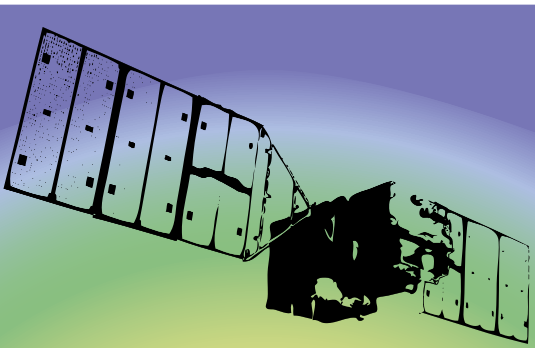

GOSAT いぶき

IBUKI

NIES GOSAT PROJECT NEWSLETTER

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

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CONTENTS

REPORT

Main events in 2014

It is more than a year after the issue #30 of this newsletter, so at first let us introduce main events since.

The 6th GOSAT RA PI Meeting was held at EPOCHAL TSUKUBA, Ibaraki, Japan, during June 9(Mon) to 12(Thu) with the participants of 60 PIs and Co-Is, and 66 from involved parties, NIES, JAXA, NASA, and others, counting a total of 126 persons. The meeting started with [1] plenary session, followed by sessions on [2] calibration, [3] algorithms, [4] validation, [5] modeling, [6] data application, and [7] closing. After each session of [1] - [6], a discussion of some 30 minutes was held.

After a welcome speech by the NIES President, Dr. Sumi and an opening remarks by Prof. Shimoda of Tokai University (RA committee chair person), session [1] saw 4 reports on current status of GOSAT project and outline of TIR L2 algorithms, closed with summary of action items from the previous meeting.

Each following session had oral presentations as follows: [2] two on O_2 A-band and TIR band of the FTS, [3] seven on latest retrieval outcomes of CO_2 and CH_4 concentrations, three on clouds, and two others (12 in all), [4] four by ground-based high resolution FTS, two by comparison with IASI*1, and two others (8 in all), [5] three each on assimilation and regional characteristics of flux, and four others (10 in all), [6] six on aerosol retrieval including PM2.5, five on regional trends of GHGs, and nine others (20 in all).

At session [7] JAXA Vice President, Mr. Yamamoto and the Ministry of the Environment, Japan made closing addresses, and the meeting was summarized after confirmation of action items to finish all agendas.

Among those which the participants confirmed and shared were: improved quality of the latest L1 product, the necessities of clarifying the cause of systematic bias in L2 products, augmentation of TCCON sites, accuracy enhancement of retrieval, further improvement of absorption cross-section database of gases, continued comparison between models, promotion of application researches.

At the entrance hall of EPOCHAL TSUKUBA, International Congress Center.

The meeting also had a poster session with 9 presentations, a reception in the second evening, and technical tours to JAXA and NIES in the fourth afternoon.

Photo left:
A group visiting NIES (Climate Change Research Hall) on a technical tour after the meeting on June 12, 2014.

Photo right:
Another group visiting JAXA (H-II rocket in the background).

*1 IASI (Infrared Atmospheric Sounding Interferometer) is a sensor mounted on the European meteorological satellites MetOp to measure infrared radiation from the ground surface to acquire humidity-, temperature-distribution at troposphere/lower stratosphere, and atmospheric trace gas data which are important for climate monitoring, global change, and atmospheric chemistry.

The Annual Summer Open House was held on July 19 (Sat) with as many as 4,144 people visiting in spite of the occasional rain on the day. At the event, the GOSAT/GOSAT-2 team presented their research outcomes around the theme of "Global Environmental Monitoring (Measurement from Space)" at the Climate Change Research Hall using a variety of means including the usual spherical displays, tablet PCs, and posters. A new attraction this year, with younger visitors as its target, was the "Panel Expedition Quiz". 790 younger visitors participated in the quiz, creating an unusually festive atmosphere this year. We would like to thank all those who visited us.

Photo above: children doing quiz with hints given from the staffs.

Photo left: a family operating the demonstration system listening to the staff's explanation.

* This event is held annually on the 3rd or 4th Sat. of July at NIES. The various centers use the occasion to introduce their research and its outcomes in an easily-understandable manner to the general public, as well the general scope of environmental issues.

UNFCCC COP20 was held at Lima, Peru for two weeks from Dec. 1 (Mon), 2014. From NIES, 6 people attended including GOSAT project leader Dr. Yokota, GOSAT-2 project team leader Dr. Matsunaga, and specialist Ms. Pang, and presented the latest research outcomes on climate change and future observation plan.

Entrance to UNFCCC COP20/CMP10 (photo by PANG Shijuan).

An event "Contributions of Japan's Satellite Remote Sensing to Climate Change Detection", co-hosted by NIES, was held at Japan pavilion on Dec. 2 (Tue), details of which can be seen here:
http://www.mmechanisms.org/e/cop20_japanpavilion/index.html

At booth, research outcomes and plans of GOSAT and GOSAT-2 were displayed as follows.

For the first week (Dec. 1-6) details of 5 years' global CO_2/CH_4 sink/source observation by GOSAT and the procedure of obtaining those data were explained, which attracted a high level of visitors' interest, especially, images of changing concentration of those gases shown on a portable display. For GOSAT-2, the successor, its latest required specification and expected outcomes were presented.

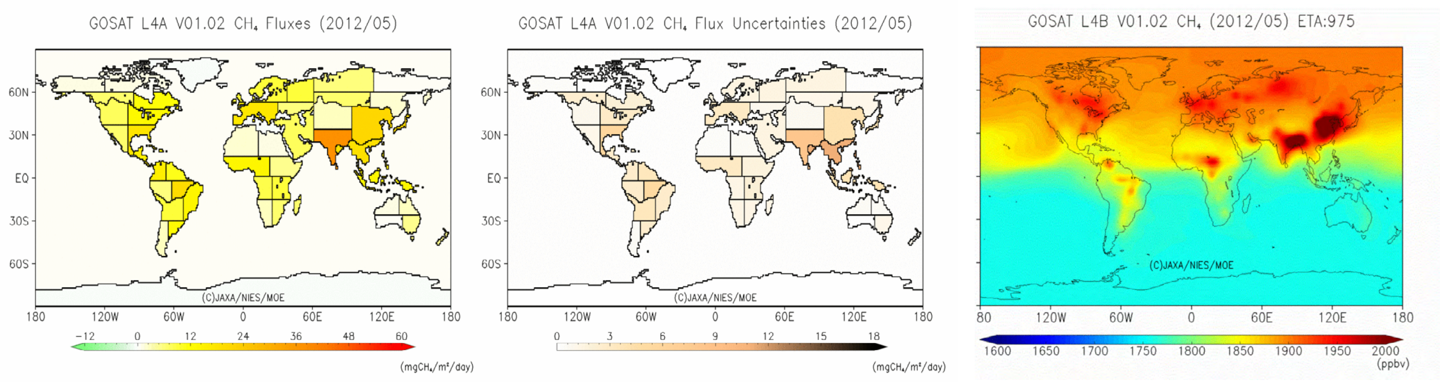
The second week (Dec. 8-12) included the explanation of the press release "*IBUKI* (GOSAT) Satellite's Historically Unprecedented Observation of Anthropogenic CO_2 Emissions of Mega-City Regions from Space" held on Dec. 4, indicating the possible monitoring of anthropogenic emission using GOSAT data measuring Mega-Cities and their adjacent areas from space. The outline of the press release is introduced at next "Major project outcomes in 2014".

Photo left: Dr. Yokota interviewed by a Peruvian TV channel at GOSAT/GOSAT-2 booth (photo by PANG Shijuan).

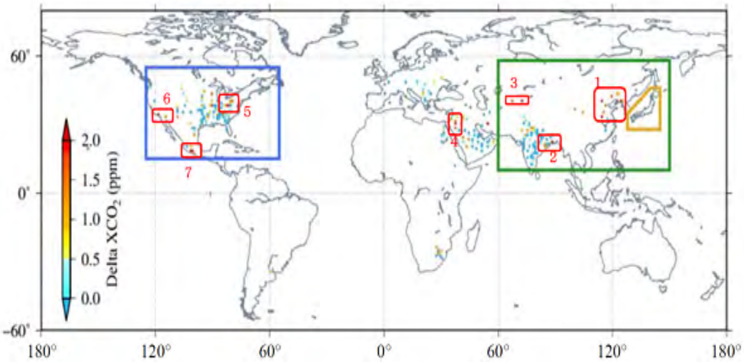
Major project outcomes in 2014

L4A global CH_4 flux and L4B global CH_4 distribution (see next page) were released to the general public as standard products upgraded from research products in July 2014, following those previously released CO_2 L4A/L4B. L4A is estimated from FTS SWIR L2 data and ground-based observation data using inverse model analysis, and L4B is a 3-dimensional concentration distribution simulated from L4A using atmospheric transport model. For details, please refer to L4A/L4B "Product Format Descriptions" and "Important Notes at Releasing" under "Document & Technical Information" – "Document (Product Description)" at GUIG site.

In Dec. 2014, *IBUKI* (GOSAT) Satellite's Historically Unprecedented Observation of Anthropogenic CO_2 Emissions of Mega-City Regions from Space" was press released showing CO_2 concentrations in mega-cities and their surroundings were analyzed for the three and a half years from June 2009 to December 2012, based on the observational data acquired by *IBUKI*, indicating the tendency for higher CO_2 concentrations in mega-cities than those in their surroundings, and furthermore, positive correlations between differences in CO_2 concentrations and the concentrations estimated from data for fossil fuel consumption, those which to indicate that *IBUKI* observations have the potential to enable us to detect enhanced CO_2 concentrations with their origin in fossil fuel consumption for mega-cities and to demonstrate the potential utility of satellite observation of CO_2 concentrations as a tool for monitoring greenhouse gas emissions (inventory) from fossil fuels. For details, please visit: http://www.nies.go.jp/whatsnew/2014/20141210/20141210-e.html



* Upper figures show an example of L4 browse image (average of May, 2012): left (L4A) shows sink/source in CH_4 weight (mg) per day/square meter for each of 43 global regions with its uncertainty at center (L4A), and right (L4B), 3-dimensional concentration showing at 800m-altitude (ETA: 975) in this case. You can view these data via the site below clicking "Login" – "Guest user login" – "L4 Browse Image". CH_4 products include animations as is the case with CO_2.
http://data.gosat.nies.go.jp/



* Lower figure, used in the press release, shows seven regions with conspicuously higher CO_2 concentrations from anthropogenic activities.

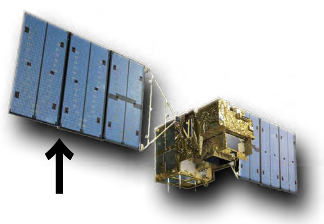
GOSAT in the year after nominal lifetime

GOSAT is now in the year after nominal lifetime, having accomplished 5 years' observation since its launch in 2009, as reported in the issue #30 of this newsletter. Let us introduce two incidents in the past year.

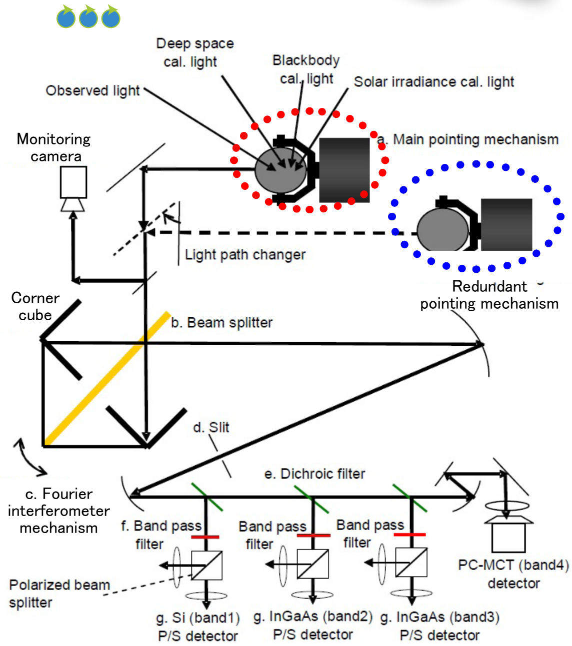
The observation equipment automatically stopped at 23:00, May 24, 2014(UT), due to power generation shortage (1/2 of normal status) caused by standstill of one of two solar paddles failing to face the Sun, eventually to resume observation at 23:00, May 30(UT), after prompt handling by JAXA, in a mode to observe just below the satellite. The present 1/2 power generation is enough for nominal observation, ensuring to continue the operation with one active paddle. Halted observation on request restarted on July 2.

Another disorder of FTS' pointing mechanism occurred, making the mirror too frequently unable to stand still after tilting to catch the targeted reflection within a determined time, however, switching to the redundant system (see figure right) was started on Dec. 15, 2014 and completed on Jan. 26, 2015, enabling to continue steady observation since.

These periods being without observation unfortunately, GOSAT runs smoothly after nominal lifetime except above two incidents, its TANSO-CAI to have achieved taking 1 million frames this April, some of which are displayed at "The Images of the Earth captured by *IBUKI*".



* Figure right above:
GOSAT faces its solar paddles right to the Sun to get the highest power generation efficiency while flying down to the south on daylight hemisphere. The disorder occurred at the "right wing" (arrowed).



* Figure right:
the main pointing mechanism (red circle) becoming unable to stand still within a determined period of time for observation, it was switched to the redundant pointing mechanism (blue circle).

SPECIAL COLUMN -1

GOSAT then and now

Dr. Akimasa Sumi, President,
National Institute for Environmental Studies, Japan

The journey to GOSAT

In the late 90s ADEOS*[1] was launched in 1996 and TRMM*[2] in 1997: an exciting period for global observation by satellites in Japan, and the years of Japan's "bubble" economy. Unfortunately, ADEOS was mal-functioned within one year, but enthusiasm and momentum were maintained with the preparation and subsequent arrival of ADEOS-II*[1]. At the same time, various proposals of sensors to follow ADEOS-II were in the air. One important idea was the ongoing orientation of our endeavours: rather than adopting newly-developed buses (the support structure and control subsystems for mission instruments), we should operate mission instruments on proven ones. This was one of the lesson learned from our experience with ADEOS. This idea led to a proposal for a series of satellites - GCOM1*[3], GCOM2*[3], and GCOM3*[3] - for long-term climate change monitoring mission, which meant 15 years operation by three satellites with a respective duration of five years. While this was a good idea in theory, making it a reality was a real challenge. The daily-changing nature of both politics and economics means that annual applications for budget must be completed, regardless of the fact that the particular proposal may be long-term. Now there seems to be a shared understanding that long and continuous operation of satellites, such as GMS*[4], should be maintained by a particular operational organization. In Japan, earth observation is being redefined as an operational development, rather than "science". This is the prevailing trend in space development today. While this way of thinking needs to change, we must deal with the current reality as it stands in regards to long-life satellites.

The same has happened at NIES: SOFIS*[5], a sensor to observe stratospheric trace gases such as ozone by Limb-viewing method*[6], was proposed following ILAS*[7] and ILAS-II*[7]. The sensor was intended to measure not only ozone but other trace gases in the atmosphere, primarily CO_2, using FTS*[8].

Time and its attendant changes

The 2000s brought recession and the MTSAT*[9] launch failure of January 2000 compounded the situation. Considerable efforts (and money) had to be used to salvage the reliability of rockets and satellite instruments. In this context, and for many other underlying reasons, the reorganization of satellite projects became imperative, and proposals for GCOM-A1 and GCOM-B1 came into being, the former with ODUS*[10] (an ozone observing sensor), SOFIS, and SWIFT*[11] from Canada, and the latter using microwave radiometers. GCOM-A1 was then proposed as a greenhouse gases observing satellite. In the meantime, the Kyoto Protocol was adopted leading to heightened awareness and attention for greenhouse gases throughout Japan, from which arose a new realm of debate which questioned the relevance of measuring ozone at that particular point in time. Rather, it was suggested that measuring global CO_2 simply by facing SOFIS down rather than sideways would be more appropriate for the needs of the time. To study the feasibility whether or not it was really possible to accomplish the objective with sufficient accuracy, the Research and Promotion Committee for the Greenhouse Gases Observing Satellite Project was convened, and six meetings were held between December 2002 and September 2003.

It seemed at the time that both NASDA*[12] and MOE were already determined to launch greenhouse gases mission, as an apparent consequence of the Kyoto Protocol, which commenced its first commitment period from 2008. The committee designated me as its chair because I was a modeler. A researcher, while having a dedicated involvement in observation itself, might generally be assumed to have difficulties seeing the broader picture. The general consensus at the time was that we would need to achieve a breakthrough in order to launch a satellite with a new concept, and also to contend with the issue of the technical feasibility of "measuring facing-down".

Dr. Gen Inoue from NIES was convinced that we could easily retrieve the total amount of CO_2 using its absorption at 1.6 μm near-infrared region, an assertion of which many others were skeptical, asking how it would be possible to ascertain the entire atmospheric mass without exact topographical data, which could easily give rise to errors of 1%. I recall that Dr. Teruyuki Nakajima of CCSR*[13] insisted that no precise measurement would be possible without knowing the aerosol amount. In addition, there was discussion on whether or not thermal infrared band should be onboard. Some parties were of the opinion that it would be of no use for measuring CO_2 near the surface, while others supported it for its capacity to sense CO_2 in the upper atmosphere, thus facilitating measurements of CO_2 in the lower atmosphere when coupled with near-infrared measurements. I was of the opinion that it would be better to have thermal infrared onboard as an "insurance," and its capacity to ensure the retrieval of water vapor and other physical amounts, even should near-infrared fail to sense CO_2. Discussions with regards to this thermal infrared had their background in the fact that IMG-II (IMG*[14]: Interferometric Monitor for Greenhouse Gases) was not onboard ADEOS-II due to difference of opinion between Ministry of International Trade and Industry, MITI (at the time) and Science and Technology Agency, STA (ditto) after Japan had unsuccessfully sent IMG, an FTS instrument, to space on ADEOS for the first time in the world. However, the Committee decided to proceed in a spirit of optimism, as a whole. Doubts remained with regard to measuring total amounts of CO_2 with 1% precision, but in this case also, awareness of the importance of CO_2 measurements and tacit support for NIES prevailed: as it were "if that is what they want to do, leave them to it". We did not have too many misgivings about our ability to achieve our ultimate goal of flux estimation on a sub-continental scale, and were confident that this could be worked out with modeling regardless. On the other hand, the community itself, who had been involved with the discontinued mission of ozone observation and atmospheric chemistry with SOFIS or ODUS, were less than impressed with this development.

After the launch

I would now like to give my account of the period following the launch of GOSAT. Before that, though, a little more background is necessitated. First, the fact that the US satellite OCO*[15] was due to launch with a similar mission at this time. JAXA (formerly NASDA) appears to have been determined get there first. Second, JAXA proposed an extremely reliable satellite bus after the serial failures of ADEOS and ADEOS-II, in particular of the heavy-duty solar paddles equipped on both sides of the satellite. This led to objections of a "Once bitten, twice shy" nature, these paddles have in fact proved to be eminently useful in prolonging the operational life of GOSAT. Naturally however, preparation for whatever inevitability must always be of the essence.

Researchers at NIES, despite their small numbers and in the face of the overwhelming skepticism of the community did their best to achieve their goals. Another factor of significant bearing on this attitude was the failure of OCO. This translated to a certain "ambivalence" on our part: while on the one hand we had positive perceptions stemming from the participation of many researchers in the project, on the other we were oppressed by the difficulties of achieving results which would rank alongside those being produced by researchers throughout the world. It is my sincere opinion that NIES did a good job despite the constraint of having insufficient numbers of researchers, in managing to produce the outcomes which we have today. Nevertheless, the point has been made that there should be more new sciences delivered from Japan, and this is true in the sense that Japan has been traditionally poor in addressing expectations for new science utilizing satellite data. Hardware first, science later: this is an old paradigm of space development in Japan, and one which needs to be overcome. However, one of the valuable lessons which GOSAT has imparted is in pointing the way forwards for how a satellite mission should be developed, that is: if you select a mission built only on 100% established technologies, while this may give you a sense of reassurance at the time, this mission will most likely have fallen behind the needs of the time for launch to come, and will risk obsolescence as an observation mission. You must live with the risk of faith in the capacity of technological development to facilitate cutting-edge science by the time of the launch, which is an extremely difficult call to make.

The MOE did not initially seem to have a high level of faith in the prospects of GOSAT. However, the project began to play a pivotal role in MOE global policymaking for warming following the Great East Japan Earthquake and the accompanying shutdown of Japan's nuclear power plants, one result of which was a hiatus in the proposal of anti-warming measures. GOSAT-2 has now acquired its budget and there is also the potential that GOSAT-3 will also do so. The issue of the awareness of the implications and inherent difficulties of utilizing space operationally remains, and I believe we have some work to do. Fortunately GOSAT has come this far, but we have to remain prepared for the possibility of failure at any time. Herein lies an essential difficulty of space business. In this context, we cannot be too careful about ensuring the ongoing and proper operation of satellites, including considerations such as the securing of a long-term budget foundation. GOSAT-2 does not preclude the need to improve GOSAT data processing, such that it is also a reality that these projects will continue to cost more and more into the future: this is ultimately what we cannot afford to forget.

*1 ADvanced Earth Observing Satellites are Japanese satellites with the objective to acquire data of global environmental changes such as ozone layer depletion, greenhouse effect, etc., launched in 1996/2002, nicknamed *MIDORI* / *MIDORI-II*.
*2 Tropical Rainfall Measuring Mission is a joint space mission between USA (NASA) and Japan (NASDA*12 and CRL (Communication Research Laboratory)), and also the name of the satellite.
*3 Global Change Observation Mission is a Japanese project to observe environmental change for a long period of time globally from space.
*4 Geostationary Meteorological Satellite (*Himawari*) is on the geostationary orbit at 140 degrees of east longitude to carry out weather observation from space being part of the World Weather Watch (WWW) project of the World Meteorological Organization.
*5 Solar Occultation FTS*8 for Inclined-orbit Satellite, is a sensor intended onboard ILAS-III.
*6 Limb-viewing method is, unlike nadir-viewing of GOSAT (looking down the globe), to observe in the direction of peripheral border, "solar occultation" of which is referred here.
*7 Improved Limb Atmospheric Spectrometers are Japan's first atmospheric observing sensors to monitor and research the ozone layer in the polar stratosphere developed by Ministry of the Environment of Japan. They were installed on ADEOS (*MIDORI*) / ADEOS-II (*MIDORI-II*). NIES processed the observation data.
*8 Fourier Transform Spectrometer obtains interfering light by moving one of a pair of 2 mirrors on each optical path and observes spectra after Fourier transformation.
*9 Multi-functional Transport SATellite is a large stationary satellite with missions of both meteorological observation and air traffic control, codeveloped by MLTI (Ministry of Land, Infrastructure, Transport and Tourism) and JMA (.Japan Meteorological Agency).
*10 Ozone Dynamics Ultraviolet Spectrometer is a Japanese sensor to observe ozone and atmospheric pollution and later renamed OPUS (Ozone and Pollution measuring UV Spectrometer), planned but not realized.
*11 Stratospheric Wind Interferometer For Transport studies is a stratospheric wind profiler.
*12 NAtional Space Development Agency of Japan is renamed and re-organized into JAXA now.
*13 Center for Climate System Research in the University of Tokyo is now re-organized into AORI (Atmosphere and Ocean Research Institute).
*14 Interferometric Monitor for Greenhouse gases is a Fourier transform spectrometer developed by MITI to observe infrared spectra, mounted on ADEOS for the purpose of greenhouse gas observation.
*15 Orbiting Carbon Observatory is one of the missions of Earth System Science Pathfinder Project in NASA, USA, a satellite dedicated to studying atmospheric CO_2. The launch of OCO-1 unfortunately failed in February, 2009, however, its successor OCO-2 was developed by NASA and successfully launched in July, 2014.

Statistics of selected RA proposals and published papers

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 activities throughout the 1st to the latest RA to realize the accumulation of 122.

On the other hand, published papers have increased rapidly in the last years. Please visit the site below to see all the papers:
http://www.gosat.nies.go.jp/eng/technology/references.htm

Field of Research	Selected RA Themes
Calibration	4
Algorithm	21
Validation	29
Carbon Balance Estimation/Atmospheric Transport Models	17
Data Application	48
Data App./Validation	2
Carbon Balance Estimation/Atmospheric Transport Models & Data App.	1
Total	122

Country *	Selected RA Themes
Japan	35
USA	22
Germany	10
China	6
Canada	5
France	5
Netherlands	5
UK	5
Russia	4
Finland	4
Others	21
Total	122

* Per organization RA PI belongs.

Year	Published Papers		
	With GOSAT data	Without GOSAT data	Total
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	0	5	5
2007	0	1	1
Total	136	49	185

SPECIAL COLUMN -2

Measuring Greenhouse Gases from Space: The GOSAT, OCO-2, and GOSAT-2 Partnership

Dr. D Crisp, Jet Propulsion Laboratory, California Institute of Technology

Human activities such as fossil fuel combustion, cement production, and deforestation have increased the atmospheric CO_2 concentration by more 40% since the beginning of the industrial age. A quarter of this increase has been added since 2000 and the rate continues to increase. Until recently, most of the CO_2 emissions were coming from the industrialized world, where there are good records of the amount of fossil fuel burned. However, in 2007, China surpassed the U.S. as the single largest emitter of CO_2, and the developing world now accounts for about 60% of all emissions. In many developing countries, fossil fuel use has been increasing so fast that it has been impossible to accurately track CO_2 emissions. The best existing inventories indicate that fossil fuel combustion and other human activities are now adding at least 40 billion tons of CO_2 to the atmosphere each year, but the uncertainties on these estimates are growing almost as rapidly as the emissions themselves.

If all of the CO_2 emitted by these human sources remained in the atmosphere, the atmospheric CO_2 concentration would increase by more than one percent (1%) per year. Interestingly, precise measurements from a global network of greenhouse gas monitoring stations indicate that less than half of this CO_2 is remaining airborne. The rest is apparently being absorbed by natural sinks in the ocean and land biosphere, whose identity, and location are poorly understood. Roughly one quarter of the human emissions are apparently being absorbed by the ocean, where they are contributing to ocean acidification. The land-based processes responsible for absorbing the other quarter of these emissions are far more mysterious. Some studies have attributed this absorption to tropical, mid-latitude, or boreal forests, while other indicate that these forest just as likely to be net sources as sinks of CO_2. The efficiency of these natural sinks also appears to vary dramatically from year to year. Some years, they absorb almost all of the CO_2 emitted by human activities, while in other years, they absorb almost none. The reasons for this are not yet known.

Because the identity, location, and processes controlling these natural sinks is not well understood, it is not possible to determine how much longer they will continue to operate, and reduce the rate of atmospheric CO_2 buildup by half. This lack of understanding introduces a major source of uncertainty in predictions of the rate of future CO_2 increases, and their effect on the climate. Measurements from the ground based greenhouse gas network accurately track the global atmospheric CO_2 budget and its trends, but do not have the resolution or coverage needed to identify the sources emitting CO_2 into the atmosphere or the natural sinks absorbing this gas at the Earth's surface. This information is critical to any carbon management strategy.

One way to improve the resolution and coverage of CO_2 measurements is to collect high resolution observations of the column-averaged CO_2 dry air mole fraction (XCO_2[*1]) from space. Estimates of XCO_2 can be derived from high resolution spectroscopic observations of reflected sunlight in near infrared CO_2 and molecular oxygen (O_2) bands. This is a particularly challenging space-based remote sensing measurement because the surface sources and sinks of CO_2 must be inferred from very small spatial and temporal variations in XCO_2. Even the largest CO_2 sources and sinks produce changes in the background XCO_2 distribution no larger than 2% on scales ranging from that of a large city or medium sized country, and most of them produce changes smaller than 0.25%. Measuring such small changes in an atmospheric trace gas from space require unprecedented accuracy in space based sensors.

The NASA Orbiting Carbon Observatory (OCO[*2]) and the Japanese Greenhouse gases Observing SATellite (GOSAT, nicknamed *IBUKI*) were the first two satellite sensors designed specifically to address this challenge and collect space-based observations of XCO_2 with the sensitivity, coverage, and resolution needed to quantify CO_2 fluxes on regional scales over the globe. While their overall objectives were similar, the sensors carried by these two missions were quite different. OCO was to carry an imaging grating spectrometer[*3] designed to collect large number of precise CO_2 and O_2 measurements along a narrow ground track. GOSAT carried the Thermal And Near infrared Sensor for carbon Observations-Fourier Transform Spectrometer (TANSO-FTS[*4]), a high resolution Fourier transform spectrometer, designed measure both CO_2 and methane (CH_4), the second most abundant human produced greenhouse gas.

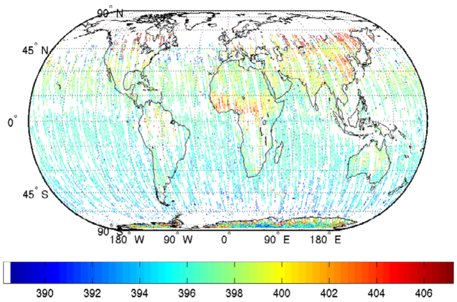
To fully exploit the capabilities of these two systems and meet their demanding measurement requirements, the OCO and GOSAT teams formed a close collaboration early in the development phases of these two missions. The primary objectives of this collaboration were to improve the accuracy and reliability of the products from both missions and to facilitate the combined use of OCO and GOSAT XCO_2 estimates in studies of CO_2 sources and sinks. The teams initially focused on the cross calibration of the OCO and GOSAT sensors and the development of a common approach for validating the XCO_2 products retrieved from these spacecraft measurements against internationally-recognized standards.

GOSAT was successfully launched on 23 January 2009 and has been returning global measurements of CO_2 and CH_4 since late April of that year. The OCO mission was lost on 24 February 2009 when its launch vehicle malfunctioned and failed to reach orbit. Immediately after the loss of OCO, the GOSAT Project Team at JAXA and NIES, invited the OCO team to contribute to the analysis of measurements collected by the GOSAT. NASA responded by reformulating the OCO science team as the Atmospheric CO_2 Observations from Space (ACOS[*5]) team and encouraged this collaboration.

Since 2009, the ACOS and GOSAT teams have conducted joint, annual, vicarious calibration campaigns[*6] at Railroad Valley, Nevada to track the long-term radiometric performance of the TANSO-FTS instrument. The methods used in these campaigns evolved from those used to characterize the radiometric performance of high spatial resolution, imaging radiometers. For TANSO-FTS, the conventional, surface based radiometric measurements have been augmented with surface and aircraft measurements of atmospheric temperature and trace gas profiles, as well as observations from other space based instruments to characterize spatial variations of the surface reflectance within the sounding footprint.

The ACOS team also used the XCO_2 retrieval algorithm developed for the OCO mission to estimate XCO_2 from the GOSAT TANSO-FTS spectra. The close collaboration with the

GOSAT Project team yielded rapid advances in the development of this retrieval algorithm and produced an independent GOSAT XCO_2 product that is widely used by the science community. Comparisons of the ACOS XCO_2 retrievals with surface-based XCO_2 estimates from the Total Carbon Column Observing Network (TCCON*7) helped to identify and correct subtle biases associated with air mass, surface pressure, optically-thick aerosols, ice-covered surfaces, and other environmental factors. Persistent spectral residuals common to TCCON and TANSO-FTS retrievals have revealed limitations in the spectroscopy of CO_2 and O_2, which are being addressed with new laboratory measurements. With these refinements, recent ACOS XCO_2 estimates show little or no bias and have random errors that are typically less than 0.5% on regional scales over much of the Earth. These XCO_2 estimates are now being used in flux inversion models to assess their impact on our understanding CO_2 sources and sinks.



*Preliminary version of global CO_2 distribution based on OCO-2 observation data (unit: ppm).

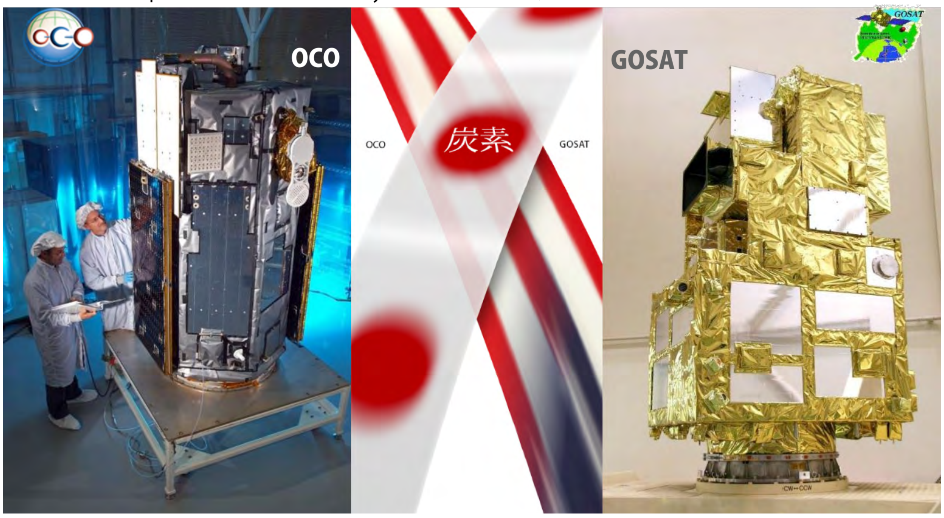
Meanwhile, in early 2010, NASA approved the Orbiting Carbon Observatory-2 (OCO-2), a "carbon copy" of the OCO*2 spacecraft. On 2 July 2014, OCO-2, was successfully launched from Vandenberg Air Force Base in California. A month later, OCO-2 entered the 705-km Afternoon Constellation (A-Train), just ahead of Japanese GCOM-W1*8 satellite. Its instrument, a 3-channel, imaging grating spectrometer, was then cooled to its operating temperatures and began a comprehensive series of instrument checkout and calibration activities. In early September, OCO-2 started collecting almost one million soundings over the sunlit hemisphere each day. Preliminary results indicate that between 15 and 30% of these measurements are sufficiently cloud free to yield precise, full column estimates of XCO_2. This high sampling rate is expected to yield almost 100 times as many useful XCO_2 measurements as GOSAT, substantially improving the spatial resolution and coverage. Initial deliveries of calibrated OCO-2 spectra to the NASA Goddard Earth Science Data and Information Services Center (GES DISC) began on December 30, 2014. Routine deliveries of XCO_2 to the GES DISC began on 30 March, 2015.

The GOSAT and OCO-2 teams are continuing to work closely together to cross calibrate the measurements and cross validate the data products from these two missions so that they can be combined to enable more comprehensive studies of CO_2 sources and sinks. To encourage this cooperation, NASA has recently added several members of the GOSAT Project Team to the OCO-2 Science team, and others are encouraged to participate. In addition, NASA and members of the GOSAT Project Team are currently negotiating a much broader collaboration that will implement a joint science team for GOSAT, OCO-2, and future CO_2 missions, including GOSAT-2 and OCO-3. GOSAT-2 is currently being developed through a partnership between JAXA, NIES, and the Ministry of the Environment of Japan in preparation for a 2018 launch. Its instruments will measure carbon monoxide (CO) as well as CO_2, CH_4 and aerosols. The OCO-3 mission will deploy the OCO-2 flight spare instrument on the Japanese Equipment Module Exposed Facility (JEM-EF) on the International Space Station (ISS) in 2018.

The operational phases of GOSAT-2 and OCO-3 will overlap substantially, but these two sensors will be deployed in orbits that sample the Earth's sunlit hemisphere in different ways. Like GOSAT and OCO-2, GOSAT-2 will be deployed in a near-polar, sun synchronous orbit, which enables measurements over most of the Earth's sunlit hemisphere at a fixed time of day in the early afternoon. In contrast, OCO-3 will be deployed in a low-inclined orbit that provides measurements at latitudes within 51 degrees of the equator. OCO-3/ISS measurements will complement those from GOSAT-2 by providing the first space-based CO_2 measurements at local times spanning dawn to dusk. This will provide the first opportunity to determine whether diurnal variations in CO_2 can be detected from space-based sensors. It will also provide the first opportunity to monitor diurnal variations in chlorophyll fluorescence, a quantity thought to be strongly correlated with the CO_2 uptake by land plants.

The strong, continuing collaboration between the GOSAT and OCO-2 teams has dramatically accelerated our ability to collect, analyze and use space based measurements of CO_2 for studies of the carbon cycle. This collaboration provides a model for future space based greenhouse gas monitoring efforts. The extension of this collaboration to the GOSAT-2 and OCO-3 missions provides opportunities to extend this valuable climate data record beyond the lifetimes of GOSAT and OCO-2 missions. This closely coordinated ad hoc constellation of greenhouse gas satellites also paves the way for future space-based greenhouse monitoring systems.

*Between the photos of OCO and GOSAT below is a *tapestry of friendship* between OCO and GOSAT.



*1 XCO_2 means Column-averaged CO_2 concentration, the ratio of the number of CO_2 molecules to that of dry air molecules in a column above a unit surface area.
*2 Please refer to *14 in page 5.
*3 An instrument to observe spectra utilizing the phenomenon that the location of strongest interference of light diffracted by grated pattern varies according to the wavelength.
*4 TANSO-FTS (Thermal And Near-infrared Sensor for carbon Observation) is the sensor onboard GOSAT with the other, TANSO-CAI (Cloud and Aerosol Imager). As for FTS, please refer to *7 in page 5.
*5 Atmospheric CO_2 Observations from Space team is a group organized around OCO (Orbiting Carbon Observatory) science team involving researchers of JPL*13, Caltech, and Colorado State University.
*6 For details, please refer to RRV (Railroad Valley) articles in Newsletters No. 7, No. 19, No. 24, and No. 29.
*7 Total Carbon Column Observing Network is a network of the ground-based high-resolution FTS observations. Currently, its observations are carried out in about twenty locations worldwide. TCCON's column-averaged abundances of greenhouse gases are used for validating greenhouse gases observation by satellites and other carbon cycle studies.
*8 GCOM-W1 (Global Change Observation Mission-W1) is a satellite launched in GCOM project (refer to *3 in page 5) to observe global water circulation, nicknamed "SHIZUKU", waterdrop in Japanese, with a microwave radiometer onboard which observes precipitation, vapor amounts, wind velocity above the ocean, sea water temperature, water levels on land areas, and snow depths.

Selected Research Themes of 7th and 8th RA

Principal Investigator	Research Organization
Research Theme	
Validation	
1. Voltaire A. Velazco	University of Wollongong (Australia)
Southern Hemisphere Validation of GOSAT XCO_2 and XCH_4 Spatio-Temporal Variability from TCCON solar FTS Measurements in Australia and New Zealand	
Data Application	
1. Muhammad Evri	Agency for the Assessment and Application of Technology (BPPT) of Indonesia (Indonesia)
Multistage Sensing of Land-Atmosphere and Monitoring of Greenhouse Gas (GHG) Over Indonesia Using GOSAT Toward National Platform of Climate Change (National Action Plan for GHG; RAN-GRK)	
2. Takafumi Sugita	National Institute for Environmental Studies (Japan)
A comparison study on CH_4 column amounts derived from TANSO/FTS, aircraft, and stratospheric limb observations	

Now accepting applications for 9th RA・・・

Update on the GOSAT Data Policy

Japan Aerospace Exploration Agency (JAXA), National Institute for Environmental Studies (NIES), and Ministry of the Environment of Japan (MOE) agreed to revise the definition of the GOSAT data products in March 2015 and updated the GOSAT Data Policy. Each GOSAT data user is expected to read and follow this GOSAT data Policy revision B hereafter.

http://www.gosat.nies.go.jp/eng/technology/download/GOSAT_Data_PolicyB_jp.pdf (N.B.: English version will be released shortly.)

PUBLISHED PAPERS (from Jan. to Dec., 2014)

Field of Research: validation, atmospheric transport models
Name of Journal: Sci. China Earth Sci. (volume 57, pages 1393-1402, 2014)
Title: A comparison of atmospheric CO_2 concentration GOSAT-based observations and model simulations
Authors: Lei, L., Guan, X., Zeng, Z., Zhang, B., Ru, F., and Bu, R.

Field of Research: data application
Name of Journal: P. Natl. Acad. Sci. USA. (volume 111, pages E1327-E1333, 2014)
Title: Global and time-resolved monitoring of crop photosynthesis with chlorophyll fluorescence
Authors: Guanter, L., Zhang, Y., Jung, M., Joiner, J., Voigt, M., Berry, J. A., Frankenberg, C., Huete, A. R., Zarco-Tejada, P., Lee, J.-E., Moran, M. S., Ponce-Campos, G., Beer, C., Camps-Valls, G., Buchmann, N., Gianelle, D., Klumpp, K., Cescatti, A., Baker, J. M., and Griffis, T. J.

Field of Research: other
Name of Journal: J. Geophys. Res.-Atmos. (volume 119, pages 2654-2673, 2014)
Title: Satellite observations of CO_2 from a highly elliptical orbit for studies of the Arctic and boreal carbon cycle
Authors: Nassar, R., Sioris, C. E., Jones, D. B. A., and McConnell, J. C.

Field of Research: data application, atmospheric transport models
Name of Journal: Polar Science, (volume 8, pages 129-145, 2014)
Title: Column-averaged CO_2 concentrations in the subarctic from GOSAT retrievals and NIES transport model simulations
Authors: Belikov, D. A., Bril, A., Maksyutov, S., Oshchepkov, S., Saeki, T., Takagi, H., Yoshida, Y., Ganshin, A., Zhuravlev, R., Aoki, S., and Yokota, T.

Field of Research: other
Name of Journal: Remote Sens. Environ. (volume 147, pages 1-12, 2014)
Title: Prospects for chlorophyll fluorescence remote sensing from the Orbiting Carbon Observatory-2
Authors: Frankenberg, C., O'Dell, C., Berry, J., Guanter, L., Joiner, J., Kohler, P., Pollock, R., and E. Taylor, T.

Field of Research: data application, carbon balance estimation
Name of Journal: Geophys. Res. Lett. (volume 41, pages 1809-1815, 2014)
Title: The seasonal variation of the CO_2 flux over Tropical Asia estimated from GOSAT, CONTRAIL, and IASI
Authors: Basu, S., Krol, M., Butz, A., Clerbaux, C., Sawa, Y., Machida, T., Matsueda, H., Frankenberg, C., Hasekamp, O. P., and Aben, I.

Field of Research: carbon balance estimation, data application
Name of Journal: Chinese Sci. Bull. (volume 59, pages 1547-1555, 2014)
Title: China's sizeable and uncertain carbon sink: a perspective from GOSAT
Authors: Zhang, L., Xiao, J., Li, L., Lei, L., and Li, J.

(continued)

Field of Research: algorithm
Name of Journal: Chinese Sci. Bull. (volume 59, pages 1499-1507, 2014)
Title: CH_4 retrieval from hyperspectral satellite measurements in short-wave infrared: sensitivity study and preliminary test with GOSAT data
Authors: Deng, J., Liu, Y., Yang, D., and Cai, Z.

Field of Research: carbon balance estimation, other
Name of Journal: Geophys. Res. Lett. (volume 41, pages 2598-2605, 2014)
Title: Influence of differences in current GOSAT XCO_2 retrievals on surface flux estimation
Authors: Takagi, H., Houweling, S., Andres, R. J., Belikov, D., Bril, A., Boesch, H., Butz, A., Guerlet, S., Hasekamp, O., Maksyutov, S., Morino, I., Oda, T., O'Dell, C. W., Oshchepkov, S., Parker, R., Saito, M., Uchino, O., Yokota, T., Yoshida, Y., and Valsala, V.

Field of Research: data application, carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 3703-3727, 2014)
Title: Inferring regional sources and sinks of atmospheric CO_2 from GOSAT XCO_2 data
Authors: Deng, F., Jones, D. B. A., Henze, D. K., Bousserez, N., Bowman, K. W., Fisher, J. B., Nassar, R., O'Dell, C., Wunch, D., Wennberg, P. O., Kort, E. A., Wofsy, S. C., Blumenstock, T., Deutscher, N. M., Griffith, D. W. T., Hase, F., Heikkinen, P., Sherlock, V., Strong, K., Sussmann, R., and Warneke, T.

Field of Research: validation
Name of Journal: Atmos. Meas. Tech. (volume 7, pages 1003-1010, 2014)
Title: Comparisons of CH_4 ground-based FTIR measurements near Saint Petersburg with GOSAT observations
Authors: Gavrilov, N. M., Makarova, M. V., Timofeev, Y. M., and Poberovsky, A. V.

Field of Research: data application
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 3991-4012, 2014)
Title: A multi-year methane inversion using SCIAMACHY, accounting for systematic errors using TCCON measurements
Authors: Houweling, S., Krol, M., Bergamaschi, P., Frankenberg, C., Dlugokencky, E. J., Morino, I., Notholt, J., Sherlock, V., Wunch, D., Beck, V., Gerbig, C., Chen, H., Kort, E. A., Röckmann, T., and Aben, I.

Field of Research: other
Name of Journal: Atmos. Meas. Tech. (volume 7, pages 1105-1119, 2014)
Title: The impact of spectral resolution on satellite retrieval accuracy of CO_2 and CH_4
Authors: Galli, A., Guerlet, S., Butz, A., Aben, I., Suto, H., Kuze, A., Deutscher, N. M., Notholt, J., Wunch, D., Wennberg, P. O., Griffith, D. W. T., Hasekamp, O., and Landgraf, J.

Field of Research: atmospheric transport models, carbon balance estimation
Name of Journal: Tellus B (volume 66, 22486, 2014)
Title: Carbon monitoring system flux estimation and attribution: impact of ACOS-GOSAT XCO_2 sampling on the inference of terrestrial biospheric sources and sinks
Authors: Liu, J., Bowman, K., Lee, M., Henze, D., Bousserez, N., Brix, H., Collatz, G. J., Menemenlis, D., Ott, L., Pawson, S., Jones, D., and Nassar, R.

Field of Research: validation
Name of Journal: IEEE T. Geosci. Remote Sens. (volume 52, pages 7764-7774, 2014)
Title: A Comparison of In Situ Aircraft Measurements of Carbon Dioxide and Methane to GOSAT Data Measured Over Railroad Valley Playa, Nevada, USA
Authors: Tadic, J. M., Loewenstein, M., Frankenberg, C., Butz, A., Roby, M., Iraci, L. T., Yates, E. L., Gore, W., and Kuze, A.

Field of Research: data application
Name of Journal: Technometrics (volume 56, pages 174-185, 2014)
Title: Spatio-temporal data fusion for very large remote sensing datasets
Authors: Nguyen, H., Katzfuss, M., Cressie, N., and Braverman, A.

Field of Research: data application
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 5853-5869, 2014)
Title: Variations of oxygen-18 in West Siberian precipitation during the last 50 years
Authors: Butzin, M., Werner, M., Masson-Delmotte, V., Risi, C., Frankenberg, C., Gribanov, K., Jouzel, J., and Zakharov, V. I.

Field of Research: validation
Name of Journal: Atmos. Meas. Tech. (volume 7, pages 1723-1744, 2014)
Title: The Greenhouse Gas Climate Change Initiative (GHG-CCI): comparative validation of GHG-CCI SCIAMACHY/ENVISAT and TANSO-FTS/GOSAT CO_2 and CH_4 retrieval algorithm products with measurements from the TCCON
Authors: Dils, B., Buchwitz, M., Reuter, M., Schneising, O., Boesch, H., Parker, R., Guerlet, S., Aben, I., Blumenstock, T., Burrows, J. P., Butz, A., Deutscher, N. M., Frankenberg, C., Hase, F., Hasekamp, O. P., Heymann, J., De Mazière, M., Notholt, J., Sussmann, R., Warneke, T., Griffith, D., Sherlock, V., and Wunch, D.

Field of Research: data application, atmospheric transport models
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 6139-6158, 2014)
Title: Assimilation of atmospheric methane products into the MACC-II system: from SCIAMACHY to TANSO and IASI
Authors: Massart, S., Agusti-Panareda, A., Aben, I., Butz, A., Chevallier, F., Crevoisier, C., Engelen, R., Frankenberg, C., and Hasekamp, O.

Field of Research: validation
Name of Journal: Journal of Korean Society for Geospatial Information System (volume 22, pages 11-16, 2014)
Title: Cross-Correlation Analysis between GOSAT and CO_2 Concentration Observed by the KGAWC Station (*in Korean language*)
Authors: Choi, J. H., Joo, S. M., Um, J. S.

Field of Research: data application
Name of Journal: Glob. Change Biol. (volume 20, pages 3103-3121, 2014)
Title: Terrestrial gross primary production inferred from satellite fluorescence and vegetation models
Authors: Parazoo, N. C., Bowman, K., Fisher, J. B., Frankenberg, C., Jones, D. B. A., Cescatti, A., Pérez-Priego, Ó., Wohlfahrt, G., and Montagnani, L.

(continued)

Field of Research: validation, data application
Name of Journal: Advances in Space Research (volume 54, Pages 1933–1940, 2014)
Title: Study of satellite retrieved CO_2 and CH_4 concentration over India
Authors: Prasad, P., Rastogi, S., and Singh, R.P.

Field of Research: data application
Name of Journal: PloS ONE (volume 9, e105050, 2014)
Title: Combining XCO_2 measurements derived from SCIAMACHY and GOSAT for potentially generating global CO_2 maps with high spatiotemporal resolution
Authors: Wang, T., Shi, J., Jing, Y., Zhao, T., Ji, D., and Xiong, C.

Field of Research: data application, carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 8173-8184, 2014)
Title: Spatially resolving methane emissions in California: constraints from the CalNex aircraft campaign and from present (GOSAT, TES) and future (TROPOMI, geostationary) satellite observations
Authors: Wecht, K. J., Jacob, D. J., Sulprizio, M. P., Santoni, G. W., Wofsy, S. C., Parker, R., Bösch, H., and Worden, J.

Field of Research: validation, data application
Name of Journal: Atmos. Meas. Tech. (volume 7, pages 2631-2644, 2014)
Title: A method for colocating satellite XCO_2 data to ground-based data and its application to ACOS-GOSAT and TCCON
Authors: Nguyen, H., Osterman, G., Wunch, D., O'Dell, C., Mandrake, L., Wennberg, P., Fisher, B., and Castano, R.

Field of Research: data application
Name of Journal: IEEE J. Sel. Top. Appl. (volume 7, pages 389-398, 2014)
Title: Comparison of Column-Averaged Volume Mixing Ratios of Carbon Dioxide Retrieved From IASI/METOP-A Using KLIMA Algorithm and TANSO-FTS/GOSAT Level 2 Products
Authors: Laurenza, L., Del Bianco, S., Gai, M., Barbara, F., Schiavon, G., and Cortesi, U.

Field of Research: validation
Name of Journal: Int. J. Remote Sens. (volume 35, pages 5628-5636, 2014)
Title: Comparisons of satellite (GOSAT) and ground-based spectroscopic measurements of CH_4 content near Saint Petersburg: influence of data collocation
Authors: Gavrilov, N. M., Makarova, M. V., Timofeyev, Y. M., and Poberovskii, A. V.

Field of Research: atmospheric transport models, data application
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 9807-9830, 2014)
Title: To what extent could water isotopic measurements help us understand model biases in the water cycle over Western Siberia
Authors: Gryazin, V., Risi, C., Jouzel, J., Kurita, N., Worden, J., Frankenberg, C., Bastrikov, V., Gribanov, K., and Stukova, O.

Field of Research: validation
Name of Journal: Atmos. Meas. Tech. (volume 7, pages 2987-3005, 2014)
Title: Validation of XCH_4 derived from SWIR spectra of GOSAT TANSO-FTS with aircraft measurement data
Authors: Inoue, M., Morino, I., Uchino, O., Miyamoto, Y., Saeki, T., Yoshida, Y., Yokota, T., Sweeney, C., Tans, P. P., Biraud, S. C., Machida, T., Pittman, J. V., Kort, E. A., Tanaka, T., Kawakami, S., Sawa, Y., Tsuboi, K., and Matsueda, H.

Field of Research: atmospheric transport models, data application
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 11427–11446, 2014)
Title: Impact of the Asian monsoon anticyclone on the variability of mid-to-upper tropospheric methane above the Mediterranean Basin
Authors: Ricaud, P., Sic, B., El Amraoui, L., Attié, J.-L., Zbinden, R., Huszar, P., Szopa, S., Parmentier, J., Jaidan, N., Michou, M., Abida, R., Carminati, F., Hauglustaine, D., August, T., Warner, J., Imasu, R., Saitoh, N., and Peuch, V.-H.

Field of Research: data application, algorithm
Name of Journal: Atmosphere (volume 5(4), pages 870-888, 2014)
Title: Mapping Global Atmospheric CO_2 Concentration at High Spatiotemporal Resolution
Authors: Jing, Y., Shi, J., Wang, T., and Sussmann, R.

Field of Research: validation
Name of Journal: Atmospheric and Oceanic Physics (volume 50, pages 904–909, 2014)
Title: Comparisons of Satellite (GOSAT) and Ground Based Fourier Spectroscopic Measurements of Methane Content near St. Petersburg
Authors: Makarova M. V., Gavrilov, N. M., Timofeev, Y. M., and Poberovskii, A. V.

Field of Research: validation
Name of Journal: Atmospheric and Oceanic Physics (volume 50, pages 910–915, 2014)
Title: Comparisons of Satellite (GOSAT) and Ground Based Spectroscopic Measurements of CO_2 Content near St. Petersburg
Authors: Gavrilov, N. M., and Timofeev, Y. M.

Field of Research: carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 14, 12883-12895, 2014)
Title: Estimating regional fluxes of CO_2 and CH_4 using space-borne observations of XCH_4: XCO_2
Authors: Fraser, A., Palmer, P. I., Feng, L., Bösch, H., Parker, R., Dlugokencky, E. J., Krummel, P. B., and Langenfelds, R. L.

Field of Research: data application, atmospheric transport models
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 13281-13293, 2014)
Title: A joint data assimilation system (Tan-Tracker) to simultaneously estimate surface CO_2 fluxes and 3-D atmospheric CO_2 concentrations from observations
Authors: Tian, X., Xie, Z., Liu, Y., Cai, Z., Fu, Y., Zhang, H., and Feng, L.

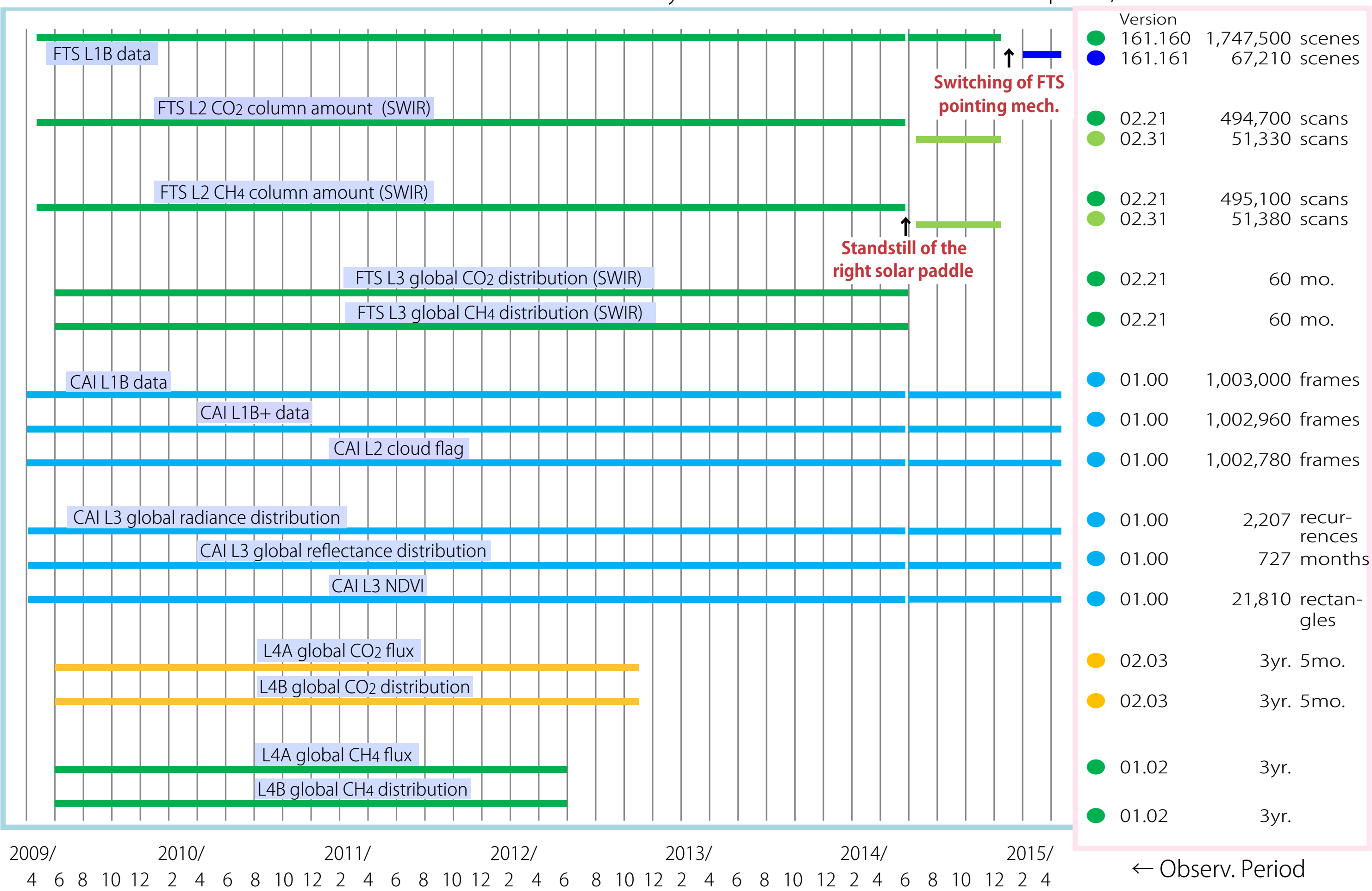
Field of Research: carbon balance estimation
Name of Journal: Atmos. Chem. Phys. (volume 14, pages 13739-13753, 2014)
Title: Satellite-inferred European carbon sink larger than expected
Authors: Reuter, M., Buchwitz, M., Hilker, M., Heymann, J., Schneising, O., Pillai, D., Bovensmann, H., Burrows, J.P., Bösch, H., Parker, R., Butz, A., Hasekamp, O., O'Dell, C.W., Yoshida, Y., Gerbig, C., Nehrkorn, T., Deutscher, N.M., Warneke, T., Notholt, J., Hase, F., Kivi, R., Sussmann, R., Machida, T., Matsueda, H., and Sawa Y.

DATA PRODUCTS UPDATE

Data Processing Status Update

Fumie Kawazoe, Specialist
NIES GOSAT Project Office

Observation Period and Versions of Publicly Released Data As of April 24, 2015



Described below are data processed and released from April 2014 to April 2015.

Disorders occurred on solar paddle and TANSO-FTS pointing mechanism reported in page 3 brought version changes: versions processed and released [before / after] them are, [V161.160 / V161.161] for FTS L1B, and [V02.21 / V02.31] for FTS SWIR L2. (There are no data released from May 24, 20:28 to May 30, 5:34, 2014(UT) due to the solar paddle disorder, and from Dec. 14, 22:50, 2014 to Jan. 31, 23:59, 2015(UT) due to the pointing mechanism switching.) L2 data after Feb. 2015 are now under identification of observed location before processing and release. New version L3, V02.21, has been released for 60 months until May, 2014 since Mar. 30, 2015.

Other latest processed and released on are: V01.00 for CAI L1B, CAI L1B+, CAI L2 cloud flag, CAI L3 global radiance/reflectance distribution, and CAI L3 NDVI, except for data between May 24, 20:27 and May 30, 5:09, 2014(UT) due to the solar paddle disorder.

L4 products have already been released to the general public as described in page 2 “Major project outcomes in 2014”, and their latest versions are V02.03 for CO_2 and V01.02 for CH_4 since Jan. 28, 2015.

“Browse images of the global radiance distribution” was added to “Gallery” at GUIG top. Please also visit “The Images of the Earth captured by *IBUKI*” and others, which are updated any time as needed.

Version upgrade of FTS L1B, CAI L1B, and CAI L2 will be performed from this spring to winter. Please check information posted on GUIG “News & Topics”.

The number of registered users as of April 24 is 624, decrease of which is because "General User" accounts were cut when they had been inactive during the past 2 years. Please email to the following address if a new registration is required: gosat-support@nies.go.jp

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