

NIES-GOSAT2-SYS-20190129-058-03

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

Vol.2
GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product

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National Institute for Environmental Studies
GOSAT-2 Project

Revision History

Version	Revised on	Page	Description
00	Nov. 2019	-	-
01	Dec. 2019	p.1	Added product version
02	May 2020	p.1	Added product version
03	Jun. 2021	p.1	Changed product version
		p.2	Fixed a part of 2 (6)
		p.8	Changed "Group / Dataset" of the following datasets <ul style="list-style-type: none"> - LineAttribute/preAmpTempQuality_FWD - LineAttribute/preAmpTempQuality_BWD

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1 Introduction

1.1 Purpose

The purpose of this document is to define the file format of the GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination 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 (hereinafter referred to as “NIES”).

1.2 Data product and version

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

Table 1-1 Product and version explained in the document

Product name	Product version
GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product	01.04

03

2 GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product

(1) Description of GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product

GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product stores clear-sky confidence levels per pixel, which are calculated by combining the results of threshold tests for multiple features such as reflectance ratio and Normalized Difference Vegetation Index (NDVI), obtained from spectral radiance data in GOSAT-2 TANSO-CAI-2 L1B Product.

This product also stores cloud status bit data, in which results of individual threshold tests and quality flags for cases liable to be erroneously recognized, are summarized.

(2) Major dataset

Integrated clear-sky confidence levels, Cloud status bit data

(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) File 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	_	0	2	C	C	L	D	D	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* (UTC)

*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. 03

PPP: Path number (001-089)

FFF: Frame number (001-036)

02: Processing level (Fixed)

C: Band (Fixed)

CLDD: 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

(7) File size

Approx. 547MB

3 Product Format

3.1 Dataset structure

Table 3-1 shows the dataset structure of GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product.

Table 3-1 Dataset structure of GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product

No.	Group	Outline
1	Metadata	The following items are mainly included to describe overview of the product. <ul style="list-style-type: none"> - 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. <ul style="list-style-type: none"> - 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. <ul style="list-style-type: none"> - Observation time - Sensor gain - Missing flag - Quality flag
4	CloudDiscrimination	The following items are mainly included to provide information related to the observation. <ul style="list-style-type: none"> - Cloud discrimination - Confidence level
5	ImageGeometry	The following items are mainly included to provide information related to the observation. <ul style="list-style-type: none"> - Geodetic latitude/longitude/height - Satellite zenith/azimuth angle - Solar zenith/azimuth angle
6	ForwardBackwardCollocation	The following items are mainly included to provide information related to the observation. <ul style="list-style-type: none"> - Pixel/Line number index (BWD) - Pixel/Line number index (FWD)

The special mention about “Group” above is shown below.

- **FrameAttribute**

There is an overlap with the adjacent frames as margin, which has a certain number of lines. 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.

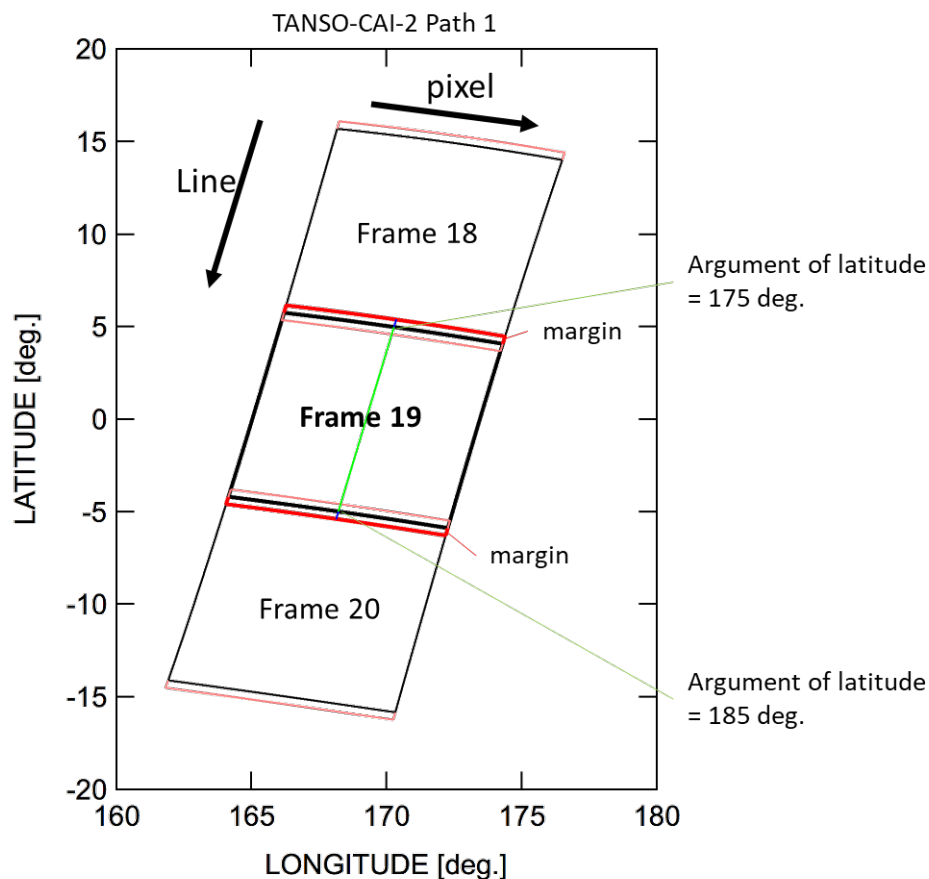


Figure 3-1 Image of margin between adjacent frames

- **CloudDiscrimination**

`confidenceLevel_FWD/confidenceLevel_BWD` under `CloudDiscrimination` store the integrated-CCL (clear-sky confidence level) of each pixel as a 4-byte real number. The integrated-CCL expresses the cloudy area with 0, the clear area with 1, and the ambiguous area with a numerical value between 0 and 1.

`cloudDiscrimination_FWD/cloudDiscrimination_BWD` under `CloudDiscrimination` store the cloud status bit data of each pixel as a 4-byte (32 bits) integer. The cloud status bit data is generated as auxiliary information by cloud discrimination processing. Table 3-2 shows the bit fields of the cloud status bit data.

- 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`.

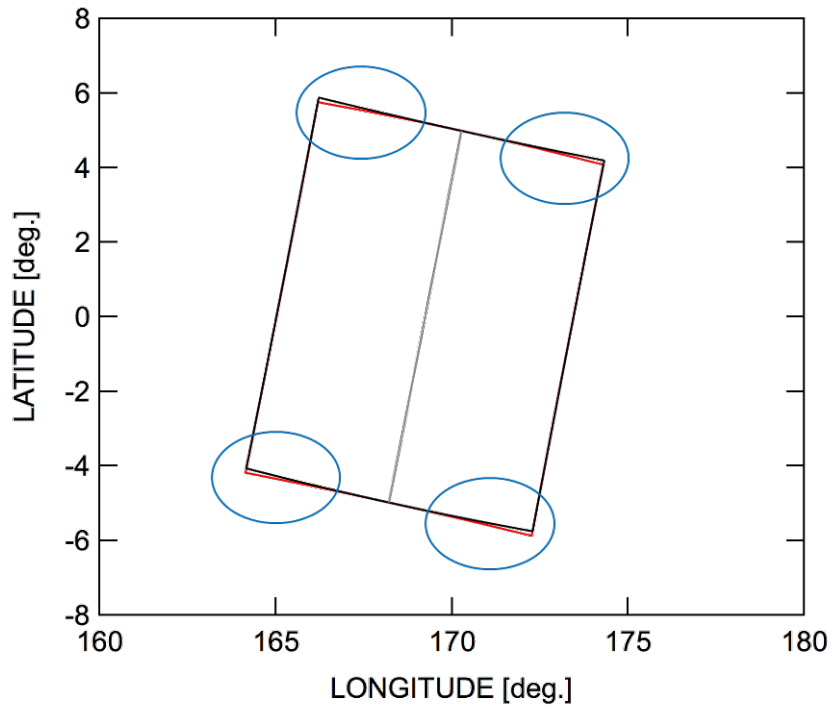


Figure 3-2 Image of observation points for forward and backward viewing bands

3.2 File format details

Table 3-3 shows the file format details of the GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product.

Table 3-3 GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product Format (1/3)

Group	Group / Dataset	Dataspace		Datatype	Dataset name	attribute			
		Rank	Size			unit	validRange	invalidValue	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: "L2" - Level 2 (Fixed)
	algorithmName	1	1	H5T_STRING	Algorithm name	(none)	(none)	(none)	algorithm name: "CLAUDIAT / CLAUDIA3" (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)

Table 3-3 GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product Format (2/3)

Group	Group / Dataset	Dataspace		Datatype	Dataset name	attribute			
		Rank	Size			unit	validRange	invalidValue	description
	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_18LE	Sensor gain (FWD)	(none)	(none)	(none)	sensor gain of pre-amplifier for the center pixel of each line and each forward viewing band
	sensorGain_BWD	2	numLine_BWD, numBand_BWD	H5T_STD_18LE	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_132LE	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_132LE	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_18LE	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_18LE	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_18LE	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_18LE	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_18LE	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_18LE	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_18LE	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_18LE	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_18LE	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_18LE	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_18LE	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 resolution.)
	satAttInterpolationQualityFlag_BWD	1	numLine_BWD	H5T_STD_18LE	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 resolution.)
G	CloudDiscrimination								
	cloudDiscrimination_FWD	2	numLine_FWD, numPixel_FWD	H5T_STD_132LE	Cloud discrimination (FWD)	(none)	(none)	(none)	cloud status bit data of forward viewing band is stored
	cloudDiscrimination_BWD	2	numLine_BWD, numPixel_BWD	H5T_STD_132LE	Cloud discrimination (BWD)	(none)	(none)	(none)	cloud status bit data of backward viewing band is stored
	confidenceLevel_FWD	2	numLine_FWD, numPixel_FWD	H5T_IEEE_F32LE	Confidence level (FWD)	(none)	0.0, 1.0	-9999.0	integrated-CCL (clear-sky confidence levels) of forward viewing band is stored
	confidenceLevel_BWD	2	numLine_BWD, numPixel_BWD	H5T_IEEE_F32LE	Confidence level (BWD)	(none)	0.0, 1.0	-9999.0	integrated-CCL (clear-sky confidence levels) of backward viewing band is stored
G	ImageGeometry								
	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

03

Table 3-3 GOSAT-2 TANSO-CAI-2 L2 Cloud Discrimination Product Format (3/3)

Group	Group / Dataset	Dataspace		Datatype	Dataset name	attribute			
		Rank	Size			unit	validRange	invalidValue	description
	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: $-180 < \text{longitude BWD} \leq 180$
	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: $0 \leq \text{satelliteZenith FWD} \leq 180$
	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: $0 \leq \text{satelliteZenith BWD} \leq 180$
	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: $0 \leq \text{satelliteAzimuth FWD} < 360$
	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: $0 \leq \text{satelliteAzimuth BWD} < 360$
	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: $0 \leq \text{solarZenith FWD} \leq 180$
	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: $0 \leq \text{solarZenith BWD} \leq 180$
	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: $0 \leq \text{solarAzimuth FWD} < 360$
	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: $0 \leq \text{solarAzimuth BWD} < 360$
	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

* If numLine_FWD or numLine_BWD is 0, corresponding datasets under the following groups are not stored.

LineAttribute, CloudDiscrimination, ImageGeometry, ForwardBackwardCollocation