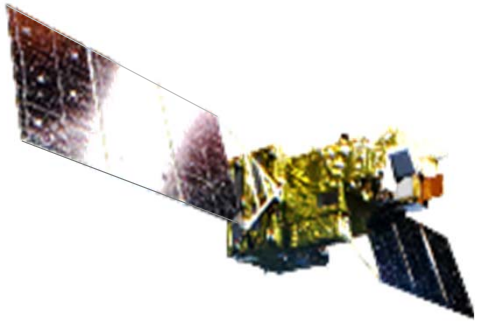
Joint PI workshop, 2020

GOSAT and GOSAT-2 update

2009-Now



2018-Now

Akihiko KUZE (JAXA/EORC)

Jan. 18, 2021

GOSAT & GOSAT-2 Organization

GOSAT and GOSAT-2 are the joint projects of JAXA, MOE (Ministry of the Environment) and NIES (National Institute for Environmental Studies)

MOE

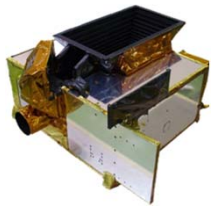
JAXA

NIES

Thermal And Near infrared Sensor for carbon Observation

2009-Now

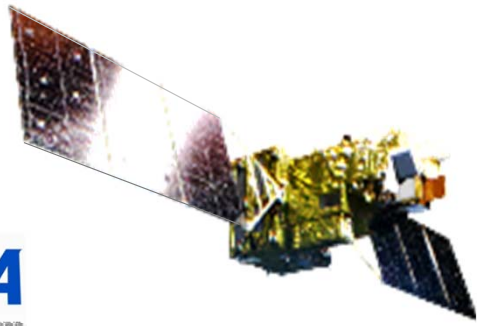
TANSO-FTS



SWIR/TIR FTS

TANSO-CAI

UV, Visible, SWIR Imager



2018-Now

- Algorithms development
- Data use for science
- Validation

- Sensor development
- Satellite development
- H-IIA launch
- Satellite operation
- Data acquisition
- Calibration
- Research Products

On orbit Status

Operation in 2020

No COVID-19 impact

12th US-Japan vicarious calibration
campaign at Railroad Valley
(ESA TROPOMI team joined)

Satellite Condition

Enough fuel to operate for at least another 10-year
All four batteries are healthy

12-year data set of JAXA EORC research product
(partial column density)

Operation in 2020

No COVID-19 Impact

Observation Pattern

Latitudinally wider glint observation

More customized observation.

More intense target observations over more megacities than GOSAT
(ex. NYC 16 points >36 points)

Apply cloud-avoidance operation for grid observation points. Not for coastal zone and cities.

Avoid non-flat topography area

Inter-comparison in Levels 1 and 2

Highlights in 2020

	June 22	June 23	June 24	June 25	June 26	June 27	June 28
GOSAT	✓	✓		✓	✓		✓
GOSAT-2					✓	✓	✓
OCO-2				✓	✓	✓	
OCO-3					✓18:45		
TROPOMI	✓	✓	✓Nadir	✓Nadir	✓	✓	✓
Surface							
Weather							

	June 29	June 30	July 1	July 2	July 3	July 4	July 5
GOSAT	✓		✓	✓		✓	✓
GOSAT-2			✓	✓	✓		
OCO-2							✓
OCO-3		✓17:11				✓15:36	
TROPOMI	✓Nadir	✓Nadir	✓Nadir	✓Nadir	✓	✓	✓Nadir
Surface						✓MODIS	✓M20 M03
Weather						Golden Day 	Golden day 

(1) 12th RRV campaign

JPL team on site, no JAXA and SRON participation
Part-1 June 22-July 5, All 5 instruments viewed on June 26.
Part-2 September 23-24, clear but hazy
International participation for RRV2021 may be still difficult.

(2) Radiance Spectra Intercomparison

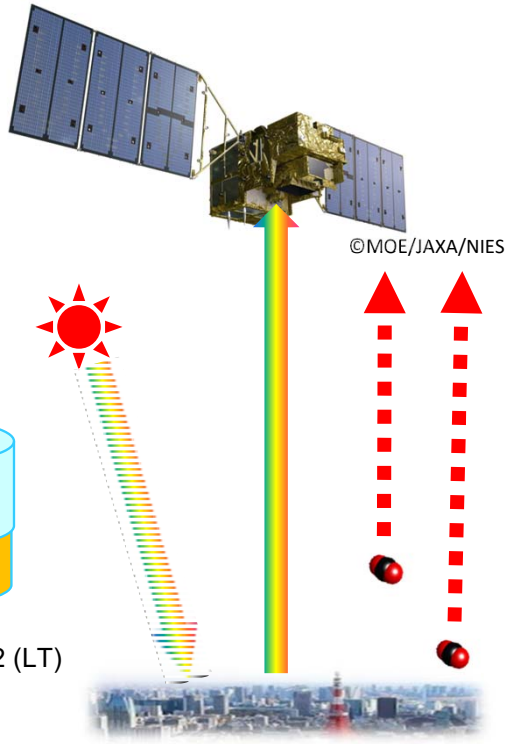
Consistent correction of BRDF, which was the largest error source. (Bruegge *et al.*, 2019)
UMass Boston provides special MODIS BRDF product for very bright RRV (Crystal Schaaf group)
MISR data can reproduce hot spot accurately in backward reflection

(3) Solar database http://lasp.colorado.edu/lisird/data/tsis1_hsrs

LASP released Hybrid TSIS data (high spectral resolution) provided by Odele Coddington (0.001 nm step)
TSIS data with JPL Solar Pseudo-Transmittance Spectrum (SPTS) solar lines

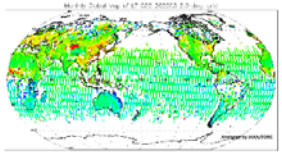
(4) GOSAT-2 EORC XCO_2 and XCH_4 release and comparison with OCO-2 and TROPOMI

JAXA EORC Level 2 (Partial Column)



FTS multiplex advantage
(1) SWIR constrains column density
(2) Two independent linear polarization data remove aerosol contamination.
(3) TIR provides difference in partial column density between lower and upper troposphere.

12 year GOSAT and 2 year GOSAT-2 products are available at
https://www.eorc.jaxa.jp/GOSAT/GPCG/index_GOSAT2.html
One file for one month global clear sky conditions,



CSV format, only 2 M byte per month file
XCO_2, XCH_4, XCO_2 (LT, UT), XCH_4 (LT, UT), XCO (GOSAT-2 only), aerosol optical thickness (AOT),Retrieved surface pressure (P), solar-induced chlorophyll fluorescence (SIF) time, geometry

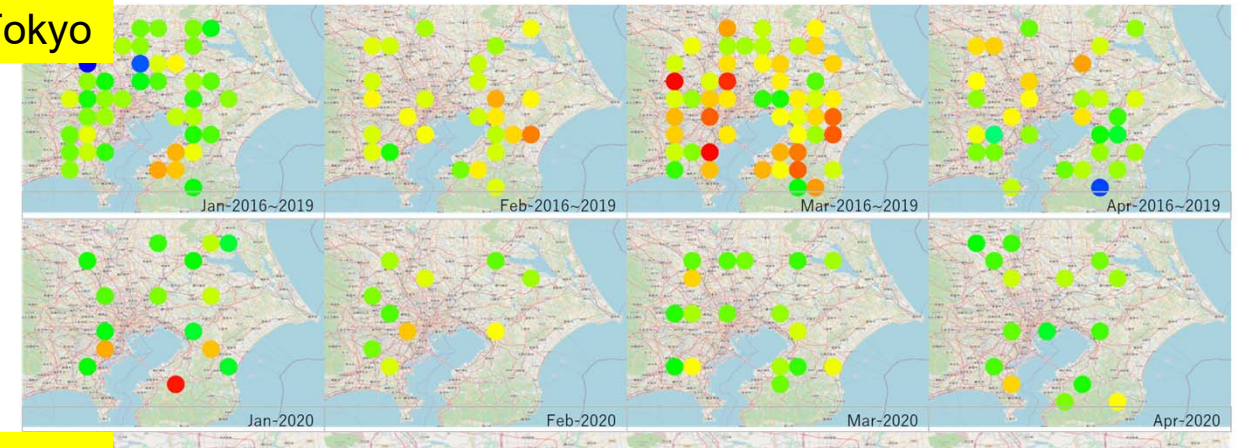
GOSAT-1 Version 1

yyyy/mm/dd	hh:mm:ss	Latitude	Longitude	LSFLG	XCO2_apr	XCO2_tot	XCO2_low	XCO2_upp	XCH4_apr	XCH4_tot	XCH4_low	XCH4_upp	XCO_apr	XCO_tot	Psrf_apr	Psrf_ret	AOT_076	AOT_160	AOT_206	SIF	Cloud	scanID
2019/01/01	01:13:04	-41.3061	173.4926	0	406.5682	397.9352	395.1537	399.3747	1.7439	1.7464	1.8315	1.7634	0.00000	0.00000	967.86	977.05	0.0963	0.0886	0.0820	10.4642	-1.000000	F190101011304
2019/01/01	02:46:15	-23.9153	151.2222	0	407.7506	402.3643	402.1988	403.2452	1.7683	1.8030	1.7950	1.8469	0.00000	0.00000	1007.32	1001.42	0.3487	0.3636	0.3583	1.2205	-1.000000	F190101024615
2019/01/01	02:47:06	-23.9548	148.3777	0	407.6141	404.1903	401.7923	406.6639	1.7696	1.8011	1.8437	1.8281	0.00000	0.00000	990.35	989.26	0.0255	0.0134	0.0110	-0.1822	-1.000000	F190101024706

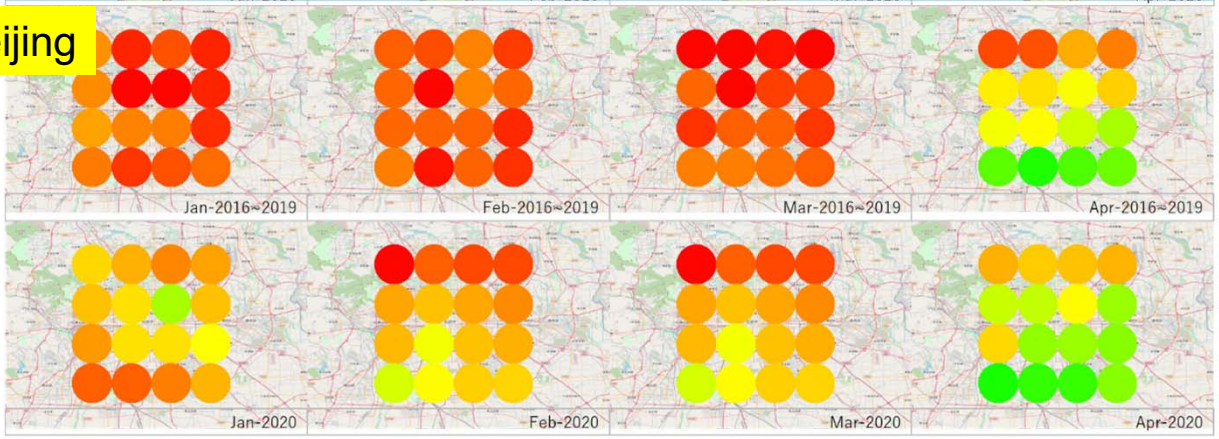
Past 4 years VS. 2020

Average monthly abundances of CO_2 in the lower troposphere

Tokyo

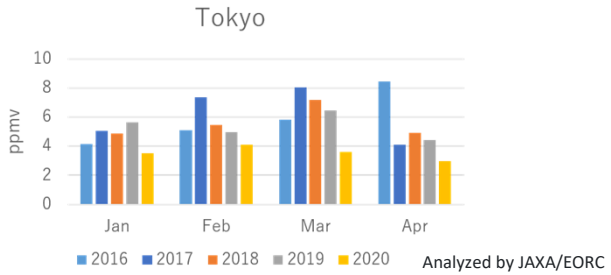


Beijing

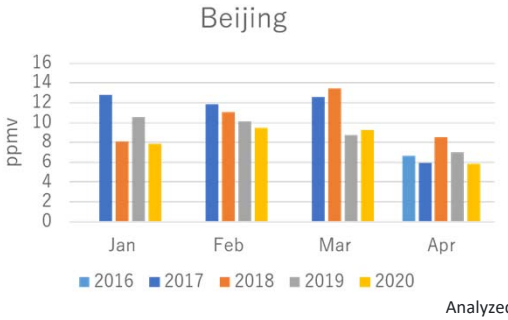


Analyzed by JAXA/EORC

The difference in CO_2 density in the upper and lower troposphere is smaller in 2020 (lower figures) compared to 2016-2019 (upper figures) in Tokyo and Beijing



Analyzed by JAXA/EORC



Analyzed by JAXA/EORC

CO_2 has accumulated in the atmosphere since the Industrial Revolution. We assume the average density of the upper troposphere is a background.

XCO_2 anomaly: $XCO_2(LT)$-$XCO_2(UT_{average})$, Partial column of lower troposphere (0-4 km)– Monthly-Area averaged upper troposphere (4-12 km)

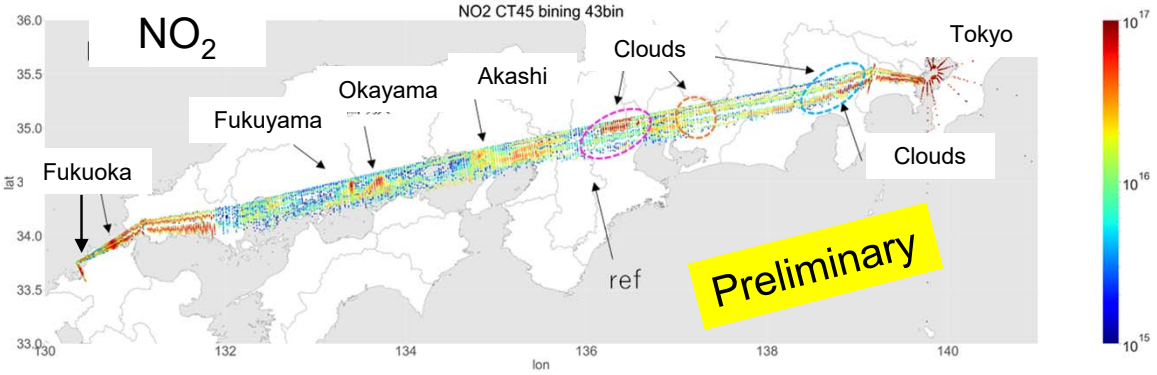
Jan. 18, 2021, Joint WS

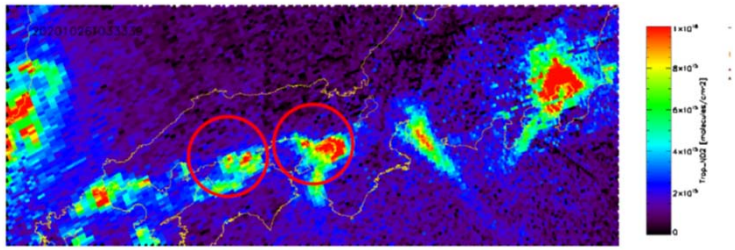
JAXA EORC will provide Delta CO_2 of more than 20 major megacities in the world

Toward COP-26 and the UNFCCC Global Stocktake

Identifying emission sources and polluted area

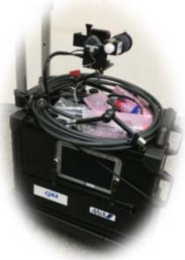
Simultanious measurements of NO_2, CO_2, CH_4, O_2A SIF using passenger aircrafts collaborating with ANA. Boeing 767 flight between Tokyo Haneda and Fukuoka-city





TROPOMI NO_2, Oct. 26, 2020

First flight on Oct. 26 from Tokyo Haneda to Fukuoka flew over **Tokyo Bay area, Nagoya , Osaka, Okayama, Hiroshima, Kita-Kyushu, and Fukuoka**
Most of the major mega cities in Japan were included.



Carry-on size

Set up before boarding

3 imaging spectrometers on cabin seats