NIES GOSAT PROJECT NEWSLETTER

Independent Administrative Institution
National Institute for Environmental Studies (NIES)
A newsletter on the Greenhouse gases Observing SATellite (GOSAT, "IBUKI") project from the NIES GOSAT Project Office.
http://www.gosat.nies.go.jp/

ISSUE #1
JAN. 2010 THE FIRST ISSUE

CONTENTS

We are pleased to present the first issue of NIES GOSAT PROJECT NEWSLETTER at the one year anniversary of "IBUKI"'s launch.

Greetings from the Executive Director

Yoshifumi Yasuoka Executive Director, NIES

It has been one year since the successful launch of the Greenhouse gases Observing Satellite (GOSAT, "IBUKI") on January 23, 2009. I am relieved that we can celebrate the first birthday of "IBUKI."

NIES GOSAT PROJECT NEWSLETTER is published to mark this one year anniversary. The goal of the newsletter is to bring you the latest news on GOSAT as straightforwardly as possible.

The development of "IBUKI" started in 2003. At that time, we did not have accurate information on how the greenhouse gases are distributed geographically on the earth or how they are changing in each season. Under such circumstance, the decision was made that the Ministry of the Environment (MOE), Japan Aerospace Exploration Agency (JAXA), and National Institute for Environmental Studies should cooperate in launching the first greenhouse gases observing satellite in the world (and the satellite was given a Japanese nickname "IBUKI" later on).

After the decision, the GOSAT Science Team, a scientific and technical advisory board lead by the GOSAT chief scientist, was organized. I had the honor of serving as the first chief scientist while I was still working at the University of Tokyo. The second and current chief scientist is Professor Gen Inoue of the Research Institute for Humanity and Nature, who was affiliated with NIES when assigned.

During the seven years of "IBUKI"'s development, the situation around the climate change, especially global warming, has changed drastically. The Intergovernmental Panel on Climate Change (IPCC) has published the Fourth Assessment Report (2007), which suggested global warming is very likely due to human activities. Since the cause and effect of the phenomenon became clear to a certain level, the researchers have started to put greater emphasis on global warming risk assessment, mitigation, and adaptation measures.

Although "IBUKI" cannot provide observation data that can fully meet the level of the precision and spatial resolution required for formulating local mitigation and adaptation plans, we believe that the satellite's capability of observing carbon dioxide and methane globally at a frequency higher than ever would greatly contribute to the effort of global warming mitigation.

Cooperating closely with MOE, JAXA, and the Science Team, we, at the NIES GOSAT Project, will try our very best to send out useful and quality information to the world. We thank you for your support.

NIES Executive Director, Yoshifumi Yasuoka

What is GOSAT Project? What is "IBUKI"?

- Tatsuya Yokota
Chief, Satellite Remote Sensing Research Section,
Center for Global Environmental Research (CGER), NIES
NIES GOSAT Project Leader

The earth observing satellite "IBUKI" was launched on January 23, 2009, from JAXA Tanegashima Space Center. "IBUKI" is a nickname given to the Greenhouse Gases Observing Satellite (GOSAT).

"IBUKI" was launched to achieve two specific goals. The primary goal is to enhance the accuracy of estimated absorptions and emissions of carbon dioxide (CO_2) and methane (CH_4) on a sub-continental scale (several thousand kilometers squares), and to contribute to the work of environmental management in identifying the geographical distribution of the absorption and emission, as well as in assessing the forest carbon balance. We expect that the data from "IBUKI" will be fully utilized to assess the climate change prediction and its risks.

The second goal is to expand the existing earth observation technology and develop new technologies for greenhouse gas measurements and for the earth observing satellites of the future.

The GOSAT Project is promoted by a cooperative partnership among JAXA, MOE, and NIES. JAXA mainly takes charge of developing, launching, and operating the satellite, and calibrating and operating the sensors onboard, acquiring the observation data, and processing the acquired data to Level 1 data products. MOE supplements the development of the sensors and bears the responsibility to promote the use of the GOSAT data in its environmental management. NIES undertakes the processing and validation of higher-level data products, and distribution of the data products to the public. The three parties also cooperatively promote the GOSAT Science Team. The GOSAT Project solicited research proposals from the scientists worldwide, and 88 proposals from 22 countries have been adopted thus far.

The GOSAT Research Team was organized here at NIES in April 2004 and has been conducting various researches. Our research activities include developing the algorithms for retrieving the column amount of CO_2 and CH_4 from the GOSAT data, and the models for estimating the absorption and emission of CO_2. We developed and are operating the GOSAT Data Handling Facility (GOSAT DHF) where the data products are processed. Also, we calibrate and validate the GOSAT data products and distribute them to the data users.

We are continuing to make progress after the launch of "IBUKI" in January 2009. The project released the reslut of the first data analysis in May 2009, and in September 2009 announced the completion of initial calibration. Over the months of October and November in 2009, we initiated the public release of the Level 1 data products. The GOSAT data are now available to the general public. The public release of Level 2 data products (concentration of CO_2 and CH_4) is scheduled in 2010.

GOSAT NEWS

Minister of the Environment Ozawa Visits GOSAT Project Office

On January 7, 2010, Minister of the Environment Sakihito Ozawa made a visit to the NIES, and the GOSAT Project office gave the group of officials a slide and video presentation on the GOSAT project. Minister Ozawa showed a special interest in the process of greenhouse gases observation and asked a few questions.

The group broke into smiles when they were being explained about JAXA's Earth Observation Research Center (the GOSAT data is received there), located in "Hatoyama"-town in Saitama prefecture, to hear the name same as Prime Minister Yukio Hatoyama.

(on the left) Minister of the Environment Sakihito Ozawa (2nd L) looks at the slide show presented by GOSAT Project Leader Tatsuya Yokota (R).

(on the right) Minister Ozawa makes a 15 minutes visit to the GOSAT Project office and receives a presentation on the project.

DATA PRODUCTS UPDATE

IBUKI's DATA PRODUCTS

Level 2 Products To be Released in Mid-February, 2010.

- Hiroshi Watanebe, NIES GOSAT Project Office Manager, CGER, NIES

As you may know, two sensors, Fourier Transform Spectrometer (FTS) and Cloud and Aerosol Imager (CAI) are onboard "IBUKI." The data obtained from these sensors generate such data products as listed on Table 1.

As we have announced on our preparation issue, we have been providing the Level 1 data products to the general public since last fall. Now, the public release of the Level 2 data products is scheduled in mid-February. The Level 2 data products released in this February include CAI cloud flag products, and column-averaged volume mixing ratio of CO_2 and CH_4 retrieved from FTS SWIR data (Short Wavelength InfraRed). Shortly after, we are also planning to release the CO_2 column-averaged volume mixing ratio retrieved from FTS TIR (Thermal InfraRed) data as soon as the data products are ready for use.

These products are available for anyone to search and download from the URL below (user registration is required). The calibration and validation activities are carried out and the quality of the data products is checked before the release. Currently, the preparation for the Level 3 data products are under way, and we are hoping to release the Level 4 data products in 2011, two years after the launch.

GOSAT User Interface Gateway(GUIG)
https://data.gosat.nies.go.jp/

Table 1. List of the GOSAT data products to be released to the public from GOSAT DHF.

Product Level	Sensor / Band	Product Designation	Description	Product Provision Unit	Data Format
L1B	FTS	FTS L1B data	Radiance spectral data obtained by performing Fourier transform on interferogram data	per FTS scene	HDF5
	CAI	CAI L1B data	Radiance data (band-to-band and geometric corrections applied / data mapping not performed)	per CAI frame	
L1B+	CAI	CAI L1B+ data	Radiance data (band-to-band and geometric corrections applied / data mapping performed)		
L2	FTS SWIR	L2 CO_2 column amount (SWIR)	CO_2 column abandance data retrieved from SWIR radiance spectral data	variable	HDF5
		L2 CH_4 column amount (SWIR)	CH_4 column abandance data retrieved from SWIR radiance spectral data		
	FTS TIR	L2 CO_2 profile (TIR)	CO_2 vertical profile data retrieved from TIR radiance spectral data		
		L2 CH_4 profie (TIR)	CH_4 vertical profile data retrieved from TIR radiance spectral data		
	CAI	L2 cloud flag	Cloud coverage data	per CAI frame	
L3	FTS SWIR	L3 global CO_2 distribution (SWIR)	CO_2 column-averaged mixing ratio data projected on a global map	per month (global)	HDF5
		L3 global CH_4 distribution (SWIR)	CH_4 column-averaged mixing ratio data projected on a global map		
	FTS TIR	L3 global CO_2 distribution (TIR)	Monthly-averaged CO_2 concentration at each vertical level projected on a global map		
		L3 global CH_4 distribution (TIR)	Monthly-averaged CH_4 concentration at each vertical level projected on a global map		
	CAI	L3 global radiance distribution	Global radiance distribution data (3 days worth, including data for cloudy segments)	per 3 days (global)	
		L3 global reflectance distribution (clear sky)	Clear-sky radiance data (composed only of clear-sky segments selected from a month worth of data)		
		L3 global NDVI	Vegitation index global distribution data (cloudy segments excluded)	per 15 days 30º × 60º (lat. × lon.)	
L4A	-	L4A global CO_2 flux	CO_2 flux per each of the 64-divided global regions (monthly average)	per year (64 regions)	Text
L4B	-	L4B global CO_2 distribution	Three-dimentional, global distribution of CO_2 concentration	per month 2.5º × 2.5º grid (lat. × lon.)	NetCDF

Notes:
1) For an outline of data product processing., we are planning to bring you more information in coming issues.
2) SWIR and TIR stand for Short Wavelength InfraRed and Thermal InfraRed, respectively. SWIR are detected in Band 1, 2, and 3 of FTS, and Band 4 captures TIR.
3) An FTS scene and a CAI frame are equivalent to 1/60 of one orbital revolution.
4) HDF5 and NetCDF stand for Hierarchical Data Format version 5 and Network Common Data Form, respectively.
5) NDVI stands for Normalized Difference Vegetation Index.
We would like to introduce you how and what tools are needed to read the data in coming issues.

INFORMATION

Announcement of IWGGMS-6

Here, we would like to the details on the Sixth International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-6). The event will take place from January 26 through 27, 2010 at the Kyoto International Conference Center, Kyoto, Japan. The goal of this workshop is to assess the latest science and technologies in spaceborne measurement of greenhouse gases. There will be presentations on the new scientific findings and results obtained from the ongoing satellite missions as well as on the concepts of the next-generation remote sensing missions.

IWGGMS-6 Agenda

January 26, 2010 (TUE)

		Presenter
09:00-09:35	Registration	
09:35-09:45	Welcome address	Yoshifumi Yasuoka (NIES, Japan)
	Space Mission Overview	**Chair : Masakatsu Nakajima (JAXA, Japan)**
09:45-10:00	One year operation results of TANSO on GOSAT	Akihiko Kuze (JAXA, Japan)
10:00-10:15	Overview of GOSAT data processing and data product distribution	Tatsuya Yokota (NIES, Japan)
10:15-10:35	Atmospheric Carbon Observations from Space (ACOS): contributions to the GOSAT mission	David Crisp (JPL, USA)
	Break (15 min.)	
10:50-11:10	Carbon dioxide (CO_2) and methane (CH_4) from SCIAMACHY on ENVISAT	Michael Buchwitz (Univ. Bremen, Germany)
11:10-11:30	Total column methane for the years 2003-2009 as seen by SCIAMACHY: Trends and variability	Christian Frankenberg (SRON, Netherlands)
11:30-11:50	7-Years of AIRS mid-tropospheric CO_2	Moustafa Chahine (JPL, USA)
11:50-12:10	Seven years' observation of mid-upper tropospheric CH_4 and CO_2 from AIRS and recent observation from IASI at NOAA	Xiaozhen Xiong (NOAA, USA)
12:10-12:30	Characterization of Tropospheric Emission Spectrometer (TES) CO_2 for carbon cycle science	John Worden (JPL, USA)
	Lunch break (60 min.)	
13:30-14:30	**Poster Session (Odd-numbered posters are presented.)**	
	GOSAT Sensor, Calibration, and Retrievals	**Chair: Ryoichi Imasu (Univ. Tokyo/CCSR, Japan)**
14:30-14:50	Overview of GOSAT/CAI measurements of the atmosphere	Teruyuki Nakajima (Univ. Tokyo/CCSR, Japan)
14:50-15:10	Status of calibration of TANSO FTS and CAI onboard GOSAT	Kei Shiomi (JAXA/EORC, Japan)
15:10-15:30	ACOS contributions to the 2009 GOSAT vicavrious calibration experiments over Railroad Valley, Nevada	Harold R. Pollock (JPL, USA)
	Break (15 min.)	
15:45-16:05	Current status of the TANSO-FTS SWIR L2 processing	Yukio Yoshida (NIES, Japan)
16:05-16:25	Sensitivity of XCO_2 retrievals from GOSAT data to aerosol distributions and optical properties	Hartmut Boesch (Univ. Leicester, UK)
16:25-16:45	Evaluation of strategies to account for scattering effects in greenhouse gas retrievals from space	Andre Butz (SRON, Netherlands)
16:45	Adjourn	

January 27, 2010 (WED)

9:00	The conference venue is opened.	
	Satellite Data Validation	**Chair: Charles Miller (JPL, USA)**
09:20-09:40	xCO_2 and xCH_4 retrievals from the Total Column Carbon Observing Network (TCCON) during the first year of GOSAT operations	Debra Wunch (CalTech, USA)
09:40-10:00	Airborne validation of total column CO_2, CH_4 and CO measurements over six European FTIR sites	Justus Notholt (Univ. Bremen, Germany)
10:00-10:20	Long-term and 3-D records of atmospheric CO_2 observed by CONTRAIL project	Toshinobu Machida (NIES, Japan)

10:20-10:40	Current status for validation of GOSAT standard products	Isamu Morino (NIES, Japan)
	Break (10 min.)	
10:50-11:50	**Poster Session (Even-numbered posters are presented.)**	
	Lunch break (70 min.)	
	Source/Sink Estimation	**Chair: Tatsuya Yokota (NIES, Japan)**
13:00-13:20	Global carbon cycle modeling tools for GOSAT data analysis	Shamil Maksyutov (NIES, Japan)
13:20-13:40	Comparing the information content of various satellite and surface measurements of CO_2	Peter Rayner (LSCE, France)
13:40-14:00	Estimation of sources and sinks of CO_2 and CH_4 from GOSAT: Expected accuracy and preliminary results with real data	Frederic Chevallier (LSCE, France)
14:00-14:20	Recent changes in the global sources and sinks of methane derived from SCIAMACHY	Sander Howeling (SRON, Netherlands)
14:20-14:40	Inverse modeling of carbon sources and sinks using TES CO_2 observations	Dylan Jones (Univ. Toronto, Canada)
	Break (20 min.)	
	General Topics and Future Missions	**Chair: Haruhisa Shimoda (Tokai Univ., Japan)**
15:00-15:20	Global measurement of CO_2 from space: Challenges and perspectives	Jianping Mao (NASA/GSFC, USA)
15:20-15:40	Future greenhouse gas observation strategies for science and society	Stacey Boland (JPL, USA)
15:40-16:00	Airborne demonstration of potential mission concept for space-based active remote sensing of CO_2	Edward Browell (NASA/LaRC, USA)
16:00-16:20	Carbon monitoring Satellite (CarbonSat): Mapping of CO_2 and CH_4 from space	Michael Buchwitz (Univ. Bremen, Germany)
	General Discussion	**Chair: Gen Inoue (RIHN, Japan)**
16:20-17:00	Workshop summary & general discussion	
17:00	Closing Remarks	Takashi Hamazaki (JAXA, Japan)
17:10	Adjourn	
17:30	**Conference Dinner**	

Poster Presentations

(All poster presenters are asked to be available at their presentations during the specified session hours.)

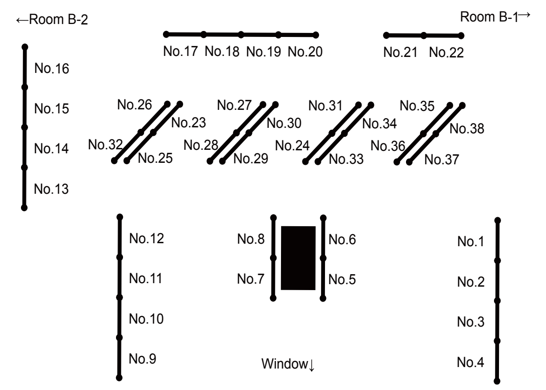
		Presenter
	GOSAT Sensor, Calibration, and Data Processing	
1	On orbit status of TANSO on GOSAT	Hiroshi Suto (JAXA, Japan)
2	Radiometric calibration accuracy of GOSAT TANSO-FTS (TIR) sensor and gaseous component retrieval	Ryoichi Imasu (Univ. Tokyo/CCSR, Japan)
3	Aircraft measurements of atmospheric CO_2 using the 1.57 μm laser absorption spectrometer during GOSAT Hokkaido campaign in August 2009	Shuji Kawakami (JAXA/EORC, Japan)
4	Latest GOSAT data processing and its availability to users	Hiroshi Watanabe (NIES, Japan)
5	High-resolution simulations of CO_2 and CH_4 using a NIES atmospheric tracer transport model for producing a priori concentrations used in the retrieval of GOSAT L2 data processing	Tazu Saeki (NIES, Japan)
6	Evaluation and early results of GOSAT TANSO-FTS SWIR Level 2 product (CO_2 and CH_4 column abundances data)	Nawo Eguchi (NIES, Japan)
7	Initial results of actual GOSAT SWIR data processing with PPDF-based method	Sergey Oshchepkov (NIES, Japan)
	Retrieval Algorithms	
8	Comparison of retrieval approaches for GOSAT	Austin Cogan (Univ. Leicester, UK)
9	Polarization model for GOSAT and its impact upon retrievals	Denis O'Brien (Colorado State Univ., USA)
10	Reference radiative transfer model including the polarization effect in a coupled atmosphere-ocean system	Yoshifumi Ota (NIES, Japan)
11	Channel selection of CO_2 retrieval from near infrared measurements using information content analysis	Le Kuai (CalTech, USA)
12	Utilization of all spectral channels of IASI for the retrieval of the atmospheric state	Samuele Del Bianco (IFAC, Italy)

13	Carbon dioxide retrieval from IASI measurements using the KLIMA inversion algorithm	Ugo Cortesi (IFAC, Italy)
14	CO_2 vertical profile retrieval from GOSAT measurements using neural network approach	Mikhail Kataev (Tomsk Univ., Russia)
15	A new Empirical Orthogonal Function (EOF) approach for methane retrieval using AIRS data	Zhang Ying (CAS, P. R. China)
16	Current results for the ACOS XCO_2 and surface pressure retrieval algorithms for GOSAT data	Christopher O'Dell (Colorado State Univ., USA)
	Regional and Global Gas Concentrations	
17	Arctic ocean atmosphere CO_2 concentration measurements from AIRS-AMSU: A complement to GOSAT project	Reginald Muskett (Univ. Alaska, USA)
18	Correlationship between methane and carbon monoxide concentration in Beijing: from AIRS Level 2 product to ground-based FTS measurements	Zhang Ying (CAS, P. R. China)
19	A plan of monitoring greenhouse gas emission from large reservoir by remote sensing	Zhao Dengzhong (China Three Gorges Corp., P. R. China)
20	Quantitative remote sensing for monitoring greenhouse gas emissions from hydroelectric reservoirs in China	Bingfang Wu (CAS, P. R. China)
21	Multispectral measurements of boundary layer and free tropospheric CO from MOPITT: Implications for carbon cycle science	Helen Worden (NCAR, USA)
22	Dynamic multiresolution spatial models applied to remotely sensed greenhouse gas data	Petr Musilek (Univ. Alberta, Canada)
23	Programming core for massive assimilation of GOSAT spectra and its first retrieval of carbon gases over Western Siberia	Konstantin Gribanov (Ural State Univ., Russia)
	Data Evaluation and Validation	
24	Validation of atmospheric CO_2 and CH_4 retrieved from GOSAT	Austin Cogan (Univ. Leicester, UK)
25	Validation of GOSAT column-averaged mole fraction of carbon dioxide using aircraft measurements by CONTRAIL, NOAA and NIES	Yuki Miyamoto (NIES, Japan)
26	Validation of GOSAT methane by ground-based MIR- and NIR FTS at the ground-truthing facility Garmisch/Zugspitze	Ralf Sussmann (IMK-IFU, Germany)
27	Aircraft measurement of carbon dioxide for calibration of ground-based high-resolution Fourier Transform Spectrometer at Tsukuba, Japan	Tomoaki Tanaka (NIES, Japan)
28	Validation of total column measurements with airborne in-situ profiles of CO_2, CH_4 and CO	Dietrich Feist (MPI, Germany)
29	Network observation of GHGs in China and concept of validating satellite remote sensing and model output	Lingxi Zhou (CAMS, P. R. China)
30	Compact optical spectrum analyzer to monitor atmospheric CO_2 and CH_4 columns via remote operation	Toshio Ibuki (Kyoto Univ., Japan)
31	Development of Balloon-borne CO_2 instruments	Tomoki Nakayama (Nagoya Univ./STEL, Japan)
32	Strategy for harmonized retrieval of column-averaged methane from the mid-infrared NDACC FTS-network and intercomparison with SCIAMACHY satellite data on global scale	Ralf Sussmann (IMK-IFU, Germany)
	Atmospheric Transport and Inverse Modeling	
33	Carbon Tracker-Asia, a tool to quantify CO_2 uptake/release focused on Asia	Chun Ho Cho (NIMR, Korea)
34	Inverse modeling system for operational processing of the GOSAT Level 4A regional CO_2 flux data product	Hiroshi Takagi (NIES, Japan)
35	A very high-resolution fossil fuel CO_2 emission inventory for the GOSAT operational flux inversion	Tomohiro Oda (NIES, Japan)
36	Can remote sensing verify carbon-dioxide emissions verification? Recent Pasadena, CA and proposed Farmington, NM studies	Manvendra Dubey (Los Alamos National Lab., USA)
	Future Lidar Measurements	
37	Pulsed airborne lidar measurements of atmospheric CO_2 column absorption and line shapes from 3-13 km altitudes	James Abshire (NASA, USA)
38	Continuous wave differential laser absorption spectroscopy of CO_2: Airborne instrument to a space mission concept	Jeremy Dobler (ITT, USA)
		(38 Posters)

List of Abbreviations for Institution Name (Alphabetical)

CalTech	California Institute of Technology
CAMS	Chinese Academy of Meteorological Sciences
CAS	Chinese Academy of Sciences
CCSR	Center for Climate System Research
EORC	Earth Observation Research Center
GSFC	Goddard Space Flight Center
IFAC	Institute of Applied Physic, Nello Carrara
IMK-IFU	Institute for Meteorology and Climate Research Atmospheric Environmental Research
ITT	ITT Corporation
JAXA	Japan Aerospace Exploration Agency
JPL	Jet Propulsion Laboratory
LSCE	The Laboratory for the Science of Climate and the Environment
MPI	The Max Planck Institute for Meteorology
NASA	National Aeronautics and Space Administration
NCAR	The National Center for Atmospheric Research
NIES	National Institute for Environmental Studies
NIMR	National Institute of Meteorological Research
NOAA	The National Oceanic and Atmospheric Administration
RHIN	Research Institute for Humanity and Nature
SRON	Netherlands Institute for Space Research
STEL	Solar-Terrestrial Environment Laboratory

IWGGMS-6 POSTER PRESENTATIONS MAP



ACCESS TO THE IWGGMS-6 VENUE

The Kyoto International Conference Center is easily accessed from Kansai International Airport (KIX) by taking JR airport express train Haruka leaving for Kyoto Station (approximately 75 minutes). Participants entering Japan through Tokyo Narita International Airport (NRT) may take JR Tokaido Shinkansen Line (super-express train) departing Tokyo Station for Kyoto Station (approximately 3 hours). The conference venue can be reached from Kyoto Station via Kyoto City Subway' s Kokusai Kaikan station on Karasuma Line (20 minutes).

Kyoto International Conference Center (ICC Kyoto)
Takaragaike, Sakyo-ku, Kyoto 606-0001 Japan
Phone: +81-75-705-1234
http://www.icckyoto.or.jp/en/

GOSAT PEOPLE

PEOPLE OF "IBUKI"

Carbon Source/Sink Estimation Field

SHAMIL MAKSYUTOV

Special Senior Researcher, CGER, NIES
Deputy Leader, NIES GOSAT Project

My involvement in greenhouse gas observations and modeling study started with participating in the NIES Siberian observation project in the 1990s. The NIES airborne observation campaigns and regular monitoring of the greenhouse gas concentrations using observation towers across the Siberian continent began in 1993. During the project I developed an atmospheric tracer transport model and a backward trajectory model for analyzing the collected observational data. Later, I joined the Greenhouse Gas Modeling group at the Frontier Research Center for Global Change (a research institute organized by the National Space Development Agency of Japan and the Japan Agency for Marine-Earth Science and Technology) and studied the interannual variability of the global carbon cycle using an atmospheric transport model operated on the supercomputer Earth Simulator.

Since 2005, I am leading a group of researchers at NIES who develop a modeling system that estimates sources and sinks of carbon dioxide (CO_2) using the GOSAT observation data.

The modeling system is composed of an atmospheric transport model, simplified models of ocean and atmospheric processes, models of the carbon cycle in the terrestrial biosphere and ocean, and inventories of anthropogenic and natural CO_2 sources such as forest fires, emissions from fossil fuel burning, and other human-induced processes. The atmospheric transport model built in this system is designed to simulate three-dimensional CO_2 variations effectively at a high resolution on modern supercomputers.

In the GOSAT Project, we use high-resolution wind data generated by the Japan Meteorological Agency's global weather forecast model. The weather forecast model has a horizontal resolution of 20 km, making it the finest-resolution global forecast model in the world. To properly account for influences by emissions from point sources such as fossil-fuel power plants that can be seen by the GOSAT's sensor that has a view field of 10 km in diameter, we use a particle plume diffusion model that can even track the paths of gas plumes stretching few kilometers. By combining the particle diffusion model with the atmospheric transport model, we can simulate the observations globally at the highest possible resolution. For this simulation, we developed a global map of fossil fuel emissions at 1 km resolution using nightlight data collected by satellites and databases of large power plants distributed around the globe.

To simulate the carbon cycle in the terrestrial biosphere, we use a process model called VISIT that simulates the carbon exchange processes of plants and soils via photosynthesis, respiration, and decomposition of organics. In this model, day-to-day changes in, rainfall, insolation, air and soil temperatures, soil moisture content, and other factors affecting the biological processes are considered.

The concentrations of CO_2 at ocean surfaces are simulated with an ocean carbon cycle model that uses ocean current data and an ocean biogeochemistry model. By using a method called data assimilation, the model-simulated oceanic CO_2 concentrations are adjusted to the values of CO_2 measured at the ocean surfaces. By repeating this assimilation process several times, the differences between the simulations and the observations are gradually reduced, and we obtain a global distribution of ocean CO_2 that matches the observations closely. From this distribution we get a reliable map of CO_2 sources and sinks over the world ocean on a monthly basis.

Combining all of these models and modeling techniques, we will use GOSAT's CO_2 and CH_4 observation data to improve understanding of the global carbon cycle and its sensitivity to anthropogenic contributions and climate variations.

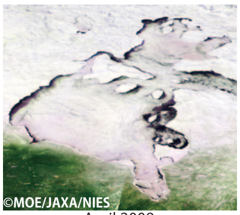
Profile:
http://www-cger.nies.go.jp/climate/person/maksyutov/e_index.html

IMAGES OF THE MONTH

Hudson Bay, CANADA

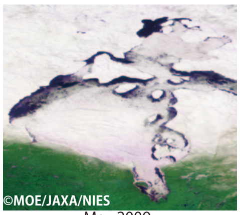
Changing Scenery of Ice and Snow

— Tsuneo Matsunaga
Chief, Office for Global Environmental Database, CGER, NIES



April 2009

※ Because of the map projection, the bay looks more condensed vertically than actual in these images.



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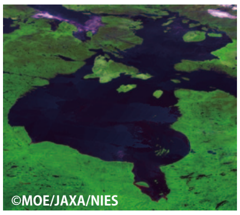

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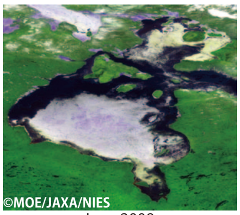
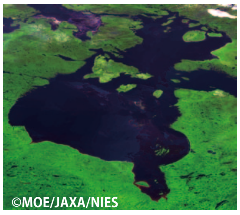


June 2009



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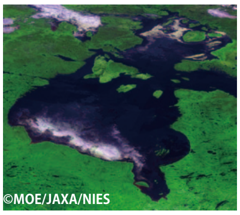
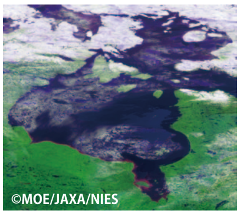


July 2009



October 2009

Blue = Band 1、Green = Band 3、Red = Band 2

Hudson Bay is a large bay (extends approx. 1000km from east to west) located in north eastern Canada, and is connected to the Arctic Ocean and the Atlantic Ocean. Since it is at high latitude (from 50 to 60 degrees north), for more than half a year, it is covered with ice.

For these "Images of the Month," we have images of Hudson Bay photographed by CAI. At NIES, with the images acquired each month, we produce composite images of using only the parts that do not contain clouds. This month, we introduce you such monthly images of Hudson Bay from April 2009 to October 2009.

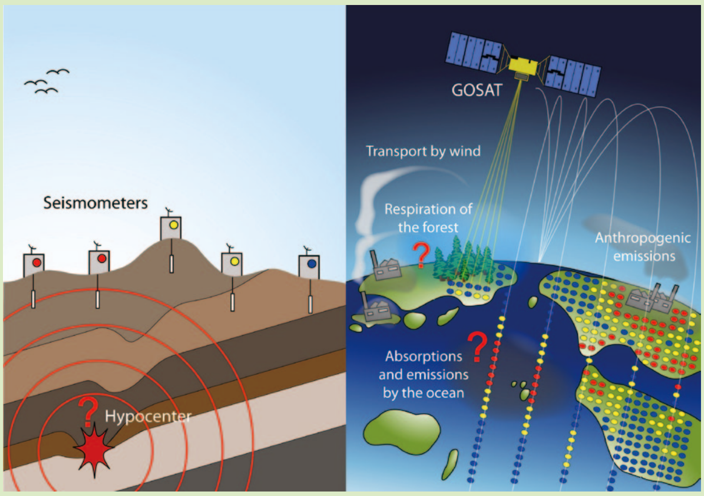
In April, the bay and the surrounding land areas are blanketed in ice and snow, but in May the water surface starts to show. By June, the snow on the ground is already gone, but more than half of the bay surface is still covered with ice. The ice has finally disappeared in August, but by October, the ice and snow are back to show the first signs of winter.

Satellites are able to witness such dynamic seasonal changes of our planet as the scenery of ice and snow in high latitude areas as presented here.

AHA! OF THE MONTH

Inverse Model Analysis

- Hiroshi Takagi
Specialist, CGER, NIES



An analytical method called inverse modeling is often used in estimating values that cannot be measured directly. With this technique, a cause can be reconstructed from its effect. In seismology, for example, the intensity of an earthquake (cause) at its hypocenter can be inversely estimated from the data of shaking ground (effect) acquired by the seismometers around the world (left figure).

The same technique is applied when estimating absorptions and emissions of CO_2 in each region of the world using the GOSAT observational data. Changes in CO_2 concentrations in each region are brought by human activities, movement of the wind that mixes and carries the emitted CO_2, respiration of the forest, and absorption and emission by the surrounding ocean (right figure). Using the inverse modeling technique, the "causes" that bring about the concentration changes in each region, the fluxes of CO_2, can be estimated inversely from the "effect", the changing concentrations of CO_2 that IBUKI monitors globally.

ANNOUNCEMENT

CALL FOR SUBMISSIONS

GOSAT PROJECT NEWSLETTER is accepting submissions from our readers.

We appreciate your opinion pieces;
"I want to read articles on ..."
"I'd like to know what ... means."
"... was really interesting. ...could have been better if ..." etc.

We also appreciate contributions from people involved in GOSAT Project;
"I'd love people to know about ..."
"My research (work) is on ...,
and I am passionate about it!" etc.

Please feel free to contact:
gosat_newsletter@nies.go.jp.

Thank you for supporting our newsletter.

-Yuki Tanaka, editor

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email : gosat_newsletter@nies.go.jp
website : http://www.gosat.nies.go.jp
address : 16-2 Onogawa, Tsukuba-City, Ibaraki,
305-8506 Japan
GOSAT Project Office
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