The Greenhouse gases Observing SATellite（GOSAT）Series

- GOSAT *1 （launched in 2009) and GOSAT-2 （launched in 2018) have been continuously observing atmospheric carbon dioxide and methane for about 16 years.
- Following the Basic Space Plan and timetable, GOSAT-GW *2, the third satellite, is being developed and manufactured together with the Ministry of Education, Culture, Sports, Science and Technology, with anticipated launch in the first half of FY2025.

*1 : GOSAT : Greenhouse gases Observing SATellite　*2 : GOSAT-GW : Global Observing SATellite for Greenhouse gases & Water cycle

GOSAT Series Purpose

○ Contributing to the development of climate change science, policy, and global stocktaking

GOSAT-GW Mission Request

① Understanding global greenhouse gas concentrations

② Ensuring transparency in emissions reporting in each country

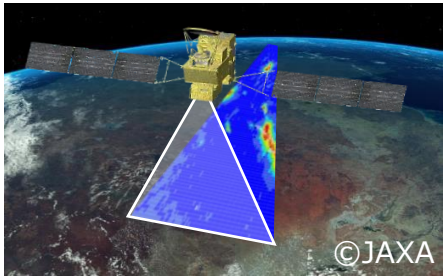
③ Monitoring of large-scale emission sources

GOSAT-2（FY2018-）

From point observation

To surface observation

GOSAT-GW (first half of FY2025-Planned)

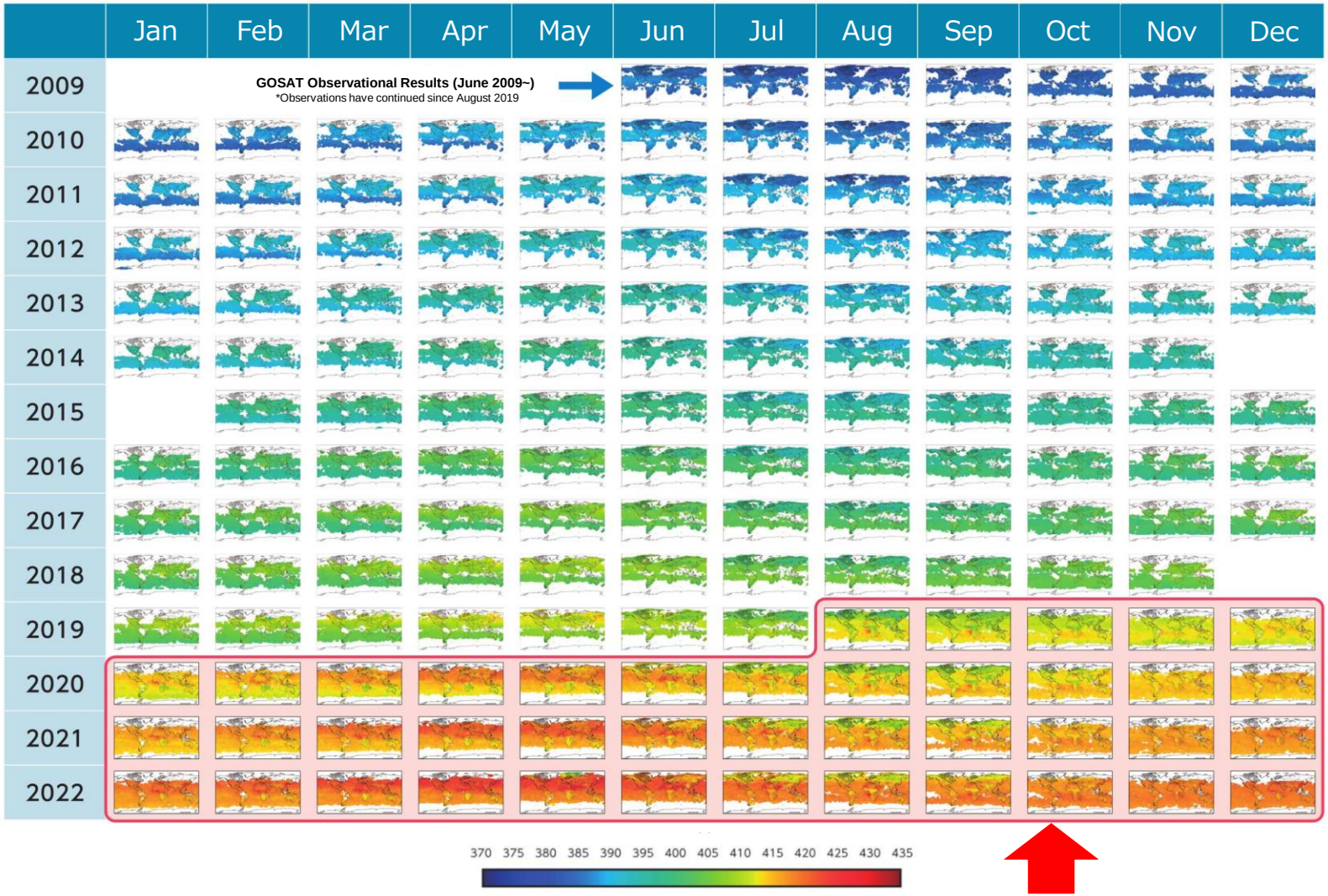


Significant Achievements to date

（1）24 papers using GOSAT-series observations were cited in the IPCC AR6 WG1 report (2021).
（2）For the first, average atmospheric concentration of carbon dioxide, excluding seasonal fluctuations, exceeded 400 ppm in January 2016.
（3）Trends in the global average concentration of atmospheric methane are shown for the first time in the world (2017).
（4）In 2021, the annual increase in total atmospheric mean concentration of methane was the largest ever recorded since observations began.
（5）The concentration of anthropogenic carbon dioxide in Japan was estimated from GOSAT observations and found to be generally consistent with emission inventories (2016).
（6）The IPCC Inventory Guidelines (2019) include the use of satellite data including GOSAT and GOSAT-2 to improve the accuracy of national emissions.
（7）In Mongolia, the technology to estimate the CO2 emission using satellite observation data has been developed, and the Mongolian government reported the second Biennial Update Report (BUR2) using GOSAT observation to UN firstly in the world.

Purpose ① Understanding global greenhouse gas concentrations

Image source: National Institute for Environmental Studies website



Purpose ② Ensuring transparency in country's emissions reporting

Aiming to ensure transparency in national emissions reporting by comparing GHG emissions inventory reports prepared and published by each country under the Paris Agreement with emissions estimates based on highly independent GOSAT observation data.

Developed a CO2 emissions estimate technique using GOSAT data for the country of Mongolia and the results will be published in the second Biennial Update Report (BUR2) to be submitted by Mongolia for the first time in the world. In parallel, this technology is being deployed in five Central Asian countries. MOUs will be signed with Uzbekistan, Kazakhstan, Tajikistan, and Kyrgyzstan by July 2024, and expert meetings have been already been held.

① GHG concentrations observed by the GOSAT series

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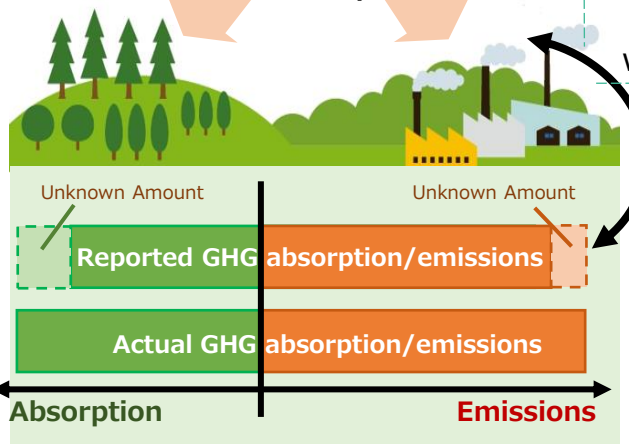
② From observed concentrations to estimated absorption/emissions

↑MOU signing ceremony with Tajikistan



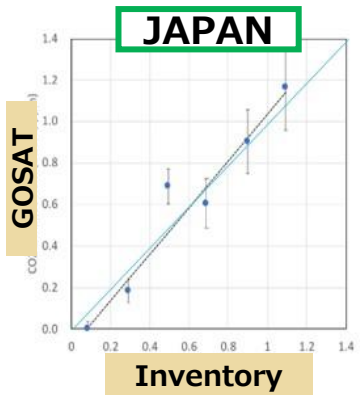
③GHG absorption/emissions prepared and reported by each country and GHG absorption/emissions estimated from satellites

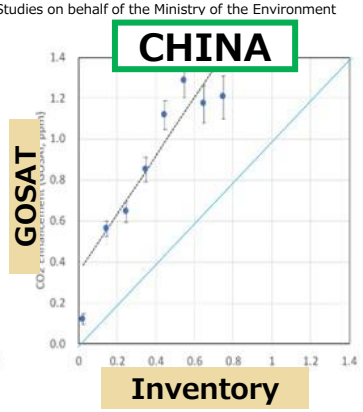
Goal to ensure transparency in national emissions reporting

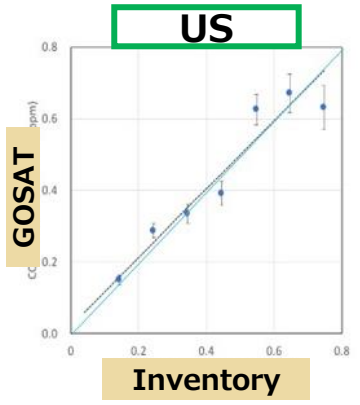
Conceptual diagram of GOSAT emissions estimates compared to emissions inventory

Example CO_2 concentration comparisons

Prepared by the National Institute for Environmental Studies on behalf of the Ministry of the Environment







※Comparison of CO2 anthropogenic emissions based on Janardanan et al. (2016) for satellite observations (GOSAT) and ODIAC statistical values (Japan, China, US)

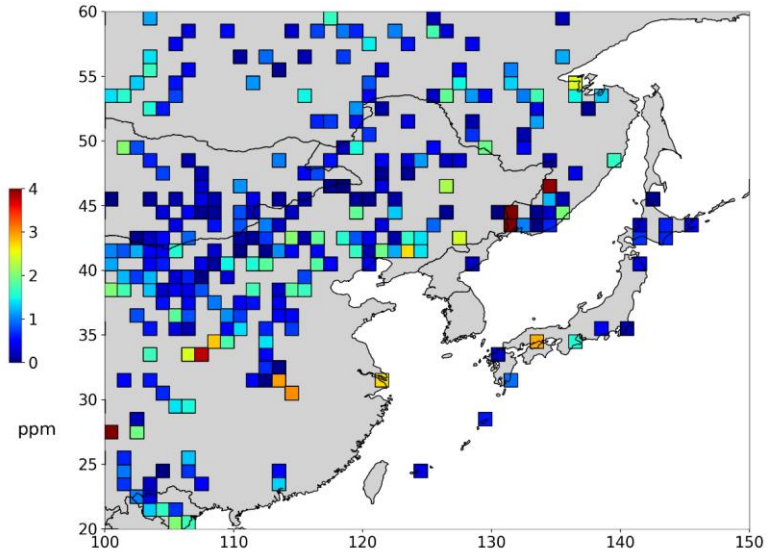
©NIES

Purpose ③ Monitoring of large-scale emission sources

In addition to monitoring GHG emissions from large-scale sources that affect the estimation of anthropogenic GHG emissions, the project will also identify emission sources that are difficult to fully identify through ground-based observations and other means.

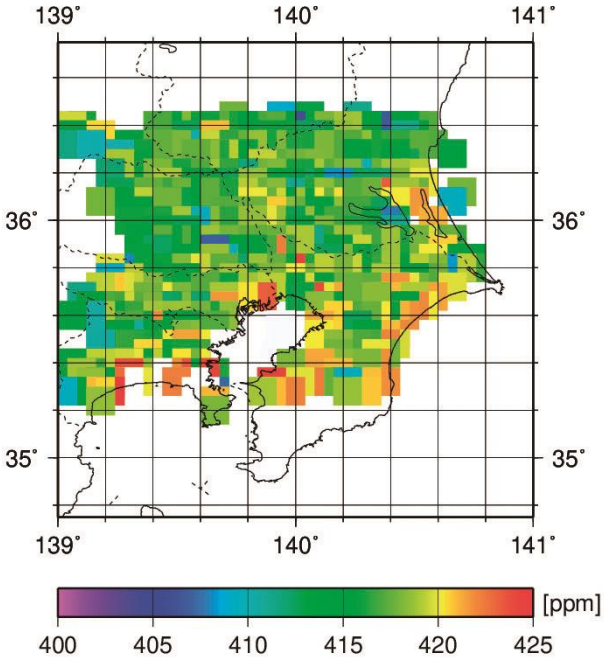
Anthropogenic CO2 concentrations estimated from GOSAT-2 data (example South - East Asia region)

(Prepared by the NIES, based on work commissioned by MOE)



CO2 concentrations estimated from GOSAT-2 data

(Example for Kanto area)



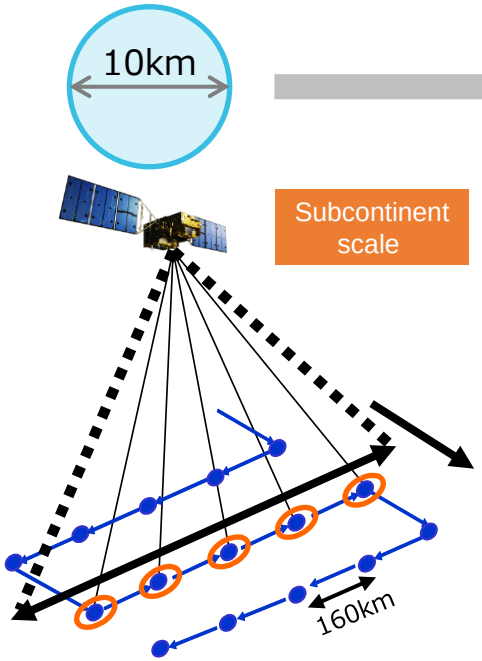
GOSAT-GW aims to further advance emissions estimates from large-scale sources through the precision observation mode.

Global Observing Satellite for Greenhouse gases and Water cycle (GOSAT-GW)

Greenhouse Gas Observation Sensor（TANSO-3）Mission

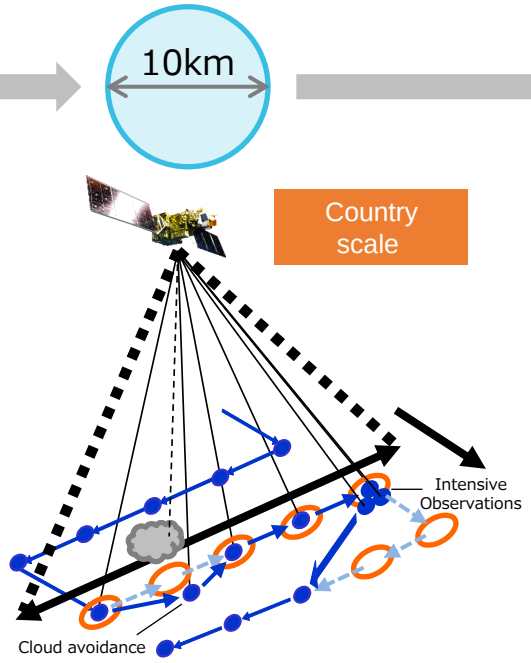
1. Monitoring of monthly average concentrations of atmospheric GHGs
2. Verification of anthropogenic GHG emissions by country
3. Monitoring of large emission sources, etc.

GOSAT（TANSO）



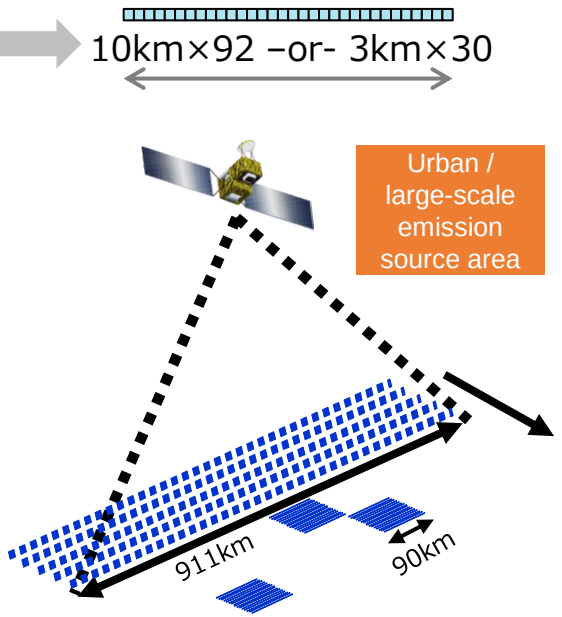
One sensor (10-km diameter field of view) observed at 160-km grid intervals. GHG concentration calculation not possible if clouds in the field of view.

GOSAT-2（TANSO-2）



One sensor (10-km diameter field of view), but can observe a specified point. Sensor automatically detects clouds and avoids them.

GOSAT-GW（TANSO-3）



Normal global observations with 10-km spatial resolution or intensive observation of a specified area (90-km wide) with 3-km spatial resolution