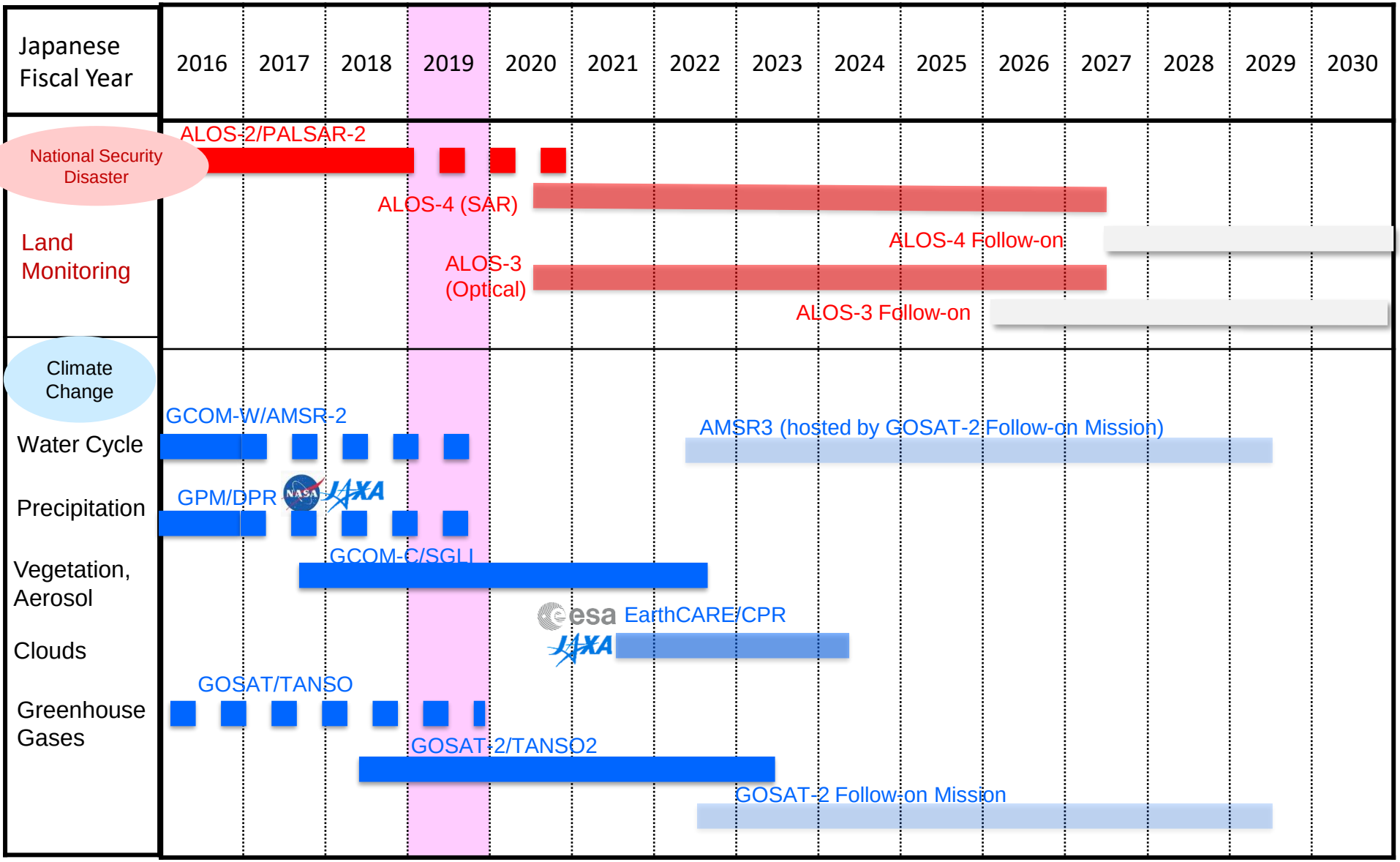
JAXA Earth Observation Program

The Coordination Group for Meteorological Satellites
CGMS-47 Plenary

Hitoshi Tsuruma

Advisor for Senior Chief Officer of Satellite Applications
Japan Aerospace Exploration Agency

Japan's Earth Observation Schedule



Current JAXA Earth Observation Satellites Contributing to Societal Benefit

Climate Change

GCOM-C

Launched:
23 December 2017

Cloud/
Aerosols/
Vegetation

GOSAT

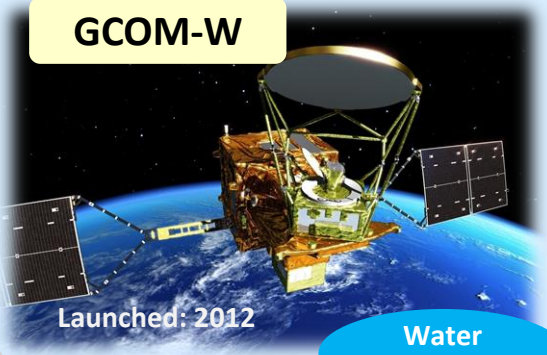
Launched: 2009

Greenhouse
Gases

GOSAT-2

Launched:
29 October 2018

GCOM-W



Launched: 2012

Water
Cycling

GPM

DPR:
Dual Frequency
Radar

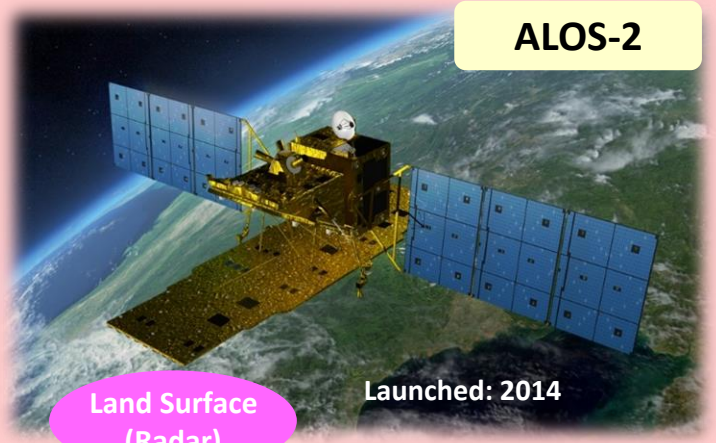
Precipitation

Launched: 2014

Courtesy of NASA

Disaster Risk Management

ALOS-2



Land Surface
(Radar)

Launched: 2014

NEWS

Satellite Observation in Support of Improvement of GHG Inventory

[Old] 2006 IPCC Guidelines for GHG Inventories

Volume 1 Chapter 6: Quality Assurance /Quality Control and Verification

[6.10.2 Comparisons with atmospheric measurements]

- Considering the limited monitoring network currently available for many of the greenhouse gases and the resulting uncertainties in the model results, inverse modeling is not likely to be frequently applied as a verification tool of national inventories in the near future. Even the availability of satellite-borne sensors for greenhouse gas concentration measurements will not fully resolve this problem, due to limitations in spatial, vertical and temporal resolution (*).

[New] Refinement to 2006 IPCC Guidelines for GHG Inventories

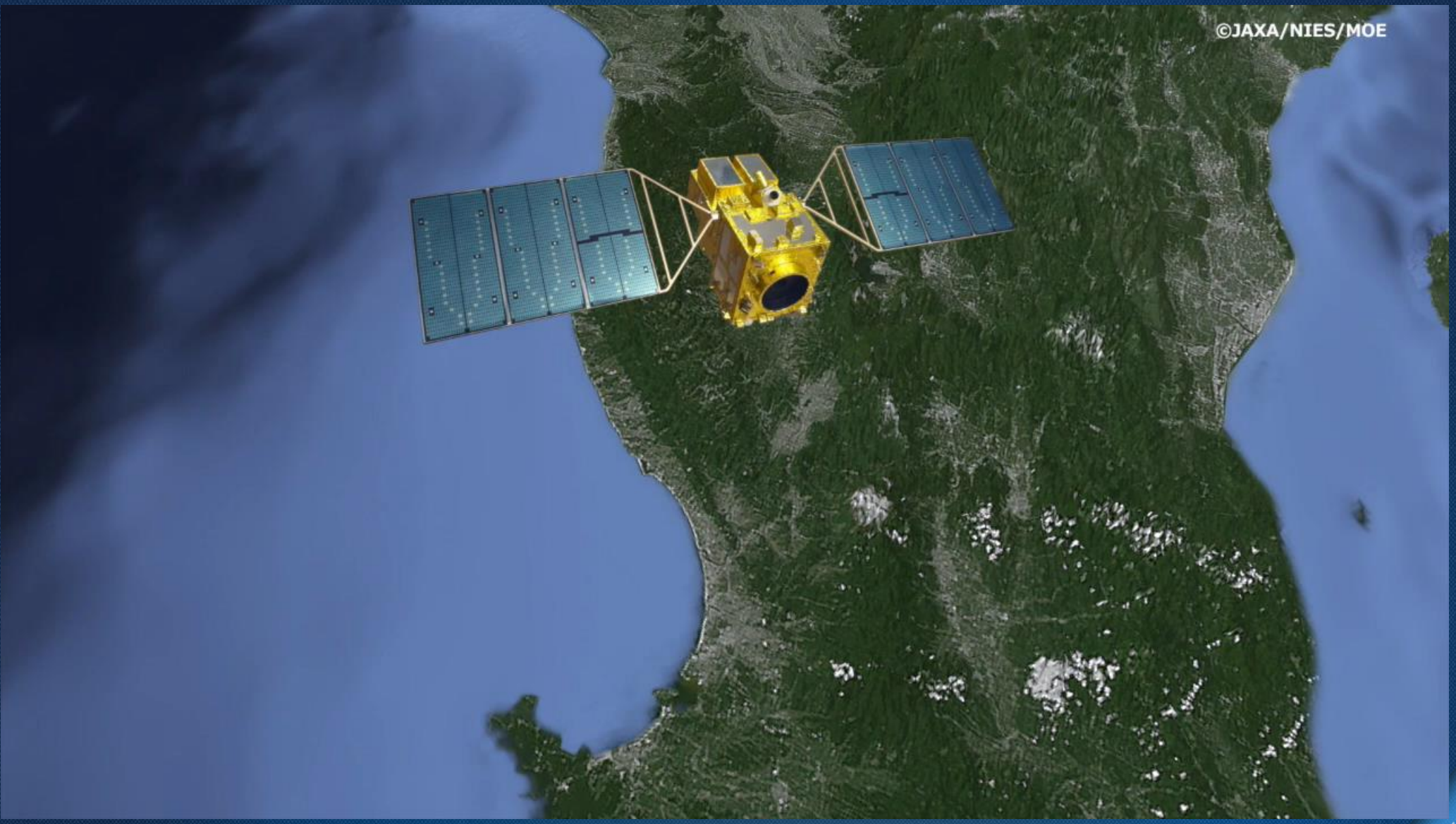
Volume 1 Chapter 6: Quality Assurance/Quality Control and Verification

- Delete: Descriptions about limitation on availability of satellite observations (* the left)
- Add: Many descriptions on usability and roles of satellite data as a comparison tool of inventories. Particularly, a new section of “Satellite Observations” are included.
  - Improvement of estimation accuracy of model by satellite data utilization at the area that in-situ data is not ready fully.
  - Prospects that satellite data estimation will quickly improve because of increase in the number of observations by new GHG observation satellites (TROPOMI, GOSAT-2, GeoCarb, TanSat etc.)

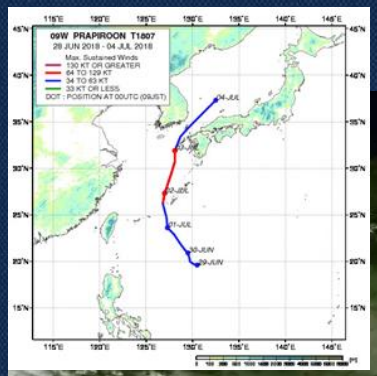
- *Changes may be made due to copyediting and to ensure consistency with the approved Overview Chapter.*

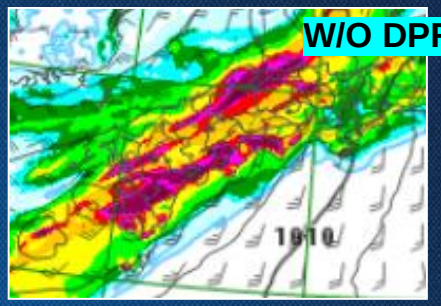
Climate Change

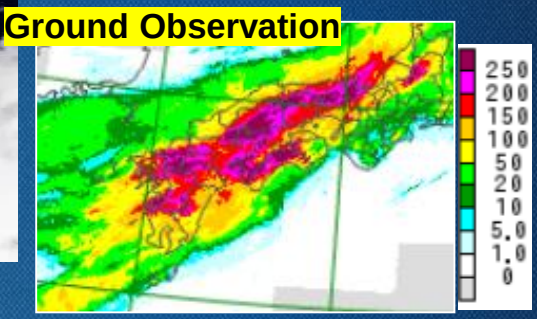
CO_2 Emission in Lower Troposphere Observed by GOSAT



GPM/DPR Improves Operational Meso-scale Numerical Weather Prediction

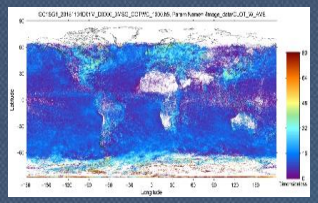




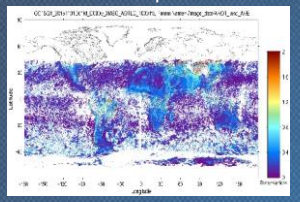


GCOM-C Data: Available for Public

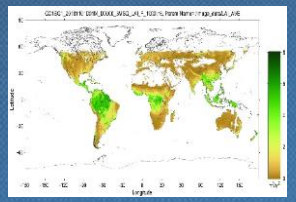
Water-cloud optical thickness



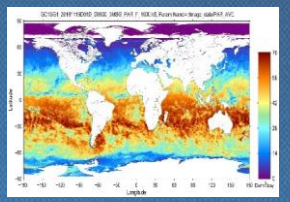
Aerosol optical thickness



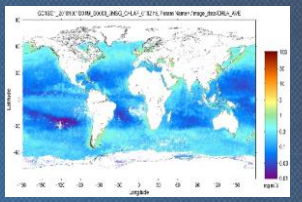
Leaf area index



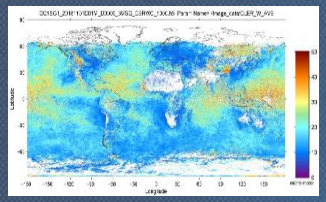
PAR



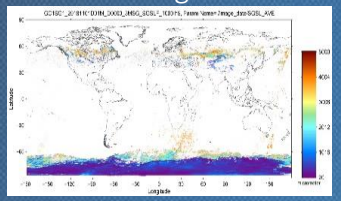
Chlorophyll-a conc.



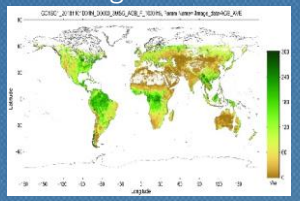
Water-cloud effective radius



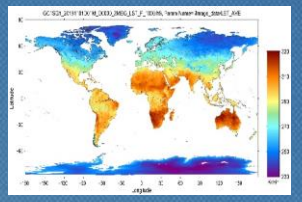
Snow grain size



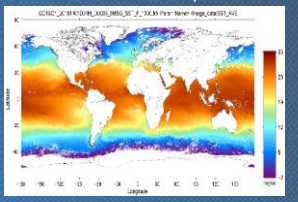
Above ground biomass

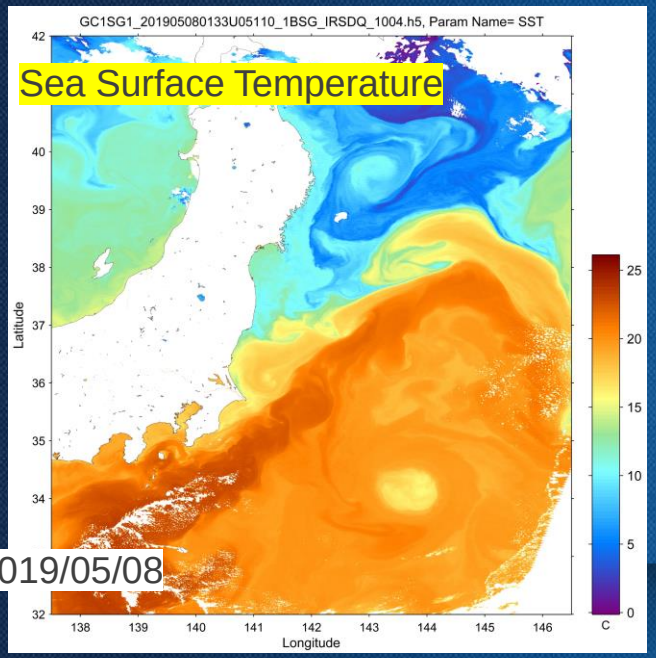


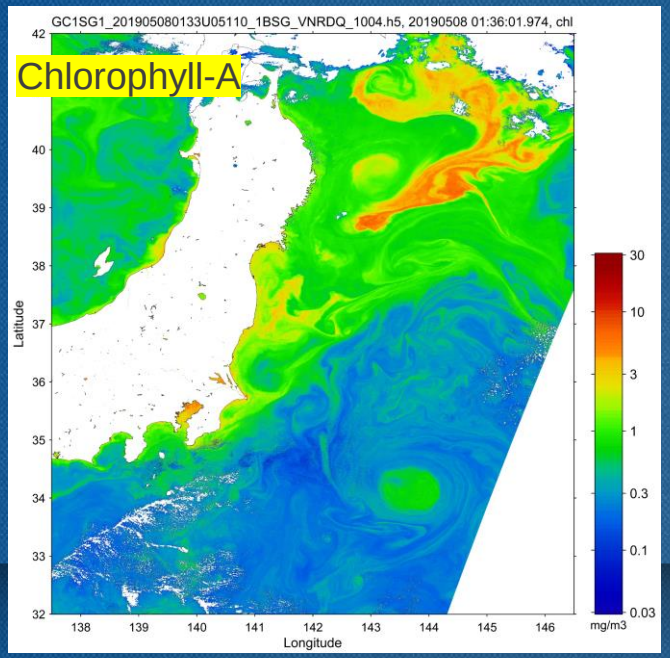
Land surface temperature



Sea surface temperature







▲ GCOM-C provides 29 data products.

◀ GCOM-C/SGLI 250-m resolution captured fine structures of ocean current and eddies.

Essential Climate Variables (ECVs) Measured by GCOM-W & C, GOSAT&GOSAT-2, GPM/DPR, and ALOS-2

Total Essential Climate Variables (ECVs)	54
ECVs measured by GCOM-C&W, GPM/DPR and GOSAT	25

by GCOM-C

by GCOM-W

by GPM/DPR

by GOSAT, GOSAT-2

by ALOS-2

Atmosphere

Surface	Upper-air	Atmospheric Composition
Precipitation	Earth radiation budget	Aerosol and ozone precursors
Pressure	Lightning	Aerosols properties
Radiation budget	Temperature	Carbon dioxide, methane & other greenhouse gases
Temperature	Water vapour	Cloud properties
Water vapour	Wind speed & direction	Ozone
Wind speed and direction		

Land

Biosphere	Hydrosphere
Above-ground biomass	Groundwater
Albedo	Lakes
Evaporation from land	River discharge
Fire	**Anthroposphere**
Fraction of absorbed photosynthetically active radiation (FAPAR)	Anthropogenic Greenhouse gas fluxes
Land cover	Anthropogenic water use
Land surface temperature	**Cryosphere**
Leaf area index	Glaciers, Snow
Soil carbon	Ice sheets and ice shelves
Soil moisture	Permafrost

Ocean

Physical

Ocean surface heat flux		
Sea ice	Sea level	Sea state
Sea surface currents		
Sea surface salinity		
Sea surface stress		
Subsurface salinity		
Sea surface temperature		
Subsurface currents		
Subsurface temperature		

Biogeochemical

Inorganic carbon	Transient tracers
Nitrous oxide	Nutrients
Ocean colour	Oxygen

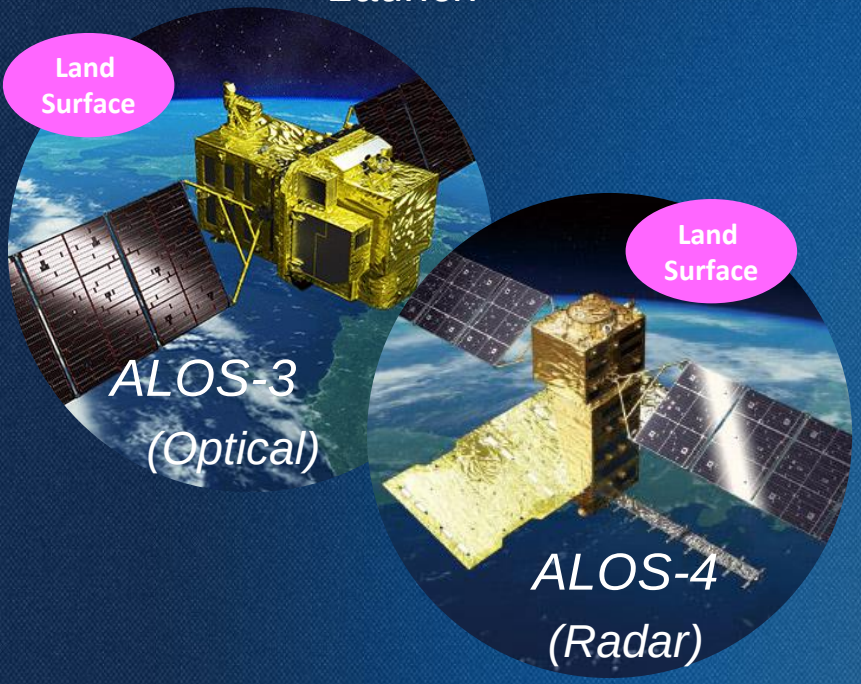
Biological/ecosystems

Marine habitat properties
Plankton

Future JAXA Earth Observation Satellites

2020-2021

ALOS-3, ALOS4 Launch

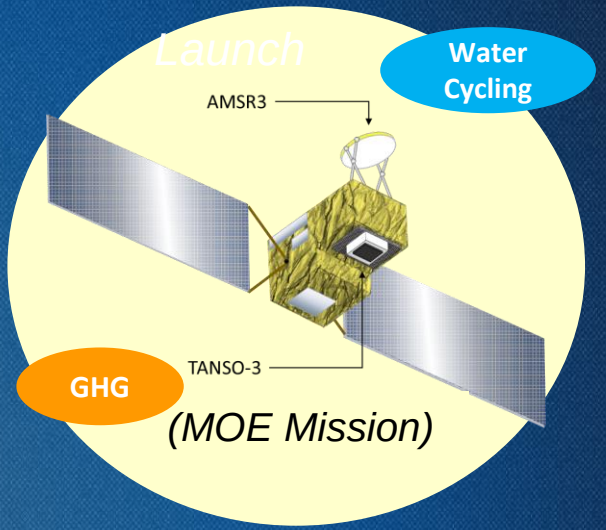


2022

EarthCARE Launch

2022-2023

GOSAT-2 Follow-on Mission / AMSR3 Launch



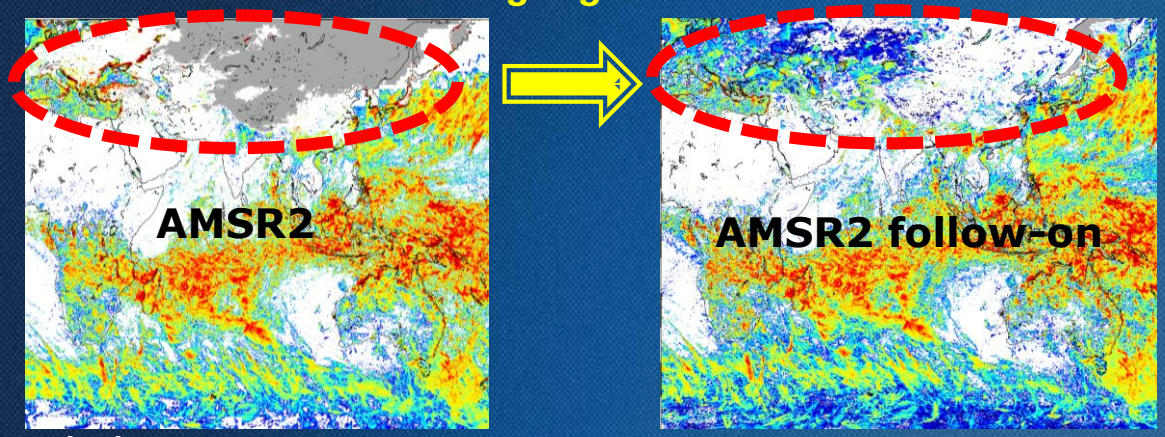
AMSR3 onboard GOSAT-2 Follow-on Mission

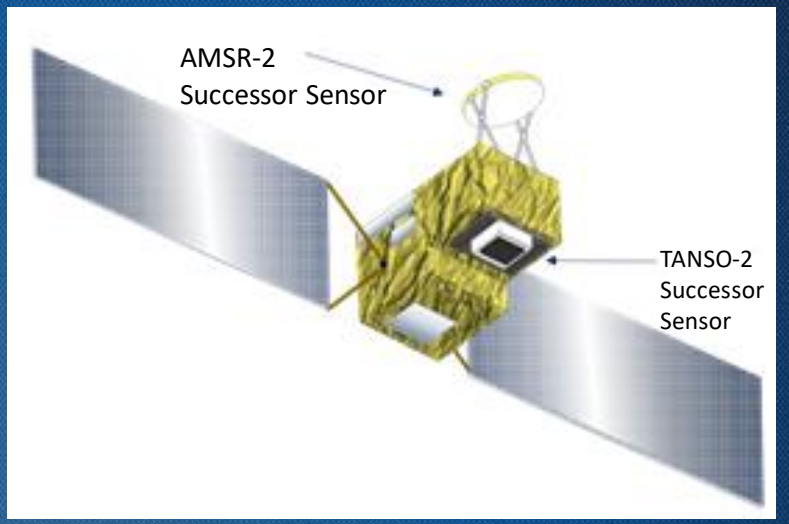
- Share the satellite bus with GOSAT-2 follow-on mission
  - GOSAT-2/TANSO-2 follow-on mission is led by Ministry of Environment

✓ AMSR3 will have new high-frequency channels (166 & 183 GHz) for solid precipitation retrievals and water vapor analysis in numerical weather prediction.

✓ GOSAT-2/TANSO-2 successor sensor will improve observation capability of greenhouse gases.

Capable of observing global precipitation including high-latitude snowfall





Mission Targets

- Understanding water cycle variation and impacts of climate change
- Improvements in numerical weather prediction, typhoon analysis, etc.
- Contributions to fisheries near coast
- Contribution to navigation support in polar oceans

JMA-JAXA Collaboration

Ground x Space

JMA x JAXA

気象庁
Japan Meteorological Agency

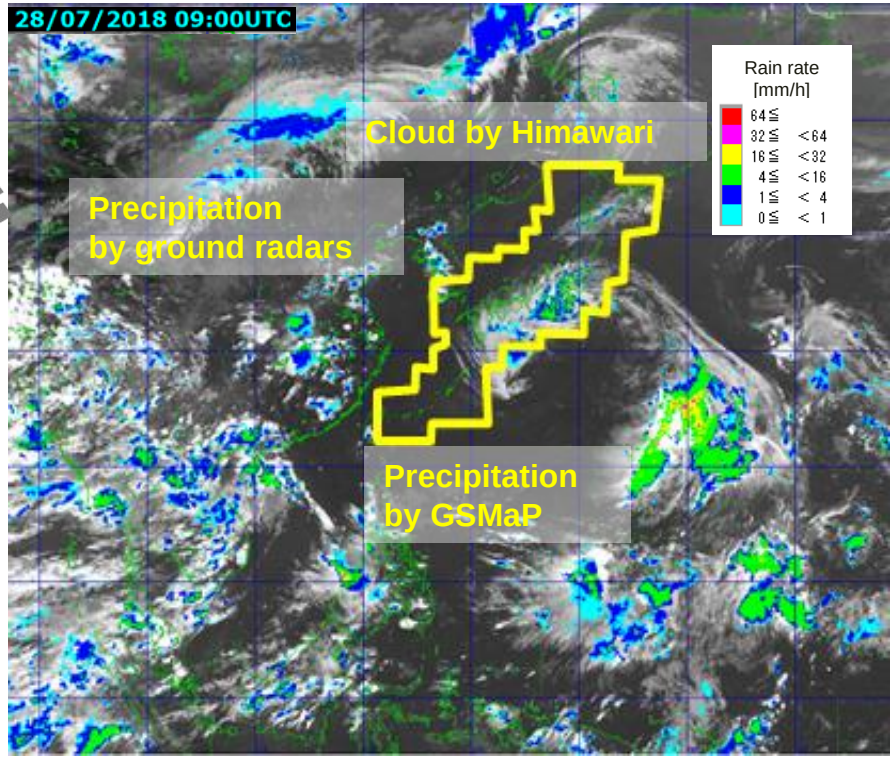
JAXA
Japan Aerospace Exploration Agency

JMA-JAXA Collaboration
Integration of ground-based & spaceborne rainfall

JMA and JAXA are closely collaborating for developing regional integrated precipitation product by using **ground/space observation**

Effect by "**JMA x JAXA**"

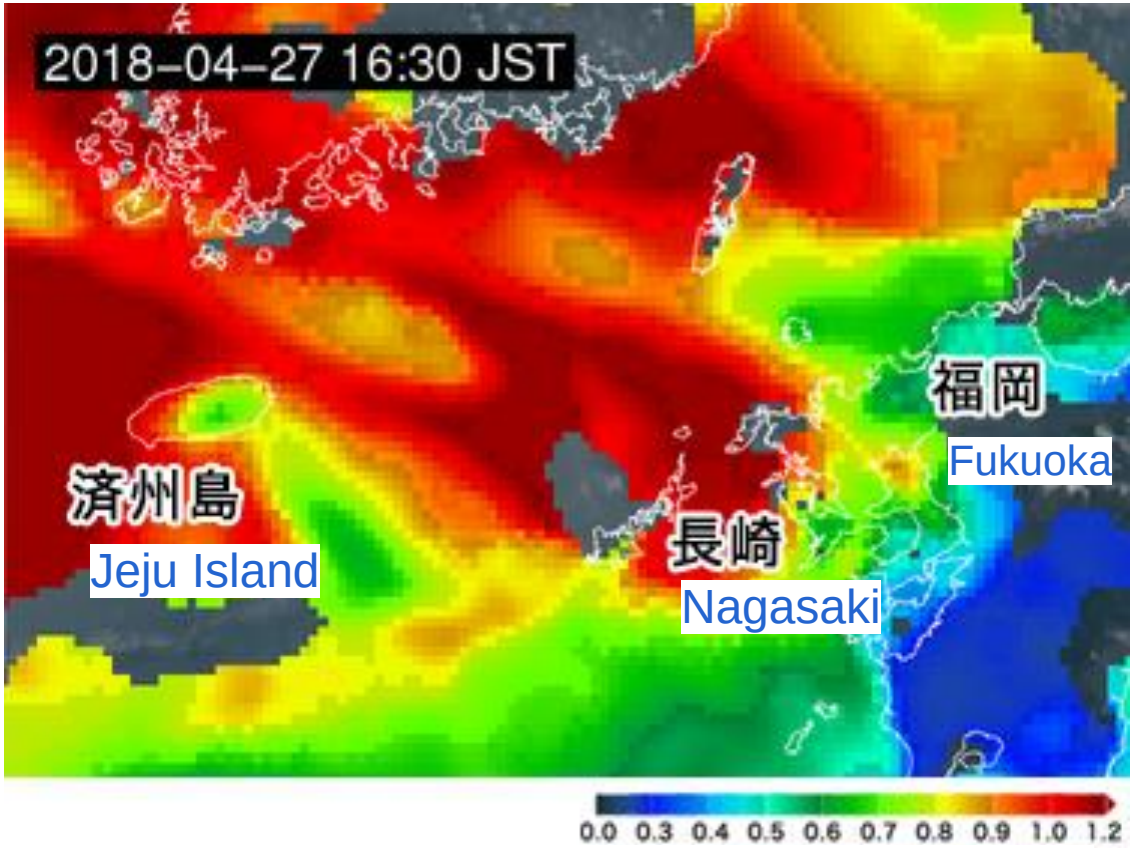
Effect by "**Ground x Space**"



one-stop approach from R&D to operation & application

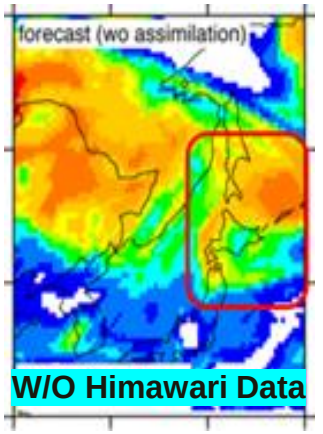
Maximize the advantage of each dataset!

JMA-JAXA Collaboration
Supporting for Improvement of Forecasting Aerosol Arrival

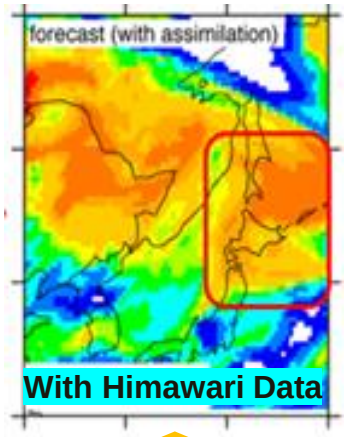


An example of Himawari Aerosol Optical Thickness

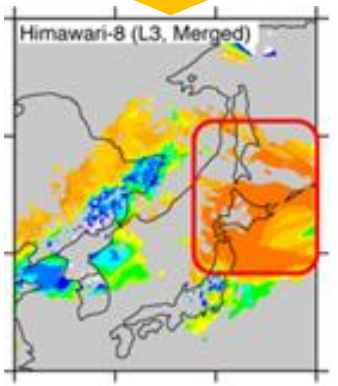
24 Hour-Forecast



Improved



better agreement



Actual Observation by Himawari

based on Yumimoto et al. 2018

- ✓ Himawari aerosol optical thickness (AOT) algorithm and the AOT assimilation system have been developed jointly by Kyushu University, Meteorological Research Institute and JAXA.
- ✓ The satellite AOT assimilation has improved the forecast of aerosol arrival in 24 hours, thus JMA will start operational aerosol forecast in JFY 2019.
- ✓ In addition to Himawari, GCOM-C, GOSAT-2 and EarthCARE data will be assimilated in the future.

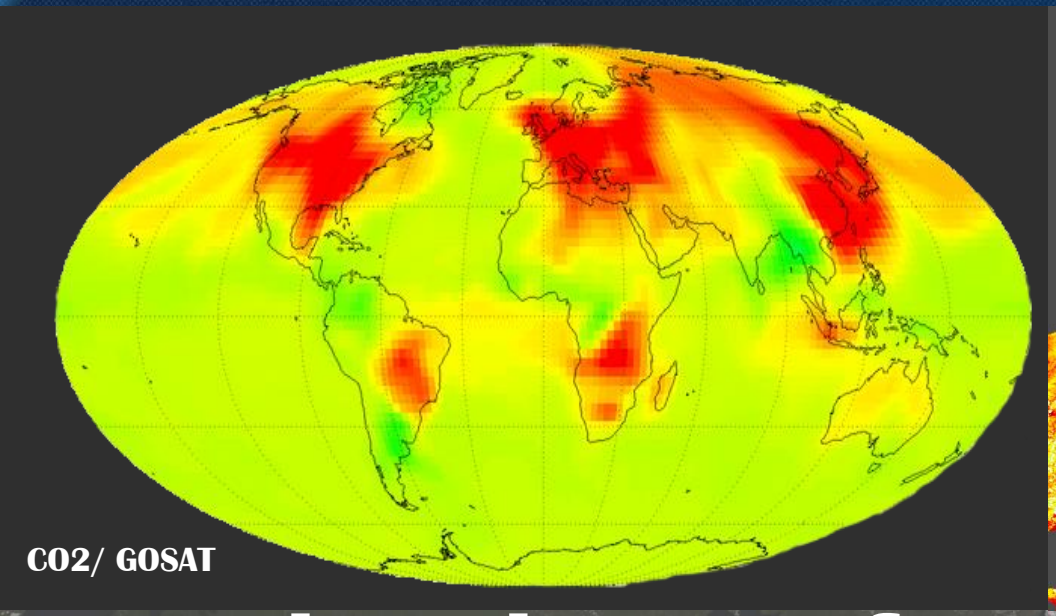
JAXA's Open and Free EO Data and Services

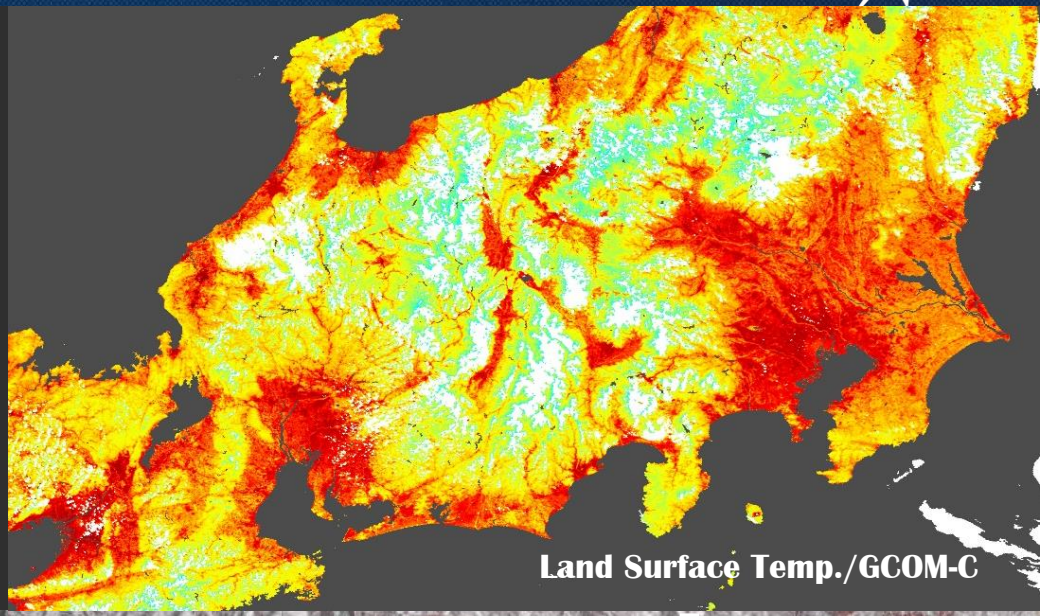
	Portal Name and URL
	**G-Portal R** Provides products of GPM, GCOM-W, GCOM-C, GOSAT, and Past Satellites and Sensors (MOS-1/1b, JERS-1, ADEOS, ADEOS-II, Aqua/AMSR-E, TRMM/PR) https://gportal.jaxa.jp/gpr/ (Contacts : z-gportal-support@ml.jaxa.jp)
	**GSMaP: Global Satellite Mapping of Precipitation** Provides hourly Global Rainfall Map in Near-Real-Time (GSMaP_NRT), available four hours after observation. (GPM-Core GMI, TRMM TMI, GCOM-W1 AMSR2, DMSP series SSMIS, NOAA series AMSU, MetOp series AMSU, and Geostationary IR) http://sharaku.eorc.jaxa.jp/GSMaP/index.htm (Contacts : Z-trmm_real@ml.jaxa.jp)
	**JAXA Himawari Monitor** Provides multi-satellite products from the Himawari Standard Data provided by the Japan Meteorological Agency (JMA) as well as the geophysical parameter data (Aerosol Optical Thickness, Sea Surface Temperature, Short Wave Radiation, Chlorophyll-a, Wild Fire, Photovoltaic Power, Cloud Optical Thickness and Cloud Type) produced by JAXA. https://www.eorc.jaxa.jp/ptree/index.html (Contacts : Z-trmm_real@ml.jaxa.jp)
	**GDAS: GOSAT Data Archive Service** **(Operated by National Institute for Environmental Studies)** Provides GOSAT products (Methane and CO2). https://data2.gosat.nies.go.jp/index_en.html (Contacts: gosat-support@nies.go.jp)

For Our Sustainable Future

Images of the Earth about 340,000 km from the center of the Earth took by the Hayabusa2 after the swing-by on December 4, 2015.

Australian continent on the upper right, and Antarctica on the lower right.





Thank you for your attention.