	～10th year
Global 50km/Japan 1km Land area simulation	Global 10km Land area simulation	Globa1km simulation

models・input data

～3rd year	～7th year	～10th year
GSMaP, MODIS, GMS8 etc.	GSMaP, GCOM-C, GMS8 etc.	GSMaP, GCOM-C, GMS8 etc.
Global 50km Land surface model	Global 10km Land surface model	Global 10km Land surface model
Japan 1km Land surface model	Satellite-Ground gauge merged data	Global 1km land surface model
		Integration with information of Ecosystem

output

～3rd year	～7th year	～10th year
Global 50km/Japan 1km land surface data sets	Global 10km land surface data set/hazard indices	Global 1km land surface Data sets/hazard indices

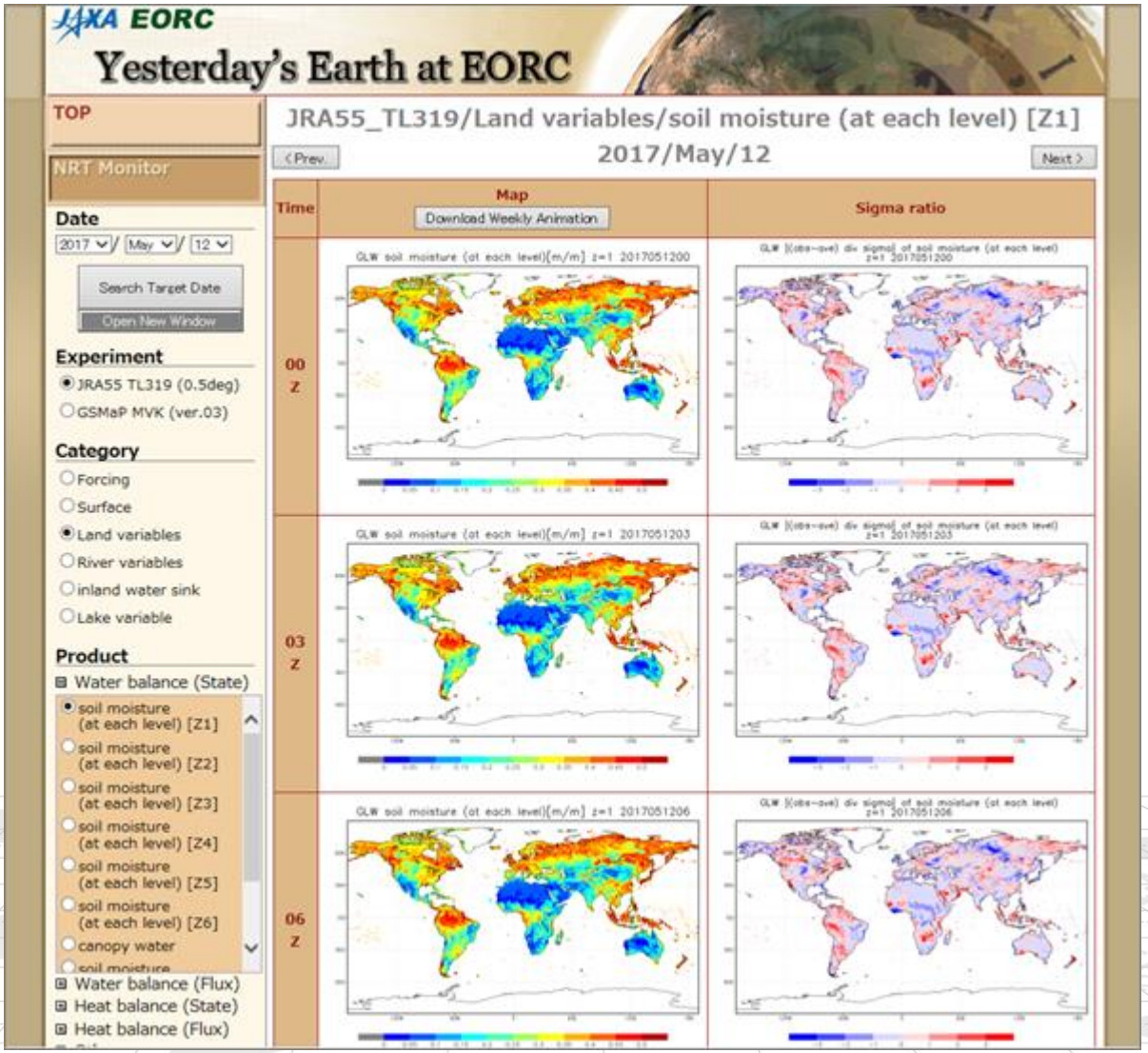
purposes/user

～3rd year	～7th year	～10th year
Monitoring Water disaster in Global large river basins	Water disaster in middle size river basins	Local scale water disaster/water resources・agriculture
hydrological agencies managing International river, big river basins	Hydrological agencies managing middle size river basins	Hydrological agencies, hydrology and agricultural division of local Municipality, international food security agency

Targeting outputs by project phase

JAXA Yesterday's Earth at EORC (YEE)

- Monitor output data from YEE system.
- Currently, global 0.5-deg model forcing & output and its sigma ratio images are available.
- Plan to improve the web system to show 3-hourly, daily and monthly images along with data download.



List of Output Parameters

Category	Product name
Forcing	surface shortwave (downward)
	surface longwave (downward)
	precipitation
	snowfall
	surface wind
	surface wind
	air temperature
	specific humidity
	10m zonal wind
	10m meridional wind
	2m temperature
	2m specific humidity
Surface	sensible heat flux
	latent heat flux
	Surface shortwave (upward)
	Surface longwave (upward)
Land Param.	soil moisture (at each level)
	canopy water
	soil moisture (total volume)
	snow amount
	river storage
	snow melt
	snow freeze
	snow sublimation
	transpiration
	canopy evaporation
	canopy sublimation
	soil evaporation
	soil sublimation
	runoff (total)
	base runoff
	surface runoff

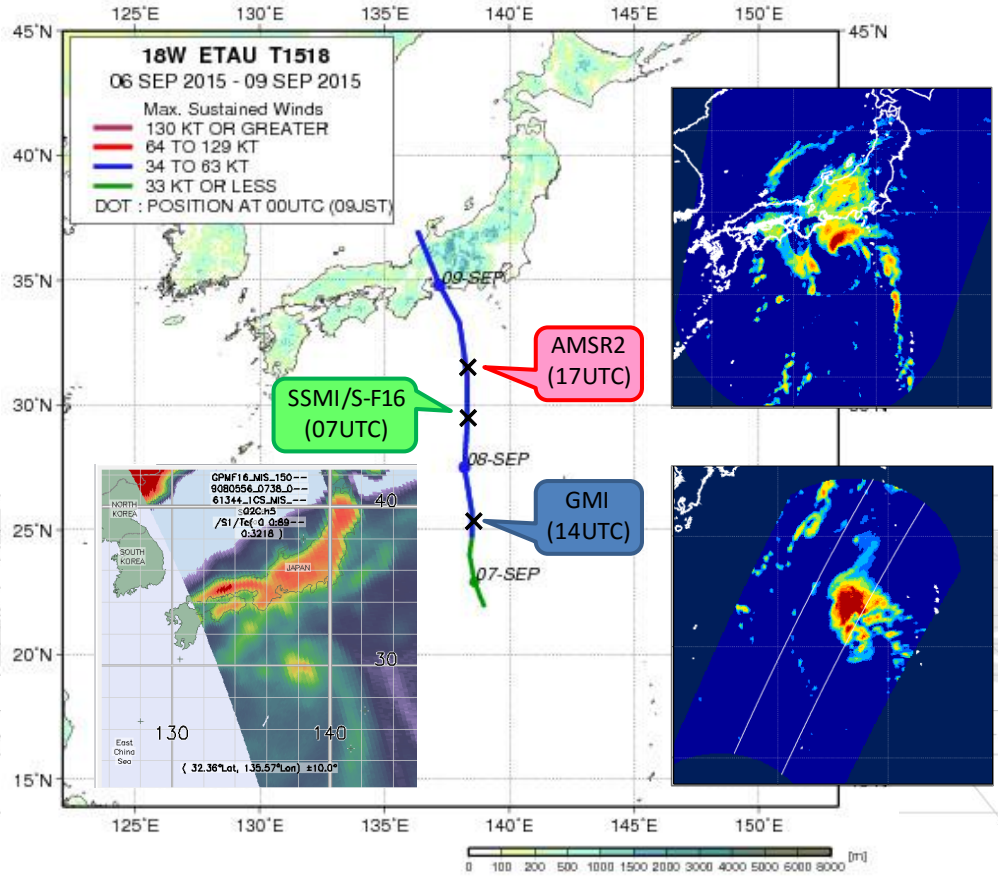
Category	Product name
Land Param.	soil ice (at each level)
	soil ice (total volume)
	Land Water
	soil temperature
	snow temperature
	land skin temperature
	canopy temperature
	air temperature
	2m temperature
	soil heat flux
	snow surface heat flux
	ground heat flux in total
	Surface shortwave (downward)
	Surface longwave (downward)
	Evapotranspiration flux times EL
	latent heat flux
	snow covered area fraction
	snow albedo
	soil potential
	dust density in snow (mass)
	ice melt
	snow & ice sublimation
	Water flux Atmosphere to Land
	Water flux Land to River
River Variables	runoff (lake & land)
	river flow
	river water
Lake and Inland Water Variables	inland water sink budget
	distributed water sink budget
	lake surface temperature

Category	Product name
CaMa Output	River Discharge
	River Water Storage
	River Water Depth
	River Flow Velocity
	Floodplain Flow
	Floodplain Water Storage
	Floodplain Water Depth
	Flood Area
	Flood Fraction
	Water Surface Elevation
	Total Discharge (Qr + Qf)
	Total Storage (Sr + Sf)
	Net bifurcation flow from grid (ix,iy)
	Flow of bifurcation channel (ipth, ilev)

○ JAXA-JMA/MRI Joint Research in Climate Modeling Task

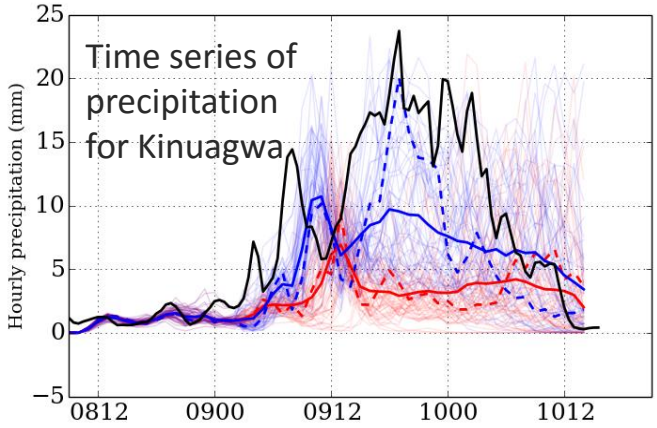
- GPM data assimilation experiments targeting typhoons
- Precipitation forecast for the case of typhoon #18 which caused Kinugawa flooding by JMA Non-Hydrostatic Model
  → Input to High-resolution (1km) ensemble simulation

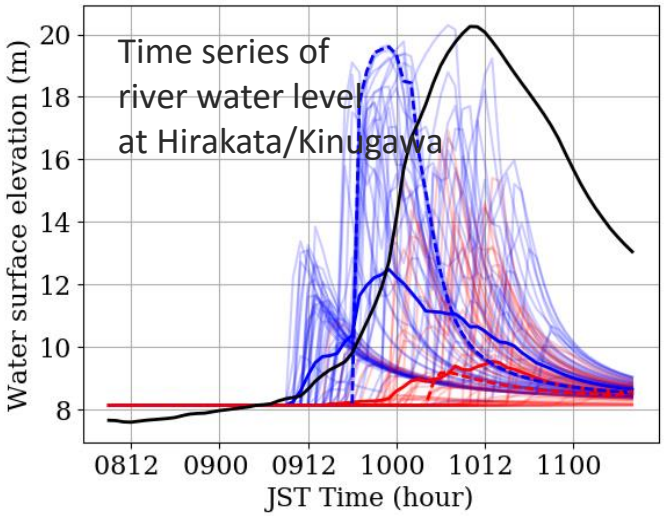
Observation by Satellite Microwave Imager in the case of September 2015 Kanto-Tohoku heavy rain induced by typhoon #18



Hind cast experiment of Kinugawa Flooding case in Sep. 9, 2015

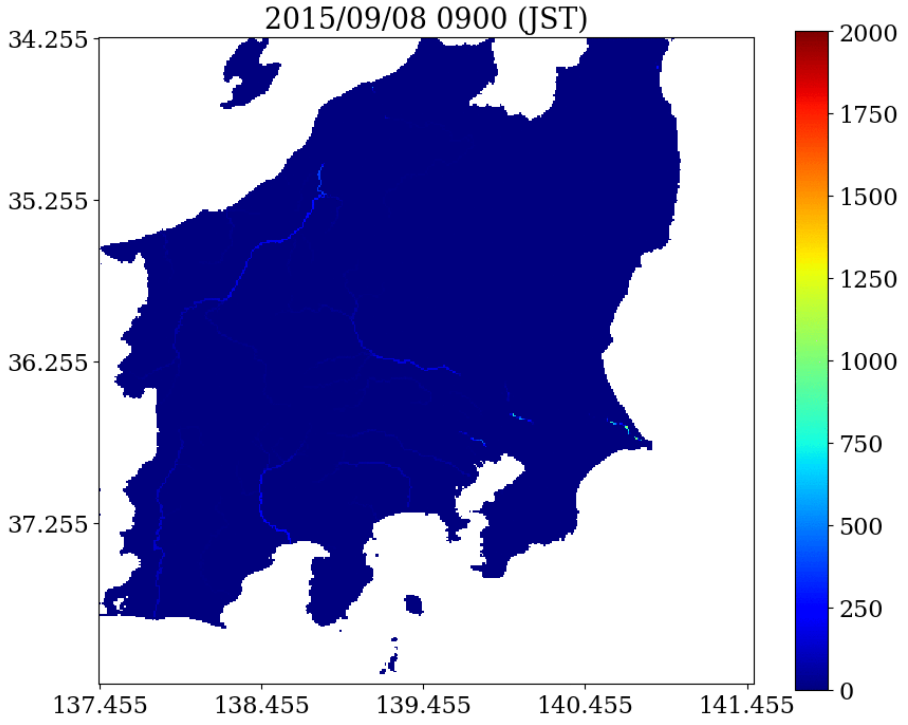
High-resolution (1km) ensemble simulation using satellite assimilated meteorological data





Blue/Red: with/without data assimilation

Black: observation



- Satellite data assimilation improved the precipitation and water level results.
- More improvements (ex. peak time of water level) are needed.

Summary

- GCOM-C was successfully launched
  - We confirmed that the all of SGLI channels were available for observation. JAXA opened the first light image to the public on January 12, 2018.
- GCOM-W and GPM achieved designed mission life in May 2017, and transferred to Extended Mission period.
  - Long term record of AMSR sensor series and PR-DPR series can contribute GEWEX science
- GOSAT-2 will be launched in 2018. EarthCARE will be launched in 2020.

- Introduced subject type research activities in EORC. Some subjects utilize models on JSS2 (super computer system) to provide information immediately.
- AMSR2 follow-on sensor is currently proposed and JFY2018 budget request to the government has been submitted to built and test prototypes of the sensor's components
- To promote Earth Observation in the Roadmap for the Basic Plan on Space Policy, academic societies union started activities to prioritize the EO missions as bottom up type activities.
  - Relationships between U.S. decadal survey, e.g. cloud-precipitation radar mission in Japan
- We need to answer to the question "How can JAXA benefit from GEWEX activities?" in JAXA.