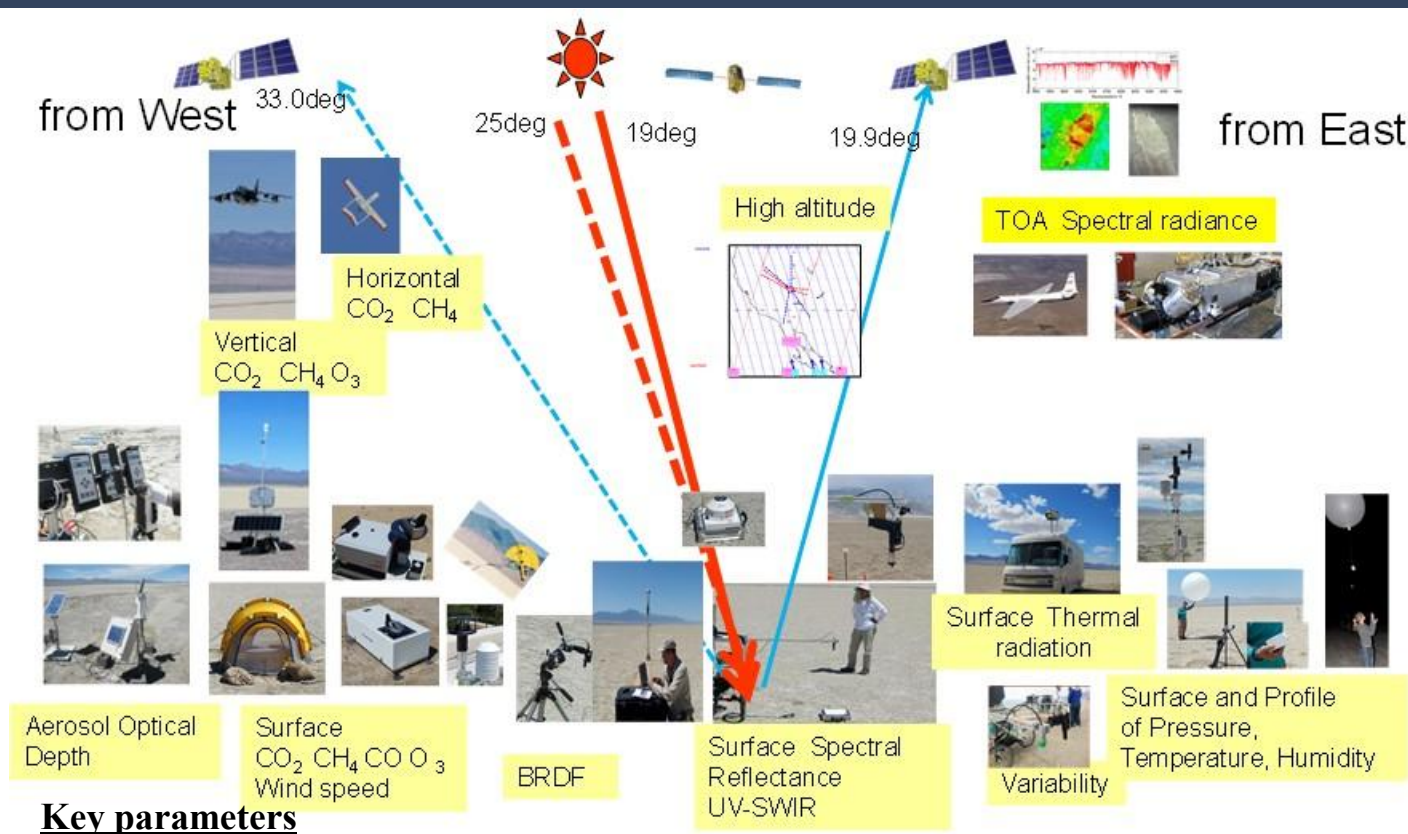


CEOS AC-VC 22 meeting

Vi-cal for SWIR/NIR
GHG&AQ sensors

Hiroshi Suto, JAXA
Agenda Item 4.4
AC-VC 22 Meeting
SRON Leiden
1-4 June, 2026

Railroad Valley (RRV) vicarious calibration for GHG and AQ

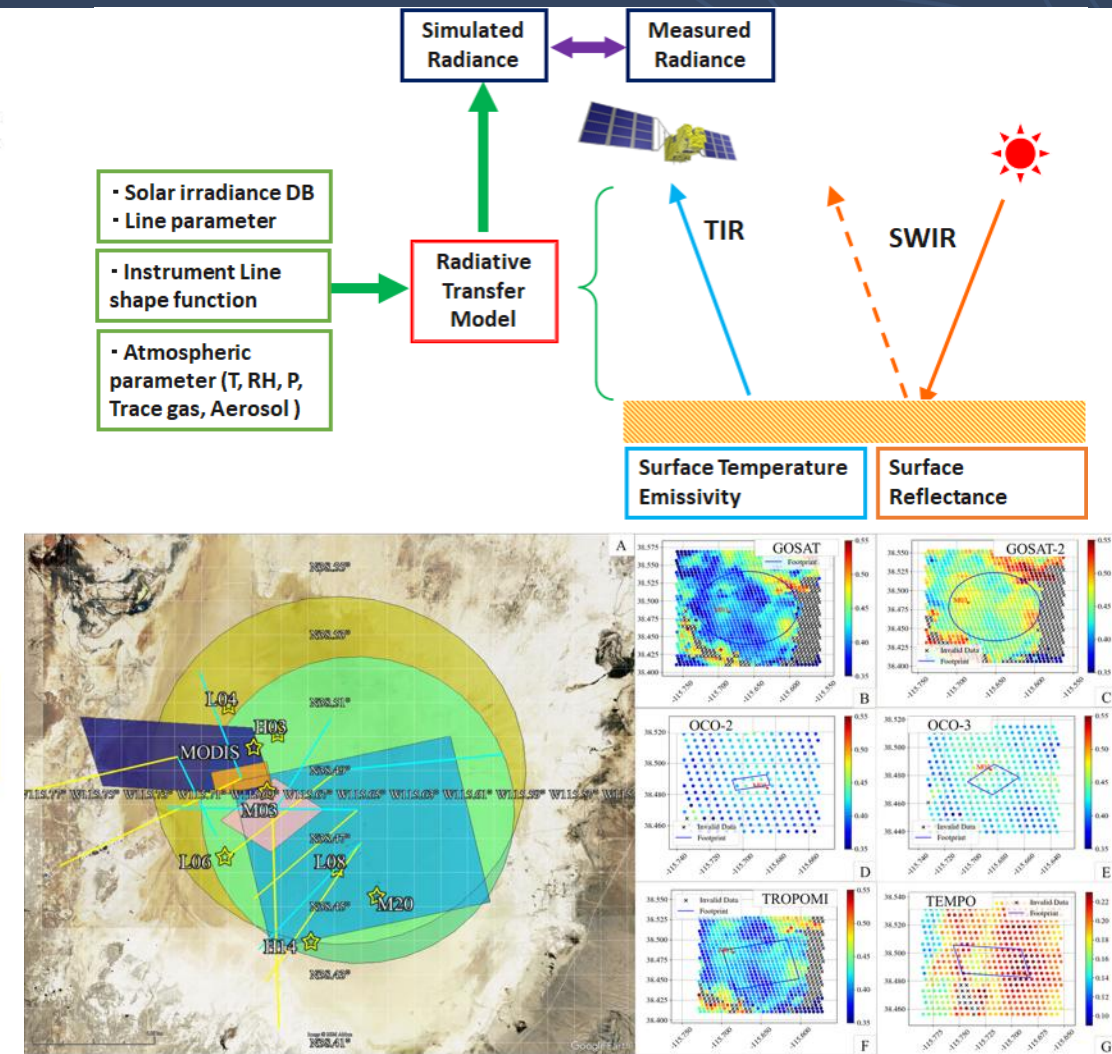


Key parameters

- (1) Surface reflectance inhomogeneity correction
- (2) Surface BRDF correction
- (3) Solar database
- (4) Atmospheric parameter

- International collaborations

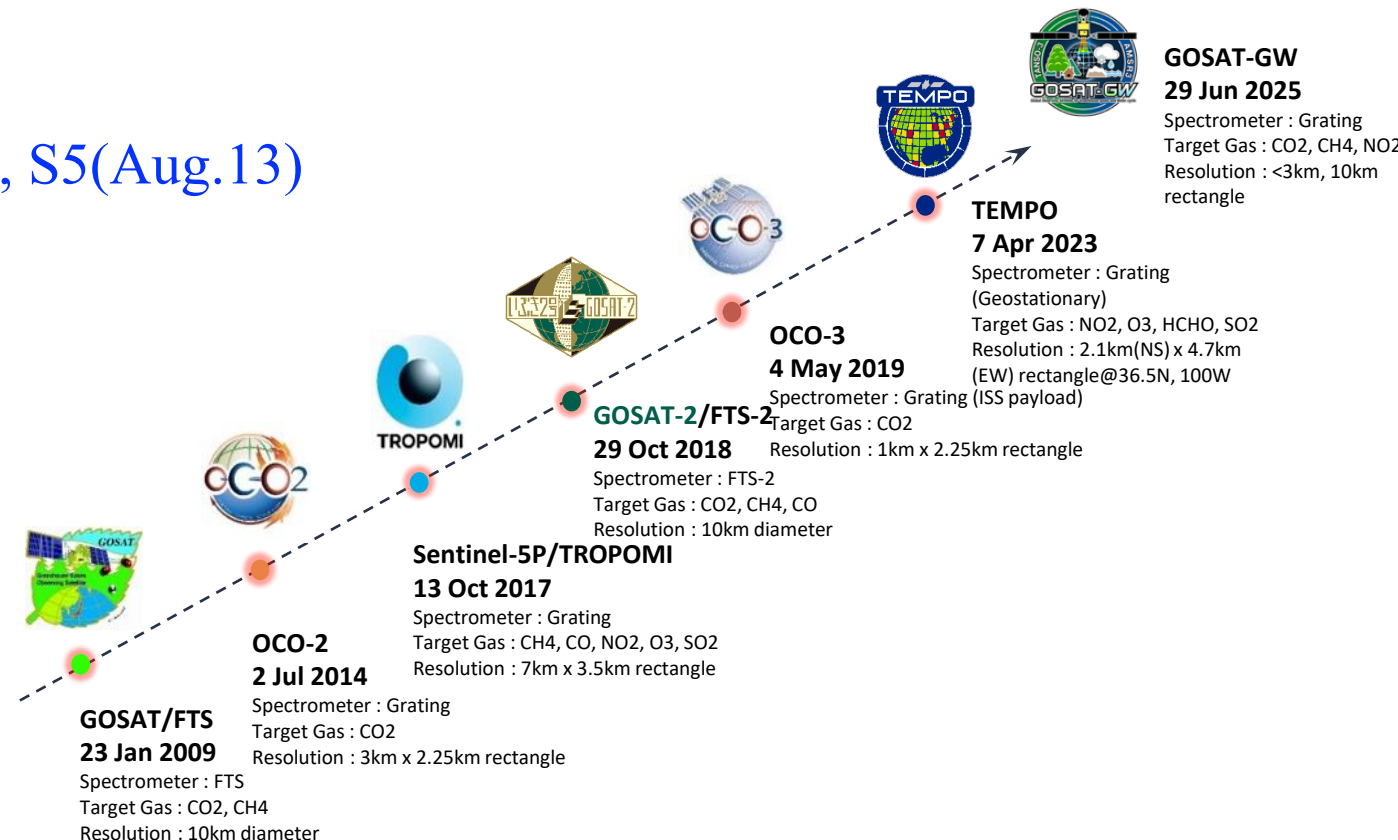
- Our team share the observation data and assessment results for spectral radiance.



Vi-cal. Campaign 2025

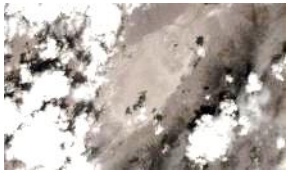


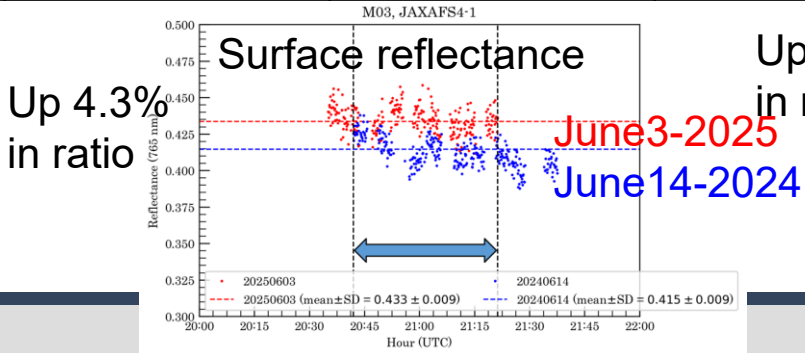
- In the 2025 Railroad Valley (RRV) campaign with JPL, 6 instruments joined **+2 (Fall)**.
(**GOSAT/OCO-2/OCO-3/TROPOMI/GOSAT-2/TEMPO +GOSAT-GW/MicroCARB**).
- 16 years of campaign data (mainly surface reflectance) were reprocessed with an improved processing algorithm
- Launched GW (Jun.29), MicroCARB(Jul.25), S5(Aug.13)
- **Plan for RRV2026**



Summary of RRV2025 summer campaign

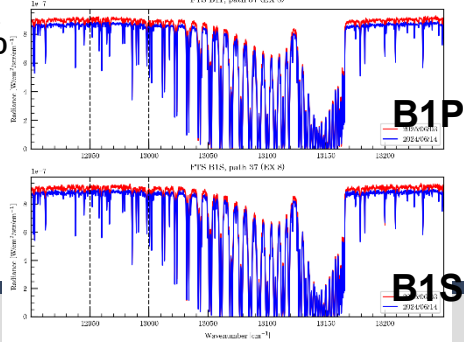


	30-May-25	31-May-25	1-Jun-25	2-Jun-25	3-Jun-25	4-Jun-25	5-Jun-25
OCO-2 path			138 (20:53UTC)		136 (20:40UTC)		
GOSAT path	36 (20:52UTC)	37 (21:24UTC)		36 (20:52UTC)	37 (21:24UTC)	No	36 (20:52UTC)
GOSAT-2 path	72 (20:54UTC)	73 (21:10UTC)	74 (21:26UTC)			No	72 (20:54UTC)
TROPOMI VZA[deg]	28deg	53.6deg	8.1deg	6.9deg	46.3deg	31.7deg	46.6deg
OCO-3			19:07UTC				17:35UTC
TEMPO		SPECICAL(21UTC)	SPECICAL(21UTC)	SPECICAL(21UTC)	SPECICAL(21UTC)		SPECICAL(21UTC)
GOSAT-1/-2 FOV camera 10km-FOV							
Weather	Clear sky (21UTC)	Clear sky (21UTC)	Clear-up just noon Partly cloudy (21UTC)	Clear sky (21UTC)	Clear sky (21UTC)		Cloudy (17:35UTC) Cloudy (21UTC)

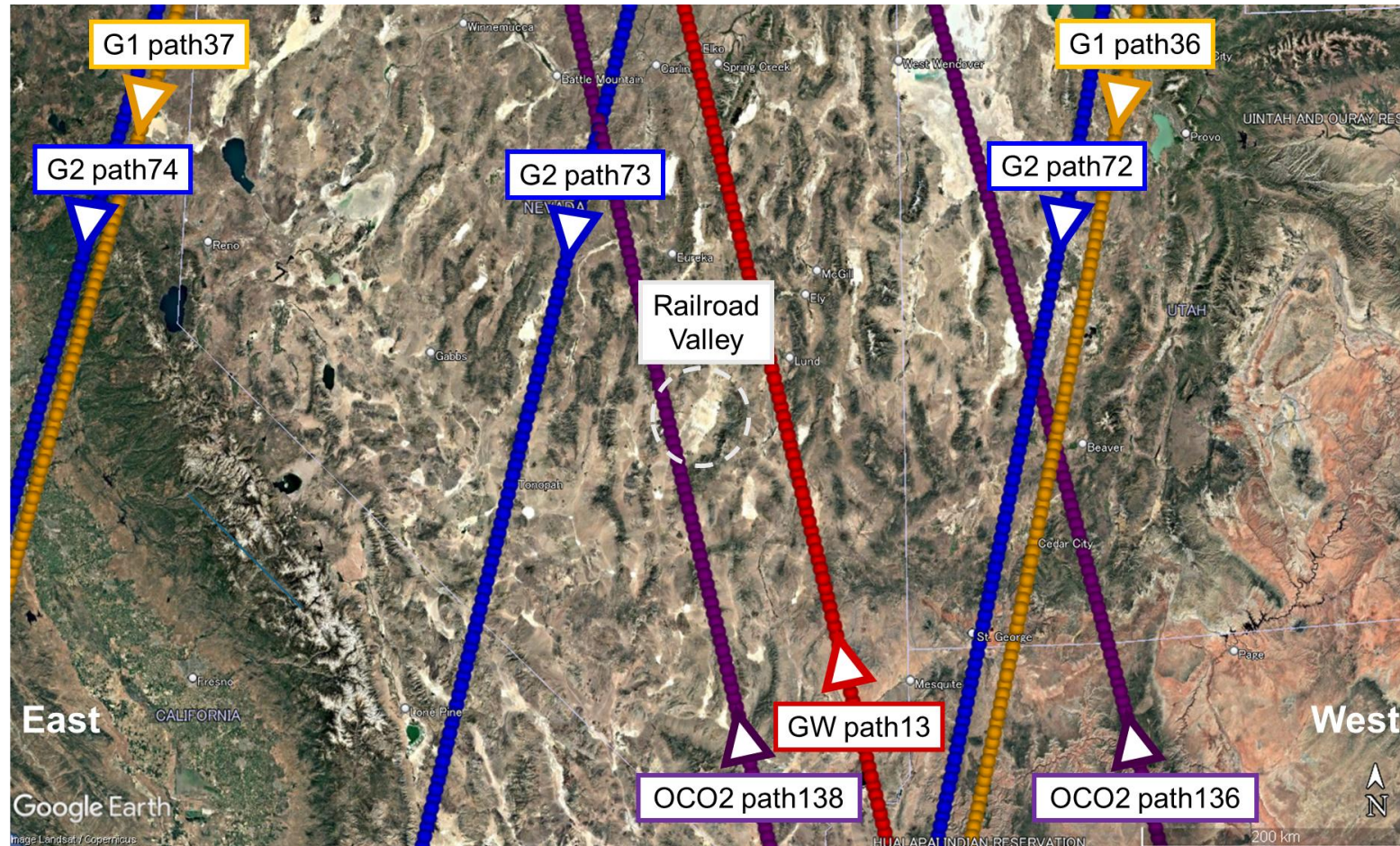


Up 3.9% in ratio

GOSAT Path37



Railroad Valley overpasses



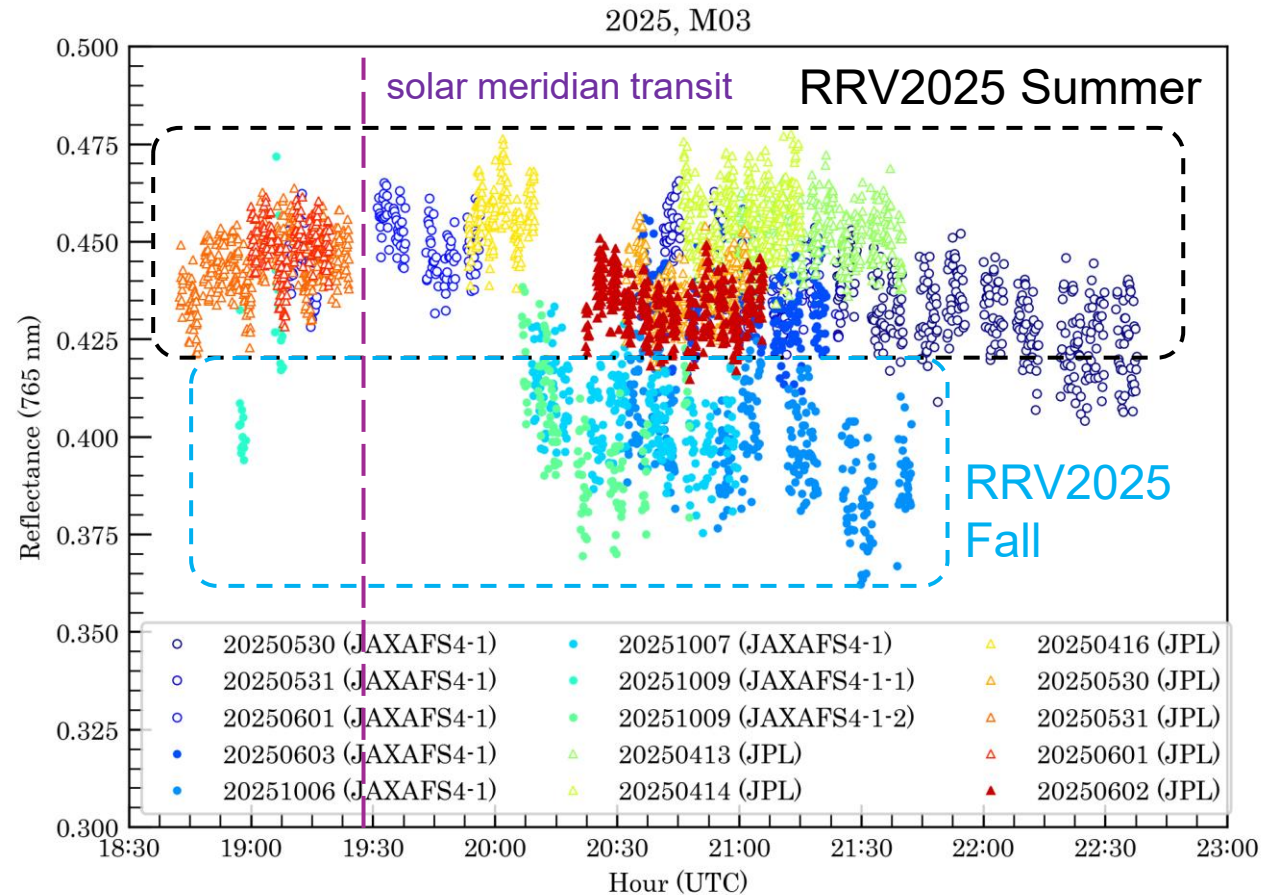
MicroCarb
~19UTC

OCO2 path136 ~	GW path13 >	OCO2 path138 >	G1 path36 >	G2 path72 >	G2 path73 >	G1 path37 >	G2 path74
20:41	20:38	20:53	20:51	20:53	21:09	21:24	21:25

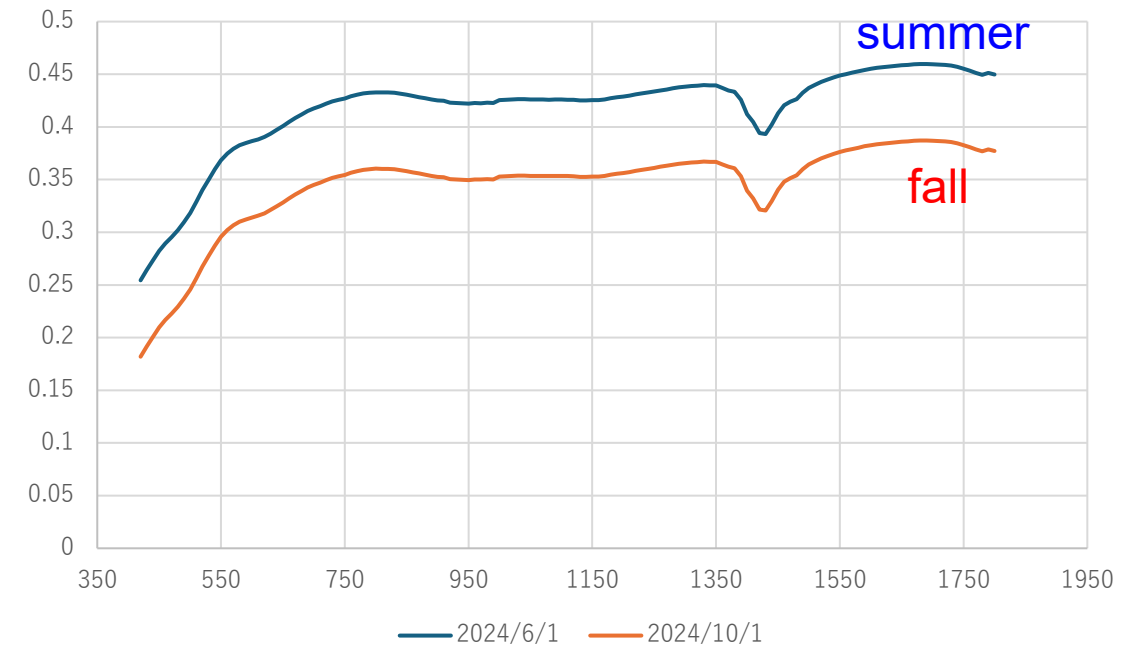
M03 surface reflectance in RRV 2025 Fall and Summer campaign



Surface reflectance time series (M03, 765nm)



RadCalNet reflectance (2024 season, UTC 21h)



Check RadCalNet and Lspec features in 2025

Update of Cal / Val portal



Vicarious Calibration Portal for Space-borne GHGs Sensors



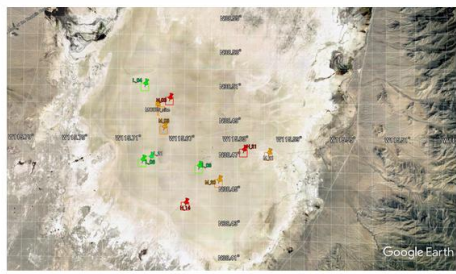
Campaign Data Surface reflectance (in-situ)

Surface nadir reflectance measured by ASD FieldSpec and Spectralon Panel Provided by Carol Bruegge, Jet Propulsion Laboratory

Data Link (V0)

Data Link (V1)

【ASD Site】



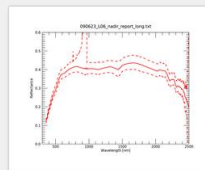
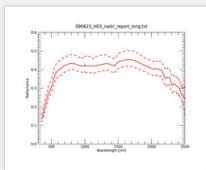
Site	centerLon[deg.]	centerLat[deg.]
H_03	-115.6812	38.5011
H_14	-115.6687	38.4399
M_03	-115.6852	38.4841
M_20	-115.6440	38.4532
L_04	-115.6997	38.5093
L_06	-115.7010	38.4648
L_08	-115.6588	38.4614
MODIS	-115.6902	38.4970

↑
PAGE TOP

【References】

Carol J. Bruegge, G. Thomas Arnold, Jeffrey Czapl-Myers, RoseAnne Dominguez, Mark C. Helmlinger, David R. Thompson, Jeannette Van den Bosch, and Brian N. Wenny. Vicarious Calibration of eMAS, AirMSPI, and AVIRIS Sensors During FIREX-AQ. Trans. Geosci. and Remote Sensing, Vol. 59(12), pp. 1-12, 2021. DOI: 10.1109/TGRS.2021.3066997, Print ISSN: 0196-2892, Online ISSN: 1558-0644

Version: V1 Year: 2009



The CEOS Cal/Val portal for GHG sensors operated by JAXA will be updated soon.

https://www.eorc.jaxa.jp/GOSAT/GHG_Vical/ghg_vical_surface_reflectance.html

New product: Version 1

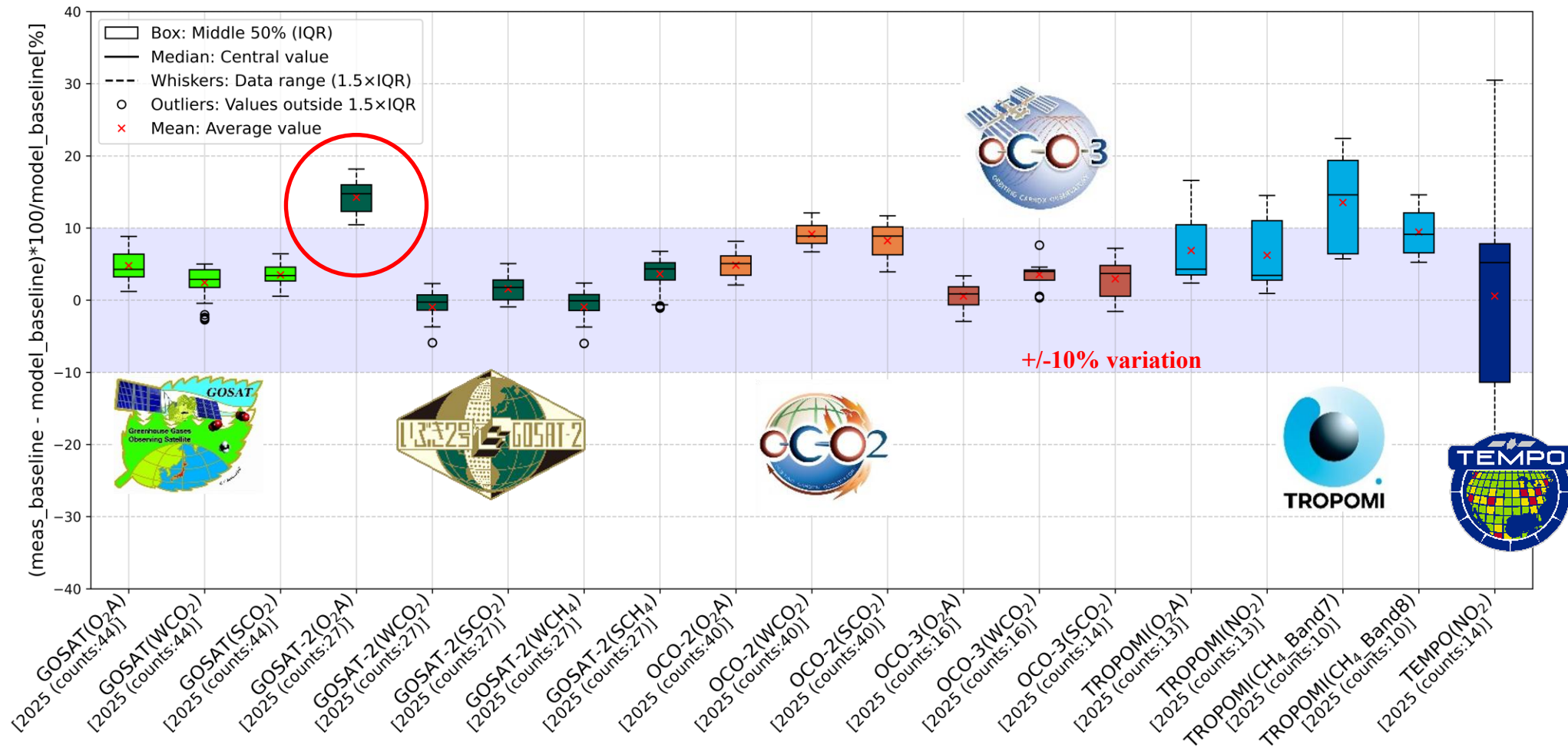
Thumbnail of Surface reflectance for each versions

Common processing by JAXA



Item	Using data	Note
Radiative Transfer Model	LIDORT v3.6 (*NASA/ACOS ' <i>RTRetrievalFramework</i> ' modified by JAXA.)	
Solar spectrum	TSIS-1 HSRS(TSIS-1 Hybrid Solar Reference Spectrum)	
Meteorological Data	NCEP North American Regional Reanalysis (NARR)	North America Only Coverage
Line Parameter	O ₂ A : ABSCO v5.2 H ₂ O : HITRAN2020 CO ₂ : ABSCO v5.2 or HITRAN2020 CH ₄ : HITRAN2020 CO : HITRAN2020 N ₂ O : HITRAN2020 NO ₂ : HITRAN2012 (Cross section) O ³ : MODTRAN-3 Cross Section Table Data	For XCO ₂ Processes : We use ABSCOv5.2 as a Line Parameter data, which is also used in OCO-2 L2 retrieval. For XCH ₄ Processes : We created Line Parameter data using HITRAN2020 data and ReFRACtor/ABSCO code. https://github.com/ReFRACtor/ABSCO * For H ₂ O, we use HITRAN2020 in the both process because of its high accuracy.
Gas A priori	O ₂ A : Fixed value (0.20935[mol/mol]) H ₂ O : Meteorological Data (NARR) CO ₂ : AJAX (long-term corrected VMR) CH ₄ : AJAX (long-term corrected VMR) CO : Corrected from a fixed value N ₂ O : Corrected from a fixed value NO ₂ : Corrected from a fixed value O ₃ : Corrected from a fixed value	▪ Included gases For XCO ₂ Processes : O ₂ A, H ₂ O, CO ₂ For XCH ₄ Processes : O ₂ A, H ₂ O, CO ₂ , CH ₄ , CO, N ₂ O ▪ AJAX is one of the RRV campaign project data measured in the past. ▪ CO, N₂O are used from gas profile data in the RtRetrievalFramework, with corrections for seasonal variation and long-term trends, etc.
Surface Reflectance	Reflectance in the nadir direction + MODIS BRDF(Ross-thick + Li-Sparse + Lambertian)	Reflectance in the nadir direction : Field measured data MODIS BRDF: MCD43A1 product is used
Aerosol	AOD@500[nm] from AERONET.	

Validation of multi-GHG satellite sensors using LIDORT (2025 Summer results)



The result indicates that GOSAT-2 band1 has large difference between observed radiance and forward cal.

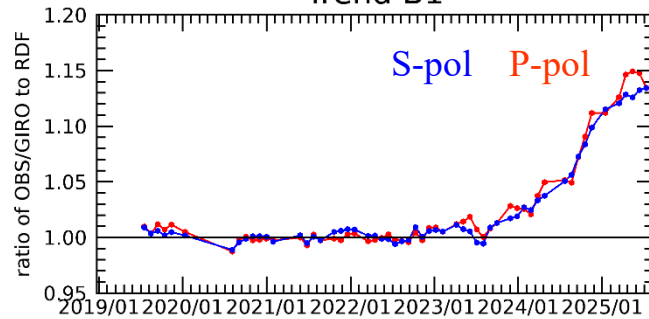
Ishida et al., to be submitted

Ex. Trend of spectral radiance for GOSAT-2

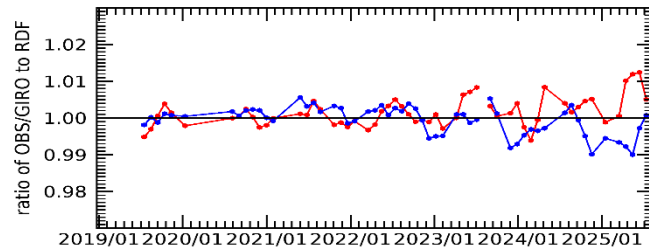
Will be presented by Shiomi-san on Thursday



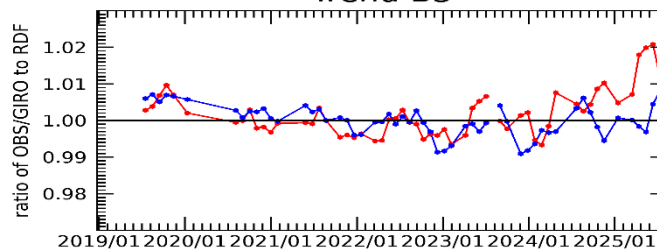
LunarCAL
monthly
Trend B1



Trend B2

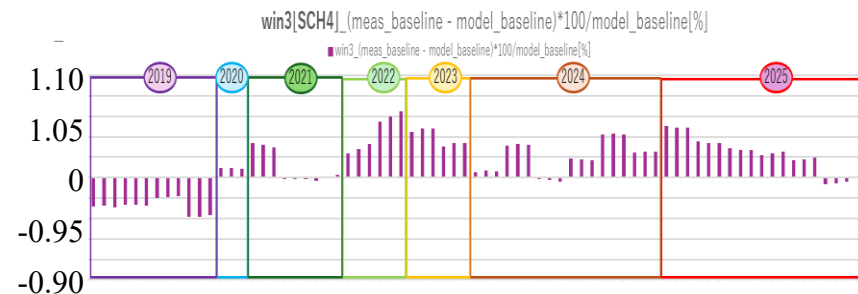
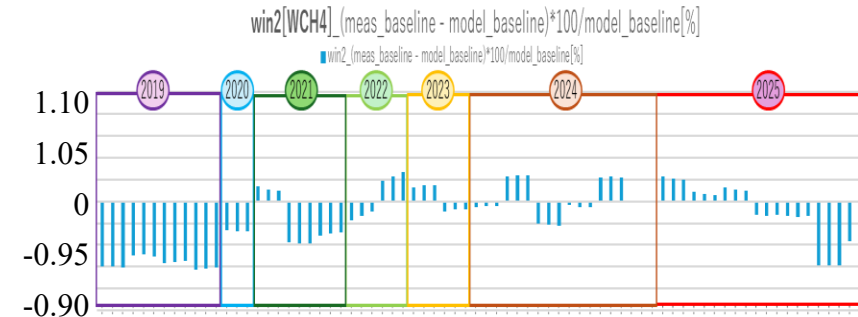
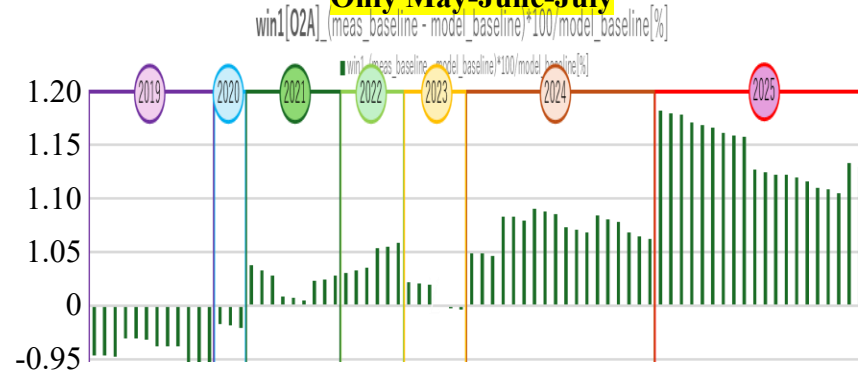


Trend B3

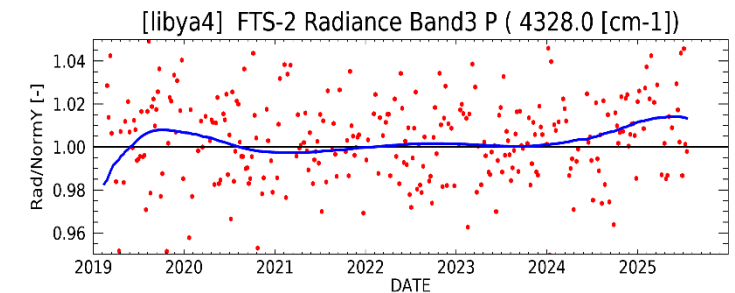
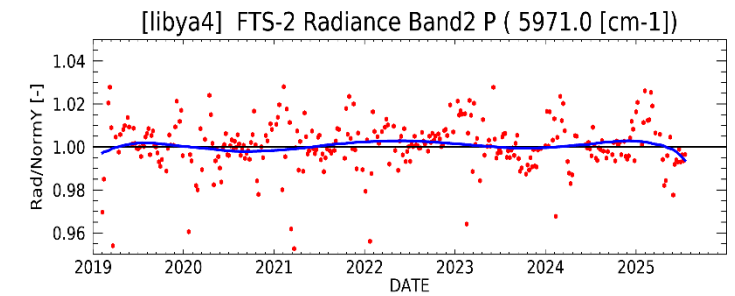
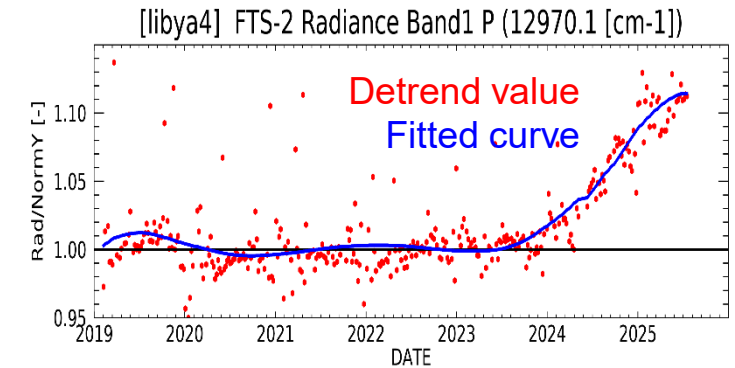


RRV ViCAL

Only May-June-July



Sahara desert
After detrend



Radiometric response change ratios to the current L1B RDF between 3 methods almost agree.

Plan for RRV2026 summer campaign



Tentative schedule

	Day from 01Jan2		OCO-2	OCO-2	GOSA T	GOSAT-2	GOSAT- GW	TROPOMI InstZA	OCO-3	
1-Jun-26	2344	Mon	15		37	73	13	4.1		Loading, Move to Tonopah
2-Jun-26	2345	Tue	16		no	74	no	28.0		① Gold+
3-Jun-26	2346	Wed	1		36	no	no	53.6		
4-Jun-26	2347	Thu	2	138	37	no	13	8.1		
5-Jun-26	2348	Fri	3		no	no	no	6.9		
6-Jun-26	2349	Sat	4	136	36	72	no	46.3		
7-Jun-26	2350	Sun	5		37	73	13	31.7		
8-Jun-26	2351	Mon	6		no	74	no	46.6		
9-Jun-26	2352	Tue	7		36	no	no	7.1		
10-Jun-26	2353	Wed	8		37	no	13	7.9		
11-Jun-26	2354	Thu	9	(139)	no	no	no	52.9		
12-Jun-26	2355	Fri	10		36	72	no	35.9		② Gold Silver+
13-Jun-26	2356	Sat	11	137	37	73	13	40.7		
14-Jun-26	2357	Sun	12		no	74	no	6.2		
15-Jun-26	2358	Mon	13		36	no	no	8.9		
16-Jun-26	2359	Tue	14		37	no	13	0.6		
17-Jun-26	2360	Wed	15		no	no	no	4.1		
18-Jun-26	2361	Thu	16		36	72	no	28.0		
19-Jun-26	2362	Fri	1		37	73	13	53.6		
20-Jun-26	2363	Sat	2	138	no	74	no	8.1		
21-Jun-26	2364	Sun	3		36	no	no	6.9		
22-Jun-26	2365	Mon	4	136	37	no	13	46.3		③ Gold+ Gold Silver
23-Jun-26	2366	Tue	5		no	no	no	31.7		
24-Jun-26	2367	Wed	6		36	72	no	46.6		
25-Jun-26	2368	Thu	7		37	73	13	7.1		
26-Jun-26	2369	Fri	8		no	74	no	7.9		
27-Jun-26	2370	Sat	9	(139)	36	no	no	52.9		
28-Jun-26	2371	Sun	10		37	no	13	35.9		

	Day from 01Jan2		OCO-2	OCO-2	GOSA T	GOSAT-2	GOSAT- GW	TROPOMI InstZA	OCO-3	
29-Jun-26	2372	Mon	11	137	no	no	no	40.7		
30-Jun-26	2373	Tue	12		36	72	no	6.2		
1-Jul-26	2374	Wed	13		37	73	13	8.9		Gold
2-Jul-26	2375	Thu	14		no	74	no	0.6		
3-Jul-26	2376	Fri	15		36	no	no	4.1		
4-Jul-26	2377	Sat	16		37	no	13	28.0		Holiday
5-Jul-26	2378	Sun	1		no	no	no	53.6		
6-Jul-26	2379	Mon	2	138	36	72	no	8.1		Gold+
7-Jul-26	2380	Tue	3		37	73	13	6.9		Gold
8-Jul-26	2381	Wed	4	136	no	74	no	46.3		Silver
9-Jul-26	2382	Thu	5		36	no	no	31.7		
10-Jul-26	2383	Fri	6		37	no	13	46.6		
11-Jul-26	2384	Sat	7		no	no	no	7.1		

- 3 plans for the RRV2026 summer campaign
- **Plan 2 is preferable close to summer solstice.**
- Flexible to shift 1 day later for the Caltech visit
- OCO-2: path138 and 136, G1: 4 overpasses, G2: 3 overpasses, GW: 2 overpasses, TROPOMI: close to nadir
- TEMPO special observation, MicroCarb: capable every 2 or 3 days (25-day revisit), Sentinel-5: every day (1-day revisit)