NIES GOSAT PROJECT NEWSLETTER

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Center for Global Environmental Research
is celebrating the 20th Anniversary.

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/

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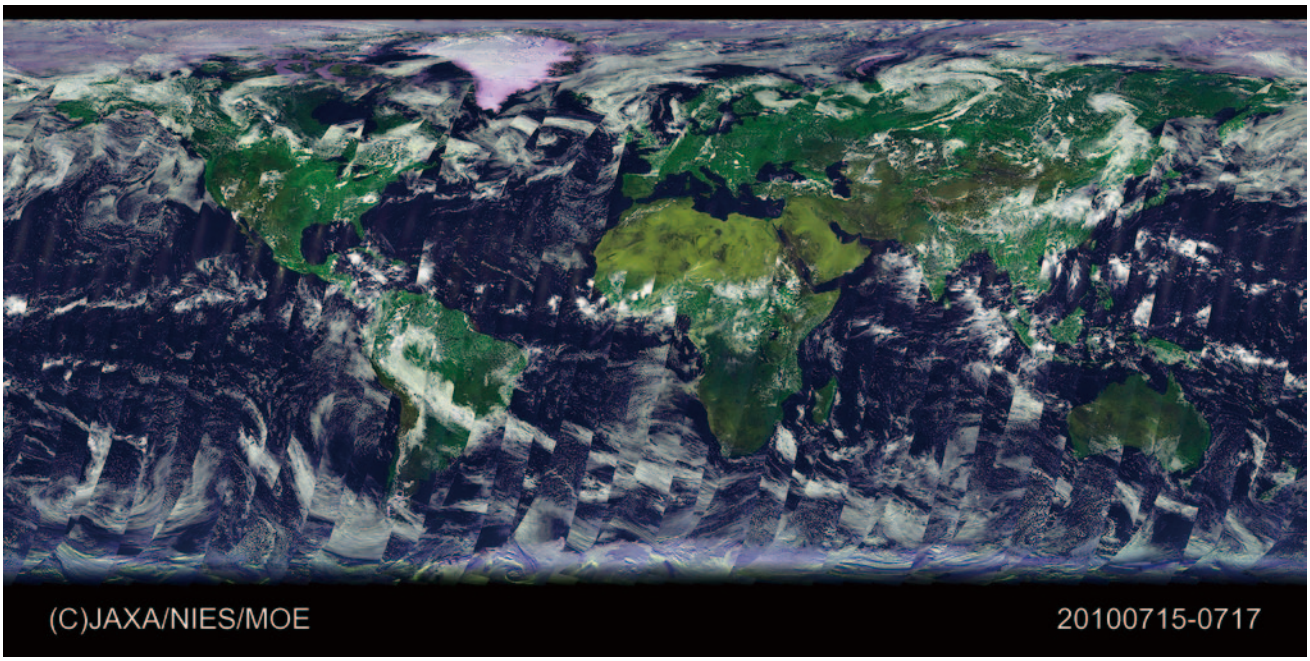


Image 1. A false color image composed of L3 CAI global radiance distribution data from July 15 to July 17, 2010.

NEWS

Level 3 CAI Global Radiance Distribution Released to General Users

- Nobuyuki Kikuchi, Specialist, NIES GOSAT Project Office

The GOSAT Project started to distribute a new kind of GOSAT data products, Level 3 CAI global radiance distribution, to the general users on November 10, 2010. A Level 3 global radiance distribution data product contains 3 days' worth of global radiance distribution data measured by the Cloud and Aerosol Imager (TANSO-CAI).

Image 1 shows that the product is made of layers of belts that flow from the top right to the bottom left to cover the whole globe with as least space in between as possible. Each belt is the trace of "IBUKI"'s one orbit around the globe. Forty-four rounds made in three days, cover the whole globe. The Antarctic was not in the image, because it was winter in the Southern Hemisphere in July, and the sunlight does not reach the area owing to the polar night.

Level 3 global radiance distribution data products are projected as equirectangular maps and the data are aligned every 0.125 degrees mesh (each data is 2880 x 1440 px). For each mesh, a L1B+ data closest to the center of mesh's latitude and longitude is selected, using the nearest neighbor algorithm. The latest data is applied if multiple dates are eligible for one mesh. One product contains the radiance data of band 1 to 4, as well as the satellite zenith/azimuthal angle and solar zenith/azimuthal angle.

NEWS

GOSAT RCF Ranks 10th Most Energy-efficient Supercomputer

- Yuki Tanaka, Specialist, NIES GOSAT Project Office

The GOSAT Research Computation Facility (GOSAT RCF) of the NIES GOSAT Project was ranked as the 10th on the Green 500, a ranking of the most energy-efficient supercomputers in the world.

The GOSAT RCF (installed at the National Institute for Environmental Studies (NIES) in March 2010) plays a critical role in the algorithm research for the higher-level data processing of IBUKI's observation.

In recent years, the enormous energy consumption by computer systems that process a large amount of data such as satellite data at high speed has been considered problematic. At the GOSAT RCF, various creative ideas made the low-energy consumption possible. The system was built with a consideration for the global environment while maintaining a high performance needed for the operation of the GOSAT Project.

In the early fiscal year of 2010, the General Purpose Computing on Graphics (GPGPU), in other words, the key to computation performance, were updated to the latest model, NVIDIA Tesla C2050. Its total theoretical peak performance (double precision floating point number) was improved to 177 TFLOPS (please refer to the April issue for other details on the specification). These efforts led to GOSAT RCF's ranking in TOP 10 for the Green500 list.

This Green 500 list was announced at the SC10[1], one of world's biggest international conferences on supercomputers in New Orleans on November 19, 2010 (JST).

The ranking is updated every June and November (For June it is announced at the International Supercomputing Conference). From Japan, Tokyo Institute of Technology ranked the second and RIKEN Advanced Institute for Computational Science ranked the fourth.

For any questions on this article, please contact the Office for Global Environmental Database (Chief Tsuneo Matsunaga).

The GOSAT Research Computation Facility (GOSAT RCF)

The Green500 List – November 2010 webpage:
http://www.green500.org/lists/2010/11/top/list.php

1 **SC 10:** An abbreviation for The International Conference for high Performance Computing Networking, Storage, and Analysis (The SC Conference Series) held in 2010.

NEWS

Blue Planet Prize Recipients Dr. James Hansen and Dr. Robert Watson visit NIES

- Yuki Tanaka, Specialist, NIES GOSAT Project Office

NIES invited the recipients of this year's Blue Planet Prizes, Dr. James Hansen (Director at NASA Goddard Institute for Space Studies) and Dr. Robert Watson (Chief Scientific Adviser of the U.K. Department for Environment, Food and Rural Affairs), for a commemorative lecture on October 28, 2010. The Blue Planet Prizes are awarded to individuals or organizations that make outstanding achievements that help solve global environmental problems. The Asahi Glass Foundation selects the recipient of prize each year. On the same day of their lecture, an informal meeting was set up for the two and the researchers at the Center for Global Environmental Studies (including NIES GOSAT Project Leader Tatsuya Yokota) to discuss the studies related to the global environment at NIES.

On "IBUKI," topics such as 'a possibility of using "IBUKI" data for validation of CO_2 emissions' and ' a possibility of minimizing possible research overlapping in future satellite projects by promoting a stronger cooperative ties in the international research community' were discussed.

Dr. Hansen pioneered in understanding and forecasting of the global climate change in 1950s and 60s. In 1980's, he predicted the 'global warming,' and testified at the U.S. Senate and House of Representatives to call for actions. He has been calling on the governments and the public to take immediate action to reduce and mitigate the impact of climate change.

Dr. Watson has played a mediator role to bridge science and politics while working for the international organizations such as NASA, the Intergovernmental Panel on Climate Change, and the World Bank, and works on handling issues of climate change and global environment.

At the informal meeting held at NIES on October 28, 2010. (from left) Dr. Robert Watson and Dr. James Hansen. Photo by Yuki Tanaka.

GOSAT PEOPLE

Messages from People of "IBUKI" Operation/Management

NIES GOSAT Project Office Manager

by HIROSHI WATANABE

Photo by Yuki Tanaka

I was born at the peak of so-called baby boom in Japan.

I was born in 1947, the Year of the Boar (one of the twelve animals of the Japanese zodiac), and at the peak of so-called baby boom. My school-year story is quite simple. I spent 12 years of my elementary, middle, and high school days at Gyosei Gakuen (Gyosei means morning star in Japanese), a private school in Tokyo. Then, I spent another 12-years, from 18 to 30 years old, at The University of Tokyo (Todai), where I received my bachelor's, master's and doctoral degrees, until I started my first job (Just for your information, the year I entered the primary school, university, and my first company were all in the Year of the Horse…). Normally at Todai, the academic programs can be finished in 4 years for the bachelor's degree, 2 years for the master's, and 3 years for the PhD. It took me one extra year for my bachelor's degree because I spent a year studying at Grenoble University on a scholarship from the French government. And then, the marriage and suffering from sudden hearing loss delayed my master's degree for one year. I finished my doctoral program in three years, but I stayed in the lab for a year afterwards for more study. At Todai, I started to major in nuclear engineering in my third year of undergraduate program at the Faculty of Engineering. My major during my graduate program was also nuclear engineering. To be more specific, my specialty was radiochemistry.

My hobbies are soccer and …

My hobby is also simple: soccer. I started kicking a soccer ball in elementary school at Gyosei, and I was a member of the soccer team all the way through middle and high school. At Todai also, I joined their soccer team, and I was a member except for during the year in France. At Gyosei, the team won the Tokyo prefecture championship, and at Todai, the team went as high as fourth in the division 2 in the Kanto region. I still play soccer now. I am a member of the ASTRA Club of Gyosei, the Todai OB Team, and the Raizes at NIES. In fact, I have another hobby (something to drink) that starts with the letter "s" in Japanese but I will talk about this in another occasion…

The petroleum exploration using remote sensing technology became my work.

So, after finishing my graduate study in 1978, I joined the JAPAN PETROLEUM EXPLORATION CO. LTD. (JAPEX). You might wonder why I jumped into the petroleum industry even though my specialty was nuclear power. There was a researcher who would come to Todai from JAPEX to study the gamma-ray and Newton logging (logging means a method to measure geophysical quantities at the petroleum well). He introduced me to his study, and it was the start. It could also be that an alumnus of the laboratory worked for JAPEX already. Right after I started at the company, I was assigned to organize the launch of their remote sensing section. I was not in control of the situation yet, but thus the petroleum exploration using remote sensing technology became my work.

This was also when I experienced my first culture shock. I jumped into the world of petroleum from the world of nuclear science. I did not take any earth science classes even in high school, so I barely knew about geology and geophysical sciences. I was used to finding out about consequences from theories such as mathematics and physics, so it was a new experience for me to find out about underlying theories from the natural phenomenon.

At that time, the only earth observation data that existed were Landsat[1]/MSS[2], but the size of this business was expanding since the oil companie's so-called the "Petroleum Majors" were going towards this direction. It was around this time when Remote Sensing Technology Center of Japan (RESTEC) was founded, and after a short while, Earth Remote Sensing Data Analysis Center (ERSDAC) was also founded. Around this time, the satellites such as SPOT[3], another Landsat, and Seasat[4] were launched one after another. My job was to load and analyze these data.

In the mid 1980's, a project to launch Japanese remote-sensors was started with the funding from the Oil Special Account of Japanese government. I was involved in the Japanese Earth Resources Satellite (JERS-1)[5] project, and then a collaborative project with NASA, the ASTER[6] plaroject. Since 1994, I had been a project manager of ASTER at EARSDAC as an expert on loan from JAPEX to develop their ground

1 **Landsat:** A series of Earth Resources Technology Satellites jointly managed by NASA and the U.S. Geological Survey. The first Landsat was launched in 1972, and the seventh and latest was launched in 1999. It is often said a pioneer of the earth observing satellites.

2 **Multi-Spectral Scanner (MSS):** An optical sensor aboard Landsat satellite. The sensor measures the reflected solar radiation with its four channels ranging from the visible to near-infrared region. As a successor of MSS, there is another high quality sensor called Thematic Mapper (TM).

3 **Satellite Pour l'Observation de la Terre (SPOT):** A series of Earth observing satellites of France. The first SPOT was launched in 1986, and the fourth and latest was launched in 2002.

4 **Seasat:** The first satellite carrying SAR with a purpose to observe the Earth's oceans from the orbit. The satellite was launched in June 1978, and the operation was ended in October 1978.

5 **Japanese Earth Resources Satellite 1 (JERS-1):** An Earth observation satellite to cover the global land area for the purpose of resource exploitation, national land survey, agriculture, forestry, and fishery, environmental protection, disaster protection, and coastal monitoring, etc.

6 **Advanced Spaceborne Thermal Emission and Reflection radiometer (ASTER):** An advanced optical sensor with 14 spectral channels ranging from the visible to thermal infrared region. It is a cooperative effort between NASA and Japan's Ministry of Economy, Trade and Industry (METI). ASTER is on Terra satellite launched in December 1999 as a part of NASA's Earth Observing System (EOS).

system, but I moved permanently to ERSDAC to work on the operation of ASTER in 1999 right before the launch of Terra[7] satellite that carried ASTER. NASA's related organizations such as Goddard Space Flight Center and the Jet Propulsion Laboratory cooperated with us in development and operation, and the ASTER data are now used globally. In the mean time, I was also involved with one of SAR[8] sensors, PALSAR[9] aboard ALOS[10] satellite.

I can take on one more new challenge.

ASTER had been operating almost steadily for more than its five year design life when I was offered a position as a project office manager for the soon-to-be-launched satellite, GOSAT "IBUKI" at NIES. I was a little nervous about changing my jobs at the age almost sixty, but I also had the feeling that I can take on one more new challenge, and I took the offer. So, in September 2006, I moved my workplace and residence altogether to Tsukuba.

This is when I experienced my second culture shock. Up until then, the land surface was the subject of remote sensing for me, and the interference from atmosphere was the subject of removal. However, this time, the targets were switched. The subject matter is the atmosphere, and the interference from land surface had to be removed. It was a precious experience that I had to think over what I had thought was the common sense. Since then, four years have already passed. I feel that I have learned to think in the atmosphere-oriented manner. It is fortunate that "IBUKI" was launched successfully in January 2009, and the operation has been quite smooth. So far, the NIES GOSAT Project has released up to level 2 and 3 products, and has facilitated exchange and cooperation among researchers worldwide through the Research Announcements that call for research proposals, as well as through interactions with similar satellite projects such as OCO[11].

I think I have to be grateful that everything including the launches and the nominal operations of the satellite projects I have been involved are successful. Under such fortunate circumstance, I was also able to work with the remote sensing both of land and atmosphere. I could experience two different standpoints. This has enabled me to look at things from the both sides of wall. I feel that there is not enough cross-genre discussion between the two. I hope to bridge them in some way with my experience of seeing things from the both sides. Another precious experience is that I was able to interact with researchers and users not only in Japan but also in the world. I feel that I gained a broad view through this as well.

I hope you enjoyed my long essay, and hope to continue my contribution to the GOSAT Project.

7 **Terra:** A satellite developed by NASA as a flagship of the Earth Observing System (EOS) series. Five sensors including ASTER and MODIS are aboard the satellite. The satellite measures clouds and aerosols and its radiation balance, land surface, and carbon cycle.

8 **Synthetic Aperture Radar (SAR):** An active microwave sensor that transmits a microwave and detects the wave reflected back by objects to observe the topographical features, such as land cover type, undulations, roughness and slopes at high resolution.

9 **Phased Array type L-band Synthetic Aperture Radar (PALSAR):** A microwave sensor developed based on JERS-1 SAR (Japanese SAR made in 90s) with improved functions and performance. With an ability to analyze the geological structure at the accuracy of a few centimeters, it is expected to contribute to resource exploration and development, observation of vegetation, classification of land use.

10 **Advanced Land Observing Satellite (ALOS):** A Japanese satellite developed by JAXA. ALOS has three remote-sensing instruments: the Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM), the Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2), the Phased Array type L-band Synthetic Aperture Radar (PALSAR). The data are used for purposes such as cartography, regional observation, disaster monitoring, resources surveying, and resource surveying. It was launched in January 2006.

11 **The Orbiting Carbon Observatory (OCO):** One of NASA's Earth System Science Pathfinder Project (ESSP) missions, designed to make precise and time-dependent global measurements of atmospheric carbon dioxide (CO_2) from an Earth orbiting satellite. Unfortunately, the launch of OCO satellite failed on February 24, 2009. However, the OCO-2 mission is now underway.

NEWS

Report: Meteorological Society of Japan 2010 Autumn Meeting Special Session 'Utilization Studies of the Greenhouse Gases Observing Satellite (GOSAT) "IBUKI" Data'

- Makoto Inoue, NIES Postdoctoral Fellow, Satellite Remote Sensing Research Section, CGER, NIES

Meteorological Society of Japan's 2010 Autumn Meeting was held in Kyoto, Japan, in October, from 27th to 29th. On the first day of the meeting, a special session 'Utilization Studies of the Greenhouse Gases Observing Satellite (GOSAT) "IBUKI" Data' was organized (The chairpersons were the University of Tokyo's Associate Professor Ryoichi Imasu, and two NIES researchers). The session attracted about 70 people, and 17 people made oral presentations.

During the first half of the session, the presentations were mainly on the calibration status of TANSO-FTS's observation data, the characteristics of retrieved concentrations of carbon dioxide (CO_2) and methane (CH_4), and comparative validation with other data.

The lecture given by Assistant Professor at Chiba University Naoko Saitoh was on the characteristics of CO_2 and CH_4 concentrations using the band 4 (thermal infrared) of TANSO-FTS. It was fascinating that with the GOSAT data, the vertical profiles of the greenhouse gases, not just their horizontal distributions, are starting to become clear.

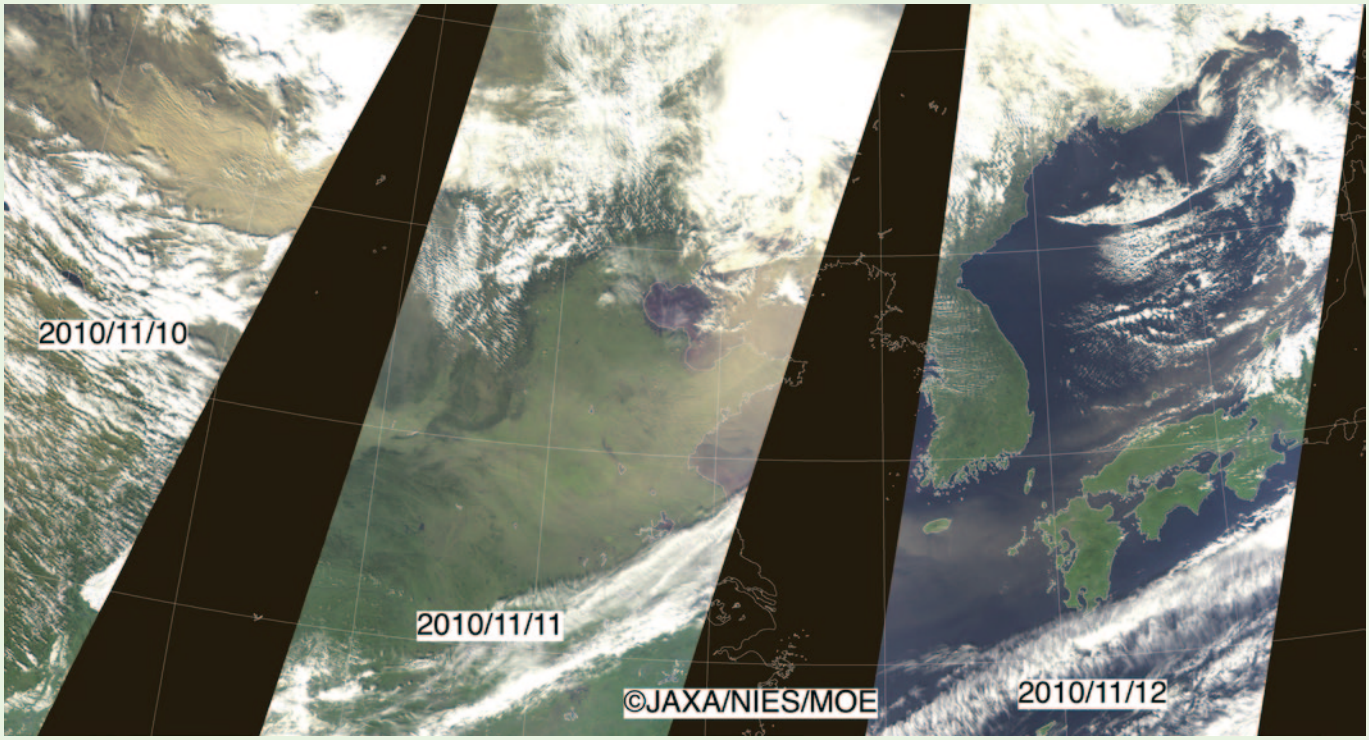
For the latter half of the session, the presentations were on various application studies using "IBUKI"'s data, including detection of cirrus clouds and aerosols, and estimation of greenhouse gas emissions. Meteorological Research Institute's Senior Researcher Dr. Takashi Maki reported that GOSAT observation data's existing bias was corrected and extreme deviations from the climatological concentrations were removed when the GOSAT data were assimilated into a chemical transport model using the ensemble Kalman filter.

This session was a great opportunity for me to learn about the current status of the GOSAT data products and the latest studies using the GOSAT data. I am expecting that the further improvement of algorithm and additional analysis will lead to a better understanding of greenhouse gases' 3D structure and evaluation of carbon balance.

At the special session 'Utilization Studies of the Greenhouse Gases Observing Satellite (GOSAT) "IBUKI" Data' during the Meteorological Society of Japan 2010 Autumn Meeting. Photo by Makoto Inoue

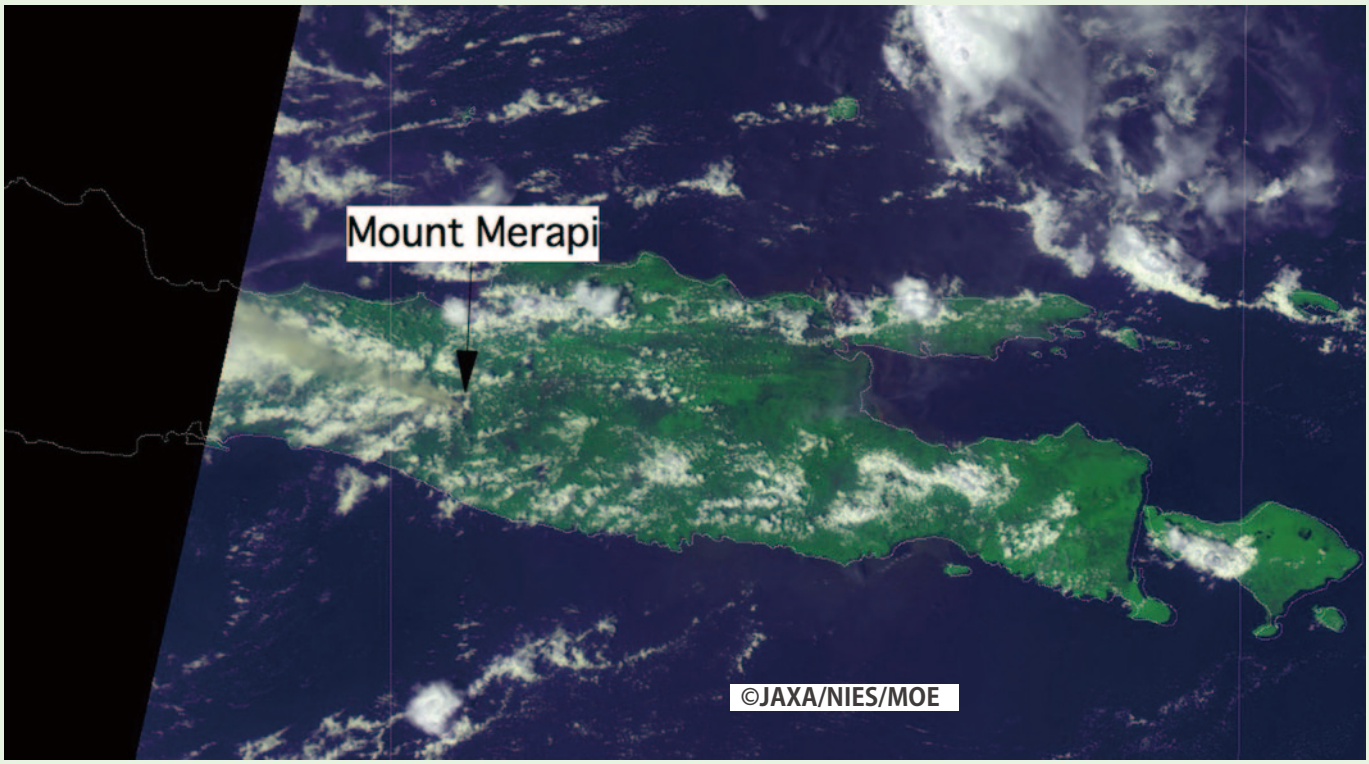
IMAGES OF THE MONTH

— Nobuyuki Kikuchi, Specialist, NIES GOSAT Project Office



Asian Dust Falls in Fall - East Asia

The Asian dust (yellow dust) phenomenon, known to occur usually in the springtime, occurred in the fall. The dust traveled all the way to Japan from China, and in Kyushu Island the visibility was less than 5 km at one point. The image is a composite of "IBUKI"'s images from November 10th, 11th, and 12th. The image shows that the yellow dust (light brown) is stirred up in the desert area in China on 10th, then it crosses Yellow Sea on 11th, and on 12th, following the low pressure in the Sea of Japan, it spreads from the Sea of Japan over Kyushu to Jeju island.



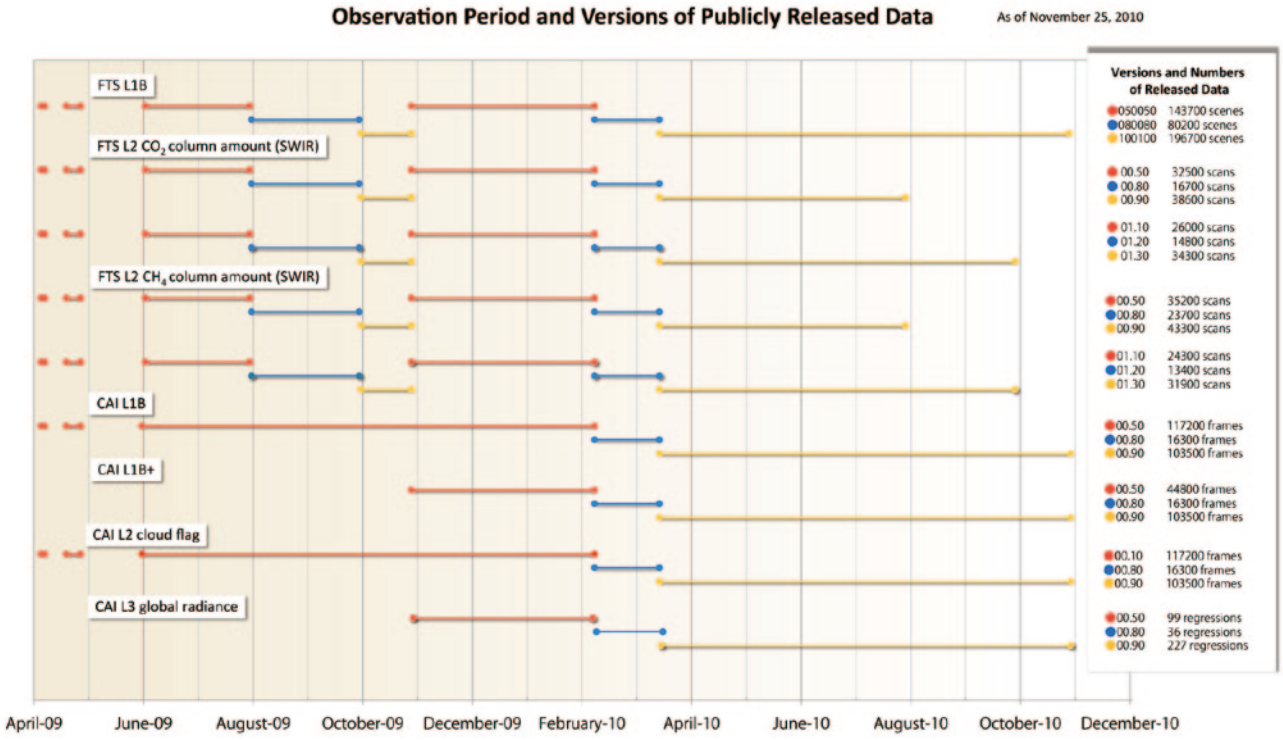
Eruption of Mount Merapi - Java Island, Indonesia

At the Mount Merapi on Java Island, Indonesia, it was spotted that the eruption continued two weeks after the first eruption on October 26, 2010.
The image taken at 05:08AM (UT) on November 10, 2010 captures the volcanic plume (light brown) from Mount Merapi.

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 October and early November 2010.

We are currenty processing and releasing the V100100 of the FTS L1B data products, the 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.

The FTS L2 SWIR CO_2 and CH_4 column amount data products (V01.30) for the months from April 2010 to September 2010 are available to the general users starting November 24. The CAI L3 global radiance distribution data products were also made available to the general users starting November 10, 2010. (For more detail, please refer to the article on page 1 'Level 3 CAI Global Radiance Distribution Released to General Users') .

Other events on the schedule are the release of the FTS L3 global CO_2 and CH_4 distribution (SWIR) data products to the general users on November 30, 2010, and an upgrade of FTS L1B data on December 2, 2010.

On October 27, 2010, GOSAT User Interface Gateway (GUIG), a website for GOSAT data distribution, was re-launched with a new design and an improved Menu section. (Please refer to the 'News & Topics' on GUIG top page for more information on the changes.)

The number of registered general users reached 927 as of November 25, 2010.

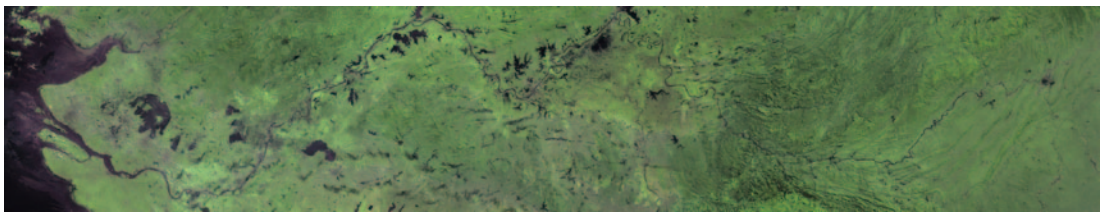
CALENDAR

2010/12/13-17

Participation at the American Geophysical Union (AGU) 2010 Fall Meeting held in San Francisco, USA.

??? IBUKI QUIZ

What is the name of this river, and where is this? (tip : The image is south-up and east-left...)



Yangtze River in China (the image is rotated 180 degrees.) The clouds were removed when synthesizing "IBUKI"s data from October 1, 2010 to October 31, 2010.

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