



Greenhouse gases observation from the space : Japan's contribution to implementing the Paris Agreement

September 3rd, 2020

NAKAJIMA Eri

Director, Office of Global Environment and Decarbonizing Innovation Research

Ministry of the Environment of Japan

Greenhouse Gases Observing Satellite series

Achievement of GOSAT (2009-)

- <u>Contributing to the scientific understanding of</u> <u>climate change</u> by revealing the global increases of GHG concentrations
- Showing the possibility of utilizing satellite data for estimating the emissions from the large-scale sources

Target of GOSAT series

- Continuously observing the global atmospheric GHGs
- Monitoring emissions from the large-scale point sources
- Used for comparison/check of national GHG inventories using the data obtained from satellites



GOSAT-2 (2018-)



GOSAT-GW (Started R&D- the design of GHG

Sensor)

Image courtesy of JAXA and NIES

Global CO₂ Concentrations Estimated Using the GOSAT Data



Refinement of IPCC Guidelines for GHG Inventories

The 49th Plenary of the IPCC held on 8th-12th May 2019 in Kyoto, Japan

Output : Adoption of "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Refinement)*" *prepared by the Inventory Task Force (TFI) of IPCC: Japan has been hosting its technical support unit (TSU) since its establishment in 1999.

The 2019 Refinement:

- verall aims to provide an updated and sound scientific basis for supporting the preparation and continuous improvement of national GHG inventories.
- has the first ever reference on the satellite observations of atmospheric GHGs for useful quality assurance of the national GHGs estimates.
- ➢ introduces several case studies using the products by GOSAT
- \succ shows expectations to the newly launched GOSAT-2 and other satellites.

representing high expectations towards GOSAT and GOSAT2 for further improvement of national GHGs estimates.

Global Stocktake and GOSAT series contribution



Capacity Building for science-based decision-making

Project on Assessment of Global Climate Change Impacts on Asia-Pacific Environment using Satellite Earth Observations

- Generated terrestrial and oceanic lowtrophic level organism databases (such as phytoplankton, vegetation, etc.) which can be accessed from the LowTroMAP database website:
- <u>https://ebcrpa.jamstec.go.jp/rcgc/e/AP</u>
 <u>N/index.htm</u>

IPB University

Project on Mapping and Modelling Vulnerability to Dengue in Vietnam and the Philippines using Geospatial and Time-series Approaches

- Developed a geospatial database of climate change related to malaria and dengue diseases
- Developed a GIS-based website presenting project results: <u>http://apn-climateandhealth.com</u>



SIA-PACIFIC NETWORK

Toward sustainable earth observations





GOSAT-2

new features of GOSAT-2

Intelligent pointing (automatically identify and avoid clouds)



GOSAT-2 will obtain <u>twice</u> valid data as much as GOSAT has

enhanced targeting-mode observation



monitoring CO emissions



monitoring large-scale GHG determining whether the emission sources like industrial observed CO₂ has been affected regions and large cities by combustion

comparative evaluations with emissions inventories



technological support for the development of emissions inventories



examination of the effects of emission reductions



We aim to contribute to enhance transparency of each country's countermeasures against climate change based on the Paris Agreement from detecting the human-induced GHG emissions with the GOSAT-2.

Satellite Data for Verification of GHG emissions



Guidebook on Use of GHG Observations by Satellites

- Developed by MOEJ and NIES
- The 1st edition, published in March 2018, will be updated soon.
- Includes GHG data analysis methodology and a number of case studies based on published research papers.



https://www.nies.go.jp/soc/en/documents/guidebook

Providing Additional Information to Complement National Inventories

FITTING



1) Top-down Analysis with Inverse Models to Estimate GHG Sources and Sinks



High-quality atmospheric GHG concentration data observed using various platforms

Inverse analysis to estimate GHG sources and sinks performed to make the difference between observed and modeled atmospheric GHG concentrations minimal 2) Flux Upscaling with Oceanic and Terrestrial GHG Flux Monitoring Data



Terrestrial and oceanic GHG flux (pCO₂) observed at multiple locations

> Verification and optimization of processbased models and machine learning systems using observed data

- 1) Top-down Analysis with Inverse Models to Estimate GHG Sources and Sinks
- 2) Flux Upscaling with Oceanic and Terrestrial GHG Flux Monitoring Data



Courtesy of Dr. Nobuko Saigusa

Anthropogenic and natural GHG sources & sinks





Natural GHG sources & sinks

Evaluation of discrepancies in spatial distribution for accuracy improvement

3) Improvement of the Reliability of GHG Inventory Data

Estimating emissions based on Earth observations for GHGs has a potential for providing additional sources of information that can complement national inventories.



Anthropogenic sources



Estimating national GHG emissions

