



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/>

NEWS 4th Japan-US Joint Vicarious Calibration of GOSAT in Railroad Valley, NV, USA

Kei Shiomi, Associate Senior Engineer,
Earth Observation Research Center,
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🌞🌞🌞 The 4th vicarious calibration was carried out from June 24 to July 2, 2012 jointly with ACOS/OCO-2 team in Railroad Valley (RRV), NV, USA. RRV is a dried-up lake (playa) of about 30-km-long with 40% ground reflectance (very bright), a suitable place for calibration from space. Synchronizing with RRV observation by GOSAT, we measure ground surface reflectance spectra and atmospheric state (temperature, water vapor, pressure, CO₂, CH₄, O₃, aerosols) of the same place with various instruments, and evaluate the sensitivity degradation of the mounted sensors by simulating spectra using a radiative transfer code with above information input and comparing with spectra observed by GOSAT. Since 2009, these calibrations have been planned on June and July with best solar altitude and sunny days. (Please refer to #7 and #19 newsletters for previous reports.)

(1) Best weather, occasionally windy

All of 6 synchronized observations were 100% sun-blessed (70% for previous years), however, occasional 25m/sec wind embarrassed us with dust. We failed to release radiosonde balloons for early 2 days, but made complete releases for the following 4 days with some help from Japan team.

(2) Real spectacle: Ultralow stealthy flight of NASA Alpha Jet

NASA Alpha Jet (commonly called as "Google Jet") comes to a low of some tens of meters above the ground to get vertical profiles of CO₂ and CH₄. The jet comes near soundlessly from behind us while

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Dr. Schwandner, excited with Alpha Jet

pushing a double baby stroller altered to carry the instruments. The roar is heard just when it passes by catching us unawares! Google donated the jet to NASA for its field observation.

(3) How people in JPL(*3) trained for 1% accuracy improvement

Ground reflectance is measured vertically against the ground, while GOSAT observes RRV with satellite zenith angles of 20 or 30 degrees. Vertical measurement is enough if the ground reflectance is isotropic, however, it really has a few percent of anisotropy, which required us to get data of GOSAT zenith angles at each sites. Mr. Gandarillas, an internship student, did the part under the mentorship of Dr. Bruegge. The information is used to correct the anisotropy of the reflectance.



Dr. Bruegge and Mr. Gandarillas, measuring the ground reflectance with several observation angles

(4) Japanese met in RRV - Masters of vicarious calibration

We met a group from AIST (National Institute of Advanced Industrial Science and Technology), Japan, having come in charge of the same task for ASTER(*4). Terra passed over us at 11:38, GOSAT at 13:45 on June 28 [LT]. Two Japanese groups encountered on the desert with respective mission. They are only two and we are six. Will it make us masters, experience of more than 10 years?

(5) Experience of record-setting abnormal dryness in US

This year is abnormally dry and the humidity is so low (5%) at Ely, the city we stayed, that we awoke at night feeling difficulty in breathing. Water was indispensable by the bed. A wildfire attracted firemen from other states, (maybe) causing earlier sold-out of breakfast at the hotel.

(6) Evolving lunches and days-off in the desert

Who imagined exquisite BBQ salmon and Paella at a desert! Lunch revolution by attentive Mr. Landeros. Japan team brought usual retort curry and Somen (Japanese noodle), but on a day-off, we made Sushi roll and served at an open-air hot spring in Duckwater, an Indian Reservation, where Mr. Muro-oka used karate chop to split a watermelon; wonderful traditional performance! The spring was a good swimming pool for us and a good bath for them staying at the base camp.

(7) Base camp in RRV became permanent

The frame of the base camp tent was left as it was after the last observation was over. It looked like a house without roof. ACOS/OCO-2 team had already decided to set up their camp at the same place next year; we recognized their enthusiasm.

This time there were 6 Japanese and 4 Americans as shown below. Involved in ACOS/OCO-2 team were Dr. Carol Bruegge and Mr. Jess Landeros from JPL who drove a 4-ton truck and a camper all the way from Pasadena; Dr. Florian Schwandner, a GOSAT RA PI, voluntarily joined from Earth Observatory of Singapore; Mr. Victor Gandarillas was in his internship under fervent Dr. Bruegge. OCO-2 starts its preparation with these ground-hugging activities.



*1 ACOS: Atmospheric CO₂ Observations from Space (OCO-1 team-based CO₂ observation & research project, using GOSAT data)

*2 OCO-2: Orbiting Carbon Observatory 2 (CO₂ observing satellite of USA to be launched on 2014)

*3 JPL: Jet Propulsion Laboratory is a federally funded research and development

Off-site supporters; Dr. Tommy Taylor of Colorado State University, to our regret, couldn't join this time, however, his great support at the University enabled us to get the preliminary results analyzed and returned by next morning (observation data was uploaded at about 19:00). Dr. Laura Iraci of AMES(*5) helped to realize the synchronized observation bay Alpha Jet. Dr. Howard Tan of JPL transferred Dr. Schwandner how to release a radiosonde (drinking at a bar in Pasadena!, invitation of which I missed after a long hesitation...) Mr. Mark Helmlinger of Labsphere with perfect attendance until the last opportunity, is the real boss of RRV knowing everything to survive there. He was told to have visited the place at night from Tonopah, a neighboring city, with his irresistible enthusiasm to the site, however busy with his business operation.

(Left bottom photo: back row from left, JAXA Kawakami, Dr. Schwandner, JAXA Shiomi (writer), JAXA Tanaka, Mr. Gandarillas, Mr. Landeros; front row from left, JAXA Kuze, RESTEC Kataoka, Dr. Bruegge, JAXA Muro-oka)

It is my sincere hope that we run around that hot ground of RRV with still more GOSAT lovers next time.



(Above photo: a long journey to the observation point; JAXA Muro-oka pushing a double baby stroller with instruments and JAXA Kuze carrying a spectralon diffuser plate; Dr. Bruegge and Mr. Gandarillas in distant view)

<< Our typical day >>

- 5:00 Wake-up, check e-mail & the analysis result
- 6:30 Breakfast
- 8:00 Depart from hotel, shopping at a supermarket
- 10:00 Arrive at RRV base camp
- 10:20 Meeting, prepare instruments, set flag at observation site
- 12:45 Release radiosonde
- 12:50 Move to the site
- 13:15 Start observation
- 13:45 GOSAT flies over (path 36)
- 14:15 End observation
- 15:00 Back to base camp, lunch, copy data, cleanup
- 16:30 Depart from RRV base camp, refueling
- 18:00 Arrive at hotel, organize and upload data, charge batteries
- 19:00 Go out for dinner
- 21:00 Breakup, check e-mail, analyze data, bath, prepare water
- 23:00 Go to bed



center located in Caltech, Pasadena, CA and operated by Caltech for NASA.

*4 ASTER: Advanced Spaceborne Thermal Emission and Reflection Radiometer (an advanced resource observation sensor developed by METI of Japan mounted on Terra, the Earth Observatory Satellite launched in 1999)

*5 AMES: NASA Ames Research Center, located in Moffett Field, CA.

NEWS

GOSAT (RA): Research Proposals are being taken anytime from now on

Fumiho Takahashi, Visiting Researcher, NIES GOSAT Project Office

🌐🌐 The spacecraft GOSAT *IBUKI*, the world first greenhouse gases observing satellite, was successfully launched on Jan. 23, 2009 and has been nominally operating ever since, accumulating high-quality data. To make the best use of the data, past years publicized three RAs (Research Announcements) to adopt 106 subjects of research in total.

In the past RAs, researchers were mainly expected to propose any of the following 5 topics: (1) Calibration, (2) Data processing algorithm, (3) Carbon balance estimation / Atmospheric transport modeling, (4) Validation, and (5) Data application, because they are essential tasks to concentrate on for ensuring the value of GOSAT data and enabling various applications.

Here are examples of particular researches: building atmospheric transport models based on the annual variation, seasonal variation, and regional variation of CO₂ and CH₄, studies on carbon cycle, algorithm development, and also studies on validation using various measurements, evaluation methods and comparative study with other satellite data for producing more accurate data, etc. Also some inventive researches: studies utilizing chlorophyll fluorescence observed

NEWS Report: IGARSS 2012

Hiroshi Watanabe, Office Manager, NIES GOSAT Project Office

🌐🌐 IGARSS 2012 (International Geoscience and Remote Sensing Symposium) was held from July 22 to 27 in Munich, under the auspices of IEEE(*1) GRSS(*2). IEEE GRSS is one of 38 societies established in 1962, celebrating its 50th anniversary this year. IGARSS is one of the biggest conferences related to remote sensing and it is 29th now. There were more than 3,200 presentations found in the abstract, which were seen in 16 different places, and also there were many poster sessions, booths of institutes/laboratories/companies, creating active discussions. Sessions on hyperspectral sensor (though with lower spectral resolution than GOSAT FTS) and synthetic aperture radar attracted special attention making the places overflowed.

Plenary session had "Remote Sensing for a Dynamic Earth" by Prof. J. Wörner of DLR(*3), "The European Earth Observation Program" by Prof. V. Liebig of ESA(*4), and "Recent Progress and Future Opportunities in Earth Observations" by Dr. G. Asrar of WCRP(*5), who is an acquaintance of mine since his career in NASA as a chief researcher at EOS(*6) project and kindly referred to GOSAT in his presentation.

I presented "Current Status of GOSAT Higher Level Products" co-authored by Prof. Shimoda, RA Committee chairperson, Dr. Yokota and Dr. Matsunaga of NIES in the 5th day invited session "Ocean as the Source and Sink of Carbon Dioxide Observed from Space." The audience asked the relation between improvements of FTS SWIR Level

*1 IEEE: Institute of Electrical and Electronics Engineers

*2 GRSS: Geoscience and Remote Sensing Society

*3 DLR: Deutsches Zentrum für Luft-und Raumfahrt (German Aerospace Centre)

*4 ESA: European Space Agency

*5 WCRP: World Climate Research Programme

*6 EOS: Earth Observing System



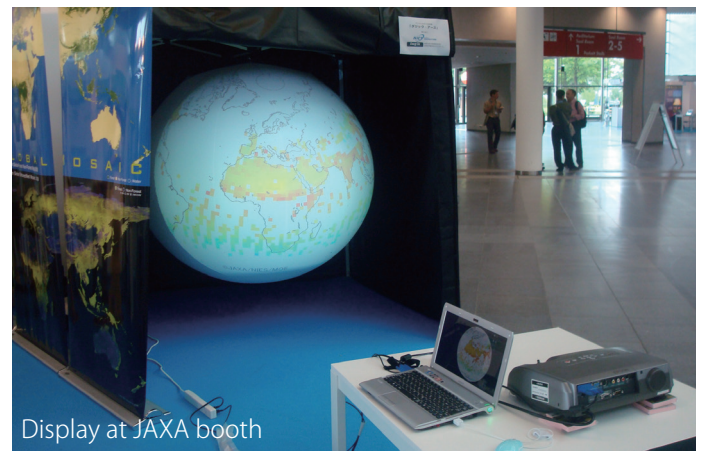
world first from space by *IBUKI*, locating the large point sources of greenhouse gases like thermal power plants etc. Including these accomplishments, there are at least 65 published papers (58 in English, 7 in Japanese).

The Japan Aerospace Exploration Agency (JAXA), the National Institute for Environmental Studies (NIES), and the Ministry of the Environment (MOE) started to take new proposals on August, 2012 for the sake of ever-flourishing and contributive accomplishments by GOSAT project. Proposals are taken anytime from now on for the applicants' convenience. Proposals are reviewed every few months, next time for proposals applied by Oct. 26, 2012.

We hope many proposals to come with inventive, cutting-edge, and ambitious ideas which are enough aware of characteristics of GOSAT data. For more details, please refer to:

<http://www.gosat.nies.go.jp/eng/proposal/proposal.htm>

We look forward to see a succession of constructive proposals.



2 quality and FTS Level 1 calibration, and spectral resolution of FTS ("Improved Level 2 algorithm contributed much" was my answer to the former one). The same session had presentations on air-sea exchange of CO₂ and AIRS(*7).

JAXA booth showed GOSAT FTS SWIR Level 2 product on portable spherical display. Some visitor from Melbourne, who sponsors next IGARSS there, was very interested in the fact that GOSAT data covers all areas of Australia in any season of the year.

IGARSS gathered remote sensing researchers not only from atmospheric field but also many from ground field: that made the opportunity valuable for me to reunite and exchange information with old friends from NASA, ESA, etc.



*7 AIRS: Atmospheric Infrared Sounder is a high spectral resolution spectrometer that measures atmospheric temperature and humidity, and land and sea surface temperature. It is installed on Aqua satellite, and launched in May 2002. The instrument is designed to support climate research and improve weather forecasting.

INTERVIEW

A Series: "IBUKI"'s PI Interview

No.8

**Prof.
Paul Wennberg**

California Institute of Technology, USA

Professor Paul Wennberg is one of the original members of remote sensing activities like TCCON(*1), OCO(*2), etc., when they were initiated, to which he refers in the interview describing how he and who came to be involved. Also he talks about his impression of GOSAT project

We had IWGGMS-8(*3) this June (please refer to the newsletter #23) and this interview was made during the period before the 4th RA PI (Research Announcement Principal Investigator) Meeting at Caltech.

(Interviewer: H. Watanabe and I. Morino, NIES GOSAT Project)



🌿🌿NIES (hereafter N): Thank you for hosting the 4th RA PI Meeting. You are the PI of GOSAT RA at the California Institute of Technology (Caltech) in association with NASA's Jet Propulsion Laboratory (JPL), and also you are involved in the ACOS activity. Firstly, I would like to hear about your life starting from your birthplace until university days and how you became involved in OCO Project

Paul Wennberg (hereafter W): I was born in Washington D.C. in 1962, but I only lived there few months.

N: So you don't remember your birthplace well?

W: Not at all. Leaving D.C., I grew up in the State of Vermont, which is a state adjacent to Canada in the northeast (near Montreal, Canada). It's a very rural state, there are no big cities in the state. I grew up on a small farm, but my parents were not farmers. My mom is a doctor and my father is a professor who studies medical care economics. In Vermont I went to a small local school, and then went to college in Ohio, where I received my bachelor's degree in chemistry. Following my undergraduate studies, I went to Harvard and received a Ph.D. in physical chemistry in 1994. Then, I moved to California in 1998 to become an associate professor here at Caltech, then professor in 2001. Caltech has about 300 professors and almost all of them are working in various sciences and engineering. It's a private university with fewer than 1000 undergraduate students.

N: So, it's 14 years since you came to Caltech. How did you become involved in OCO?

W: When I came to Caltech, I had a number of good colleagues at JPL. A small group of scientist in Pasadena including D. Crisp, C. Miller, G. Toon, Y. Yung and R. Salawich (who is now a professor at University of Maryland) began to think about how to measure CO₂ from space. We helped to write the proposal that NASA selected to build the OCO project.

N: Where is C. Miller? It seems that he is not here.

W: No, he is in the field right now with a NASA project called "CARVE" (*4). They are studying emissions of CO₂ and methane in the Arctic from the ground and from an airplane. In fact, on the airplane is a copy of the GOSAT airborne FTS sensor! Going back to OCO, the

proposal was submitted and it was selected in 2002. A major component of the project was to build a ground-based validation program. This was the origin of the Total Carbon Column Observing Network (TCCON) that B. Connor, G. Toon, J. Notholt and I began. It has now grown to a global network that is being used in many carbon cycle science investigations as well as in validation of GOSAT and other space-based retrievals of CO₂ and methane.

N: Where is the first TCCON site?

W: We set up the first two TCCON sites in Lauder, New Zealand and Park Falls, Wisconsin. One of my first graduate students, Rebecca Washenfelder, was responsible for building the Park Falls instrument. She just got to meet President Obama when she was awarded a Presidential Early Career Award!

N: All TCCON is controlled by whom?

W: I am the chair of TCCON with co-chair of J. Notholt (University of Bremen) and D. Griffith (University of Wollongong). Each TCCON site is operated by a local scientist or laboratory. At Caltech we organize the software for producing 'homogenized' data from the spectra obtained at the sites.

N: How long will you serve as Chair of TCCON?

W: I will be the chair two more years.

N: You are too young to leave your chair's post. So in total are there how many TCCON sites?

W: We have approximately 20 sites now.

N: In Japan, are there three?

W: Yes. Tsukuba has been operating for a long time. Morino-san is PI of Tsukuba site. The other sites in Hokkaido and in Saga are new.

N: What other science do you work on?

W: OCO is just one part of what I work on. I also work on carbon cycle sciences, with simulation and retrieval. My laboratory also studies the chemistry of the air. We build instruments that operate on the ground and on aircraft to measure the develop a better understanding of atmospheric chemistry. Recently we have been studying the chemistry of chemicals emitted by trees and plants. Currently, most of my research is actually studying chemistry.

N: So next question. What is your impression of GOSAT data and GOSAT project and future expectation maybe for GOSAT-2 ?

W: I would like first to say that the spirit of generosity shown by the GOSAT three parties is a wonderful model for how we should attack problems which are important to all people on Earth. I'm very impressed to watch the collaboration between the different research groups as we each make progress on developing the science from GOSAT (and soon OCO-2). As part of the ACOS project (the development of the JPL retrieval algorithm), we have been making great progress in improving our retrievals. As we learn from the work at NIES and elsewhere, they learn for our efforts. I'm amazed at is how far we've come, because that GOSAT data now is telling us new things about the Earth. The data are telling us about where sources and sinks of carbon dioxide are. The Japanese scientists, engineers, and those who funded the project can rightfully be proud of their accomplishment.

N: This is my very personal impression, but... probably because of language... the relationship between our group in Japan and the groups in US and Europe, is somewhat distant. I feel like that.

W: The collaboration I see both inside of the Three Parties and with the International RA groups seems excellent.

N: In fact, we can have a good communication with D. Crisp, you, and also with European people, like P. Palmer and H. Boesch, also A. Butz, F. Chevallier, C. Camy-Peyret, P. Rayner. In that context I think we are in good relation with international retrieval group, validation group and model group, while there is some competition.

W: As long as it is done openly and with good intent, I think the competition is healthy.

N: What do you think of GOSAT-2 or OCO-2?

W: The future seems bright at the moment. TCCON should continue and will help maintain comparability between the old and new data sets. Of course we all hope that GOSAT keeps going for many years

– at least until OCO-2 will be launched, maybe in 3 years from now. I know GOSAT-2 is being formulated and so perhaps will launch before OCO-2's lifetime is over. So, I think the future looks very good with this type of monitoring system and now it's a question of imagination, right now, on how can we get most of good science. We have operational system and operational retrieval and produce things that are of great value.

N: TCCON will continue for OCO-2 and GOSAT-2?

W: Yes, it will keep going; there are now many projects riding on the availability of TCCON data so it seems that both NASA and our other TCCON partners will continue to support the network.

N: Final question is that, while we have an impression that there are a lot of good data, unexpectedly good data from GOSAT, do you have any idea on the future OCO-2?

W: The timing of the launch of OCO-2 is currently being decided by NASA.

N: You know I think there are many other products that are released, now you are working on methane, or now working on methane in ACOS project. Result of methane seems to be good?

W: Well the methane data retrieval by NIES and Europe groups look good. ACOS is not, however, currently working on methane. OCO-2 can not measure methane. But we are looking at additional products such as plant fluorescence, water vapor and its isotopic composition, and perhaps some new aerosol products.

N: For aerosol, we have CAI, but it is not completely successful.

W: Because OCO and OCO-2 do not have an imager, the ACOS retrievals do not use CAI. I understand, however, that others are making good use of the CAI for aerosol research.

N: Final word is "Thank you for taking your time."

W: Thank you, too. I look forward to hosting the RA meeting this year, and we will see everyone next year in Japan in Hokkaido.



From left, Prof. Wennberg, Dr. Crisp, Watanabe, Morino

*1 TCCON: Total Carbon Column Observing Network is a network of the ground-based high-resolution FTs observations. Currently, its observations are carried out in more than 20 locations worldwide. TCCON's column-averaged volume mixing ratios of greenhouse gases are used for validating greenhouse gases observation by satellites and other carbon cycle studies.

*2 OCO: Orbiting Carbon Observatory (OCO) is one of the missions of Earth System Science Pathfinder Project in NASA, USA, a satellite dedicated to

studying atmospheric CO₂. The launch of OCO-1 unfortunately failed and now OCO-2 is being developed by NASA and its launch is scheduled in 2014.

*3 IWGGMS: International Workshop on Greenhouse Gas Measurements from Space (please refer to NEWSLETTER #23 where an article "Report: IWGGMS-8" is on page 3.)

*4 CARVE: Carbon in Arctic Reservoirs Vulnerability Experiment

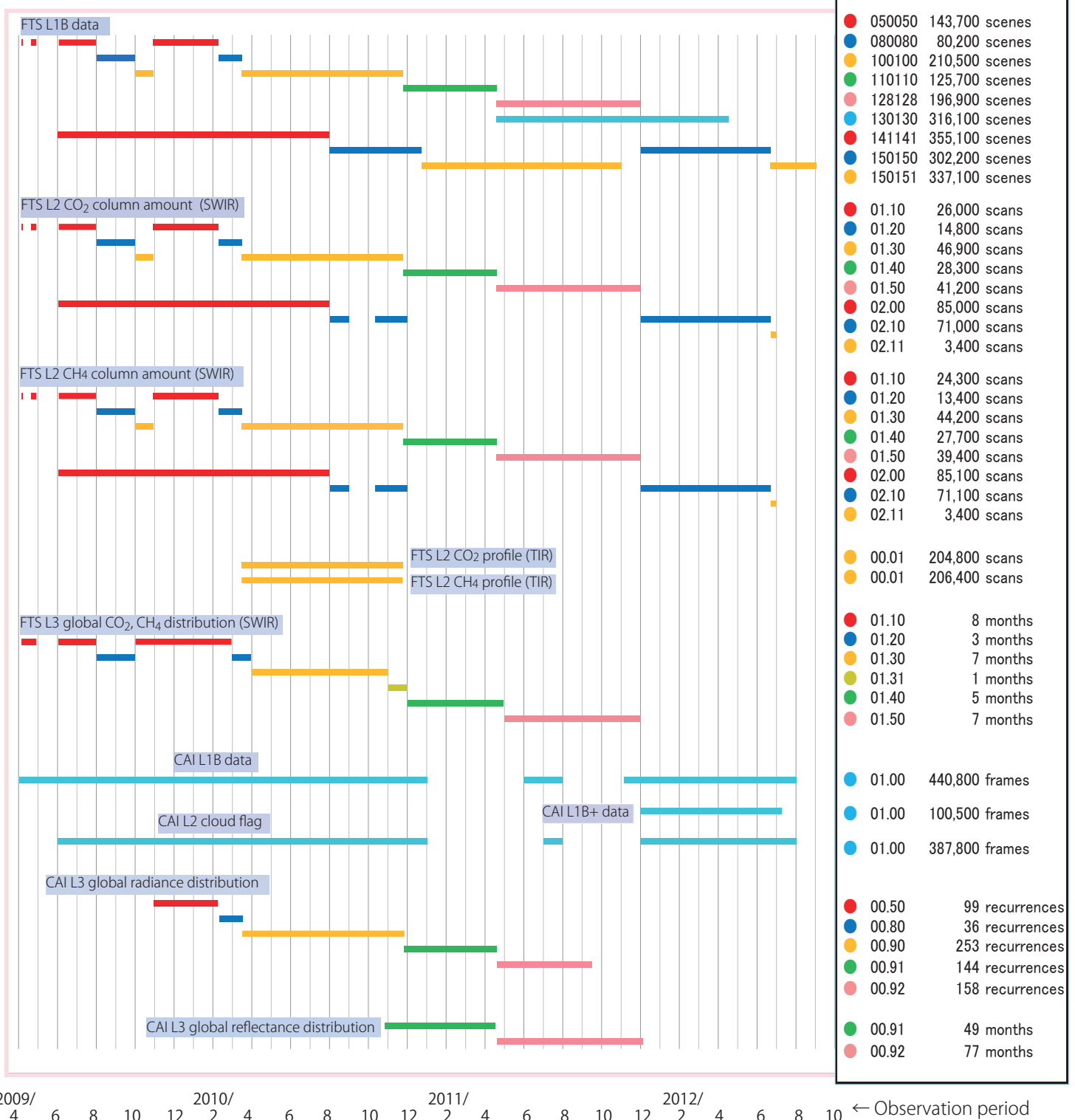
DATA PRODUCTS UPDATE

DATA PROCESSING STATUS UPDATE FROM GOSAT PROJECT OFFICE

Fumie Kawazoe, Specialist, NIES GOSAT Project Office

Observation Period and Versions of Publicly Released Data

As of September 3, 2012



🔄🔄🔄 The chart above is as of September 3, 2012. The latest processed and released on are: FTS L1B in V150.151; CAI L1B/L1B+/L2 cloud flag in V01.00; FTS L2 CO₂/CH₄ column amount (SWIR) in V02.10 and V02.11.

As for Sept. 1 - Oct. 10, 2010, V02.10 FTS L2 CO₂/CH₄ column amount (SWIR) were once released, however, an error was found in the geolocation correction processing for the period and they are

under reprocessing now. We are very sorry for any inconvenience it may cause to users. We expect the situation will be recovered within October. Please refer to our website for the latest situation.

Old versions of FTS SWIR L2 products (V01.10, V01.20, V01.30, V01.40, V01.50) are terminated on Oct. 21. Please download them until then if necessary

The number of registered users is 1296 as of Sept. 3, 2012. 🌍🌍🌍

PUBLISHED PAPERS (After November, 2011)

Field of Research: calibration, validation
Name of Journal: Atmosphere (Volume 2, pages 702-714, 2011)
Title: Carbon Dioxide and Methane at a Desert Site—A Case Study at Railroad Valley Playa, Nevada, USA
Authors: E. L. Yates, K. Schiro, M. Lowenstein, E. J. Sheffner, L. T. Iraci, J. M. Tadić, and A. Kuze

Field of Research: validation, data processing algorithm
Name of Journal: Atmospheric Chemistry and Physics (Volume 12, pages 3393-3404, 2012)
Title: Influence of aerosols and thin cirrus clouds on the GOSAT-observed CO₂: a case study over Tsukuba
Authors: O. Uchino, N. Kikuchi, T. Sakai, I. Morino, Y. Yoshida, T. Nagai, A. Shimizu, T. Shibata, A. Yamazaki, A. Uchiyama, N. Kikuchi, S. Oshchepkov, A. Bril, and T. Yokota

Field of Research: other (tutorial paper)
Name of Journal: Aeronautical and Space Sciences Japan (Volume 60, pages 338-344, 2012)
Title: Achievements from Greenhouse Gases Observing Satellite "IBUKI" Project up to FY2011
Authors: T. Yokota, Y. Yoshida, I. Morino, O. Uchino, H. Watanabe, and S. Maksyutov
 N.B.: this paper is written in Japanese

Field of Research: data application
Name of Journal: Atmospheric Measurement Techniques (Volume 5, pages 809-829, 2012)
Title: Filling-in of near-infrared solar lines by terrestrial fluorescence and other geophysical effects: simulations and space-based observations from SCIAMACHY and GOSAT
Authors: J. Joiner, Y. Yoshida, A. P. Vasilkov, E. M. Middleton, P. K. E. Campbell, Y. Yoshida, A. Kuze, and L. A. Corp

Field of Research: validation, data processing algorithm
Name of Journal: Journal of Geophysical Research (Volume 117, D12305, 18 PP., 2012)

Title: Effects of atmospheric light scattering on spectroscopic observations of greenhouse gases from space. Validation of PPDF-based CO₂ retrievals from GOSAT

Authors: S. Oshchepkov, A. Bril, T. Yokota, I. Morino, Y. Yoshida, T. Matsunaga, D. Belikov, D. Wunch, P. Wennberg, G. Toon, C. O'Dell, A. Butz, S. Guerlet, A. Cogan, H. Boesch, N. Eguchi, N. Deutscher, D. Griffith, R. Macatangay, J. Notholt, R. Sussman, M. Rettinger, V. Sherlock, J. Robinson, E. Kyrö, P. Heikkinen, D. G. Feist, T. Nagahama, N. Kadyrov, S. Maksyutov, O. Uchino, and H. Watanabe

Field of Research: calibration, validation
Name of Journal: Atmospheric Measurement Techniques (Volume 5, pages 2003–2012, 2012)

Title: Aircraft measurements of carbon dioxide and methane for the calibration of ground-based high-resolution Fourier Transform Spectrometers and a comparison to GOSAT data measured over Tsukuba and Moshiri

Authors: T. Tanaka, Y. Miyamoto, I. Morino, T. Machida, T. Nagahama, Y. Sawa, H. Matsueda, D. Wunch, S. Kawakami, and O. Uchino

Field of Research: data application
Name of Journal: Atmospheric Measurement Techniques (Volume 5, pages 2081-2094, 2012)

Title: Remote sensing of near-infrared chlorophyll fluorescence from space in scattering atmospheres: implications for its retrieval and interferences with atmospheric CO₂ retrievals

Authors: C. Frankenberg, C. O'Dell, L. Guanter, and J. McDuffie

Field of Research: data application
Name of Journal: Geophysical Research Letters (Volume 39, L17806, 5 PP., 2012)

Title: Space-based observations of megacity carbon dioxide
Authors: E. A. Kort, C. Frankenberg, C. E. Miller, and T. Oda

**EDITOR'S NOTE**

Welcome again to our revived newsletter No. 2, collectively No. 24. "PUBLISHED PAPERS" above contains 8 entries after a long absence; please check and read ones you find unseen.

We appreciate readers' voices, such as "I want to read articles on ...",

"The ... was really interesting," or any other comments you like to make. Please feel free to contact : gosat_newsletter@nies.go.jp.

Thank you for supporting the newsletter.

S. Aikawa

