NIES GOSAT PROJECT NEWSLETTER

ISSUE # 10
OCT.2010

Center for Global Environmental Research
is celebrating 20th Anniversary.

CONTENTS

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/

GOSAT PEOPLE

People of "IBUKI"
Operation/Management

by MASAKATSU NAKAJIMA

Photo by Yuki Tanaka

GOSAT Mission Manager
Satellite Applications and Promotion Center
Japan Aerospace Exploration Agency (JAXA)

My Roll in GOSAT Project

GOSAT Project is a cooperative effort among the Japan Aerospace Exploration Agency (JAXA), the National Institute for Environmental Studies (NIES), and the Ministry of the Environment, and I represent JAXA as a mission manager.

Even though there are exceptions depending on the project, usually at JAXA, a project team that developed a satellite checks the functional capability and monitors the condition of the satellite for one year after the launch. After confirming that the stable operation can be carried out, the team passes its operation onto a team led by a mission manager. In the case with GOSAT, "IBUKI", one year and two months after the launch, the project team passed on the operation and I was appointed Mission Manager.

In order to acquiree data of concentrations of carbon dioxide (CO_2) and methane (CH_4), we need to collect users' requests for observational locations and other conditions for sensors (such as amplifier gain levels) , to mediate conflicting requests, then to create a schedule, and transmit these requirement data to the satellite.

The satellite makes observations according to these requirements, and downlinks the observational data to the ground station in Svalbard, Norway, every two orbits around the globe (and twice a day to the Earth Observation Center in Saitama, Japan). The data, just some lists of numbers at this point, are sent to the Tsukuba Space Center to be processed as Level 0 (extraction of the data), Level 1A (conversion of the data to a form of interferogram[1]), and Level 1B(conversion of interferogram into spectra), then the data are sent to NIES. At NIES, the concentrations of greenhouse gases and so on are calculated. Figure 1 is the flowchart of

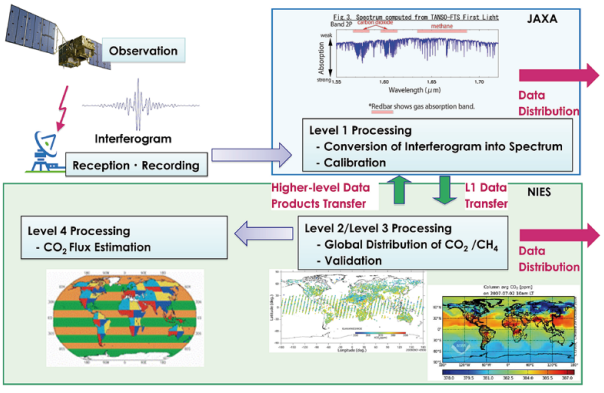


Figure 1. A flowchart of "IBUKI" observation from data acquisition to calculation of greenhouse gases concentrations.

1 Interferogram is a pattern of light intensity obtained as a result of the following steps: i) split incident light into two beams using the beam splitter, ii) change one of the path lengths of the two split beams, and iii) merge the two beams of light by letting them interfere with each other.

this series of processes. The data of spectra and concentrations are available to the public at NIES GOSAT Project website (http://www.gosat.nies.go.jp/). JAXA also transmits all the data of spectra and concentrations to the Jet Propulsion Laboratory (JPL) of the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) for the purpose of calibration, validation, and easier access to the data for oversea users. JAXA is also responsible for promotion of the data usage, in other words, sales and marketing of the data to broader users. Mission Manager is the very position responsible for execution of this series of missions handled by JAXA.

How I Became Involved in GOSAT Project

I have had an interest in the space since childhood. I used to stare at the pictures of solar system and the photographs of the moon in illustrated encyclopedia for children, and would go to my friend's house to watch stars or lunar eclipses with his telescope. It was the heyday of Apollo's moon landing when I was in elementary school, but I wasn't thinking about the space for my career (dream) option. I wanted to become a pilot. After my eyesight deteriorated and gave up my dream to become a pilot in my junior high school years, I became interested in subatomic particles and nuclear fusion, and went to university to pursue the study of what was then called "dream energy," nuclear fusion. Then again, my interest came back to the space (astronomy) and studied infrared astronomy in my senior year. Finally, this time, my interest shifted from astronomy to rockets, and landed a job at JAXA (then National Space Development Agency, NASDA). However, two and half years later I was transferred to a division where the sensors for Earth observation are developed. That was the start of how I was drawn deep into Earth observation. The first thing I handled was a design study of AVNIR[2], a visible and near infrared imaging sensor aboard ADEOS[3]. It was more like learning rather than handling, and I was able to learn about optical sensors through the design study for AVNIR, my benefactor. After AVNIR became a part of the ADEOS project, I started to work on studies on various kinds of optical sensors including GLI[4], a successor of OCTS[5], LIDAR, and Fourier Transform Spectrometers. I became a part of the ADEOS-II project at its launch with GLI sensor, and I was responsible for it until I handed it to the satellite system. After handling several other optical sensors for Earth observation satellites, I was transferred to the GOSAT project. Years before that, I remember saying to a rookie colleague who was assigned a position in GOSAT project, "Good thing your position is challenging, their observation method is really extraordinary." I never imagined I would be in the same project in a few years. As I have been handling the project, I am realizing what I said to the rookie was true. Fourier Transform Spectrometer is a sensor of "artisanal technology." Now, as "IBUKI" continues to acquire data, I would like to continue my efforts to promote "IBUKI" data to be used by more people and institutions.

2 Advanced Visible and Near Infrared Radiometer (AVNIR) is a high spatial resolution optical sensor aboard ADEOS satellite for observing the visible and near-infrared regions of solar radiation reflected by land and coastal zones. The objective of the sensor was to monitor desertification, destruction of tropical forests, and pollution of coastal zones as well as to be used for resource exploration and understanding of land use.

3 Advanced Earth Observing Satellite (ADEOS) is a Japanese satellite with an objective to acquire data of worldwide environmental changes such as the greenhouse effect, ozone layer depletion, tropical rain deforestation, and abnormal climatic conditions. Launched in August 1996 and stopped its operation in June 1997.

4 Global Imager (GLI) is an optical sensor that observes the reflected solar radiation from the Earth surface including land and ocean, and the atmosphere including aerosols and clouds as well as infrared radiation globally and frequently. The GLI data were aimed to be used for grasping the global circulation of carbon, monitoring cloud, snow, ice, and sea surface temperature, and grasping the primary marine production.

5 Ocean Color and Temperature Scanner (OCTS) is an optical radiometer to measure the color and surface temperature of ocean. The OCTS data were aimed to be used mainly for determination of ocean primary production and carbon cycle, and be used for getting information of ocean conditions for fishery and environment monitoring.

NEWS

Minister of State Banri Kaieda visits GOSAT Project Office

- Yuki Tanaka, Specialist, NIES GOSAT Project Office

Japan's Minister of State for Science and Technology Policy Banri Kaieda visited NIES and paid a visit to the GOSAT Project Office on October 10, 2010. At the office, NIES Executive Director (Research) Yoshifumi Yasuoka, GOSAT Project Leader Tatsuya Yokota, and Chief of the Office for Global Environmental Database Tsuneo Matsunaga gave the minister a 20-minute presentation on the current status of GOSAT project. Minister Kaieda made comments about his expectations for the project to produce the data that will keep world's trust, and for this to lead to a possible infrastructure that will serve useful purposes for Japan's 25 percent reduction of green house gas emission.

Banri Kaieda, Minister of State for Science and Technology Policy on October 10, 2010 at the GOSAT Project Office. Photograph by Yuki Tanaka.

NEWS

Change in the Observational Operation of TANSO-FTS

- Nobuyuki Kikuchi, Specialist, NIES GOSAT Project Office

The nominal observation of the TANSO-FTS sensor aboard "IBUKI" was changed from 5 lattice-point pattern (Figure 1 left) to 3 lattice-point pattern (Figure 1 right) starting August 1st, 2010. With TANSO-FTS's two axis pointing mechanism, the sensor's fields-of-view can be moved ± 20 degrees angle in along-track direction and ± 35 degrees angle in cross-track direction. The observation is operated using 3 lattice-point pattern because the errors detected during the 5 point observation rarely happen in 3 lattice-point observation.

Information on differences between 5 lattice-point pattern and 3 lattice-point pattern is summarized in Table 1. Because of the change, the intervals between neighboring observational points are wider, and the number of global observation points is now decreased to 1/3. However, a total number of data is still the same because now the satellite observes three times at each point. For Level 2 data products, at each point, three observational data are processed, and at maximum of three data products are produced.

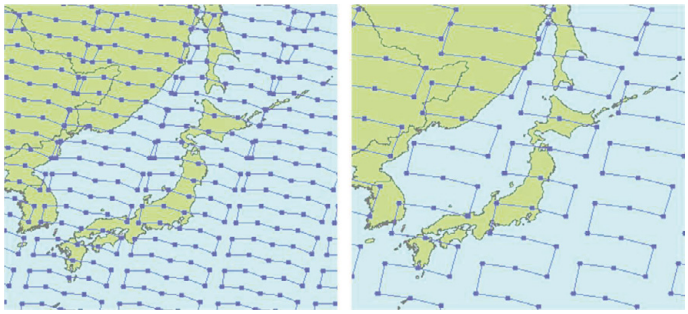


Figure 1. The difference of scanning patterns in cross-track direction near Japan. The left image is 5 lattice-points pattern and the right is 3 lattice-points pattern. However, the actual patterns around Japan are not necessarily the same as shown in the figure because of the frequent observation requests in the area.

For further details on observational points, please refer to the following documents.

(1)Information on the GOSAT TANSO-FTS: Change in the Observational Operation
http://data.gosat.nies.go.jp/GosatUserInterfaceGateway/guig/doc/20101014en.pdf

(2) GOSAT Level 1 Product Description Document
http://data.gosat.nies.go.jp/GosatWebDds/productorder/distribution/user/NEB-080035D_GOSAT_Level_1_Product_Format_eng.pdf

(3) Thermal And Near infrared Sensor for carbon Observation on board the Greenhouse gases Observing SATellite (GOSAT), Research Announcement, Appendix C, Operation Policies of GOSAT and Basic Observation Plan of the TANSO Sensor
http://www.gosat.nies.go.jp/eng/proposal/download/GOSAT_RA_3rd_C_en.pdf

Table 1. Scanning patterns in cross-track direction.

Number of Observation Points in cross-track direction	Duration of Each Observation	Number of Observations at Each Point	Horizontal Interval	Vertical Interval
3 points	4.0 seconds	3 times	262.9 km	283.1 km
5 points	4.0 seconds	1time	157.8 km	152.2 km

NEWS

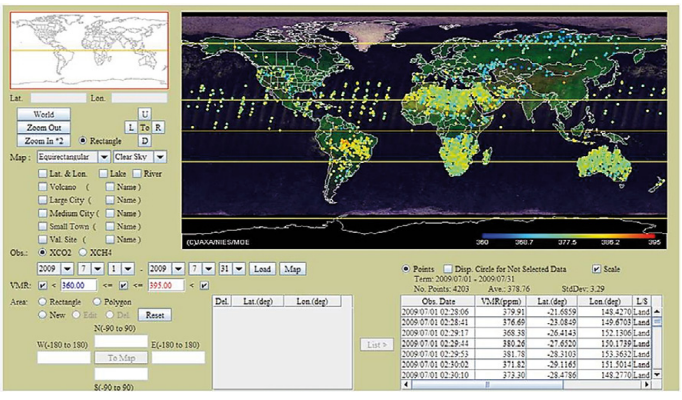
GOSAT Workshop Held at SPIE Europe Remote Sensing 2010

- Hiroshi Watanabe, NIES GOSAT Project Office Manager

SPIE Europe Remote Sensing 2010 was held in Toulouse, France from September 20 to September 24, 2010. In one of the conferences named "Sensors, Systems, and Next-Generation Satellites", a session called "Japanese Missions" (Chairperson: Professor Haruhisa Shimoda of Tokai University) was set up along with the U.S. and European satellite observation missions. Three presentations related to GOSAT were made during the session, and I gave a presentation on the current status of higher-level products of GOSAT data. On the third day, NIES Post-doctoral Fellow Andrey Bril of NIES GOSAT Project gave a presentation on the retrieval method (and its results) based on PPDF (Photon Pathlength Distribution Function).

Besides the presentations, we set up a special event, GOSAT Workshop, on the second day of the event to promote GOSAT data products to a body of potential users. This is reflecting the current situation that the GOSAT Level 1 and 2 data products have been publicly available and Level 3 were just released to the collaborating researchers of Research Announcement. With the cooperation of Professor Haruhisa Shimoda, a chairperson of the GOSAT Research Announcement Selection and Evaluation Committee, and the Earth Observation Research Center of Japan Aerospace Exploration Agency, the details on GOSAT sensors, the current status of data products, and the Third Research Announcement was explained. Other things introduced at the workshop were basic operation of the GOSAT User Interface Gateway (GUIG): http://data.gosat.nies.go.jp including user registration, how to search and order data products, and how to download the ordered products. The number of participants was around 10, but it was a good opportunity for in-depth discussions.

GOSAT Workshop at SPIE Europe Remote Sensing 2010



An example of GUIG SWIR L2 Global Distribution Map. A map shows the results of FTS L2 SWIR CO_2, the background is the CAI L3 global reflectance distribution image.

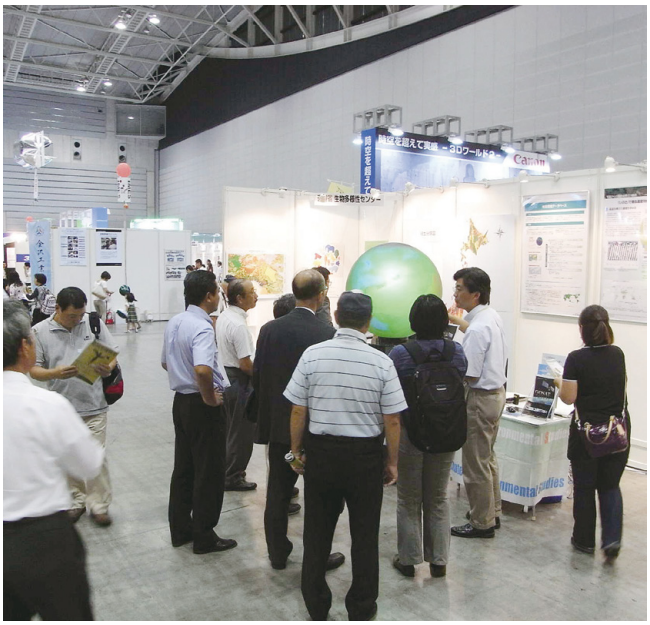
NEWS

G-spatial EXPO "When &Where"-Information Changes our Lives, Now and in the Future
GOSAT's Achievement Introduced at Exhibition Booth

- Soushi Kato, NIES Postdoctoral Fellow, Office for Global Environmental Database, CGER, NIES

GOSAT's achievement was introduced at an exhibition booth at the G-spatial EXPO held at PACIFICO YOKOHAMA from September 19, 2010 to September 21, 2010. G-spatial EXPO is an event started this year targeting the general public, and hosted a number of lectures and symposiums on new industries such as map distribution and navigation systems, exhibitions on new products and services, and communication meetings for the purpose of collaborations among industry, academia, and government. It was reported that 36,819 people attended the exhibition space during the three-day event.

The National Institute for Environmental Studies (NIES) in collaboration with the Biodiversity Center of Japan, Ministry of the Environment (MOE) of Japan, hosted an exhibition booth, and the Office for Global Environmental Database exhibited and introduced the achievement of GOSAT project. The exhibit included poster panels that showed the theoretical explanation of GOSAT observation and the spherical display that showed the observational data and simulation results.



Displaying GOSAT projects research achievement at the booth hosted by NIES/Biodiversity Center of Japan, MOE at during the G-spatial EXPO. Photographed on September 20, 2010 by NIES Fellow Jiye Zeng (Office for Global Environmental Database, CGER, NIES).

Since the device itself of spherical display was eye catching, many people especially families and students stopped by at the booth. However, the most visitors seemed interested in the subject matter after listening to the explanation on the satellite measurement of carbon in the global atmosphere. I believe that the research achievement had as much impact as the way it was exhibited. Participating in an expo in the field of geographical information system was a good opportunity to introduce GOSAT project to people who are not professionally involved in the environmental studies or enterprises.

IMAGES OF THE MONTH

THE GLITTERING PLAIN
SALAR DE UYUNI, BOLIVIA

- Nobuyuki Kikuchi
Specialist, NIES GOSAT Proejct Office

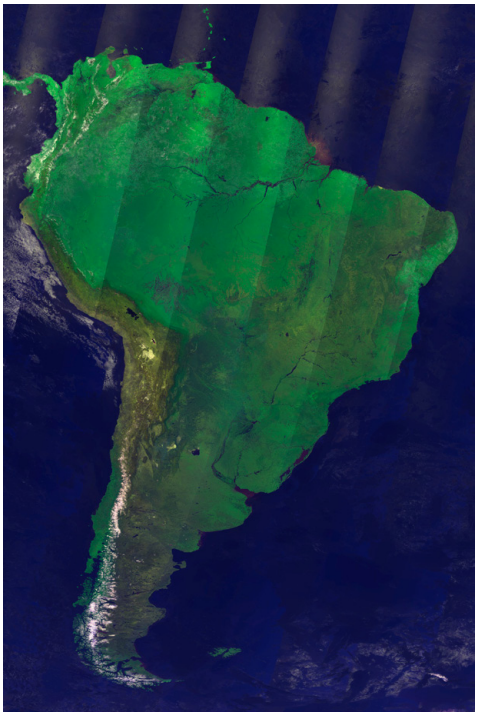


Image 1. A false color image of the clear-sky reflectance data of South America for the month of August 2010. Red = Band 2, Green = Band 3, Blue = Band 1.

Image 1 is a clear-sky reflectance data of South America composed of the CAI data acquired in the month of August 2010. By gathering the data of minimum reflectance, it is possible to eliminate clouds in the image and monitor the ground surface condition over a large area. A little trace of clouds are left near the equator, but you can see the clear shape of the Amazon River and the snow-capped mountains that stretch in the Andes. The white spot that stands out in the Bolivian Plateau is not cloud or snow, but it is Salar de Uyuni, a salt flat left behind by dried up lake.

Image 2 is an enlarged image of Salar de Uyuni taken by CAI sensor on August 7, 2010. A large lake in the northern top is Lake Titicaca, Salar de Uyuni is in the middle, and there are several other lakes different in size are in the area. Lakes that are in the process of drying up appear in wine red. This is because the red color is assigned to the light detected in band 2 (670 nm). The light in band 1 (380 nm) and band 3 (870 nm) are more easily-absorbed by water compared to the light in band 2. Of the light reflected by the white salt at the bottom of lake, only the light in band 2 is emphasized and appears as red.

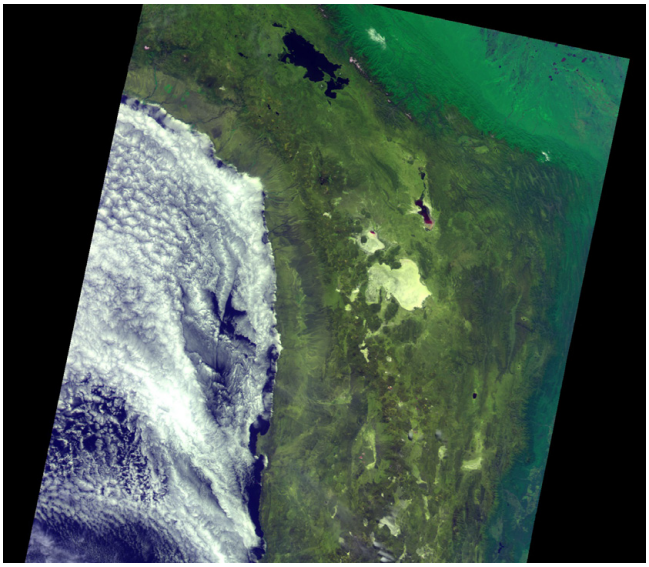
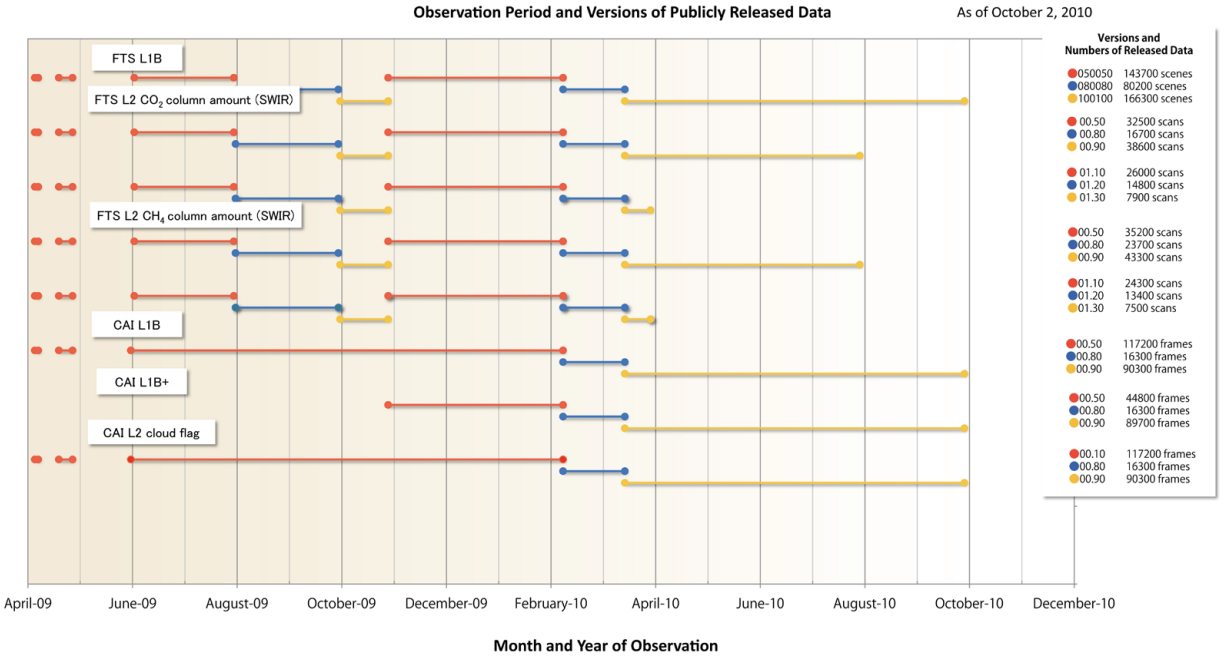


Image 2. An enlarged image of Salar de Uyuni photographed on August 7, 2010. Color assignment is the same as Photo 1.

DATA PRODUCTS UPDATE

Data Processing Status Update from GOSAT Project Office

- Fumie Kawazoe, Specialist, NIES GOSAT Project Office



Here we report an update on data processing status for late September and early October 2010. We are processing and releacing the V100100 of the FTS L1B data products, V00.90 of the CAI L1B, L1B+, and L2 cloud flag data products. Continued from the previous month, FTS L2 SWIR CO_2 and CH_4 column amount data products are processed and available to the general users as V01.xx. On September 30, the FTS L2 SWIR CO_2 and CH_4 column amounts data products from the months of June, August, September, November, December of 2009 and February and March of 2010 were released to the public. Please have a look at the updated Remarks on monthly FTS SWIR L2 Product and Gallery section.
The number of registered users reached 904 as of October 12, 2010.

PUBLISHED PAPERS

Field of Research: Validation
Name of Journal : Atmospheric Measurement Techniques (Volume 3, Number 5, October 2010, pages 1351-1362)
Title : Calibration of the Total Carbon Column Observing Network using aircraft profile data
Authors: D. Wunch, G. C. Toon, P. O. Wennberg, S. C. Wofsy, B. B. Stephens, M. L. Fischer, O. Uchino, J. B. Abshire, P. Bernath, S. C. Biraud, J.-F. L. Blavier, C. Boone, K. P. Bowman, E. V. Browell, T. Campos, B. J. Connor, B. C. Daube, N. M. Deutscher, M. Diao, J. W. Elkins, C. Gerbig, E. Gottlieb, D. W. T. Griffith, D. F. Hurst, R. Jiménez, G. Keppel-Aleks, E. A. Kort, R. Macatangay, T. Machida, H. Matsueda, F. Moore, I. Morino, S. Park, J. Robinson, C. M. Roehl, Y. Sawa, V. Sherlock, C. Sweeney, T. Tanaka, and M. A. Zondlo

Field of Research: Carbon balance estimation / Atmospheric transport modeling
Name of Journal: Tellus B (Volume 62, Issue 5, November 2010, pages 821-840)
Title: Simulation and assimilation of global ocean pCO_2 and air-sea CO_2 fluxes using ship observations of surface ocean pCO_2 in a simplified biogeochemical offline model.
Authors: V. Valsala and S. Maksyutov

CALENDAR

2010/11/17-19
Participation at the the 54th Symposium on Space Science and Technology held in Shizuoka, Japan.

2010/11/17-19
Participation at the 16th Atmospheric Chemistry Conference held in Tokyo, Japan.

NIES GOSAT PROJECT NEWSLETTER **ISSUE #10 OCT. 2010**

Issued On : 2010.11.01
Revised On : 2011.02.08

edited and published by : NIES GOSAT Project Office

email : gosat_newsletter@nies.go.jp
website : http://www.gosat.nies.go.jp/eng/newsletter/top.htm
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