JAXA Earth Observation Program and Contribution to Paris Agreement

The Coordination Group for Meteorological Satellites
CGMS-45 Plenary
15 June 2017

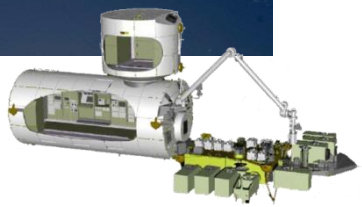
Akiko Suzuki

Associate Senior Chief Officer of
Satellite Applications

JAXA Activities

Space Transportation

Human Space Activities



Satellite Program

Lunar & Planetary Exploration Program

Aviation Program

Space Science

Current Situation

❖ Global Issues:

- Tackle common challenges; “Sustainable Development Goals (SDGs)”, “Sendai Disaster Prevention Framework” and “Paris Agreement”

❖ Japanese Government Policies in Science & Technology :

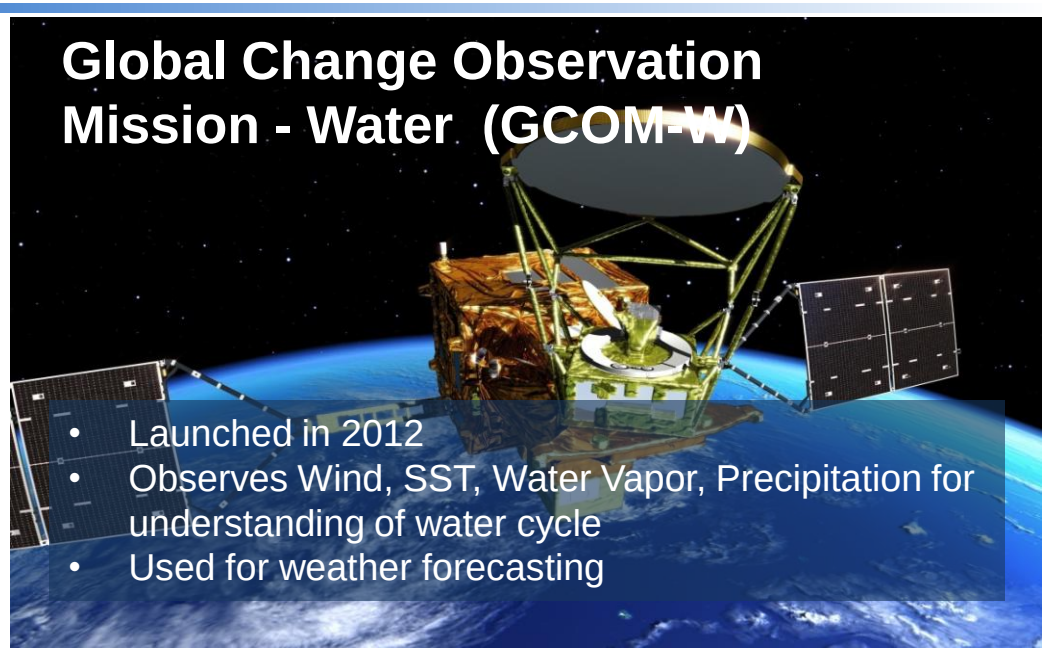
1. Sustainable growth and self-sustaining regional development
2. Ensure safety and security for our nation and its citizens and a high-quality, prosperous way of life
   - Disaster Risk Management Using Satellite Data and Applications: ALOS-2
3. Respond to global challenges and contribute to global development
   - Contribution to understanding of Climate Change Using Satellite and Applications: GOSAT, GCOM-W, GCOM-C, GPM and EarthCARE
   - Contribution to Paris Agreement
4. Sustainable creation of intellectual property

JAXA's Current Earth Observation Satellites

Greenhouse gases Observing SATellite (GOSAT)

- Launched in 2009
- Observes CO2 and Methane (CH4) globally once every 3 days

Global Change Observation Mission - Water (GCOM-W)

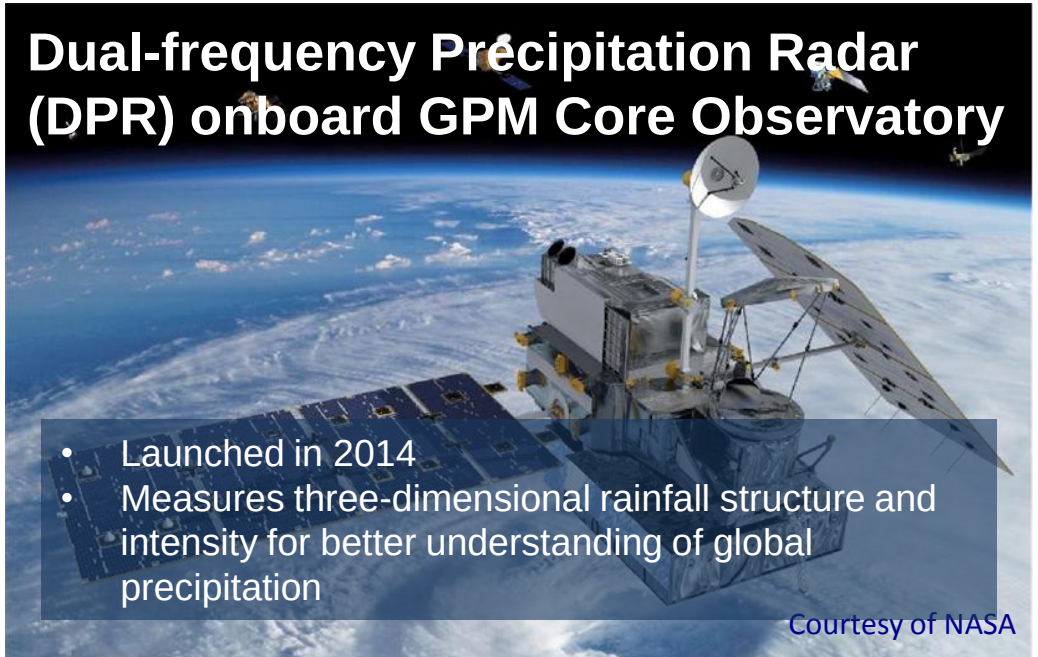


- Launched in 2012
- Observes Wind, SST, Water Vapor, Precipitation for understanding of water cycle
- Used for weather forecasting

Advanced Land Observing Satellite-2 (ALOS-2)

- Launched in 2014
- Capable of observing day and night, and in all weather conditions
- Contributes to disaster risk management and forest monitoring

Dual-frequency Precipitation Radar (DPR) onboard GPM Core Observatory



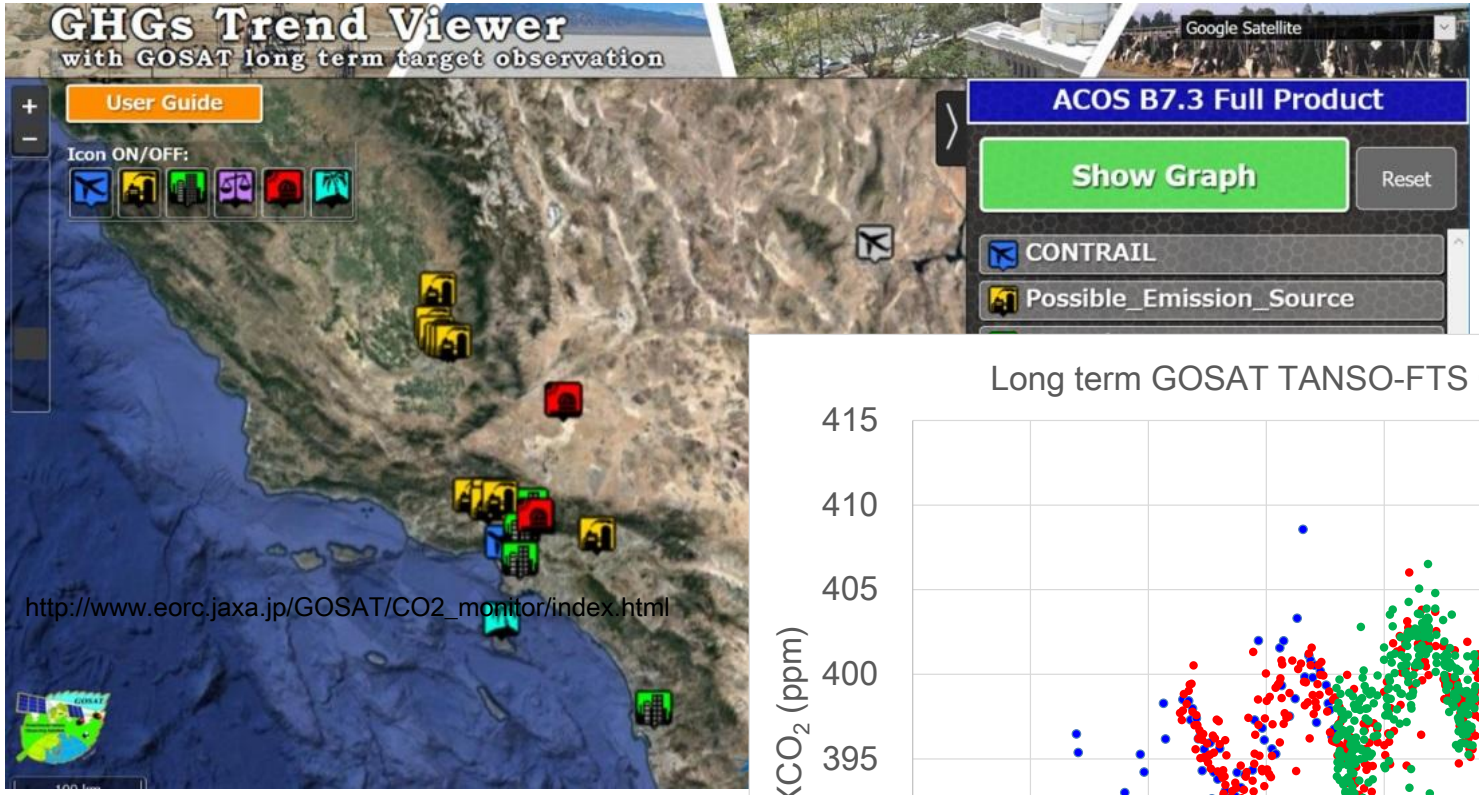
- Launched in 2014
- Measures three-dimensional rainfall structure and intensity for better understanding of global precipitation

Courtesy of NASA

GOSAT Scientific Outcomes (1/3)

- Acquires 56,000 data of GHG concentration on the entire surface of the earth once every 3 days
- Monitored that the whole-atmospheric CO2 mean exceeded 400ppm in December 2015
- Understood trends of 8-year GHG concentrations of 100 sites of large cities and major emission sources all over the world
- Anthropogenic CO2 concentrations in global mega-cities estimated from GOSAT data well agreed with those estimated from emission inventories
- Found that the monthly-averaged CH4 concentration marked a record high of 1815ppb in January 2017

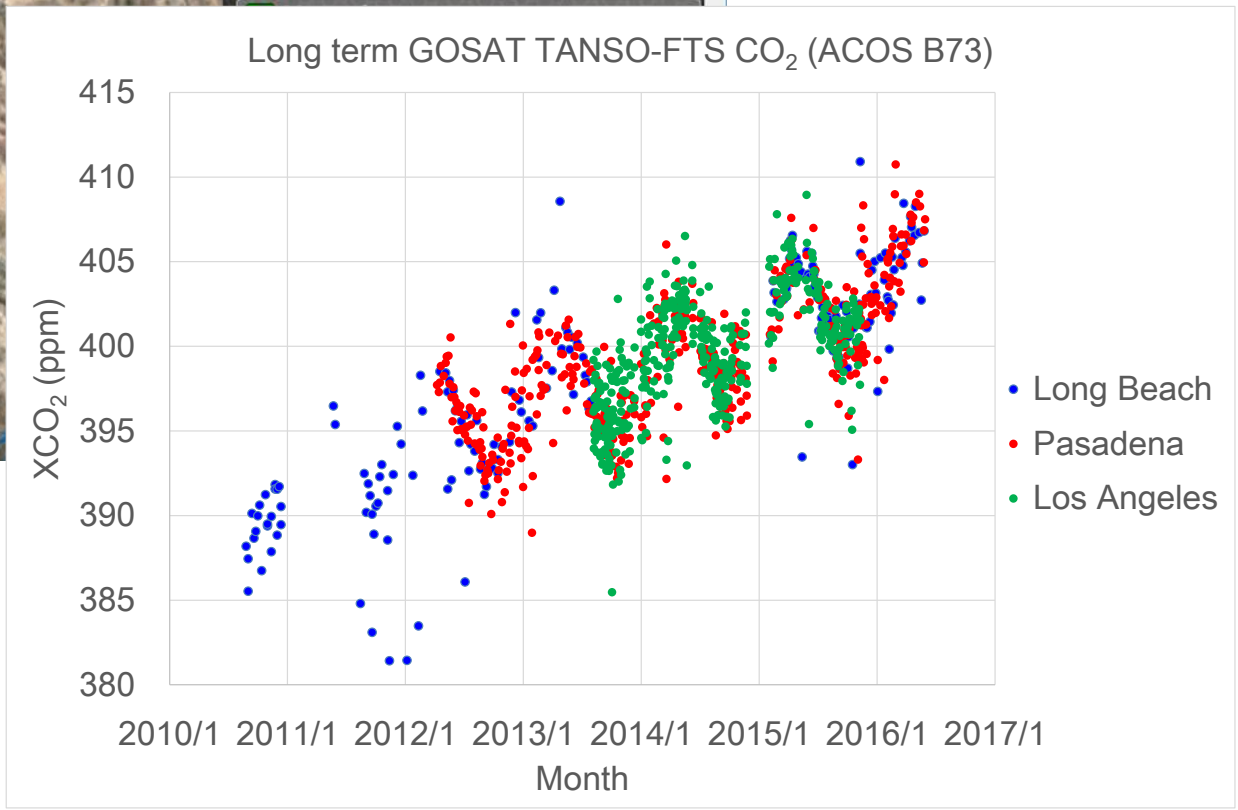
Trends of 8-year GHG Concentrations of 100 sites of Large Cities & Major Emission Sources



CO_2 long term trend

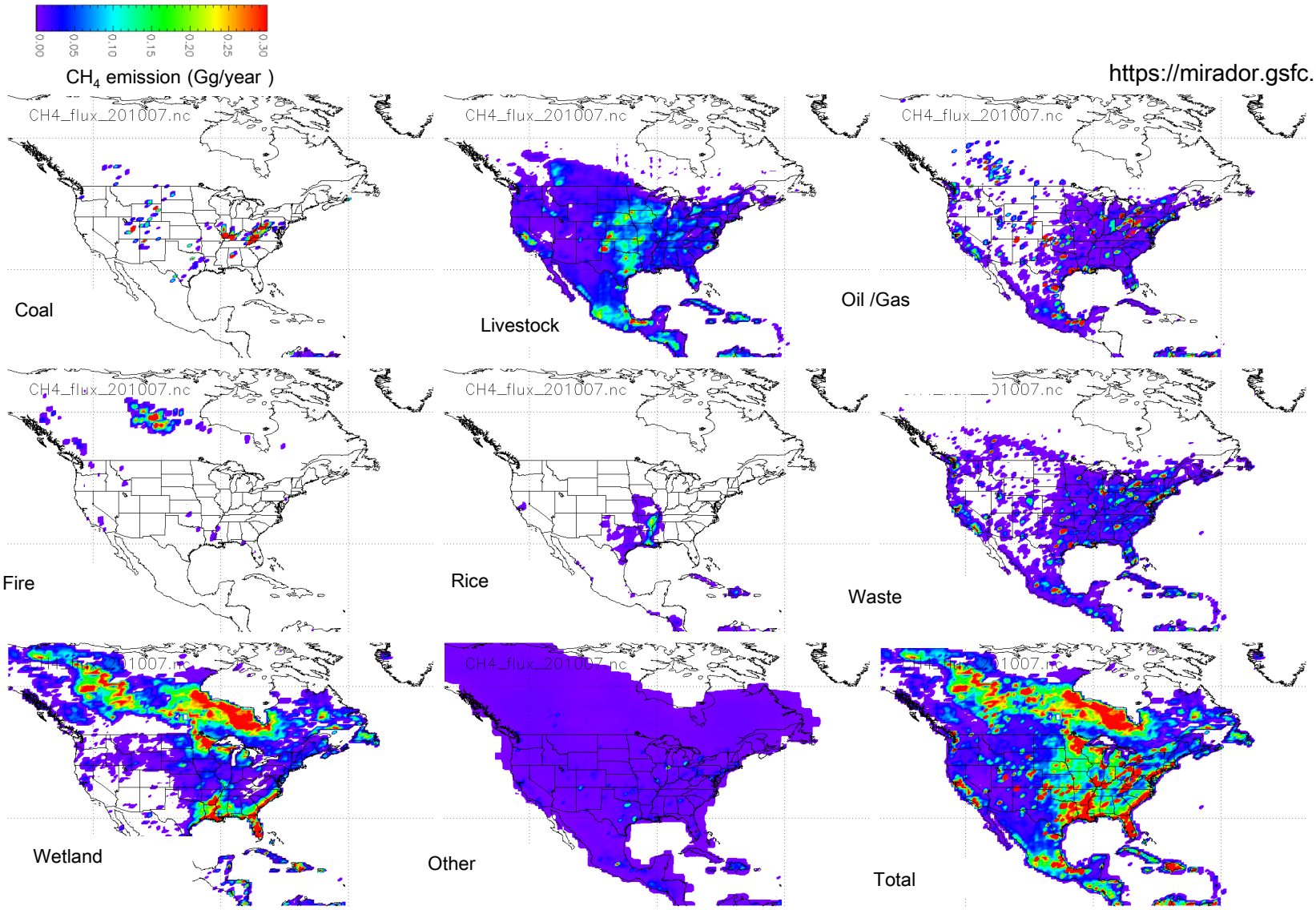
ACOS B7.3 is the level 2 product version released in Jan. 2017.
The same algorithm as OCO-2 V7.

OCO-2 V8 will be released summer 2017.



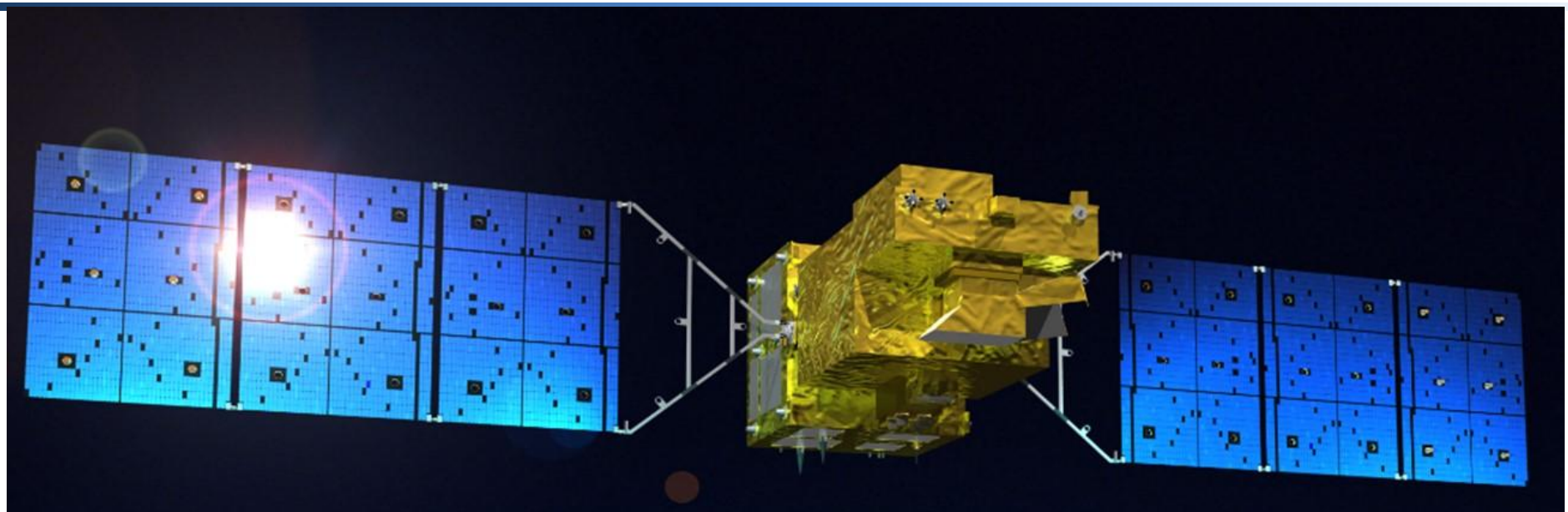
CH4 Emissions Estimated from Each Category of Emission Sources

July 2010



Future Launch

GOSAT-2



- Continuous Observation of CO2 &CH4 by GOSAT/GOSAT-2 for Long Period
- More Accurate Estimation of CO2 Emissions by Measuring CO

- Launch: JFY2018
- Gases: CO2, CH4 and CO
- Accuracy: 0.5 ppm (CO2) and 5 ppb (CH4) at 500-km mesh over earth's surface
- Nominal Operation Period: 5 years
- Mass: Approx. 2,000Kg
- Launch Vehicle: H-IIA

Contribution to Paris Agreement by Satellite GHG Observation Data

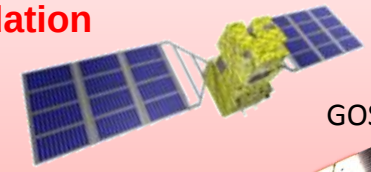
IPCC Guidelines（to be refined in 2019）

◆ **Support accuracy of national GHG inventory reporting**

Satellite-based GHG Data

◆ **Provide highly accurate and quality-controlled data set through cross-calibration and validation**

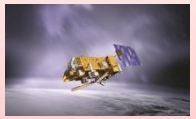
Cross-calibration and Validation

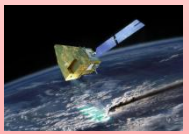

GOSAT


GOSAT-2


OCO-2


TROPOMI/Sentinel-5P


IASI/MetOp


MicroCarb

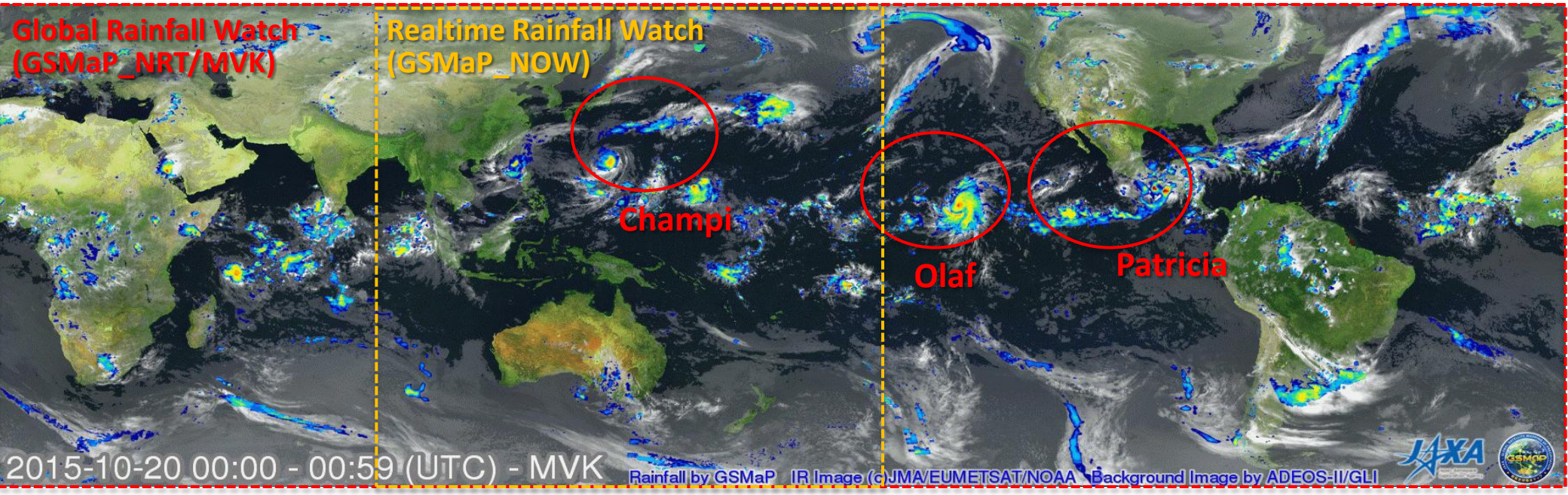

TanSat


FLEX

[Image Credit]
OCO-2: NASA; Sentinel-5P: ESA/ATG medialab; MetOp: ESA/Eumetsat; McroCarb: © CNES/Illustration Oliver Sattler 2015;
TanSat: TanSat collaboration; FLEX: ESA/ATG medialab

Monitoring of Global Precipitation on Real-time & Contribution to Disaster Risk Management

- Integrated data: GPM core observatory, microwave radiometers/sounders and infrared radiometers of geostationary satellites



GSMaP observing hurricane Patricia and Olaf and Typhoon Champi: 2015/10/20～2015/10/24（hourly animation）

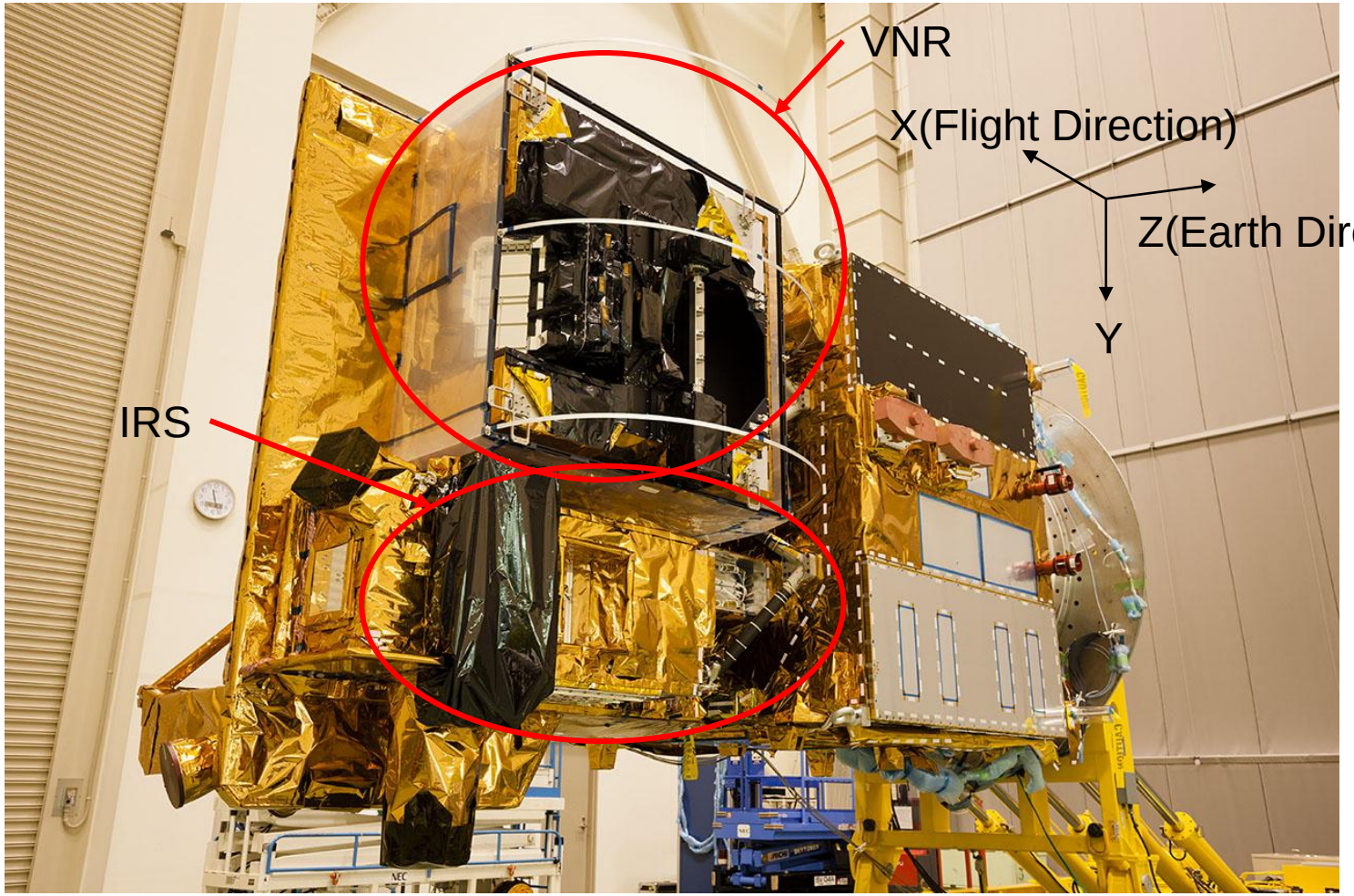
JAXA Global Rainfall Watch (4-hr delay) : http://sharaku.eorc.jaxa.jp/GSMaP
JAXA Realtime Rainfall Watch (Himawari-area): http://sharaku.eorc.jaxa.jp/GSMaP_NOW

Current Status and Future of GCOM Mission

- Nominal Operation Period of GCOM-W was successfully completed in May 2017.
- GCOM-W's condition is extremely well. Extended Operation was determined.
- GCOM-C will be launched in latter half of JFY 2017.
- GCOM-C & W will contribute to understanding of Climate Change.
- Study on the capability of AMSR2's successor sensor onboard GOSAT-3 was stipulated in "the Roadmap for the Basic Plan on Space Policy" which has been effective since April 2017, and JAXA has started its study.

GCOM-C

- Launch in latter half of JFY 2017
- Observes Radiation Budget and Carbon Cycle



GCOM-C Satellite PFM @ JAXA Tsukuba Space Center

Essential Climate Variables Covered by GCOM-C & W

Atmospheric

Surface	Upper-air	Composition
Air temperature	**Temperature**	**Carbon dioxide**
Wind speed & direction	**Wind speed & direction**	**Methane**
Water vapour	**Water vapour**	**& other long-lived GHGs ***
Pressure	**Cloud properties**	**Ozone & Aerosol**
Precipitation	**Earth radiation budget (including solar irradiance)**	**supported by their precursors ****
Surface radiation budget		

* including N2O, CFCs, HCFCs, SF6, PFCs
** in particular NO2, SO2, HCHO, CO

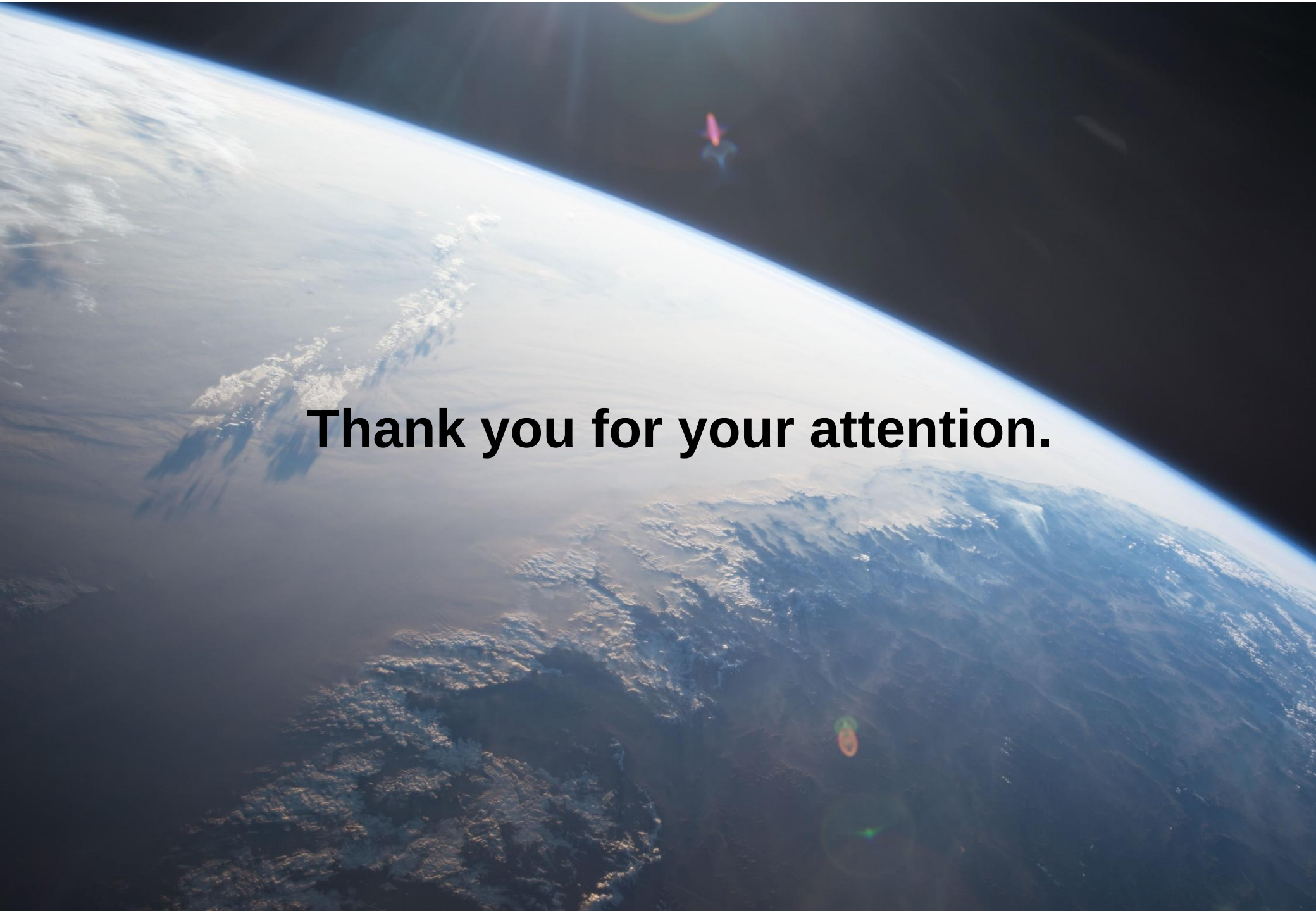
Terrestrial

River discharge
Water use
Groundwater
Lakes
Snow cover
Glaciers and ice caps
Ice sheets
Permafrost
Albedo
Land cover (including vegetation type
Fraction of absorbed photosynthetically active radiation (FAPR)
Leaf area index (LAI)
Above-ground biomass
Soil carbon
Fire disturbance
Soil moisture

Oceanic

Surface	Sub-surface
Sea-surface temperature	Temperature
Sea-surface salinity	Salinity
Sea level	Current
Sea state	Nutrients
Sea ice	
Surface current	
Ocean colour	
CO2 partial pressure	CO2 partial pressure
Ocean acidity	Ocean acidity
Phytoplankton	
	Oxygen
	Tracers

Total Essential Climate Variables (ECVs) (ECVs largely dependent on satellite observations identified by CEOS and GCOS are shown in **bold**.)	50
ECVs covered by GCOM-W and GCOM-C	**21**


Thank you for your attention.