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A newsletter on the Greenhouse gases Observing SATellite (GOSAT, "IBUKI") project from the NIES GOSAT Project Office.
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NEWS

GOSAT DHF Resumes Its Operation

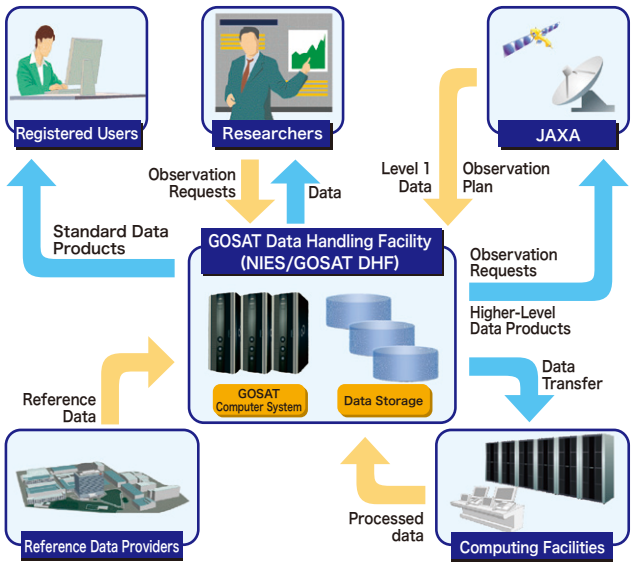
Nobuyuki Kikuchi, Specialist, NIES GOSAT Project Office

On March 11, 2011, a 9.0-magnitude earthquake hit northeastern Japan (the Great East Japan Earthquake). The "IBUKI" satellite continued its nominal observation as there was no interruption to the control of the satellite, however, the NIES GOSAT Project office was closed for the following week due to the electric power failure. On March 22, as the office was re-opened, we started to work on the recovery of the GOSAT Data Handling Facility. We resumed the data distribution service on April 1, and data processing on April 6.

The GOSAT DHF is the central resource for processing of the GOSAT data. Its main tasks include: (1) Processing the observational data from JAXA into higher-level data products, the Level 2 and Level 3, which include the column abundances of CO_2 and CH_4. (2) Distributing the data products to the researchers and general users. (3) Collating requests for targeted measurements sent from the qualified researchers, and transferring the organized requests to JAXA. Other tasks include collaborative work with external agencies to supplement the functions at the GOSAT DHF: (4) Gathering reference meteorological data. (5) Bridging the supercomputers at the NIES and other computing resources.

We are working to catch up on the three weeks of delay, and get back to the quasi-real-time processing.

GOSAT Data Handling Facility (DHF) located in the main research building III at the National Institute for Environmental Studies.



Wrokflow of GOSAT data processing.

INTERVIEW

DR. ALEXEY YAREMCHUK

Dr. Alexey Yaremchuk is a mathematician from Russia, who has also been an advisor to the modeling group since the start of the NIES GOSAT Project. The NIES GOSAT PROJECT NEWSLETTER interviewed him during his visit to the NIES. (Interviewer: NIES GOSAT Project Leader Tatsuya Yokota and Sub-leader Shamil Maksyutov. Interviewed on January 28, 2011.)

"my father got a book on Einstein's theory and ..."

Maksyutov (MAK): So Alexey, it is very nice that you could come to Japan again. My first question is how you got interested in science. Maybe it is related to your study in the high school or university?

Yaremchuk (YAR): Definitely. In Russia, we have ten years of education prior to university. In about the fifth year, we started studying English. It was very interesting for me, but grew less interesting in a couple of years, and I became more interested in physics instead. When I was in seventh grade or so, I remember my father got a thin popular book on Einstein's theory of gravitation. I had a look into it. I couldn't understand anything because of the formulas there, but I was greatly impressed by the descriptions of black holes and Schwarzschild horizons. After that, I was going just more and more into this direction.

Yokota (YOK): Where were you born and where did you go to school?

YAR: I was born in a small city near Moscow in Russia. Last year of high school, I changed to a specialized school in Moscow. There were four special schools over the Soviet Unions founded by the mathematician Andrey Nikolaevich Kolmogorov for young people who liked mathematics, so that they had opportunities to study somewhere in the center. So, I graduated from that school in Moscow, but actually I spent there only the last year.

YOK: What did you study in the university?

YAR: I initially started in the department for radio technique. We already had to take specialized classes in the second year, and it was about technology, radars..., and I felt that I should switch to studies that were more theoretical. I switched to general physics, although it was not so easy. So, I graduated from the department of general physics.

MAK: What was your research for master's degree?

YAR: I received my master's degree from the department of theoretical physics at the Moscow Institute for Physics and Technology. At that time students there were normally doing solid-state physics, and elementary particles were not recommended. I worked in mathematical physics. My graduate thesis was on exact solutions to a chiral field model. It was published in a well-appreciated journal Nuclear Physics B. I deviated from chiral fields after this.

MAK: Did you work on your Ph.D. in the same department?

YAR: Yes. We could stay either in the university or in one of research institutes belonging to the Russian Academy of Sciences. So, I worked on my PhD at the Landau Institute for Theoretical Physics. My doctoral thesis was on exact solutions of classical Heisenberg and Landau-Lifshitz magnetic models. The classification that was written on my diploma was theoretical and mathematical physics.

YOK: Then, you started working in a research institute or university?

YAR: After graduation I was employed by N. N. Andreev Acoustics Institute. It is part of the Russian Academy of Sciences, and is in the area of Moscow where many institutes for Earth sciences are located.

"my experience and knowledge are what I always rely on"

MAK: Can you tell us about your experience before working on carbon cycle and the transition from the theoretical physics into the data assimilation?

YAR: OK. This happened in 1995. At that time in Russia, strong theorists have already flown to the West. I was more or less just staying alone, and I was not so young, either. You know, the great moves in theory are done by young people somewhere at the age below thirty. Meanwhile, I have a brother who used to work in the field of data assimilation in the ocean sciences. He was in Germany, and he had some problems with computing. The problems appeared to be solvable, so I went to Germany to help them. At that time, I did not expect it to be the turn in my life. Even when they asked me to stay there for one and half years, I said, "Oh, I have other interests," and left in half a year to Russia, but eventually I returned back to Germany. It was at the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven, Germany. While I was there, I was lucky to go on an Antarctic expedition with the German people by Polarstern, it's their icebreaker which they use for research. This was great. They had a problem with the instruments that they deployed in the Antarctic for making underwater observations. These instruments were acoustically controlled. However, frequently it appeared that they could not establish a bidirectional communication with them. The instruments were left under a sea ice and lost forever. Since I was from the Acoustics Institute, they suggested me to work on the problem. I had experience in engineering work in the Acoustics Institute, so I made some recommendations. I could not actually help them immediately, but they were able to send a report to France where this acoustic positioning technique was developed. I cannot say it was because of me, but the system was totally changed in several years. Then, the leader of the expedition wanted me to go with them once more, but this time I could not do it because someone recommended me to a person in the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). I came to Japan in the fall of 2000. I thought that I shall stay for one year at first, but stayed for five years.

MAK: So, what is the connection between your work in data assimilation and your background in theoretical physics, and your problems like the carbon dioxide assimilation?

YAR: My experience and knowledge are what I always rely on, and it helps somehow. Engineers have nice ideas, but sometimes they may not be very strong in mathematics and think that mathematics can help.

The point is that problems are of two types: those that can be solved and those that cannot. When I was at the Landau Institute for Theoretical Physics, Alexei A. Abrikosov[*1], who received a Nobel Prize in 2003, was there. He said that when you work on a problem, and if you feel no move, then stop and change to another because the life is short. With the data assimilation, it appeared to me that the theory is not well developed and something could be done. Research in carbon dioxide cycle is also related to the problem of data assimilation. If we only talk about assimilation itself and not physics and development of transport models, one should start from carbon dioxide, because it is much more linear than the ocean. I am not a guy who develops life. The life takes me here and there. So, I do not know what to say more.

observation instruments based on satellites are the future but more investigation into their potential is needed

MAK: What do you think about the satellite observation of GOSAT from the point of view of a data assimilation specialist? What is the difference between the fixed-point observation of a small network done before GOSAT, and the GOSAT observation with a global coverage maybe less accurate but more frequent?

YAR: In my opinion, the remote observation instruments based on satellites are the future, and we should mainly work only in this direction. Even when all the existing fixed observation points are combined, they appear to be too sparse to cover the whole planet. Also, I feel that potential of the satellite-borne instruments is not investigated precisely. So far we only have speculations. We should do it more on applied mathematical grounds using numerical modeling. I think that this is the future, and there might not be a small comparison between satellites and in-situ measurements.

MAK: So how did it happen that you joined the GOSAT project? Was it by occasion or your interest in the global warming?

YAR: Of course, it was by occasion, because we met in JAMSTEC. Although, I was on the forth floor there, working in the global climate change group, my interest was only in mathematics or physics of data assimilation itself. Actually, I am concerned about climate change only when I look out in the window and we have rain in winter instead of snow. It makes me unhappy.

YOK: What is your position with the NIES GOSAT Project modeling group?

YAR: When I came to work with Shamil's group, they already had a transport model. My work is mainly related to data assimilation itself, and a transport model is necessary for this. First of all, I was involved into development of the so-called adjoint model. It is a technical tool that is necessary for data assimilation. Last year, I already started assembling the system itself. It relies both on the original direct model and the adjoint model on more or less equal grounds. Now we are applying it to process data collected by point measurements. Last year, we made an initial run using GOSAT data. But this was a development stage, and our computer program was not very well parallelized. We did not run it on super computers, the present task is just to ensure that everything is correct and there are no programming errors. And now, at least we feel so, that it is time to apply it to a huge amount of data provided by GOSAT to see what happens. It is better than to make hand waving and say some theoretical or near theoretical words.

YOK: I think you are mathematical or theoretical based researcher, but you are using computer systems.

YAR: All these programs that I use are programmed by me. Before going to Germany I never programmed. I only used computers for typing mathematical texts. In my opinion, my programming style is much more advanced than the styles of others who studied programming 20 years ago when there was no modern language of Fortran. Of course, I am not a professional in parallelization and real computing, I am just rearranging the main ideas on how it should be done.

MAK: We will release our estimate of surface CO_2 fluxes as a product of GOSAT Project from NIES particularly. What is your expectation for the data products that we are delivering and can deliver in the future with the GOSAT satellite?

YAR: I am a technical processing person, and the product itself may be more significant for those who are working in ecological fields. With that said, I think it is highly valuable, judging that no such product exists now. Concerning the quality, from some point of view, our contribution might not be seen as highly precise, but from my personal point of view, it will be one of the most advanced systems all over the world even though it is not heavily advertised in such a way.

YOK: We have been struggling with the noises and errors in retrieving concentrations, and CO_2 surface fluxes also contain some estimation errors. Our duty is to minimize these errors. Do you think the theoretical discussion or a theoretical, mathematical, or physical treatment of the estimation methods is important?

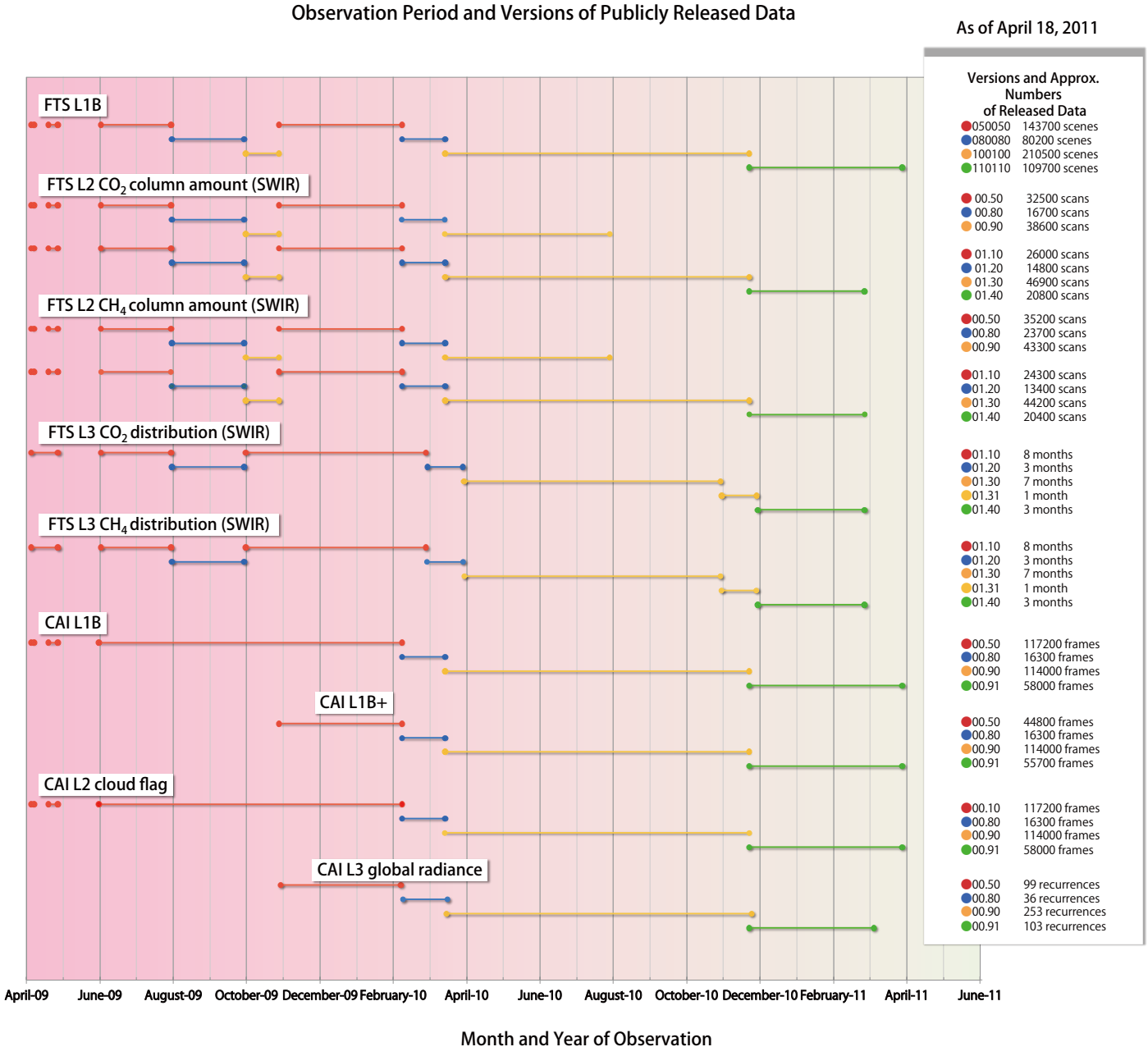
YAR: I think so. I'm only involved in the reconstruction of the surface emissions and sinks, the L4 stage. Whereas the task more related to retrieving the column amounts is the L2 stage. I have talked to some members of the project about physics of what is happening at the L2 stage for maybe one year. Up to now, the field is still nontransparent to me, but I think that maybe sometime I shall also try to contribute to their methods because as in data assimilation in atmospheric transport, I feel something can also be done in this field. I think that situation is similar to development the steam engines, which were started at the times of James Watt before creation of accurate theory. The engines were widely used and highly productive already, but later, when the theory appeared, a great improvement in efficiency was possible. So with GOSAT I feel that there also might be such a jump.

*1 Alexei A. Abrikosov (born 1928) is a Russion theoretical Physicist. He was awarded the Nobel Prize in Physics in 2003 "for pioneering contribution to the theory of superconductors and superfluids."

DATA PRODUCT UPDATE

Data Processing Status Update from GOSAT Project Office

- Fumie Kawazoe
Specialist, NIES GOSAT Project



We have restarted the operation of GOSAT data processing on April 6, 2011, after it was down due to the Great East Japan Earthquake. The data processing of some products is still delayed, but here we report an update on data processing status for late March 2011 and early April 2011.

Continued from last month, we are processing and releasing the V110110 of the FTS L1B data products, V00.91 of the CAI L1B, L1B+, L2 cloud flag data products, and the L3 global radiance distribution products, and V01.40 of the FTS L2 CO_2 and CH_4 column amount (SWIR) data products, and FTS L3 global CO_2 and CH_4 distribution (SWIR). We released the V01.40 of the FTS L2 CO_2 and CH_4 column amount (SWIR) data products and FTS L3 global CO_2 and CH_4 distribution (SWIR) data products for the month of February 2011.

The number of registered users is 1028 as of April 18, 2011.

IBUKI QUIZ

Q1

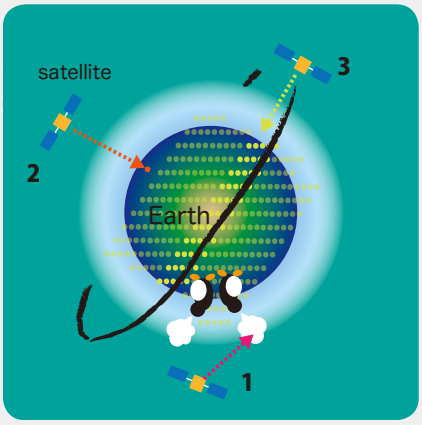
What is the duty of NIES GOSAT Project "modeling group"?

1) estimates the balance of CO_2 emission and absorption near the earth surface using computers
2) builds miniatures of satellite and sensors
3) walks the runway and strikes a pose

Q2

What is one of the things that were made possible by "IBUKI"?

1) measurement of amount of CO_2 breathed out by penguins in the Antarctic
2) continuous measurment of greenhouse gas concentrations at one observation point on the earth from the ground
3) frequent and regular measurement of greenhouse gas concentrations that covers the whole globe including the areas where there is no ground-based observation point.



The answers can be easily found in this issue. Please send us an email with your answers along with name, title, and comments on the newsletter at gosat_newsletter@nies.go.jp (due: May 22, 2011). We will give the right answers to those who send us emails!

PUBLISHED PAPERS

Field of Research : data processing algorithm
Name of Journal : Atmospheric Measurement Techniques
(Volume 4, Number 4, pages 717-734)
Title : Retrieval algorithm for CO_2 and CH_4 column abundances from short-wavelength infrared spectral observations by the Greenhouse gases observing satellite.
Authors : Y. Yoshida, Y. Ota, N. Eguchi, N. Kikuchi, K. Nobuta, H. Tran, I. Morino, and T. Yokota

Field of Research : calibration
Name of Journal : IEEE Transactions on Geoscience and Remote Sensing
(Volume 49, Number 5, pages 1781-1795)
Title : Vicarious Calibration of the GOSAT Sensors Using the Railroad Valley Desert Playa
Authors: A. Kuze, D. M. O'Brien, T. E. Taylor, J. O. Day, C. W. O'Dell, F. Kataoka, M. Yoshida, Y. Mitomi, C. J. Bruegge, H. Pollock, R. Basilio, M. Helmlinger, T. Matsunaga, S. Kawakami, K. Shiomi, T. Urabe, and H. Suto

ANNOUNCEMENT

NIES GOSAT PROJECT NEWSLETTER welcomes letters from our readers.
We appreciate your opinions,
"I want to read articles on ...," "... was really interesting." etc.
We also appreciate opinions or contributions from people involved in the GOSAT Project.
Please feel free to contact : gosat_newsletter@nies.go.jp.
Thank you for supporting the newsletter.

- Yuki Tanaka, editor

CALENDAR

2011/05/16-18
Participating in the 7th International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-7) held at the University of Edinburgh, Scotland, UK.
2011/05/18-21
Participating in the 2011 Spring Meeting of the Meteorological Society of Japan held at the National Olympics Memorial Youth Center in Tokyo, Japan.
2011/05/19-20
Hosting the 3rd GOSAT Research Announcement Principal Investigator Meeting (GOSAT RA PI Meeting) at the John McIntyre Conference Centre, Edinburgh, Scotland, UK.
2011/05/22-27
Participating in the Japan Geoscience Union (JpGU) Meeting 2011 held at the Makuhari Messe International Conference Hall in Chiba, Japan.
2011/05/23-27
Participating in the Network for the Detection of Atmospheric Composition Change Infrared Working Group (NDACC IRWG) / the Total Carbon Column Observation Network (TCCON) Meeting held in Boulder, Colorado, USA.
2011/05/26-27
Participating in the 50th Spring Conference of the Remote Sensing Society of Japan held at the Century Anniversary Hall of Nihon University, Tokyo, Japan.

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email : gosat_newsletter@nies.go.jp
website : http://www.gosat.nies.go.jp/eng/newsletter/top.htm
address : 16-2 Onogawa, Tsukuba-City, Ibaraki,
305-8506 Japan
GOSAT Project Office
Center for Global Environmental Research
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