NIES-GOSAT2-SYS-20190129-056-09

NIES GOSAT-2
Product File Format Descriptions
(Product edition)

Vol.1

GOSAT-2 TANSO-CAI-2 L1B Product

November 2025

National Institute for Environmental Studies
GOSAT-2 Project

Revision History

Version	Revised	Page	Description
00	Feb. 2019	-	-
01	Mar. 2019	p.1, p.2	Fixed the definition of product version
02	May 2019	p.1	Added product version
03	Aug. 2019	p.1	Added product version
04	Sep. 2019	p.1	Added product version
		p.2	Fixed part of the file naming convention
05	Dec. 2019	p.1, p.3, p.5	Fixed the product name
		p.1	Added product version
			Fixed part of the product description
		p.2	Fixed part of the file naming convention
06	Aug. 2020	p.1	Added product version
		p.7	Renamed the following datasets • LineAttribute/preAmpTempQuality_FWD • LineAttribute/preAmpTempQuality_BWD
07	Apr. 2021	p.1	Changed product version
08	May 2022	p.1	Added product version
09	Nov. 2025	Entire	Modified document format (No revision line)
		p.1	Added product version
		p.2	Fixed part of the file naming convention
		p.3	Fixed part of Table 3-1
		p.9	Fixed “Description” of the following datasets • ImageGeometry/solarAzimuth_FWD • ImageGeometry/solarAzimuth_BWD

Table of Contents

1 Introduction

1.1 Purpose

The purpose of this document is to define the file format of GOSAT-2 TANSO-CAI-2 L1B Product which is one of the Greenhouse gases Observing SATellite-2 (hereinafter referred to as “GOSAT-2”) products generated by the National Institute for Environmental Studies, Japan.

1.2 Product and version

The product and its version described in this document are listed in Table 1-1.

Table 1-1 Product and version

Product name	Product version
GOSAT-2 TANSO-CAI-2 L1B Product	03.12 03.13 03.20

09

2 GOSAT-2 TANSO-CAI-2 L1B Product

(1) Product description

GOSAT-2 TANSO-CAI-2 L1B Product contains spectral radiance data per pixel converted from sensor outputs stored as digital values in TANSO-CAI-2 L1A Product. Band-to-band registration of each forward- and backward-viewing band is applied to this product. In addition, ortho-correction is performed to observation location data based on an earth ellipsoid model, which are decimated and stored in TANSO-CAI-2 L1A Product, using digital elevation model data to put information of observation location with regard to elevation to all pixels.

(2) Main contents

Spectral radiance

(3) Category

Standard

(4) Unit

CAI-2 frame*

* Forward-viewing bands (Band 1-5) data and backward-viewing bands (Band 6-10) data are stored in the same file.

(5) Format

HDF5

(6) File naming convention

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
G	O	S	A	T	2	T	C	A	I	2	Y	Y	Y	Y	M	M	D	D	H	H	m	m	P	P	P	F	F	F	_	1	B	C	C	L	1	B	V	M	M	N	N	R	R	o	o	o	o	.	h	5

GOSAT2: Satellite name (Fixed)

TCAI2: Sensor name (Fixed)

YYYYMMDDHHmm: Start date of observation* (Year, Month, Day, Hour, minute) (UTC) | 09

* In principle, it is observation time of the first line without margin in forward-viewing frame. If there is no forward-viewing frame, it is observation time of the first line without margin in backward-viewing frame.

PPP: Path number (001-089)

FFF: Frame number (001-036)

1B: Processing level (Fixed)

C: Band (Fixed), not distinguished with forward- and backward-viewing | 09

CL1B: Product code (Fixed)

V: Processing identifier (V: Steady, T: Test), added as necessary

MMNN: Product version (MM: Major version, NN: Minor version)

RR: Revision

oooo: Input data version

h5: Extension (Fixed) | 09

(7) File size

Approx. 641 MB

3 File format

3.1 Dataset structure

The dataset structure of the product is shown in Table 3-1.

Table 3-1 Dataset structure of GOSAT-2 TANSO-CAI-2 L1B Product

No.	Group	Outline	
1	Metadata	The following items are mainly included to describe overview of the product. • Processing date • Start/End date • Sensor name • Processing level • Algorithm researcher	
2	FrameAttribute	The following items are mainly included to provide information related to the observation. • Number of bands • Number of lines • Number of pixels • Frame edge latitude/longitude • Missing pixels rate	
3	LineAttribute	The following items are mainly included to provide information related to the observation. • Observation time • Sensor gain • Missing flag • Quality flag	
4	ImageData_FWD	The following items are mainly included to provide information related to the observation. • Calibrated radiance of Band 1-5 • Saturation flag	09
5	ImageData_BWD	The following items are mainly included to provide information related to the observation. • Calibrated radiance of Band 6-10 • Saturation flag	09
6	ImageGeometry	The following items are mainly included to provide information related to the observation. • Sunglint angle • Geodetic latitude/longitude/height • Satellite zenith/azimuth angle • Solar zenith/azimuth angle	
7	ForwardBackwardCollocation	The following items are mainly included to provide information related to the observation. • Pixel/Line number index (BWD) • Pixel/Line number index (FWD)	
8	SatelliteGeometry	The following items are mainly included to provide information related to the observation. • Satellite position/velocity/attitude	
9	SolarGeometry	The following items are mainly included to provide information related to the observation. • Solar position/velocity	

The special mention about “Group” above is shown as follows:

- FrameAttribute
  There is an overlap with the adjacent frames as margin, which has a certain number of lines (Figure 3-1). Therefore, it is necessary to consider these overlaps when handling several continuous frames.
  These overlaps can be avoided by using frameLineMargin_FWD or frameLineMargin_BWD under FrameAttribute. In addition, the number of contained lines between forward- and backward-viewing bands are different.

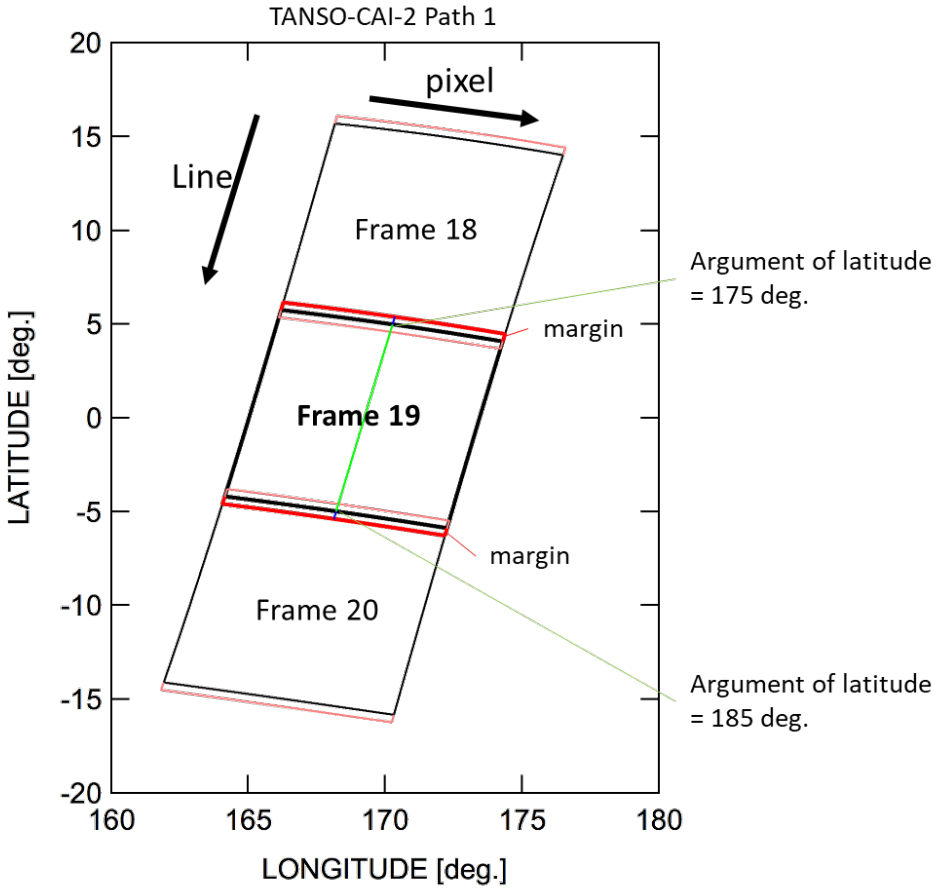

Figure 3-1 Image of margin between adjacent frames

- LineAttribute
  Since frame division and margin provision are processed according to observation data of TANSO-CAI-2 L1A Product, overlaps between adjacent frames can be avoided by using index_L1A_FWD or index_L1A_BWD under LineAttribute when handling several continuous frames. In addition, the observation time between forward- and backward-viewing bands are different since each frame is divided according to the argument of latitude at an observation point.

- ForwardBackwardCollocation
  Since the frames are divided according to the argument of latitude at the center pixel of each line, several locations of observation points at corners of each line are different (blue circle in Figure 3-2) between forward-viewing bands (shown as red frame in Figure 3-2) and backward-viewing bands (shown as black frame in Figure 3-2).
  Each pixel between forward- and backward-viewing bands can be corresponded by using datasets under ForwardBackwardCollocation. The pixel/line number of each pixel in backward-viewing bands which corresponds to a pixel in forward-viewing bands is stored in index_BWD_pixel/index_BWD_line, and the pixel/line number of forward-viewing bands which corresponds to a pixel in backward-viewing bands is stored in index_FWD_pixel/index_FWD_line.

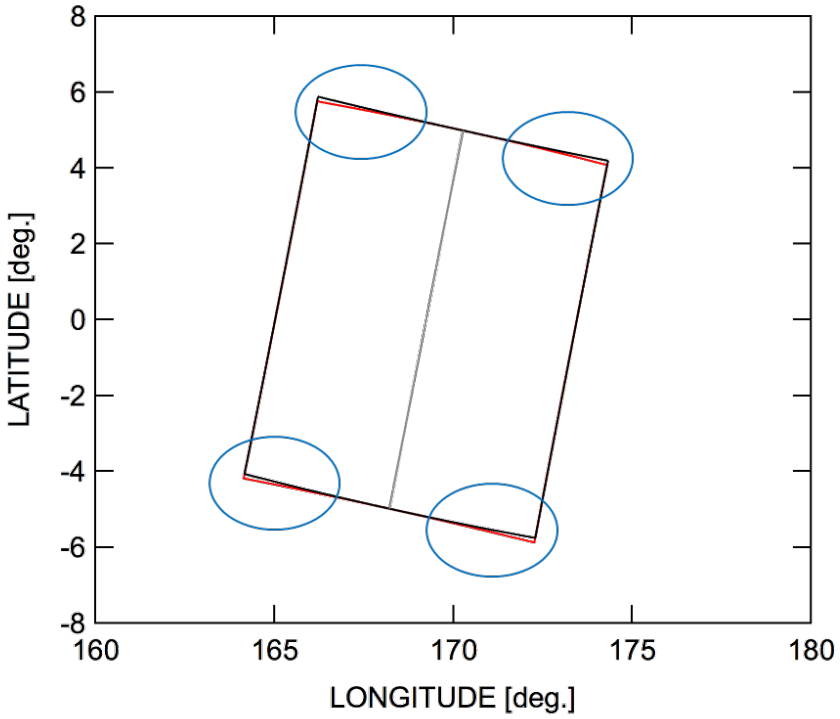

Figure 3-2 Image of observation points for forward- and backward-viewing bands

3.2 File format details

The file format details of the product are shown in Table 3-2.

Table 3-2 File format deteils of GOSAT-2 TANSO-CAI-2 L1B Product (1/4)

Group	Group / Dataset	Dataspace		Datatype	Dataset name	Attribute			
		Rank	Size			Unit	Valid range	Invalid value	Description
G	Metadata								
	fileID	1	1	H5T_STRING	File identifier	(none)	(none)	(none)	file identifier of the product
	operationMode	1	1	H5T_STRING	Operation mode	(none)	(none)	(none)	operation mode: "OBSM" - Observation Mode (day)
	processingDate	1	1	H5T_STRING	Processing date	UTC	(none)	(none)	date of product creation (UTC): Time format is "YYYY-MM-DDThh:mm:ss.ffffffZ".
	startDate_FWD	1	1	H5T_STRING	Start date (FWD)	UTC	(none)	"-"	start date of frame of forward viewing band (UTC): Time format is "YYYY-MM-DDThh:mm:ss.ffffffZ".
	startDate_BWD	1	1	H5T_STRING	Start date (BWD)	UTC	(none)	"-"	start date of frame of backward viewing band (UTC): Time format is "YYYY-MM-DDThh:mm:ss.ffffffZ".
	endDate_FWD	1	1	H5T_STRING	End date (FWD)	UTC	(none)	"-"	end date of frame of forward viewing band (UTC): Time format is "YYYY-MM-DDThh:mm:ss.ffffffZ".
	endDate_BWD	1	1	H5T_STRING	End date (BWD)	UTC	(none)	"-"	end date of frame of backward viewing band (UTC): Time format is "YYYY-MM-DDThh:mm:ss.ffffffZ".
	geodeticDatum	1	1	H5T_STRING	Geodetic datum	(none)	(none)	(none)	reference ellipsoid model/frame of reference: "WGS84/WGS84" (Fixed)
	satelliteName	1	1	H5T_STRING	Satellite name	(none)	(none)	(none)	satellite name: "GOSAT-2" - Greenhouse gases Observing SATellite-2 (Fixed)
	sensorName	1	1	H5T_STRING	Sensor name	(none)	(none)	(none)	sensor name: "TANSO-CAI-2" - Cloud and Aerosol Imager-2 (Fixed)
	processingLevel	1	1	H5T_STRING	Processing level	(none)	(none)	(none)	processing level: "L1B" - Level 1B (Fixed)
	algorithmName	1	1	H5T_STRING	Algorithm name	(none)	(none)	(none)	algorithm name: "TANSO-CAI-2_L1B" (Fixed)
	algorithmVersion	1	1	H5T_STRING	Algorithm version	(none)	(none)	(none)	algorithm version is stored
	productVersion	1	1	H5T_STRING	Product version	(none)	(none)	(none)	product version is stored
	inputDataVersion	1	1	H5T_STRING	Input data version	(none)	(none)	(none)	version of input data list is stored
	processingFacility	1	1	H5T_STRING	Processing facility	(none)	(none)	(none)	processing facility name: "G2DPS" - GOSAT-2 Data Processing System (Fixed)
	contact_01	1	1	H5T_STRING	Organization name 01	(none)	(none)	(none)	organization name: "Japan Aerospace Exploration Agency (JAXA)" (Fixed)
	contact_02	1	1	H5T_STRING	Organization name 02	(none)	(none)	(none)	organization name: "National Institute for Environmental Studies (NIES)" (Fixed)
	contact_03	1	1	H5T_STRING	Algorithm researcher	(none)	(none)	(none)	researcher
	e-mail	1	1	H5T_STRING	E-mail address	(none)	(none)	(none)	e-mail address
G	FrameAttribute								
	numBand_FWD	1	1	H5T_STD_I32LE	Number of bands (FWD)	(none)	(none)	(none)	number of forward viewing bands "5" (Fixed)
	numBand_BWD	1	1	H5T_STD_I32LE	Number of bands (BWD)	(none)	(none)	(none)	number of backward viewing bands "5" (Fixed)
	numLine_FWD	1	1	H5T_STD_I32LE	Number of lines (FWD) *	(none)	(none)	(none)	number of lines of forward viewing band
	numLine_BWD	1	1	H5T_STD_I32LE	Number of lines (BWD) *	(none)	(none)	(none)	number of lines of backward viewing band
	numPixel_FWD	1	1	H5T_STD_I32LE	Number of pixels (FWD)	(none)	(none)	(none)	number of pixels per line of forward viewing band "2048" (Fixed)
	numPixel_BWD	1	1	H5T_STD_I32LE	Number of pixels (BWD)	(none)	(none)	(none)	number of pixels per line of backward viewing band "2048" (Fixed)
	frameEdgeLatitude_FWD	1	4	H5T_IEEE_F32LE	Frame edge latitude (FWD)	deg	-90.0, 90.0	-9999.0	geodetic latitude of four corners of the frame of forward viewing band starting at the upper left and proceeding clockwise: -90 <= frameEdgeLatitude_FWD <= 90
	frameEdgeLatitude_BWD	1	4	H5T_IEEE_F32LE	Frame edge latitude (BWD)	deg	-90.0, 90.0	-9999.0	geodetic latitude of four corners of the frame of backward viewing band starting at the upper left and proceeding clockwise: -90 <= frameEdgeLatitude_BWD <= 90
	frameEdgeLongitude_FWD	1	4	H5T_IEEE_F32LE	Frame edge longitude (FWD)	deg	-180.0, 180.0	-9999.0	geodetic longitude of four corners of the frame of forward viewing band starting at the upper left and proceeding clockwise: -180 < frameEdgeLongitude_FWD <= 180
	frameEdgeLongitude_BWD	1	4	H5T_IEEE_F32LE	Frame edge longitude (BWD)	deg	-180.0, 180.0	-9999.0	geodetic longitude of four corners of the frame of backward viewing band starting at the upper left and proceeding clockwise: -180 < frameEdgeLongitude_BWD <= 180
	missingPixelRate_FWD	1	numBand_FWD	H5T_IEEE_F32LE	Missing pixels rate (FWD)	(none)	0.0, 1.0	-9999.0	ratio of missing pixels to all pixels in one frame of forward viewing band
	missingPixelRate_BWD	1	numBand_BWD	H5T_IEEE_F32LE	Missing pixels rate (BWD)	(none)	0.0, 1.0	-9999.0	ratio of missing pixels to all pixels in one frame of backward viewing band
	frameLineMargin_FWD	1	2	H5T_STD_I32LE	Number of margin lines (FWD)	(none)	(none)	(none)	number of margin lines of forward viewing band: overlapped with the prior-frame and the post-frame in order
	frameLineMargin_BWD	1	2	H5T_STD_I32LE	Number of margin lines (BWD)	(none)	(none)	(none)	number of margin lines of backward viewing band: overlapped with the prior-frame and the post-frame in order
G	LineAttribute								
	observationTime_FWD	1	numLine_FWD	H5T_STRING	Observation time (FWD)	UTC	(none)	(none)	observation time UTC for each line at the center of integration time of the reference band of forward viewing band (YYYY-MM-DDThh:mm:ss.ffffffZ)
	observationTime_BWD	1	numLine_BWD	H5T_STRING	Observation time (BWD)	UTC	(none)	(none)	observation time UTC for each line at the center of integration time of the reference band of backward viewing band (YYYY-MM-DDThh:mm:ss.ffffffZ)
	sensorGain_FWD	2	numLine_FWD, numBand_FWD	H5T_STD_I8LE	Sensor gain (FWD)	(none)	(none)	(none)	sensor gain of pre-amplifier for the center pixel of each line and each forward viewing band

Table 3-2 File format deteils of GOSAT-2 TANSO-CAI-2 L1B Product (2/4)

Group	Group / Dataset	Dataspace		Datatype	Dataset name	Attribute			
		Rank	Size			Unit	Valid range	Invalid value	Description
	sensorGain_BWD	2	numLine_BWD, numBand_BWD	H5T_STD_I8LE	Sensor gain (BWD)	(none)	(none)	(none)	sensor gain of pre-amplifier for the center pixel of each line and each backward viewing band
	integrationNum_FWD	2	numLine_FWD, numBand_FWD	H5T_STD_I32LE	Integration number (FWD)	(none)	(none)	(none)	integration number (0 to 31) denoting integration time for the center pixel of each line and each forward viewing band
	integrationNum_BWD	2	numLine_BWD, numBand_BWD	H5T_STD_I32LE	Integration number (BWD)	(none)	(none)	(none)	integration number (0 to 31) denoting integration time for the center pixel of each line and each backward viewing band
	missingFlag_FWD	2	numLine_FWD, numBand_FWD	H5T_STD_I8LE	Missing flag (FWD)	(none)	0, 1	2	missing data in line of forward viewing band: 0 - No missing pixels, 1 - Missing pixel exists
	missingFlag_BWD	2	numLine_BWD, numBand_BWD	H5T_STD_I8LE	Missing flag (BWD)	(none)	0, 1	2	missing data in line of backward viewing band: 0 - No missing pixels, 1 - Missing pixel exists
	sensorTempQuality_FWD	2	numLine_FWD, numBand_FWD	H5T_STD_I8LE	Quality flag of sensor temperature (FWD)	(none)	0, 1	2	quality flag of sensor temperature for the center pixel of each line and each forward viewing band: 0 - Good, 1 - No good (invalid range)
	sensorTempQuality_BWD	2	numLine_BWD, numBand_BWD	H5T_STD_I8LE	Quality flag of sensor temperature (BWD)	(none)	0, 1	2	quality flag of sensor temperature for the center pixel of each line and each backward viewing band: 0 - Good, 1 - No good (invalid range)
	preAmpTempQuality_FWD	2	numLine_FWD, numBand_FWD	H5T_STD_I8LE	Quality flag of pre-amplifier temperature (FWD)	(none)	0, 1	2	quality flag of pre-amplifier temperature for the center pixel of each line and each forward viewing band: 0 - Good, 1 - No good (invalid range)
	preAmpTempQuality_BWD	2	numLine_BWD, numBand_BWD	H5T_STD_I8LE	Quality flag of pre-amplifier temperature (BWD)	(none)	0, 1	2	quality flag of pre-amplifier temperature for the center pixel of each line and each backward viewing band: 0 - Good, 1 - No good (invalid range)
	AmpTempQuality_FWD	2	numLine_FWD, numBand_FWD	H5T_STD_I8LE	Quality flag of output amplifier temperature (FWD)	(none)	0, 1	2	quality flag of output amplifier temperature for the center pixel of each line and each forward viewing band: 0 - Good, 1 - No good (invalid range)
	AmpTempQuality_BWD	2	numLine_BWD, numBand_BWD	H5T_STD_I8LE	Quality flag of output amplifier temperature (BWD)	(none)	0, 1	2	quality flag of output amplifier temperature for the center pixel of each line and each backward viewing band: 0 - Good, 1 - No good (invalid range)
	yawSteeringOperation_FWD	1	numLine_FWD	H5T_STD_I8LE	Yaw steering operation (FWD)	(none)	0, 1	2	yaw steering operation of the satellite for each line of forward viewing band: 0 - Yaw steering Off, 1 - Yaw steering On
	yawSteeringOperation_BWD	1	numLine_BWD	H5T_STD_I8LE	Yaw steering operation (BWD)	(none)	0, 1	2	yaw steering operation of the satellite for each line of backward viewing band: 0 - Yaw steering Off, 1 - Yaw steering On
	satAttInterpolationQualityFlag_FWD	1	numLine_FWD	H5T_STD_I8LE	Quality flag of satellite attitude interpolation (FWD)	(none)	0, 1	2	quality flag of satellite attitude interpolation for each line of forward viewing band: 0 - Good (Interval of source data is fine resolution.), 1 - Poor (Interval of source data is coarse
	satAttInterpolationQualityFlag_BWD	1	numLine_BWD	H5T_STD_I8LE	Quality flag of satellite attitude interpolation (BWD)	(none)	0, 1	2	quality flag of satellite attitude interpolation for each line of backward viewing band: 0 - Good (Interval of source data is fine resolution.), 1 - Poor (Interval of source data is coarse
	argumentLatitudeLOS_FWD	1	numLine_FWD	H5T_IEEE_F32LE	Argument of latitude at the observation point (FWD)	deg	0.0, 360.0	-9999.0	argument of latitude at the observation point for the center pixel of each line of forward viewing band by the projection of line of sight onto the Earth
	argumentLatitudeLOS_BWD	1	numLine_BWD	H5T_IEEE_F32LE	Argument of latitude at the observation point (BWD)	deg	0.0, 360.0	-9999.0	argument of latitude at the observation point for the center pixel of each line of backward viewing band by the projection of line of sight onto the Earth
	argumentLatitudeSubSat_FWD	1	numLine_FWD	H5T_IEEE_F32LE	Argument of latitude at the sub-satellite point (FWD)	deg	0.0, 360.0	-9999.0	argument of latitude at the sub-satellite point for each line of forward viewing band
	argumentLatitudeSubSat_BWD	1	numLine_BWD	H5T_IEEE_F32LE	Argument of latitude at the sub-satellite point (BWD)	deg	0.0, 360.0	-9999.0	argument of latitude at the sub-satellite point for each line of backward viewing band
	index_L1A_FWD	1	numLine_FWD	H5T_STD_I32LE	Index L1A (FWD)	(none)	(none)	-999	line number in the CAI-2 L1A file (hemispherical strip) corresponding to this L1B file (frame) for the reference of forward viewing band
	index_L1A_BWD	1	numLine_BWD	H5T_STD_I32LE	Index L1A (BWD)	(none)	(none)	-999	line number in the CAI-2 L1A file (hemispherical strip) corresponding to this L1B file (frame) for the reference of backward viewing band
G	ImageData_FWD								
	band01	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Calibrated radiance of Band 1	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 1 after registration to the reference band by the nearest neighbor method
	band02	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Calibrated radiance of Band 2	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 2 after registration to the reference band by the nearest neighbor method
	band03	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Calibrated radiance of Band 3	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 3 after registration to the reference band by the nearest neighbor method
	band04	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Calibrated radiance of Band 4	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 4 after registration to the reference band by the nearest neighbor method
	band05	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Calibrated radiance of Band 5	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 5 after registration to the reference band by the nearest neighbor method

Table 3-2 File format deteils of GOSAT-2 TANSO-CAI-2 L1B Product (3/4)

Group	Group / Dataset	Dataspace		Datatype	Dataset name	Attribute			
		Rank	Size			Unit	Valid range	Invalid value	Description
	saturationFlag_FWD	2	numLine_FWD, numPixel_FWD	H5T_STD_U8LE	Saturation flag (FWD)	(none)	(none)	(none)	bit flags indicating the saturation in each forward viewing band: Bit7 = Band 1, Bit6 = Band 2, Bit5 = Band 3, Bit4 = Band 4, and Bit3 = Band 5 (Bit2 to Bit0 are not used). 0 - Good (No Saturation), 1 - No good (Saturation)
G	ImageData_BWD								
	band06	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Calibrated radiance of Band 6	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 6 after registration to the reference band by the nearest neighbor method
	band07	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Calibrated radiance of Band 7	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 7 after registration to the reference band by the nearest neighbor method
	band08	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Calibrated radiance of Band 8	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 8 after registration to the reference band by the nearest neighbor method
	band09	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Calibrated radiance of Band 9	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 9 after registration to the reference band by the nearest neighbor method
	band10	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Calibrated radiance of Band 10	W/m^2/micron/sr	0.0 or more	less than 0.0	calibrated radiance of Band 10 after registration to the reference band by the nearest neighbor method
	saturationFlag_BWD	2	numLine_BWD, numPixel_BWD	H5T_STD_U8LE	Saturation flag (BWD)	(none)	(none)	(none)	bit flags indicating the saturation in each backward viewing band: Bit7 = Band 6, Bit6 = Band 7, Bit5 = Band 8, Bit4 = Band 9, and Bit3 = Band 10 (Bit2 to Bit0 are not used). 0 - Good (No Saturation), 1 - No good (Saturation)
G	ImageGeometry								
	glintAngle_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Sunglint angle (FWD)	deg	0.0, 180.0	-9999.0	the angle of forward viewing band between specular solar reflection vector and satellite vector at the observation footprint: 0 <= glintAngle_FWD <= 180
	glintAngle_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Sunglint angle (BWD)	deg	0.0, 180.0	-9999.0	the angle of backward viewing band between specular solar reflection vector and satellite vector at the observation footprint: 0 <= glintAngle_BWD <= 180
	latitude_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Geodetic latitude (FWD)	deg	-90.0, 90.0	-9999.0	geodetic latitude of forward viewing band based on topography at the observation footprint: -90 <= latitude_FWD <= 90
	latitude_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Geodetic latitude (BWD)	deg	-90.0, 90.0	-9999.0	geodetic latitude of backward viewing band based on topography at the observation footprint: -90 <= latitude_BWD <= 90
	longitude_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Geodetic longitude (FWD)	deg	-180.0, 180.0	-9999.0	geodetic longitude of forward viewing band based on topography at the observation footprint: -180 < longitude_FWD <= 180
	longitude_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Geodetic longitude (BWD)	deg	-180.0, 180.0	-9999.0	geodetic longitude of backward viewing band based on topography at the observation footprint: -180 < longitude_BWD <= 180
	height_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Topographic height (FWD)	m	-443.0, 8648.0	-9999.0	topographic height of forward viewing band above the WGS84 Earth geoid model at the observation footprint
	height_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Topographic height (BWD)	m	-443.0, 8648.0	-9999.0	topographic height of backward viewing band above the WGS84 Earth geoid model at the observation footprint
	landWaterMask_FWD	2	numLine_FWD, numPixel_FWD	H5T_STD_I8LE	Land/Water mask (FWD)	(none)	0, 1	-128	Land/Water mask of forward viewing band at the observation footprint: 0 - Land, 1 - Water surface
	landWaterMask_BWD	2	numLine_BWD, numPixel_BWD	H5T_STD_I8LE	Land/Water mask (BWD)	(none)	0, 1	-128	Land/Water mask of backward viewing band at the observation footprint: 0 - Land, 1 - Water surface
	satelliteZenith_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Satellite zenith angle (FWD)	deg	0.0, 180.0	-9999.0	angle of forward viewing band between the normal to the Earth geoid and the satellite view vector at the observation footprint based on topography: 0 <= satelliteZenith_FWD <= 180
	satelliteZenith_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Satellite zenith angle (BWD)	deg	0.0, 180.0	-9999.0	angle of backward viewing band between the normal to the Earth geoid and the satellite view vector at the observation footprint based on topography: 0 <= satelliteZenith_BWD <= 180
	satelliteAzimuth_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Satellite azimuth angle (FWD)	deg	0.0, 360.0	-9999.0	angle of forward viewing band between local North and the projection of the satellite view vector onto the Earth at the observation footprint based on topography: 0 <= satelliteAzimuth_FWD < 360
	satelliteAzimuth_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Satellite azimuth angle (BWD)	deg	0.0, 360.0	-9999.0	angle of backward viewing band between local North and the projection of the satellite view vector onto the Earth at the observation footprint based on topography: 0 <= satelliteAzimuth_BWD < 360
	solarZenith_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Solar zenith angle (FWD)	deg	0.0, 180.0	-9999.0	angle of forward viewing band between the normal to the Earth geoid and the solar direction at the observation footprint based on topography: 0 <= solarZenith_FWD <= 180
	solarZenith_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Solar zenith angle (BWD)	deg	0.0, 180.0	-9999.0	angle of backward viewing band between the normal to the Earth geoid and the solar direction at the observation footprint based on topography: 0 <= solarZenith_BWD <= 180

Table 3-2 File format deteils of GOSAT-2 TANSO-CAI-2 L1B Product (4/4)

Group	Group / Dataset	Dataspace		Datatype	Dataset name	Attribute			
		Rank	Size			Unit	Valid range	Invalid value	Description
	solarAzimuth_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Solar azimuth angle (FWD)	deg	0.0, 360.0	-9999.0	angle of forward viewing band between local North and the projection of the solar direction onto the Earth at the observation footprint based on topography: 0 <= solarAzimuth_FWD < 360
	solarAzimuth_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Solar azimuth angle (BWD)	deg	0.0, 360.0	-9999.0	angle of backward viewing band between local North and the projection of the solar direction onto the Earth at the observation footprint based on topography: 0 <= solarAzimuth_BWD < 360
	solarDistance_FWD	1	numLine_FWD	H5T_IEEE_F32LE	Solar distance (FWD)	AU	(none)	-9999.0	distance of forward viewing band from sun to the observation footprint for the center pixel in each line (astronomical unit)
	solarDistance_BWD	1	numLine_BWD	H5T_IEEE_F32LE	Solar distance (BWD)	AU	(none)	-9999.0	distance of backward viewing band from sun to the observation footprint for the center pixel in each line (astronomical unit)
G	ForwardBackwardCollocation								
	index_BWD_pixel	2	numLine_FWD, numPixel_FWD	H5T_STD_I32LE	Pixel number index (BWD)	(none)	(none)	-999	pixel number index of backward viewing band corresponding to forward viewing band for each line and each pixel
	index_BWD_line	2	numLine_FWD, numPixel_FWD	H5T_STD_I32LE	Line number index (BWD)	(none)	(none)	-999	line number index of backward viewing band corresponding to forward viewing band for each line and each pixel
	index_FWD_pixel	2	numLine_BWD, numPixel_BWD	H5T_STD_I32LE	Pixel number index (FWD)	(none)	(none)	-999	pixel number index of forward viewing band corresponding to backward viewing band for each line and each pixel
	index_FWD_line	2	numLine_BWD, numPixel_BWD	H5T_STD_I32LE	Line number index (FWD)	(none)	(none)	-999	line number index of forward viewing band corresponding to backward viewing band for each line and each pixel
G	SatelliteGeometry								
	satPos_ECR_FWD	2	numLine_FWD, 3	H5T_IEEE_F64LE	Satellite position in ECR (FWD)	km	(none)	(0, 0, 0)	satellite position in ECR (WGS84) for each line of forward viewing band
	satPos_ECR_BWD	2	numLine_BWD, 3	H5T_IEEE_F64LE	Satellite position in ECR (BWD)	km	(none)	(0, 0, 0)	satellite position in ECR (WGS84) for each line of backward viewing band
	satVel_ECR_FWD	2	numLine_FWD, 3	H5T_IEEE_F64LE	Satellite velocity in ECR (FWD)	km/s	(none)	(0, 0, 0)	satellite velocity in ECR (WGS84) for each line of forward viewing band
	satVel_ECR_BWD	2	numLine_BWD, 3	H5T_IEEE_F64LE	Satellite velocity in ECR (BWD)	km/s	(none)	(0, 0, 0)	satellite velocity in ECR (WGS84) for each line of backward viewing band
	satAtt_FWD	2	numLine_FWD, 4	H5T_IEEE_F64LE	Satellite attitude (FWD)	(none)	(none)	(0, 0, 0, 0)	satellite attitude as quaternion in ECI (J2000) for each line of forward viewing band : scalar and vector parts in order
	satAtt_BWD	2	numLine_BWD, 4	H5T_IEEE_F64LE	Satellite attitude (BWD)	(none)	(none)	(0, 0, 0, 0)	satellite attitude as quaternion in ECI (J2000) for each line of backward viewing band : scalar and vector parts in order
G	SolarGeometry								
	solarPos_ECR_FWD	2	numLine_FWD, 3	H5T_IEEE_F64LE	Solar position in ECR (FWD)	km	(none)	(0, 0, 0)	apparent solar position in ECR (WGS84) for each line of forward viewing band
	solarPos_ECR_BWD	2	numLine_BWD, 3	H5T_IEEE_F64LE	Solar position in ECR (BWD)	km	(none)	(0, 0, 0)	apparent solar position in ECR (WGS84) for each line of backward viewing band
	solarVel_ECR_FWD	2	numLine_FWD, 3	H5T_IEEE_F64LE	Solar velocity in ECR (FWD)	km/s	(none)	(0, 0, 0)	apparent solar velocity in ECR (WGS84) for each line of forward viewing band
	solarVel_ECR_BWD	2	numLine_BWD, 3	H5T_IEEE_F64LE	Solar velocity in ECR (BWD)	km/s	(none)	(0, 0, 0)	apparent solar velocity in ECR (WGS84) for each line of backward viewing band

09

* If numLine_FWD or numLine_BWD is 0, corresponding datasets under the following groups are not stored.
LineAttribute, ImageData_FWD, ImageData_BWD, ImageGeometry, ForwardBackwardCollocation, SatelliteGeometry, SolarGeometry