Worldwide Engagement for Greenhouse Gases Emission Monitoring from Space

55th Committee on the Peaceful Uses of Outer Space
Scientific and Technical Subcommittee
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First Light Image of GCOM-C “SHIKISAI”

Latest News

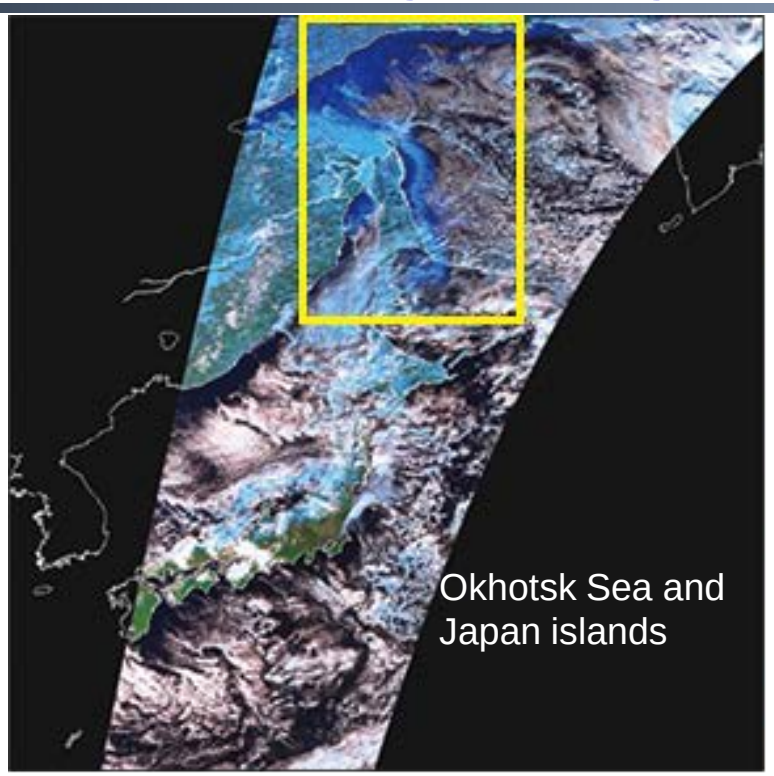
Global Change Observation Mission – Climate

GCOM-C VNR RGB image on 1 Jan, 2018

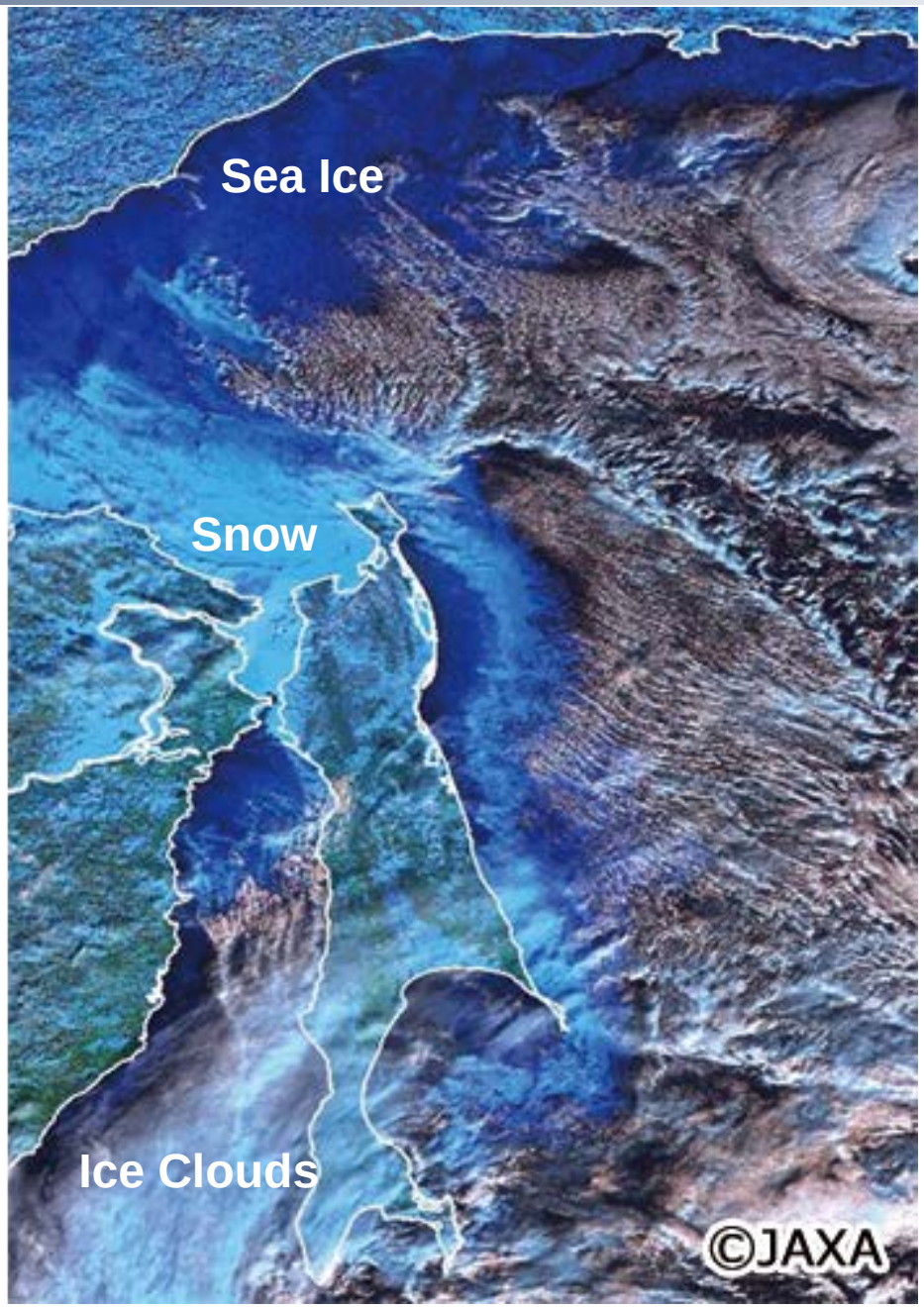
R: 0.67um,
G: 0.53um,
B: 0.43um

First Light Image of GCOM-C “SHIKISAI”

Latest News



250m spatial resolution



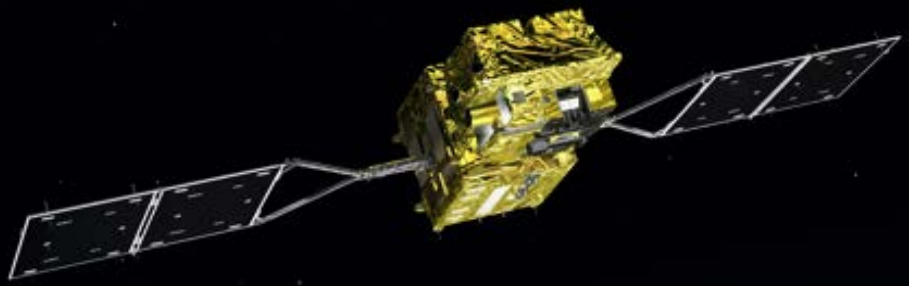
- Launched on 23 December 2017
- The image was captured on 6 January 2018

Japanese Satellites
Contributing to Understanding Global Climate Change

National Institute for Environmental Studies, Japan

SHIKISAI (GCOM-C)

Cloud・Aerosols Vegetation



Launched:
23 December 2017

IBUKI (GOSAT)

Launched: 2009

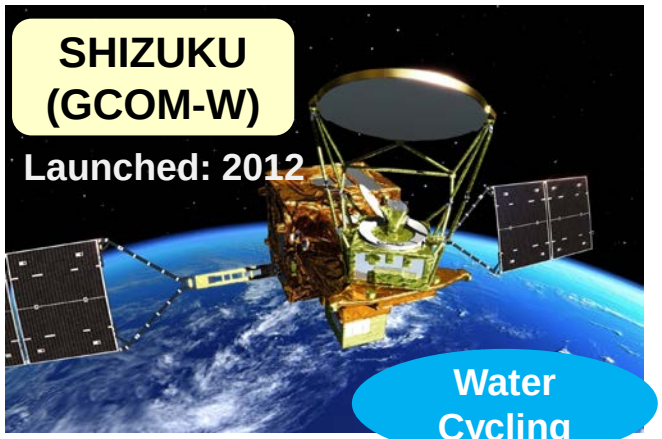
IBUKI-2 (GOSAT-2)

To be Launched:
JFY2018

Greenhouse Gases

SHIZUKU (GCOM-W)

Launched: 2012

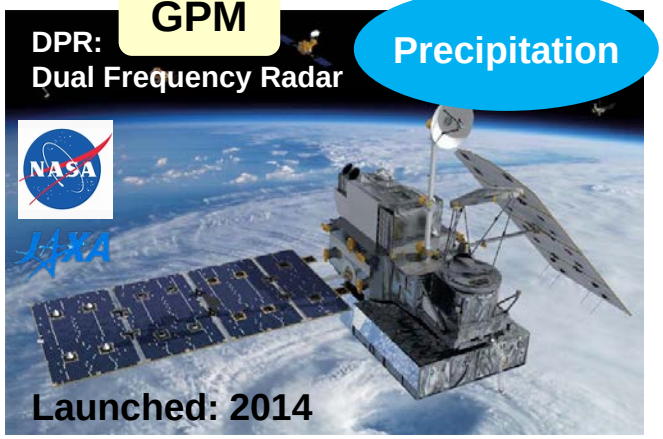


Water Cycling

GPM

DPR:
Dual Frequency Radar

Precipitation



Launched: 2014

Courtesy of NASA

EarthCARE

CPR:
Cloud Profiling Radar

Cloud/Aerosol Radiation Budget

To be Launched:
2019

Courtesy of ESA

Paris Agreement

Paris Agreement

The global target was agreed to keep global average temperatures from rising 2 degrees compared to temperatures pre-industrial revolution.

COP21・CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

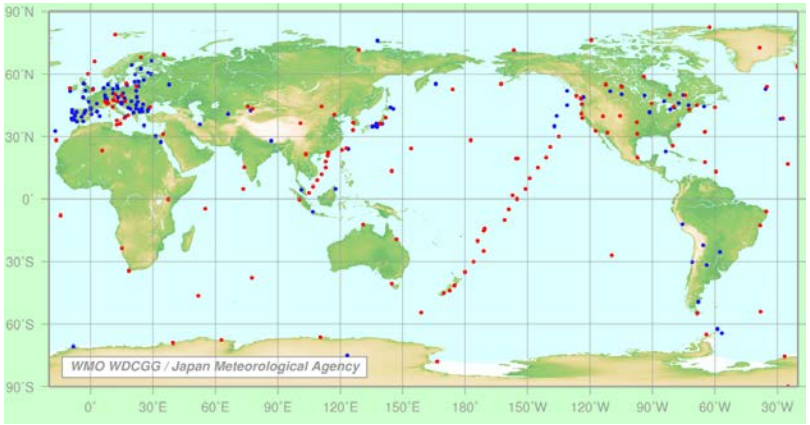
Courtesy of UNFCCC

Global GHG Monitoring with GOSAT

GOSAT: the word's 1st satellite dedicated to GHG monitoring

Increase observation points:
Measures 13,000 points

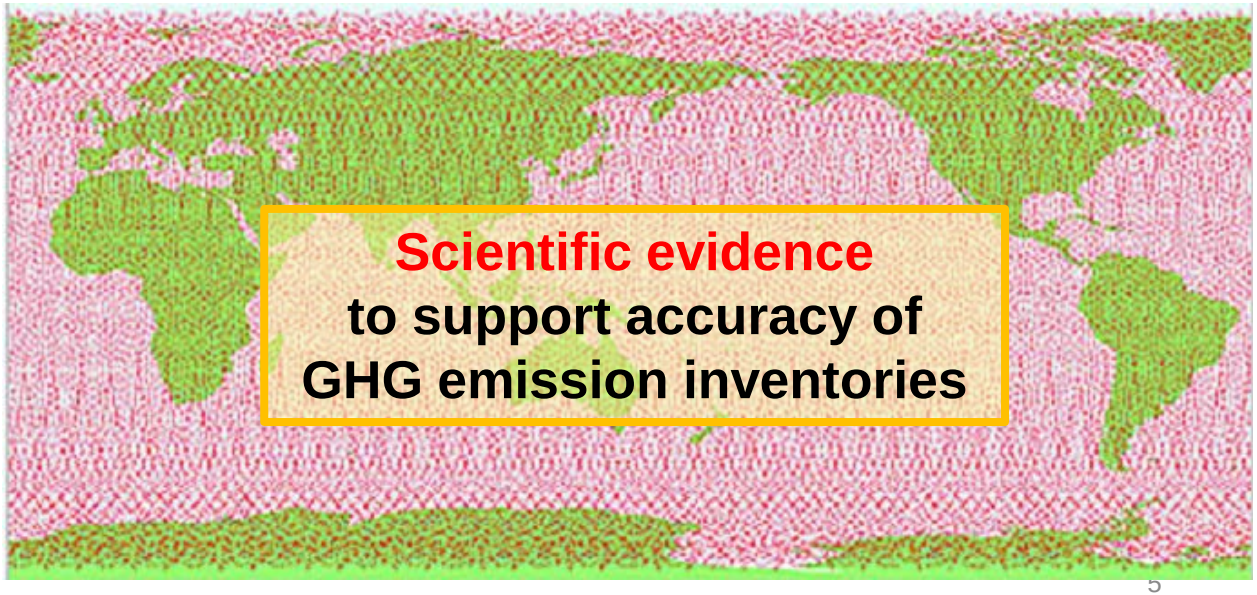
In-situ observation: Accurate measurement



Complement each other

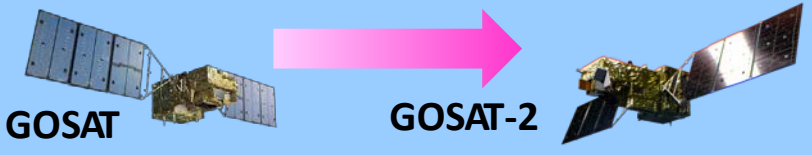
Satellite observation:

- ✓ Global measurement with one sensor
- ✓ Enables to measure without influence by difference of instruments and methods

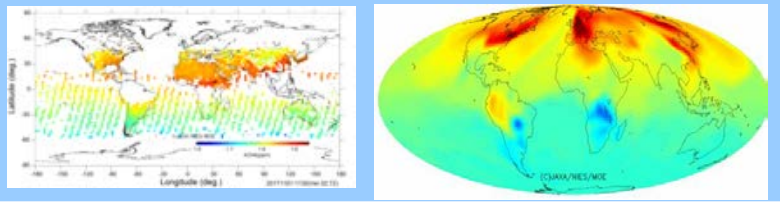


Japan's Approach for Tackling GHG Issues for Contributing to Paris Agreement

1. Continuous observation of global GHG concentration by GOSAT satellites

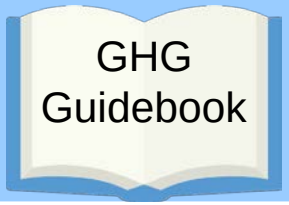


2. Provision of GOSAT data products under free and open data policy



3. Enhancement of reliability of satellite GHG data in cooperation with space agencies

4. Development of "GHG Guidebook" which explains how to use satellite data



5. Future plans of capacity building to use satellite GHG data in development of national GHG inventories

World GHG Satellites
Engagement of Space Agencies (1/2)

1. Since the launch of GOSAT, the world's first satellite dedicated to monitoring GHG, in 2009, the world's GHG monitoring capability from space has been increased.

In Operation

GOSAT
2009 ～

OCO-2
2014 ～

TanSat
2016 ～

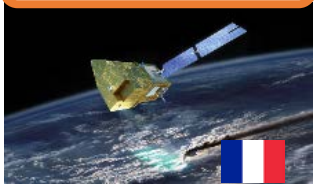
Sentinel-5P
2017 ～

Under development or planning

GOSAT-2
2018

OCO-3
To be determined

MicroCarb
2020



MERLIN
2021

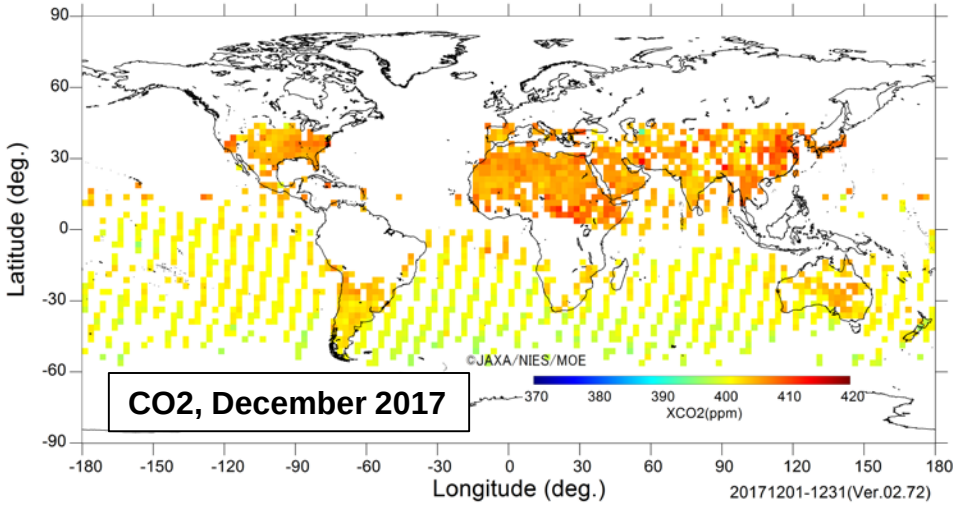
World GHG Satellites
Engagement of Space Agencies (2/2)

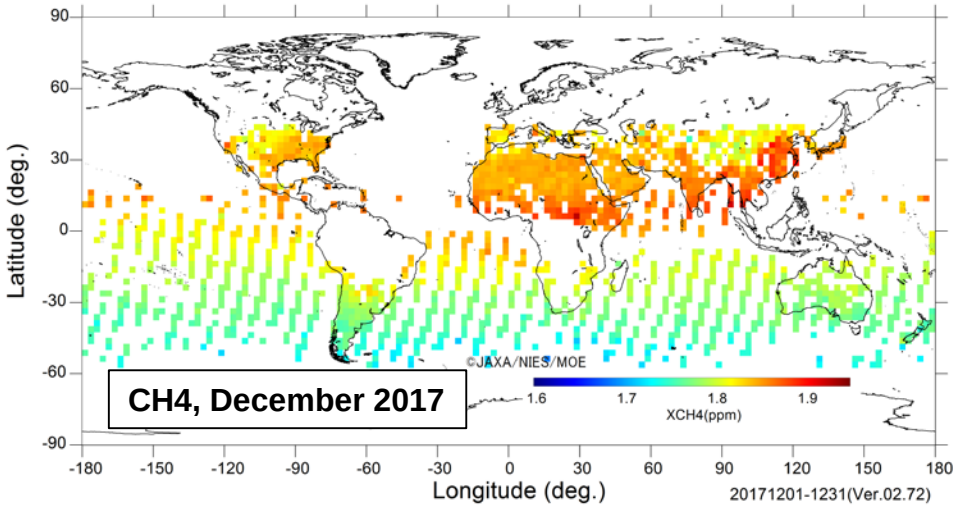
2. For contributing to enhance transparency framework of action under the Paris Agreement, Space Agencies are mutually cooperating.

3. JAXA and NIES concluded agreements with NASA, ESA, CNES and DLR for:
   - ✓ Provision of reliable and consistent satellite GHG data for governments, UN organizations and scientists for effective implementation of Paris Agreement;
   - ✓ Promotion of satellite GHG data utilization and cooperation with custodian agencies for capacity building.

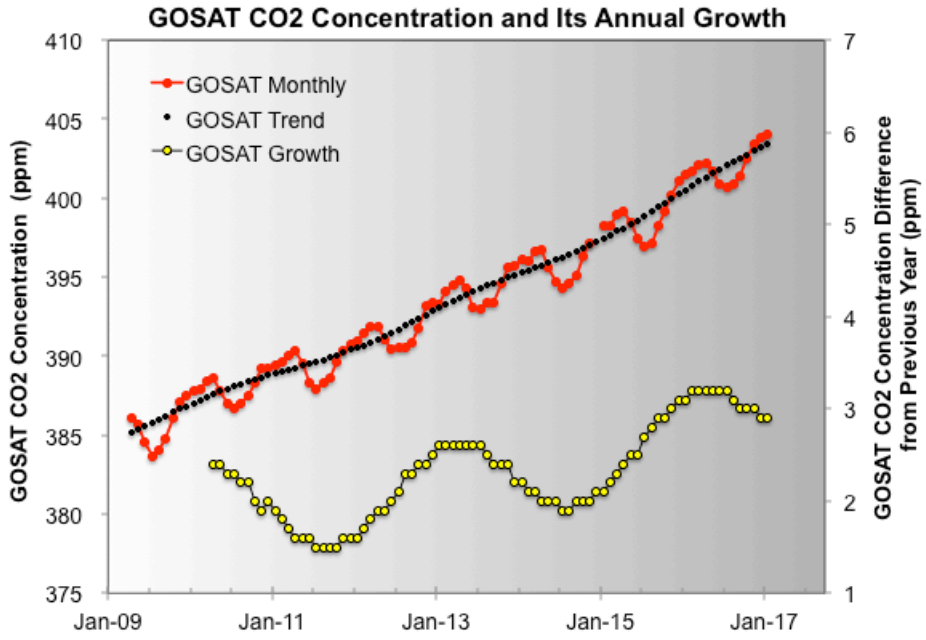
GOSAT Achievements (1/2)

Nine year record of CO2 and methane measured by GOSAT revealed the dynamics of such gases in local, regional, and global scales.





https://data2.gosat.nies.go.jp/gallery/gallery_en.html

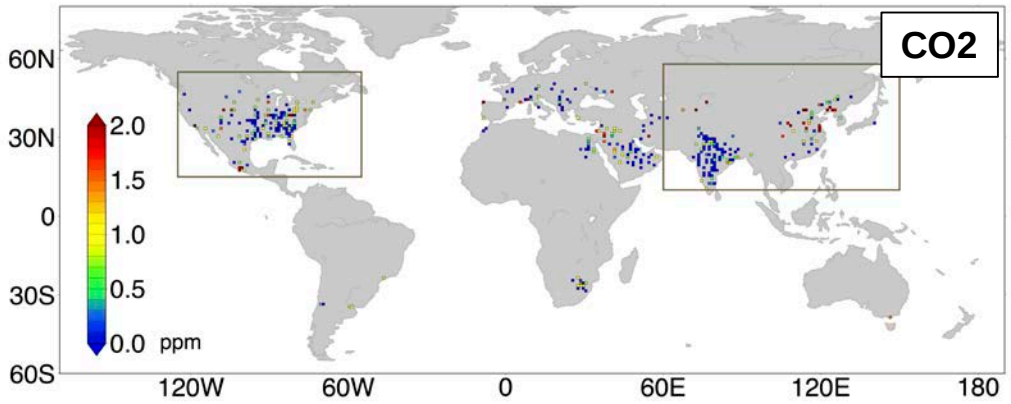


- Whole-atmosphere mean CO2 (above) and CH4 concentrations are calculated from GOSAT Level 2 products (upper left) with a model-based correction.
- CO2 and CH4 monthly data show the increasing trends with seasonal variations since 2009.
- High CO2 and CH4 growths in recent years are coincident with 2015 - 2016 ENSO event.

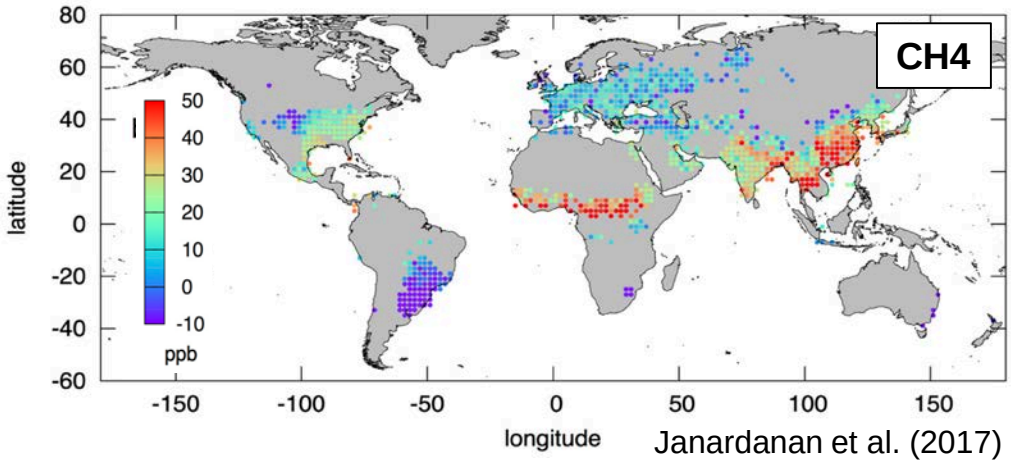
http://www.gosat.nies.go.jp/en/recentglobalghg.html

GOSAT Achievements (2/2)

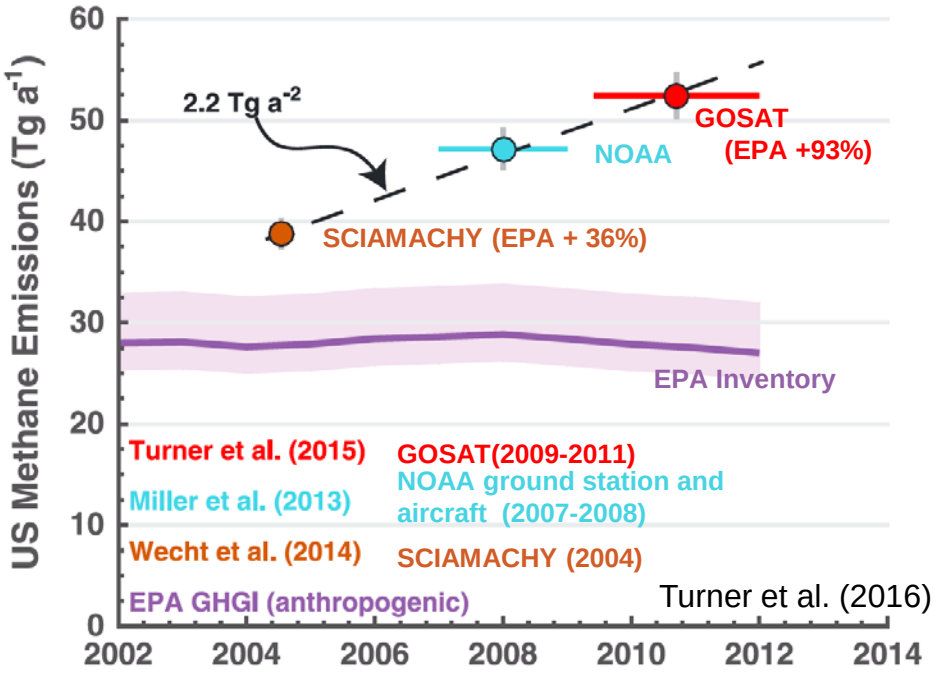
GOSAT data are now being used to estimate anthropogenic emissions of CO2 and CH4. Emission estimates can be compared to inventories.



Janardanan et al. (2016)



Janardanan et al. (2017)



Turner et al. (2016)

- Global distributions of anthropogenic emissions of CO2 and CH4 (left) can be mapped using GOSAT.
- CH4 emissions in CONUS derived from satellite and ground concentration data were compared with EPA inventory.

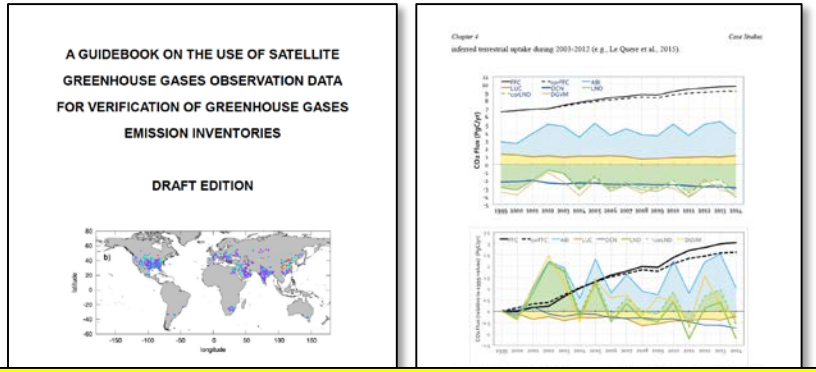
GHG Satellite Guidebook

- ✓ The basics of GHG satellite remote sensing and the know-how to use such data in verification of national GHG emission inventories are described in the guidebook.

- ✓ Schedule
  - Draft = Oct. 2017
  - UNFCCC COP23 = Nov. 2017
  - Open review = Nov. 2017 - Feb. 2018
  - 2nd Expert Mtg. = Feb. 2018
  - 1st edition = Mar. 2018

- ✓ 9 case study contributions from scientists in Canada, Finland, Germany, Japan, and US.

- ✓ It will be used as one of textbooks in future capacity building activities for inventory compilers starting from FY2019.

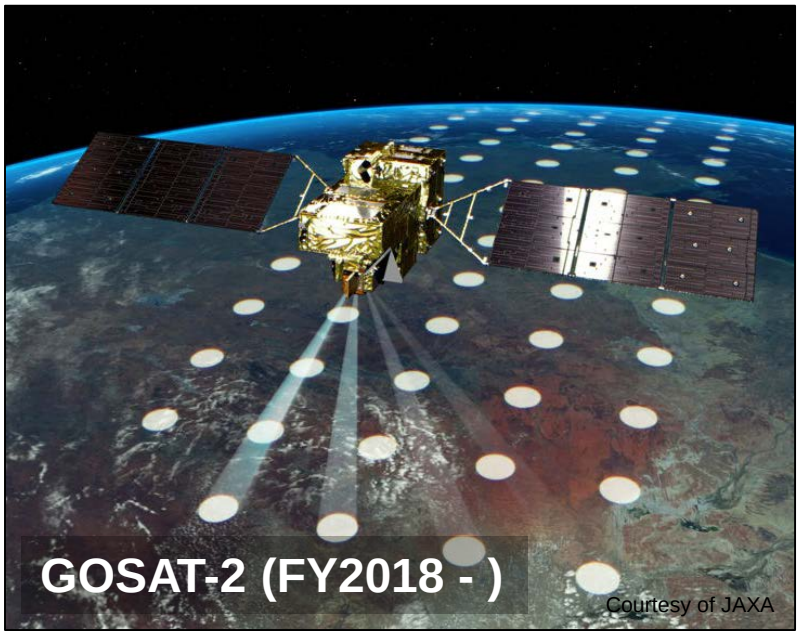


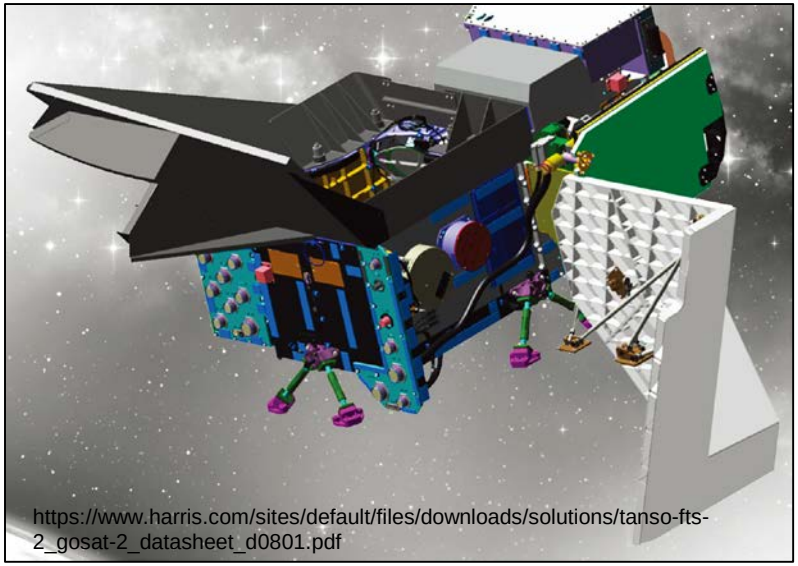
"A Guidebook on the Use of Satellite Greenhouse Gases Observation Data for Verification of Greenhouse Gases Emission Inventories"
http://www.nies.go.jp/soc/en/documents/

"Cutting-edge Satellite Monitoring and Scientific Knowledge to Contribute to the Paris Agreement: Focusing on the IPCC Guidelines for National Greenhouse Gases Inventories" (Japan Pavilion, UNFCCC COP23)

GOSAT-2 Launch in FY2018

- ✓ The successor of GOSAT, namely GOSAT-2, will be launched in FY2018 by H-IIA rocket from JAXA's Tanegashima Space Center.
- ✓ GOSAT-2 will carry advanced earth observation instruments based on the heritage of GOSAT.
- ✓ Carbon dioxide, methane, and carbon monoxide concentration data from GOSAT-2 will be publicly released one year after its launch.
- ✓ GOSAT-2 will acquire data for 5 years. Its data will contribute to 1st global stocktake under Paris Agreement in 2023





Take-home Messages

- ✓ Japanese Greenhouse gases Observing SATellite (GOSAT) launched in 2009 has been measuring atmospheric CO2 and methane concentration globally for more than eight years.
  Its successor, GOSAT-2, will be launched in FY2018.

- ✓ GHG data acquired by satellites such as GOSAT and OCO-2 are now being used in carbon cycle science and evaluation of GHG emission inventories.

- ✓ Tackling global climate change requires cooperation by all countries. Japan contributes to convene efforts by respective countries, space agencies and environmental institutes.

Thank you for your attention.