National Institute for Environmental Studies (NIES)
A newsletter on the Greenhouse gases Observing SATellite "IBUKI" (GOSAT) project from Satellite Observation Center
http://www.gosat.nies.go.jp/

ISSUE # 32
Winter 2016

CONTENTS

REPORT

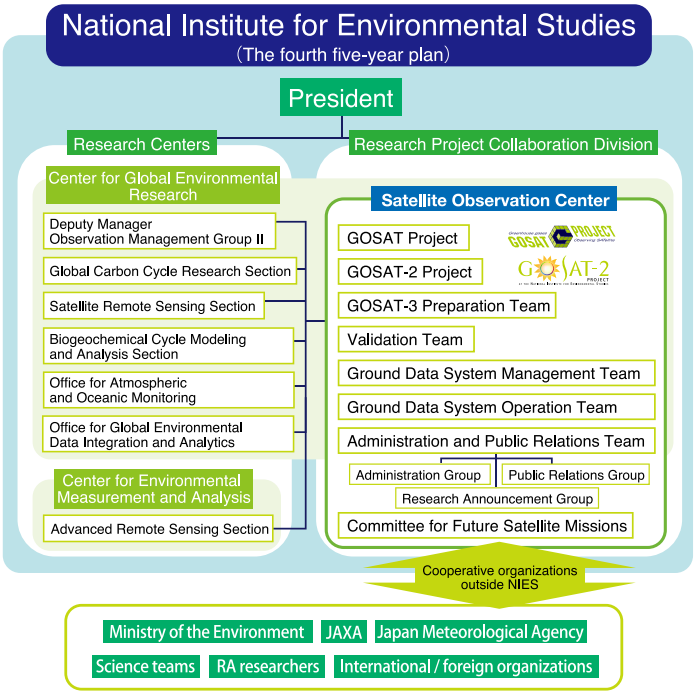
Satellite Observation Research Projects and Satellite Observation Center

Dr. T. Matsunaga, Director of Satellite Observation Center, NIES

The National Institute for Environmental Studies (NIES) has entered the Fourth five-year plan (April 2016 – March 2021) and six Research Projects are introduced. They are closely related with various research fields at NIES which requires to be continually developed as an organization as well as NIES taking the domestic/global leadership to be productive.

The two Earth observation satellite projects implemented in the Third five-year plan, Greenhouse gas Observation SATellite GOSAT and its successor GOSAT-2, are consolidated as one of the Satellite Observation Research Projects in the Fourth plan, and Satellite Observation Center (SOC) has been established under the Research Project Collaboration Division to drive the business. There are 54 members (as of Oct. 2016) at SOC including the concurrent staffs and contract/dispatched employees working in the Main Research Building II and III, Climate Change Research Hall, GOSAT-2 Research Computation Facility, and GOSAT-2 Office.

The SOC organization is shown on the right. The members consist of those who are specially nominated from the research centers (Center for Global Environmental Research and Center for Environmental Measurement and Analysis) working concurrently for the sake of Satellite Observation Research Projects. The SOC's main activities are two projects, GOSAT and GOSAT-2, and four teams are organized for their smooth operation and implementation to cover common works across the projects: Validation; Ground Data System Management; Ground Data System Operation; and the Administration and Public Relations. The GOSAT-3 Preparation Team and Committee for Future Satellite Missions are also established.



<Organization Chart of Satellite Observation Center>

The Satellite Observation Research Projects in the Fourth five-year plan consists of six activities:

1) to continue operational processing of GOSAT data;
2) to implement the finalizing reprocessing of all GOSAT data;
3) to continue validation, archiving, provision, and PR activities for GOSAT products and their recognition;
4) to establish the data processing systems for GOSAT-2;
5) to implement operational data processing for GOSAT-2, and validate/archive/provide its products, promoting PR activities;
6) to coordinate requirements for GOSAT-3 and make an overall plan.

The SOC is determined to do our best to take over the heritage accomplished by NIES' satellite-related projects and develop it further. We highly appreciate your continuous advice and support for the years to come.

RA PI Meetings in 2015 - 2016

The 7th GOSAT RA PI Meeting was held at CALTECH (California Institute of Technology) in Pasadena, CA, USA on June 15 (Mon), 2015 with 58 participants consisting of 36 PIs and Co-Is, and those from involved parties of NIES, JAXA, NASA, and others. Since the meeting was compressed to a day from a few days due to schedule constraints, only some closed-door presentations were given leaving others to the 11th IWGGMS (International Workshop on Greenhouse Gas Measurements from Space) held from June 16 (Tue) to June 18 (Thu), 2015.


At California Institute of Technology

At the RA PI Meeting, two–minute summary presentations were given after the Plenary Session by the speakers who were to present later at the IWGGMS. There were Sessions of Validation and Application/ Algorithms/Inverse Modeling followed by the General Discussion and Closing Session. At the Plenary Session, Dr. Shiomi (JAXA) reported on the present status of GOSAT Project, Dr. Yokota (NIES) on the redefined Data Products and the revised Data Policy approved by the 3 parties (JAXA/NIES/MOE) in March, and Mr. Ajiro (NIES) on the present status of GOSAT Products and the results of the past action items. 19 Two–minute summary presentations were given consisting of 4 Algorithm, 6 Validation, 3 Model, and 6 Application summaries.


Oral Presentation at 7th RA PI Meeting

In the afternoon, Validation Session had 6 presentations on measures to improve accuracy of observed data, refinement of a cloud-aerosol model, distribution schedule of OCO-2 next version products, reprocessing plan of GOSAT data, and validation with TCCON data and ground-based lidar. The Application/ Algorithms/Inverse Modeling Session had presentations on the large difference still remaining between the model-calculated value based on ground-based flux and the observed data by GOSAT and others, especially in the South Hemisphere and particularly in Australia, while the difference being much smaller when focused on large cities.

Dr. Suto (JAXA) introduced GOSAT-2 and Dr. Uchino (NIES) reported the latest validation results on CO_2 bias (reduced by 0.5ppm) at the General Discussion, and a topic on reflectance ratio (of snow especially) attracted high attention as a possible cause of seasonal/regional fluctuation of GOSAT FTS L2 products at the closing general discussion.

The 11th IWGGMS saw 150-over attendees including the presenters from RA PI Meeting, 54 oral, and 90 poster presentations. The Workshop consisted of 5 Sessions including 9 oral and 10 poster presentations by GOSAT RA PIs: Observation/Calibration; Retrieval Algorithm; Validation; Flux Inversion; and Future Mission.

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The 8th GOSAT RA PI Meeting was held at Kyoto University in Japan from June 6 (Mon) to June 7 (Tue), 2016 with 71 participants consisting of 38 PIs and Co-Is, and those from involved parties of NIES, JAXA, NASA, and others. Only closed-door presentations were given as was at the 7th Meeting, leaving others to the 12th IWGGMS from June 7 (Tue) to June 9 (Thu), 2016.

At the RA PI Meeting, two-minute summary presentations were given after the Plenary Session by the speakers who were to present at the IWGGMS. There were Sessions of Validation/Algorithms, Inverse Modeling/Application, and Discussions by each 4 working groups on the first day. The second day had Sessions of GOSAT-2 and the Closing Session.

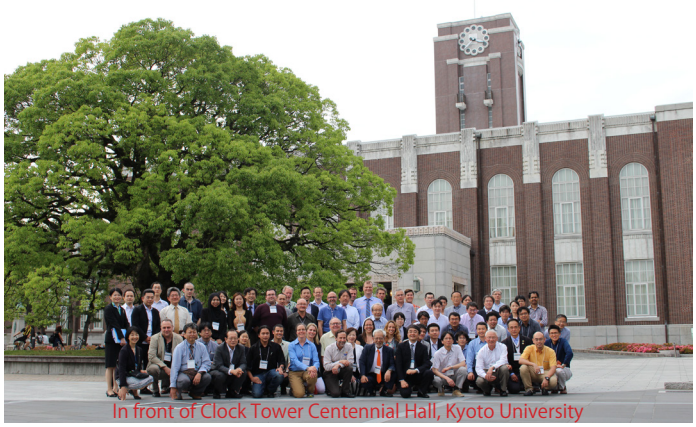
After Logistics by Dr. Yokota, the Plenary Session started with welcome speeches by Dr. Matsunaga (NIES) and Dr. T. Nakajima (JAXA), and opening remarks by Dr. Shimoda (Tokai Univ., Chair of RA Committee) followed by 3 reports: Dr. Shiomi (JAXA) reported on the present status of GOSAT project; Mr. Ajiro (NIES) on GOSAT product; and Dr. Uchino (NIES) on the validation of FTS SWIR products.

18 Two-minute summary presentations were given consisting of 8 Validation, 3 Algorithms, 2 Inverse Modeling, and 5 Application summaries.

Validation/Algorithms Session had reports from Dr. Crisp (JPL) on cross calibration/validation of GOSAT and OCO-2, Prof. Notholt (Univ. of Bremen) on improvement of GOSAT CO_2 retrieval, Dr. Camy-Peyret (Institut Pierre-Simon-Laplace) on possible detection of Arctic sea warming, Associate Prof. Dr. Shibata (Tokyo Metropolitan Univ.) on ground-based CO_2 DIAL (DIfferential Absorption Lidar), Assistant Prof. Dr. Eguchi (Kyushu Univ.) on cirrus detection with TIR, Associate Prof. Dr. Imasu (Univ. of Tokyo) on relationships between the surface reflectance and emissivity for synergetic usage of SWIR & TIR, etc.

Inverse Modeling/Application Session saw reports from Mr. Maki (Japan Meteorological Agency) on 4-dimensional GOSAT data assimilation using LETKF (Local Ensemble Transform Kalman Filter), Dr. Nassar (Environment and Climate Change Canada) on GOSAT XCO_2/XCH_4 comparisons with Canadian carbon assimilation system, Dr. Schwandner (JPL) on volcanic CO_2 emission, Dr. Sugita (NIES) on comparison of methane profiles between GOSAT-TIR and aircraft measurement in West Siberia, Associate Prof. Dr. Sakuno (Hiroshima Univ.) on aerosol angstrom exponent estimation for coastal zone using GOSAT-CAI data, Dr. Ricaud (CNRS) on summertime mid-to-upper tropospheric N_2O transportation over the Mediterranean, etc. In the Group Discussions, 4 working groups were made to discuss CAI Aerosols, FTS SWIR, FTS TIR, and CO_2/CH_4 Fluxes.

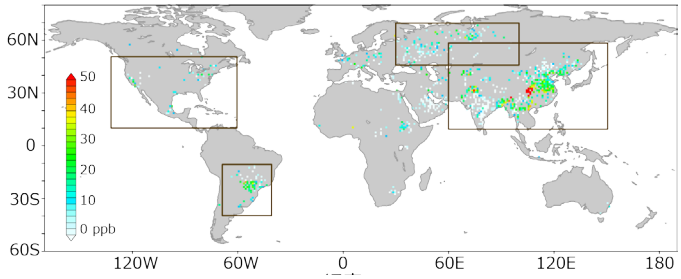
On the second day, Dr. M. Nakajima (JAXA) reported on the current status of GOSAT-2 and the 4 working groups reported their discussion to close the Meeting.


In front of Clock Tower Centennial Hall, Kyoto University

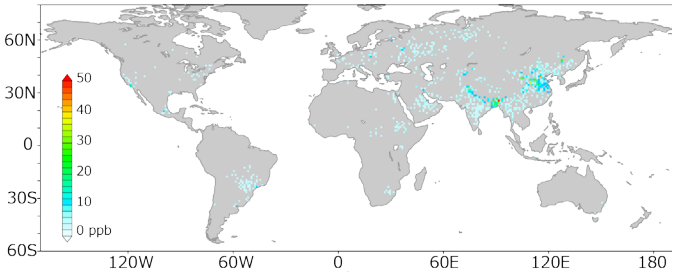
Major project outcomes in 2015 - 2016

Major Press Release (1) — Anthropogenic CH_4 to be captured —

Following the news "Historically Unprecedented Observation of Anthropogenic CO_2 Emissions from Space" by IBUKI (Newsletter #31), CH_4 was also analyzed for the same period based on the observational data acquired by IBUKI. The result showed that CH_4 in densely populated, intense farming, or oil/natural gas producing/refining areas (anthropogenic area) had the tendency for higher concentrations compared to their surrounding environments. Furthermore, strong positive correlations were found between the observed CH_4 concentrations and the concentrations estimated from the inventory data. This indicates that IBUKI has the potential to enable us to detect enhanced CH_4 concentrations due to anthropogenic emissions. This demonstrates the potential utility of IBUKI as a tool for monitoring and validating anthropogenic CH_4 emissions in addition to CO_2. For details, please visit:
http://www.nies.go.jp/whatsnew/2015/20151127/20151127.html
- Date of press release: November 27, 2015 (in Japanese)



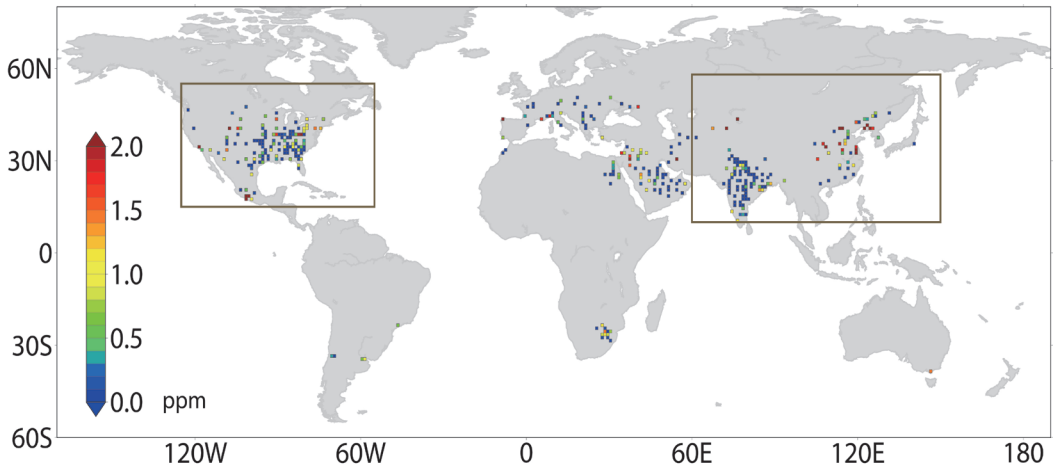
CH_4 concentration increase observed by "IBUKI" (ppb)



CH_4 concentration increase predicted by inventory (ppb)

Major Press Release (2) — Anthropogenic CO_2 to be captured by country —

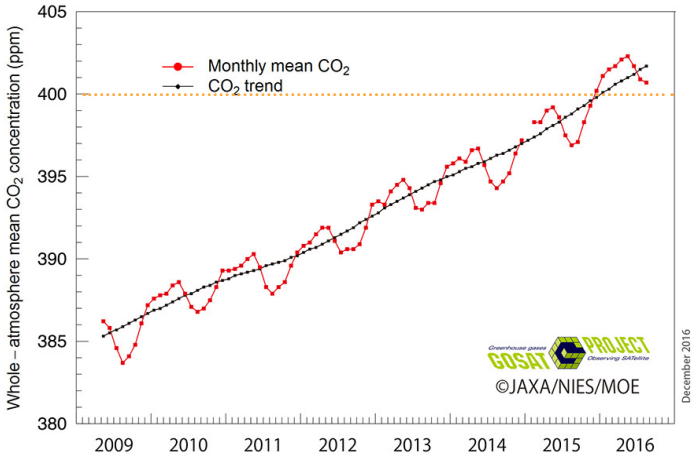
The CO_2 observational data by IBUKI was analyzed again for 5.5 years (2 years added) from June 2009 to December 2014. Estimation was made for Tokyo's urban areas for the first time in addition to the mega-cities and their surroundings regarding the anthropogenic CO_2 concentrations. Furthermore, the comparison between the estimate from IBUKI data and the inventory calculated statistics showed basic agreement of both values. This is the first-ever opportunity to accomplish that granularity at country level, which demonstrates the potential feasibility of monitoring and validating CO_2 emissions by satellite's observation for each country to create and publish data to meet the requirements of Paris Agreement. For details, please visit:
http://www.gosat.nies.go.jp/newpdf/GOSAT_press20160901.pdf
- Date of press release: September 1, 2016



Regions found to be with high anthropogenic CO_2 concentrations observed by "IBUKI"

Major Press release (3) — Provisional CO_2 concentrations open to the public —

MOE, NIES, and JAXA have published preliminary figures of (a) monthly mean CO_2, and (b) CO_2 trend based on (a), which are analyzed and estimated using about 7 years' data from May 2009, at "Whole-atmosphere monthly mean CO_2 concentration based on GOSAT observations" page of GOSAT Project site, NIES (http://www.gosat.nies.go.jp/en/recent-global-co2.html). The latest figures (August 2016) are (a) 400.7 ppm, and (b) 401.7 ppm. For details, please visit:
http://www.nies.go.jp/whatsnew/2016/20161027/20161027.html
- Date of press release: October 27, 2016 (in Japanese)



Whole-atmospheric concentrations monitored by GOSAT: monthly mean ● and trend ●

GOSAT PEOPLE

Greetings

Dr. T. Matsunaga, Director, Satellite Observation Center, NIES

The Satellite Observation Center (SOC) was newly established in NIES in April 2016 and I, Tsuneo Matsunaga, have taken office as the Director. I work concurrently for the center, GOSAT project, and GOSAT-2 project, for which I will describe some policies and plans for their operation along with an introduction of myself.

◆ Self-Introduction ◆

During my undergraduate years, I majored in technological studies of remote sensing by satellites/aircrafts mainly for resource exploration. I was particularly engaged in developing an algorithm to estimate the temperatures of ground/water surfaces using high-resolution multispectral thermal infrared imaging function which was the world's first-ever on board a spacecraft. The function was intended for a high-resolution multispectral camera ASTER which was under development by the Ministry of International Trade and Industry (MITI), now renamed as the Ministry of Economy, Trade and Industry(METI) to mount on a large NASA satellite EOS-AM1 (later renamed as "Terra") to observe the Earth. Coincidentally, Dr. Yokota wrote his doctoral dissertation on the same theme which made me feel connected with him in a way. The study intends to accurately measure the thermal radiation and temperature from the ground and water surfaces, correcting the effect of the atmosphere. This is just the reverse of GOSAT/GOSAT-2 works which handles the atmosphere itself. However, I also took vertical distribution data of temperature and H_2O by radiosonde, and calculated atmospheric heat absorption and emission using radiative transfer models at the same time.

After completing my master's degree, I entered MITI and started my life as a researcher at Geological Survey of Japan in the Agency of Industrial Science and Technology (now a part of AIST: National Institute of Advanced Industrial Science and Technology). At first, I continued the technological study of remote sensing for resource exploration and geological survey. In 1999, I had a chance to witness the launch of Terra with ASTER on board and shared the delight of its success with the US researchers. I also developed a new method to estimate spectral emissivity on the land surface using ASTER's thermal infrared data as a part of my doctoral dissertation. An algorithm developed based on this method in collaboration with US researchers was adopted in the ground data processing systems both in Japan and US for ASTER, and is used in generating standard products even now. One of the test sites for ASTER was Railroad Valley, the playa in Nevada, US, which is also used for vicarious calibration of GOSAT. 1996 was the first year for me to have an experiment there and it was also the year when the place became the common calibration site for NASA's Earth Observing System, where groups from various satellites/sensors gathered to collaborate in experiments.

Besides resource exploring, I also worked on environmental monitoring of lakes and coral reefs by satellites and aircrafts in collaboration with those researchers within Geological Survey of Japan, who specialized in coasts and lakes. Ishigaki Island, coral reefs in Australia, and eutrophied lakes in Japan such as Suwako or Shinjiko were especially my fields to have repeated in-situ measurements and synchronized satellite observation experiments with the collaborative researchers. I also started a study of geological investigation of the Moon in collaboration with Institute of Space and Astronautical Science (ISAS) as a new application of remote sensing technology for geological survey. I was involved in Lunar-A (an unlaunched ISAS lunar explorer) and SELENE named "KAGUYA" (launched in 2007), a joint lunar exploring mission of ISAS and JAXA. Particularly in the latter mission, I was entirely engaged from proposal, design, development, test, operation, and data processing of a visible near-infrared spectrometer, Spectral Profiler. This was really a valuable experience and the most unforgettable memory was the world's first discovery of a large scale exposure of plagioclase, which is supposed to constitute the Moon's primordial crust at the far side of the Moon. It still remains a profound experience today.

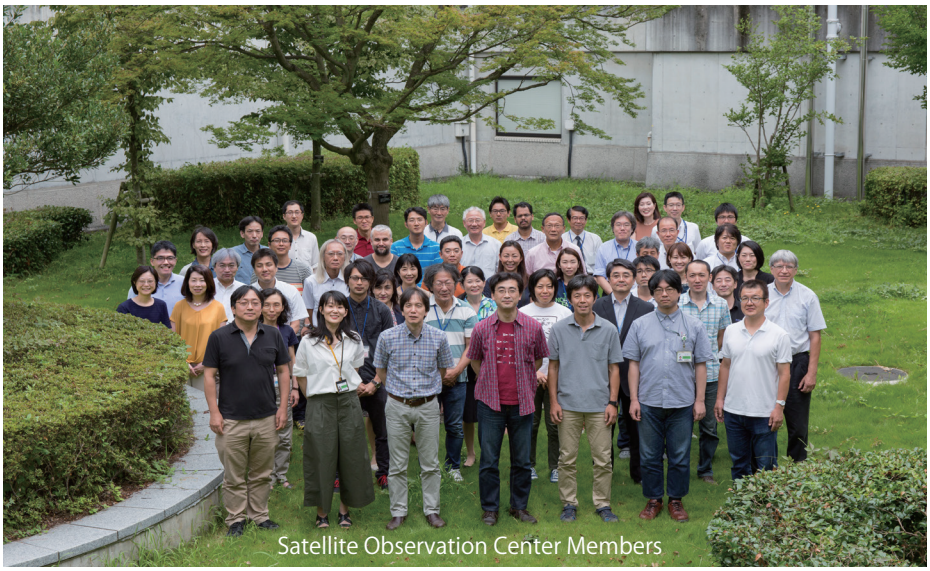
Then I transferred to Tokyo Institute of Technology where I became a member of the Laboratory of Architecture/Urban Environment and got engaged in a completely different field from the previous resource exploration/geological research. I challenged in analyzing the heat island effect and its various causes by using the methods of remote sensing, field measurements, and numerical analysis with my students. The targeted regions at that time were residential areas near the university, suburban hilly districts/woods, and even Metro Manila of Philippines (how diverse!), and my co-researchers were not from natural science field but from architecture and urban/civil engineering – completely different from the deserts, the wildernesses, the Moon – all of which gave me a huge range of stimuli. There were also other stimuli from the students who advanced to the doctoral program. They were studying radiation transfer of light in the vegetation canopy or amount of photosynthesis in plant community, snow and ice, etc. which I was not so familiar with, and invited me to various fields to study from the very beginning. This was part of my everyday life then.

I left the university and joined NIES in 2001, where I got affiliated at Social and Environmental Systems Division for the first 5 years where I applied remote sensing technology to various environmental issues. In particular, monitoring the inland grassland in China by a satellite camera for wide-area observation and estimating daily minimum temperature by thermal infrared observation with high temporal resolution several times a day were the important studies focused then. Monitoring coral reefs by an airplane-mounted hyperspectral camera and surveying wildlife using airplane/drone were also undertaken with my colleagues. In 2006, I moved to the Center for Global Environmental Research (CGER) to manage and operate its database there. This kind of job was something I have never experienced before - to organize and distribute data which were not observed/acquired by myself – and yet I learned

much from the job. Constructing a system to handle biodiversity/ecology data was another really impressive experience for me because I learned a lot by working with researchers in completely different research fields, background, and history from remote sensing and geology. Furthermore, I was also involved in studies of specifications for the ASTER's successor then, which is now nearing reality as Hyperspectral Imager Suite (HISUI) to be operated on International Space Station (ISS) in 2019 after some bumps and detours.

On the other hand, I started preparing GOSAT-2 Project requested by Dr. Inoue who had just launched GOSAT project. I remember I was then entirely focused on reading literatures, attending related conferences to listen to other researchers' presentations and discussions due to lack of experiences in greenhouse gas observation. I also joined in GOSAT project in parallel to work on developing the ground system and introducing the computer facilities for that system. The GOSAT Research Computing Facility (RCF), the GOSAT-dedicated supercomputer, was introduced in 2009. Thanks to many people's cooperation, it had the honor to be ranked as the 10th best in the Green 500 in 2010, which is a ranking of the most energy-efficient supercomputers in the world. This got me involved in constructing rooms and buildings for the facilities, where my knowledge and experience about architecture from the former position in Tokyo Institute of Technology became useful.

In 2010, after GOSAT's successful launch, the then Director of CGER Dr. Yasuhiro Sasano started hosting workshops to study



Satellite Observation Center Members

requirements for GOSAT-2. That resulted in the agreement on GOSAT-2 Project by the three parties (MOE, JAXA, and NIES) in the summer of 2011, just when GOSAT Level 4 product began to appear on the product list. The GOSAT-2 Preparation Team (Matsunaga as Deputy Leader) and GOSAT-2 Project Team (Matsunaga as Leader) were established in February 2012/ April 2013 respectively at NIES based on the agreement. From then on, we have been advancing various preparation works toward the launch of GOSAT-2 in collaboration with GOSAT project.

◆ From now on ◆

Expecting the launch of GOSAT-2 as planned in FY 2018, SOC is currently developing its ground system "G2DPS" (Gosat-2 Data Processing System) and others. The GOSAT-2 will observe not only CO_2 and CH_4 but also CO, urban air pollution, etc. which may increase the load on the ground system. It's a challenge for us to make a better system based on experiences gained through GOSAT project, and we will do our best to gain more outcomes by cooperating in close relationship with MOE, JAXA, GOSAT-2 science team members in Japan, and overseas researchers including NASA.

Fortunately, GOSAT is continuing its observation for nearly 3 years over its nominal lifetime, thus, we are organizing SOC to handle GOSAT and GOSAT-2's simultaneous operation and data processing. In particular, common works for the two satellites such as computer facilities maintenance, validation, public relations, etc. will be tackled efficiently and comprehensively by the dedicated teams. A preparatory work with younger researchers for GOSAT-3 has just started with high expectation for their best performance in the mid-2020s.

We look forward to seeing your full involvement into this great journey to find out the truth of global warming with GOSAT, GOSAT-2, and GOSAT-3 for the years to come.

GUIG services closed

GUIG site was closed and stopped all its services on December 28, 2016, 8:00 (UT). Thank you for using GUIG services for a long time. Please access to GDAS (GOSAT Data Archive Service) now providing compressed and archived GOSAT data products.

https://data2.gosat.nies.go.jp/

As all GUIG accounts have been transferred to GDAS, no additional registration is required if you have had a GUIG account, whose ID and password enables you to login to GDAS. If you are new, please register on the site above. If you have any questions, don't hesitate to contact us at:

gosat-support@nies.go.jp

GDAS Top

Statistics of selected RA proposals and peer-reviewd published papers

Shown below are statistics of selected RA proposals (left: per field of research, center: per country of the research organization). The number of applications peaked around 2008 - 2010, still keeping steady responses throughout the 1st to the latest RA to realize the accumulation of 126. On the other hand, published papers (right) have increased rapidly in the last several years and keep going. Please visit the site below to see all the papers.
http://www.gosat.nies.go.jp/news/reference2015.html

Field of Research	Selected RA Themes
Calibration	4
Algorithm	22
Validation	30
Carbon Balance Estimation/Atmospheric Transport Models	17
Data Application	50
Data App./Validation	2
Carbon Balance Estimation/Atmospheric Transport Models & Data App.	1
Total	126

Country *	Selected RA Themes
Japan	36
USA	22
Germany	10
China	6
Canada	5
France	5
Netherlands	5
UK	5
Russia	4
Finland	4
Others	24
Total	126

* Per organization RA PI belongs

Year	Published Papers		
	With GOSAT data	Without GOSAT data	Total
2015	38	3	41
2014	42	1	43
2013	50	4	54
2012	25	7	32
2011	15	5	20
2010	3	14	17
2009	1	12	13
2008		5	5
2007		1	1
Total	174	52	226

PUBLISHED PAPERS (from Jan. to Dec., 2015)

Field of Research: atmospheric transport models, carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 113-133, 2015)
Title: Inverse modelling of CH_4 emissions for 2010-2011 using different satellite retrieval products from GOSAT and SCIAMACHY
Authors: Alexe, M., Bergamaschi, P., Segers, A., Detmers, R., Butz, A., Hasekamp, O., Guerlet, S., Parker, R., Boesch, H., Frankenberg, C., Scheepmaker, R.-A., Dlugokencky, E., Sweeney, C., Wofsy, S.-C., and Kort, E. A.

Field of Research: atmospheric transport models, carbon balance estimation
Name of Journal: Biogeosciences (volume 12, pages 5393-5414, 2015)
Title: Natural and anthropogenic methane fluxes in Eurasia: a mesoscale quantification by generalized atmospheric inversion
Authors: Berchet, A., Pison, I., Chevallier, F., Paris, J.-D., Bousquet, P., Bonne, J.-L., Arshinov, M.Y., Belan, B.D., Cressot, C., Davydov, D.K., Dlugokencky, E.J., Fofonov, A.V., Galanin, A., Lavrič, J., Machida, T., Parker, R., Sasakawa, M., Spahni, R., Stocker, B.D., and Winderlich, J.

Field of Research: validation, atmospheric transport models, carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 11133-11145, 2015)
Title: On the statistical optimality of CO_2 atmospheric inversions assimilating CO_2 column retrievals
Author: Chevallier, F.

Field of Research: validation
Name of Journal: Korean Journal of Remote Sensing (volume 31, 409-419, 2015)
Title: Application of seasonal AERI reference spectrum for the improvement of cloud data filtering method (in Korean language)
Authors: Cho, J., Goo, T., and Shin, J.

Field of Research: atmospheric transport models, carbon balance estimation, data application
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 11773-11788, 2015)
Title: Sensitivity analysis of the potential impact of discrepancies in stratosphere-troposphere exchange on inferred sources and sinks of CO_2
Authors: Deng, F., Jones, D.B.A., Walker, T.W., Keller, M., Bowman, K.W., Henze, D.K., Nassar, R., Kort, E.A., Wofsy, S.C., Walker, K.A., Bourassa, A.E., and Degenstein, D.A.

Field of Research: data application, carbon balance estimation
Name of Journal: Geophys. Res. Lett. (volume 42, pages 8177-8184, 2015)
Title: Anomalous carbon uptake in Australia as seen by GOSAT
Authors: Detmers, R.G., Hasekamp, O., Aben, I., Houweling, S., van Leeuwen, T.T., Butz, A., Landgraf, J., Köhler, P., Guanter, L., and Poulter, B.

Field of Research: algorithm
Name of Journal: Atmos. Meas. Tech. (volume 8, pages 859-874, 2015)
Title: Tropospheric aerosol profile information from high-resolution oxygen A-band measurements from space
Authors: Geddes, A., and Bösch, H.

Field of Research: algorithm, data application
Name of Journal: IEEE J. Sel. Top. Appl. (volume 8, pages 376-385, 2015)
Title: Evaluation of spatio-temporal variogram models for mapping XCO_2 using satellite observations: A case study in China
Authors: Guo, L., Lei, L., Zeng, Z.-C., Zou, P., Liu, D., and Zhang, B.

Field of Research: data application
Name of Journal: Int. J. Remote Sens. (volume 36, pages 4363-4383, 2015)
Title: Estimating CO_2 concentration during the growing season from MODIS and GOSAT in East Asia
Authors: Guo, M., Xu, J., Wang, X., He, H., Li, J., and Wu, L.

Field of Research: data application, atmospheric transport models
Name of Journal: J. Geophys. Res.-Atmos. (volume 120, pages 3852-3871, 2015)
Title: Impact of atmospheric convection on south Tibet summer precipitation isotopologue composition using a combination of in situ measurements, satellite data, and atmospheric general circulation modeling
Authors: He, Y., Risi, C., Gao, J., Masson-Delmotte, V., Yao, T., Lai, C.-T., Ding, Y., Worden, J., Frankenberg, C., Chepfer, H., and Cesana, G.

Field of Research: algorithm, validation
Name of Journal: Atmos. Meas. Tech. (volume 8, pages 2961-2980, 2015)
Title: Consistent satellite XCO_2 retrievals from SCIAMACHY and GOSAT using the BESD algorithm
Authors: Heymann, J., Reuter, M., Hilker, M., Buchwitz, M., Schneising, O., Bovensmann, H., Burrows, J.P., Kuze, A., Suto, H., Deutscher, N.M., Dubey, M.K., Griffith, D.W.T., Hase, F., Kawakami, S., Kivi, R., Morino, I., Petri, C., Roehl, C., Schneider, M., Sherlock, V., Sussmann, R., Velazco, V.A., Warneke, T., and Wunch, D.

Field of Research: carbon balance estimation
Name of Journal: J. Geophys. Res.-Atmos. (volume 120, pages 5253-5266, 2015)
Title: An intercomparison of inverse models for estimating sources and sinks of CO_2 using GOSAT measurements
Authors: Houweling, S., Baker, D., Basu, S., Boesch, H., Butz, A., Chevallier, F., Deng, F., Dlugokencky, E.J., Feng, L., Ganshin, A., Hasekamp, O., Jones, D., Maksyutov, S., Marshall, J., Oda, T., O'Dell, C.W., Oshchepkov, S., Palmer, P.I., Peylin, P., Poussi, Z., Reum, F., Takagi, H., Yoshida, Y., and Zhuravlev, R.

Field of Research: atmospheric transport models, data application
Name of Journal: Adv. Meteorol. (volume 2015, ID 680264, 2015)
Title: Analysis of long-range transport of carbon dioxide and its high concentration events over East Asian region using GOSAT data and GEOS-Chem modeling
Authors: Kim, S.-Y., Lee, S.-D., Lee, J.-B., Kim, D.-R., Han, J.-S., Choi K.-H., and Song, C.-K.

Field of Research: algorithm
Name of Journal: IEEE Geosci. Remote Sensing Lett. (volume 12, pages 1446-1450, 2015)
Title: Simplified physically based retrieval of sun-induced chlorophyll fluorescence from GOSAT data
Authors: Köhler, P., Guanter, L., and Frankenberg, C.

Field of Research: algorithm
Name of Journal: Atmos. Meas. Tech. (volume 8, pages 2589-2608, 2015)
Title: A linear method for the retrieval of sun-induced chlorophyll fluorescence from GOME-2 and SCIAMACHY data
Authors: Köhler, P., Guanter, L., and Joiner, J.

Field of Research: carbon balance estimation, data application
Name of Journal: J. Geophys. Res.-Biogeo. (volume 120, pages 1226-1245, 2015)
Title: Comparison of the data-driven top-down and bottom-up global terrestrial CO_2 exchanges: GOSAT CO_2 inversion and empirical eddy flux upscaling
Authors: Kondo, M., Ichii, K., Takagi, H., and Sasakawa, M.

Field of Research: data application
Name of Journal: Glob. Change Biology (volume 21, pages 3469-3477, 2015)
Title: Simulations of chlorophyll fluorescence incorporated into the Community Land Model version 4
Authors: Lee, J.-F., Berry, J.A., van der Tol, C., Yang, X., Guanter, L., Damm, A., Baker, I., and Frankenberg, C.

Field of Research: validation, data application, algorithm
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 13023-13040, 2015)
Title: Does GOSAT capture the true seasonal cycle of carbon dioxide?
Authors: Lindqvist, H., O'Dell, C.W., Basu, S., Boesch, H., Chevallier, F., Deutscher, N., Feng, L., Fisher, B., Hase, F., Inoue, M., Kivi, R., Morino, I., Palmer, P.I., Parker, R., Schneider, M., Sussmann, R., and Yoshida, Y.

Field of Research: data application
Name of Journal: Atmosphere (volume 6, pages 1695-1713, 2015)
Title: A cluster of CO_2 change characteristics with GOSAT observations for viewing the spatial pattern of CO_2 emission and absorption
Authors: Liu, D., Lei, L., Guo, L., and Zeng, Z.-C.

Field of Research: carbon balance estimation
Name of Journal: J. Geophys. Res.-Atmos (volume 120, pages 5214-5236, 2015)
Title: Source-receptor relationships of column-average CO_2 and implications for the impact of observations on flux inversions
Authors: Liu, J., Bowman, K.W., and Henze, D.K.

Field of Research: carbon balance estimation, atmospheric transport models
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 9765-9780, 2015)
Title: Sensitivity of the recent methane budget to LMDz sub-grid-scale physical parameterizations
Authors: Locatelli, R., Bousquet, P., Saunois, M., Chevallier, F., and Cressot, C.

Field of Research: other
Name of Journal: J. Quant. Spectrosc. Radiat. Transfer (volume 154, pages 63-71, 2015)
Title: GOSAT-2014 methane spectral line list
Authors: Nikitin, A.-V., Lyulin, O.-M., Mikhailenko, S.-N., Perevalov, V.-I., Filippov, N.-N., Grigoriev, I.-M., Morino, I., Yoshida, Y., and Matsunaga, T.

Field of Research: validation, data application
Name of Journal: SOLA (volume 11, pages 160-164, 2015)
Title: Comparison of GOSAT SWIR and aircraft measurements of XCH_4 over West Siberia
Authors: Ono, A., Hayashida, S., Sugita, T., Machida, T., Sasakawa, M., and Arshinov, M.

Field of Research: carbon balance estimation, atmospheric transport models
Name of Journal: Geophys. Res.-Atmos. (volume 120, pages 734-765, 2015)
Title: Assessing the magnitude of CO_2 flux uncertainty in atmospheric CO_2 records using products from NASA's Carbon Monitoring Flux Pilot Project
Authors: Ott, L.-E., Pawson, S., Collatz, G.-J., Gregg, W.-W., Menemenlis, D., Brix, H., Rousseaux, C.-S., Bowman, K.-W., Liu, J., Eldering, A., Gunson, M. R., and Kawa, S.-R.

Field of Research: data application
Name of Journal: Environ. Res. Lett. (volume 10, 065005, 2015)
Title: Impact of equatorial and continental airflow on primary greenhouse gases in the northern South China Sea
Authors: Ou-Yang, C.-F., Yen, M.-C., Lin, T.-H., Wang, J.-L. Schnell, R.C., Lang, P.M., Chantara, S., and Lin, N.-H.

Field of Research: carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 8615-8629, 2015)
Title: On the use of satellite-derived CH_4 : CO_2 columns in a joint inversion of CH_4 and CO_2 fluxes
Authors: Pandey, S., Houweling, S., Krol, M., Aben, I., and Röckmann, T.

Field of Research: algorithm, validation
Name of Journal: Atmos. Meas. Tech. (volume 8, pages 4785-4801, 2015)
Title: Assessing 5 years of GOSAT Proxy XCH_4 data and associated uncertainties
Authors: Parker, R.-J., Boesch, H., Byckling, K., Webb, A.-J., Palmer, P.-I., Feng, L., Bergamaschi, P., Chevallier, F., Notholt, J., Deutscher, N., Warneke, T., Hase, F., Sussmann, R., Kawakami, S., Kivi, R., Griffith, D.-W. T., and Velazco, V.

Field of Research: carbon balance estimation, atmospheric transport models
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 1087-1104, 2015)
Title: A regional carbon data assimilation system and its preliminary evaluation in East Asia
Authors: Peng, Z., Zhang, M., Kou, X., Tian, X., and Ma, X.

Field of Research: data application
Name of Journal: Adv. Meteorol. (volume 2015, ID 125059, 2015)
Title: Preliminary assessment of methane concentration variation observed by GOSAT in China
Authors: Qin, X., Lei, L., He, Z., Zeng, Z.-C., Kawasaki, M., Ohashi, M., and Matsumi, Y.

Field of Research: algorithm, data application
Name of Journal: Atmos. Meas. Tech. (volume 8, pages 3601-3616, 2015)
Title: Sensitivity analysis of polarimetric O_2 A-band spectra for potential cloud retrievals using OCO-2/GOSAT measurements
Authors: Sanghavi, S., Lebsock, M., and Stephens, G.

Field of Research: data application
Name of Journal: Geosci. Model Dev. (volume 8, pages 3311-3319, 2015)
Title: Mapping of satellite Earth observations using moving window block kriging

Authors: Tadić, J.-M., Qiu, X., Yadav, V., and Michalak, A.-M.

Field of Research: validation, data application
Name of Journal: Acta Physica Sinica (volume 64, pages 70704-070704, 2015)
Title: Observation of ambient CH_4 variations using ground-based high resolution Fourier transform solar spectrometry (in Chinese language)
Authors: Tian, Y., Sun, Y., Xie, P., Liu, C., Liu, W., Liu, J., Li, A., Hu, R., Wang, W., and Zeng, Y.

Field of Research: carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 15, pages 7049-7069, 2015)
Title: Estimating global and North American methane emissions with high spatial resolution using GOSAT satellite data
Authors: Turner, A.J., Jacob, D.J., Wecht, K.J., Maasakkers, J.D., Lundgren, E., Andrews, A.E., Biraud, S.C., Boesch, H., Bowman, K.W., Deutscher, N.M., Dubey, M.K., Griffith, D.W.T., Hase, F., Kuze, A., Notholt, J., Ohyama, H., Parker, R., Payne, V.H., Sussmann, R., Sweeney, C., Velazco, V.A., Warneke, T., Wennberg, P.O., and Wunch, D.

Field of Research: data application
Name of Journal: Int. J. Remote Sens. (volume 36, pages 1509-1528, 2015)
Title: Global mapping of greenhouse gases retrieved from GOSAT Level 2 products by using a kriging method
Authors: Watanabe, H., Hayashi, K., Saeki, T., Maksyutov, S., Nasuno, I., Shimono, Y., Hirose, Y., Takaichi, K., Kanekon, S., Ajiro, M., Matsumoto, Y., and Yokota, T.

Field of Research: algorithm, data application
Name of Journal: Atmos. Meas. Tech. (volume 8, pages 3433-3445, 2015)
Title: Quantifying lower tropospheric methane concentrations using GOSAT near-IR and TES thermal IR measurements
Authors: Worden, J.R., Turner, A.J., Bloom, A., Kulawik, S.S., Liu, J., Lee, M., Weidner, R., Bowman, K., Frankenberg, C., Parker, R., and Payne, V.H.

Field of Research: data application
Name of Journal: J. Clean. Prod. (volume 103, pages 819-827, 2015)
Title: A high-accuracy method for filling voids on remotely sensed XCO_2 surfaces and its verification
Authors: Yue T.-X., Zhao, M.-W., and Zhang, X.-Y.

Field of Research: validation, data application
Name of Journal: Science Bulletin (volume 60, pages 380-386, 2015)
Title: Comparing simulated atmospheric carbon dioxide concentration with GOSAT retrievals
Authors: Zhang, H., Chen, B., Xu, G., Yan, J., Che, M., Chen, J., Fang, S., Lin, X., and Sun, S.

Field of Research: validation
Name of Journal: Int. J. Remote. Sens. (volume 36, pages 1406-1423, 2015)
Title: Comparison analysis of the global carbon dioxide concentration column derived from SCIAMACHY, AIRS, and GOSAT with surface station measurements
Authors: Zhang, L., Jiang, H., and Zhang, X.

Field of Research: validation, algorithm
Name of Journal: Sci. China Earth Sci. (volume 58, pages 1191-1197, 2015)
Title: XCO_2 satellite retrieval experiments in short-wave infrared spectrum and ground-based validation
Authors: Zhou, M.-Q., Zhang, X.-Y., Wang, P.-C., Wang, S.-P., Guo, L.-L., and Hu, L.-Q.

Field of Research: validation
Name of Journal: Atmos. Meas. Tech. (volume 8, pages 5263–5276, 2015)
Title: Observations of XCO_2 and XCH_4 with ground-based high-resolution FTS at Saga, Japan, and comparisons with GOSAT products
Authors: Ohyama, H., Kawakami, S., Tanaka, T., Morino, I., Uchino, O., Inoue, M., Sakai, T., Nagai, T., Yamazaki, A., Uchiyama, A., Fukamachi, T., Sakashita, M., Kawasaki, T., Akaho, T., Arai, K., and Okumura, H.

Field of Research: algorithm, data application
Name of Journal: Remote Sens. of Environ. (volume 162, pages 344-362, 2015)
Title: The Greenhouse Gas Climate Change Initiative (GHG-CCI): Comparison and quality assessment of near-surface-sensitive satellite-derived CO_2 and CH_4 global data sets
Authors: Buchwitz, M., Reuter, M., Schneising, O., Boesch, H., Guerlet, S., Dils, B., Aben, I., Armante, R., Bergamaschi, P., Blumenstock, T., Bovensmann, H., Brunner, D., Buchmann, B., Burrows, J.P., Butz, A., Chédin, A., Chevallier, F., Crevoisier, C.D., Deutscher, N.M., Frankenberg, C., Hase, F., Hasekamp, O.P., Heymann, J., Kaminski, T., Laeng, A., Lichtenberg, G., De Mazière, M., Noël, S., Notholt, J., Orphal, J., Popp, C., Parker, R., Scholze, M., Sussmann, R., Stiller, G.P., Warneke, T., Zehner, C., Bril, A., Crisp, D., Griffith, D.W.T., Kuze, A., O'Dell, C., Oshchepkov, S., Sherlock, V., Suto, H., Wennberg, P., Wunch, D., Yokota, T., and Yoshida, Y.

GOSAT in the years after nominal lifetime

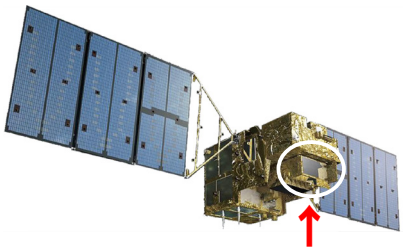
Around noon of August 2, 2015 (JST), at TANSO-FTS, the thermal infrared (TIR) detector-temperature increased to the environment temperature due to the failure of the cryocooler to keep the detector at -200° C, which made TIR operations (observations by band 4) stopped, while the short-wave infrared (SWIR) bands 1, 2 and 3 were operating normally and providing O_2, CO_2 and CH_4 spectra.

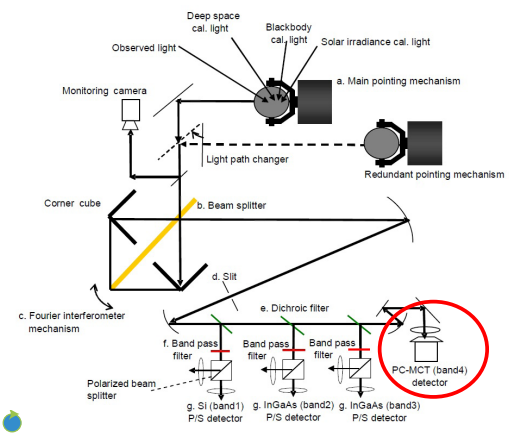
The failure analysis suggested the malfunction had been caused by a one-time factor of space radiation or the like, so the cryocooler was restarted to cool the detector on September 14, 2015, which brought the normal temperature back for the TIR band detector to operate, enabling GOSAT to resume grid point observation on all bands including SWIR bands (band 1, 2, 3) on September 15, getting back to nominal operation including specific and sunglint point observations on September 16.

SWIR L2 data products during the period are provided under different version numbers before and after the cryocooler stoppage, whose outline can be seen on the last page of this newsletter. (For the details of L1 data of the period, please refer to https://data2.gosat.nies.go.jp/doc/documents/20150817_en.pdf)
Please note the event had no effect on any operation by TANSO-CAI.

* Cryocooler for TIR band 4 detector (in red circle, right) stopped and raised the temperature to stop observation temporarily.

** TANSO-FTS is mounted at the front botom part of GOSAT (in white circle, above)





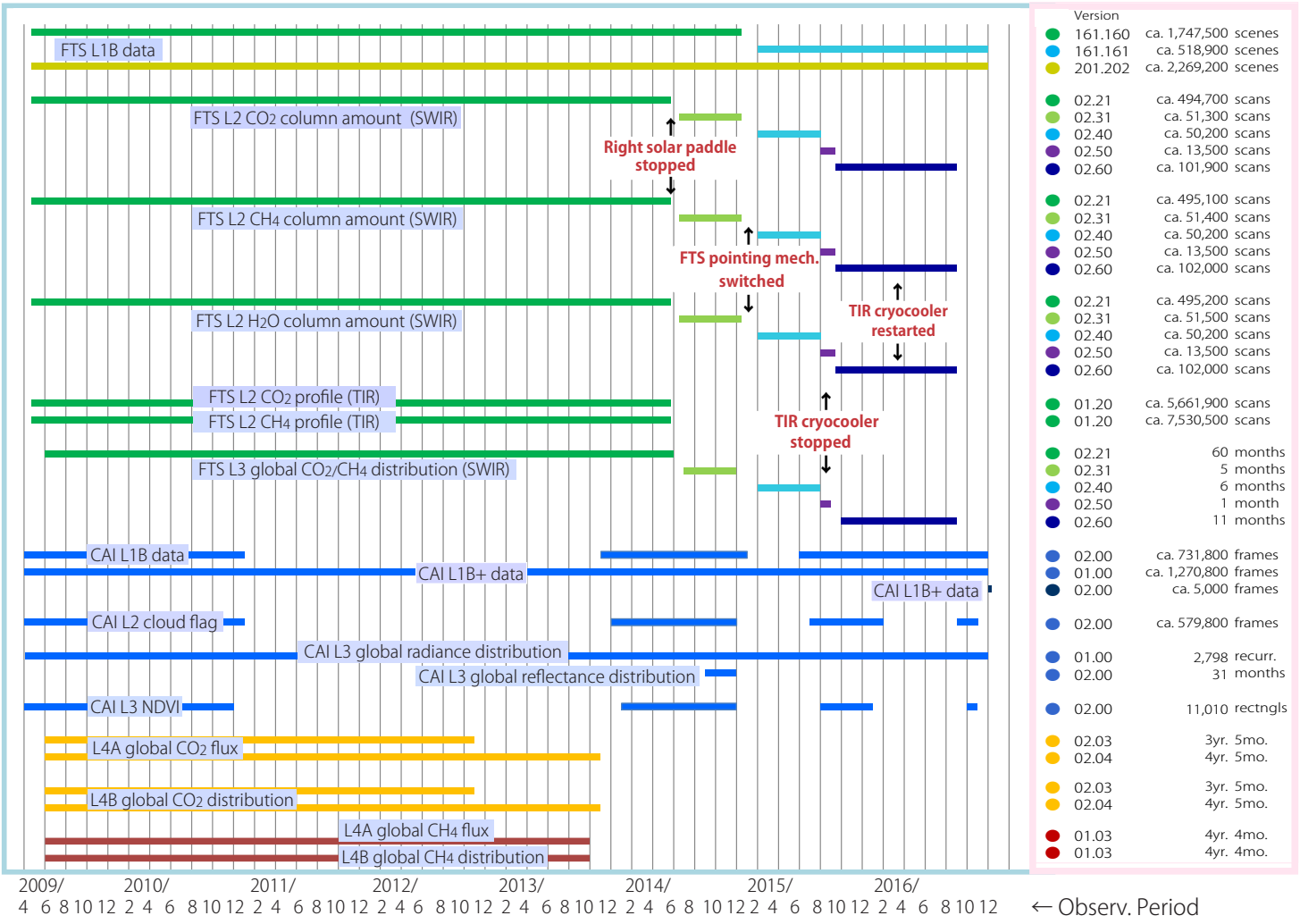
DATA PRODUCTS UPDATE

Data Processing Status Update

Fumie Kawazoe, Specialist
NIES GOSAT Project

Observation Period and Versions of Publicly Released Data

As of January 10, 2017



Described below are data processed and released from April 2015 to mid-January 2017. As GUIG is closed (see P.5), this page is to be based on GDAS from now on.

As for FTS L1B product, the same FTS instrumental function was applied for all observation periods to release V201.202 with improved quality, and V161.160 and V161.161 are also provided as was.

FTS SWIR L2 CO_2/CH_4 column amount and FTS SWIR L3 CO_2/CH_4 global distribution products are provided until August 2016, each of which as V02.21/V02.31 before/after the solar paddle disorder, V02.40 after the pointing mechanism switching, V02.50 during the TIR cryocooler disorder, and V02.60 after its recovery. Also FTS SWIR L2 H_2O column amount product was released to the public on September 1, 2016, changed from a research product.

FTS TIR L2 CO_2/CH_4 profile products V01.20 were released to the public on October 5, 2016. Please refer to the release note on GDAS for their detail.

Version-upgraded to V02.00 were products of CAI L1B, L2 cloud flag, and L3 NDVI on December 1, and CAI L1B+ and L3 global reflectance on December 27, 2016. CAI L1B, L2 cloud flag, L3 NDVI, and global reflectance are reprocessing past data. Details of these upgrades are found on GDAS release note. CAI L3 global radiance is also to be upgraded shortly, which will be announced on GDAS when released to the public.

Other latest processed and released are: version-upgraded V02.04 for L4A global CO_2 flux and L4B global CO_2 distribution from June 2009 to October 2013; version-upgraded V01.03 for L4A global CH_4 flux and L4B global CH_4 distribution from June 2009 to September 2013.

The number of GDAS registered users is 572 as of January 10, 2017. (Old GUIG user accounts were transferred to GDAS when they were active within last 2 years.)

NIES GOSAT PROJECT NEWSLETTER ISSUE #32 WINTER 2016

Issued on : 2017/1/13

edited and published by : Satellite Observation Center, NIES

email : gosat_newsletter@nies.go.jp
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